Effective Chinese-to-English Geotourism Translation: An Interdisciplinary Corpus-based Approach to Benchmarking and Translation Taxonomy for Chinese UNESCO Global Geoparks

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Abstract

Geotourism is a holistic form of tourism which links geology (**A**biotic), with a range of flora and fauna (**B**iotic) which closely link to how people have lived in a place (**C**ulture) in the past as well as today (Geological Society of Australia, 2015). These three components are referred to as the ABC elements of geotourism. The main objective of geotourism is to promote sustainable tourism through the exchange of geomorphological, ecological, and cultural knowledge. The global development of geotourism has heightened the demand for high-quality translation of this area. Nonetheless, due to the lack of systematic theoretical guidance, translators frequently resort to ineffective translation strategies, leading to confusion and inaccuracy in geotourism expressions (e.g., geological jargon, geological and ecological processes).

Therefore, the aims of this research project are to address this problem by developing a translation quality evolution model and a taxonomy of effective geotourism strategies (hereafter, Taxonomy) and thus standardise (in terms of accuracy and consistency) the Chinese-to-English geotourism translation system. The theoretical framework used for this project is the three-dimensional transformations (i.e., language, culture, and communication) of Hu's Eco-Translatology (2003). Based on this framework, the proposed SSC (**S**emantic, **S**tyle, and **C**ultural) equivalence Model is designed to serve as a benchmark for assessing the quality of Chinese-to-English geotourism translation, while the development of the Taxonomy is intended to optimise the Chinese-to-English translation.

To develop the SSC Model and the Taxonomy, six research questions were sequentially designed and investigated with data collected from nine Chinese UNESCO Global Geoparks (UGGps). Specifically, the four empirical chapters included in this thesis each uses a corpus built from a different set of the UGGps, sequentially focusing on the development of the SSC Model, the identification of translation strategies and problems of the ABC elements (i.e., the Taxonomy), and a validation of the SSC Model and the Taxonomy. The datasets were used to build Chinese-to-English parallel corpora, which helps to visualise direct comparison of the interpreted expressions in the two languages. For each chapter, I performed corpus-based qualitative and quantitative analysis of these corpora. For data processing and data analysis, I used the digital tool Tmxmall (https://www.tmxmall.com) and the Corpus Query Language (CQL) function in Sketch Engine (https://www.sketchengine.eu/).

The findings indicate that the SSC Model is an optimal model for evaluating how effective the geotourism translations map onto Hu's Eco-Translatology. The Model effectively miminises ineffective Chinese-to-English translations in geotourism data and ensures the precise delivery of information for geotourism in Chinese UGGps. The SSC Model also functions as a cornerstone in developing the taxonomy of translation strategies of ABC elements for geotourism. For example, I found that the strategy *literal translation* can generally be applied to the translation of all of the ABC elements. Nevertheless, other translation strategies (e.g., *Shift* as well as *Division and Shift*) are common among all the elements, but especially important for textual description of geological (A element) and biotic processes (B element), because of the stylistic contrast between Chinese and English languages. Finally, the empirical study validated the effectiveness of both the SSC Model and Taxonomy, recommending their use to future translators.

There are many implications of this study in the fields of geotourism translation in terms of theoretical pursuits and practical applications. The proposed SSC Model and the Taxonomy provide valuable theoretical guidance for

geotourism translation. Moreover, the results from this study provide practical implications for the field of translation practice and training. I intend to share the qualitative results where I optimise problematic translations in the **A**biotic, **B**iotic and **C**ultural data of geotourism with popular science education centers in Chinese UGGps. My focus on corpus-based methodology in this project provides translators access to data-driven pedagogical materials which uses empirically tested authentic language samples to enhance their translation skills and output. Because effective geotourism translation promotes better geomorphological, ecological, and cultural communication, this project may help to facilitate the development of the geotourism sector by enhancing translation quality provided to Chinese UGGps, and therefore more commitment to geotourism sustainability.

Acknowledgements

People often liken academic research to climbing a mountain, in which one has to overcome various difficulties before reaching the top. On a personal note, however, I would see my PhD journey as crossing a vast ocean, where I kept exploring new fields in uncharted waters. And there'd be no way for me to complete this journey without the great support of my excellent supervisors and close friends. I am honoured to enjoy the challenges and glories together with them.

This journey started under the clouds of COVID-19. Despite all my enthusiasm and beautiful anticipations, I was stricken with deep anxiety and uneasiness at first. Throughout this challenging voyage, I would like to give special thanks to my supervisors, Dr. Gavin Brookes and Professor Tony McEnery; their immense humanistic care has brought me invaluable solace. In those dark cold waters ravaged by the pandemic, they charted an accurate course for me with their professional guidance, dispelled the mists on the way and led me to the shore of success as their hope in me beamed so bright. In them, I saw what makes a true scholar and a respectful supervisor: a rigorous and critical dedication to scientific research and innovation. For that, I would always see them as the lodestars in my pursuit of academic accomplishments.

But not just challenges, the pandemic also brought opportunities. In the second year of my PhD training, my research data collection was seriously hampered by the COVID-19 restrictions. At that moment, Dr. Young Ng and Mr. Angus Robinson from the Geological Society of Australia came to my aid and helped me establish close contact with the management of Chinese UNESCO Global Geoparks. As my friend and collaborator, Dr. Young frequently encouraged me to break free from dogma and scrutinise between the known and the unknown. Our friendship was like a lighthouse that navigated me out of the darkness. We published three open-access articles together in the *International Journal of Geoheritage and Parks* and *Geoheritage* that year, and I am particularly grateful to Lancaster University for the financial support.

Entering the third year of my PhD, academic writing emerged as the biggest obstacle between me and top-tier journals. I would like to express my gratitude to my supervisors Gavin and Tony, as well as Professor Dr. Guodong Yu, Dean of the College of Foreign Languages at Ocean University of China; Dr Sally Ren, Senior Research Associate at Lancaster University; my friends Dr. David Wei Dai, a lecturer at University College London and Ms. Bron Vanzino, for their insightful comments on my thesis writings. I would also like to thank Dr. Mingzhuo Qiao, Dr. Meizhen Jiang, and Dr. Guodong Dou for their excellent healthcare when I was writing my article and thesis. Finally, the publication of my article in the *Journal of Sustainable Tourism* marks a turning point in my academic journey.

The last year of my academic pursuit has been like a new chapter after the storm. Thanks to the support of my supervisors, my fifth article is around the corner, bringing this voyage to a successful conclusion. Looking back at the past four years, I am indebted to Dr. Xin Li, Dr. Yao Meng, Mr. Yaojing Chen, Mr. Yangyang Gan, Ms. Qingzi Ye, and Ms. Chunyu Lu, who generously took care of my accommodation and provided academic insights when I was out collecting data. Special thanks go to Professor Xiufang Zhang, Professor Yanchun Qiu, and Associate Professor Shengyu Fan, who in my graduate and undergraduate years, turned the boring theories of translation and linguistics into interesting lectures, which laid a solid foundation for my doctoral research. Meanwhile, I want to thank my friend Haitao Qiu for his valuable inputs on geotourism interpretation. In addition,

I would also like to extend my thanks to Dr. Chan-yi Yang, Dr. Qiang Li, Dr. Chen Tang, Dr. Yingnian Tao, Dr. Shengnan Liu, Dr. Xuan Li, Dr. Haoran Yang, and PhD candidates Guangxiang Liu, Fangzhou Zhu, Ruixue Wu, Zhenfang Zhang, Huihuang Jia, Shaoqiang Zhang, and many other colleagues and friends for their support along the way.

In the end, I am eternally grateful to my family. Their endless and everlasting love has given me the courage to finish this journey. My parents gave me the first name ‘Qiang’, which means ‘strong’ in Chinese, as they want me to build a strong character. I did not fail them. This academic voyage has ultimately shaped a strong personality in me. Regardless of what I choose to do or who I aspire to be, I always have their unwavering support. My parents made countless sacrifices in raising me, giving up their own dreams, careers, and ambitions. Some of my warmest and fondest memories are of times spent with my grandparents. Their love and laughter coloured the happiest chapters of my childhood and youth. Whenever I doubted myself and fell into despair, it was their love that gave me the strength to move on, and in the light of that love I travelled through storms in my voyage and navigated the path to victory. With immense gratitude, I dedicate this thesis to them – the stars of my life.

More precious than all the worldly riches and discoveries is the courage to go ahead, regardless of what may lurk in the future.

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Declaration

I hereby declare that this thesis is my own work and has not been submitted for a higher degree at any other institutions. This thesis is presented as an Alternative Format (AF) Ph.D. Thesis, comprising five academic peer-reviewed articles: one literature review (Chapter 2) and four empirical studies (Chapter 4 to 7), all of which have been submitted for publication in academic journals. In line with the principles of an AF Ph.D. Thesis, I am listed as both the first author and the corresponding author on all these papers. Since the published papers were co-authored, I have included signed authorship statements detailing the contributions of each co-author for every paper. These contributions are also documented in each published article. Chapter 2 has been published in the *International Journal of Geoheritage and Parks*, Chapter 4, Chapter 5 and Chapter 7 in *Geoheritage*, Chapter 6 in the *Journal of Sustainable Tourism*.

Qiang Li

Authorship Statement for Chapter 2: Strategies and problems in geotourism interpretation: a comprehensive literature review of an interdisciplinary Chinese to English translation (*International Journal of Geoheritage and Parks*)

As the corresponding author and the first author, I completed the organisation and analysis of literature as well as writing up the entire paper. At the planning stage of this paper, I received meticulous guidance from Dr. Young Ng, who provided advice on selecting relevant literature on geotourism as the second author. He plays an important role in enriching the discussion about geotourism, which was crucial for the successful completion of the literature review. Moreover, he meticulously reviewed the manuscript and offered valuable comments before its submission. Ruixue (Rachel) Wu, as the third author, provided guidance on the framework and structure of the paper. The research guidance from Dr. Ng and Rachel was invaluable.

I confirm that the above is accurate.

Young Ng

I confirm that the above is accurate.

Ruixue (Rachel) Wu

Authorship Statement for Chapter 4: Benchmarking the quality of Chinese to English geotourism interpretation: the SSC Model based on Eco-Translatology (*Geoheritage*)

As the corresponding author and the first author, I developed the Chinese-to-English Parallel Geotourism Corpus, which involved manually aligning the corpus and tagging interpretation strategies and problems. I also completed the data analysis and wrote the entire paper individually. The second author, Fangzhou (Noah) Zhu, is a PhD candidate in linguistics at Lancaster University provided valuable advice on the methodological details for extracting linguistic patterns using CQL in Sketch Engine. In addition, he also provided invaluable comments on the research question and the structure of the paper. Dr. Young Ng, an expert in geotourism and serving as the third author, provided essential background information on geotourism. He also thoroughly reviewed the paper, offering insightful comments on the paper before its submission.

I confirm that the above is accurate.

Fangzhou (Noah) Zhu

I confirm that the above is accurate.

Young Ng

Authorship Statement for Chapter 5: Developing culturally effective strategies for Chinese to English geotourism translation by corpus-based interdisciplinary translation analysis (*Geoheritage*)

As the corresponding author and the first author, I developed the Chinese-to-English Geotourism Parallel Corpus, which involved manually aligning the corpus and tagging interpretation strategies and problems. I also completed the data analysis and wrote the entire paper individually. During the process, the second author, Ruixue (Rachel) Wu, provided technical supervision for the corpus tagging and gave advice on the structure and revisions of the paper. During the pandemic when in-person data collection was impossible, Dr. Young Ng, the third author of this paper, kindly supplied me with geotourism data from Yandangshan and Danxiashan UGGps. As an expert in geotourism, he also enriched my understanding of the interpretation and meaning of Abiotic and Cultural elements of geotourism.

I confirm that the above is accurate.

Ruixue (Rachel) Wu

I confirm that the above is accurate.

Young Ng

Authorship Statement for Chapter 6: Effective Chinese-to-English biotic interpretation in ecotourism destinations: a corpus-based interdisciplinary study (*Journal of Sustainable Tourism*)

As the corresponding author and the first author, I developed the Chinese-to-English Parallel Ecotourism Corpus, which involved manually aligning the corpus and tagging interpretation strategies and problems. I also completed the data analysis and wrote the entire paper individually. The second author, Dr. Young Ng, provided me with critical connections from whom I received the data from Chinese UNESCO Global Geoparks for the paper. In addition, as an expert on geotourism, he provided essential background knowledge on ecotourism along with suggestions for addressing reviewers' comments.

I confirm that the above is accurate.

Young Ng

Authorship Statement for Chapter 7: A new approach to the interpretation of geotourism texts (*Geoheritage*)

As the corresponding author and the first author, I developed the Chinese-to-English Parallel Geotourism Corpus, which involved manually aligning the corpus and tagging interpretation strategies and problems. I also completed the data analysis and wrote the entire paper individually. The second author, Dr. David Wei Dai, provided invaluable and detailed guidance on the structure, language, as well as content of this paper. He was also in charge of making final rounds of editing of this paper before submission. Dr. Young Ng, as the third author, offered valuable insights and relevant literature on geotourism to support my work. He also made contribution on final revisions and editing, especially in refining the discussion of the ABC elements in the results and discussion section.

I confirm that the above is accurate.

David Wei Dai

I confirm that the above is accurate.

Young Ng

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Chapter 1: Introduction

Geotourism can be understood as a relatively new form of tourism that centres around touristic engagements with living and mineral elements and that is guided by notions of environmental protection and sustainability. Since the 1990s, geotourism has become increasingly relevant to the preservation of geomorphology, ecology and local culture (Dowling, 2013). This in turn has resulted in an increased demand for high-quality translation of terms and expressions related to geotourism (Ng, 2017), especially in geoparks, as an essential way for educating and raising the awareness of the public to preserve the environment. However, the current translations of geotourism terms are largely unsystematic and prone to various problematic representations, thereby hindering its clarity and professionalism (Ng, 2017). To address this issue and to contribute to a coherent system for effective geotourism translation, this research adopts a corpus-based approach, combined with a translation theory (i.e., Hu's Eco-Translatology, 2003) as a theoretical framework, to standardise the system of Chinese-to-English geotourism translation. It is worth noting that, the term 'translation' is used throughout to refer to the process of converting content from one language (i.e., Chinese) to another (i.e., English). However, the term 'interpretation' is also used, and is intended to be used interchangeably with the term 'translation'. According to Dowling (2013; 2020), geotourism 'interpretation' may be carried out through publications and websites, electronic educational resources, visitor centres, self-guided trails, and guided touring. These situations are referred to as interpretation, indicating that written forms of translation, in this case, can be referred to as interpretation as well. For the purposes of some of the publications included in this thesis that was composed for audiences outside of linguistics, using 'interpretation' instead of 'translation' conforms more to the disciplinary norms.

Using authentic linguistic data from nine Chinese UNESCO (United Nations Educational, Scientific and Cultural Organisation) Global Geoparks (UGGps), this thesis aims to develop a benchmarking model (SSC: **S**emantic, **S**tyle and **C**ulture equivalence) for evaluating the quality of geotourism translation. Additionally, based on the SSC Model, this thesis develops a taxonomy of translation strategies specifically for the ABC (**A**biotic, **B**iotic and **C**ulture) elements in geotourism.

In this introductory chapter, I provide a brief overview of the research context, including issues related to geotourism being a multi-disciplinary field, challenges and gaps in geotourism translation, and the rationale for this study. The subsequent discussion provides an overview of the main research goals, and the specific research questions investigated in different empirical chapters. Finally, after a brief discussion of research contribution, the structure of the thesis is outlined in the end.

1. Research Context

1.1 Geotourism translation as a multi-disciplinary field

Geotourism is defined by the Geological Society of Australia (GSA) as 'tourism which focuses on an area's geology and landscape as the basis for providing visitor engagement, learning and enjoyment (2015, p.1).' As mentioned here, the field of geotourism not only promotes tourism and recreational activities, but also serves as an intended instrument for learning, helping the tourists to foster deeper understanding of geological features, geological processes, and cultural relevance. Geotourism focuses on the current urgency of environmental conservation and sustainability. It is concerned with a wide range of elements, including geological features, geological processes, flora and fauna, as well as the deep cultural heritage of the localities. These elements are

mainly found in geoparks of the world. A geopark is defined by UNESCO as '*a nationally protected area that contains a number of geological heritage sites of particular importance, rarity of aesthetic appeal, and is one element in an integrated concept of protection, education and sustainable development* (2006, p.2)*'*. Geotourism activities in geoparks play an important role in promoting the awareness and responsibility for geoconservation (Ólafsdóttir & Dowling, 2013). For example, common geological terms such as 'karst formations' or 'quartz sandstone pillars' capture not only the unique scientific and geological features of these rock formations, but also the cultural and historical stories associated with them. These terms carry meaning that reflects how people value and understand the natural world. A vague translation like 'stone mountain' would fail to reflect the depth of these terms, losing both the scientific importance and the engaging backstory that could help the audience connect with the site. This disconnect makes it difficult for people to care about understanding and preserving such significant features.

The unexplored scope of geotourism translation means foremost that it requires a theoretical foundation based on in-depth research. This research should include the systematic translation of geotourism (translation strategies and scientific naming requirements), an interrogation of the popularised science education function of geotourism, and an explicit understanding of the significance of the relationship between geotourism and environmental protection. Geotoursim differs from other tourism in its focus on promoting effective awareness from relating geo features to its cultural-historical characteristics. Effective translation of geotourism related features and terms involves accurate reflection of those social values in addition to geological terminologies. Therefore, ensuring high-quality translation is critical. However, there are as yet no published translation standards which can be used to ensure systematic and high-quality translation of geotourism terms and expressions.

Researchers focusing on the topic of geotourism translation are encouraged to base their research methods and objectives on literature in other related fields, such as ecotourism (i.e., a subfield of geotourism) or linguistics (i.e., contributing to the connections between the linguistic terms we use and their referents). In this case, the field of corpus linguistics is particularly useful for deriving systematic benchmarking systems and empirically based taxonomy from authentic language data from the geoparks.

1.2 Challenges and difficulties of geotourism translation

It is important to appreciate the responsibility geotourism translation holds in promoting public awareness and responsibility for conservation. Without the quality of translation of data, geotourism cannot provide the critical information and understanding necessary to support the public educational process (Ólafsdóttir & Dowling, 2013; Ng, 2017). The accurate and high-quality translation of geotourism terms help to effectively convey the underlying scientific, cultural, and environmental significance of geosites to diverse audiences. Precise translations ensure that the essence of these terms is preserved, minimising the risk of mistranslation or oversimplification. Through clear and contextually appropriate translations, geotourism not only informs but also engages audiences in the broader goals of geoconservation. With many science centres and museums in geoparks, geotourism also promotes the popularisation of all the geosciences. From an economic perspective, geotourism promotes micro sustainable business to the local indigenous population and national economic support from geotourist visitor income. These two factors – awareness building and economic growth – are interactive and vital parts to the success of geoconservation but need to be firmly underpinned by quality translation of geotourism texts for the learning process. It was deemed necessary, from the outset of this research, to organise the geotourism texts into its three

elements, so that patterns could be established in Chinese-to-English translation. The first element, the **A**biotic (A) element, is primarily concerned with minerals, water, air and the sun. This element is composed of geological features and geological processes. Therefore, unsurprisingly, geological features and geological processes are frequently expressed in scientific, and somewhat technical, terms and expressions. Furthermore, geological features can also include cultural factors. For example, the Chinese characters '丹', '青' and '碧' are difficult to translate because they include specific cultural descriptors encoded in their surface meaning, which are red, cyan, and green. The direct style of the target language, English, is another predicament for translators of geological processes from the more convoluted Chinese linguistic style. The second element, the **B**iotic (B) element, contains difficult botanical Latin plant and animal names. Also in the B element, various species of Chinese plants and animals are given in local terms. Similarly to the challenges of the A element, there are references to complex descriptions in the development processes of B elements that present stylistic challenges to the target language. The third element is the **C**ultural (C) element where the geographical sites may have cultural references. These cultural references may have unique meanings in Chinese that represent religious, historic, or artistic facts, which is not directly translatable in the target culture. Finally, the general inconsistent approach to translation reflects a need for more professionalism in geotourism translation. All these elements (the ABC elements, thereafter) point to the need for a systematic theoretical guidance to translations in Chinese UGGps. As described, the complexity in linguistic, semantic, and cultural aspects presents challenges to geotourism translation.

1.3 The needs for a benchmarking model and a taxonomy of effective strategies for geotourism translation

Although geotourism has some similarities to tourism, there are important differences. Geotourism, according to Hose (1996), is a new type of science that, although integrated into tourism in a practical sense, is firmly based on the science of the geological environment. Ng (2017) describes and emphasises the three key differences: 1) Geotourism is about visiting and appreciating geo-features and phenomena: the bio and cultural characteristics associated with them; 2) Geotourism is about learning in addition to travelling, not just leisure or sight-seeing; 3) Geotourism is able to develop a definitive sense of place, and detailed identity of belonging to an area or region. These key differences show the distinctive aims of geotourism and its specialised technical aspects. For these reasons, geotourism requires careful treatment regarding the translation of its related terms and expressions, ensuring its cultural, historical, and educational significance is accurately preserved and communicated to diverse audiences.

Focusing on the ABC (i.e., **A**biotic, **B**iotic and **C**ultural) elements mentioned in section 1.2, a quality evaluation model (SSC: **S**emantic, **S**tyle and **C**ultural equivalence) was developed to suit the needs for geotourism translation using specialised authentic linguistic data from nine Chinese UNESCO Global Geoparks. Because this model is developed empirically using large amount of linguistic data, it provides data-driven standard and objectives for effective translation. Essentially, the SSC model evaluates whether a translation of specialised geotourism terms or expressions reaches semantic equivalence, style equivalence, or cultural equivalence. Guided by this model, a comprehensive list of translation strategies of the ABC elements were derived.

2. Research Aims and Questions

As mentioned above, geotourism translation plays a vital role in improving cultural understanding and promoting positive changes in geoconservation. However, geotourism translation requires specific and accurate transferring of meaning that reflects not only the geological terminologies across languages, but also cultural aspects of meaning. The existing translation theories and frameworks do not specialise in this field (see a detailed discussion in Chapter 2 Section 3.5) and are prone to inappropriate translation if adopted to the field of geotourim. This is especially challenging in Chinese-to-English interpretation, where both cultures and language use embed distinct styles, syntax, and references that are not always comparable to each other. To address these issues, I propose to create a synergetic approach that incorporates previous literature and methodology in translation, geotourism, and linguistics respectively. The overall objectives for this project are to:

(1) create a benchmarking model which could effectively address the objectives of effective geotoursim translation from Chinese to English, under the guidance of previous translation theory (specifically, Eco-Translatology).
(2) create a taxonomy of strategies specifically used for effective translations of geotourism expressions in authentic linguistic data, under the guidance of the benchmarking system.

To achieve these two overall objectives, a series of specific research questions were developed and investigated in three empirical studies included in this thesis, accumulatively aiming to provide validity evidence of the proposed benchmarking model and taxonomy of translation strategies for geotourism terminologies and expressions.

As indicated in the first overall objective, the foundational step is to establish a specialised benchmarking model that works with the Chinese-to-English geotourism texts. For the scope of the thesis, I provide the definition of geotourism texts to refer to written materials connected to the ABC elements that constitute geotourism. To achieve this, the first empirical study (Chapter 4) in this thesis introduces an empirically developed **S**emantic, **S**tyle and **C**ultural (SSC) model for assessing the quality of geotourism translation. This model uses Hu's Eco-Translatology (2003) as a framework, and is guided by the contemporary literature on previous models and principles for benchmarking translation. Like any specialised fields of translation, geotourism translation demands flexibility and precise strategies for accurate and culturally sensitive translation, particularly given the field-specific nature of terminologies and the socio-historical factors involved for Chinese-to-English translation. Therefore, the SSC model proposed in chapter four aims to provide a specialised and standadised framework to guide translators in navigating these complexities effectively, ensuring high-quality translation outcomes. After introducing this model, Chapter 4 includes an empirical investigation based on the following specific research question:

1) Is the SSC Model, based on Hu's Eco-Translatology combined with principles of geotourism interpretation, sufficient to effectively guarantee a quality interpretation of geotourism materials?

This research question aims to guide the validation of the SSC model to be used for later investigations of translation strategies, using authentic linguistic data collected from two geoparks in China.

At this point, it is important to note that the authentic linguistic data provided by the geoparks should not be treated as 'effective' translations by default. Instead, when identifying translation strategies, a first step should be a scientific scrutinization of the collected translation data to evaluate the effectiveness of geotourism translation.

The SSC model enabled the critical step to distinguish effective translation versus the ineffective ones. This step then leads to the observation of strategies used for the effective translations, which can then be used for making improvements of the problematic translations. Following this logic, in Chapter 5, I focused on the following two specific research questions:

2) How effective is the English translation in conveying the original Chinese geotourism (A and C elements) messages? [Research question 1 in Chapter 5]
3) In what specific ways can the current translation (A and C elements) in geotourism be improved? [Research question 2 in Chapter 5]

As the first empirical chapter to explore SSC (i.e., **S**emantic, **S**tyle and **C**ulture equivalence) application in real-world data, these two research questions allow for a careful examination of translation strategies used at the exploratory stage. The first research question guided the identification and classification of strategies used for effective translation, and the second research question guided the revision process for problematic translation using the previously identified strategies. As mentioned in Section 1.2, the field of geotourism encompasses three elements: **A**biotic; **B**iotic; and **C**ultural (or, A, B, and C). Chapter 5 focuses on element A (i.e., geological features and geological processes) as well as element C (human lifestyle, both past and present), due to the reason that these two elements together are typically viewed as 'pure' geotourism, according to Dowling (2013). Therefore, investigating these two elements together contributes to the coherency of geotourism translation.

Chapter 6 essentially follows the same methodology and motivation, but focuses on element B (i.e., flora and fauna), which is typically referred to as the ecotourism element separately. The previous chapter (Chapter 5) investigated the **A**biotic and **C**ultural elements, so Chapter 6's focus on the **B**iotic element completes the investigation of all three elements in geotourism in the broader sense. The research questions in Chapter 6 follows the same pattern of investigation with those of Chapter 5, with slightly modified wording to provide a focused analysis of the **B**iotic element of geotourism. Research question 4 focuses on the identification of effective translation strategies, and research question 5 focuses on a separate step where the observed problematic translations are improved by using the effective translation strategies.

4) What effective interpretation strategies can be identified from linguistics expressions related to flora and fauna in the two Chinese UGGps? [Research question 1 in Chapter 6]
5) How could effective interpretation strategies inform the revision or improvement of ineffectively interpreted linguistic expressions related to flora and fauna? [Research question 2 in Chapter 6]

As the thesis stands for now, Chapter 4 establishes the SSC model, and Chapter 5 and 6 identify strategies used for effective geotourism translation. These three chapters together fulfill the research aim of developing a benchmarking model and a taxonomy of translation strategies. Although each of these chapters use real-world language data, the results are derived from data of certain geoparks. To test the validity and generalisability of the model and the taxonomy, the next step would be to apply them to a new dataset. Therefore, Chapter 7 aims to use data from additional geoparks on all three elements of geotoursim to test the applicability of the SSC Model and the taxonomy of effective translation strategies. The research question in Chapter 7, therefore, aims to guide the investigation of the validation process using new data from three additional geoparks:

6) Would the Chinese-to-English geotourism interpretation data in three Chinese UGGps (Mount Kunlun, Fangshan, and Xiangxi) align with the SSC Model and taxonomy of interpretation strategies based on Eco-Translatology? [Research question in Chapter 7]

3. Research Contributions

This project aims to enhance the field of geotourism translation by providing a professional framework for researchers, linguists, and practitioners working in geoparks. The SSC equivalence Model introduced in Chapter 4 offers a customised evaluation process for geotourism translation, particularly improving Chinese-to-English translations in Chinese UGGps. This model and the insights from Eco-Translatology create a new standard of quality translation, ensuring high-quality information communication across cultures. The research also provides criteria for standardising geotourism translation process, helping practitioners to deliver meaningful and accurate information for sustainable tourism (see a detailed flowchart for real world implementation in Chapter 4, Figure 6).

For translators, this project offers a foundation to apply professional standards in their work. It includes a detailed framework and examples to help practitioners integrate the ABC interpretative concept efficiently, ensuring consistency and comprehensiveness in their translations. The project also serves as a valuable resource for translation education, offering a rich bank of educational materials and real-life language references. Additionally, the research broadens the scope of Chinese-to-English geotourism translation and provides novice researchers with practical methodologies for their studies. By combining Eco-Translatology, corpus-based methods, and the ABC interpretative concept, this project sets a firm foundation for future scholarship in geotourism translation and related fields, emphasising the importance of effective translation for accurate scientific meaning, as well as facilitating environmental conservation and cultural preservation.

4. The Structure of the Thesis

The main body of this thesis is composed of eight chapters. In Chapter 2, a comprehensive literature review is provided to illustrate the lack of relevant academic research in the field of Chinese-to-English geotourism translation as well as to highlight the need for a systematic and theoretical guidance. This chapter is published in the *International Journal of Geoheritage and Parks* on 17 February 2022, which is indexed in Scopus (Citescores: 5.1). The publication is titled *Strategies and problems in geotourism interpretation: A comprehensive literature review of an interdisciplinary Chinese to English translation*. Chapter 3 focuses on the theoretical framework and methodology. It describes Hu's Eco-Translatology as the theoretical framework as well as the general procedure of the corpus-based methods used in the studies in this thesis. The first three chapters of this research serve as its foundation, while the subsequent four continuous published chapters, 4 to 7, are dedicated to individual empirical analyses.

In Chapter 4, I establish the SSC Model (SSC: **S**emantic, **S**tyle and **C**ultural equivalence) based on Hu's Eco-Translatology. This chapter is published in the SSCI-indexed journal: *Geoheritage* on 1 August 2022, entitled *Benchmarking the quality of Chinese to English geotourism interpretation: the SSC model based on Eco-Translatology*. In Chapters 5 and 6, I analyse strategies used to translate expressions of the ABC (**A**biotic, **B**iotic and **C**ultural) elements for geotourism, aiming to achieve the optimal translation outcome - **S**emantic, **S**tyle and **C**ultural equivalence (aka. The SSC model). Specifically, Chapter 5 focusing on A and C elements is published in

the SSCI-index journal: *Geoheritage* on 16 December 2021 under the title *Developing culturally effective strategies for Chinese to English geotourism translation by corpus-based interdisciplinary translation analysis.* Chapter 6 focuses on the B element, and is published in SSCI-indexed journal: *Journal of Sustainable Tourism* under the title *Effective Chinese to English biotic interpretation in ecotourism and geotourism destinations: A corpus-based interdisciplinary study.* In Chapter 7, I validate the effectiveness of the SSC model formed in Chapter 4 and the taxonomy of translation strategies for the ABC elements in geotourism built in Chapters 5 and 6. This chapter entitled *A New Approach to Applying Geotourism Interpretation*, is currently under minor revision for publication in the SSCI-indexed journal: *Geoheritage*. All these four empirical chapters (4, 5, 6 and 7) are based on corpus-based quantitative and qualitative method along with the theoretical framework of Hu's Eco-Translatology.

Lastly, in Chapter 8, I revisit the motivation of my project through each step of my research, and show how the research aims align with the goals of geotoutism translation and the need for a systematic approach to efficient geotourism translation. Furthermore, in this chapter, I demonstrate the link between the empirical findings and the benchmarking model built on the taxonomy of effective translation strategies for the ABC elements in geotourism. This chapters also contains a detailed discussion of my main research contributions to geotourism, and the research's methodological innovations, and how they both serve the various stakeholders in this emerging field of geotourism translation and corpus linguistics, itself. I conclude the chapter by addressing the pragmatic challenges encountered in my project, the existing research limitations of it, and by proposing potential avenues for future study to further enhance the professionalism of geotourism translation.

By submitting my thesis in an alternative format, I have adhered to the regulations of PhD theses in alternative formats which are: 1) to write three to four publishable peer-reviewed papers related to the PhD topic; 2) to be the first author of published peer-reviewed papers; and 3) show originality. My thesis constitutes a body of materials containing a coherent and continuous thesis, rather than a series of disconnected chapters and publishable papers. I am consistently positioned as first author or designated corresponding author in these publications, on the basis I solely performed the data processing and data analysis. Moreover, I independently authored the five published articles (Chapters 2, 4, 5, 6 and 7) and carried out revisions based on the comments received from peer-reviewed journals. Thus, the work that I present as original research, in this thesis, is indeed my own. Other collaborators include: Dr. David Wei Dai, a linguistics lecturer at UCL; Dr. Young Ng, a geologist at the Geological Society of Australia; Fangzhou (Noah) Zhu, a linguistics PhD candidate from Lancaster University; and Ruixue (Rachel) Wu, a linguistics PhD candidate from Leiden University. The help I received from them was on format aspects such as the structure of articles, semantic aspects such as coherence of my English language, and background knowledge such as scientific expertise in the field of geotourism. I have listed their specific contributions in the '**Author Contribution(s)**' section at the end of each published paper, as well as in the 'authorship statement' section in this thesis.

The reason that this thesis is submitted in an alternative format is that it facilitates the coherence of the larger project and speeds up the usability of individual findings. Firstly, it has enabled a variety of academic viewpoints into my research by allowing access to various types of scholarly journals and subsequent reviewer comments. This means that I have benefitted from multiple rounds of positive revision prior to the final completion of my thesis. The reviewers for the manuscripts provided multi-disciplinary comments that enabled a fuller coverage of

content and audience base for my papers, including the fields of corpus linguistics, translation theory, and geotourism research. Moreover, adopting an alternative format for my thesis strengthened, rather than weakened, the combined coherence and contribution of my individual papers. As mentioned in the previous section, each of the publications alone addresses one aspect of the issue, especially when it comes to covering all three of the ABC elements (i.e., it was published as two separate papers). All five publications together weave into a coherent translation system with the benchmarking model, contributing directly to the field of geotourism translation, and can be readily adopted into the practice in the field.

Chapter 2: Literature Review – Strategies and Problems in Geotourism Interpretation: A Comprehensive Literature Review of an Interdisciplinary Chinese to English Translation (*International Journal of Geoheritage and Parks*)

ABSTRACT

The steady growth of geotourism is increasing the demand for geotourism translation. Because in China geotourism is implemented mainly on the basis of geoparks and this study is Chinese to English (C-E) language based, this review uses Chinese UNESCO Global geopark data to explore the current status of geotourism translation. This comprehensive literature review has five aspects: (1) tourism translation; (2) the conceptual debate about translation strategies, methods, techniques, and procedures; (3) recent advances in corpus-based translation studies (CTS or CBTS); (4) the application of a theoretical framework, Hu's Eco-translatology, in the translation studies; and (5) evidence of the current status of geotourism translation. As a result of this review, two research gaps were identified: (1) the absence of systematic geotourism translation publications; and (2) the absence of systematic translation and interpretation model for geopark data. Therefore, to fill these gaps, a project is proposed: *Effective Chinese to English Geotourism Translation and Interpretation: An Interdisciplinary Corpus-based Case Study in Geoparks*. Furthermore, completion of this project will provide an analytical and theoretical framework, necessary to guide further research and pragmatic application of C-E geotourism translations or even English to Chinese (E-C) geotourism translations.

Keywords: geotourism; UNESCO Chinese geoparks; corpus-based translation studies; Eco-translatology

1. Introduction

In essence, geotourism is a specialised field of tourism, aligned to meet the objectives of environmental conservation which targets the key goal of public education for preserving geoheritage. However, the following definition by Newsome and Dowling (2018) helpfully distinguishes geotourism from geoheritage:

> *'Geoheritage refers to the elements of the Earth that humans value, whereas geotourism is a* [wider] *type of tourism that is based on some aspects of the Earth's geological and/or geomorphological heritage.'*

As a new concept and global phenomenon within tourism, geotourism has quickly attracted the attention of geologists and geotourists around the world (Dowling, 2013). Chinese geologists have published some works such as *The Principles of Geotourism* (2015) and *Dictionary of Geotourism* (2019) by Chen et al., and *Timeless Oceania* (2021) by Ng and Li. Geotourism, has been defined from two different standpoints: (1) geological or geomorphological (Hose, 1995 and 1996; Joyce, 2006; Newsome and Dowling, 2010) and (2) geographical (National Geographic, 2003). For the purposes of this research, the Geological Society of Australia (GSA, 2015) definition is used which succinctly describes it:

> '*As holistic nature-based tourism focusing on an area's geology and landscape as the basis for providing visitor engagement, learning and enjoyment.'*

Previous literature is focused on systemising geotourism rather than addressing the failures and inconsistencies in translation that have already been found in C-E geotourism. Both Chinese scholars and foreign scholars have conducted systematic research on geotourism based on Dowling's (2013) ABC (Abiotic, Biotic and Cultural elements) approach. For example, Chen (2013, 2015 and 2020), Ng (2015, 2020 and 2021), Dowling (2013, 2015 and 2018), Newsome (2013 and 2018), Hose (2020) and Coghlan (2021) focus on geology, geomorphology and ecotourism. However, none of these scholars have published any literature on C-E geotourism translation based on ABC. Meanwhile Li, Wu and Ng (2022) argue the rapid growth of geotourism itself demands attention to the quality of geotourism interpretation. This current neglect is serious for two reasons. First, it is allowing geotourism to fall into disrepute for reliability in communicating data and second, it is hindering the growth of geotourism research itself. Thus, this new research is proposed: *Effective Chinese to English Geotourism Translation and Interpretation: An Interdisciplinary Corpus-based Case Study in Geoparks* to fill the research gap in C-E geotourism translation to meet the needs of geotourism development. This project aims to optimise the quality of (C-E) geotourism interpretation and translation and at the same time boost the growth of geotourism research.

The specific data (corpora) for this project are derived from a selection of C-E translations used in UNESCO geoparks recognised in China. As for method, corpus will be employed to conduct corpus analysis quantitatively and qualitatively. Meanwhile, a theoretical framework is also utilised because of the challenge of cultural difference between the two languages. This framework is the Eco-translatology theory, first proposed by Hu in 2001 and later developed and widely applied in various translation fields. Register Theory,[1] proposed by Halliday

[1] Register theory includes three parameters: field, tenor and mode. These three parameters were defined by Halliday (1985). Field means the subject matter or topic being developed in a particular situation. Tenor means the roles and relationships being enacted in a particular situation. Mode refers to the channel of communication being used in a particular situation such as oral, written and visual. Translation principles of any special genre can be concluded based on this theory.

(1985) will also be used to simplify technical aspects of geotourism translation. An SSC (semantic, style and cultural equivalence) model of geotourism translation will be built for benchmarking purposes. New translation versions will be optimised using the wholistic principles of Eco-translatology. Finally, a taxonomy of geotourism translation strategies, in ABC categories, will be outlined.

As a result of this pioneer research, it is intended the SSC model could build a standard of criteria to assess the quality of ongoing geotourism translation as well as further research. Above all, this research specifically aims to increase the quality of C-E translation which will effectively realise geotourism's goals of engagement, learning and enjoyment.

In view of the absence of direct previous literature, this review is intended to support the choice of corpus and Eco-translatology. The literature using these methods includes tourism translation, the development and application of corpus linguistics (corpus-based method) and Hu's Eco-translatology theory (2001). Appendix A, explaining linguistics terms, will be helpful for non-specialists.

2. Data Sources and Methods

A comprehensive search of literature and data, as well as assessment and analysis of that literature, will produce systematic results on which to build recommendations for further translation of geotourism and limit potential bias from individualistic sources. In accordance with this method, Petticrew and Roberts (2008) emphasise these advantages as well as point to it as a means of identifying research gaps. Thus, this review aims to integrate current information and help guide future study.

To build a comprehensive picture, this review is divided into three processes: (1) search, (2) evaluation and (3) classification of related literature. Related literature was extensively searched on the wide topic of culturally effective strategies for C-E geotourism translation. Key terms were determined to be: geotourism, geotourism translation, translation strategy, corpus linguistics (CL), CTS, and Eco-translatology (see article title, abstract, keywords and topic headings). The key terms were used in the Web of Science (SSCI, SCI, and A&HCI), Scopus, Google Scholar and China National Knowledge Infrastructure (CNKI) websites.

In regards to the geotourism and tourism search, Hose (1996) builds a foundational definition of geotourism as a new type of science which is embedded in tourism, based on the geological environment. Therefore, noting the connection he makes, it was decided the key phrase, 'tourism translation', should also be considered in the search process. Geoparks and geotrails are subcategories of geotourism and therefore, these two terms are also added. The search was undertaken from February to May, 2021, with a total of 4272 results. The website breakdown was: Web of Science 407, Scopus 106, Google Scholar 71, CNKI 3688. All these papers were used to evaluate the various relevant research areas: current CTS; methodology of CL in translation studies; translation strategy, translation methods, translation procedures and techniques; tourism translation; and Eco-translatology applied in translation studies. Corpus-based research methodology and translation theory of Eco-translatology by Hu (2001) are the main methods to be employed to determine the effective strategies.

As was noted, geotourism translation has no scholarly articles yet written. Therefore, it is particularly important to obtain raw data and information through field research. Original data and information came from four channels (1) GSA; (2) brochures, pamphlets, interpretative panels, signs, display boards, and museum displays particularly

at geopark entrances, visitor centers, and museums in six[2] out of the 41 Chinese geoparks approved by UNESCO; (3) four recently published Chinese English double translation geopark tourist guidebooks (2017, 2018, 2020); and (4) geology guidebooks published in Chinese (2007b) and English (2007a) by the Hong Kong Geopark. These data were used to assess current geotourism translation.

After the search process was complete, the 4272 articles were evaluated using five criteria: (1) single-blind peer review (CBPR) or double-blind peer review (DBPR) papers; (2) those without cross repetition; (3) those closely related to research purposes; (4) those meeting the key information of research questions; and (5) Chinese literature from 15 influential Chinese linguistics and translation journals[3], and postgraduate theses. Firstly, 2491 papers that were not CBPR or DBPR articles, were directly deleted. Secondly, the 1781 remaining articles were scanned and 933 deleted for cross repetition. Then, the abstracts and conclusions of these 848 papers were skimmed and 541 papers were excluded that were insufficiently aligned to the research purposes. After a more careful reading, the contents of nine articles were eliminated as they did not align with the subject matter of research questions. Finally, 36 books, book chapters, and dictionaries of geotourism were added as working references to the 298 relevant remaining articles, and with the raw data and information from six Chinese geoparks, and four previously published Chinese English double translation geopark tourist guidebooks, the total of 344 working bibliographies were analysed to build the current literature review. The detailed evaluation process is shown in Fig. 1:

[2] Leiqiong UNESCO Global Geopark, Taishan UNESCO Global Geopark, Danxiashan UNESCO Global Geopark, Wudalianchi UNESCO Global Geopark, Yandangshan UNESCO Global Geopark, and Mount Kunlun UNESCO Global Geopark

[3] The 15 influential Chinese journals on Eco-translatology are:《中国翻译》(*Chinese Translators Journal*),《外国语》(*Journal of Foreign Languages*),《上海翻译》(*Shanghai Journal of Translators*),《中国科技翻译》(*Chinese Science & Technology Translators Journal*),《外语研究》(*Foreign Languages Research*),《外语与外语教学》(*Foreign Languages and Their Teaching*),《当代外语研究》(*Compemporary Foreign Languages Studies*),《外语教学与研究》(*Foreign Language Teaching and Research*),《中国外语》(*Foreign Languages in China*),《外国语文》(*Foreign Language and Literature*),《山东外语教学》(*Shandong Foreign Language Teaching*),《外语学刊》(*Foreign Language Research*),《外语界》(*Foreign Language World*),《外语电化教学》(*Technology Enhanced Foreign Language Education*), and《外语教学》(*Foreign Language Education*)

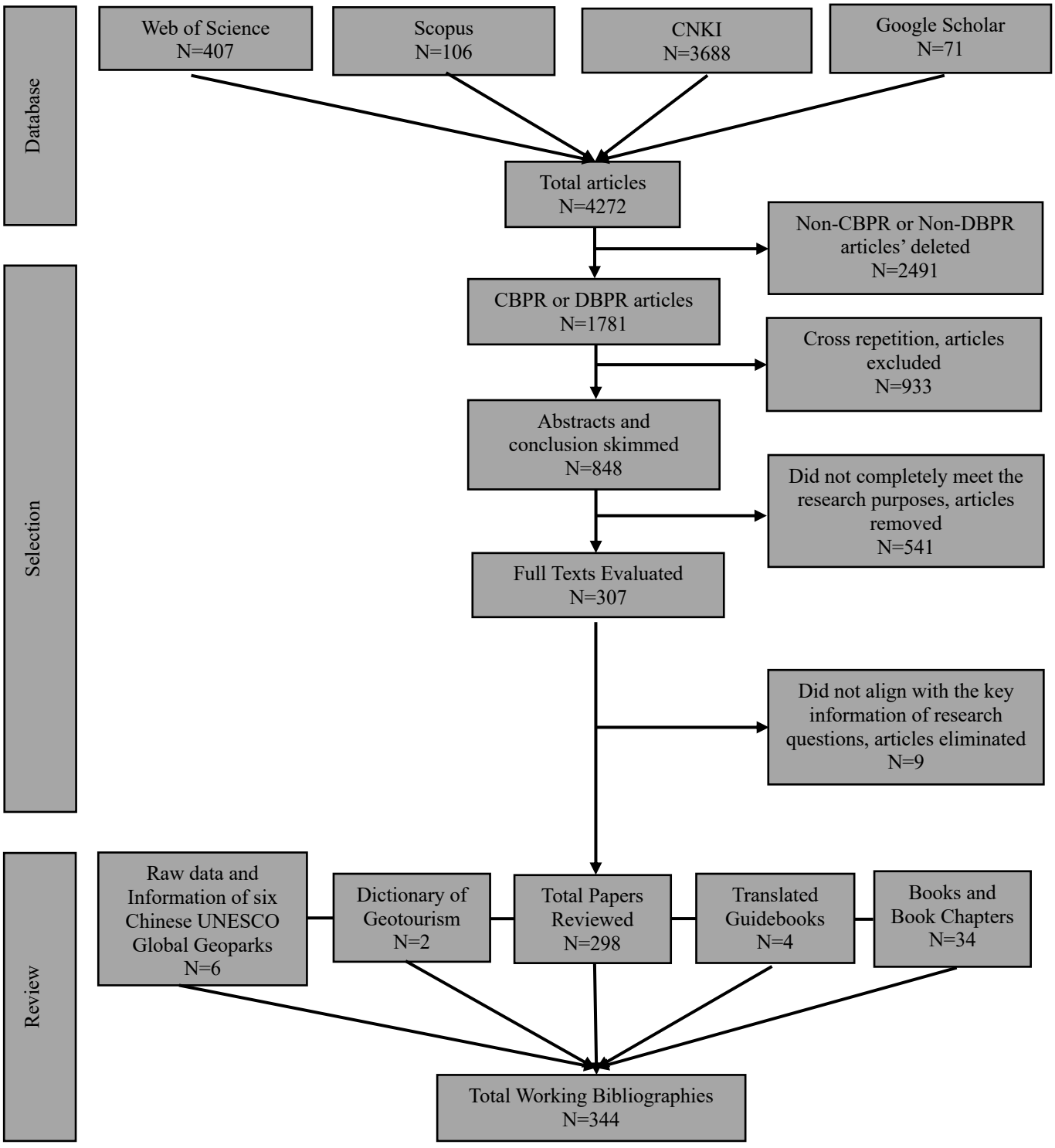

Fig. 1. Flow chart of assessing literature process

In the third process, these selected working bibliographies (journal articles, books, book chapters, dictionaries, and original data and information) were further classified according to author, date, publication, journal name and content via a Word Table to clearly flag the categories. Finally, the evaluated texts were all classified into the five following parts according to the research purpose and literature review structure: (1) Main features of various related literature; (2) Review of tourism translation research; (3) Issues about translation strategies, methods,

techniques and procedures; (4) Advances and applications of CTS; (4) Hu's Eco-translatology theory applied in other translation areas; and (5) Summary of current geotourism translation research.

All selected materials were either in English or Chinese. This is because in academic study, English is most prolific although this study data is China based. Moreover, Eco-translatology is a native Chinese translation theory, and its generation, growth, and application in translation studies are mainly in Chinese. To avoid any potential bias, only CBPR or CDPR journal articles in the Chinese and English literature were chosen such as *The Journal of Specialised Translation*, and *Chinese Translators Journal*. Similarly, only established publishers were used such as Springer, and Edinburgh University Press. Esteemed scholars (geoscientists/geologists/geotourism scholars) and their key books and papers were also selected, such as Hose (*Geotourism, or can tourists become casual rock hounds?*, 1996), Newsome and Dowling (*Geotourism: The tourism of geology and landscape*, 2010), and Ng (*Dictionary of Geotourism*, 2019); linguists: House (*Using translation and parallel text corpora to investigate the influence of global English on textual norms in other language*, 2011) as well as McEnery and Wilson (*Corpus Linguistics*, 1996); translation scholars: Baker (*In other words: A coursebook on translation*, 1992) and Newmark (*A Textbook of translation*, 1988). Finally, only published literature within the last five years was reviewed to keep within current issues of the field.

3. Results

3.1 Main features of various related literature

The bar chart of Fig. 2 illustrates the rate of publication of relevant literature in this review. To illustrate research development, this bar chart pattern can be interpreted in three stages: before 2007, from 2007 to 2015 and from 2016 to 2021 (to beginning of June). In the first period before 2007, many translation theories, and new research like CL, corpus-based methodology and some taxonomies of translation strategies were produced and advanced by eminent translation scholars and linguists. At the same time, the concept of geotourism was proposed and developed by Hose (1995, 1996), Joyce (2006), Newsome and Dowling (2010) as well as GSA (2015). Geotourism was taking shape and becoming widely accepted by geologists and geoscientists. From 2007 to 2014, corpus-based method was being more widely applied and the paradigm of Eco-translatology was shaped. They were both applied in translation studies. Therefore, at this stage, research literature increased rapidly and maintained a high level. In the final stage, the application of Hu's Eco-translatology, corpus-based research methodology and translation strategy were systematically reviewed in translation studies.

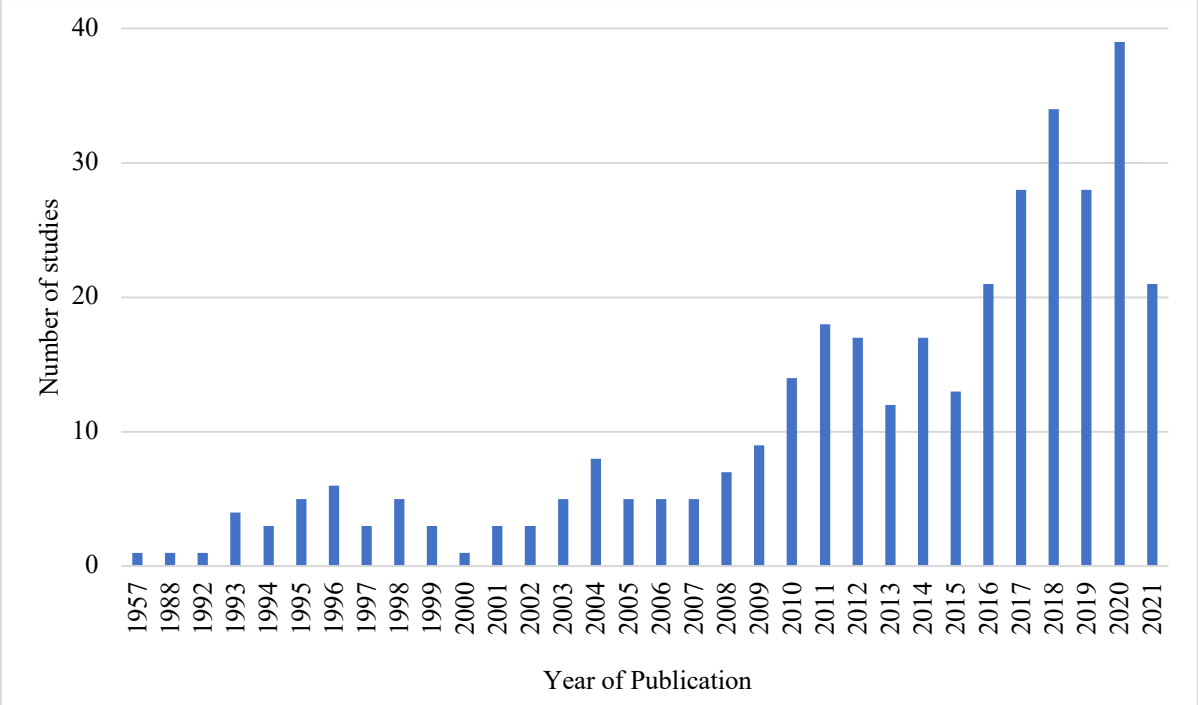

Fig. 2. Total number reviewed of working bibliographies by year of publication (Before 2007 to 2021 - beginning of June)

The literature for this review was based on approximately 350 sources that cover a broad variety of disciplines (see Data 1 in Supplementary Material Section). The largest proportion of literature (66.6%) focuses on Linguistics and Translation Studies, followed by smaller categories of geotourism (11.9%), tourism (9.6%) and geoheritage (7.0%). The discipline of geography accounts for the smallest proportion, which was 0.3%. A total of less than 5.0% of the literature focuses on geology (2.0%), original data and information (1.7%), and earth sciences (0.9%).

These works of literature can be classified into a variety of groups according to their core study focus. However, these categories usually overlap and are interrelated since the same publication frequently discusses multiple topics. Table 1 demonstrates the percentage of each of the research topics covered in the reviewed literature. According to the results of analysis, corpus-based methodology leads the way as the foremost research method in the field of translation studies (26.2%), followed by Eco-translatology and translation strategies (25.3%); translation thoughts and translation theories (17.2%), CL (11.3%) and tourism and its translation (7.8%). As regards the object of research, the total of 42 (12.2%) pieces of literature focus on geotourism, these can be broken down into two results: geoparks (6.7%) and new concepts of geotourism (5.5%). Therefore, it can be seen no literature is systematically conducted on geotourism translation. The literature, original data and information in the geotourism field mainly focuses on the concept of geotourism, translations of geopark guidebooks, public signs and panels rather than translation of the data details in geotourism, ABC elements.

Table 2, the type of data collected in the literature, has an important bearing in Table 3, the collection method. Collection of primary data was carried out for 72.9% of literature, while less than a quarter relied on secondary data (23.7%), while very few combined both primary and secondary data for their research (3.4%). Looking more closely at the use of primary data, it mainly comes from case studies (52.3%) (to exam corpus and Eco-translatology applied in translation studies), while only a small proportion used field research (8.7%) (original

data and information in UNESCO Global Geoparks), and even fewer (0.8%), interviews (with managers and staff of geoparks and geotourists) and surveys (of local populations, and visitors). The secondary data employed in literature was obtained via biographic research and literature (the generation, growth and formation of translation thoughts and theory), documents and records (original data and information offered by GSA), and analysis of webpages of geoparks. Finally, concerning broad research method type, the data in this literature was dominantly a combination of qualitative and quantitative (84.9%) with only 8.5% qualitative and 6.6% purely quantitative.

Table 1. Research topics covered in the reviewed literature

Research Topic	No.	Percentage
CTS	90	26.2%
Eco-translatology and strategies applied in translation studies	87	25.3%
Translation thoughts, and translation theories	59	17.2%
CL	39	11.3%
Tourism and its translation	27	7.8%
Geoparks	23	6.7%
New concepts of geotourism	19	5.5%
Total	344	100%

Table 2. Type of data collected in the literature

Data	No.	Percentage	Data Analysis	No.	Percentage
Primary	231	72.9%	Qualitative	27	8.5%
Secondary	75	23.7%	Quantitative	21	6.6%
Both	11	3.4%	Combination	269	84.9%
Total:	317	100%	Total:	317	100%

Table 3. Data collection methodologies applied in the reviewed researches

Data Collection Methodologies	No.	Percentage
Case study	203	52.3%
Biographic research/Literature review	76	19.5%
Field research	34	8.7%
Documents and records	27	6.9%
Interviews	19	4.9%
Webpage	7	1.8%
Desk research	6	1.5%
Survey	3	0.8%
Other	14	3.6%

3.2 Research on tourism translation

Initially, it would be beneficial because of the formative relationship to tourism, to compare tourism research. Newsome and Dowling (2010), global pioneers in various kinds of tourism research, compare the relationship between geotourism and other types of tourism. They point out ecotourism is related to biotic (plants and animals) which is embedded in geotourism. Therefore, geologists can often mention ecotourism when they research

geotourism. These authors further claim, in fact, one in three geologists discuss geotourism. Figure 3 analyses the related fields of tourism and uses solid lines and dotted lines to demonstrate the strength of connection between fields. Thicker lines represent stronger relationships between fields. As can be seen from this diagram, the connection between geotourism and ecotourism is the strongest.

However, some tourism shows many strong contrasts to geotourism. Fundamentally, geotourism is about appreciating geological features and phenomena as well as its associated all the biological and cultural characteristics. This opinion is confirmed by Dowling in 2013 who states geotourism starts from understanding the abiotical environment and building more understanding of the biological environment of plants and animals, as well as the past and present cultural environment of human beings. A second major difference to tourism is travelling to a specific destination, to understand and appreciate, not a sightseeing holiday which could include an unlimited target list. Thirdly, geotourism attempts to develop a sense of identity of an area or region (Briggs, 2020). Therefore, travelling to a destination in geotourism has a higher meaning and is not just for leisure. It is helpful to be aware of these significant differences when looking at tourism translation research and its objectives.

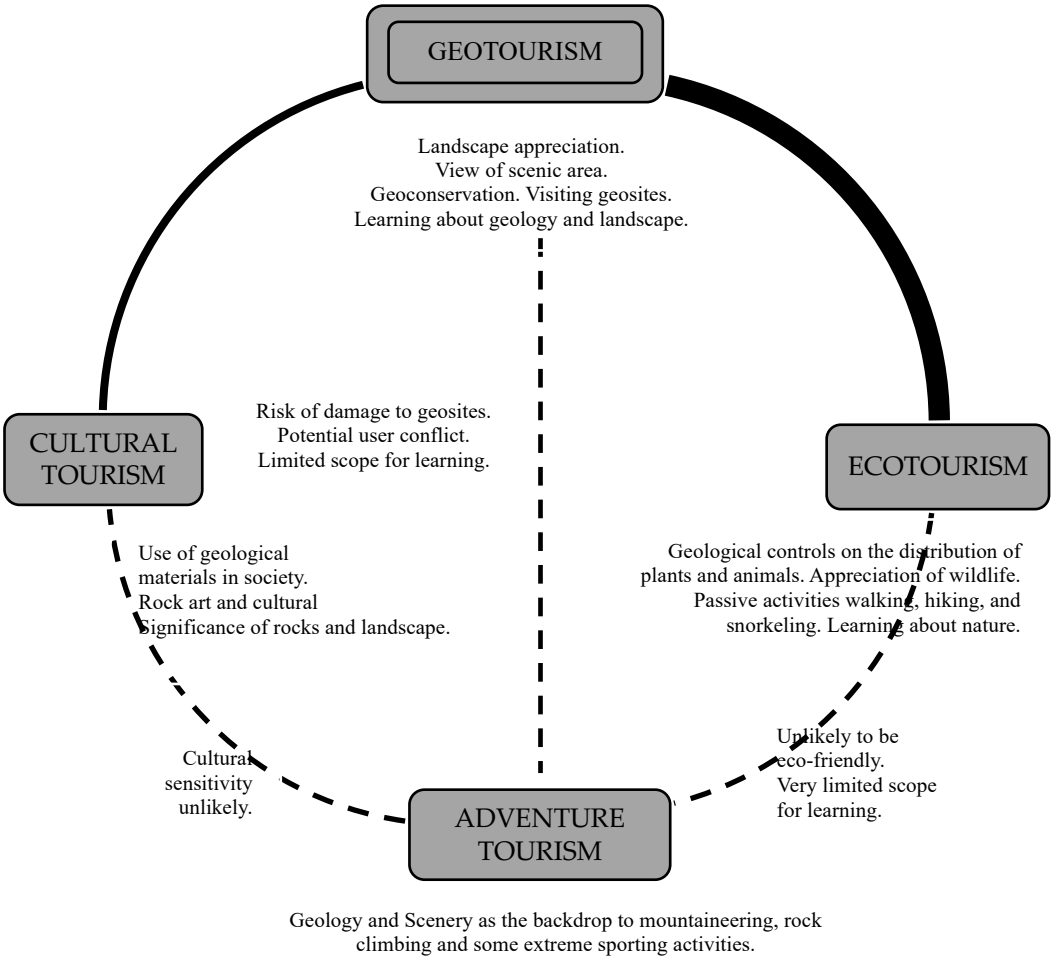

Fig. 3. The relationship between geotourism and other types of tourism (Dowling, 2013)

Tourism translation can include translation of public signs, tourism brochures, guidebooks, tourism discourse, menus, tourism websites and tourism promotional materials (TPMs). However, in the past five years, research on tourism translation has mainly focused on rendering restaurant menus, tourism websites, and TPMs. Firstly, the growth of digital services has meant tourism websites can directly provide tourists with regional tourism

information, this brings a high significance to the power of high-quality translation as it can attract more tourists/money and promote regional tourism. Conversely, Novozhilova et al. (2018) show hotels lose tourists and finance through dysfunctional translation. Taking hotel reservation websites as examples, Novozhilova et al. collect English, French and Russian translations from official hotel websites. They apply critical discourse analysis (CDA) and find grammar, spelling and other issues. These translation problems cause the source text (ST) to lose pragmatic and communicative function. These authors recommend changing sentence structure, loan translation and generalisation strategies. Later Cowan (2019) advances website translation by paying attention to deep 'out-of-awareness' cultural differences in translating. This effect delivers awkward expressions that alienate potential clients. Similarly, when Cowan analyses French wine tourist websites from French to English, she finds poor cross-cultural application. This author applies Hall's anthropological iceberg model and Hofsted's cultural dimensions. She concludes that localised tourism websites are likely to be more successful to engage the UK market.

Similarly, tourism researchers have found menu translation can influence customer satisfaction and the tourist economy. Fuentes-Lique (2016) analyses the quality of restaurant menu translations in Andalusia, Southern Spain, and makes some suggestions for better rendering of menus. He uses a mistake classification framework, combined with a short questionnaire for qualified menu translators. Li (2019) researches translations of ingredients and cooking methods for culturally distinctive Chinese dishes and finds reliance on image to supplement translation is deficient. She concludes Pinyin (Chinese Phonetic Alphabet) as an intralingual translation menu is attractive to readers. She claims interlingual interpretation can clarify the ingredients, cooking methods and cultural particularities of a dish. This author applies CL to conduct qualitative and quantitative analysis to compare the 3000 translations from China, Taiwan and one other location. Li finds there are many translation problems like omission and inconsistency. This author uses Jacobson's tripartite theory to improve the quality of menu translation. When Petrc et al. (2019) study the menu translations (French to English) in Kvarner, Croatia, they find translation mistakes like misspelling, capital letters, incomprehensibility and inconsistency. They propose translation improvement to promote customer satisfaction.

TPMs also have a need for quality translation in order to be effective. As experts in tourism translation, Sulaiman and Wilson (2018) have advanced the study of TPMs translation. Firstly, they put forward a cultural-conceptual translation (CCT) model. Two key ideas were embedded in this model which are cultural conceptualisation (CC) and destination image (DI). They state CC is the key expression of 'Silent' or 'Unconscious' culture while the concept of DI is considered an essential factor in tourism promotion and advertising. They claim that the effectiveness of TMPs translation depends on the rebuilding of the 'favorable' image of the DI which in turn is based on the CC of the target audience (TA). In their book, *Translation and Tourism: Strategies for Effective Cross-Cultural Promotion* (Sulaiman & Wilson, 2019) analysis of TPMs translation from English to Malay demonstrates the TT of Malay TPMs fails to reconstruct an attractive DI for Malay TA. This is mainly because it fails to solve the CC differences between English speaking countries and Malay culture. (It is interesting to note their outcomes received an optimistic response from many Malay TAs.) Therefore, they conclude that the CCT model is more likely to be a potential tool for enhancing the quality of TPMs translation.

3.3 Debate about translation strategies, methods, techniques, and procedures

In translation studies, scholars have long debated the application of literal translation and free translation. However, Vinay and Darbelnet (2004) point out the problem is not that simple. They claim literal translation is only one of three different basic procedures in direct translation. When Shuttleworth and Cowie (2014) published their *Dictionary of Translation Studies* they highlighted free translation and literal translation are just two of the many 'strategies' applied by translators. van Doorslaer (2007) develops this idea and shapes his own map of 'strategies' adding 'procedures' for them. Xiong (2014) takes the debate deeper by claiming literal translation is, in fact, a translation method based on foreignisation strategy, while free translation is based on domestication strategy. He uses Venuti's translation equivalent theory, to form a modal or system. Furthermore however, there is no agreement on the meaning of terms 'domestication' and 'foreignisation' by scholars. Venuti (1995), van Doorslaer (2007), and Xiong (2014) all share the same opinion that foreignisation and domestication are translation strategies. However, Gong's (2011) believes they can be methods as well as strategies. Labelling continues to be inconsistent across various studies as it is different over the range of translators. 'Naturalisation' is identified as a procedure by Newmark (1988), while van Doorslaer (2007) regards it as a strategy. Gottlieb (1992) proposes 'condensation' as an effective strategy for subtitling, but it is a procedure according to van Doorslaer (2007). Newmark (1988) treats 'synonymy' as a procedure, while Aixela (1996) proposes 'synonymy' is one of the strategies to translate cultural-specific items (CSIs). Qiu (1998) points out 'transliteration' is one of strategies to render CSIs, but it is regarded as a method based on foreignisation strategy in Xiong's modal (2014). Furthermore, there is an overlap of the use of terms for the same meaning. Aixela's (1996) uses 'deletion', Newmark (1988) 'omission' and van Doorslaer (2007) uses 'procedures' and Xiong (2014) 'technique'. 'Transposition' in Vinay and Darbelnet's modal (2004) is the same as 'word shift' in Xiong's technique (2014). Therefore, for the purposes of this research, a hypothesis statement has been shaped to determine whether 'strategy', 'method', 'technique' and 'procedure' can be equivalently cross used in translation studies.

More examples of term overlap can be found in subtitling translation. Abdelaal (2019) employs Pedersen's (2005) typology and his quality assessment model (2017) to qualitatively analyse the strategies and translation quality of culture-bound words of subtitling from English to Arabic language. In the 1999 American film *American Pie,* she points out omission strategy is more effective to translate sexual swear words from English to Arabic, because in Arabic culture, these terms are taboo. So 'omission' here is regarded as a strategy. However, it is classified as a procedure by Newmark (1988) and van Doorslaer (2007). Baker (1992) terms it as a strategy and Xiong (2014) as a technique. In *Talent or Strategies: Y. R. Chao's Translation Philosophy Reflected in the Alice Duology*, Wang (2020) explicitly states literal translation and idiomatic translation are both translation strategies. He takes '游客止步' as an example, giving two idiomatic translations which are 'Tourists Should Stop Their Steps' and 'Staff Only'. He concludes 'Staff Only' is easier to understand than the former, literal translation. In contrast, idiomatic translation is regarded by Vinay and Darbelnet (2004) as one of four procedures in oblique translation. Thus, across several genres: debate about the terminology and definition of terms can be exemplified to exam the hypothesis statement that the four translation concepts (strategy, method, technique and procedure) can be applied crosswise in translation studies.

3.4 Advances in CTS

CTS has advanced through many stages, since it emerged on the tails of technical linguistic development. Linguistics itself only formed as a discipline in the 1930s. The systematic study of linguistics developed more

technical branches in the 1950s and 1960s based on scientific research methods. In the 1970s, with the progress of computer hardware and software, large-scale storage of electronic texts was realised. This enabled many corpora to be built and CL to be employed as a research methodology. CL involves the analysis of a collection or a body of words (McEnery, & Wilson, 1996). The word *corpus* is from the Latin word for 'body' and the Latin plural, *corpora,* is used. McEnery and Wilson (1996) further explain the body of data is most likely to be composed of collections of printed or existing language data. Before the 1990s, corpus had not been used in the field of translation studies, instead from the 1980s it was used as a tool for language comparison and translation criticism. In 1996 in original type research, McEnery and Wilson began to apply parallel aligned corpus data to machine translation. Since then, CL in translation studies has been applied continuously. CTS research has meant there has been a marked shift in linguistics from the analysis of the ST to the analysis of the TT that is equivalent and accurate, so that the TT becomes an independent text. The implication of this shift has moved the focus to the importance of the TTs in the receiving culture. According to Biel (2008), this shift, from the ST to the TT, is regarded by Pym (2004) as a 'paradigm shift' in translation studies.

CTS now plays an important role in translation studies and has attracted attention from translation theory and translation scholars. The outstanding representatives of the further development in CTS are Mona Baker, Sara Laviosa, Juliane House, Kefei Wang and Richard Xiao. Baker is regarded as the pioneer of CL in translation studies. In 1993, Baker published, *Corpus Linguistics and Translation Studies: Implications and Applications,* advocating the use of CL and marking the birth of the CTS paradigm. Meanwhile, she contributed significantly to translation theory, pointing out the influence of translation on language (polysystem theory), the importance of recording translation methods (descriptive translation studies) and the central role of the translator's purpose (Skopos Theory). She maintained CL in translation studies would by its very nature of including these aspects, contribute to the advance of translation. Also, she predicts that the emergence of large corpora of original and translated texts and the development of relevant research methods would, by its broad dimension, enable translation scholars to discover the communicative nature of translated texts. In later research (1996), she discusses three basic aspects of CTS: (1) the relationship between CTS and target language (TL); (2) the unique methodology applied in CTS; (3) the potential of CTS. Finally, Baker claims that the ultimate goal of CTS is to explore the causes and driving factors of uniformity in the TT, which may be related to the status of the ST in the target culture. As Baker (1999) predicts this has become a central issue. At present, translation scholars are discussing the influence of the various strategies used by translators on the TT. In alignment with her claims, Baker (1999) emphasises that corpus research should focus on the interrelationship of three main aspects of translation process: (1) public expectation; (2) theorist's hypothesis or proposition; and (3) professional translators' practice.

In the 21st century, the issue of influences on translation has continued to be a key focus of research. Laviosa (2002) points out in the initial stages of corpus design, the selection of external, temporary, and the TL system means translation is heavily influenced by descriptive translation theory. Laviosa (2002) analyses the characteristics of CTS and finds: (1) The elements of theory, description, method and application are integrated with each other, but of equal importance (2) The status of competing research methods is very important when comparing translation outcomes. Traditionally in translation research, translation standard models limit research outcomes and in turn limit building effective theories, however in CTS, construction of data for research builds standard translation references and thereby builds more accurate theories. Therefore, she claims CTS describes

the process of translation which in turn will advance the development of descriptive translation studies and translation studies as a whole. House (2011) breaks the previous single corpus investigation mode, by creating a composite corpus structure of: English ST, German translated text and German ST. Using the method of abductive reasoning, she investigates the changes between languages through a written language translation from a diachronic perspective. According to House's research results, there are three hypotheses: (1) translation has influenced the change of German language and can be called a 'regulator'; (2) translation reflects the change of the German language but is not the 'initiator'; (3) the process of translation resists change and is the 'umbrella' (protection) of culture. In contrast, in the specialist register of science House et al. (2012) explain it is clear that 'in the scientific field, the influence of translation on German from English is a marginal phenomenon.' (Kranich, House, & Bechor). Furthermore, they put forward a new research paradigm for corpus analysis that combines analytical-nomology and explorative-interpretation. They predict this research paradigm is likely to become a new trend in the field of CTS.

In Fig. 4, there is a diagram of the overall framework for translation proposed by Holmes (Tourny, 1995). This shows a summary of the growth of awareness of influencing factors on translation. Besides the above, representative translation scholars, Wang and Xiao, have made special contributions to CL in Chinese English double translation research. According to Wang (2012), the construction of CL in translation studies system has both horizontal and vertical aspects: the horizontal refers to the construction of corpus related to translation, while the vertical refers to translation research related to corpus. Wang describes theoretical development by drawing a longitudinal outline of the paradigm of CTS, including theoretical research, descriptive research and applied research, as shown in the diagram below (Fig. 5). In this system, research is bidirectional. Therefore, description is the source of theory, and theory can provide guidance for description; description provides guidance for application, and application promotes description. Theory and application are connected through description as an intermediary. Xiao (2004, 2007, 2012), another translation scholar, has made a significant contribution to the construction of C-E/E-C parallel bilingual corpora (C-E/E-C PBC). He and McEnery (2004) have built the modern C-E/E-C PBC: The Lancaster Corpus of Mandarin Chinese (LCMC). This corpus is compiled in strict accordance with the mode of Freiburg-LOB Corpus of British English (FLOB), and its completion is helpful for comparative study of Chinese monolingual or C-E (E-C) and Chinese studies based on the corpus. Later, Xiao (2004) employs the three corpora, LCMC, FLOB and Freiburg-Brown Corpus of American English (Frown) to describe and compare the stylistic distribution of Chinese, British English and American English. He found that the common feature of these three languages is that stylistic markers appear more frequently in narrative style than in declarative style. The difference of body marks between British and American English is not as obvious as that between Chinese and English. Later Xiao, as a joint researcher with Tao, was involved in the construction of UCLA Written Chinese Corpus. They completed the first (2007) and the second (2012) editions of UCLA Written Chinese Corpus. This corpus is a scholarly complement to LCMC.

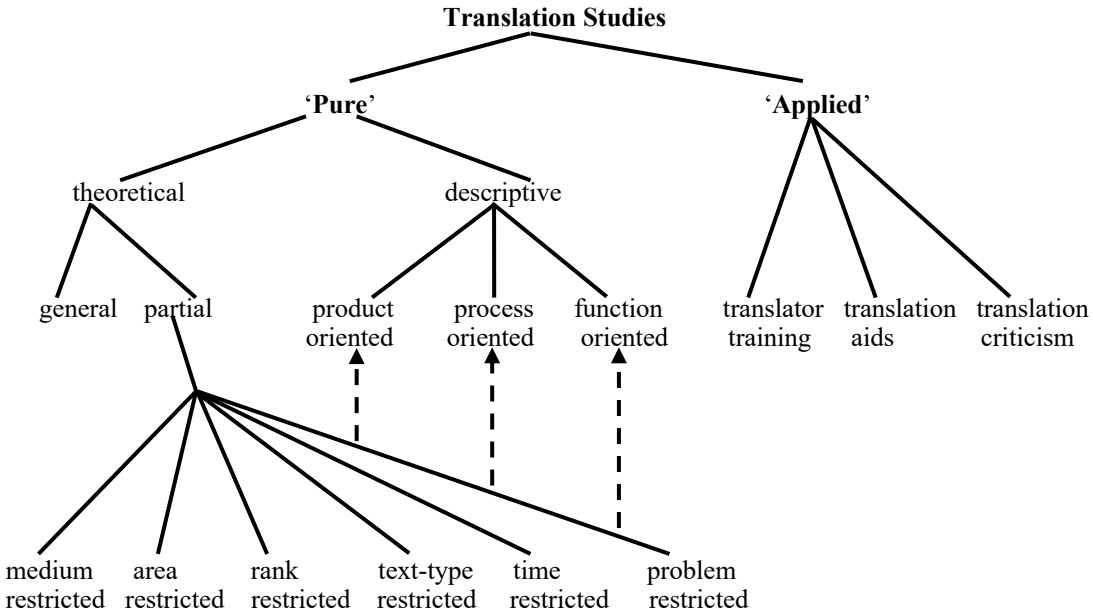

Fig. 4. Holmes' 'map' of translation studies (Tourny, 1995)

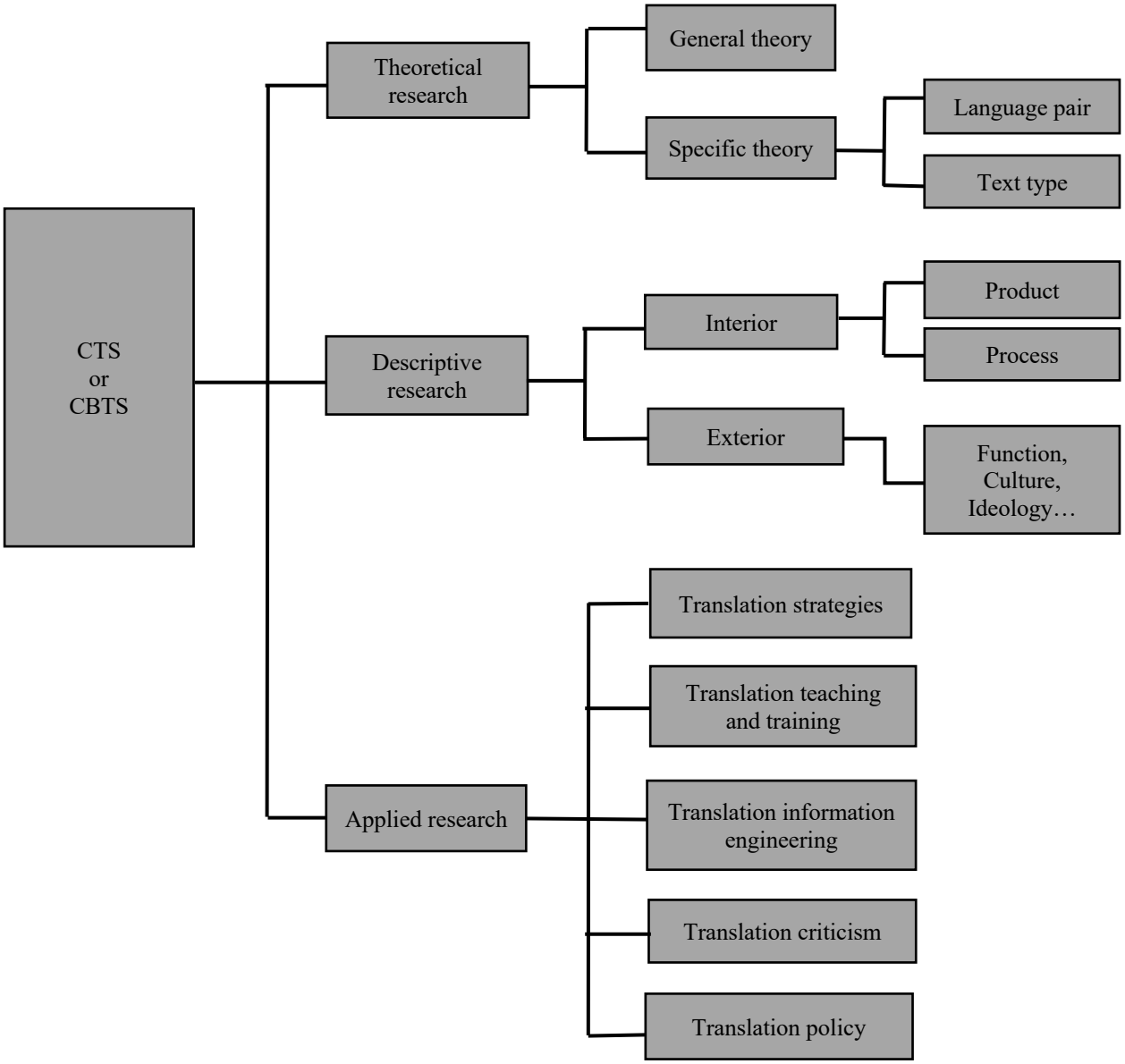

Fig. 5. A paradigm of CTS (Wang, 2012)

3.4.1 Application of corpus methods to the study of translation

As a new branch and research paradigm of translation studies, CTS has birthed great capabilities. CL has enabled the small-scale, manual research on language and text types of traditional translation to be transformed into a rapid, large-scale, systematic, target text (TT) research. The advantages of corpus-based method are (1) speed and accurate in complex analysis by computer; (2) large scale of register, text, and language information; (3) and functional comprehensive results. Furthermore, as a method of translation studies, it shows strong advantages in cultural approach and descriptive method. Corpus not only changes the quantity but the quality of research in translation studies. CTS develops the original direct and somewhat vague concepts of translation studies into clear, detailed and operable theoretical hypotheses. The scattered and incomplete findings of previous studies are marshalled into more consistent and abundant results (predicting the trend and considering the exceptions). Its capability enables CTS to capture patterns of social and cultural factors, such as the relative status of languages and literary genres. There are minor disadvantages, however, pointed out by Lavisoa (2002) who notes that the word/phrase concordance as an analysis tool cannot sometimes provide enough context, thus hindering the analysis of the whole text and/or semantic phenomenon. Further, this author draws attention to the fact that with CTS only one translated text is usually included from a ST, which hides an important aspect of translation phenomenon, that is, there may be different versions of the same ST word/phrase.

In recent years, the Corpus approach has been employed in many genres in translation studies, such as: literary translation, tourism translation (discussed in 3.2.), legal translation (LT), audiovisual translation (AVT), and political discourse translation (PDT); not to mention sub-genres such as International Economic Law (IEL), and business law (BL). Furthermore, rendering IEL has become a significant factor in fostering cross-cultural communication and in the modern global economy therefore, translation in this subgenre has developed a high profile and increased its importance. CTS shows itself a skillful tool in this area. Based on parallel corpus, Chen (2017) examines and discusses the feasibility of the translation of legal terms used in IEL at three linguistic levels: word level, syntactical level and discourse level especially in focusing on the influence of cultural elements. Then, Chen explores the application of corpus-based approach in interdisciplinary research by applying quantitative and qualitative analysis of the translation strategies of three non-linguistic aspects of IEL: law, economy and culture from the perspective of Chinese translators. She finally concludes that cultural elements in the non-linguistic factors have the greatest influence on IEL translation. This author recommends cultural factors need to be understood and transformed into clear communication in the TL. Chen's research can be compared to Medina's (2019). Medina (2019) points out in American BL, because of various geographical situations, and their diversity of existing entitlements, names are changed, and different degrees of equivalence are produced. This author takes Peru, a Spanish speaking country, as an example, and finds the use of terms is not equivalent. Medina proceeds to build a typology for the cause of the denominative variation, which was originally put forward by Freixa (2006), that is, she tests the existence of dialects and cognitive variations in American BL language compared with Peruvian BL language. It is found that some variations are limited to specific American states or specific kinds of business organisations and cannot be utilised interchangeably. This study enriches the research of legal translation studies (LTS) and provides a comprehensive methodology for translators to solve the problem of equivalence in

business documents. Both these CTS method studies have uncovered important practical translation challenges and offered strategies.

Secondly, Corpus approach has been applied in AVT. There are two sub-genres in AVT which are subtitling and dubbing. Soares's (2020) researches the simultaneous use of these two sub-genres in the movies, *Ice Age* (2002) and *Madagascar* (2005) in English and Portuguese fixed expressions. CTS analysis was used to show how domestication and foreignisation strategies can either destroy or strengthen the authentic relationship between dubbing and subtitling. This author's research concludes subtitling is more inclined to adopt foreignisation but not when it comes to fixed expressions (idiomatic usage). Translation deliberately deviates from them for the TL. Similarly, Pavesi (2018), claims corpus offers advantages in translation research for audiovisuals. Sandrelli (2020) adopts Ranzato's (2016) strategies for English to Italian dubbing of legal references in *The Good Wife,* an American courtroom drama TV series. The results show that the most frequently used strategies in corpus are functional equivalents, periphrases and calque strategies, but a mix of strategies are needed dubbing a foreign legal drama. Alexander's (2020) research of subtitling strategies of Extralinguistics Cultural-bound References (ECRs) finds the linguistic cultural elements are closely related to the original language (English) of an English courtroom drama (*Suits*). Meanwhile, some poor-quality translations of ECRs in *Suits* were assessed and improved by this author through Pedersen's (2017) FAR Model (a model to exam the quality of subtitling). This author summarises a framework of strategies in ECRs to support future subtitle translation. These examples show how CTS can be applied to new technologies which demand great quantitative detail and deep analysis to determine cultural and technical translation improvements.

The rise of China as a global player had demanded a new appraisal of Chinese political discourse translation (CPDT). Li and Xu (2018), Li and Zhu (2020), Li and Pan (2021) as well as Li and Hu (2021) use various corpora to shape different C-E parallel corpora and research CPDT. Li and Xu (2018) analyse translation of appraisal epithets in graduation ceremonies. By this means, they aimed to examine a person's attitude to China compared to other countries. In C-E PDT, attitudes to China become less positive and those towards other countries become less negative Meanwhile, they find translation participants adherence to politeness strategies. In a later research, Li and Zhu (2020) examine the lexical items reflecting attitudes of China and other countries in political discourse. They find (1) Chinese political discourse (CPD) represents the ideological level of positive Self/ negative Other linguistic-terms; (2) While raising the negative image of 'Others', China is also raising the negative image of 'Self'; (3) When expressing Self attitude through CPD, more external voices are allowed. Similarly, Li and Pan (2021) select 90 high-quality translations from the work reports of the National Congress of the Communist Party of China. The work reports of the central government are white papers translated by Chinese professional translators and reviewed by native English speakers. These English translations and Chinese form a parallel corpus of Chinese and English political discourse. Van Dijk's ISM (Van Dijk, 1998) was applied to analyse the reconstruction of China's image. This research demonstrates three outcomes: (1) translation shifts frequently occur in the evaluative epithets in CPD, but equivalence translation is used by translators; (2) Among three subcategories ('graduation', 'engagement', and 'attitude') of AS, the translation models of evaluative epithets are different. Based on previous studies, Li and Hu (2021) develop translation strategies of evaluative epithets in CDP among three subcategories ('graduation', 'engagement', and 'attitude') of AS and in 'Self' and 'Other' categories. They summarise translation strategies for each category for future CPD translators to avoid this cultural dysfunction, thus serving CPD.

3.5 Application of theoretical framework, Hu's Eco-translatology, in translation studies

As an interdisciplinary translation theory, Eco-translatology conducts a holistic study of translation from an ecological perspective. Hu (2001) pioneered this theoretical method of translation based on Darwin's ideas of natural selection and adaptation (1859). According to Darwin's principle, natural selection and adaptation mean that the fittest survive and the unfit are eliminated in the struggle for survival in the environment. Similarly, in Hu's theory (2001), if the translation meets the needs of society and target readers, it will be 'retained', otherwise it will be 'abandoned'. Hu (2001) proposes translation be centered on the translator who must strive for an ideal of cross-cultural equilibrium. Hu (2003) further points out during the translation process, translators should focus on the transformation of 'three dimensions', namely 'linguistic, cultural and communicative dimensions. Translations' linguistic dimension pays attention to the forms of the original linguistic features; the cultural dimension focuses on the transmission of recognisable elements of meaning between English and Chinese; and the communicative dimension focuses on whether the intention of the original is reflected in the translation. Thus, the translator must consider the differences between English and Chinese in: thinking mode, language expression, habit and culture. In other words, the translator must consider the whole 'translational eco-environment' when translating. A translational eco-environment refers to the worlds of the ST and the source and target languages, comprising the linguistic, communicative, cultural, and social aspects of translating, as well as the author, client, and readers (Hu, 2003). Therefore, the quality of translation depends on the translator's adaptation to the ecological translation environment.

The emergence of Eco-translatology has proved foundational to modern Chinese translation studies over the past two decades. It has been overwhelmingly adopted by most Chinese scholars. For the purposes of this paper, a search was made in CNKI to analyse Chinese literature publications on Eco-translatology from 2001-2021. Keywords: '适应/选择/翻译/三维转换 (Adaptation/Selection/Translation/Transformation of three dimensions)' and '生态翻译学 (Eco-translatology)' were used. Initially, 3688 pieces of literature were found; the earliest, was Hu's work in 2001. Next, the criterion was tightened for academic literature which brought the relevant literature total down to 1163. The specific publication time and quantity are shown in Fig. 6. It can be seen from the chart, since 2001, the total number of items related to Eco-translatology has steadily increased overall with some minor fluctuations, reaching a peak of 156 in 2019. There are two main reasons for this growth trend. First, many translation scholars began to use the basic terms, concepts, and research methods of Eco-translatology to study translation problems and translation phenomena. The implication of this is that the 'Eco-paradigm' of Eco-translatology gradually shaped a formative academic influence. Second, as the research system of Eco-translatology in China improved and was enriched, a strong translation research school was formed and enabled excellence in further research.

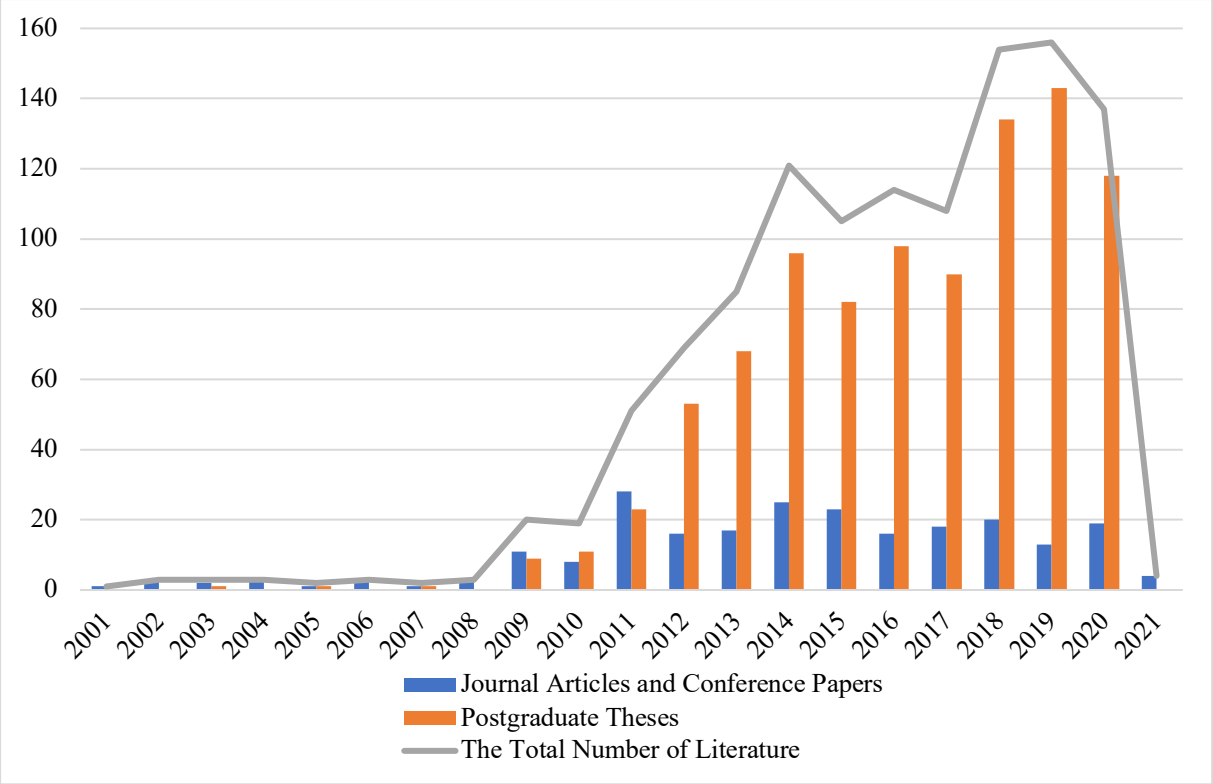

Fig. 6. Data and quantity of literature on Eco-translatology in China

Chinese literature applying Eco-translatology mainly focuses on four areas: reviews and comments, theoretical discussion, translation practice, and translation pedagogy. The distribution of these four areas is shown in Fig. 7. From these two pie charts, it can be seen that in the field of Eco-translatology in China, whether in theory or pedagogy, Eco-translatology has triggered the attention of many scholars. In terms of journal articles and conference papers, the percentage of theoretical discussion is the largest contributor (59%) followed by translation pedagogy (30%) and translation practice (9%). The smallest proportion is accounted for in reviews and comments (2%). In contrast, postgraduates overwhelmingly focus on researching theoretical discussion (74%) though there is a substantial work on translation practice (26%).

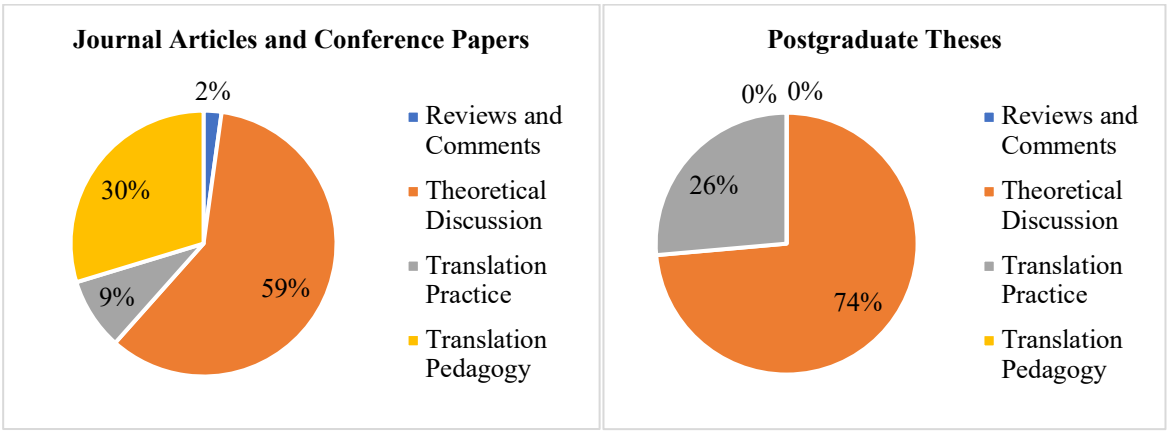

Fig. 7. Topic distribution of Eco-translatology in China

According to Fig. 6, it is clear, the development of Eco-translatology can be divided into two stages: the initial stage (2001-2008) and the development stage (2009-2021). The initial stage (2001-2008) of Eco-translatology is

mainly the proposal and construction of this theory. Hu (2001), the pioneer of Eco-translatology, published the first article about Eco-translatology to explain it from a theoretical perspective. Later, he (2003) published *Translation as Adaptation and Selection* on *Perspective*. These early papers discuss the translation adaptation to the ecological environment and how selection is made for translation. A more systematic construction of the theory of adaptation and selection of translation soon followed, laying the foundation for the development of Eco-translatology theory. Thus, drawing a parallel to Science, Hu (2004) introduces Eco-translatology boldly as he borrows the basic principles of 'natural selection' and 'survival of the fittest' in Darwin's theory of 'Adaptation and Selection'. In Hu (2006, 2008), he continues to develop the theoretical basis of Eco-translatology. The main contents are (1) the construction of philosophical motivation of translation adaptation and selection in translation process through a translator centered view and (2) the elaboration and proof of translation theory. Even in the early stage of the theory's development and construction, other scholars, Liu and Xu (2004), Li and Huang (2005), as well as Zu (2007), in addition to 37 postgraduate theses, fully affirmed this theory.

The characteristic of the second stage (2009-2021) of the above graph is the sharp increase in the number of research papers, the number of researchers at different levels, and the scope of research. As can be seen from Fig. 6, 2009 was the landmark year of Eco-translatology development. In this year, Hu completed its unique theoretical framework. Besides Hu, Sun, Huang, Jiang, and Liu published many papers on empirical research to test and develop the theory. After 2010, theoretical and empirical studies continue to deepen. Hu (2010) makes a more detailed theoretical elaboration which makes his theory clearer: he further compares translation ecology and natural ecology. Also, he points out the direction for the future development of Eco-translatology.

Meanwhile, other scholars began to explore the theory and practice of Eco-translatology from different perspectives including analysis of translated texts, and in regard to foreign language teaching. Using Eco-translatology as their guiding theory, Jiao (2010), Zhao (2013), Zhang (2018), Wang (2019) and Chen (2020) respectively analyse classic C-E translations of *Tian Yan Lun*, *A Dream of Red Mansions*, *The Analects of Confucius*, *Journey to the West* and *The Peony Pavilion*. Using a now well-established perspective, conceived by Hu (2006, 2008), of the overall ecological translation environment and the principle of 'three dimensions' (linguistic, cultural and communicative), they analyse the reasons for the success of these classic translations. They point out only by adapting to the ecological environment (which includes linking to target readers) can translators render these classics effectively. Furthermore, Yu (2017) compares two Chinese versions of *The Vagina Monologue* (original in English), and analyses one translator's version using the three dimensions (linguistic, cultural and communicative). This version through the adaptive ecological environment, the author explains, is why one version is superior and survives longer than the other. Shu (2010), Chen (2016), Wang and Yang (2018), Ding (2018) and Zheng (2019) analyse and give guidance for the effective translation of different types of public signs, public signs in film studios, TCM hospital signs, tourist attractions and road traffic signs. From 2013 to 2017, there are 37 postgraduate theses on the text analysis of film titles and subtitles. Also scholars analyse film title translation and subtitle translation from the perspective of the 'three-dimensional transformation'. Liu (2009), Guo (2011) and Yang (2019) analyse the text of news translation. Liu (2009) analyses and discusses the effective translation of metaphorical idioms in news reports from the perspective of Eco-translatology. Similarly, Guo (2011) analyses and explains 'faithfulness' in translation from E-C news. Yang (2019) believes news translators play a central role in the process of 'soft' news translation. In addition to the above text genres, Internet language, advertising language and poetry are also analysed by translation scholars under the guidance

of Eco-translatology. All these examples are strong evidence for the wide application and academic analysis shows the effectiveness of Eco-translatology.

In addition, and significantly, Hu was the first to study the translator's thought process using Eco-translatology. Hu (2009) interprets and discusses translation thoughts of another Chinese translator pioneer, Fu (1957). After Hu, many translation scholars interpret the translation thoughts of different translators. Sun (2009) discusses Zhang's practice and ideas. Tong and Huo (2010) explain Chang's marginalised identity as a translator. Liu (2011) believes Xu's translation activities are the result of his constant adaptation of the multi-faceted and multi-level translation environment. Deng and Meng (2012) claim the evolution of Wang's translation thought is consistent with context 'fit' and neutralisation. Moreover simultaneously, questions about Eco-translatology have emerged: Leng (2011) and Wang (2011) question the relevance of Eco-translatology: whether the translator should be the central reference point. Later, Hu (2011) responds to them, defending his work. Thinking critically, Chen (2014) points out three significant paradoxes of Eco-translatology: (1) The ecological environment is regarded as the overall environment of the translator and the TL, ignoring its 'cross regional' characteristics, which is contrary to the nature of translation differences; (2) Too much emphasis on translator centeredness in the process of translation can show a one-sided and narrow value orientation, which is contrary to ecological ethics; (3) Taking adaptive selection theory as the 'backbone' of Eco-translatology ignores the broader research space, which is contrary to the fundamental concept of Eco-translatology. Hu (2014) also responds to Chen's three paradoxes and gives him some guiding suggestions including the idea that the emergence of multiple voices shows the concern of Eco-translatology and may promote improvement of Eco-translatology. In a similar vein, Song and Hu (2016) focus on several key ethical issues in the field of translation studies, such as translatability, and retranslation. Continuing in the spirit of development, Hu (2017) proposes a wider application of his theory to translation teaching, translation history, translation criticism, translation ethics and translation schools.

Finally, the application of Eco-translatology in translation pedagogy has proven a promotion of research and teaching. In the light of Eco-translatology, some scholars have proposed basic design concepts for translation textbooks in colleges and universities. Tao (2012) points out translation textbooks should have balance and conform to the basic concept of ecological design. Specifically, she proposes translation textbooks should promote the connection between translation knowledge and learners' personal experience. Li (2012) promotes Eco-translatology designed teaching material and Hu (2017) himself even suggests a system tailored for translation textbooks. Deng (2012) analyses the effective teaching methods of Eco- translatology in MTI, and proposes a new mode of MTI interpretation teaching from a theoretical basis and goal orientation. Shu (2014), using Eco-translatology, researches teaching objectives, contents, methods and evaluation system, so as to integrate information technology with translation teaching. Zhang (2021) proposes English teachers can fully combine the ecological translation theory with the translation teaching of cross-cultural theory. These examples show Eco-translatology has stimulated development in translation teaching and pedagogy research.

This overall review shows the wide development and acceptance of Eco-translatology in China. Notably the broad applications of the theory of Eco-translatology to study specific translation phenomena, and the uses in the development of teaching translation have been shown.

In contrast, scholars in other parts of the world have not widely recognised the value of the tool of Eco-translatology. It has attracted only a handful of overseas translation scholars. Scott (2015) discusses poetry

translation from the perspective of Eco-translatology, and points out its main benefit is to enhance readers' Eco consciousness in the translation of any text. Cronin (2015) made an analogy between language translation and food value and advocated the construction of a new ecological translation system. He agrees with McEntyre (2009) that 'language, like water, land, animals, plants and food systems, is another valuable and shared resource, which needs to be well managed and should not be easily consumed like disposable goods.'. Magagnin (2020) proposes the purpose of Eco-translatology resonates with the knowledge production policy of the People's Republic of China and the national ideological agenda. He claims this self-proclaimed discipline supports the promotion of 'Chinese discourse' in the field of translation studies and Chinese scholars and theories in the international scientific community. He politicises Eco-translatology as ultimately contributing to the construction and consolidation of Chinese academic power and influence. Perhaps the Western lack of recognition can be explained by this perspective.

3.6 Research on current geotourism translation

Because the field of geotourism translation has so recently emerged, no scholarly journal articles or academic books have yet been published. Therefore, data is the only foundation to identify the translation needs of this genre. For the purposes of this current research, geotourism translation can be researched in the following four locations: (1) GSA; (2) six Chinese geoparks accredited by UNESCO; (3) four recently published C-E tourist guidebooks from Chinese geoparks**;** (4) geology guidebooks published in Chinese and English by the Hong Kong Geopark. The significance of this data selection includes the values that: (1) geoparks are quality geotourism destinations; (2) the geology and geomorphology of activities in these parks necessitates a high level of linguistic detail when translating technical jargon or complicated ecological and cultural processes or explanations linked to these activities. (3) geoparks are a convenient way to gather primary data. These data are publicly available from a variety of source types: brochures, pamphlets, interpretative panels, signs, display boards, and museum displays particularly at entrances, visitor centers, and museums. To minimise bias, from obscure venues, the data were gathered solely from popular and easily accessible public sources. For the purposes of research for this article, data was categorised into the three foundational categories of geotourism: A, abiotic (GFs and GPs), B, biotic (plants and animals), and C (cultural items and influences). These categories include particular language features, an information hierarchy, and some cultural factors that are essential for effective translation.

Firstly, for organisational purposes when looking at translation data, three significant points should be noted. (1) There are many technical terms in GFs of the STs which are difficult to translate. These terms can be divided into two groups: those that have equivalent words in English such as '辉绿岩 (diabase)', and '侵入岩 (intrusive rocks)', and those that may not have an equivalent because of some cultural gaps or differences, like'丹霞山'.'丹'and'霞'which are colour names or characters only occurring in Chinese. (2) Another notable point is that the explanation of GPs is often expressed in many long and complex sentences in Chinese STs. For example,'距今一亿年左右，受燕山运动影响，在泰山南侧形成泰前断裂，泰山开始抬升，覆盖在上面的沉积岩被剥蚀，泰山古老岩石漏出地表，形成泰山的雏形。'which can be translated into 'About 100 million years ago, under the influence of Yanshanian Orogeny, the Taiqian Fault came into being in the most southern part of Mount Taishan. Then Mount Taishan began to lift up. The overlying sedimentary rock on Mount Taishan was eroded and the embryonic form of Mount Taishan was revealed, with the exposure of its ancient rocks.' This is an example of the long convoluted Chinese ST style. Most GPs in the English TTs are shifted to

passive voice to bring the nouns forward in the sentence for emphasis. For instance, '距今 3 千万年左右，受喜马拉雅运动影响，泰前断裂、中天门断裂、云步桥断裂运动，形成了泰山的三个阶段，泰山基本轮廓确定。' was rendered: 'Dating back 30 million years ago, beginning with the original Himalayan movement, the Taiqian, Zhongtianmen, and Yunbuqiao Faults formed three step faults which in turn determined the basic outline of Mount Taishan.' (3) The final note is concerning some CEs in Chinese STs are difficult to interpret because of unique historical, religious, architectural and poetic culture. For instance, '织金苗族人是蚩尤的后裔之一。' should be rendered: 'Hmong in Zhijin is one of the descendants of Chiyou (the head of Jiuli Clan).' In this sentence, '蚩尤' is translated into 'Chiyou (the head of Jiuli Clan)' instead of simply, 'Chiyou'. '蚩尤' is a character that contains a rich Chinese historical nuance which connects in meaning to the head of the tribal alliance of the Jiuli Clan who in ancient times inhabited downstream of the Yellow and Yangtze Rivers. The oversimplified translation into 'Chiyou' (using Chinese Pinyin) would lose, for the target readers, the depth of the meaning attached to this Chinese character. This is an example of the translation strategy of addition for a cultural element.

Before examining data, another important and more complex issue to take account of is the strong relationship between some of the abiotic elements in GFs and GPs and the biotics (fauna and flora) elements. This is because some local plants and animals are supported by GFs or GPs therefore their characteristics, appearance and habitat are closely affected by GFs and GPs. In fact, the introduction of some plants and animals is dependent on some of the GPs and GFs. Therefore, the unique geotourism names can be synthesised with the GFs and surrounding habitat. Care is needed to deconstruct in translation for geotourists. An example is an animal, '猕猴主要栖息在山石峭壁、溪旁沟谷和江河岸边的密林中或疏林岩山上，群居。' which is translated '*Macacamulatta,* a social animal living in forests, prairies or in bogs, particularly in the sparse mountain forest or the dense forest on steep cliffs, in valleys or by riverbanks.' A second example is related to a plant, '落叶乔木，高达 15 米，胸径 40 厘米，小枝粗壮，幼时有绢毛。产于安徽、浙江西部、江西（庐山）、福建、湖南南部、广东北部、广西北部和东北部。生于海拔 300-1,400 米的林中。' translated: 'With a height of 15 m and a DBH of 40 cm, it is a deciduous tree featuring stout branchlets which have sericea in the juvenile stage. It is produced in the forest with the altitude of 300-1,400 m in places including Anhui, western Zhejiang, Jiangxi (Lushan Mountain), Fujian, southern Hunan, northern Guangdong, and northern and northeastern Guangxi.' A more complex type of example is shown in Supplementary Material Section (Data 2) where the element is formed through a relationship of plants and animals: '三叶虫化石（literally trilobite fossil）'; and '石生树（literally, tree growing from rocks）.' The latter was possible because of were biological weathering. A different but complex example is in the use of biological names, mostly from Latin (that are hard to pronounce and remember) and the use of Chinese local names. Firstly, it is unhelpful if translators only use Latin to render biological names. For instance, '蛤蒌' is a kind of pepper plant according to its interpretation. Thus, it can be translated into '*Piper samentosum* Roxb (Pepper Plant)' rather than the Latin '*Piper samentosum* Roxb'; nor it is helpful to render it into Chinese Pinyin 'Halou' which has no significance to English speakers. Besides, translators cannot translate Chinese local names literally. For example, '田鸡' is literally 'chicken in the field' but means 'edible frog' and untranslatable to English culture; secondly, '影树' is actually jacaranda, but literally is: 'shadow tree' because of the particular shaded light underneath it in daytime. Therefore, the principle used in translating biological names can be quite different from translating geological names or terms.

For the purposes of exemplifying for future geotranslation, the researcher analyses the raw data to formulate some culturally effective strategies. To facilitate clarity in the process of translation, these strategies are organised into the three foundation levels: A, abiotic (GFs and GPs), B, biotics (fauna and flora), and C, cultural, elements (CEs). Specific examples of this organisation are in Supplementary Material Section (Data 2).

While processing the raw data several translation problems were identified which mainly include four types: (1) 'Use Chinese Pinyin to Replace English Words (UCPREW)', (2) 'Mistranslated', (3) 'Not Translated (NT)', and 'Incongruent Translation for Same Name (ITSN)'. Examples of these four problems of geotourism translation are illustrated in Supplementary Material Section (Data 3) under the three types (or foundation levels).

Apart from the data and information from the geoparks via field research and the data provided by GSA, there are two innovative dictionaries of geotourism: *A Grand Tourism Earthscience Dictionary* (Chen, Lu, Zhang, & Tian, 2013), and *Dictionary of Geotourism* (Chen, Ng, Zhang, & Tian, 2020). The former is in Chinese and the latter in English, edited by the same authors. Each dictionary has more than 3000 definitions. The content of these two dictionaries is systematic and comprehensive, covering natural landscape and human landscape entries in geology, geography, ocean, atmosphere, hydrology and other disciplines. At the end of the dictionaries, there are appendices and indices. Text is facilitated by many diagrams and photos. The entries follow scientific information, and the definitions are accurate, concise, and accessible. Both have become popular self-help travel manuals for tourists to understand human and scientific knowledge of landscape. However, these dictionaries do not employ the ABC approach. However, Gulas et al. (2020), employ Dowling's ABC concepts (2013) in their research on Styrian Eisenwurzen, the UNESCO Global Geopark in Austria. These authors' objective is to engage local residents in the protection of the region's geoheritage and natural resources, as well as to increase the region's visibility and tourism appeal. They conclude the use of the ABC interpretive concept can enhance both the landscape conservation and geoheritage by its improvement in communication of data. Pásková et al. (2021) also applied the ABC concept with qualitative method to interpret and compare two UNESCO Global Geoparks, one in Japan and the other is Peru: the Colca canyon and volcanoes in Andagua (Peru) and Muroto in Japan. Their results contrasted the two different situations: a high level of visible ABC application can be seen in the Muroto Geopark interpretation, whereas the Andagua Geopark interpretation needs to develop the local people's knowledge of cultural aspects into their Earth heritage interpretation.

4. Discussion

This project, as foundational research into the new field of geotourism, has taken a comprehensive approach to gauge the status of the current data and literature of geotourism in order to establish a systematic model for C-E geotourism translation. The research objective to explore culturally effective strategies is driven by an interdisciplinary corpus method and framed by the theories of Hu's Eco-translatology. Literature was searched, analysed and filtered by relevance to the research objectives. First, literature from tourism (closely related to geotourism) translation was examined in the areas of description, discourse, menus, websites and TPMs, in the past five years. Second, this paper considered the issue of translation methods used in the relevant literature. It was shown, translation theorists have long argued about translation strategies, methods, techniques and procedures and even the correct use of these terms is debated. It was concluded that translation scholars hold a wide range of different views on each of these terms. For future analysis in geotourism translation, it is therefore proposed these four terms (strategies, methods, techniques and procedures) be employed synonymously to facilitate a systematic

taxonomy of geotourism translation strategies. Third, the issue of advances in CTS was discussed, in particular, linguistic development of CTS, and the formation of a CTS paradigm. As well, application of corpus to translations was evaluated. Finally, examples were included about the use of corpus as a method to study some E-C/C-E translated texts. Significantly, it was noted, at present, there are no translation publications based on geotourism or the corpus of geotourism. In regard to the development of theoretical frameworks, Hu's Eco-translatology was selected, discussed and examined in its application in E-C/C-E translation pedagogy. Two distinctive results were noted in these particular studies: (1) as a guiding theory, Eco-translatology has been well proven in its wide use in C-E/E-C translation of various genres such as literary translation, subtitle translation and tourism translation, and pedagogy; (2) the significant imbalance of Eco-translatology's application between East and West maybe understood in terms of its political interpretation by westerners, not in in intrinsic value terms. Understandingly, since it is a new field there is no current research in geotourism translation, nor, by correlation, has Eco-translatology been employed as a theoretical framework to this field of study. These are two well defined research gaps. Finally, attention was given to the only reference for UNESCO data from Chinese global geoparks: the Dictionary of Geotourism (Chinese or English version) however, this dictionary does not include any reference to the systematic ABC categories of geotourism which are recommended by recent research and will facilitate the proposed data research. This literature review may have clearly described the status of geotourism translation research and its related fields, the available methodologies and theories available for future research, as well as the research gaps.

Although yet without its own literature, an analysis of data was done (see Data 3 in Supplementary Material Section) to demonstrate the types of translation challenges faced by this new field. Some of the complex nature of these challenges was revealed by the approach of three categories (ABC) of geotourism translation. As mentioned previously, specifically these were rendering:

- abiotic elements (geological phenomena: GFs and GPs),
- biotic elements (flora and fauna), and
- unique Chinese cultural elements (historical, architectural, religious, artistic, and poetic).

These are found on geopark brochures, pamphlets, interpretive panels, signs, display boards, and museum features. The first finding by analysis was there are many technical challenges of translation: scientific jargon and expressions. Since the target of translation in geoparks are the public visitors, the register of geotourism translation should appeal to them, not to scholars or officials. To this end, some translation direction and vocabulary suggestions are offered via a summary of some effective geotourism translation (see Data 2 in Supplementary Material Section). The second finding was there are significant grammatical contrasts between the language styles which are challenging to translation. First, the Chinese GPs are complex and in convoluted sentences but when translated, English TT require a short and simple style. Thirdly, it was found there are difficulties at the biotical level (names, biotical information and the formation of GFs by animals and plants). This biotical level has three types of difficulty: translating the Latin biological names, the local Chinese names (meaningless in literal translation) and briefly mentioning the habitat codependency of animals and plants. Fourthly, it was found that without translation precedents, CEs are often difficult for semantic, style and cultural equivalence. To effectively translate and overcome these four obstacles, recommended translation strategies within the framework of Eco-translatology were applied. These findings mean the translation goals of accuracy, completeness of meaning, readability, and sufficient cultural interpretation for English geotourists can be fulfilled. By this method, that is,

using the theoretical framework, the ABC approach and ecological strategies, it is proposed the translator may arrive at a model standard of geotourism translation. Finally, given the innovation of this new genre, it is expedient to carry out testing of the quality of geotourism translation using a model similar to Pedersen's FAR Model (a model used to exam the quality of subtitling, mentioned in 3.4.1). With quality translation of geodata, guides or interpreters, can fully engage with and use this information in geoparks. They may prepare by reading the geopark material before they take geotourists through, and if they do not understand the data, they can ask their supervisor to explain it. Besides, they might lookup certain difficult words themselves in the geotourism dictionary, to be fully prepared to guide geotourists.

5. Conclusions

Although much attention is being paid by geologists and geotourists to geotourism, C-E translation effectiveness has not been addressed by research and is urgently required to serve geotourism's objectives to educate and inspire conservation of Earth's heritage. Thus, a fundamental research gap was found in the publication of matter on the systematic translation of C-E geotourism. A further gap was discovered in the need for a systematic model to guide the translation of C-E data. This project of C-E corpus-based geotourism translation study, guided by Hu's Eco-translatology points to both the necessary translation amendments and a reliable system of guidance for future translators. A review of literature was used to shed light on the methodology (Corpus) and framework (Eco-translatology) but only literature by renown translation scholars and linguists was used and limited to the last five years to connect to the most current issues. Thus, the review of tourism translation, CL development and the application (CTS) provided a pioneer corpus as a method and as a theoretical application of Eco-translatology to this undeveloped area of research. Collation of the corpus results provides a guiding model for the work of future geotourism translators. To strengthen the translators' use of this system, a quality assurance test (SSC model) has also been constructed. Given the fundamental absence of research in this new field, there is vast scope for further geotourism translation research. Therefore, projected research work is planned as follows:

- Further research to identify effective translations and translation problems in ABC categories based on the register of geotourism (principles of geotourism translation and interpretation).
- Further development of the SSC Model by using more categorised examples.
- Further field work aimed at collecting more examples to enlarge the existing corpus and widen its application of analysis.
- Construction of a summary of geotourism translation strategies which will provide a taxonomy which will be another tool for translators.
- Further field work aimed at construction of a comprehensive taxonomy which includes not only strategies but elements of the underlying framework theory and quality assurance system.

It is hoped these five major research tasks will firmly establish geotourism's practical and theoretical framework for future geotourism translation excellence. Meanwhile recently, Li, Wu and Ng (2022) have used the ABC concept to explore culturally effective strategies in A and C element. They have summarised and recommended effective strategies in A and C to translators, interpreters, and trainee guides. It is also possible geotourism researchers can potentially widen the E-C research data base by considering geotourism in other countries, for example in the Blue Mountains National Park, a world heritage area in Australia.

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Appendices

Appendix A. Comprehensive List of Linguistic Jargon

NO.	Linguistic Term	Comments
1	Addition	It is also called annotation. This strategy can make up for the absence of equivalent words in the TL.
2	Calque/Loan translation	A new neologism was generated and employed in the TL by translators through adopting the structural features of the SL.
3	Changing sentence structure	Changing the form of the SL but not the content of the SL in the TL.
4	Condensation	This is a subtitle translation strategy which is used to alleviate the problem of a limited number of subtitle lines on a screen.
5	Corpus	Corpus is a collection of natural language information, either written or spoken, that is saved on a computer and used to study how language is used.
6	Corpus-based method	It is an approach that relies on an underlying corpus to serve as a repository for linguistic information.
7	Corpus-based translation studies	CTS or CBTS is to uncover both the universal and particular characteristics by combining theoretical frameworks and hypotheses, diverse data, innovative descriptive categories, and a rigorous, flexible methodology.
8	Corpus linguistics	CL is an approach that combines computer-based empirical assessments (both quantitative and qualitative) of language use through the use of huge, electronically available collections of naturally occurring spoken and written texts, referred as corpora.
9	Critical discourse analysis	CDA is a qualitative analytical method for critically characterising, interpreting, and explaining how discourse build, perpetuate, and legitimate social inequalities.
10	Culture-bound words	Culture-bound terms are those that have cultural connotations and have been adopted from another language because of linguistic interaction.
11	Cultural-specific items	CSIs are those that are unique to a certain culture. These principles may be applied to a variety of sectors, including plants, animals, food, law and religion.
12	Deletion	It refers to cases in which the ST elements are removed from the TT.
13	Descriptive translation studies	It is used to present faithfully the values, the hegemonic views or ideological positions of the TT participants.

14	Division	Translation strategy in which a long sentence is divided into several small parts, each of which has a connected meaning, is used.
15	Division and inversion	It is a compound translation strategy combining No. 14 and No. 25 to deal with the syntactical level.
16	Division and literal translation	A combined translation strategy (No. 14 and No. 28) to solve the syntactical level of geotourism translation.
17	Division and shift translation	Shift is a translation strategy applying change of word/s, sentence structure or voice of the ST to fit the TL. Division and shift is a compound translation strategy combing shift and No. 14.
18	Domestication	It is a strategy for tightly conforming text the culture of the TL, which may result in the loss information from the ST.
19	Extralinguistics cultural-bound references	ECRs are expressions that refer to entities outside language, such as names of people, places, institutions, food and customs, which a person may not know, even if s/he knows the language in question.
20	Free translation	It generates the TT without the style, form, or content of the ST.
21	Foreignisation	It is a strategy for keeping information from the ST that entails intentionally violating the TL's rules in order to maintain its meaning.
22	Functional equivalents	The translator understands the notion in the source language and finds a means to communicate the same concept in the target language that conveys the same meaning and intent as the original.
23	Generalisation	Translation strategy in which a translator replaces a specific term in the TL with a more generic or neutral phrase.
24	Idiomatic translation	It faithfully reproduces the 'message' of the ST, but tends to skew subtleties of meaning by favoring colloquialisms and idioms in place where they do not appear in the ST.
25	Inversion	It refers to the inevitable or necessary change in a sentence according to the usage of the TL.
26	Language pair	It is a term that refers to the process of translating one language into another. For example, if a translator is rendering from Chinese to English, the translation pair is Chinese-English.
27	Linguistic features	Linguistic features in translation include register, lexical aspect, syntactical aspect, cultural proverbs, and technical jargon.
28	Literal translation	This translation converts the SL grammar to its closest TL equivalent, but the lexical terms are translated separately.
29	Naturalisation	It is employed when cultural characteristics unique to the culture of the ST are substituted with close equivalences in the destination culture.

30	Oblique translation	The strategy is employed when the structural or conceptual aspects of the source language cannot be translated directly without distorting the content or disturbing the destination language's grammatical and stylistic characteristics.
31	Omission	It refers to the acting of omitting a word and words from the SLT during translation.
32	Parallel aligned corpus data	A parallel corpus is a collection of translations of the same document into two or more languages that are at least sentence-level aligned.
33	Periphrases strategy	It is circumlocution, or extended rewording of an object through one of its aspects: Green continent = Australia.
34	Polysystem theory	A theory that explains how literary systems behave and evolve.
35	Skopos theory	A translation theory which represents 'the idea that translating and interpreting should primarily consider the function of both the ST and TT. It contains three rules: skopos rule, coherence rule and fidelity rule.
36	Synonymy	A strategy for overcoming cultural disparities between SL and TL.
38	Translation strategy	It aims to deliver effective meaning in the TT as translator considers whole ecology of the ST.
39	Translation theory	Translation theory is based on the recognition of a sound foundation for understanding how a language functions, as well as the realization of the fact that different languages have distinct forms. It instructs translators to maintain meaning by employing the language's most natural forms.
40	Transliteration	A special translation strategy in which symbols from one linguistic system are used to communicate letter symbols in another. For example, '山东' in Chinese is rendered into 'Shandong' in English.
41	Transliteration and free translation	During the translation process, these two methods (No. 40 and No. 20) are sometimes combined since they are both important for achieving a successful outcome.
42	Transposition/Word shift	This is a change of one part of speech for another (noun for verb) without changing the sense.

Appendix B: Supplementary Data

Data 1: Discipline and publication sources of this review

Discipline	Title of Publication Sources and No.	Total No.	%
Geotourism	Environ. Interpret 1	41	11.9%
	GSA 2		
	GGN 1		
	Geoscience 11		
	Sustainability 7		
	Postgraduate theses 3		
	Chinese UNESCO Global Geoparks 1		
	Fangshan Global Geoparks, Beijing China 1		
	Global Geopark: Zhangjiajie 1		
	Dictionary of Geotourism 1		
	Geoconservation Research 5		
	UNESCO 3		
	Sustainable Geoscience and Geotourism 4		
Tourism	The Tourism of Geology and Landscape 1	33	9.6%
	The Practice of Sustainable Tourism: Resolving the paradox 1		
	Czech Journal of Tourism 10		
	Journal of Ecotourism 9		
	Mount Taishan 1		
	Mount Danxiashan 1		
	Asia Pacific Journal of Tourism Research 6		
	Current Issue in Tourism 4		
Geoheritage	Geoheritage 7	24	7.0%
	International Journal of Geoheritage and Parks 12		
	From Geoheritage to Geotourism—New Advances and Emerging Challenges 2		
	Geojournal of Tourism and Geosites 3		
Geography	National Geographic 1	1	0.3%
Geology	Geology on your Doorstep 1	7	2.0%
	University of Melbourne 1		
	Mt. Yandang Volcanic Geology and Landforms 1		
	Civil Engineering and Development Department, Hong Kong 2		
	Geologos 2		

Linguistics and Translation Studies	Hong Kong Translation Conference 1 SHS Web of Conferences 1 Conference of in Southern and Eastern Europe 1 Challenges of Multidimensional Translation, Proceedings of Mutra Conference 1 The Second International Symposium on Eco-translatology 1 Perspectives: Studies in Translatology 14 The Journal of Internationalisation and Localisation 1 Journal of Multilingual and Multicultural Development 1 Translation and Tourism: Strategies for Effective Cross-Cultural Promotion 1 The Translation Studies Reader 1 Dictionary of Translation Studies 1 Target 11 Scala Conference 1 Chinese Translators Journal 19 The Translator's Invisibility: A History of Translation 1 A General Introduction to Translation Studies 1 A Textbook of Translation 1 Routledge Encyclopedia of Translation Studies 1 Translation, Power, Subversion 1 Introduction to Chinese-English Translation: Key Concepts and Techniques 1 Heliyon 1 In Other Words: A Coursebook on Translation 1 Journal of Translation Studies 9 Computer Assisted Language Learning 1 Corpus Linguistics 1 SKASE Journal of Translation and Interpretation 5 Corpus Linguistics and Translation Studies: Implications and Applications 1 Corpus-based Translation Studies: The Challenges That Lie Ahead 1 International Journal of Corpus Linguistics 8 Corpus-based Translation Studies: Theory, Findings, Applications 1 Corpus-based Translation Studies: Research and Applications 1 Multilingual Individuals and Multilingual Societies 1 Descriptive Translation Studies and Beyond 1 Exploration of Corpus-based Translation Studies 1 Lancaster University 1 The Development of the Compilation and Application of Parallel Corpora 1 UCLA 2 Corpus-based Research in Legal and Institutional Translation 1 Terminology 12	229	66.6%

	Ilha Desterro 2		
	The Routledge Handbook of Audiovisual Translation Studies 1		
	Lingue e Linguaggi 3		
	Translating culture specific references on television: The case of dubbing 1		
	Subtitling Norms for Television: An exploration focusing on extralinguistics cultural references 1		
	The Journal of Specialised Translation 13		
	Discourse, Context & Media 3		
	Discourse & Society 4		
	Reappraising and Others: A Corpus-based Study of Chinese Political Discourse in English Translation 1		
	The Language of Evaluation: Appraisal in English 1		
	Ideology: A Multidisciplinary Approach 1		
	The Pragmatics of Politeness 1		
	An Approach to Translation as Adaptation and Selection 1		
	Across Languages and Culture 9		
	Foreign Languages and Their Teaching 2		
	Foreign Language Education 2		
	Foreign Languages in China 2		
	Journal of Foreign Languages 2		
	Shanghai Journal of Translators 14		
	Foreign Languages Research 1		
	Postgraduate Theses 8		
	Interpreter and Translator Trainer 5		
	Chinese Science & Technology Translators Journal 1		
	Wen Yi Bao 1		
	Contemporary Foreign Languages Studies 1		
	Foreign Language World 1		
	Computer-Assisted Foreign Language Education in China 2		
	Dix-Neuf 1		
	Translator 5		
	Caring for Words in a Culture of Lies 1		
	Babel 7		
	Meta 11		
	Translation Studies 9		
Original data and Information	Taishan Global Geopark, China 1 Danxiashan Global Geopark, China 1 Yandangshan Global Geopark, China 1 Fangshan Global Geopark, China 1 Wudalianchi Global Geopark, China 1	6	1.7%

	Mount Kunlun Global Geopark, China 1		
Earth sciences	A Grand Tourism Earth Science Dictionary 1	3	0.9%
	Environmental Earth Science 2		
	Total:	344	100%

Data 2: Effective strategies employed in three foundation levels of geotourism

Group	Chinese STs	English TTs	Types	Strategies
Abiotic	扇子崖	Fan Cliff	GF	Literal Translation
	水仙洞	Shuixian Cave		Transliteration and Free Translation (TF Trans)
	千枚岩	Phyllite		Literal Translation
	形成年龄约 27 亿年的望府山英云闪长质片麻岩，在 25 亿年被大量的傲徠山二长花岗岩脉穿插，形成了条带状英云闪长质片麻岩，岩体中的条带曲折多姿，酷似层层波浪，俗称“海浪石”，这就是举世闻名的泰山石。	The banded amphibolitic gneiss of Mount Wangfu rock body (2.7 Ga ago) is intruded by the yellowish grey adamellite of Mount Aolai rock body (2.5 Ga ago). The bands in rocks are tortuous and beautiful, which is the famous Mount Taishan rock.	GP	Division and Shift Translation (DS Trans)
	流水侵蚀	river erosion		Literal Translation
Biotics	泰山特有物种蝻霖鱼，就生长彩石溪中。神山有神水，神水孕神鱼，为彩石溪增添了一丝灵动。	The Chilin Fish, a species native to Mount Taishan, lives in the Colourful Rock Stream. There is sacred water flowing in the sacred mountain, and sacred fish breed in the sacred water. The fish just adds a streak of ethereality to the water.	Fauna	Division and Literal Translation (DL Trans)
	蒿里山虫就是大家熟知的一种三叶虫化石，因其发现于蒿里山而命名。泰山沉积岩主要出露于泰山周边，如蒿里山、陶山，反映了泰山海陆演化时期的环境。蒿里山虫是寒武纪地层	Kaolishania is what we all know as one type of trilobite fossil. And it has got its name for it was founded in the Haolishan. The sedimentary rocks of Mount Taishan exist in the surrounding area of Mount Taishan, reflecting the sedimentary environment for the evolution on both the land and sea of Mount Taishan.		Division Translation

	的标准化石之一，是远古海洋中的生物，距今也有 5 亿多年的历史。	Kaolishania is one of the typical fossils of Cambrian Period strata, with a history of over 500 million years.		
	台湾杉是一种大型的杉属植物，为台湾特有种。属于国家一级保护植物，它的树皮淡灰褐色，裂成不规则长形条，树冠呈锥形，为中国台湾的主要用材树种之一。	*Tanwani Acryptomerioides* is a common tree of Taiwan and is a large tree in the Taiwania genus in the Taxodiaceae family. It has a conical crown and string-colored bark that splits into irregular strips. It is under first-grade national protection and is one of the main commercial tree species in Taiwan China.	Flora	Inversion and Division (ID Trans)
	石生树:生长在岩石表面的植物，根系深入岩石裂缝之中，随着根系的不断发育使裂隙扩大，进而破坏岩石，直至崩裂，这种风化现象在地质学上被称为“根劈作用”，是典型的生物风化作用。	**Tree Growing from Rocks**: The roots of the plant growing on rocks penetrated deeply into the cracks. As a result, the cracks expanded and finally break the rocks. This geological process is called ‘root splitting’ and is a typical form of biological weathering.		DS Trans
CEs	会当凌绝顶，一览众山小。	Someday may I climb up to its highest summit, with one sweeping view see how small all other mountains are.	Poetry Culture	Literal Translation
	三官庙	Temple of Three Officials (Heaven, Earth and Water)	Religious Culture	Addition
	科举考试	imperial examination	Historical Culture	Free Translation
	山东快书	Shandong Clapper Ballad	Local Cultural folk performance Heritage	TF Trans

Data 3: Problems of geotourism translation in three foundation levels

Group	Chinese STs	English TTs	Types	Problems
Abiotic	响水岩	Xiangshui Rock	GF	UCPREW
	彩石溪	Choi Shek Brook		ITSN
		Colourful Rock Stream		
	海贝听涛	Shells		NT
	小龙湫	Small Dragon Waterfall		Mistranslated
	这是由于流纹岩层中发育两个方向的裂痕，在裂痕处岩石较破碎，后经风化作用和**流水侵蚀，岩石崩塌，残留下两个峰柱**。	Developed in the rhyolite strata are two fissures of different patterns. The spectacular shape came into being after the collapse of weathered rocks in the fissures.	GP	NT
	因长期受到昼夜温差变化和热胀冷缩的影响，此处的中天门岩体（形成于约 2.5 亿年前）。石英闪长岩由表及里，层层剥落，地质学上称之为球形风化。	Because of the influence of long-term, great temperature difference between daytime and night, the quartz diorite (Zhongtianmen rock body, about 2.5 Ga ago) was peeled off from the surface layer to inner ones, so the rock shows a dome-like appearance. The spherical weathering is distinct.		Mistranslated
Biotics	**岩石裂缝**中的植物	Plant growing in rocks	Fauna	NT
	植物的根系生长时能沿着裂隙发育—特别是大树的根，它随年龄增长而变得更粗大，可以劈开岩石。	The roots of plants grow along cracks – especially the roots of big trees, which grow thicker with age and can split rocks.		Mistranslated
	富含**蓝绿藻的湖面**	Abundant algae in the lake		NT
	在较为静止的自然水体中，像湖泊、池塘、水库和流动缓慢的河流中，经常会有大量的微生物繁殖。它们小到几微米，大	In relatively stationary natural bodies of water, such as lakes, ponds, reservoirs, and slow-moving rivers, there is often a large microbial population. Each can be as small as a few microns or as large as a few hundred microns, and they can't be distinguished by the naked eye. They also		

	也不过几百微米，肉眼根本无法分辨，它们也决定了水的颜色，如：蓝藻使水变成蓝绿色，绿藻使水变为绿色，硅藻使水变为灰褐色。 最终，哪种藻类居多，水就呈现哪种颜色。	determine the color of water. For example, cyanobacteria make water blue-green, green algae make water green, and diatoms make water grayish-brown. Ultimately, the color of the water depends on which algae are most abundant.	Flora	Mistranslated
CEs	转运司	Zhuanyunsi	Historical Culture	UCPREW
	碧霞元君	Bixia Yuanjun The Goddess of the Blue Dawn Emperor Bixia	Religious Culture	ITSN
	泰山是独一无二的文化大山。两千五百多年前，孔子“**登泰山而小天下**”。其后，历代文人名士纷至沓来，观光揽胜，吟诗作文，留下了不朽的名篇，成为中华民族的文化瑰宝。	Mount Taishan is a unique mountain with cultural significance. Over 2,500 years ago, Confucius visited Mount Taishan and was followed by other literati who composed famous pieces of prose which were later preserved as a precious asset for the Chinese nation.	Poetry Culture	NT
	封禅祭祀	Worshiping the Heaven and Earth and the Sacrificing Ritual	Religious Culture	Mistranslated

(Note: Both bold and underlined of the STs are NT in the TTs.)

Chapter 3: Theoretical Framework and Research Methodology

This chapter provides an overview of the methodology of the projects included in this thesis, as well as the foundational theoretical framework that guided the development of a benchmarking model for evaluating the quality of Chinese-to-English translation of geotourism texts, as well as a systematic taxonomy for effective strategies used to translate the expressions of the ABC (i.e., **A**biotic, **B**iotic and **C**ultural) elements in geotourism. This chapter provides a broad description of the methods used in the studies, and the steps and data used for each of the empirical studies are described in detail in each chapter. The design of this research is a four-part data analysis, based on the theoretical framework and tailored to the six corresponding research questions (see Chapter 1, Section 2). This chapter also stated the researcher's positionality to clarify the motivation and justifications for the topic and methods chosen for this thesis.

3.1 Theoretical Framework

The concept of 'equivalence' or 'faithfulness' has served as the foundational or definitive standard by which the quality of a translation is evaluated. However, as Baker (1996) notes, this criterion may also engender oversimplification or stereotype in an endeavour to standardise a particular term's translation. For example, complicated cultural references may be omitted or mis-interpreted in the process of literal translation. Since translation is a complicated human endeavour, additional considerations, such as vividness and style, cannot be overlooked (Baker, 1996, p.177). It is important to strike a balance between standardisation and the dynamics in the richness of language and culture. Baker (1996) recommends the use of the corpus approach, in identifying and analysing complicated linguistic patterns. As an empirical approach to studying translation, the corpus-based method allows for quantitative as well as comparative analysis of authentic language.

In his 2001 paper, *The Primary Exploration of an Approach to Translation as Adaptation and Selection*, Hu described the definition, process, principles and methods of translation from the perspective of adaptation and selection. The 'adaptation and selection' process in Eco-Translatology emphasises translators' ability to *adapt* to linguistic, cultural, and communicative differences while *selecting* effective translation strategies. This approach ensures ecological information is accurately conveyed, promoting comprehension, environmental awareness, and the balance between humanity and nature. This 2001 paper marks the beginning of Eco-Translatology studies. In his later development of a systematic translation theory, Hu (2003) describes 'a selection activity of the translator's adaptation to fit the translational eco-environment'. This addition further stresses translator centeredness and proposes a 'multi-dimensional adaption' that focused on three dimensions: linguistic dimension, cultural dimension, and communicative dimension. Along with his later publications (e.g., Hu, 2008, 2011), Hu bridged these dimensions systematically through the lens of Eco-Translatology, even though the focus on the intersection between culture, language, and communication is not new in the field of translation. Focusing on translator's choice, Hu (2008, 2011) proposes that the translator should achieve the *linguistic dimension* through precise word selection, grammatical structures, syntactic logic, and language style. For the *cultural dimension*, Hu (2008, 2011) proposes that translators should focus on accurately transmitting and bridging the cultural connotations of both the source and target languages (Hu, 2008, 2011). Finally, at the *communicative* level, Hu (2008, 2011) emphasises that the translator should concentrate on the communicative intention of the source text to ensure that it can be accurately reflected in the translation.

Tying back to translator's role in Eco-Translatology, the degree of holistic adaptation and selection in translation depends on the translator's engagement across the three dimensions, which can be seen as a criterion for judging the translation quality. Translations that meet one or any combinations of the three dimensions are deemed as effective translation. Hu (2011) asserts that the level of holistic adaptation and selection in translation is determined by the extent of the translator's engagement with adaptation and selection across linguistic, cultural, and communicative dimensions. In essence, the more dimensions to which the translator adapts during the translation process, the greater the degree of holistic adaptation and selection that can be realised. The strategies used for achieving such translations are deemed as effective translation strategies. Hence, the concept of 'multi-dimensional adaptation' and 'adaptive selection', as proposed by Hu (2011) in his Eco-Translatology, is instrumental in ensuring a higher quality of translation. In this project, I applied the three-dimensional transformations of Eco-Translatology (2003, 2008, 2011) to identify both effective and ineffective geotourism translations as to guide the optimization of those that were ineffective. The details of applying three-dimensional transformations of Hu's Eco-Translatology (2003, 2008, 2011) in the empirical studies included in this thesis are explained in Chapter 4 (Section 4), Chapter 5 (Section 4.3), Chapter 6 (Section 3), and Chapter 7 (Section 3).

3.2 Application of Corpus-based Method in this Thesis

A *corpus*, Latin for 'body' with the plural form *corpora*, is a substantial collection of texts sampled to effectively represent a specific language or linguistic variety in certain contexts (Leech, 1992, p. 116; Baker & Brookes, 2021, p. 559; McEnery, 2022, p. 494). Brookes and McEnery (2020) and Hunston (2022) describe corpus linguistics as a research methodology that systematically analyses large collections of texts. In modern days, through computational and statistical techniques, this approach enables researchers to identify linguistic patterns, discover trends and draw conclusions about how language works in its context.

In translation studies, corpora serve as a foundation for empirical descriptive research, typically referred to as Corpus-Based Translation Studies (CBTS or CTS) (Baker, 1993). In CTS, parallel corpora and comparable corpora are the most frequently used types. According to Baker (1999), a parallel corpus comprises a collection of original texts in one language (L_1) and their translations into one or more languages ($L_2 \ldots L_n$). Typically, a parallel corpus includes data from just two languages. In comparison, comparable corpora consist of texts from two or more languages about different content, but in the same genre, topic, and register. Laviosa (2002) and Zanettin (2014) note that CTS typically involves the comparison of two (sub)corpora, wherein translated texts are compared with either their source texts (parallel corpus) or with another (sub)corpus constructed according to similar design criteria (comparable corpus). This comparison can occur within the same language or across different languages.

The parallel corpus allows researchers to examine translation across different language pairs and cultural contexts, revealing diverse translation strategies. By analysing a large number of translated texts in a parallel corpus, researchers can identify patterns in a special translation genre (e.g., legal texts and political texts). Such patterns often suggest general practices that translators tend to follow in specific contexts, such as approaches to handling cultural references, which may involve preserving their source-culture specificity (Toury, 1995). For these considerations, this thesis adopted corpus linguistics methods to explore translation strategies in parallel corpora, aiming to address underlying patterns that reflect effective (or ineffective) reflection of culture, linguistic and communicative meanings. To ensure the data is representative of the target genre and mode (i.e., geotourim

translation in geoparks), data from nine Chinese UGGps are collected and analysed (i.e., Taishan, Leiqiong, Yandangshan, Danxianshan, Jiuhuashan, Wudalianchi, Fangshan, Xiangxi, and Mount Kunlun).

The application of the corpus-based approach to translation has many benefits. It not only provides translation scholars with flexible and rigorous analytical tools but also helps translation practitioners in refining and clarifying their strategies to optimise translation quality. First, corpus-based methods are flexible and rigorous approaches that can effectively reveal both the universal and specific features of translation. Curry and McEnery (2024) point out that the corpus method used in translation studies is valued for its flexibility because it allows researchers access to a diverse and large range of textual resources. This approach does not limit researchers to a particular type of texts or confined datasets; rather, it enables them to work with a variety of texts such as literary works and news reports (Krüger, 2024). This diversity greatly enhances scholars' ability to cover different text types and linguistic expressions, which is essential for analysing how differences in genre, style, and context influence the choice of translation strategies. The corpus-based method enhances the empirical rigor of translation through its affordances of scale. Besides, this method supports both quantitative (e.g., frequency of specific translation strategies) and qualitative analysis (e.g., contextual factors influencing those choice). This dual capability allows for a more nuanced understanding of translation strategies and norms.

Second, corpus-based method facilitates the development of translation practice. This method directs practitioners to refine and clarify their initially vague and abstract ideas for translation with concrete real-world data. By relying on actual translated texts as empirical evidence, the corpus approach grounds its findings in real-world data. This complements the experiential summary method, which might rely more on anecdotal evidence and subjective translations. According to Laviosa and Liu (2021), initial approaches to translating a text may be based on intuition or less defined translation. The corpus-based approach, however, provides specific examples and empirical evidence that enable translators to refine these initial ideas, making them more precise and applicable in real-world usage. For example, when translating Chinese-to-English legal texts with cultural connotations unique to Chinese characteristics (e.g., '身体权' into 'right to corporeal integrity'), translators can use the parallel corpus of *The Civil Code of the People's Republic of China* developed by An and Sun (2022). This resource aid them in selecting more accurate and contextually appropriate strategies for translating similar terminology and sentences in new translation tasks.

In this current research task, Chinese-to-English parallel corpora are developed and analysed. The corpora used in this were built using data from multiple UNESCO-approved geoparks in China. In the following section, I provide a general procedure for collecting, processing, and using the corpora compiled for the four empirical studies in this thesis. The general procedure introduced in this chapter is repeated with more details and minor variations to suit the purpose of each empirical study, and are described in more details in each induvial chapter (Chapter 4 to Chapter 7).

3.3 Building the Chinese-to-English Parallel Corpora

For each of the studies in this thesis (Chapter 4 to Chapter 7), Chinese-to-English corpora were built to perform both qualitative and quantitative analysis. There are the three stages in this process, namely: 1) data collection, 2) corpus cleaning, and 3) corpus alignment.

3.3.1 Data collection

The initial step in building parallel corpora is data collection. For this project, I collected research data from Chinese UGGps in preparation for the construction of the Chinese-to-English parallel corpora. It is necessary, in the process of corpus selection, that representativeness and quality are fully considered (Hu & Li, 2018). The datasets analysed in this study came from nine Chinese UGGps (i.e., Taishan, Leiqiong, Yandangshan, Danxiashan, Jiuhuashan, Wudalianchi, Fangshan, Xiangxi and Mount Kunlun). These nine Chinese UGGps were selected for two practical considerations. First, they were well-established globally and had gone through several stages of development and translation updates since 2016. This meant the quality of some translations could be higher than other Chinese UGGps. Second, collecting data from these nine Chinese UGGps was comparably simpler than others, the managers of these nine geoparks were willing to provide us with all the available Chinese-to-English translations within the parks. This meant that accessing data from these locations was straightforward, requiring neither payment of funds nor complex processes to solve copyright issues. The parallel raw datasets were provided in the form of Word documents which included Chinese-to-English translations of materials, such as brochures, interpretive boards, and geological museum exhibits.

My PhD thesis includes five published academic journal articles (Chapter 2 and Chapters 4-7). Among these, four relate to empirical data analysis (Chapters 4-7), and one for literature review (Chapter 2). These four research articles on data analysis are all case studies. Although in this project, nine Chinese UGGps were selected for case analysis, this does not mean that every journal article would use all the datasets from the selected nine Chinese UGGps for the case study. The information of these nine Chinese UGGps is demonstrated in Table 3.1.

Table 3.1. Information of the nine Chinese UGGps

Name of Chinese UGGps	**Location**	**Year of the updated translation system (Year of data retrieval)**	**Size (tokens) (number of words)**		**Chapter in the thesis**
			Chinese	**English**	
Taishan	Tai'an, Shandong Province	2016	32,003 characters	51,204 words	Chapter 4
Leiqiong	Zhanjiang, Guangdong Province; Haikou, Hainan Province	2021	28,022 characters	44,803 words	
Danxiashan	Shaoguan, Guangdong Province	2022	35,217 characters	59,869 words	Chapter 5
Yandangshan	Leqing, Zhejiang Province	2019	23,265 characters	37,224 words	
Jiuhuashan	Chizhou, Anhui Province	2023	34,206 characters	51,039 words	Chapter 6
Wudalianchi	Heihe, Heilongjiang Province	2022	20,372 characters	32,596 words	
Fangshan	Fangshan, Beijing City; Baoding, Hebei Province	2018	22,432 characters	33,648 words	Chapter 7
Xiangxi	Xiangxi Tujia and Miao Autonomous Prefecture, Hunan Province	2022	27,019 characters	43,231 words	
Mount Kunlun	Ge'ermu Qinghai Province	2020	20,104 characters	36,187 words	
Total (Raw)			242,640 characters	389,801 words	Chapter 4-Chapter 7

3.3.2 Corpus data re-organisation

The raw data from each Chinese UGGp was first cleaned and re-organised to focus on each of the ABC elements of geotourism. For example, Figure 3.1 shows a page of sample data from the Taishan UGGp, representative of the general format of data from the other UGGps. There are two entries on this page, with entry 37 (red fox) being a type of fauna in **B**iotic (B) element, while entry 38 being a stretch of text descriptive of a cultural phenomenon. Therefore, for data shaped like this, entry 37 is re-grouped into the dataset for the B element, while entry 38 is re-grouped into the dataset for the C element. Because the data are all later aligned and analysed in Tmxmall for line-by-line manual analysis, this process ensures that the manual analysis concentrates on the specific element, but the entirety of each entry within the element is preserved. In chapters where certain element is not analysed (e.g., Chapter 5 only focuses on element A and C), entries from the other element (i.e. entries of the B element in Chapter 5) were removed.

Figure 3.1. Sample data page of raw data from Taishan UGGp

37 WDLC00067 赤狐

37 WDLC00067 *Vulpes vulpes* (red fox)

公元 20 世纪 单一质地有机质 其他动物质 二级 78 完整

20th Century AD Single texture organic matter, animal II 78 Complete

狐狸，善于快速及长距离奔跑，多喜群居，常追逐猎食。杂食性，以食草动物及啮齿动物等为食；有些食腐肉、植物或杂食。狐狸繁殖率高，抗病力强，食性杂，好饲养。当它们猛扑向猎物时，毛发浓密的长尾巴能帮助它们保持平衡，尾尖的白毛可以迷惑敌人，扰乱敌人的视线。

Red foxes are fast runners and good at running long distances. They are gregarious and often chase their prey. They are omnivorous, mainly feeding on herbivores and rodents. Some also feed on carrion and plants. They are highly reproductive and resistant to disease. They have a mixed diet and are thus easy to feed. When pouncing on the prey, they maintain their balance with the long, thickly furred tail, and the white hairs at the tip of the tail can confuse and disrupt their enemies.

38 泰山文化实质上是一种信仰文化。以东岳大帝、碧霞元君、泰山石敢当为代表的民俗信仰，从这里走向全国，走向世界，千百年来成为平安吉祥的象征。

38 The Mount Taishan Culture, in essence, is spawned from local beliefs. With famous icons such as *Dongyue Dadi* (the Great Deity of Mount Taishan), *Bixia Yuanjun* (Goddess of the Azure Clouds) and *Taishan Shigandang* (stone tablets that can drive away misfortune and evil spirits), the folk beliefs here have spread nationwide and worldwide, which remain to be the symbols of a halcyon life for thousands of years.

As shown in Figure 3.1, the resulting corresponding Chinese and English passages were presented in alternating paragraphs, with the original Chinese text appearing first, followed by the corresponding English translation. After data re-organisation, the dataset includes a total 270,613 words, comprising 104,105 Chinese characters and 166,508 English words. These data were then processed for corpus alignment and annotation in Tmxmall.

3.3.3 Corpus alignment

The next step after the four Chinese-to-English corpora were composed and cleaned is text alignment. The 'alignment' is required before any further processing of the language data. This procedure ensures that the

language data (specifically, the Chinese and English corpora in our cases) are aligned by words, sentences, or paragraphs. This foundational procedure aids in the efficiency and accuracy of identifying and annotating effective and ineffective translations and it is used in all of the empirical studies in this thesis.

To align the texts, the corpora were imported into a tool called Tmxmall (https://www.tmxmall.com/aligner/home). Tmxmall is an online language analysis platform that enables users to upload, align, and simultaneously view content in two or more languages in a parallel format (Cheng, 2023). This tool automatically analyzes the texts and provide an initial alignment of the texts. This procedure is the foundation of the identification and coding of the data in the next step. In this process, any problematic alignment of texts was manually corrected. Figure 3.2 provides an example of the aligned texts from the Jiuhuashan and Wudalianchi UGGps.

Figure 3.2. Aligned corpus text from Jiuhuashan and Wudalianchi UGGps

1484	扭扭兰	Spiranthes sinensis (Pers.) Ames (Shou Tsao)
1485	“扭扭兰”的茎短，近基部生2~5枚叶。	The stem of Shou Tsao is short, with 2~5 leaves near the base.
1486	阴阳草	Gymnadenia conopsea (L.) R. Br. (Palm ginseng)
1487	“阴阳草”是一种多年生的兰科植物。	Palm ginseng is a kind of perennial orchid plant.
1488	八头七	Herminium monorchis (L.) R. Br. (Musk orchid)
1489	“八头七”的花期是6~8月。	The musk orchid blooms from June to August.
1490	刺拐棒	Acanthopanax senticosus (Rupr. Maxim.) Harms (Siberian Ginseng)
1491	“刺拐棒”分布于中国黑龙江、吉林和辽宁省。	Siberian Ginseng is distributed in Heilongjiang, Jilin and Liaoning provinces in China.
1492	余岚吊/梢瓜	Schisandra chinensis (Turcz.) Baill. (Chinese magnoliavine)
1493	“余岚吊”秋季果实成熟时采摘，晒干或蒸后晒干，除去果梗及杂质。	The fruits of Chinese magnoliavine are picked in autumn when they are mature, dried or steamed and dried to remove the stalks and impurities.
1494	黄玻璃	Phellodendron amurense Rupr. (Chinese corktree)
1495	“黄玻璃”是枪托、家具、装饰的优良材料，亦为胶合板材。	Chinese corktree is an excellent material for gunstocks, furniture, and decoration, and it is also a plywood.
1496	土三七	Gynura japonica (Thunb.) Juel. (Herb of chrysanthemum-like groundsel)
1497	“土三七”是一种植物，根茎粗而木质，叶不具距，平，互生。	The herb of chrysanthemum-like groundsel is a kind of plant with thick and woody root neck, non-spacing leaves, flat and alternate.
1498	刺嘴	Rubus corchorifolius L.f. (Raspberry)
1499	“刺嘴”花期2~3月，果期4~6月。	The flowering period of raspberry occurs between the months of February and March, while its fruiting season spans from April to June.
1500	金达莱	Rhododendron dauricum L. (Xing'an Rhododendron)
1501	“金达莱”属半常绿灌木丛，高可达2米，分枝多。	Xing'an rhododendron is a semi-evergreen shrub, up to 2 meters high, with many branches.
1502	老婆子花	Pulsatilla dahurica (Fisch.) Spreng. (Dahurian pulsatilla root)
1503	“老婆子花”根茎长达16厘米，粗5~7毫米。	The rhizome of dahurian pulsatilla root is 16 cm and 5~7 mm thick.
1504	山胡黍	Spodiopogon cotulifer (Thunb.) Hack. (Oily silver grass)
1505	“山胡黍”生长于向阳山坡、山谷草地和荒芜之地。	Oily grows on sunny hillsides, valley grasslands and barren land.

3.4 Qualitative Analysis

The qualitative analyses in all of the empirical chapters in this thesis generally involve two recursive steps: pattern identification and data coding. The first step of pattern identification started with reading through the entire corpora, gaining a general impression of translation types and potential needs for levels of categorization. Then, a series of codes were developed to reflect the different levels of information I investigated in the data. Depending on the specific empirical chapters, these codes may vary slightly from each other, but generally, these coding contains the following four levels of information:

1) The interpretive element of ABC (Dowling, 2013); for example, if the language being coded relates to element A (geological features and geological processes), then it would be coded with a tag <GF> or <GP>.
2) Subcategories of the interpretive elements, if applicable. Specifically, among the ABC elements, the B element (Flora and Fauna) involves six subcategories. Therefore, when analysing B element in Chapter 6, the coding procedure involved specific tags that indicate whether they are Common Plant Names (CPN), Chinese Cultural Plant Names (CCPN), Flora Processes (FLP), Common Animal Names (CAN), Chinese Cultural Animal Names (CCAN), or Fauna Processes (FAP).

3) Effective or problematic translations. Guided by three-dimensional transformations of Hu's Eco-Translatology (2003), all translations in the corpora were identified as effective or ineffective. Effective translation aligns with the linguistic, cultural, or communicative dimensions. If so, it was given a tag to indicate that it was effective; and the opposite is indicated that it is problematic. The tags used for these indications slightly vary across the chapters.
4) Specific types of translation strategies or translation problems, if applicable. In Chapter 5, 6, and 7, specific translation strategies and translation problems were identified and categorized based on previous literature (Baker, 2018; Ren, 2020; Wang, 2018) with empirical data from the UGGps. In other words, in addition to tagging the language data as effective or problematic, I also provided information regarding which specific strategies of problems it falls into.

To illustrate the label structure mentioned in the above four points, Table 3.2 below displays the four levels of information (in the first four columns) as well as label examples used in Chapter 6.

Table 3.2. Label structure example

Label elements				**Label Example**
Components of Element B	**Effective or problematic**	**Subcategories of components**	**Translation strategy**	
Flora <FL>	Interpretation Strategies <IS>	Common Plant Names <CPN>	Latin and English <LE>	<FL, IS, CPN, LE>
			Literal Interpretation <LI>	<FL, IS, CPN, LI>
			Creative Interpretation <CI>	<FL, IS, CPN, CI>
			Foreignisation <Foreignisation>	<FL, IS, CPN, Foreignisation>
		Chinese Cultural Plant Names <CCPN>	Latin and English <LE>	<FL, IS, CCPN, LE>
			Literal Interpretation <LI>	<FL, IS, CCPN, LI>
			Creative Interpretation <CI>	<FL, IS, CCPN, CI>
		Flora Processes <FLP>	Literal Interpretation <LI>	<FL, IS, FLP, Division>
			Division <Division>	<FL, IS, FLP, Shift>
			Shift <Shift>	<FL, IS, FLP, DS>
			Division and Shift <DS>	<FL, IS, FLP, DS>
			Combination <Combination>	<FL, IS, FLP, Combination>
			Restructuring the Word Order <RWO>	<FL, IS, FLP, RWO>
	Interpretation Problems <IP>	Common Plant Names <CPN>	Not Interpreted <NI>	<FL, IP, CPN, NI>
			Misinterpreted <Misinterpreted>	<FL, IP, CPN, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<FL, IP, CPN, IISN>
			Use Chinese Pinyin to Replace English Words <UCPREW>	<FL, IP, CPN, UCPREW>
		Chinese Cultural Plant Names <CCPN>	Not Interpreted <NI>	<FL, IP, CCPN, NI>
			Misinterpreted <Misinterpreted>	<FL, IP, CCPN, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<FL, IP, CCPN, IISN>
			Use Chinese Pinyin to Replace English Words <UCPREW>	<FL, IP, CCPN, UCPREW>
		Flora Processes <FLP>	Not Interpreted <NI>	<FL, IP, FLP, NI>
			Misinterpreted <Misinterpreted>	<FL, IP, FLP, Misinterpreted>
		Common Animal Names	Latin and English <LE>	<FA, IS, CAN, LE>
			Literal Interpretation <LI>	<FA, IS, CAN, LI>

Fauna <FA>	Interpretation Strategies <IS>	<CAN>	Creative Interpretation <CI>	<FA, IS, CAN, CI>
			Foreignisation <Foreignisation>	<FA, IS, CAN, Foreignisation>
		Chinese Cultural Animal Names <CCPN>	Latin and English <LE>	<FA, IS, CCPN, LE>
			Literal Interpretation <LI>	<FA, IS, CCPN, LI>
			Creative Interpretation <CI>	<FA, IS, CCPN, CI>
		Fauna Processes <FAP>	Literal Interpretation <LI>	<FA, IS, FAP, LI>
			Division <Division>	<FA, IS, FAP, Division>
			Shift <Shift>	<FA, IS, FAP, Shift>
			Division and Shift <DS>	<FA, IS, FAP, DS>
			Combination <Combination>	<FA, IS, FAP, Combination>
			Restructuring the Word Order <RWO>	<FA, IS, FAP, RWO>
	Interpretation Problems <IP>	Common Animal Names <CAN>	Not Interpreted <NI>	<FA, IP, CAN, NI>
			Misinterpreted <Misinterpreted>	<FA, IP, CAN, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<FA, IP, CAN, IISN>
			Use Chinese Pinyin to Replace English Words <UCPREEW>	<FA, IP, CAN, UCPREW>
		Chinese Cultural Animal Names <CCPN>	Not Interpreted <NI>	<FA, IP, CCPN, NI>
			Misinterpreted <Misinterpreted>	<FA, IP, CCPN, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<FA, IP, CCPN, IISN>
			Use Chinese Pinyin to Replace English Words <UCPREW>	<FA, IP, CCPN, UCPREW>
		Fauna Processes <FAP>	Not Interpreted <NI>	<FA, IP, FAP, NI>
			Misinterpreted <Misinterpreted>	<FA, IP, FAP, Misinterpreted>

*For the detailed tag systems used for each empirical chapter (Chapter 4 to Chapter 7), please refer to Figure 3 and Figure 4 in Chapter 4, Figure 2 and Figure 3 in Chapter 5, Appendix B in Chapter 6, and Appendix B in Chapter 7.

The coding process was carried out in Tmxmall, after which the corpora data were exported in TMX format and fed into Sketch Engine (https://www.sketchengine.eu/) for further data analysis. The coded texts not only serve as a detailed searchable documentation of the various translation strategies and issues, it also forms the foundation for the following quantitative analysis.

3.5 Quantitative Analysis

3.5.1 Pattern extraction using Corpus Query Language (CQL)

After the corpora were annotated and exported from Tmxmall, all data was uploaded to Sketch Engine. Sketch Engine (https://www.sketchengine.eu/) is a language processing software tailored for analysing texts from extensive corpora. The various functions in Sketch Engine support analyses such as identifying linguistic patterns, extracting and quantifying identified patterns, and usages for various applications such as text analysis and mining (Kilgarriff et al., 2015). An important feature of Sketch Engine that facilitated this research is its CQL compatibility. CQL is a specialized code or query language employed in Sketch Engine to enable the search for complex grammatical or lexical patterns, or to implement retrieval criteria (Kilgarriff et al., 2015; Merz, 2003).

For the empirical studies in this thesis, CQL was used to extract the target patterns of translation (in the published chapters, translation is referred to as interpretation) in the corpora used in each chapter. The target patterns here refer to the annotated translations that were labelled using the system discussed in section 3.4. For example, when a pattern is labelled <Fl, IS, CCPN, LI>, it refers to effective translation of Chinese cultural plant names in the category of flora using the strategy of literal interpretation (see more examples in Table 3.2). This extraction is the foundation for the quantitative analysis. Based on the coding scheme described in the previous section, any interpretations that encompasses any combinations of the four types of information can be identified. A complete entry of CQL, also called function formula, typically include a series of identifying codes that matches the codes assigned to the target linguistic feature. For example, if we are looking for interpretations of Chinese cultural plant names (CCPN) of flora (FL) in the **B**iotic element that is interpreted effectively (IS) and used the literal interpretation (LI) strategy, the CQL for locating all the linguistic patterns that meet these requirements in the corpora would look like:

[word="FL"] [word=","] [word="IS"] [word=","] [word="CCPN"] [word=","] [word="LI"]

where each time the frame *[word=" "]* appears, it searches for one specific code that represent one type of information. Because the comma is used to separate levels of information, it is also included in the CQL search query. Note that for each chapter the component of the CQL query is slightly different due to their different purposes, the general procedure remains the same. For details of the CQL query components, please see the methodology sections in each empirical chapter. The CQL enabled the identification and counting of all possible interpretation strategies and problems of each of the specific subcategories of the ABC elements.

3.5.2 Focusing on effective and problematic translations

A critical focus of this thesis is its focus on effective and problematic translations. Using CQL, all patterns that represent different interpretation strategies used for each of the ABC elements were extracted in Sketch Engine, as well as ineffective interpretations (i.e., problematic interpretations). Each of these types were extracted and counted for their frequency in the corpora in Sketch Engine. The quantitative analysis helps with identifying the most used interpretation strategies or the most frequency interpretation problems.

In terms of effective interpretations, for the **A**biotic element (geological feature and geological process), a total of eight unique strategies were identified. Specifically, six and four types of interpretation strategies were identified for interpreting geological feature (GF) and geological process (GP) respectively, where two strategies were used both for the interpretation of GF and GP. Figure 3.3 displays the relationship in a Venn diagram, depicting the types of interpretation strategies used or shared when interpreting the A element in Chapter 5. For the **B**iotic element, a total of nine unique strategies were identified. It is worth noting that the **B**iotic element encompasses three subcategories: common biotic names, local Chinese biotic terms, and ecological processes. Each of these subcategories exhibit different varieties in the usage of the strategies. Figure 3.4 displays the interpretation strategies used in the three subcategories in the B element, as described in Chapter 6. For the **C**ultural element, the cultural component, a total of four unique strategies were identified. They are literal interpretation, transliteration and free interpretation, free interpretation, and addition, as described in Chapter 5.

Figure 3.3. Interpretation strategies used for the **A**biotic element (GF and GP).

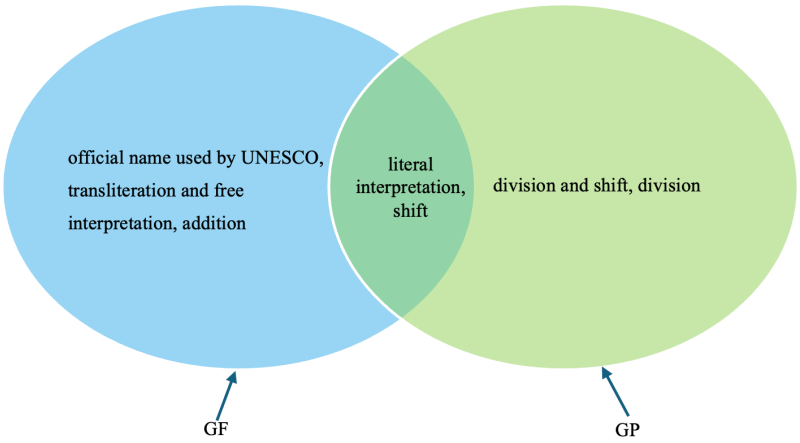
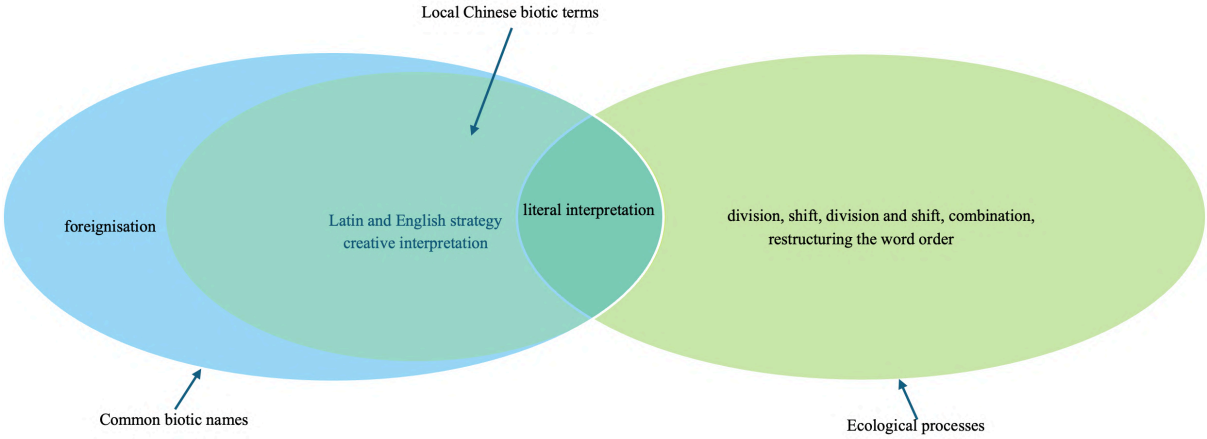


Figure 3.4. Interpretation strategies used for the **B**iotic element (common biotic names, local Chinese biotic terms, and ecological processes).



The processes of identifying and categorizing problematic interpretations are exactly the same as the ones used for identifying effective interpretation strategies. These problematic incidences were then modified using effective interpretation strategies. For all types of ineffective interpretations (four types in the A element, four types in B, and four types in C), the problematic parts were optimised using appropriate interpretation strategies.

3.6 Researcher Positionality

As a native Chinese speaker with a deep-rooted understanding of Chinese culture and geological expressions, I am uniquely positioned to conduct research on Chinese-to-English geotourism translation. My familiarity with the nuances of the Chinese language, including idiomatic expressions and cultural references, allows me to critically evaluate translated content for both accuracy and appropriateness. This cultural and linguistic competence provides a strong foundation for assessing how effectively translations convey intended meanings while preserving the cultural richness inherent in Chinese geotourism texts.

In addition to my cultural and linguistic background, I have acquired expertise in translation studies and corpus linguistics, underpinned by six years of specialised training in Chinese-and-English translation at the Bachelor's and Master's levels. This training has equipped me with a robust methodological framework for developing translation strategies grounded in empirical evidence. My expertise in corpus linguistics (during my Ph.D.) enables me to systematically analyse authentic language data from the Chinese UGGps, providing insights into

existing translations' strengths and weaknesses. By critically evaluating these translations, I developed a structured translation system that prioritises semantic accuracy, stylistic appropriateness, and cultural sensitivity.

My role as a researcher is further defined by a commitment to enhancing communication between cultures through effective translation strategies. Recognising the specialised nature of geotourism language, I compiled a comprehensive list of translation strategies tailored to address its unique challenges. These strategies are informed not only by my knowledge of both Chinese and English linguistic and cultural frameworks but also by my training in corpus linguistics, which allows me to draw conclusions based on real-world language use. This integrated expertise ensures that the system I propose is both academically robust and practically applicable, emphasising the broader goal of fostering cross-cultural understanding in global geotourism.

3.7 General Remarks

This section summarises the procedures used in the empirical studies in this thesis. In each empirical study, a corpus-based approach was used with the three-dimensional transformations (i.e, language, culture, and communication) of Eco-Translatology (2003) for interpreting geotourism texts from Chinese to English. I discuss how the corpus-based method is ideally suited for this purpose and detail the steps involved in constructing Chinese-to-English parallel corpora. The corpora were compiled using data collected from nine Chinese UGGps. The general procedure of both qualitative analysis and quantitative analysis are reported. My research aims to explore a benchmark model and develop a taxonomy of effective geotourism translation strategies from Chinese to English. To achieve these aims, six research questions were formed to guide four studies included in this thesis. The following chapters each present an individual study, including all sections in a research paper.

Linking Statement I – From Theory to Practice: The Establishment of a Benchmarking Model and the Taxonomy for Chinese-to-English Geotourism Translation

As mentioned in the previous chapters, Hu's Eco-Translatology (2003) is used as the main guiding framework for this thesis, primarily because it allows translators to make flexible and principled decisions in choosing translation strategies for the complex nature of geotourism interpretation. Indeed, this flexibility greatly promotes the translation quality in terms of linguistic accuracy, cultural transparency, and communicative efficiency. However, as mentioned in Chapter 2 (Section 3.5), although this general framework has been adopted widely such as in the translation of subtitles, hospital signs, and advertising language, it has not been used in the domain such as geotourism texts. This particular domain, as an emerging field, requires complex considerations. After all, when it comes to translating the components of geotourism (i.e., the ABC elements), there are multiple considerations that require flexible and principled choice of translation strategies. The translation of these elements encompasses the complexity between language, culture, and interpersonal communication and requires the translators to consider the discipline-specific content, which is also often influenced by socio-historical factors (e.g., plants that are named after an object or a person with rich cultural reference). More importantly, as biology and geology have been developing separately yet simultaneously around the world, many terminologies for the same species are either drastically distinctive from their counterparts in a different language or are borrowed from each other, or from a similar or the same root in a different language (mostly commonly Latin). This is relevant to the scientific accuracy of the translations, which is not considered in Hu's Eco-Translotology. In such complex situations, it is critical that a translation model provide detailed guidance on such linguistic intricacies to distinguish when to use which translation strategies for the most effective translation outcome.

Moreover, the choice of translation strategies should be based on linguistic patterns, which is not exactly addressed in Hu's Eco-Translatology. For example, strategies used to translate geotourism lexical terms are typically different from those used for sentences or longer phrases, due to the various considerations mentioned before. For lexical terms, the choice of translation strategies should rely more on achieving semantic equivalence, where the linguistic forms in the source and target languages may not be literally translatable. In contrast, translation of sentences requires more attention to syntax coherence in the target language, which may require modifications of the sentence structure in the source language. Thus, it becomes clear that a more tangible and standardised framework, taking into consideration the scientific and linguistic complexity of geotourism translation, should be developed in extension to Hu's existing framework of Eco-Translotology (2003).

Therefore, sequentially, the following empirical chapters (i.e., Chapter 4 to 7) presents a carefully designed project that addresses the issues mentioned here:

- A translation model specifically needed for the quality benchmarking in geotourism (Chapter 4)
- The translation strategies used and their linguistics patterns for the ABC elements (Chapter 5 and Chapter 6)
- A validation of the benchmarking model and the taxonomy of effective transaltion strategies for geotourism (hereafter, the Taxonomy), as proposed from Chapter 4 to Chapter 6 (Chapter 7)

Specifically, the following four chapters are each prepared as an individual manuscript that contains the entirety of an empirical research study. The actual corpora used for each empirical study as well as the details of their research methods are detailed in each chapter below, for which Chapter 3 also provides a detailed account. The next chapter, Chapter 4, is the first step in my empirical endeavour to promote a comprehensive taxonomy of geotourism translation strategies – the establishment of a benchmarking model. This benchmarking model later serves as a foundation for the Taxonomy of the ABC elements in geotourism in Chapter 5 and Chapter 6.

Chapter 4: Empirical Study 1 – Benchmarking the Quality of Chinese to English Geotourism Interpretation: The SSC Model Based on Eco-Translatology (*Geoheritage*)

Abstract

The global growth of geotourism has increased the demand and quality for geotourism interpretation. However, in its pioneer stage, geotourism interpretation has much ineffective interpretation, which hinders the informative purpose of geotourism. Moreover, geotourism interpretation lacks a systematic quality evaluation model. Such a model is essential to the future of reliable interpretation and the minimising of ineffective interpretation. This paper exams whether the currently proposed SSC model (Semantic, Style and Cultural Equivalence) for translation benchmarking purposes can effectively ensure the quality of geotourism interpretation. The SSC model is built on the three geotourism categories (ABC-Abiotic, Biotic and Culture), the unique principles of geotourism interpretation (which are determined by its objectives) and the theory of Eco-translatology. To enhance corpus research, the digital auxiliary tools, Tmxmall (2014) and Sketch Engine (2003), were used. The detailed SSC model was shaped through corpus-based contrastive analysis. The model contains a total of eight criteria that the interpreter should follow, including four for semantic equivalence: linguistic accuracy, scientific accuracy of terminology, reader acceptability of terminology, and semantic completeness of geo-information; and three for style equivalence: logical syntax, concise syntax and appropriate voice syntax. The final criterion is accurate connotation in cultural elements. The main research findings were that the SSC model can minimise ineffective interpretation of Chinese to English geodata and guarantee accurate transmission of data for geotourism in Chinese UNESCO Global Geoparks.

Keywords: SSC model; geotourism interpretation; corpus-based contrastive analysis; benchmarking quality; Eco-translatology.

1. Introduction

Geotourism is variously described but has been aptly defined by its emphasis on the learning and engagement of the tourist (Geological Society of Australia 2015; Newsome and Dowling 2018; Dowling 2021). Hence effective interpretation of geotourism data is the foundation (Dowling 2013) to provide accurate information to help geotourists respond to the environment intelligently and appropriately. In the earliest years of geotourism, there was a lack of data classification. To facilitate clarity, Dowling (2013) introduces three categories of all geotourism data: Abiotic, Biotic and Cultural (ABC). The abiotic (A), element (AE), mainly refers to geological features (GFs) and geological processes (GPs). Biotic (B), element (BE), involves the interpretation of flora and fauna while cultural (C), element (CE), relates to the interpretation of people's culture and lifestyle, past and present. Moreover, there is often a close and sometimes complex relationship between the elements (Dowling 2013). This author also claims AEs (GFs and GPs) are the most important part of geotourism because the AEs are the foundation for the survival of the BEs (flora and fauna) and significantly, the CEs are embedded in the AEs. For the purposes of this paper, geoparks will be used for data as most geotourism activities are practiced within them. The ABC system will also be employed because it is the most effective way of elucidating the interpretation of data in geoparks, as was found by recent studies (Pásková et al. 2021; Li et al. 2022).

Many interpretation challenges are embedded in interpreting ABC elements in Chinese UNESCO Global Geoparks (UGGps). These elements are located in various places, namely, signage in geomuseums, visitor centres, walking trails, or reserves. The difficulty within AEs will be analysed first. GFs or GPs of AEs contain much scientific geological knowledge and terminology which are difficult to understand. As well, often for reasons which will be explained, the AEs may be difficult to interpret from Chinese to English (C-E) because of a lack of equivalence. For example, unique cultural colour terms, such as‘丹’and‘碧’as well as specific Chinese cultural words such as‘独秀’in‘独秀峰’. Apart from scientific jargon and lack of direct equivalence, the dissimilarity of the two linguistic patterns presents obstacles. For example, the AEs in the Chinese GPs involve long and complex processes that are difficult to satisfactorily interpret into the English language structure. The challenge of BEs will be examined second. The challenge here mostly comes in interpreting Latin names of plants and animals, which, for the geotourist, are academic, hard to pronounce and remember. Another BE challenge is associated with the many local Chinese names for different flora and fauna such as‘红果草’and‘飞鼠’. Interpreters may lack the ecological cultural background to interpret these local names accurately. BEs also have the structural differences between Chinese and English languages causing obstacles when (1) interpreting the formation process of geological features by some primitive animals or plants; or when (2) interpreting complex processes such as features and inhabitants of plants and animals. Similarly, it is difficult to effectively interpret the CEs in geotourism. The religious, artistic or historical Chinese lifestyle may be unknown to the geotourists, such as‘文房四宝’and‘大篆’. More specific examples about ABC interpretations will be discussed in section 6. In sum, there are many challenges in interpreting A, B, and C geotourism elements from C-E. The nature of these challenges has been outlined but can be summarised as linguistic, communicative and cultural. Thus, this paper will focus on finding a model of semantic, style and cultural equivalence (SSC equivalence).

Even after from the application of Dowling's (2013) ABC categorisation, there is still a somewhat haphazard approach to interpretation strategies, due to there being no systematic theoretical framework for interpreters. This lack of guidance has led to inconsistency and some confusion in data output. To ameliorate the current

interpretative situation, this paper will explore an SSC model based on a complex theoretical framework, partly including Eco-translatology (2001). This theory combined with the principles of geotourism interpretation, and the ABC system will be used as the theoretical guidance system and using corpus research will build the model. This SSC model aims to benchmark the quality of C-E geotourism interpretation in Chinese UGGps. Mixed research methodologies, which are field research and corpus-based contrastive analysis, are used in this research. In this manner, the main difficulties of C-E geotourism interpretation will be explored according to the targeted research question below. (Some linguistics terms will be explained in Appendix A.)

2. Literature Review

When considering the SSC model, it is helpful to first consider several previous models for benchmarking translation. For example, House's translation quality assessment (TQA) (2015) is used to evaluate translation quality in various related genres. As well, the customised model of NER (originally the NERD model, cf. Remero-Fresco and Martinez 2015) is applied for evaluating the translation quality of intralingual subtitling while NTR (Romero-Fresco and Pöchhacker 2017) and FAR (Pederson 2017) are tailored to assess the translation quality of interlingual subtitling. Furthermore, Huang's (2020) model can be employed to test translation quality of traditional Chinese medicine (TCM). For the deeper purposes of the current paper on geotourism interpretation and translation, House's TQA model (2015), Pederson's FAR model (2017) and Huang's TCM model (2020) will be discussed.

House's TQA model (1977) is considered the most methodical model for quality assessment (Munday 2016) and has been widely applied. House (1977) revises her original TQA model in 1997, and again recently in 2015 when basing it on the Hallidayan (1985) functional system of register (field, tenor and mode) and applying it to a comparative English–German corpus analysis of 52 children's books. Over the forty years of TQA's complex development, it has been effectively applied to a wide variety of genres, confirming its reliability. For example, Jiang (2010) uses TQA to evaluate the translation quality of museum texts. The following year, *The Lord of the Rings* translation from English to Swedish was examined through TQA by Gehrmann (2011). After their own translation revisions, Faghih and Jazaei (2015), as well as Al-haddad (2015), tested the translation quality of their resultant poetry and literary texts. Manafi Anari and Varmazyari (2016) apply House's (2015) revised TQA model to test Sari Aslani's Persian translation of Chomsky's *Media Control.* Their results show the target text (TT) fails to make full sense of the meaning of the source text (ST). Also, using the House (2015) TQA, Sharif and Abadi (2017) find it effective evaluating the quality of medical translation; as does, Hedayati and Yazdani (2020) selecting religious and political texts, concluding the House (2015) model is successful. Therefore, TQA (2015) has been well tested.

Some other frameworks are notable for evaluating the quality of translation. The FAR model evaluates quality in interlingual subtitling. The inventor of this model, Pedersen (2017), states the model was constructed by combining existing models, empirical data, best practice, and new eye-tracking studies. It was then tested by him on Swedish fansubs (subtitles made by fans for fans) based on corpus quantitative analysis. This model was proposed from three aspects: Functional equivalence (do the subtitles convey the speaker's meaning?); Acceptability (do the subtitles sound correct and natural in the target language?), and Readability (can the subtitles be read in a fluent and non-intrusive way?). In later research, Pederson (2019) selects 16 subtitled versions of 10 movies in the English language as corpus to continue to test the Swedish translation quality via FAR model and

also investigate creativity. The findings indicate that there is considerable variation among the various fansub versions. Fansubbers are generally determined to be more informal, less adherent to norms, and also more inclusive of abusive language in the original script than professional subtitlers in Sweden. Other translation researchers, Abdelaal (2019) and Alexander (2020) use the FAR model. Abdelaal (2019) takes the American film, *American Pie* to test the quality and explore strategies of cultural bound terms from English to Arabic while Alexander (2020) uses a courtroom drama, *Suits* (first session), to exam the quality and develop strategies of Extralinguistic Cultural References from English to Dutch. They both use Pedersen's (2005, 2011) typology and FAR model (2017) for qualitative analysis. The results show that direct translation is the most frequently used strategy and most of the range of strategies proposed by Pedersen are adopted. In addition, Abdelaal (2019) proposes two new subtitle strategies, namely, using euphemism, and using formal language similarly, Alexander (2020) makes some specific recommendations for future legal subtitlers. In a contrast model, Huang's (2020) study, is guided by Skopos Theory and can be compared with Li's (1997) TCM terminology translation. Huang (2020) proposes a reader-centered TCM terminology evaluation. However, because Skopos Theory is always concerned with the function of the target language (TL), it cannot be regarded as a complete model or an adequate comprehensive theory for bidirectional translation evaluation.

In regard to the literature on geotourism interpretation itself, firstly, there are general limitations of quantity and scope. Initially Dowling (2013) coined the ABC system to study geotourism interpretation which has been widely used by scholars. For example, Ren et al. (2014) compare the interpretation in Chinese geoparks and the American National Parks through a case study. They provide an interpretation model for geoheritage, from the perspective of communication, to aid the layperson in comprehending geoscience knowledge. This study does not evaluate the C-E geotourism interpretation, however. In more recent research, Gulas et al. (2020), Pásková et al. (2021), Li et al. (2022) and Newsome et al. (2022) apply ABC. Gulas et al. (2020) conduct research on Styrian Eisenwurzen, an Austrian UGGp. The authors' goal is to engage local citizens in the protection of the region's geoheritage and natural resources, while also increasing the region's exposure and tourism appeal. They suggest that by improving data exchange, the ABC interpretative idea can benefit both landscape conservation and geoheritage. Pásková et al. (2021) compare two UGGps, the Colca canyon and volcanoes in Andagua (Peru), and Muroto (Japan). They find the Muroto Geopark interpretation demonstrates a high level of visible ABC application, but the Andagua Geopark interpretation lacks local people's cultural knowledge to inform their Earth heritage interpretation. More significantly for evaluation of interpretation, Li et al. (2022) shape a taxonomy of interpretation strategies in A and C based on quantitative and qualitative analysis of data in Yandangshan UGGp and Danxiashan UGGp. Finally, in geotourism interpretation, Newsome et al. (2022) confronted gaps in research by using ABC to interpret the regolith of southwest Australia. In fact, the difficulty of scientific jargon presented an obstacle to interest in regolith. The innovation of this research was to simplify the scientific terminology to show the current significance of regolith to geotourists.

In conclusion, through review of relevant literature, it can be seen that although the ABC system has brought a measure of organisation to geotourism, specifically there is not yet a systematic model proposed to guide and evaluate the quality of interpreting geotourism texts from C-E. As was seen from the literature review, the inspiration for this type of research modelling has come from the TQA pioneers and precedents: that is, House (2015), Pedersen's FAR Model (2017), and to some extent, Huang's (2020) TCM translation model based on Skopos Theory. In order to research the lack of a benchmarking geotourism model, firstly, data was collected from

Taishan UGGp and Leiqiong UGGp for the research corpus. The quality of interpretation of all the collected data will be categorised, analysed and guided by the theoretical framework of Hu's Eco-translatology combined with principles of geotourism interpretation. Finally, the benchmarking quality model of C-E interpretation will be generated from three parameters: semantic, style, and cultural equivalence based on Hu's Eco-translatology. The researcher is indebted to previous models and research, particularly by House (2015) and Pedersen (2017), in identifying the challenges in geotourism interpretation. Therefore, the targeted research question can be proposed as based on the following research gap of TQA in geotourism:

> **Is the SSC Model, based on Eco-translatology combined with principles of geotourism interpretation, sufficient to effectively guarantee a quality geotourism interpretation and translation of data?**

This research question directs contributions to two fields: linguistics and geotourism, specifically benchmarking quality of C-E geotourism interpretation and corpus-based geotourism interpretation and translation studies. Firstly, it is hoped this model will provide a pioneer standard for assessing the quality of geotourism interpretation and translation. For instance, the field of geotourism interpretation will be provided with its own interpretation and translation quality assessment model and a theoretical basis for the development of geotourism translation in the future. Secondly, this model will facilitate the growth of corpus-based geotourism translation. For example, geotourism translation researchers can use this model which provides the basis for tagging data in parallel geotourism corpus (PGC). Besides, effective interpretation can educate geotourists through interpreters, and finally achieve the purpose of geotourism: (1) better understanding and appreciation of our Earth; (2) Conservation, more specifically geoconservation; and (3) increased quality of livelihood for local communities.

3. Register and Principles of C-E Geotourism Interpretation

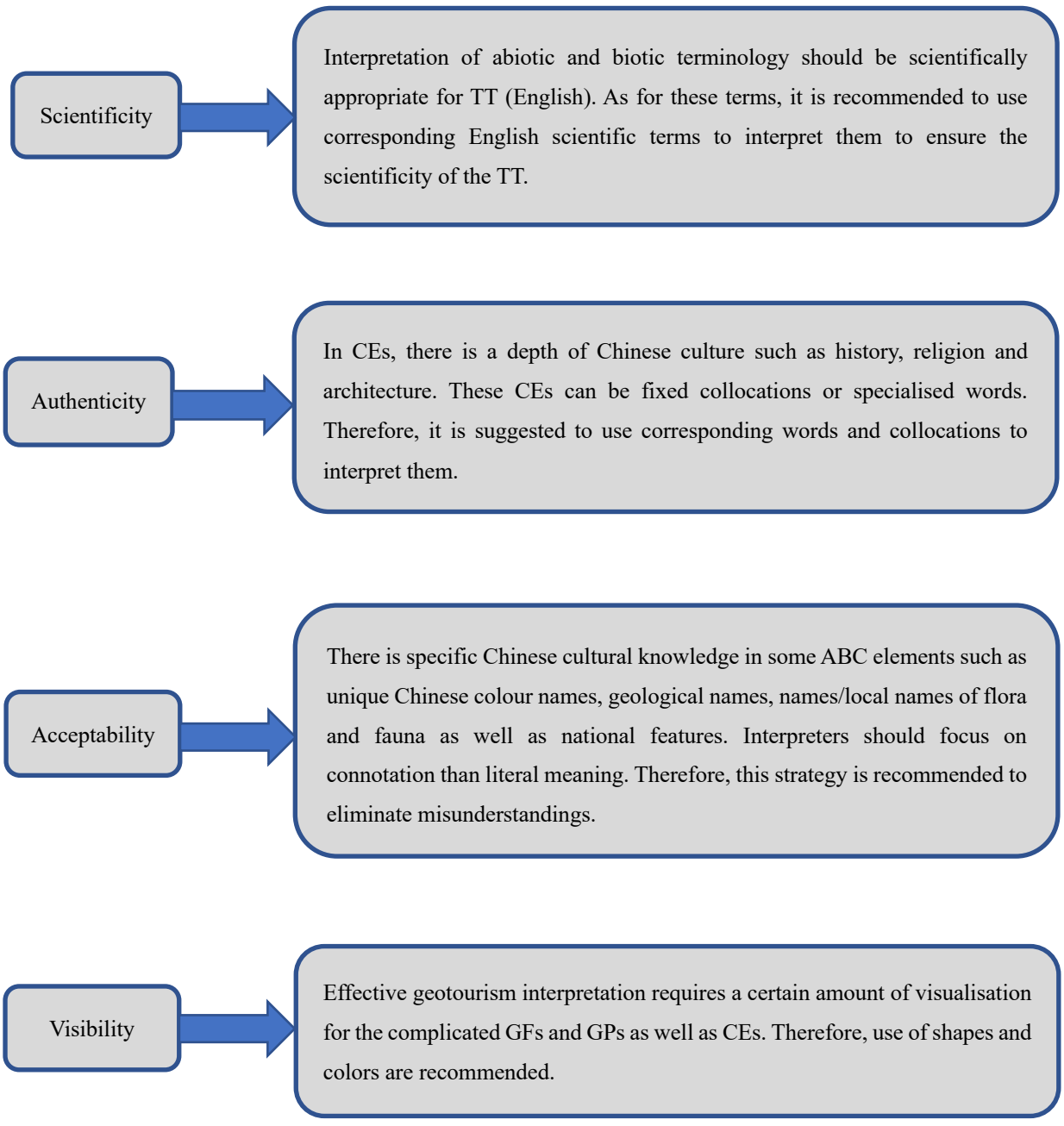
One of the fundamental principles of geotourism is the need for simple communication for the geotourist audience (Newsome et al. 2022). This means the benchmarking SSC model for translation needs to align with this. This paper is the first suggestion for a systematic approach to aligning translation with the principles of C-E geotourism interpretation. It can be done by using the framework of register theory, an idea proposed by Halliday (1978). In his innovative research, Halliday (1978) defined register and the three variables of register. He used the term, 'register', to encompass the whole vocabulary signature of a field, as well as to describe the functional unit of a specific discourse. Therefore, in its latter and specific application, it can label the quality or tenor of a discourse. These are the three variables of register: field, mode and tenor.

In aligning the principles of geotourism with Register Theory, field can be identified as ABC, abiotic (GFs and GPs) and biotic (fauna and flora) elements as well as cultural elements (history, culture, and local features of community). This means the field of geotourism includes a great deal of information, such as scientific jargon and complex geological processes.

The second category for the register theory is mode, which for this paper, is written mode (not spoken). Data is written either on brochures, leaflets, interpretive panels, signs, display boards, or geomuseum exhibits in Chinese UGGps. Mode also includes linguistic stylistic features. The written sentences in the ST (Chinese) of geotourism discourse can be long and complex because of Chinese syntax contrasted to the TT (English). Mode also includes cultural context. Therefore, translators may need to supplement with contextual information.

The third aspect of text is tenor which relates to the level of formality (Halliday 1985; O'Donnell 2021). Interpreters and geotourists are not closely related, therefore geotourism discourse is formal which is reflected at the lexical and syntactic level. Formal lexicon means there are many flowery adjectives, much scientific jargon, and rare use of first and second personal pronouns. Formal syntax may also mean long and complex sentences in the ST. Furthermore, in Chinese, more passive sentences are used to interpret complicated GPs while more active voice sentences to interpret complex flora and fauna. These variables of Register theory highlight the challenges presented by data interpretation and can be used to systematically address the challenges of translation in accordance with the principles of geotourism.

These principles of geotourism C-E interpretation based on Register Theory are summarised as below in Fig. 1. It is intended the results of geotourism data analysis using these variables and aligning with the principles of geotourism will deliver an SSC model which can be used for assessing geotourism interpretation. Therefore, this is a model of translating interpretation from C-E, not a general model.



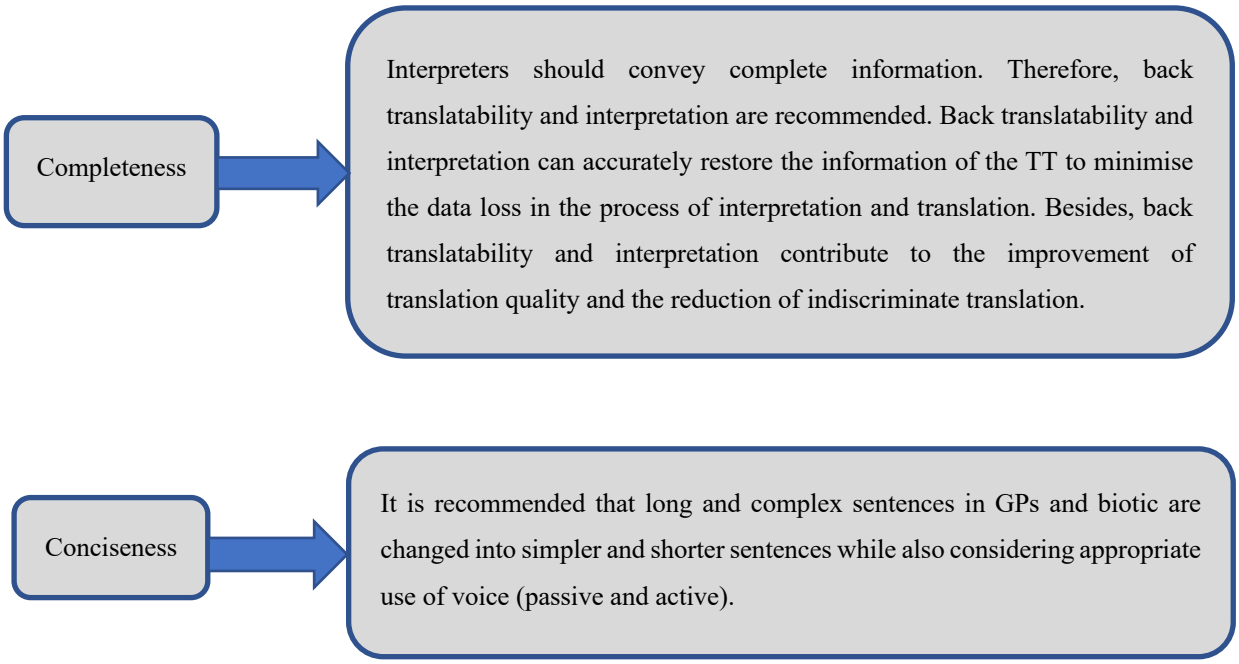


Fig 1. Principles of geotourism interpretation

4. Theoretical Framework

4.1 Basic Concepts of Eco-translatology

To allow the translator to be guided by appropriate strategies, the principles of geotourism themselves are not enough. A wider approach to translation is needed and this is accommodated by Hu's (2001) Eco-translatology. Hu (2001) defines his key term, Eco-translatology as "'the translator's selection activity to adapt to the translational eco-environment", and advocates the concept of "translator-centredness"'. Hu (2003) describes the translational eco-environment as 'the worlds of the ST and the source and target languages, comprising the linguistic, communicative, cultural, and social aspects of translating, as well as the author, client, and readers.' Therefore, translation is 'a selection activity of the translator's adaptation to fit the translational eco-environment' (Hu 2003).

For the purposes of explaining his theory, Hu (2001) embraces many Darwinian terms. Hu (2003) advises translators should not only learn to 'adapt', but also do their best to 'select'. Specifically, the characteristics of selective adaptation and adaptive selection are (Hu 2003): (1) translators' adaptation to the ST of translational eco-environment, and (2) translators in the central position to select the TT. However, Hu (2003) emphasised although the translator is in the central position, it does not mean that he can manipulate the source language (SL) and the TL at will because he is constrained by the principles of translation effectiveness. The fundamental principles of adaptation and selection, like Darwin's (1859) biological theory, are survival of the fittest or best adaption. The translator forms a close internal relationship in the continuous alternating cycle of selective adaptation and adaptive selection to optimise selection. This process of activity can be demonstrated by the diagram (Fig. 2).

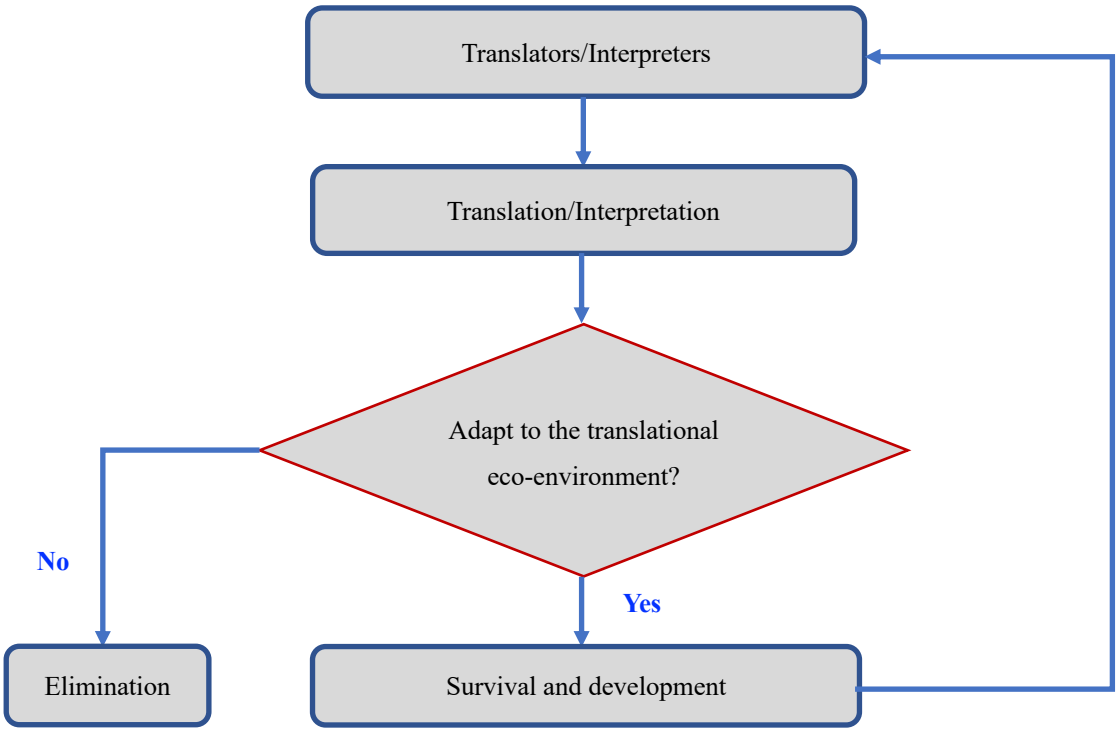


Fig 2. 'Adaptation/selection' of translation activity (Hu 2003)

Hu (2003) claims translation is realised through multiple dimensions. Hu (2008) calls them the three key dimensions of translation (linguistic, cultural and communicative dimensions). It is the three dimensions that form the basic method of Eco-translatology by adaptation and adaptive selection.

4.2 Geotourism Translation and Eco-translatology

Eco-translatology fully considers the SL and the TL, as mentioned above in part 4.1. Other theories, such as Skopos theory, pay more attention to the TL readers and therefore may miss important details and nuances of meaning in the SL.

Eco-translatology and geotourism translation are interdisciplinary researches that share the ecological level. Dowling (2013) notes ecotourism's formative relationship with geotourism. This means ecotourism translation has deep interconnections with geotourism translation and scholarship is intertwined in theory and application.

Another reason for the suitability of Eco-translatology as a foundational framework is the goal of geotourism translation (adaption and selection) matches Eco-translatology's. An example of the shared goal and application of Eco-translatology (adaption and selection) can be seen in geotourism's GFs. Because GFs contain much geological jargon, hence wrong interpretation strategies: such as using Chinese Pinyin to Replace English Word (UCPREW), Mistranslated, Not Translated (NT), and Incongruent Translation for Same Name (ITSN), may be used which result in semantic inequivalence — Hu's linguistic and communicative dimension (2003). Besides, there are many cultural terms embedded in GFs or GPs such as Chinese colour terms and specific Chinese cultural words, in which case, imprecise strategies may cause cultural inequivalence — Hu's linguistics, cultural and communicative dimension (2003). As well, style inequivalence — Hu's (2003) linguistic and communicative dimension can occur during the process of interpreting GPs from C-E. This is because Chinese language style tends to paratactic while English is hypotactic. Overall, accurate interpretation needs to be transformed by using

Hu's three dimensions (language, culture and communication). A model (SSC) can be formed using this theoretical framework of Eco-translatology together with the tool of Register Theory applied to the principles of geotourism. Detailed information for this model will be analysed and discussed in part 6.

5. Corpus and Methodology

5.1 Data Collection Procedure

Fieldwork was used to collect the data from Chinese UNESCO-recognised Global Geoparks, the most appropriate place for Chinese geotourism interpretation. They are the high-quality Chinese geotourism destinations because geology and geomorphology are their cornerstone. Specifically, Taishan UGGp, and Leiqiong UGGp were selected as a case study to test in this research. Data examples clearly illustrate the interpretation issues that most Chinese geoparks are currently facing. It should be noted, as there have been several stages of development in interpretation of data in various parks, there is an inconsistent standard throughout these collected examples. Data research sources include brochures, leaflets, interpretive panels, signs, display boards, and museum exhibits distributed freely particularly at entrances, visitor centres, and museums. To avoid selection bias, it was necessary to limit data collection to easily accessible public sources, due to the potentially high number of translation issues. The following diagram (Fig. 3) illustrates a succession of procedures.

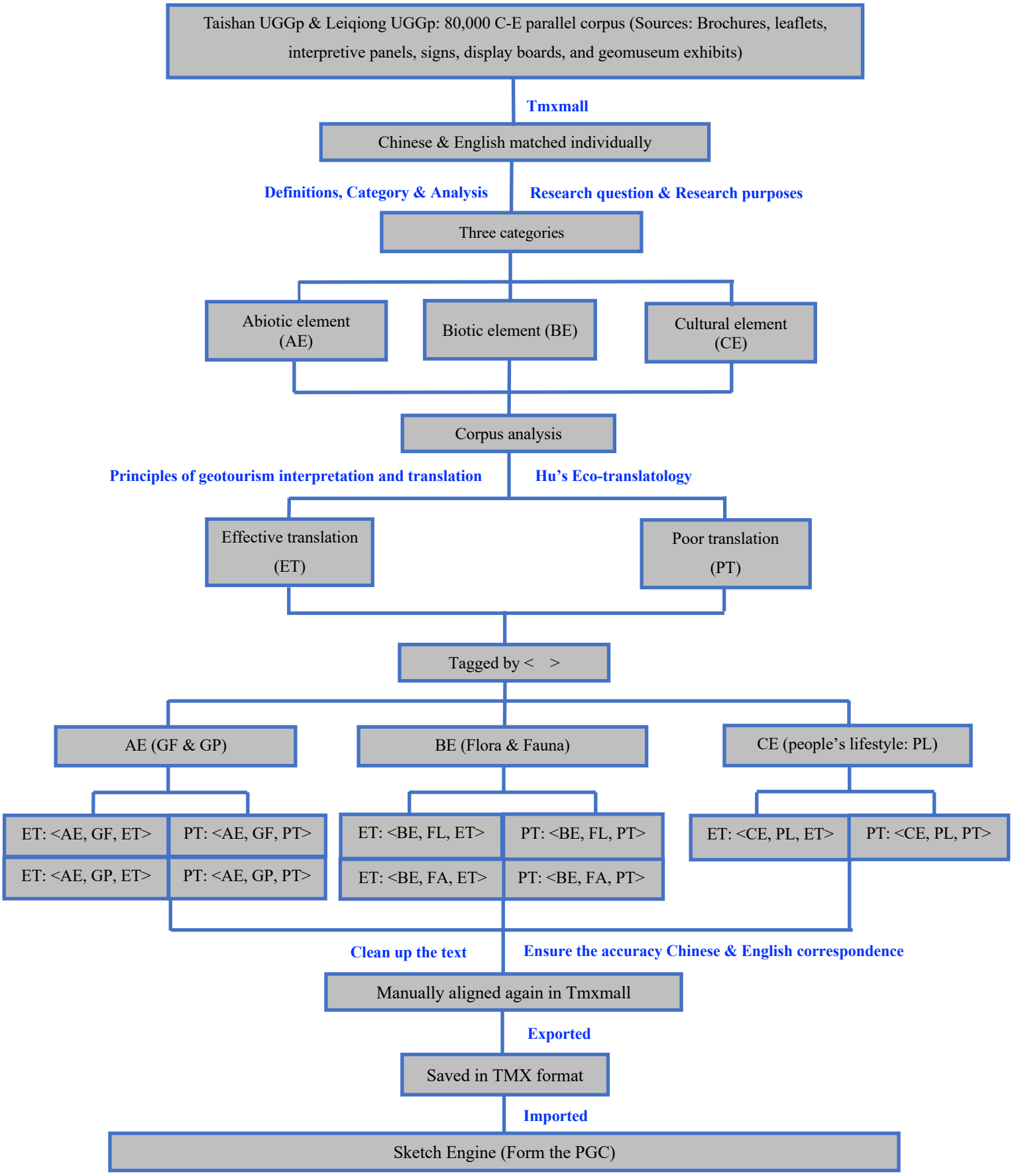


Fig 3. Diagram of data processing

The annotated categories of the above diagram were demonstrated in the below table (Fig. 4).

Annotated categories	Tag
Abiotic element	AE
Biotic element	BE
Cultural element	CE
Effective translation	EF
Poor translation	PT
Geological features	GF
Geological processes	GP
Flora	FL
Fauna	FA
People's lifestyle	PL

Fig 4. Specific annotated comments

5.2 Corpus Procedure

After building the concordance (PGC), corpus linguistics (corpus-based) research methodology was applied. Li (2020) points out three advantages of corpus-based method. Firstly, it can process fast, accurate and complex analysis by computer. Secondly, the corpus has a large scale, including a comprehensive register, so a large amount of text can be used and a wide range of language information can be gathered. Finally, this method has both quantitative and qualitative functions, so the results and the description of language is comprehensive. In this paper, corpus-based contrastive analysis was applied in three categories (ABC elements) based on this PGC. Taking C element as an example of the contrastive analysis, the specific retrieval operation steps are as follows: (1) click the Parallel Concordance at DASHBORD page; (2) click the ADVANCE at the PARALLEL CONCORDANCE page; (3) choose English in 'Search in' and then click CQL Query type. Then follow the function formula as below:

Search in

English

Query type

CQL

CQL

[word="CE"] [word=","] [word="PL"] [word=","] [word="PT"]

or

[word="CE"] [word="[[:punct:]]"] [word="PL"] [word="[[:punct:]]"] [word="PT"]

Default attribute: word

Subcorpus: non (the whole corpus)

The specific examples of poor interpretations in semantic, style and cultural inequivalence in C element were selected respectively through the above process. These poor interpretations cannot conform Eco-translatology combined principles of geotourism interpretation. After identifying poor translations, the specific examples of effective interpretations in semantic, style and cultural equivalence in C element were also chosen respectively. These effective interpretations were also identified by Eco-translatology combined with principles of geotourism interpretation. Therefore, an example of the function formula of effective translations of the C element can be depicted below as:

Search in

English

Query type

CQL

CQL

[word="CE"] [word=","] [word="PL"] [word=","] [word="ET"]

or

[word="CE"] [word="[[:punct:]]"] [word="PL"] [word="[[:punct:]]"] [word="ET"]

Default attribute: word

Subcorpus: non (the whole corpus)

Poor interpretations were contrasted with effective interpretations which were determined using semantic, style and cultural equivalence. Poor translations of C element in semantic, style and cultural inequivalence can be optimised with reference to effective interpretations to achieve semantic, style and cultural equivalence. A (GFs and GPs) and B (Fauna and Flora) elements can also be optimised by repeating the above analysis procedure. In this paper, 58 examples of ineffective and ineffective interpretations of ABC were selected for contrastive analysis from Data 1 to Data 11 in the Supplementary Material Section.

6. Results and Discussion

6.1 Abiotic element in GFs and GPs according to the SSC Model

The function formulas [word="AE"] [word=","] [word="GF"] [word=","] [word="PT"] and [word="AE"] [word=","] [word="GF"] [word=","] [word="ET"] were used to retrieve poor and effective interpretations of GFs

in semantic level respectively. All the results are shown in the Data 1 (text 1-6). As can be seen from the Data 1 (text 1-3), inaccurate interpretation strategies that cause the semantic inequivalence of interpretation in GFs are ITSN, Mistranslated, and NT in GFs. These poor interpretations should be optimised with reference to effective interpretations (Data 1: text 4-6) which were identified by Eco-translatology combined with principles of geotourism interpretation.

Firstly, ITSN can cause semantic inequivalence in interpreting GFs. Results in the PGC show,‘马鞍岭’(text 1) occurs 39 times, but there are four different interpretations: Mt. Ma’anling, Ma’anling Volcano, Ma’anling Mountain, and Saddle Ridge Volcano. By contrast,‘扇子崖’(text 4) occurs 21 times in the PGC which were only interpreted as ‘Fan Cliff’. This is an effective version, because this interpreter fully considers the connotation of text 4, that it is in the shape of text 4, a fan. This version empowers geotourists to imagine, visualise and understand the complicated GF. Meanwhile, this version achieves transformation of linguistic and communicative dimensions and further semantic equivalence. Compared with this interpretation, text 1 was interpreted as ‘Mt. Ma’anling’ and ‘Ma’anling Mountain’ which fail to succeed as interpretation in the linguistic aspect or dimension, because the interpreter does not accurately understand the ST. Text 1 is a GF (volcano) which was formed by volcanic eruption. Besides, most geologists define a mountain as ‘A landform which rises at least 1,000 feet (300 metres) above its surrounding area.’ (National Geographic 2022). Because the highest peak of‘马鞍岭’only reaches 222.6 metres, ‘mountain’ or ‘Mt’ cannot technically be used but ‘volcano’ would be appropriate in the final interpretation. Because‘马鞍岭’looks like a saddle, with the reference to the interpretation of text 4, it can be interpreted into ‘Saddle Ridge Volcano’ to achieve semantic equivalence.

Another factor that can result in the semantic inequivalence of interpretation in GFs is Mistranslated.‘云母鱼’(text 2) was interpreted into ‘Biotite Fish Texture’ which was misinterpretation. By contrast, the accurate and scientific expression ‘Vesicular Basalt’ can be directly found in English to interpret‘多孔状玄武岩’(text 5). Therefore, it easily achieves semantic equivalence and transformation of linguistic and communicative dimensions. Although‘云母鱼’(text 2) was interpreted into ‘Biotite Fish Texture’ to relate to the shininess of fish, ‘biotite’ is an obscure term. This opinion was supported by Grotenhuis et al. (2003) who explains biotite is a type of mica. So, when talking about biotite, ‘mica’ is a more commonly recognised and suitable term. Therefore, text 2 should be interpreted into ‘Mica Fish’ for the geotourist. This fulfils the scientificity and the principles of geotourism for interpretation.

NT can also cause semantic inequivalence of interpretation in GFs.‘玄武岩上的圆形空洞’(text 3) was ineffectively interpreted into ‘Holes on Basalt’. This interpreter ignored the significant pattern of the shape of the hole in the rock which is also contained in the ST. Based on principles of geotourism interpretation, interpreters should transfer the detail of GF with integrity to geotourists and fully demonstrate the nature of the GF. The interpretation of text 3 can be changed into ‘Round Holes on Basalt’. The shape (round) of this GF was supplemented to guarantee the completeness of the ST. However,‘崩塌堆积（仙人桥）’(text 6) better interprets detailed information of GFs. Text 6 was rendered into ‘Talus: Colluvial Deposits (Immortal Bridge)’. This interpretation conveys the detailed information of the ST to geotourists. This empowers them to imagine a colluvial deposit of rock debris caught in motion.

Apart from semantic inequivalence, inaccurate GF interpretations can also generate cultural inequivalence. To obtain the data and category, the same function formulas [word="AE"] [word=","] [word="GF"] [word=","] [word="PT"] and [word="AE"] [word=","] [word="GF"] [word=","] [word="ET"] were used to search poor and effective interpretations in the PGC. The selected examples (Data 2: text 7-12) were used to make a contrastive analysis. As can be seen from the Data 2 (text 7-9), wrong interpretation strategies such as ITSN, Mistranslated, and UCPREW are the main elements causing the cultural inequivalence of interpretation in GFs. These inaccurate interpretations were also improved with reference to effective interpretations (Data 2: 10-12) identified by Eco-translatology combined with principles of geotourism interpretation.

Firstly, in terms of ITSN, there are cultural words embedded in some GFs which are sometimes but not always interpreted consistently.‘彩石溪’(text 7) occurs 47 times, but three interpretations can be found in the PGC which are ‘Choi Shek Brook’, ‘Caishixi Stream’, and ‘Colourful Stone Stream’. By contrast,‘碧石岩’(text 10) appears 61 times in the PGC which were effectively interpreted into the same term, ‘Green Rock’. In text 10,‘碧’in Chinese can mean green or blue but according to the principles of geotourism interpretation, ‘green’ should be selected instead of ‘blue’, because ‘green’ can be observed from this GF. Therefore,‘碧石岩’was interpreted into ‘Green Rock’ which matches the three-dimensional transformation of Eco-translatology and achieves cultural equivalence. This interpretation can give‘彩石溪’the correct direction of revision. The Chinese colour character,‘彩’, can used to mean either chromatic or achromatic colour. The former can include red, orange, yellow, green, blue or purple while the latter refers to black, white or gray. The name‘彩石溪’refers to the combination of the two different rock formations: the colourful Amphibolite with the river like belt of steel grey Arizonite. Therefore,‘彩石溪’cannot be interpreted into ‘Choi Shek Brook’ and ‘Caishixi Stream’ as this is misleading and fails to demonstrate the meaning of the GF. These two versions do not adapt to geotourists’ need, guided by the interpretation of‘碧石岩’should, whereas ‘Colourful Stone Stream’ is an accurate version to interpret‘彩石溪’. This version not only realises the three-dimensional transformations and cultural equivalence, but inspires the geotourists’ wonder and appreciation of GFs.

Secondly, Chinese and Western cultures are embedded in the translation of some GF terms such as‘龙’in text 8 and‘圣婴’in text 11. The presence of cultural inequivalence means direct translation can fail to realise the full dimension of successful interpretation.‘黑龙潭’(text 8) was literally interpreted into ‘Black Dragon Pool’ which is Mistranslated. Text 8 can be improved with reference to‘龙’(dragon). Dragon is an auspicious symbol of Chinese culture while Westerners relate it to fantasy stories or traditions of evil. However, in the modern digital development of Western culture there are also occasional hero dragons and notably baby dragons are recently loved by preteens. This means‘龙’can be interpreted into ‘dragon’. However,‘黑龙’in text 8 was interpreted into ‘Black Dragon’ which would connote an evil force to Westerners. Therefore, such literal interpretation fails to fully consider the admiration in the original culture. In this case,‘黑龙’can be regarded as Chinese cultural function characters which are rendered into ‘Heilong’ via transliteration. Because‘潭’refers to the GP of pool formation and can simply be interpreted as ‘pool’, text 8 was optimised into ‘Heilong Pool’. This version not only retains the SL culture, but also transmits the connotation of the SL. Text 11,‘圣婴’contains a cross, one of the symbols of Christianity. However, the interpreter did not literally interpret it as ‘the Christ Child’ or ‘Divine Infant’,

because in this context, two connected volcanoes are compared to‘圣婴’. If it was interpreted into ‘the Christ Child’, this would make foreign geotourists mistakenly believe the local people were Christian. Therefore,‘火山圣婴’(text 11) should be interpreted into ‘Volcanic Twins’ rather than ‘the Christ Child Volcano’ . The version of ‘Volcanic Twins’ allows geotourists to quickly imagine the GF is two volcanoes and adapts to achieve cultural equivalence.

Besides the above examples, UCPREW causes cultural inequivalence of interpretation in GF.‘虎阜石’(text 9) was inaccurately interpreted into ‘Hufu Stone’, while another GF,‘永茂岭火山’(text 12) was accurately rendered into ‘Yongmaoling Volcano’. These two GFs have one thing in common that they can be divided into two parts. In text 12, the former section‘永茂岭’can be regarded as Chinese cultural function characters which just refer to a geographical place name, while the latter part‘火山’is the GF. These two parts together constitute a GF. Li et al. (2022) state when it comes to interpreting the names of certain rocks, caverns, peaks, and waterfalls, direct translation cannot sometimes adequately convey their essence. In this case, the first section (culture function characters) can be represented using transliteration, whereas the second section can be directly rendered the GF. Thus, text 12 was scientifically interpreted into ‘Yongmaoling Volcano’. Similar to text 12, in text 9, the former part‘虎阜’are Chinese cultural terms and the latter section‘石’is the GF. Unlike text 12, the shape can be observed from the former section of text 9 (relating to geotourism principle of visual importance of element’s interpretation). Thus, the former part‘虎阜’should be interpreted as ‘Couching Tiger’ rather than ‘Hufu’, because this particular GF can be seen very clearly as a crouching tiger. The latter part,‘石’, should be directly rendered into ‘Stone’ . Text 9 should be rendered into ‘Crouching Tiger Stone’. This realises the transformation of Eco-translatology and cultural equivalence.

Similarly, the function formulae, [word=“AE”] [word=“,”] [word=“GP”] [word=“,”] [word=“PT”] and [word=“AE”] [word=“,”] [word=“GP”] [word=“,”] [word=“ET”], were used to retrieve poor and effective interpretations of GPs respectively in the PGC. The selected examples (Data 3: text 13-18) were analysed contrastively. As can be seen from Data 3, the interpretation of GPs mainly focuses on the lexical and syntactical level. At the lexical level, ITSN and Mistranslated lead to the semantic inequivalence of the GP. In text 13,‘燕山运动’occurs 72 times in the PGC which were inconsistently interpreted into ‘Mount Yan’s Movement’, ‘Yanshan Movement’, and ‘Yanshanian Orogeny’. Text 13, ‘Yanshanian Orogeny’ is more accurate than the other two, and many geological researchers use this version in their articles, such as in Zhu et al. (2019) and Yang et al. (2020). Text 15‘地下岩浆’was ineffectively interpreted into ‘underground lava’. In English,‘岩浆’can be expressed as ‘magma’ or ‘lava’. Oxford English Dictionary (2022) defines magma as very hot liquid rock found below the earth’s surface while lava, as hot liquid rock coming out of a volcano. Thus,‘岩浆’in text 18 was accurately translated into ‘magma’. By contrast,‘地下岩浆’and‘岩浆’in text 15 were interpreted ‘underground lava’ and ‘lava’ which should be replaced by ‘magma’ according to the context. However,‘球形风化’(text 16) appears 94 times in the PGC and were scientifically and accurately interpreted into ‘Spheroidal Weathering’, because this English phrase, is widely accepted by geologists.

At the syntactic level, firstly, NT causes the semantic inequivalence of GPs. In text 14,‘或裂开，从而形成断层’is not translated which cannot accurately recover information in the ST to geotourists. Thus, the omission of

key information affects the transformation of linguistic and communicative dimensions and semantic equivalence. Therefore, the omitted information in text 14 should read 'When the stress load on the rock stratum exceeds its limit, the rock will fracture, partially or fully.' By contrast, in text 17, the complex formation of a mixed cone was effectively interpreted to geotourists in detail and completeness.

Furthermore, Mistranslated errors result in style inequivalence in interpreting complex GP. According to Huang and Ren (2020), the language styles of Chinese and English are very different. In Chinese style, complex long sentences can be used while in English, people usually use direct shorter sentences. Another relevant contrast is in the frequent use of passive in English to emphasise the nouns which carry the data. These two grammatical differences affect the accuracy of the interpretation of GPs from C-E. For example, in text 21, the formation process of the prototype of Mount Taishan was precisely interpreted from C-E. Firstly,'控制'and'形成'as implicit passive verbs were rendered into 'controlled by' and 'be formed' respectively. Meanwhile,'被风化和流水侵蚀'as an explicit passive structure was interpreted into 'was gradually weathered and eroded by waves and currents'. Besides, one long and complicated sentence was divided into three short and simple sentences in the TT. This realises the transformation of linguistic and communicative dimensions and conforms to the English style. However, the interpretations of cooling process of basaltic magma (text 19) and orogenesis (text 20) were not interpreted well. In text 19, cooling process of basaltic magma was ineffectively interpreted to English geotourists, because this GP was interpreted into a long complex sentence and passive was interpreted as active. Therefore, ST 19 should be optimised into 'During the cooling of basaltic magma, numerous contractions are formed on the surface of the lava, resulting in fissures. The volume of magma shrinks as it cools forming a polyhedral column, mostly either, pentagonal or hexagonal.' In this interpretation, the implicit passive'形成'was interpreted as 'was formed' and a long complex sentence was divided into two short simple sentences. The process of orogenesis (text 20) was also inaccurately interpreted to target readers, because implicit passive structures'挤压'and'变形'were interpreted into active. Text 20 can be revised into 'Orogeny refers to earth movement when the crust is compressed and stressed so that rock is uplifted on a large scale to form mountains.' Note passive voice was used in this version.

6.2 Biotic element in flora and fauna according to the SSC Model

The function formulas [word="BE"] [word=","] [word="FL"] [word=","] [word="PT"] and [word="BE"] [word=","] [word="FL"] [word=","] [word="ET"] were employed to retrieve poor and effective interpretations of flora. These are the instances (Data 5: text 22-26) that were chosen for contrastive analysis. In data 5 (text 22-24), inaccurate strategies such as NT, UCPREW, ITSN and Mistranslated result in semantic inequivalence. Firstly, using inaccurate strategies ITSN and UCPREW to interpret names of flora causes semantic obstacles for geotourists.'海南黄花梨' (text 22) occurs 53 times in PGC while its interpretation occurs in four different versions: 'China Scented Rosewood', 'Yellow Ormosia', 'Yellow Rosewood' and '*Dalbergia odorifera T. Chen'*. Similarly,'蛤蒌'(text 23) occurs 42 times which was ineffectively interpreted as 'Halou' via UCPREW. Compared with these two inaccurate interpretations,'箭毒木(见血封喉)'(text 25) appears 74 times which was consistently and scientifically interpreted into '*Antiaris toxicaria* Lesch. (Arrow Poison Wood) (Upas))'. According to principles of geotourism interpretation, names of flora should be scientific and commonly acceptable, therefore, using Latin and English together to interpret them will be more effective than using English or Latin

alone. Latin scientific names should be in italics. 'Arrow Poison Wood' can direct correspond to text 25 in English. In this way, geotourists can understand what the specific plant is and achieve semantic equivalence. Meanwhile, this interpretation method finishes the transformation of language and therefore achieves the final goal of the interpretation: communication. This interpretation can guide interpreters to optimise the interpretations of text 22 and text 23. In English, 'China Scented Rosewood' and 'Wild Pepper Plants' can directly correspond to text 22 and text 23 respectively. Thus, text 22 can be interpreted into '*Dalbergia odorifera T.Chen* (China Scented Rosewood)' and text 23 is '*Piper sarmentosum* Roxb. (Wild Pepper Plants)' to achieve semantic equivalence. It is significant to note when a type of plant is interpreted alone on the interpretative panel, to comply with scientific and acceptable principles of geotourism interpretation, the plant name as the title on the interpretation board should be interpreted via Latin and English simultaneously. When this plant only appears in the interpretation content, to accord with principles of simplicity and conciseness of geotourism interpretation, only English is used. This rule also applies to the interpretation of animal names to be mentioned next.

Secondly, NT and Mistranslated can also cause semantic inequivalence in interpreting complex biotic processes. In text 24, the underlined sentence was not rendered, and '系明代嘉靖年间所植，约三百年许，被雷击倒' was misinterpreted when history and the particular feature of the Chinese Wolong Scholar tree were interpreted. By contrast, the complicated process of 'Pines of Han Dynasty (Two connected Pines)' (text 26) was effectively interpreted to geotourists, because accurate formal words and phrases were used in the TT to convey the complete information to geotourists. Thus, the TT 26 obeys linguistic and communicative transformation of Eco-translatology to achieve semantic equivalence. This interpretation provides a paradigm for successful interpretation of text 24. To achieve semantic equivalence, the omitted interpretation should be added, and the misinterpreted part should be revised. Thus, text 24 can be improved into 'the Chinese scholar's tree, Sophora, leguminous plant, defoliating arbor. There are altogether over eight metres between the north and the south trees. The tree has odd and vigorous limbs of primitive simplicity with twisted roots and an upward facing tree crown. The shape is just like a sleeping dragon raising his head high. After growing for about 300 years, the tree was struck by lightning and now grows horizontally. So, it now maintains a horizontal position with its stem taking root by touching down to the ground'. All significant detailed information is now interpreted completely and accurately.

In data 6 (text 27-29), Mistranslated causes style inequivalence when complex biotic processes were interpreted. Firstly, the use of many compound sentences in the TT makes it difficult to achieve style equivalence. For instance, in the ST 27, there are seven compound sentences to interpret the features of '*Ampelopsis Glandulosa* var. *Kulingensis* (Kuling Porcelain Berry)'. The TT 27 was also mistakenly interpreted into seven compound sentences to make a long and complex sentence, because this is not in line with the simple, short and concise language style of English. In contrast, compound sentences in the ST 30 were transformed into many simple and short sentences in the TT 30 when the features of '*Caesalpinia bonduc* (Linn.) Roxb (Gray Nickernut)' were interpreted. Guided by this effective interpretation, compound long sentences in the ST 27 are also divided into simple and concise sentences in the TT. Therefore, to achieve style equivalence, the ST 27 should be optimised as 'Kuling Porcelain Berry is a vine with hairless branchlets, petioles and inflorescences. Leaves are alternate, simple or compound, with a length of 5-16 centimeters and a width of 4-16 centimeters. The flowers are hermaphrodite and born in cymes opposite the leaves, each flower has 4-5 free petals that extend and fall off individually. The calyx is

inconspicuous. Stamens are short and identical in number with the petals. The ovary is inferior to the receptacle and has 2 locules, with soft styles. Fruits are 5-10 millimeters in diameter, circular, containing 1-4 seeds and usually are blue or red'. In this way, the TT completes the transformation of linguistic dimension and communicates effectively.

Secondly, the mistakes of word order and voice in the TT also lead to style inequivalence in interpreting flora. According to Jiang and Niu (2022), Chinese language has equally coordinated elements in the sentence (paratactic) while English subordinates parts of the sentence to other parts (hypotactic). This means English focuses on logical priority. In English language style, significant information is usually put first and then detailed information follows. In the ST 31, important information and accurate voice were identified by the interpreter. Therefore,'此柏为岱庙标志性景观之一' was put first to interpret at the beginning of the TT. Besides in this text,'所植' was interpreted into 'was planted' which was passive in English because'植' is an implicit passive in Chinese. Thus, the TT 31 is concise and complete which obeys linguistic and communicative dimensions of Eco-translatology to achieve style equivalence. This successful interpretation can guide the interpreter to revise the interpretation of text 28. In text 28,'距地表 2.60 米' cannot be interpreted at the beginning of the TT because it is detailed information. Besides,'被认为' is an explicit passive in this text. Therefore, it should be interpreted into passive rather than active. Therefore, restructuring the word order and using passive are successful ways to interpret text 28 to achieve style equivalence. The whole version of the TT 28 should be rendered into 'On a tree trunk there is a globular burl, and on a branch above, extending northward, is a moon-shaped scar. Together these suggest a Chinese mythical creature, a chimerical Qilin, looking at the moon. The effect is enhanced by the height of the burl, 2.6 meters (8.5ft). This is why the tree is named the Cypress of a Qilin in Moonlight. For thousands of years, Qilin has always been seen as the symbol of auspiciousness, and its looking at the moon implies people's aspirations to live a better life. This is one of the eight strange-looking ancient cypresses in the vicinity of Daimiao Temple'. This version is successful in communication and is authentic to style interpretation.

Finally, misinterpretation of a long sentence in the biotic process also results in style inequivalence. For example, the last long sentence of the ST 29, the growing environment of '*Cycas revoluta Thunb* (Sago Palm)'. By contrast, during interpreting plant strangulation (text 32), a long sentence in the ST was interpreted into three short and simple sentences in the TT to obey Eco-translatology which makes the TT concise. The ST 29 should be improved into 'In the tropical and subtropical regions in southern China, specimens over 10 years old bloom and bear fruits almost every year. In contrast, specimens in and to the north of the Yangtze River Basin usually do not bloom all year round, or only bloom and bear fruits occasionally'. The long sentence was divided into two short and simple sentences.

The challenges of cultural differences can be illustrated in several examples of cultural inequivalence. Data 7 (text 33-34), local Chinese names of flora are not accurately and scientifically interpreted for geotourists probably because interpreters lack a full ecological cultural background,'稔子' (text 33) was interpreted into 'Renzi' via inaccurate strategy UCPREW.'红果草' (text 34) which was literally interpreted into 'red fruit grass', a misinterpretation. Text 35,'点不' was successfully interpreted into 'Java Apple', because'点不' was called'莲雾' by local Hainanese. In English, 'Java Apple' can correspond'莲雾' directly. Thus,'点不' was also 'Java Apple'. This interpretation points the way to improve the interpretations of text 33 and text

34. In terms of‘稔子’(text 33),‘桃金娘’(myrtle) was called‘稔子’by local Cantonese. Thus, the interpretation of‘稔子’is the same interpretation as‘桃金娘’, ‘myrtle’. In terms of‘红果草’(text 34) also called‘艾堇’by Cantonese and Hainanese, it cannot be interpreted into ‘red fruit grass’, because geotourists may regard‘红果草’as an edible grass. There is no English phrase to correspond to‘红果草’(‘艾堇’) directly so in this case, the Latin scientific name of‘艾堇’*Sauropus Bacciformis* can be a bridge to English interpretation. In Latin, ‘*Sauropus*’ is the genus of‘艾堇’which is a noun while ‘*Bacciformis*’ is the specific epithet of‘艾堇’which is an adjective. Therefore, Latin language is a ‘noun + adjective’ structure. The Latin adjective ‘*Bacciformis*’ means ‘Berry-shaped’ in English. Because the genus of plants is named according to their features and types, to make it understandable, genus of plants can be replaced by types of plants such as trees, shrubs, bushes, herbs, climbers and creepers. According to the specific context of the interpretation of‘艾堇’in text 34, it belongs to herbs. Therefore, the Latin noun ‘*Sauropus*’ can be replaced by ‘herbs’. Compared with Latin, the structure of English is ‘adjective + noun’. Thus,‘红果草’(‘艾堇’) should be interpreted into ‘Berry-shaped herb’ to achieve cultural equivalence.

Similarly, to analyse poor and effective interpretations of fauna, the function formulas [word=“BE”] [word=“,”] [word=“FA”] [word=“,”] [word=“PT”] and [word=“BE”] [word=“,”] [word=“FA”] [word=“,”] [word=“ET”] was used to concordance the PGC. The results show there are similar interpretation problems to flora interpretations. Selected examples for contrastive analysis from the PGC are in Data 8 to Data 10. At the semantic level (Data 8: text 36-38), firstly, ITSN fails to achieve semantic meaning when names of fauna were interpreted. For example,‘赤鳞鱼（螭霖鱼）’(text 36) in the PGC occurs 110 times, but it was inconsistently interpreted into four versions: ‘Red Fish Scales’, ‘Chilin Fish’, ‘Red Scale Fish’, and ‘Red-scaled Fish’. However,‘点斑原海豚’(text 39) in the PGC appears 77 times which was consistently interpreted into ‘*Stenella attenuate* (Pantropical Spotted Dolphin)’. This version achieves semantic equivalence. Text 36,‘赤’is a Chinese colour term which means ‘red’.‘赤鳞鱼（螭霖鱼）’is a unique fish only found in Mount. Taishan and it lives in large groups in the Colourful Stone Stream. Therefore, in English, text 36 should be rendered into ‘Mount Taishan Red-scaled fish’ to achieve semantic equivalence. Secondly, the underlined sentence was omitted describing the relationship between fish and fish culture in ST 37. Compared with a complete and detailed interpretation of the characteristics and living habits of spadefish (text 40), Text 37 will not convey complete meaning of the ST to geotourists. ST 37 should be optimised into ‘Fish culture is an important part of traditional Chinese culture, which symbolises the creative spirit of the Chinese nation. It is not hard to see that fish culture has long played multiple roles in diverse areas throughout Chinese history and carries a hint of artistry’. Apart from ITSN and NT, the uses of inaccurate language and non-standard English expression also lead to misinterpretation. For example,‘枕部’(text 38) was interpreted into ‘headrest’ but because this relates to chairs not birds, it should instead be ‘crest”.‘白杂黑’was interpreted into ‘white and black’ but should be interpreted into ‘black and white’ rather than ‘white and black’ according to the order of English language habit. To achieve semantic equivalence, high formal and standard English expressions were used in text 41 to interpret the features and living habits of Kentish Plover such as ‘migrate reasonable distances’ and ‘abundant water’.

At the style level (Data 9), misinterpretation causes style inequivalence when interpreting features of fauna. Short and simple is one of principles of geotourism interpretation. *Sousa chinensis* (Chinese White Dolphin) in text 46

is interpreted into three short and simple English sentences which achieves style equivalence. However, the characteristics of *Accipiter gentilis* (Goshawk)' in text 42, turns the three Chinese compound sentences into three compound sentences in the TT which results in misinterpretation. Text 42 should be revised into 'The Northern Goshawk is a species of medium-large raptor, which reaches about 60 centimeters (2 ft) in length with a 1.3 meters (4.3 ft) wingspan. It has a dark head with a wide white stripe over the eye, a white nape and fine grey bars on the breast. Its back is dark brown and its rudderlike tail is mostly gray with four black bars. Its wings are wide and light gray with black streaking below. Females are obviously heavier than males.' In this successful version, long sentence was divided into simple and short sentences. Text 43 fails to interpret well, in this text, '黑尾塍鹬，中型涉禽，体长 36-44 厘米。嘴、脚、颈皆较长。' was rendered into two sentences 'The black-tailed godwit is a medium-sized wading bird. It has a body length of 36-44 centimeters.' Text 43 was better rendered into one sentence: 'The Black-tailed godwit is a medium-large wader at 36-44 centimeters (14-17 in), with long bill, neck and legs. By contrast, text 47 fits style equivalence based on rules of Eco-translatology. Two Chinese sentences '珊瑚是珊瑚虫分泌出的外壳。珊瑚虫是珊瑚虫纲珊瑚目动物。' were interpreted into one English sentence via combination: 'Corals are the shells secreted by coral polyps, which belong to the Gorgonacea invertebrates within the class Anthozoa.' This concise version can be understandable for geotourists. To avoid repeated use of pronouns 'it' or 'its' in the whole process of interpretation, a relative clause can be used as a bridge to translate two Chinese sentences into an English sentence with complete information for geotourists.

Moreover, the use of short sentences and accurate passive can achieve style equivalence when features of fauna were interpreted. In text 47, short sentences and passive were accurately used to interpret the formation and features of coral. Firstly, the last long sentence was divided into five English short sentences. Furthermore, implicit passives were identified. For example, '分泌' was interpreted into 'be secreted' and '固定' were interpreted into 'be fixed'. This also conforms to transformation of linguistic and communicative dimensions. By contrast, when interpreting features of pied harrier (text 44) and white butterfly oyster (text 45), there were misinterpretations. In text 44, long sentence '头部、颈部、背部和胸部均为黑色，尾上的覆羽为白色，尾羽为灰色，翅膀上有白斑，下胸部至尾下覆羽和腋羽为白色，站立时外形很像喜鹊，所以得名。' was also rendered into a long sentence in the TT 44. This does not accord with the simple and concise language style of the English language. In text 45, '其分泌的角蛋白和碳酸钙可包裹外来物质形成珍珠。' was interpreted into 'The keratin and calcium carbonate it secretes can wrap foreign substances to form pearls.' This interpreter ignored the implicit passive '形成'. Guided by the interpretation of text 47, to achieve style equivalence, the ST 44 should be improved into 'Its head, neck, shoulders and upper chest are black, while below — from the lower chest to the axillaries and covert feathers under the tail — are white. The tail feathers are gray, and its wings have white patterns. In Chinese, it is called "magpie harrier" because it looks like a magpie when perching.' Long sentence in the ST was divided into three short and simple sentences. In the ST 45, '形成' should be rendered into passive 'be formed'. Thus, the whole ST 45 should be revised into 'A pearl is formed when an irritant works its way into the Pinctada maxima and the oyster defends itself by secreting a fluid, which mainly consists of keratin and calcium carbonate, to coat the irritant'.

Data 10 (text 48-49) demonstrates poor and effective interpretations of fauna names at the cultural level. The problems of this level are similar to interpretations of flora names in the cultural level. The interpreter lacks

ecological background which results in failure to interpret Chinese local fauna names. For example,‘水鱼’(text 48), also called‘鳖’by local Cantonese, was literally rendered into ‘water fishes’ which is mistranslated. Text 49,‘麻鹰’was rendered into ‘black kite’ rather than ‘eagle’ or ‘hawk’. This is a successful interpretation which follows Eco-translatology, because‘黑鸢’was called ‘麻鹰’by local Cantonese and Hainanese.‘黑鸢’is ‘black kite’. In English, ‘Chinese Softshell Turtle’ can directly correspond to‘ 鳖’. Thus, guided by the three dimensions of Eco-translatology,‘水鱼’was also interpreted as ‘Chinese Softshell Turtle’ to achieve cultural equivalence. Because the above two Chinese local flora names are located in the text of interpretative panels, English only can be used to interpret them to accord with concise and simple principles of geotourism interpretation.

6.3 Cultural element according to the SSC Model

To obtain the results of the CE in the corpus, the function formulas [word=“CE”] [word=“,”] [word=“PL”] [word=“,”] [word=“PT”] and [word=“CE”] [word=“,”] [word=“PL”] [word=“,”] [word=“ET”] were used to search for relevant cultural failed and effective interpretations. The examples selected for contrastive analysis are in the Data 11 (text 50-58). In summary, Data 11 (text 50-54) shows inaccurate strategies such as NT, Mistranslated, ITSN and UCPREW can result in semantic (meaning) and/or cultural inequivalence. This can be on a lexical (word) and/or a syntactic (grammatical) level. A failure in meaning transference or semantic inequivalence, in this case, is closely related to cultural issues of difference. The translator’s lack of SL cultural background thus leads to ineffective interpretation of local poetic, religious, historical and stone sculpture culture, which causes this cultural inequivalence.

Firstly, poetic and historical features of data were not completely interpreted causing semantic and cultural inequivalence. For example, a line from a poem‘登泰山而小天下’(text 50) written by Mencius and historical culture‘探花’(text 51) were completely omitted. Therefore, the true semantic and cultural significance cannot communicate the content of the ST to geotourists. The omitted content of the‘登泰山而小天下’(text 50) and‘探花’(text 51) should be supplemented in accordance with the three dimensions of Eco-translatology and principles of geotourism interpretation. Thus,‘登泰山而小天下’(text 50) should be interpreted as ‘Confucius ascended Mount Taishan and ‘all beneath the Heaven appeared to him small’.’‘探花’(text 51), in ancient Chinese dynasties, refers to the third place in the imperial examination. Thus, this connotation cultural meaning, ‘the third place in the imperial examination’, should be supplemented in the TT. By contrast, Chinese historical figure, Confucius (text 55), was effectively interpreted, because the interpretation content is not only detailed and complete, but accurately conveys the semantic and cultural meaning of Mencius’s poetry line‘孔子登东山而小鲁，登泰山而小天下。’.

Furthermore, even if translators can understand the basic meaning of the data, they might miss the cultural connotation of, for instance, Chinese religious beliefs, resulting in ITSN.‘碧霞祠’(text 52) appears 69 times in the PGC, with a total of three versions of interpretation: The Shrine of the Blue Dawn, Azure Cloud Temple and Bixia Temple. This interpreter has not fully understood the original culture. However, an example similar to text 52,‘青帝庙（宫）’(text 56) appears 79 times in the PGC and was consistently interpreted into ‘The Green Emperor Temple’. The connotation of this religious culture was identified by the interpreter. Firstly,‘太昊伏羲

(Fuxi)’was enshrined in‘青帝庙（宫）’who is one of the five emperors in Chinese mythology. Therefore, it should be an emperor temple. Besides, in Chinese culture,‘青帝’is the one who presides over the east, for ‘green’ corresponds to the east in the theory of the five elements. Therefore,‘青帝庙（宫）’should be interpreted into ‘The Green Emperor Temple’ to achieve three dimensional transformation of Eco-translatology and cultural equivalence.‘碧霞祠’(text 52) can be optimised with reference to the interpretation of text 56. In terms of text 52, the words ‘shrine’ and ‘temple’ in English have different meanings because the terms have different purposes. A shrine can simply be a pile of rocks that are consecrated to someone or some god while temples accommodate priests/priestesses and/or people for worship of a deity or goddess. A shrine can also be a single constructed monument but a temple is essentially a building with inside space. Therefore, because the bronze statue of‘碧霞元君’is housed and worshipped inside‘碧霞祠’a space, it is a ‘temple’ rather than a ‘shrine’. In regards to the accurate naming of shades of color in English,‘碧’, cyan, is perceived in English as azure. Based on this,‘碧’should be rendered into ‘azure’ rather than ‘blue’. As well, the word ‘cloud’ is more accurate than the word ‘dawn’ in interpreting‘霞’. Moreover, ‘azure dawn’ may be unimaginable to English readers. Thus ‘Azure Cloud Temple’ is an accurate version to interpret‘碧霞祠’which achieves the semantic and cultural equivalence of the three dimensions of Eco-translatology. This also explains why‘碧霞祠’cannot be interpreted into ‘Bixia Temple’. Although‘碧霞’can be regarded as Chinese cultural characters which can be interpreted as ‘Bixia’, Li et al. (2022) claim when Chinese cultural characters contain connotational meaning, it should be explicitly interpreted to geotourists.

Thirdly, in text 53,‘东岳大帝’,‘碧霞元君’and‘泰山石敢当’were misinterpretation, because they did not carry the meaning of the original culture. However, the interpretation of text 56 accurately conveys cultural connotation of Chinese folklore and beliefs to geotourists. In text 56,‘武相石狗’and‘文相石狗’were effectively translated as ‘Valiant Stone Dog’ and ‘Peaceful Stone Dog’. The expression of‘武相石狗’is ferocious, representing the warrior value of valour (here “valiant’) while the literal ‘smiling face of’‘文相石狗’signifies ‘peaceful’. Geotourists can visibly confirm the data in the dogs’ expressions. These are all cultural examples achieving semantic and cultural equivalence. The misinterpretation of text 53 can be improved, guided by the effective interpretation of this text. In text 53,‘东岳大帝’is a term used to mean the incarnation of Mount Taishan, the holy messenger of heaven and earth. Therefore,‘东岳大帝’is a deity rather than a human emperor. Thus, it should be interpreted into ‘Dongyue Dadi (the Great Deity of Mount Taishan)’ instead of ‘Emperor Dongyue’. Similarly, the term,‘碧霞元君’is the Taoist name of the Goddess of Mount Taishan. Therefore,‘碧霞元君’should be translated as ‘goddess’ rather than an ‘emperor’. Based on the above analysis of‘碧霞’,‘碧霞元君’should be rendered into ‘Bixia Yuanjun (Goddess of the Azure Cloud)’ to convey the meaning of its connotation. Although‘泰山石敢当’can be translated as ‘Mount Taishan Stone’, again, the mountain is termed a deity, a protective guardian. Hence,‘泰山石敢当’should be interpreted as ‘Taishan Shigandang (meaning ‘stone tablets that can drive away misfortune and evil spirits’)’.

A final example can be taken from Chinese geographical and calligraphic culture. For example, text 54,‘《水经注》’is mistakenly interpreted into ‘Shuijingzhu’, because the UCPREW strategy cannot accurately express the semantics or convey the connotation of Chinese geographical culture to geotourists. A small interesting

comparison to the above example is in text 58, where addition was used as a strategy to interpret ‘篆书’into ‘Zhuanshu (an ancient Chinese calligraphy style)’. Through addition, geotourists are familiar with Chinese calligraphy in general from ancient China. Similarly, to achieve semantic and cultural equivalence, addition can also be used to interpret text 54. ‘《水经注》’refers to an ancient treatise on the concept of the country’s waterways and canals, compiled during the Northern Wei Dynasty by Li Daoyuan (386-534 AD). Therefore, text 54 should be interpreted as ‘*Shuijingzhu* (*Commentary on the Water Classic*)’.

6.4 SSC Model formation

Through the corpus-based contrastive analysis of the PGC, the detailed SSC model was shaped. Eight different criteria were embedded in the three parameters of sematic, style and cultural equivalence. Firstly, for semantic equivalence, linguistic accuracy, scientific accuracy of terminology, reader acceptability of terminology, and semantic completeness of geo-information should be followed. In terms of linguistics accuracy, the major goal of geotourism translation and interpretation is communicable information. Therefore, language should be used which can empower geotourists to imagine, visualise and understand. In terms of scientific accuracy of terminology, the TT should transmit the science meaningfully. In terms of reader acceptability of terminology, both Latin and English can be used to interpret and translate biological terms such as flora names and fauna names. Geo-information should be interpreted and translated completely and in detail to geotourists and this geo-information cannot be omitted. The detail and completeness of the translation and interpretation not only increase the readability and lucidity of geotourism text, but realise the purpose of geotourism.

Secondly, when ABC elements were interpreted, logical syntax, concise syntax and appropriate voice syntax can help interpreters to achieve style. At the logical syntax level, translators and interpreters should identify and understand the logical relationship of the sentences. In the hypotactic language of English, important geo-information should be put first and then detail following. At the concise syntax level, long and complex sentences should be shifted into short and simple sentences for geotourists. Meanwhile, complex and redundant information in the ST should be simplified. In the appropriate voice syntax level, passive and active voice should be used appropriately during interpreting and translating complicated GPs and biotic information for geotourists. When complicated GPs are interpreted and translated, passive voice is recommended, because many implicit and explicit passives are embedded in the ST. In contrast, active voice is usually used to interpret and translate complicated biotical information, because most biotical information is related to flora and fauna features and life habit. This means simple possessive and describer verbs such as ‘具有/有 (have)’and ‘是 (is/are)’are in the ST. These verbs are simple, and just connect descriptive terms. However, when interpreting and translating biotical information, passive voice is also used occasionally such as implicit passive ‘覆盖 (cover)’and ‘形成 (form)’as well as explicit passive marker ‘被’in the ST.

Finally, when the interpreters carry out cultural transmission, the rule of accurate cultural connotation should be followed to achieve cultural equivalence. There is much geological, ecological and local Chinese culture embedded in geotourism discourse. When this culture is interpreted and translated, the connotation rather than literal meaning for geotourists should be conveyed via effective strategies. The SSC evaluation model based on Eco-translatology combined with principles of geotourism interpretation is illustrated in Fig. 5.

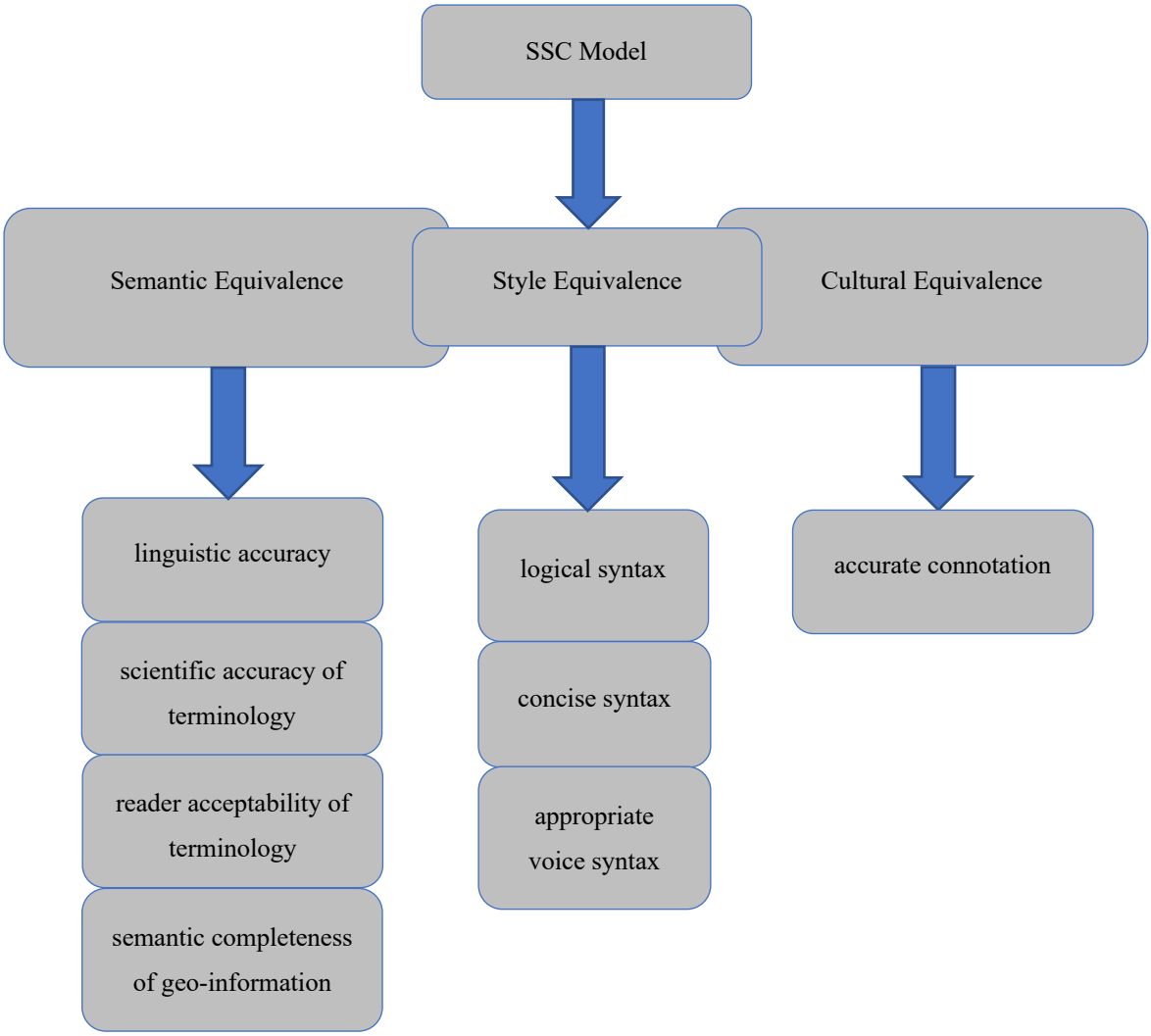


Fig 5. SSC Model of benchmarking for C-E geotourism interpretation showing eight criteria.

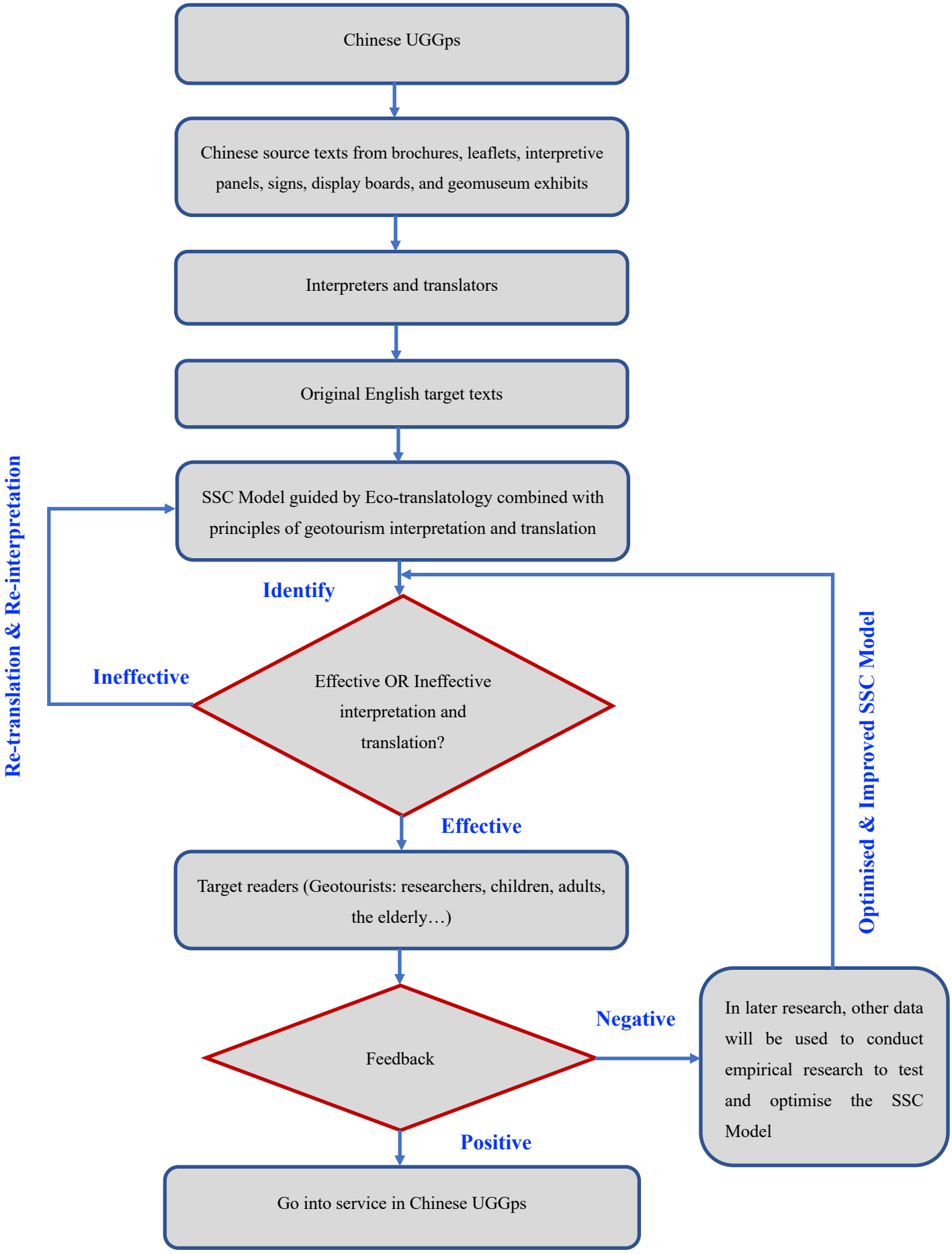


Fig 6. Diagram of assessing C-E geotourism interpretation quality in Chinese UGGps

7. Conclusions

Through corpus-based contrastive analysis of the PGC, guided by Eco-translatology combined with principles of geotourism interpretation, the SSC model was shaped to evaluate and improve the quality of C-E geotourism translation. As can be seen from the Fig. 5, in SSC model, there are eight criteria for assessing the quality of C-E geotourism interpretation embedded in three parameters (semantic equivalence, style equivalence and cultural equivalence). This means in summary, that with the SSC model to achieve semantic equivalence, interpreters and translators should obey four rules which are: linguistic accuracy, scientific accuracy of terminology, acceptability of terminology, and completeness of geo-information. To realise style equivalence, three criteria: logical syntax, concise syntax, and appropriate voice should be followed. To achieve culture equivalence, the connotation of culture should be conveyed. Based on this model, the specific process of evaluating C-E geotourism translation and interpretation quality in Chinese UGGps was summarised in Fig. 6.

The implication of findings in this research is, geotourism interpretation can now have its own customised evaluation model and evaluation process. The process and model can be used to assess and improve the quality of C-E geotourism interpretation and translation in Chinese UGGps. Meanwhile, this model can also serve as a theoretical basis for labeling geotourism corpus in future corpus-based geotourism interpretation and translation studies. Apart from the linguistics level, the results may also be applied for geotourism purposes. Firstly, the optimisation of interpretation quality of China UGGps is conducive to the growth of the geotourism market. Effective geotourism interpretations can attract more geotourists to Chinese UGGps which contributes to boosting the development of the economy and therefore, also the livelihood of local communities. Secondly, optimised geotourism interpretations are helpful to geotourists concerning geotourism education in the Nature Resource Science Popularisation Centres and International Field Study Centres of geoparks. Effective interpretations empower the goal of geotourism, that is, that geotourists imagine, visualise, better understand and appreciate our Earth. This will achieve a broader and shared mission of conservation, more specifically geoconservation.

A limitation of this research may lie in the size of the data set which consists of 80,000 Chinese and English parallel corpora from two Chinese UGGps. This means in the process of analysing and exploring the SSC model, individual cases of effective or poor translation and interpretation of ABC may be missed. This may affect the effectiveness of the SSC model. To minimise the impact of this limitation on empirical research, two representative geoparks, Taishan UGGp and Leiqiong UGGp, were selected, because they contain rich ABC elements and have improved through different stages of ongoing development of their interpretation system.

Because this is the first geotourism translation quality evaluation model obtained through empirical research, ineffective translations were optimised into effective translations through this model (Fig 6) but they are still not tested by geotourists, nor is there any feedback from them. Therefore, in future empirical research, this model needs to be verified with more data from other Chinese UGGps so that it can become more effective.

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Appendices

Appendix A. An Exhaustive Glossary of Linguistic Terms

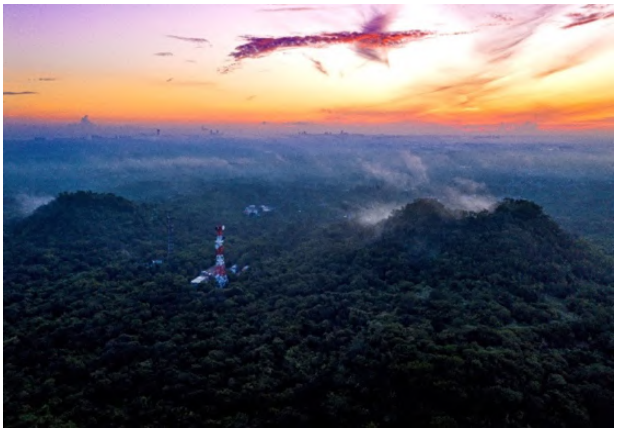
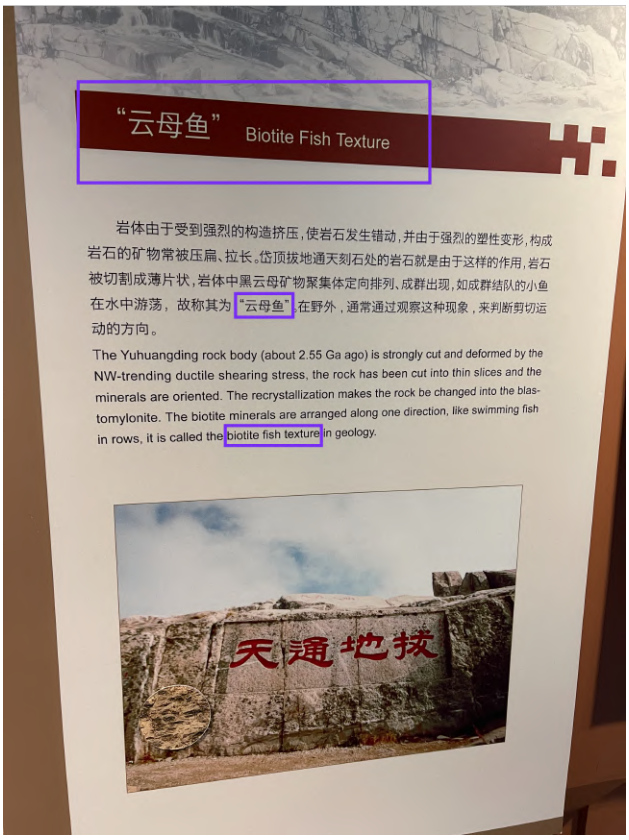
NO.	Linguistic terminology	Comments
1	<s>	In the PGC, this symbol indicates the beginning of a complete sentence.
2	</s>	In the PGC, this symbol indicates the end of a complete sentence.
3	Addition	Addition is an interpretation strategy of inserting new words, short or long sentences to interpret the connotation meaning to geotourists.
4	Chinese Pinyin	Chinese Phonetic Alphabet
5	Corpus-based contrastive analysis	In this paper, it means analysis of effective and ineffective geotourism interpretation data by contrast in the PGC. Through quantitively and qualitative analysis, effective interpretations provide optimisation direction for poor interpretations.
6	Corpus linguistics	Corpus linguistics, also called corpora, is an approach that employs enormous electronically accessible collections of spoken and written texts to conduct empirical studies (both quantitative and qualitative) of language use.
7	Cultural bound terms	Cultural-bound terms, or cultural-specific items, are those that have no analogues or distinct placements in the target reader's cultural system, resulting in difficulty in translating their functions and meanings from the source text to the target text.
8	Cultural equivalence	For the purpose of interpretation or translation, cultural equivalence is a broad term encompassing the appropriate words to carry the whole meaning of historical, literary, artistic or social references of a particular culture.
9	Eye-tracking studies	Eye-tracking is a popular technique which is used to examine cognitive effort involved in written translation, audiovisual translation and conference interpreting.
10	Explicit passive structure	In Chinese,‘被’is the marker of explicit passive structure which is similar to the structure of ‘be+done’ in English.

11	Extralinguistic cultural references (ECR)	ECRs frequently represent the distinctive characteristics of a culture. The inhabitants of another culture are generally unfamiliar with such cultural terminology, and their language does not have an equivalent term/s.
12	Implicit passive structure	In Chinese, although the structure of‘被’does not appear, this structure implies passive, such as‘分布 (be distributed)’and‘覆盖 (be covered)’.
13	Interpretation/translation strategy	A technique for interpreting or translating a linguistic unit into another language.
14	Interlingual subtitling	Interlingual subtitling is the process of translating the original language (OL) into the target language (TL) by retaining the OL, and embedding the TL synchronously at the bottom of the screen or picture.
15	Intralingual subtitling	Intralingual subtitling, also called vertical subtitling translation, converts discourse into untranslated text. Thus, intralingual subtitling is subtitling within the same language.
16	Local Chinese flora/fauna name	The specific name given to flora and fauna by local people. Thus, these names may contain much ecological cultural knowledge such as local dialect.
17	Manually aligned	A research technique in which, because the machine is not trained to always match the source and target texts properly, some manual adjustment is necessary to straighten up the corresponding sequences.
18	Parallel geotourism corpus (PGC)	PGC is one-to-one correspondence between Chinese and English geotourism text, formed in Sketch Engine software through automatic alignment, tagging, and manual alignment.
19	Semantic equivalence	Language terms, not necessarily having the same form of grammar, but equivalent in meaning.
20	Sketch Engine	A software tool for quantitative and qualitative analysis of the PGC.

21	Skopos Theory	Skopos Theory is a translation theory which was developed in Germany in the late 1970s. Skopos rule, coherence rule and fidelity rule are three application rules of Skopos Theory.
22	Specific Chinese cultural words	These are words that reflect unique Chinese culture, connotations and style.
23	Style equivalence	The interpretation that matches the source language style while being suitable for target readers.
24	Subtitle strategy	Translation technique for effective subtitle translation.
25	Tagging (annotation)	Application of special symbols to annotate effective and ineffective data in research for control purposes. It aids in corpus retrieval. (Thus, a corpus can easily be used to store additional linguistic data.)
26	Tmxmall	A software bilingual corpus alignment tool which includes both manual and automatic machine alignment.

Appendix B. Supplementary Data

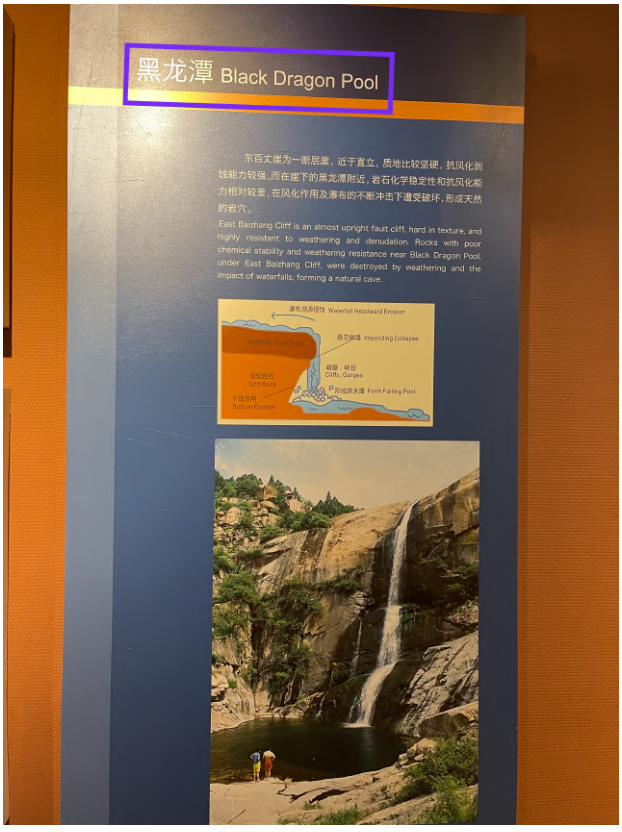
Data 1: Ineffective and effective interpretations of GFs (semantic level)

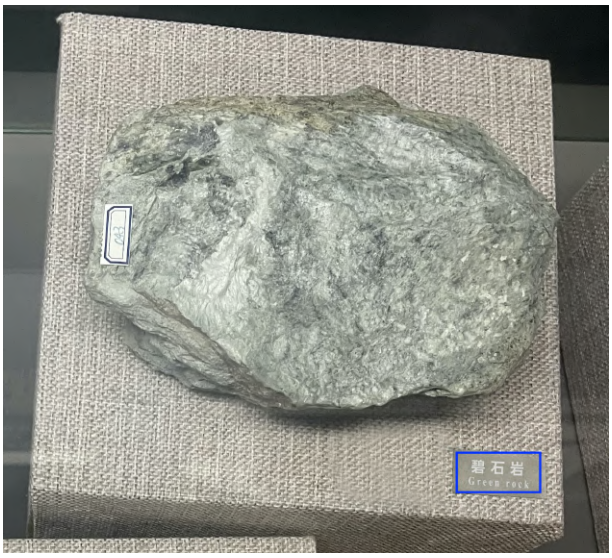
Ineffective interpretations of GFs				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Problems**
1	 (Leiqiong UNESCO Global Geopark 2021)	马鞍岭	Mt. Ma'anling Ma'anling Volcano Ma'anling Mountain Saddle Ridge Volcano	ITSN
2	 (Taishan UNESCO Global Geopark 2021)	云母鱼	Biotite Fish Texture	Mistranslated

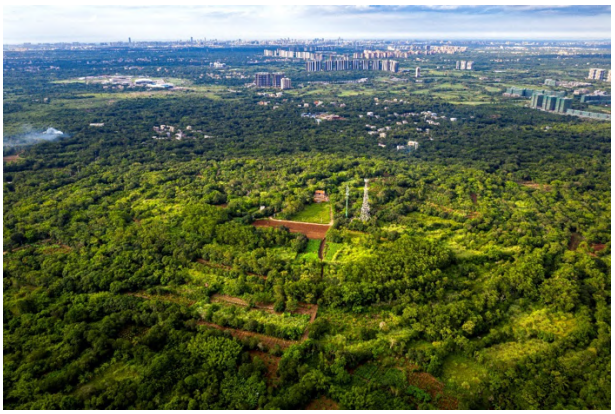
3	 (Leiqiong UNESCO Global Geopark 2021)	玄武岩上的圆形空洞	Holes on Basalt	NT
Effective interpretations of GFs				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**
4	 (Taishan UNESCO Global Geopark 2021)	扇子崖	Fan Cliff	Literal Translation

5	 (Leiqiong UNESCO Global Geopark 2021)	多孔状玄武岩	Vesicular Basalt	Literal Translation
6	 (Taishan UNESCO Global Geopark 2021)	崩塌堆积（仙人桥）	Collapsed Accumulation (Immortal Bridge)	Literal Translation

Data 2: Ineffective and effective interpretations of GFs (cultural level)

Ineffective interpretations of GFs				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Problems**
7	 (Taishan UNESCO Global Geopark 2021)	彩石溪	Choi Shek Brook Caishixi Stream Colourful Stone Stream	ITSN
8	 (Taishan UNESCO Global Geopark 2021)	黑龙潭	Black Dragon Pool	Mistranslated

9	 (Taishan UNESCO Global Geopark 2021)	虎阜石	Hufu Stone	UCPREW
Effective interpretations of GFs				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**
10	 (Taishan UNESCO Global Geopark 2021)	碧石岩	Green Rock	Literal Translation
11		火山圣婴	Volcanic Twins	Literal Translation

	(Leiqiong UNESCO Global Geopark 2021)			
12	 (Leiqiong UNESCO Global Geopark 2021)	永茂岭火山	Yongmaoling Volcano	Transliteration and Free Translation

Data 3: Ineffective and effective interpretations of GPs (semantic level)

Ineffective interpretations of GPs			
Text	**ST**	**TT**	**Problems**
13	燕山运动 (Taishan UNESCO Global Geopark 2021) (Leiqiong UNESCO Global Geopark 2021)	Mount Yan's Movement Yanshanian Orogeny Yanshan Movement	ITSN
14	<s>当岩层受力的作用超过了本身所承受的限度时，它就会错断**或裂开，从而形成断裂**。</s> (Taishan UNESCO Global Geopark 2021)	<s>Rock strata dislocate if they are subject to excessive forces beyond their limits <AE, GP, PT>.</s>	NT
15	<s>涌流凝灰岩是**地下岩浆**在上升过程中遇到地下水或地表水后发生蒸汽岩浆爆发，将岩石、**岩浆**炸成碎屑冲涌出地表堆积而成的岩石。</s> (Leiqiong UNESCO Global Geopark 2021)	<s>When rising hot **underground lava** contacts surface or sub-surface cool water, it turns into steam and explodes when it has sufficient pressure <AE, GP, PT>.</s><s>All rocks and **lava** are mixed to form surge tuff <AE, GP, PT>.</s>	Mistranslated
Effective interpretations of GPs			
Text	**ST**	**TT**	**Strategies**
16	球形风化 (Taishan UNESCO Global Geopark 2021)	Spheroidal Weathering	Literal Translation
17	<s>混合锥是火山锥的一种，又称复合锥。</s><s>其形态为比较标准的圆锥形，一般由熔岩构成混合锥的骨架，因此形成的火山锥比较高大壮观，也较坚固。</s> (Leiqiong UNESCO Global Geopark 2021)	<s>The mixed cone, also known as the composite cone, is a kind of volcanic cone <AE, GP, ET>.</s><s>It has a more standard conical shape. <AE, GP, ET>.</s><s>Generally, the skeleton of the mixed cone is constituted by the lava, so the volcanic cone is tall, spectacular and firm <AE, GP, ET>.</s>	Division + Shift
18	<s>盾火山是由黏度较低的**岩浆**，从火山口溢出，沿火山斜坡溢流过程中形成的坡度缓、宽阔穹状的盾状体。</s> (Leiqiong UNESCO Global Geopark 2021)	<s>The shield volcano is a broad dome-like shield with a gentle slope that is formed by the overflow of the **magma** with lower viscosity from the crater and along the volcanic slope <AE, GP, ET>.</s>	Shift

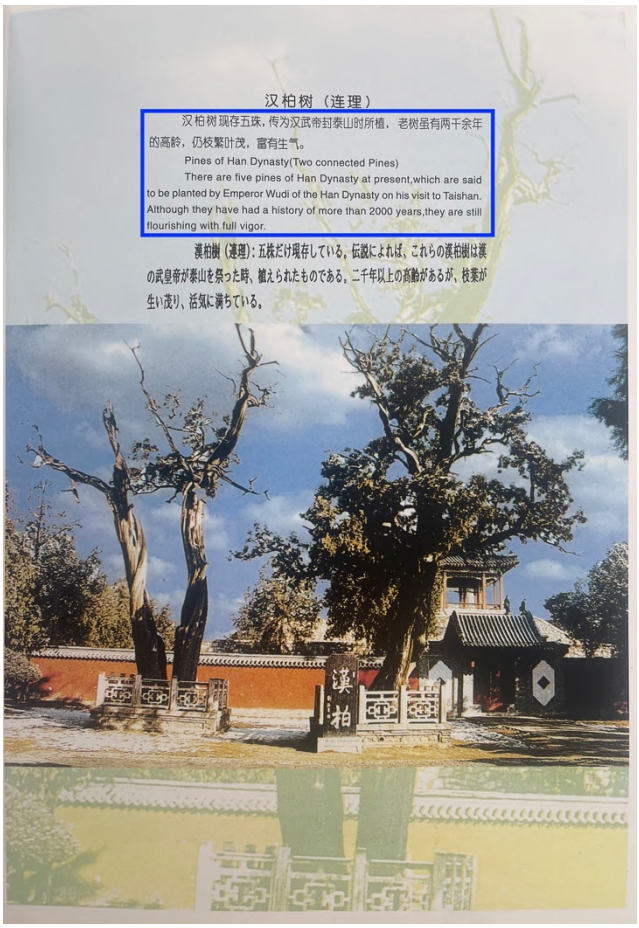
Data 4: Ineffective and effective interpretations of GPs (style level)

Ineffective interpretations of GPs			
Text	**ST**	**TT**	**Problems**
19	<s>在玄武质岩浆冷却过程中，熔岩表面形成无数的收缩中心，产生垂直于收缩方向的裂隙，体积向中心收缩聚集，**形成**多面体柱体，多为五边形、六边形。</s> (Leiqiong UNESCO Global Geopark 2021)	<s>During the cooling of basaltic magma, numerous centers of contraction are formed on the surface of the lava, resulting in fissures perpendicular to the direction of contraction, and the volume shrinks and gathers toward the center, **forming** polyhedral columns, mostly pentagonal and hexagonal <AE, GP, PT>.</s>	Mistranslated
20	<s>造山运动指地壳局部充分**挤压**受力，岩石急剧**变形**而大规模隆起形成山脉的运动。</s> (Taishan UNESCO Global Geopark 2021)	<s>Orogenesis refers to the drastic deformation and massive uplift of the rocks into mountain due to the **pressing** force on part of the earth crust <AE, GP, PT>.</s>	Mistranslated
Effective interpretations of GPs			
21	<s>受最南侧泰前断裂的**控制**，泰山开始抬升，覆盖在古老岩石之上的巨厚沉积岩**被风化和流水侵蚀**，泰山岩群及其它多期次的岩浆岩暴露地表，**形成**了今日的泰山雏形。</s> (Taishan UNESCO Global Geopark 2021)	<s>**Controlled by** the southernmost Taiqian Fault, Mount Taishan began to rise <AE, GP, ET>.</s><s>The thick-bedded sediment on the paleo rock bodies **was gradually weathered and eroded by waves and currents**, re-exposing the Taishan Group-Complex <AE, GP, ET>.</s><s>A rudiment of today's Mount Taishan **was formed** <AE, GP, ET>.</s>	Division + Shift

Data 5: Ineffective and effective interpretations of flora (semantic level)

Ineffective interpretations of flora				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Problems**
22	 (Leiqiong UNESCO Global Geopark 2021)	黄花梨	China Scented Rosewood Yellow Ormosia Yellow Rosewood Dalbergia odorifera T.Chen	ITSN
23	 (Leiqiong UNESCO Global Geopark 2021)	蛤蒌	Halou	UCPREW

24	 (Taishan UNESCO Global Geopark 2021)	卧龙槐 <s>豆科，槐属：落叶乔木，南北相距八米余，**根际盘曲，树冠仰起，宛如卧龙翘首，古拙离奇，形态若飞，枝干古朴苍劲**，系明代嘉靖年间所植，约三百年许，被雷击倒，树干平卧山坡，干端着地生根，俗称“卧龙槐”。</s>	Wolong Scholartree Wolong Scholartree, Leguminosae, Sophora japonica, Deciduous Tree <BE, FL, PT>.</s><s>It had been planted during Jiajing Period in Ming Dynasty and is 300 years old <BE, FL, PT>.</s>	NT /Mistranslated
Effective interpretations of flora				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**
25	 (Leiqiong UNESCO Global Geopark 2021)	箭毒木（见血封喉）	Arrow Poison (Upas)+Antiaris toxicaria Lesch	English + Latin

26	 (Taishan UNESCO Global Geopark 2021)	汉柏树（连理） <s>汉柏树现存五株，传为汉武帝封泰山时所植，老树虽有两千余年的高龄，仍枝繁叶茂，富有生气。</s>	Pines of Han Dynasty (Two connected Pines) <s>There are five pines of Han Dynasty at present, which are said to be planted by Emperor Hudi of Han Dynasty on his visit to Mount Taishan <BE, FL, ET>.</s><s>Although they have had a history of more than 2000 years, they are still flouring with full vigor <BE, FL, ET>.</s>	Division + Shift

Data 6: Ineffective and effective interpretations of flora (style level)

Ineffective interpretations of flora				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Problems**
27	 (Leiqiong UNESCO Global Geopark 2021)	<s>藤本植物，小枝、叶柄及花序均无毛；叶互生，单叶或复叶，长 5-16 厘米，宽 4-16 厘米；花两性，排成与叶对生的聚伞花序；花萼不明显；花瓣 4-5，分离而扩展，逐片脱落；雄蕊短而与花瓣同数；花盘隆起，与子房合生；子房 2 室，有柔弱的花柱；果为一小浆果，近球形，径 5-10 毫米，红蓝色，有种子 1-4 颗。</s>	<s>It is a liana with hairless branchlets, petioles and inflorescences; the simple and compound leaves grow in alternation; they are 5-16 centimeters long and 4-16 centimeters wide; the flowers are bisexual and arranged into cymes opposite to the leaves; the calyx is inconspicuous; the petals number four to five; they are separated and stretch out, and fall off one by one; the short stamens number as many as the petals; the flower disc rises and is concrescent with the ovary; the ovary has two chambers and weak stylets; the fruit is a small near spherical berry; it is 5-10 millimeters in diameter, red blue, and has one to four seeds <BE, FL, PT>.</s>	Mistranslated
28	 (Taishan UNESCO Global Geopark 2021)	“麒麟望月”柏 <s>**此树在距地表 2.60 米**的主干上有一球状树瘤，酷似一只双目仰视的瑞兽麒麟。</s><s>在其上后方，有一北出的侧枝上有个圆圆的疤痕，恰如一轮历月，树因此而得名。</s><s>麒麟一向**被认为**是吉祥的象征。</s><s>麒麟望月，表达了人们对美好生活的向往。</s><s>此景为岱庙古柏八景之一。</s>	THE KYLIN APRRECIATING THE MOON CYPRESS TREE <s>**At the height of 2.6 meters (8. 5 feet)** above the ground, on the trunk there is a burl in the shape of a ball, creating a scene of an imaginary animal called Kylin looking upward with two big eyes <BE, FL, PT>.</s><s>Right behind the burl there is a round scar on a branch extending northward, looking like the moon <BE, FL, PT>.</s><s>So the two composes a whole picture of Kylin appreciating the moon <BE, FL, PT>.</s><s>The auspicious animal Kylin **symbolizes** good luck and fortune <BE, FL, PT>.</s><s>And the imaginary scene of Kylin appreciating the	Mistranslated

			moon indicates people's yearning for a better life <BE, FL, PT>.</s>	
29	 (Leiqiong UNESCO Global Geopark 2021)	苏铁 科属：苏铁科 学名：*Cycas revoluta Thunb* <s>别称有铁树、凤尾铁、凤尾蕉、凤尾松，树干高约 2 米，可达 8 米或更高。</s><s>苏铁喜温暖湿润的环境，不耐寒冷，生长甚慢，寿命约 200 年。</s><s>**在中国南方热带及亚热带南部树龄 10 年以上的数树木几乎每年开花结实，而长江流域及北方各地栽培的苏铁常终生不开花，或偶尔开花结实。**</s>	Sago Palm FAMILY & GENUS: Cycas SCIENTIFIC NAME: *Cycas revoluta Thunb* <s>Also known as Folium Cycadis Revolutae, sago cyca, and cycas, it has a trunk of about 2 meters tall or even 8 meters or taller <BE, FL, PT>.</s><s>The sago palm prefers a warm and humid environment <BE, FL, PT>.</s><s>It is not resistant to cold <BE, FL, PT>.</s><s>Besides, it grows slowly but can live for around 200 years <BE, FL, PT>.</s><s>**In the south of tropical and subtropical regions in southern China, sago palms more than 10 years old almost bloom every year, but those planted in the Yangtze River Basin and northern China do not bloom all their lives or only bear blossoms and fruits occasionally** <BE, FL, PT>.</s>	Mistranslated
Effective interpretations of flora				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**
30	 (Leiqiong UNESCO Global Geopark 2021)	<s>刺果苏木属刺藤本，各部均被黄色柔毛；刺直或弯曲。</s><s>叶轴有钩刺；对生；羽片柄极短，托叶大，叶状，常分裂，脱落；在小叶着生处常有托叶状小钩刺 1 对；两面均被黄色柔毛。</s><s>总状花序腋生，具长梗，上部稠密，下部稀疏；顶端有喙，膨胀，外面具细长针刺；近球形，铅灰色，有光泽。</s>	<s>Gray Nickernut is a prickly vine with yellowish pubescent throughout <BE, FL, ET>.</s><s>Prickles are straight or somewhat recurved <BE, FL, ET>.</s><s>The rachis has opposite, recurved prickles and the petiolule is very short with large, deciduous and leaflike stipules that often split <BE, FL, ET>.</s><s>Leaflets are pubescent on both surfaces and have a pair of stipule-like barbs <BE, FL, ET>.</s><s>Axillary racemes have long peduncles,	Division

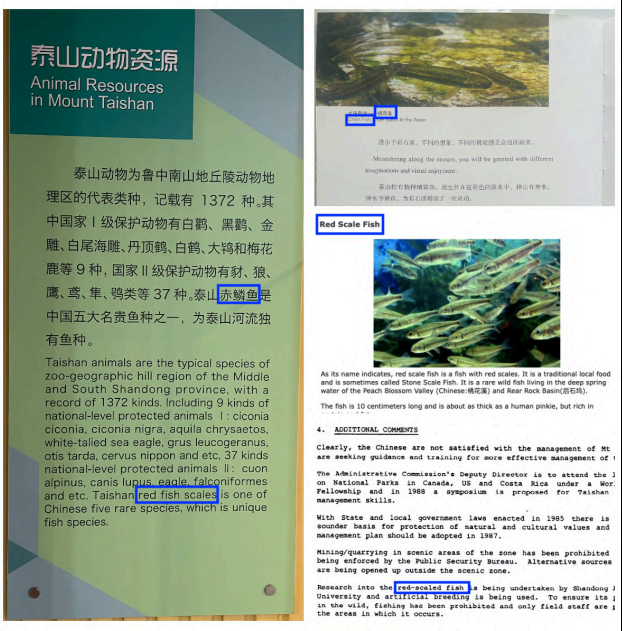
			densely flowered in upper part and sparsely so in lower part; apex rounded and with beak, swollen, with dense, slender spines <BE, FL, ET>.</s><s>The legume is grayish, shiny and ovoid to globose <BE, FL, ET>.</s><s>It is native to Guangdong, Guangxi and the Taiwan region of China; and it grows in tropical regions across the world <BE, FL, ET>.</s>	
31	 (Taishan UNESCO Global Geopark 2021)	汉柏连理 <s>又名“连理柏”，《水经注》载：“盖汉武帝**所植**也。”距今已有 2100 多年。</s><s>**此柏为岱庙标志性景观之一**。</s>	Interlocked Han Cypress <s>**The Interlocked Han Cypress, also named simply, “Interlocked Cypress”, is one of the symbolic landscapes in Dai Temple** <BE, FL, ET>.</s><s>As recorded in *Commentary on the Water Classic*, it **was planted** by Emperor Wu Di himself in the Han Dynasty 2100 years ago <BE, FL, ET>.</s>	Inversion + Shift
32	 (Leiqiong UNESCO Global Geopark 2021)	植物绞杀 <s>此处的植物绞杀现象正处于初期阶段，榕树（绞杀植物）的种子正附生于棕榈树（被绞杀植物）上，其气生根正在向下延伸，若干年后，这棵棕榈树将被绞杀死亡。</s>	Plant Strangulation <s>The phenomenon of plant strangulation in the below picture is in its early stage <BE, FL, ET>.</s><s>The seeds of the banyan (strangler fig) are attached to the palm tree (strangled plant), and their aerial roots are extending downwards <BE, FL, ET>.</s><s>In a few years, the palm tree will be killed by strangulation <BE, FL, ET>.</s>	Division + Shift

Data 7: Ineffective and effective interpretations of flora (cultural level)

Poor interpretations of flora				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Problems**
33	 (Leiqiong UNESCO Global Geopark 2021)	稔子	Renzi	UCPREW
34	 (Leiqiong UNESCO Global Geopark 2021)	红果草	red fruit grass	Mistranslated
Effective interpretations of flora				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**

35	 (Leiqiong UNESCO Global Geopark 2021)	点不	Java Apple	Literal Translation

Data 8: Ineffective and effective interpretations of fauna (semantic level)

<table>
<tr><th colspan="5">Ineffective interpretations of fauna</th></tr>
<tr><th>Text</th><th>Data from Chinese UNESCO Global Geoparks</th><th>ST</th><th>TT</th><th>Problems</th></tr>
<tr><td>36</td><td> 

(Taishan UNESCO Global Geopark 2021)</td><td>赤鳞鱼（鳜霖鱼）</td><td>Red Fish Scales

Chilin Fish

Red Scale Fish

Red-Scaled Fish</td><td>ITSN</td></tr>
<tr><td>37</td><td> 

(Taishan UNESCO Global Geopark 2021)</td><td><s>中国传统文化中几乎都有鱼文化的印记，形象地展现着中华民族伟大的创造精神，<u>构成了我们文化史上年代久远、涵盖广泛、功能多样、艺术性强的一条鱼文化长链</u>。</s></td><td><s>Fish culture is imprinted in Chinese traditional culture <BE, FA, PT>.</s><s>It vividly shows the great creativity of the Chinese nation <BE, FA, PT>.</s></td><td>NT</td></tr>
<tr><td>38</td><td> 

(Leiqiong UNESCO Global Geopark 2021)</td><td><s>苍鹰是中小型猛禽。体长可达 60 厘米，翼展约 1.3 米。头顶、<u>枕</u>和头侧黑褐色，枕部有白羽尖，眉纹<u>白杂黑</u>纹；背部棕黑色；胸以下密布灰褐和白相间横纹；尾灰褐，有 4 条宽阔黑色横斑，尾方形。</s><s>飞行时，双翅宽阔，翅下白色，但密布黑褐色横带。</s><s>雌鸟显著大于雄鸟。</s></td><td><s>The goshawk is a medium and small-sized raptor <BE, FA, PT>.</s><s>Its length can reach 60 centimeters and its wingspan is about 1.3 meters <BE, FA, PT>.</s><s>The head top, <u>headrest</u> and head side are dark brown; the headrest has white feather tips on it; the superciliary stripes are <u>white and black</u>; the back is brown and black; grayish brown and white stripes are densely distributed below the chest; the</td><td>Mistranslated</td></tr>
</table>

			square tail is gray and brown, with four wide black horizontal spots on it. When it flies, it displays wide wings with white feathers below <BE, FA, PT>.</s><s>The wings are densely covered with dark brown stripes <BE, FA, PT>.</s><s>The females are significantly larger than the males <BE, FA, PT>.</s>	
Effective interpretations of fauna				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**
39	 (Leiqiong UNESCO Global Geopark 2021)	点斑原海豚	Pantropical Spotted Dolphin (*Stenella attenuata*)	English + Latin

40	 (Leiqiong UNESCO Global Geopark 2021)	<s>金钱鱼又名金鼓鱼，长约 20 厘米，体侧扁而高，略呈六边形。</s><s>体褐黄色，散具黑斑。</s><s>背、臀、尾鳍均具黑斑，头部常具黑横带。</s><s>栖息近海岩礁处，常进入咸淡水或河口。</s><s>摄食甲壳动物及附着石上的软体动物。</s><s>游泳缓慢，不成群。</s><s>初春至近岸产卵，产卵后游向外海。</s><s>分布于印度-太平洋热带海域，包括台湾南部、北部及西部。</s><s>常在河口区的蚵棚、红树林或堤防区的消波块附近活动。</s>	<s>The spadefish, also known as the spotted scat, butterfish or the “golden drum fish” in Chinese, attains a total length of about 20 centimeters (7.8 in) <BE, FA, ET>.</s><s>The body is strongly compressed, slightly hexagonal and yellowish-brown with dark, rounded blotches which are also seen on the dorsal, anal, and caudal fins <BE, FA, ET>.</s><s>The head often has dark bars <BE, FA, ET>.</s><s>This is a species of sheltered, shallow coastal waters such as estuaries and the lower parts of fresh or salt water streams <BE, FA, ET>.</s><s>It feeds on shellfish and molluscs attached to rocks <BE, FA, ET>.</s><s>This slow-moving, solitary animal spawns at the coast in early spring and leaves for the sea after that <BE, FA, ET>.</s><s>It inhabits the tropical waters of the Indo-Pacific and the southern, northern and western parts of the Taiwan region of China, and often can be found in oyster racks and mangroves in estuaries, or near tetrapods in dike areas <BE, FA, ET>.</s>	Literal Translation + Shift
41	 (Leiqiong UNESCO Global Geopark 2021)	<s>环颈鸻，全长约 16 厘米。</s><s>属中小型涉禽。</s><s>羽毛的颜色为灰褐色，常随季节和年龄而变化。</s><s>环颈鸻是迁徙性鸟类，具有极强的飞行能力。</s><s>通常沿海岸线、河道迁徙。</s><s>生活环境多与湿地有关，离不开水。</s><s>栖息于海滨、岛屿、河滩、湖泊、池塘、沼泽、	<s>The Kentish plover is a small shorebird with a total length of around 16 centimeters (6.2 in) <BE, FA, ET>.</s><s>The bird has pale plumages but often changes color in different seasons or as it grows old <BE, FA, ET>.</s><s>The species can migrate reasonable distances, often along the coastline or river channel <BE, FA, ET>.</s><s>It cannot live without abundant water,	Literal Translation

		水田、盐湖等湿地之中。</s><s>分布于欧洲、亚洲、非洲和美洲等许多国家。</s>	therefore always can be found in wetlands such as coasts, islands, floodplains, lakes, ponds, swamps, paddy fields, salt lakes, etc <BE, FA, ET>.</s><s>Kentish plovers have an extremely wide geographical distribution and their habitats cover many countries and regions in Europe, Asia, Africa and the Americas <BE, FA, ET>.</s>	

Data 9: Ineffective and effective interpretations of fauna (style level)

Ineffective interpretations of fauna				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Problems**
42	 (Leiqiong UNESCO Global Geopark 2021)	<s> 苍 鹰 是 中 小 型 猛 禽 。 </s><s>体长可达 60 厘米，翼展约 1.3 米。</s><s>**头顶、枕和头侧黑褐色，枕部有白羽尖，眉纹白杂黑纹；背部棕黑色；胸以下密布灰褐和白相间横纹；尾灰褐，有 4 条宽阔黑色横斑，尾方形。**</s><s> 飞行时，双翅宽阔，翅下白色，但密布黑褐色横带。</s><s>雌鸟显著大于雄鸟。</s>	<s>The goshawk is a medium and small-sized raptor <BE, FA, PT>.</s><s>Its length can reach 60 centimeters and its wingspan is about 1.3 meters <BE, FA, PT>.</s><s>**The head top, headrest and head side are dark brown; the headrest has white feather tips on it; the superciliary stripes are white and black; the back is brown and black; grayish brown and white stripes are densely distributed below the chest; the square tail is gray and brown, with four wide black horizontal spots on it. When it flies, it displays wide wings with white feathers below** <BE, FA, PT>.</s><s>The wings are densely covered with dark brown stripes <BE, FA, PT>.</s><s>The females are significantly larger than the males <BE, FA, PT>.</s>	Mistranslated
43	 (Leiqiong UNESCO Global Geopark 2021)	<s>**黑尾塍鹬，中型涉禽，体长 36-44 厘米。**</s><s>**嘴、脚、颈皆较长。**</s><s>是一种细高而鲜艳的鸟类。</s><s>嘴长而直、微向上翘。</s><s>夏季头、颈和上胸栗棕色，腹白色，胸和两胁具黑褐色横斑。</s><s>冬季上体灰褐色、下体灰色，头、颈、胸淡褐色。</s>	<s>**The black-tailed godwit is a medium-sized wading bird** <BE, FA, PT>.</s><s>**It has a body length of 36-44 centimeters** <BE, FA, PT>.</s><s>Long-billed, footed and necked, it is a slender, gaily-colored bird <BE, FA, PT>.</s><s>The long bill is straight and slightly upturned <BE, FA, PT>.</s><s>Its head, neck and upper chest are chestnut brown in summer, the abdomen is white, and the chest and both sides have dark brown transverse spots on them <BE, FA, PT>.</s><s>The upper body is brown, the lower body is	Mistranslated

			gray, and the head, neck and chest are light brown in winter <BE, FA, PT>.</s>	
44	 (Leiqiong UNESCO Global Geopark 2021)	<s>鹊鹞是一种中型猛禽。体重 250-380 克，体长 42-48 厘米。</s><s>**头部、颈部、背部和胸部均为黑色，尾上的覆羽为白色，尾羽为灰色，翅膀上有白斑，下胸部至尾下覆羽和腋羽为白色，站立时外形很像喜鹊，所以得名。**</s><s>虹膜黄色，嘴黑色或暗铅蓝灰色，下嘴基部黄绿色，蜡膜也为黄绿色，脚和趾黄色或橙黄色。</s>	<s>The pied harrier is a medium-sized raptor with a body weight of 250-380 grams and a length of 42-48 centimeters <BE, FA, PT>.</s><s>**The head, neck, back and chest are all black; the wing covert on the tail is white; the tail feathers are gray; the wings have white spots on them; the wing covert and axillar on the lower chest and the tail are white; a standing pied harrier looks like a magpie, hence the name.** <BE, FA, PT>.</s><s>Its iris is yellow; its bill is black or dark blue gray; the base of the lower bill is yellow green; the cere is also yellow green; the feet and toes are yellow or orange yellow <BE, FA, PT>.</s>	Mistranslated
45	 (Leiqiong UNESCO Global Geopark 2021)	<s>大珠母贝又称白蝶贝，是一种海洋杂食性瓣鳃动物。</s><s>其贝壳呈蝶状；壳面呈棕褐色，壳顶鳞片层紧密；壳内面为银白色。</s><s>**其分泌的角蛋白和碳酸钙可包裹外来物质形成珍珠。**</s>	<s>Pinctada maxima, also known as white butterfly oyster, is a marine omnivorous pelecypod <BE, FA, PT>.</s><s>The shell is butterfly-shaped; the surface is brown, the scale on the shell top is densely layered; the inner surface is silvery white <BE, FA, PT>.</s><s>**The keratin and calcium carbonate it secretes can wrap foreign substances to form pearls** <BE, FA, PT>.</s>	Mistranslated

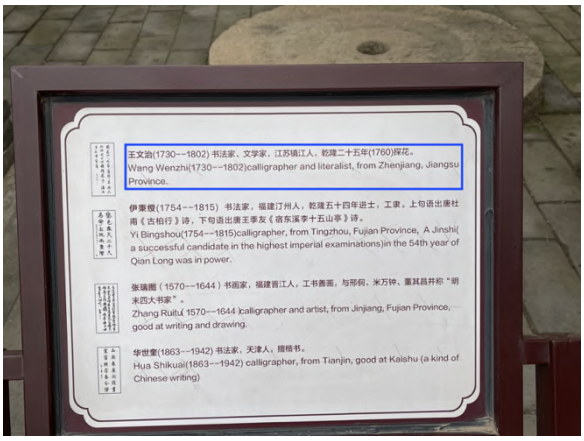
Effective interpretations of fauna				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**
46	 (Leiqiong UNESCO Global Geopark 2021)	<s>中华白海豚是一种海洋肉食性哺乳动物。</s><s>**其身体呈纺锤型，喙突出狭长；背鳍呈后倾三角形；胸鳍较圆浑；尾鳍水平状，分左右对称两叶；全身呈象牙色或乳白色。**</s><s>中华白海豚属国家一级保护动物，**素有**“水上大熊猫”之称。</s>	<s>The Chinese white dolphin is a marine mammal, carnivore. <BE, FA, ET>.</s><s>It has a streamlined fusiform body and a distinct, long, thin beak <BE, FA, ET>.</s><s>Its dorsal fin is triangular and falcate, pectoral fin rounded, and caudal fin flat and homocercal with two symmetrical lobes <BE, FA, ET>.</s><s>It is usually gray, white or pink <BE, FA, ET>.</s><s>The Chinese white dolphin **has always been cherished as** the “giant panda in the water” and is currently under first-class state protection in China <BE, FA, ET>.</s>	Division + Shift
47	 (Leiqiong UNESCO Global Geopark 2021)	<s>**珊瑚是珊瑚虫分泌出的外壳。**</s><s>**珊瑚虫是珊瑚虫纲珊瑚目动物。**</s><s>珊瑚虫是腔肠动物门中最大的一个纲，有 7000 多种，均为海产。</s><s>**珊瑚虫在白色幼虫阶段便自动固定在先辈珊瑚的石灰质遗骨堆上，珊瑚是珊瑚虫分泌出的外壳，珊瑚的化学成分主要为 $CaCO_3$（碳酸钙），以微晶方解石集合体形式存在，成分中还有一定数量的有机质，形态多呈树枝状，上面有纵条纹，每个单体珊瑚横断面有同心圆状和放射状条纹，颜色常呈白色，也有少量蓝色和黑色，珊瑚不仅形象像树枝，颜色更是鲜艳美丽，同时也是**	<s>**Corals are the shells secreted by coral polyps, which belong to the Gorgonacea invertebrates within the class Anthozoa** <BE, FA, ET>.</s><s>Corals are marine invertebrates within the class Anthozoa of the phylum Cnidaria. Anthozoa is the largest taxon of cnidarians; over seven thousand species have been described, which are exclusively marine <BE, FA, ET>.</s><s>**Coral polyps are born to be fixed on the coral skeletons, which are the colonies of former generations** <BE, FA, ET>.</s><s>**A coral reef is composed of $CaCO_3$ (calcium carbonate) and is an aggregate of microcrystalline calcite with certain amount of**	Combination + Division + Shift

		海域水质清洁程度的重要标志。</s>	**organic matter** <BE, FA, ET>.</s><s>**It has branches with streaks and concentric, radiant circles on the cross section, which are mostly white while some being blue or black** <BE, FA, ET>.</s><s>**Despite of their branch-like shape and iridescent color, coral reefs are also important indicators of water quality** <BE, FA, ET>.</s><s> **There are currently 25 species of corals in 16 genera and 8 families in the Qiongzhou/Hainan Strait and its adjacent waters** <BE, FA, ET>.</s>	

Data 10: Ineffective and effective interpretations of fauna (cultural level)

Ineffective interpretations of fauna				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Problems**
48	 (Leiqiong UNESCO Global Geopark 2021)	水鱼	water fishes	Mistranslated
Effective interpretations of flora				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**
49	 (Leiqiong UNESCO Global Geopark 2021)	麻鹰	black kite	Literal Translation

Data 11: Ineffective and effective interpretations of cultural element (semantic level and cultural level)

Ineffective interpretations of CEs				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Problems**
50	 (Taishan UNESCO Global Geopark 2021)	<s>泰山是独一无二的文化大山。</s><s>两千五百多年前，孔子“**登泰山而小天下**”。</s><s>其后，历代文人名士纷至沓来，观光揽胜，吟诗作文，留下了不朽的名篇，成为中华民族的文化瑰宝。</s>	<s>Mount Taishan is a unique mountain with cultural indication. <CE, PL, PT>.</s><s>Over 2,500 years ago, Confucious has ever visited the Mount Taishan and then was followed by other literates to compose famous proses, which later preserved as the precious asset for the Chinese nation <CE, PL, PT>.</s>	NT
51	 (Taishan UNESCO Global Geopark 2021)	<s>王文治（1730—1802）书法家、文学家，江苏镇江人，**乾隆二十五年（1760）探花**。</s>	<s>Wang Wenzhi (1730—1802) calligrapher and literalist, from Zhenjiang, Jiangsu Province <CE, PL, PT>.</s>	NT

52	 (Taishan UNESCO Global Geopark 2021)	碧霞祠	The Shrine of the Blue Dawn Azure Cloud Temple Bixia Temple	ITSN

53	 (Taishan UNESCO Global Geopark 2021)	<s>泰山文化实质上是一种信仰文化。</s><s>以**东岳大帝**、**碧霞元君**、**泰山石敢当**为代表的民俗信仰，从这里走向全国，走向世界，千百年来成为平安吉祥的象征。</s>	<s>The Mount Taishan culture is a kind of religion, featuring **Emperor Dongyue**, **Emperor Bixia** and **Mount Taishan Stone**, which symbolizes safety and auspice and became world-renowned <CE, PL, PT>.</s>	Mistranslated
54	 (Taishan UNESCO Global Geopark 2021)	《水经注》	SHUIJINGZHU	UCPREW
Effective interpretations of CEs				
Text	**Data from Chinese UNESCO Global Geoparks**	**ST**	**TT**	**Strategies**

55	 (Taishan UNESCO Global Geopark 2021)	<s>孔子（前 551−前 479），是中国的圣人。</s><s>孟子曰：“**孔子登东山而小鲁，登泰山而小天下。**”</s><s>这是一种文化巡礼。</s>	<s>Confucius (551-479 BCE) is the sage of China. Mencius said that **“Confucius ascended the Eastern Hill, and the State of Lu appeared to him small; while he ascended the Mount Taishan, and all beneath the Heaven appeared to him small.”** <CE, PL, ET>.</s>That is a kind of cultural pilgrimage <CE, PL, ET>.</s>	Literal Translation
56	 A little further on stands the Ch'ing-ti Kung 青帝宮 the "Temple of the Green Emperor". This divinity is the one who presides over the east, for green corresponds to the east in the theory of the five elements. (Taishan UNESCO Global Geopark 2021)	青帝庙（宫）	Temple of the Green Emperor	Literal Translation
57		武相石狗	Valiant Stone Dog	Literal Translation

	 (Leiqiong UNESCO Global Geopark 2021)	文相石狗	Peaceful Stone Dog	
58	 (Taishan UNESCO Global Geopark 2021)	篆书	Zhuanshu (an ancient Chinese calligraphy style)	Addition

Linking Statement II – From the Benchmarking Model to the Examination of the ABC Elements

The SSC Model established in Chapter 4 outlines eight criteria that translators may follow for effective geotourism translation. Four of these criteria are for **S**emantic equivalence: linguistic accuracy, scientific accuracy of terminology, reader acceptability of terminology, and semantic completeness of geo-information. Three criteria are for **S**tyle equivalence: logical syntax, concise syntax, and appropriate voice. The last criterion is for accurate connotation in **C**ultural elements. These criteria provide specific guidance at a practical level for interpreters to choose the appropriate strategies for effective translation, which complements Hu's Eco-Translotolgy which only provides a general goal for translation quality. From here, this equivalence model serves as a guideline for developing a comprehensive taxonomy for geotourism translation strategies; specifically, the ABC elements.

To examine and illustrate the use of SSC in translation of geotourism terms and expressions in real geoparks, the following empirical studies use authentic language data collected from Chinese UNESCO Global Geoparks (UGGps) to identify effective translation strategies as well as cases of problematic translations that could be optimised using those strategies. Specifically, Chapter 5 investigates such strategies used for the A and C elements, while Chapter 6 investigates the B element. The reason A and C elements are examined together is that these two elements are typically viewed as 'pure' geotourism (Dowling, 2013).

The A and C elements of geotourism include geological features, geological processes, and cultural elements. For this exploration, I established an additional parallel geotourism corpus, using geotourism data from two Chinese UGGps, namely Danxiashan and Yandangshan. Through detailed quantitative and qualitative analysis of this corpus, I identified eight types of unique strategies of effective translation for the A element, and four types of unique strategies for the C element. Once the strategies are identified, I also manually identified and improved problematic translations using the identified strategies.

Chapter 5 is published in 'Geoheritage' under the title *Developing Culturally Effective Strategies for Chinese to English Geotourism Translation by Corpus-Based Interdisciplinary Translation*.

Chapter 5: Empirical Study 2 – Developing Culturally Effective Strategies for Chinese to English Geotourism Translation by Corpus-Based Interdisciplinary Translation Analysis (*Geoheritage*)

Abstract

As a new field of translation with its own special genre, geotourism has not yet been firmly established because geotourism translations are currently not of a sufficient professional standard. This situation does not provide geotourists with the genre's full target of enjoyment, learning, and engagement through science popularisation tourism activities. In order to better meet these three definitive purposes in geotourism, this study analyses the three basic categories of geotourism — geological features (GFs), geological processes (GPs), and cultural elements (CEs) — to determine effective strategies of geotourism translation from Chinese into English. Challenges in translation include scientific jargon, language style and cultural gaps. In this article, the advantages of Hu's Eco-translatology theory are explained and used for minimising translation problems; and the corpus linguistics method, superior for quantitative and qualitative analysis, is utilised. As well, digital auxiliary tools Tmxmall (2014) and Sketch Engine (2003) were employed to facilitate corpus research. Through analysis, effective strategies in each of the key geotourism categories, GFs, GPs and CEs, were identified, shaped and recommended for future translators' attention. In the results, literal translation, transliteration and free translation, addition, and use of official UNESCO names were recommended to render GFs. Division and shift translation, literal translation, and shift and division were recommended for GPs. Literal translation, transliteration and free translation, and addition were recommended for CEs. Since this is an initial investigation in the genre of geotourism, this study has attempted to build a model platform for future study and wider research in geotourism translation and translation pedagogy for the improvement of geotourism translation quality.

Keywords Geotourism translation, Translation strategies, Eco-translatology, Corpus linguistics

1. Background

General concern for land and ocean degradation has been growing since the late twentieth century. This has led to a strengthening of the conservation movement which involves the need for public awareness of the dilemma and better understanding of planet Earth. This impetus led to the birth of geotourism which seeks to pursue conservation and public education as its definitive purposes. There are various definitions of geotourism (Hose 1996; National Geographic 2005; Joyce 2006; Dowling and Newsome 2006) whether they are geological or geographical in nature, and they are all taking geology and landscapes as a foundation to promote the geographical character of a place (National Geographic 2005). The Geological Society of Australia (GSA) most concisely defines it as a 'holistic nature-based tourism focusing on an area's geology and landscape as the basis for providing visitor engagement, learning and enjoyment' (GSA 2015).

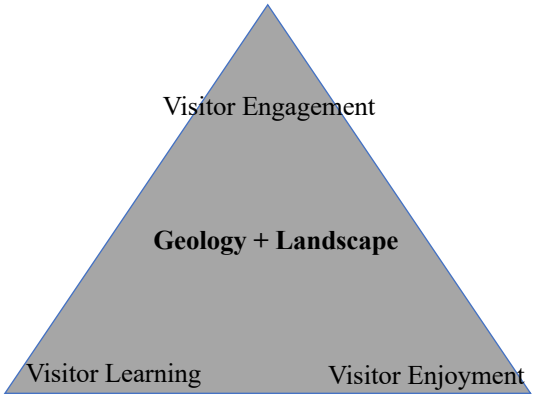


Fig. 1 Diagram explaining the purpose of geotourism (GSA, 2015)

In turn, the growth of geotourism has increased the amount of Chinese to English translation in nature tourism activities in China, especially after the establishment of UNESCO Global Geoparks in 2004 which encourages opening of geoparks to non-Chinese-speaking tourists. Science popularisation of geotourism and geoparks aims at transmitting information and meaning to the general public and therefore it calls for accuracy in translation. However, geopark development also presents serious concerns to the geopark management as geotourism translation in geoparks involves challenges in technical language, language style and cultural gaps to geotourism translators. Therefore, the need for effective geotourism translation has become incresingly important.

Geoparks, by their nature, are the main focus of geotourism. Geodata is found in a variety of locations in Chinese UNESCO Global Geoparks: on the signage and interpretation boards of geological museums, visitor centres and on walking trails of geoparks, national parks or reserves. This data can include translating geological phenomena (GFs and GPs), and CEs, all of which are key elements of geotourism. The concept of geological phenomena (GFs and GPs) was defined by Dowling (2013) as the overall description of all the natural features and processes of Earth formation. While GFs refer to any physical feature, but it is usually rock or landform of the Earth's surface that is formed by a single GP or a combination of different processes. A feature (GF) could be a volcano, a desert or a cave. A process (GP) could be a volcanic eruption (formation of a volcano), sedimentation (which can result in a desert) or water or wind erosion (which may result in the formation of a cave). Dowling (2013) helpfully explains that CEs in geoparks are both past (historical accounts) and present (community customs and culture), such as life style of people.

Geotourism translation from Chinese to English has, in sum, to address three main challenges: linguistics, communication and culture. Firstly, there are many geological scientific jargon and expressions in GFs. These scientific terms are difficult to interpret into their English equivalent counterparts. The nature of the two language structures is so different that another challenge presents itself in the GPs. This is because the process in the Chinese source text (ST) is expressed in a complex and convoluted style while English target text (TT) demands some simple and short sentences which are concise and clear. Moreover, the passive voice sometimes needs to be added and word order changed to render active voice in Chinese ST to translate into English GPs. The nature of a third challenge stems from translating unique Chinese CEs (poetry, religion, traditions, symbols and architecture). Native Chinese have difficulty in interpreting these to another culture because there is no common CE. Hence, in geotourism, it is sometimes difficult to achieve semantic equivalence, style equivalence and cultural equivalence between Chinese and English.

Some current examples from Chinese UNESCO Geoparks can clearly illustrate the above problems. For example, in Taishan UNESCO Global Geopark,‘天贶殿’was translated into ‘Tian Kuang Hall’. Here,‘贶’in Chinese culture means ‘the emperor’s residence’. Therefore,‘贶’should be translated into ‘palace’ instead of ‘hall’. In English, a ‘hall’ is a public meeting place for formal events, whereas a ‘palace’ is a private home that would not only probably be grand but bound by many formal protocols. Similarly,‘延禧殿’should be rendered into ‘Yan Xi Palace’ rather than ‘Yan Xi Hall’. Apart from the wrong choice of translation, another problem is lack of consistent translation of the same Chinese term. For instance,‘泰山’was variously translated into ‘Mount Tai’, ‘Taishan Mountain’, ‘Mountain Taishan’ and ‘Mount Taishan’. These are a couple of the simpler examples of inadequate translation. The other more complex challenges of scientific terms, contrasting grammar structures, and lack of shared cultural knowledge, strengthen the argument for a systematic approach to geotourism translation from Chinese to English.

Therefore, the purpose of this paper is to outline the problems of translating GFs, GPs and CEs and identify effective approaches of addressing these problems for the successful and long-term development of geoparks in China. To fulfil the research purpose, first, a corpus is built and then utilised to find effective translation strategies through using the methodology of corpus linguistics in a research process. Thus, an attempt is made to meet the challenges of scientific jargon, language styles and cultural gaps when translating from Chinese to English of the three main categories (GFs, GPs and CEs) of geotourism. Moreover, data of geotourism translation in GFs, GPs and CEs in geoparks are analysed within a theoretical framework of Hu’s Eco-translatology. This theoretical framework offers direction for difficulties and therefore some effective translation strategies can be recommended to bridge these technical, grammatical and cultural difficulties. Finally, the resulting effective strategies for improved geotourism translation in each category (GFs, GPs and CEs) will be summarised to build a model of translation approach based on the Hu’s Eco-translatology theory. Thus recommendations will be made for the future application of translators when working from Chinese to English in geotourism data. This paper contains extensive linguistic terminology which is listed at the conclusion of the paper in the ‘Appendix’ to assist readers with no translation background.

2. Literature Review

Corpus linguistics for the purposes of translation strategies for tourism has been widely used in past research, and translation scholars have been involved in geotourism and geoparks. For the purposes of demonstrating corpus linguistics application as a methodology, a research example by Han and Wang (2014) will be described. They propose that English swear words, as a kind of culture-specific issue, in subtitling, are difficult to render into Chinese. They chose an Australian reality TV series called *The Family* to shape a parallel English to Chinese translation corpus. The authors found some subtitling translation strategies do not express the authentic sound of Chinese and also at the same time that it is hard to retain the original sense of the English swear words. Therefore, they adopt a 'reverse engineering' model of translation (looking at desired effect not content) to analyse them and consequently find the application of this model facilitates authenticity in the Chinese subtitles. They conclude that in order to retain the communicative intention of the original swearing, the translator can simply employ the 'category shift' and 'literal' subtitle two important features: one, that research can shape a customised corpus and that it does not merely have to use an existing corpus for research; and two, traditional translation methods do not always deliver effective results.

Furthermore, in regard to the complexity of translation methods and more relevantly to the topic of tourism, Li (2019) uses a corpus-based research method to study the translation for foreigners of a restaurant menu according to three categories: each dish's ingredients, cooking methods and culturally specific names. This author compares their translation in a parallel corpus, only to find these translations are not consistent or equivalent to Chinese because of oversimplification in translation strategies which prove inadequate. Li introduces the multimodal translation method, which includes Roman Jakobson's tripartite theory (1959), in order to improve the translation. Jakobson (1959) structured translation into three types: use of the same language, borrowing from another language, or the use of symbols/nonverbal signs. This author concludes that nonverbal signs, in this case, the application of Pinyin (Chinese Phonetic Alphabet), most easily facilitate translation for foreigners for understanding the ingredients, cooking methods and cultural background of dishes, especially when the Pinyin is supported with an attractive pictorial representation of the dish's cuisine artistry.

Tourism translation has facilitated translation techniques for rendering translation in geotourism. For example, Rezaei and Kuhi (2014) take two tourist guidebooks rendered by Beheshti and Hakimian from Persian into English as the corpus for the sake of developing translation strategies of cultural-specific items (CSIs). In the TT, they use Newmark's Model (1988) which analyses translation into two aspects: the effectiveness of the translation and the style of it in the TT. These authors, Rezaei and Kuhi (2014), collected data to analyse whether translators adopt the domestication or foreignisation in rendering CSIs. Their results illustrate that the optimised translation strategy in the two guidebooks is the Newmark's transference with the addition of some notes. The authors significantly conclude, although both foreignisation and domestication are applied in these two translated tourist guidebooks, foreignisation is the most common strategy used. Later, Zainal Arifin (2019) uses the Javanese tourism brochures of *Wisata Kuliner di Kota Batil* to further test Rezaei and Kuhi's (2014) research outcome. The author, Arifin (2019), states that in the process of Javanese to English translation, the gaps of understanding cultural words make it difficult for English and Javanese to be equivalent in meaning. This author claims that in order to tackle these non-equivalent cultural words, appropriate translation strategies should be adopted to generate the equivalent meaning. Therefore, this author explores the translation strategies of specific-culture terms (SCTs) in the translated Javanese tourism text by the descriptive qualitative method. To do this, the author, employs an interactive model for data analysis: data simplification, data demonstration, and its conclusion. He shows that when the translator

needs to render these SCTs, the translation strategies used are mostly borrowing, borrowing with explanation, cultural substitution as well as adoption with explanation. This last research points to the complexity of translation methods even within a single technique such as foreignisation and that there is not a single dominant strategy (such as foreignisation) that can be effectively used but that in fact explanation can accompany foreignisaton strategies. Thus, Arafin (2019) contrasts to the oversimplified findings of Rezaei and Kuhi (2014) who found foreignisation was the most common strategy.

This paper regards geotourism as a unique type of general tourism, related to nature tourism and for that reason, earlier tourism research is relevant. However, rather than the broad spectrum of nature, geotourism is closely related to geoparks. A geopark is officially defined by The United Nations Educational, Scientific and Cultural Organisation (UNESCO 1999) as 'an area comprising one or more places with scientific significance and having archaeological, ecological and cultural values and geological value.' The researcher, Ng (2017), identifies geoparks as the cornerstone in geotourism. Gordon (2018) highlights the conservation, education and sustainable development via providing geological interpretation for tourists. The high level of interest in geoparks and the demand for more accurate geodata has propelled further research in geotourism and the global movement of people creates the need for effective translation strategies in geotourism. Corpus linguistics method is confirmed as an effective method, but although scholars have used corpus linguistics as a methodology, there is no apparent study in the particular area of geotourism translation using corpus linguistics, and also, there is no comparative translation strategies for geotourism. With the growth of the significance of geotourism, the need for informative and effective translation strategies is more urgently demanded. Therefore, this research will be a corpus-based translation study in Chinese to English geotourism translations.

3. Research Questions and Objectives

Based on the research gap of geotourism translation, two key research questions can be put forward as below:

a. How effective is the English translation in conveying the original geotourism messages in Chinese?

This would include various purposes of text such as description or explanation. For example, many geological terms and GPs need an explanation into English because of Chinese cultural background of colour, language or historical significance in the Chinese text (ST). If Chinese translators cannot make a clear and effective explanation to the target readers (TT), it will be difficult to understand these data.

The research objective to deal with this first question would include analysing corpus data to retrieve the nature of the patterns of translation in the comparative language.

b. In what specific ways can the current translation in geotourism be improved?

This question seeks to bring some translation discipline into the area of geotourism translation so that there would be consistency in the translation and interpretation of key terms and processes. This consistency would lessen confusion and dissatisfaction in the target readers. The translator needs to identify underlying assumptions behind the meaning of words, cultural knowledge that might be necessary to understand the term and gaps in the target language (TL) that need to be bridged in a concise manner.

Engaging in research of the second question (b) would entail comparison of efforts in different areas of geotourism (geological interpretation, geological description, for example) using corpora. It would also entail determining

which criteria would best used to overcome ineffective translations. This in turn would invite analysis of translation strategies, and their application in corpora.

Through solving the above two key research questions, this paper aims to contribute to three different areas of research: a recommended standard approach for translation of geotourism, various types of education material, and future support of geotourism translation. Firstly, the obtained research results will provide a standard of criteria to inform translators and benefit the output of geotourism translation, and secondly, provide materials for teaching and learning in modern education classes. For teaching, lecturers can impart translation strategies to help students select the effective translation strategies for geotourism translation. For example, in learning, based on corpus linguistics method, students can learn how to choose more appropriate translation strategies in order to minimise the negative language interference between ST and TT through parallel geotourism translation corpus. Consequently, this will lead to improving the quality of future geotourism translation. Most importantly, studies on geotourism translation may not only promote the interest and development of geotourism translation, but also provide reference tools for future geotourism translators and linguistic researchers of other languages.

4. Corpus and Methodology

4.1 Data collection procedure

A selection of Chinese to English translations used in Chinese geoparks, approved by UNESCO, was used as corpora for the case study. At present, geotourism is commonly practised in geoparks. Therefore, the focus is on geoparks for the following reasons: (1) geoparks are probably the best quality venues for geotourism; (2) tourism activities within geoparks are mostly associated to some degree with geology and geomorphology and therefore demand high linguistic detail for translating technical vocabulary. Moreover, these activities are usually also linked with ecological and CEs of the geoparks which may require complex linguistic treatment; (3) information and data are easier to collect from geoparks for this research. In this paper, the data were collected from the most commonly used information for tourists in the two renowned and typical global geoparks namely Yandangshan UNESCO Global Geopark and Danxiashan UNESCO Global Geopark. These two global geoparks were also chosen because (1) they are representative of translation problems currently facing most Chinese global geoparks and (2) they are two of the earliest global geoparks in the world and in China. They have both gone through stages of development and their interpretation system and translation materials have been regularly updated. The sources of data include brochures, pamphlets, interpretative panels, signs, display boards and museum displays which were readily free-of-charge to all tourists within the geoparks, especially at their entrances, visitor centres and museums. To avoid any bias, the data were only collected from easily available public sources as this was the area where many of translation problems were found. A series of procedures was illustrated below (**Figure 2**).

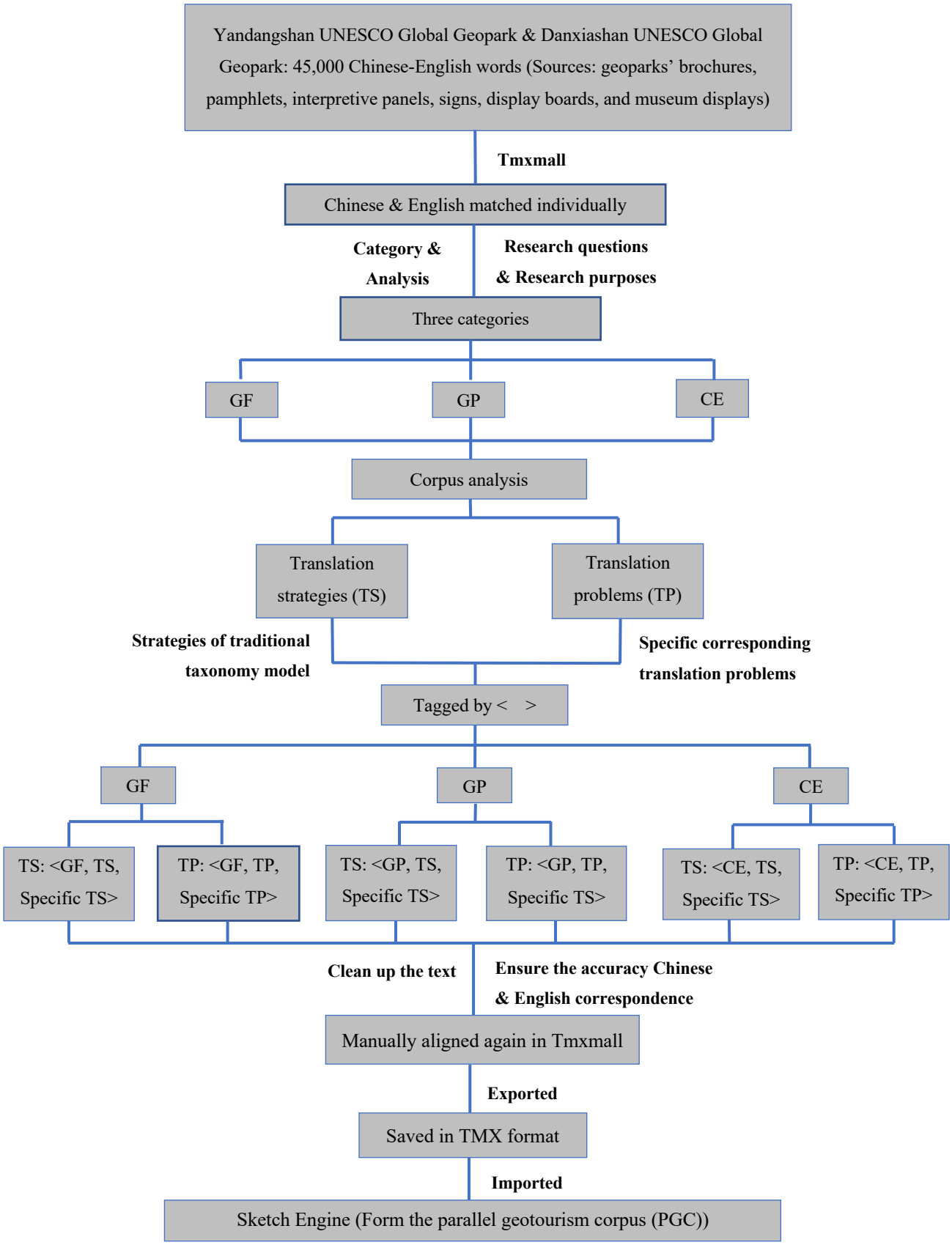


Fig. 2 Diagram of analysis procedure

The specific TSs and specific TPs for this research are shown in the tables below (**Figure 3** and **Figure 4**):

Specific Translation Strategy (TS)	Tag
Free translation	Free Trans
Literal translation	Literal Trans
Foreignisation	Foreignisation
Addition	Addition
Shift	Shift
Division	Division
Division and Shift	DS Trans
Transliteration and Free translation	TF Trans

Fig. 3 Annotated specific TSs and comments

Specific Translation Problem (TP)	Tag
Use Chinese Pinyin to Replace English Words	UCPREW
Mistranslated	Mistranslated
Not Translated	NT
Incongruent Translation for Same Name	ITSN

Fig. 4 Annotated specific TPs

4.2 Corpus procedure

After building the concordance (PGC), the corpus linguistics method was applied. First, the three categories (GFs, GPs and CEs) were retrieved from the concordance. The data retrieval steps are as follows: (1) click the Parallel Concordance at DASHBORD page; (2) click the ADVANCE at the PARALLEL CONCORDANCE page; (3) choose English in 'Search in' and then click CQL in Query type. Then follow the function formula as below:

Search in

English

Query type

CQL

CQL

[word="one of three categories' name"] [word=","] [word="TS"] [word=","] [word="specific TS"]

or

[word="one of three categories' name"] [word="[[:punct:]]"] [word="TS"] [word="[[:punct:]]"] [word="specific TS"]

Default attribute: word

Subcorpus: non (the whole corpus)

A bar chart was utilised to visually project the quantitative analysis of the translation strategies used in the three different categories. Finally, the reasons for using translation strategies for selected texts was summarised after analysis.

4.3 Eco-translatology application

Geotourism is also a new direction within the discipline of geoscience. Many geoscientists are still trying to establish a solid theoretical foundation for geotourism to align it with other geosciences. This means terms and technical matters are yet to be standardised and therefore not are translation publications yet standardised in geotourism. Hence, in this research, Eco-translatology, a translation theory, is used as a theoretical framework and platform to guide the quality of translation. This systematic translation theory was originally put forward by Chinese scholar, Hu (2001). He innovated an approach to translation based on the principles of Darwin's theory of natural selection and adaptation. It is an ecological approach to translation studies. His framework uses the translator as the dominant influence and aims at an ideal of cross-cultural balance. This procedure is described below in the diagram (**Figure 5**):

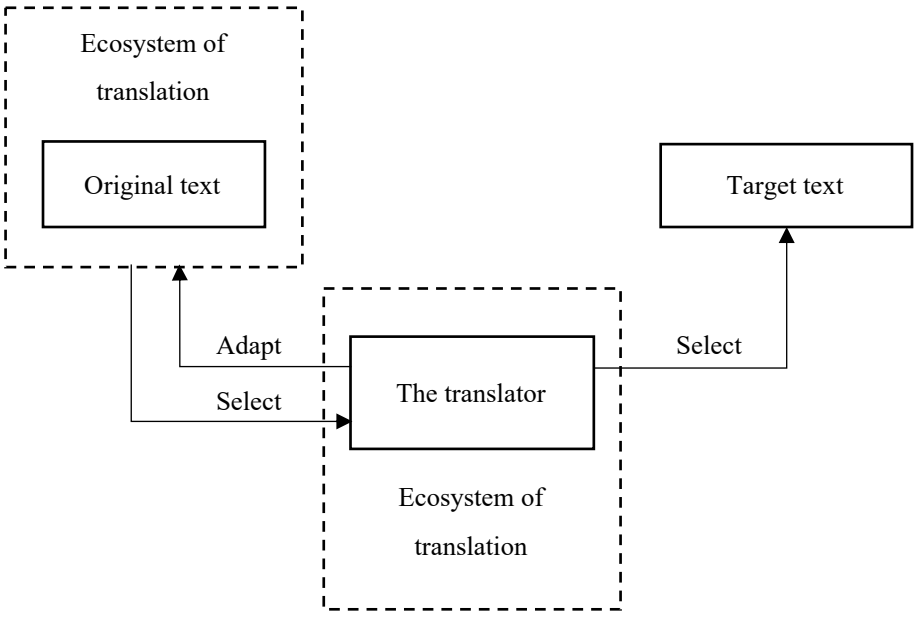


Fig. 5 'Adaptation/selection' of translation activity (Hu, 2003)

Hu states on the one hand this theory refers to 'metaphorical reference' to adaption, and on the other hand, it refers to 'actual reference' in the text. Here 'metaphorical reference' means translation ecology compared to natural ecology, while 'actual reference' means the translators compared to the translational eco-environment (Hu 2003). Thus, he finally describes Eco-translatology as an interdisciplinary study of Eco-translation, text ecology and 'translation participants'. By 'translation participants', he means a group related to each other through the eco-environment and personal transactions.

According to the translation methods of Eco-translatology, 'how to translate' is a rather complicated issue, as it contains various factors like text type, translation purpose, register (vocabulary), the degree of adaptation and selection. In his approach, a three-dimensional transformation is conducted: (1) the adaptative and selective transformation from the aspect of linguistics; (2) the adaptive and selective transformation from the aspect of culture; (3) the adaptative and selective transformation from the aspect of communication. Thus, Hu (2003) defines the three-dimensional transformation as the adaptative and selective transformation from the aspect of linguistics, and determines the translator should make a reasonable transformation of the language according to the specific translation environment which includes such matters as language structure, collocation, writing style, tone, and rhetoric. The adaptative and selective transformation from the aspect of culture means the translator needs to transform the cultural connotation of the source language (SL) to the TL in such a way as to avoid misunderstanding. Therefore, he intends when translators transform the ST, they should focus on the whole intercultural system. Finally, the adaptative and selective transformation from the aspect of communication means the translator should objectively and accurately reflect the original author's information intention, so as to achieve the purpose of that communication. Therefore, the quality of the levels of the three-dimensional system is one of the most significant ways to measure the quality of translation. In other words, the better the translator adapts each aspect of translation, the higher the degree of overall translation excellence.

The use of this theory in this research inspires translation of geotourism data by principal idea, text type, and translation methods. In terms of principal idea, this study aims to translate Chinese UNESCO Global Geoparks' brochures, pamphlets, interpretive panels, signs, display boards, and museum displays, which are directly tied to the environment. The special reason for using geoparks as they contain millions of years of natural geological change and evolution as well as rich CEs. Therefore, geoparks need more attention and protection than other ordinary parks. However, one of problems encountered in the global promotion of Chinese UNESCO geoparks is the lack of interpretation depth in translation. The application of Eco-translatology can improve each translation in detail. Moreover, Eco-translatology has a theoretical foundation shaped on ecological holism, the belief that translation is a holistic, systematic and harmonious system. In such a scenario, the principal idea of the theory is to respect the balance of people and nature. Scholars using Eco-translatology are concerned with the ecological balance in translation. For instance, Rosanna (1989) proposes translation is like life because a literary work rendered from one language to another is like a plant or animal relocated which can live only if it completely adapts to its new environment. Hence, the Eco-translatology and the translation of brochures, pamphlets, interpretive panels, signs, display boards, and museum displays in geoparks are complementary from the perspective of principal idea. Guided by Eco-translatology, translators can seek the main basis for the translation of brochures, pamphlets, interpretive panels, signs, display boards, and museum displays in geoparks and better understand the special functions of these in geoparks.

The use of this theory in terms of text type would apply to brochures, pamphlets, interpretive panels, signs, display boards, and museums. Museum displays in geoparks can be found at geopark entrances and visitor centres and attract more importance compared to other tourist text. All the texts contain many geological phenomena (GFs and GPs) and local CEs. This means translators need to interpret the contents to geovisitors in detail, clearly and accurately. In this way, GFs, GPs and CEs can be appreciated by geotourists and geoscientists. Certain recommendations have been made to improve the standardisation of text. Firstly, the content of those translation works in geoparks need to be comprehensive to include knowledge of geological (GP and GF) and CE (religion, history and arts). This means the TT should achieve semantic equivalence, style equivalence and cultural equivalence. Thus, the Chinese to English translation of geoparks should be one of most systematic translations. Furthermore, translation in geoparks should be practical, appealing to geotourists, not to scholars or senoir managers of parks or government officials. It is important to emphasise that geovisitors include foreign visitors as well as Chinese visitors. For foreign geotourists, they can observe the formation of GFs and experience Chinese cultures from the TT. Poor translations are potentially misguiding and can have a negative influence on the study of English by students. Hence, translation in geoparks is important for overseas geotourists, Chinese English learners and geoacademics. Therefore, from a text type standpoint, Eco-translatology can be used as a theoretical framework to guide translations in geoparks. Using the theory, text type should transmit basic information, convey the internal cultural connotation; and conclude the communicative process. Guided by this theory, translators will place a greater emphasis on the environment in which the ST and TT exist. Additionally, with the use of this theory, translators gain a better understanding of the translation environment in which they work and their own roles within it, that is decision maker for each word and expression, creator of a near-perfect translation to adapt various types of original texts, and bridge for transmitting culture to different countries or areas. Being conscious of such responsibilities, translators will develop a feeling of mission and accountability. In comparison to viewing themselves solely as 'language tools,' the theory can help translators develop their self-awareness and self-identification. In that instance, the translation performance will very probably be superior than what it was previously.

The use of this theory in terms of translation methods means translation activities should be carried out from three dimensions: language, communication and culture. To better facilitate comprehension of various functions of diverse texts, all brochures, pamphlets, interpretive panels, signs, display boards, and museum displays in geoparks collected in the investigation are classified and analysed from a pragmatic perspective: offering geotourists geological information, spreading Chinese geological knowledge and unique culture to foreign geotourists, stimulating interest, and better understanding and appreciation of Earth, and its geoconservation. When rendering a text, translators should first determine what type the text belongs to. After establishing its kind and function, translators should decide on the dimension to use in the translation activity. For linguistic text whose main task is to convey geological information (GF and GP) to geovisitors, then translators should focus on accuracy, detail and language style which should follow semantic equivalence and guarantee style equivalence of TT. Therefore, in linguistic dimension, translation issues mainly focus on UCPREW, language style (short and long; passive voice and active voice; simple and complex). For cultural texts, they may contain numerous cultural components and background, translators should consider not only the accurancy of literal information, but also achieve cultural equivalence which means translator should ensure that foreign readers completely understand cultural information or, at the very least have a rough idea of the meaning of some cultural terms. Therefore, in

cultural dimension, translation problems are UCPREW, Mistranslated, NT and ITSN. For communicative texts, more attention should be paid to geotourists' reaction to the translation. Geotourists in accepting the content, should reach the same understanding as in the ST effecting a better understanding and appreciation of Earth, and its geoconservation. Thus, in communicative dimension, translation problems of NT, Mistranslated and ITSN will be solved. As can be seen, the three dimensions of Eco-translatology (principle idea, text type and translation method) can carry out effective translation activities for various types of geotourism texts.

Without the guidance of Hu's Eco-translatology, the application of traditional translation methods has led to many instances of inaccurancy, confusion and inconsistency, in GF, GP and CE geotourism translation. For example, '老黑山' is a GF in Wudalianchi UNESCO Global Geopark which was formed by volcanic eruption. There are two translated versions of it which are 'Laoheishan Mountain' and 'Laoheishan'. However, acccording to the linguistics and communicative dimension of Eco-translatology, if translators rendered it into 'Laoheishan', for foreign geotourists, they will miss the understanding that a mountain was formed. 'Laoheishan Mountain' is an appropriate choice, because it can make overseas geotourists immediately realise the object of this GF is the 'Mountain'. This translation strategy, TF trans, not only achieves semantic equivalence in principles of geotourism translation, but also finishes the transformation of language and communication dimensions. Another example is the formation process (GP) of Mount Huangshan UNESCO Global Geopark, '随着地壳的间歇抬升，地下岩体及其上的盖层遭受风化、剥蚀，同时也受到来自不同方向的各种地应力的作用，在岩体中有产生出不同方向的节理' which was rendered into 'With the sporadic uplift of the earth's crust, the underground rock mass and its caprock undergo weathering and denudation, and are also affected by various in-situ stresses from different directions, resulting in fractures in different directions in the rock mass.' This translation does not conform to the English style of using clear, simple short sentences and passive voice. Therefore it cannot be an effective way to communicate geological information to foreigners and to achieve the equivalence of English and Chinese language styles. Using Eco-translatology principles, DS trans was generated to solve the style equivalence. Therefore, this GP should be translated into 'As the crust was intermittently uplifted, both rock formations underground and those on the surface suffered weathering and erosion. At the same time, they were affected by various tectonic stresses from different directions, resulting in the formation of geological jointings going in different directions.' A further example is the CE in Taishan UNESCO Global Geopark, '元君庙' was rendered into 'Yuanjun Temple'. This word by word translation has lost its cultural connotation. '元君', in Taoist culture, is the goddess who guards Mount Tai. Thus, the use of free translation strategy to render it into 'Taoism Goddess Temple' was more accurate. This TT achieves cultural equivalence by completing the transformation of cultural and communication dimensions based on Hu's Eco-translatology. Hence, the use of Eco-translatology is most effective. GFs, GPs and CEs will be analysed and translation strategies will be generated based on Eco-translatology in detail in the 'Results and Discussion' section.

The purpose of this research is to improve the TT by using a combination of corpus linguistics and Eco-translatology. Firstly, after a quantitative and qualitative analysis is performed, the translation problems, annotated into three categories (GFs, GPs and CEs) respectively, were retrieved in concordance. The function formula should be put in the PARALLEL CONCORDANCE page as below:

Search in

English

Query type

CQL

CQL

[word="one of three categories' name"] [word=","] [word="TP"]

or

[word="one of three categories' name"] [word="[[:punct:]]"] [word="TP"]

Default attribute: word

Subcorpus: non (the whole corpus)

Secondly in the research method, through extensive concordance in the PGC, the specific translation problems (UCPREW, Mistranslated, NT and ITSN) of the three categories (GFs, GPs, CEs) were found and annotated accordingly. Thirdly, according to the definition and principles of three-dimensions of Eco-translatology, these four translation problems were classified into the three-dimensions (linguistics, cultural and communicative). Fourthly, through a small-scale concordance, translation problems of each category were counted and shown in a bar chart. The function formula should be put at the PARALLEL CONCORDANCE page as below:

Search in

English

Query type

CQL

CQL

[word="one of three categories' name"] [word=","] [word="TP"] [word=","] [word="specific TP"]

or

[word="one of three categories' name"] [word="[[:punct:]]"] [word="TP"] [word="[[:punct:]]"] [word="specific TP"]

Default attribute: word

Subcorpus: non (the whole corpus)

Fifthly, translation problems of each category were improved through developing new effective strategies. Finally, translation problems of the three categories (GFs, GPs, and CEs) and the corresponding translation strategies were summarised based on the Hu's Eco-translatology theory, an operating model shaped and recommendations made.

5. Results and Discussion

5.1 Translation strategies and improvements in GFs

After retrieving the PGC, the different translation strategies used in GFs were counted in order to conduct the quantitative and qualitative analyses. An extensive concordance was compiled on the PGC through function formula: [word="GF"] [word=","] [word="TS"]. The frequency total of applied translation strategies in GFs was

found after analysis to be 422 including literal translation, transliteration and free translation, shift, and addition. After this quantitative analysis, the types of translation strategies mentioned in the previous sentence above were retrieved in the PGC respectively through function formula: [word="GF"] [word=","] [word="TS"] [word=","] [word="specific TS"]. The specific statistics found are listed as follows by the table (**Figure 6**) and bar chart (**Figure 7**):

Translation strategies	Frequency	Percentage
Literal Trans	325	77.02%
TF Trans	88	20.85%
Foreignisation	1	0.24%
Addition	5	1.18%
Shift	3	0.71%
Total number	422	100%

Fig. 6 Applied translation strategies in GFs

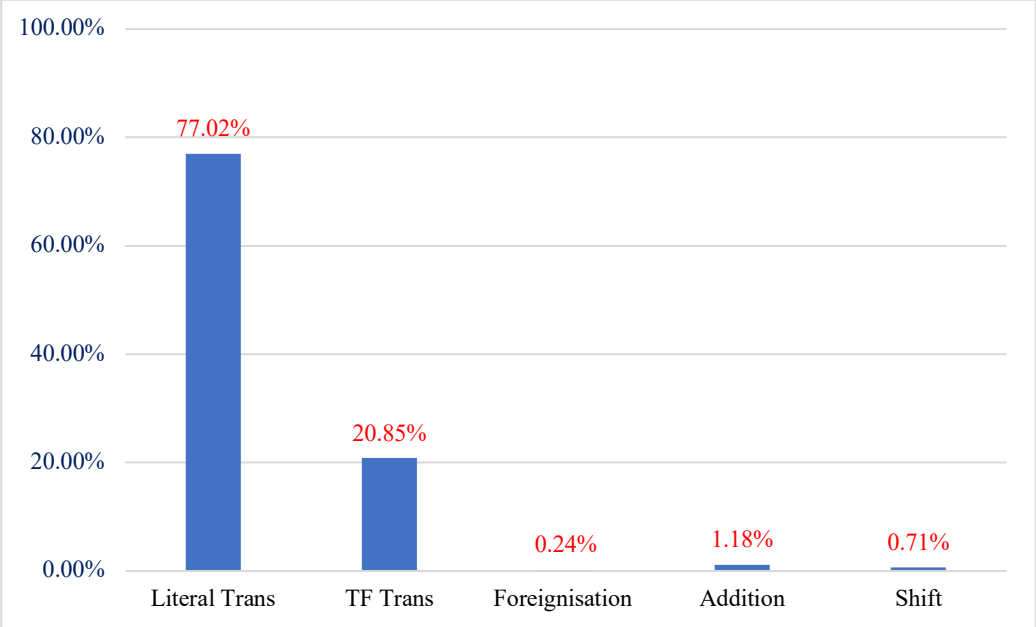


Fig. 7 Percentage of translation strategies applied in GFs

The above table and bar chart show the frequency and percentage of applying translation strategies in GFs. Firstly, the complexities of the literal translation category will be examined. When translators rendered GFs, as expected, literal translation (77.02%) is by far the most frequently used, followed by transliteration and free translation (20.85%) which is about four times less but still of some comparative significance. It was seen through parallel concordance in the PGC, translators use straightforward literal translation when they deal with two types of occurrences of GF jargon. The first occurrence is if the geological terms of semantic equivalence can be found

between English and Chinese. For example,‘节理’was translated into ‘joint’ and‘火山岩’was translated into ‘volcanic rocks’. The second occurrence is with names of some caves, rocks or peaks that relate to a specific shape. For example,‘孔雀峰’was translated into ‘Peacock Peak’, because the upright peak looks like a peacock. Similarly,‘鱼骨岩’was translated into ‘Fish Bone Rock’ as the rock has a fish bone shape. Literal translation is the optimum if possible, through equivalence, as it enables foreigners to appreciate the identification of the rock as a likeness to a particular animal. In this case, literal translation is like a simple mirror image which only requires equivalent linguistics.

However, literal translation cannot be applied for all the GF items. When translators deal with the translation of some names of rocks, caves and peaks that relate to specific cultural knowledge in SL, transliteration and free translation need to be adapted. For example,‘独秀峰’was rendered into ‘Duxiu Peak’. It is clear that the translation of‘独秀峰’is the combination of Chinese Pinyin ‘Duxiu’ and the translated GF ‘peak’.‘独秀(Duxiu)’is a specific Chinese cultural word, which has no equivalent word in English. In this case, the transliteration and free translation strategy takes into account the difference between Chinese and Western cultures. Therefore, the first half of the Chinese characters was translated by transliteration (keeping the Chinese Pinyin part), while the latter part of the Chinese characters was rendered by free translation to know what kind of shape the GF is. Thus, part of the TT retains the meaning of the GF, and the other part, the similar pronunciation but neither part uses literal translation. It is worth mentioning that the use of transliteration and free translation strategy in the PGC (20.85%) all comes from the translation of the names of caves, rocks and peaks.

Another type of example also shows the complexity of literal translation, the translators used the literal translation to render four-Chinese-character cultural structures which are related to GFs. This kind of GF was formed by GP such as weathering, water erosion and volcanic eruption. For example,‘崇山峻岭、险壑幽谷’was translated into ‘lofty, precipitous mountain ranges, deep and serene valleys’ and‘奇峰叠障、怪石飞瀑’was rendered into ‘fantastic landscapes of rocks, peaks and waterfalls’ in the PGC. Therefore, these four-Chinese-character cultural structures were interpreted to geotourists by using elegant language through literal translation. In this case, it was helpful for them to capture the dramatic feelings of the landscape in the geoparks and geomuseums. These various examples of translation strategy demonstrate the complexity of literal translation by following the framework of the three-dimensional transformation of Eco-translatology.

The remaining three categories of applied translation strategies, foreignisation, addition, and shift, account for such a small proportion that they can be defined as exceptional. The percentage of foreignization, addition and shift is less than 3%. This means the frequency of addition, foreignisation and shift in this PGC is negligible but at times necessary. Since there are great differences between Chinese and English grammar and style, it is at times important to add explanation of the original text information in order to effectively convey the desired meaning to the geotourists. For an example, the typical addition strategies applied in the PGC are as follows:

ST 1: <s>抗风化能力弱的凹陷处成了‘田’，反之凸出处成了‘**埂**’。</s>

TT 1: <s>The less resistant parts become ‘fields’<GF, TS, Literal Trans> and the more resistant parts become ‘banks’ **(the low banks of earth between fields)**< GF, TS, Addition ><GP, TS, Division>.</s>

In the above case, addition was adopted to translate ‘埂’ in order to make up for the lack of information at the cultural level to make the TT more meaningful to the foreign tourist. This strategy aligns with the transformational cultural dimension of eco-translatology. When‘田’and‘埂’are combined into‘田埂’, the translator applied foreignisation to render it into ‘traditional Chinese paddy fields’. This is because traditionally Chinese farmers have cultivated rice in‘田埂’. In another minor category, shift, an example can be found when a part of speech conversion is used in the PGC.

ST 2: <s>岩石表面纹路纵横交错, 形似‘**田埂**’, 故民间称之为‘**仙人造田**’。</s>

TT 2: <s>The rock <GF, TS, Literal Trans> has crisscrossing lines on the surface, which look like **traditional Chinese paddy fields** <GF, TS, Foreignisation>.</s><s>That is why locals call it ‘**Divinely Crafted Farmland**’<GF, TS, Shift>.</s>

In this example, the translator rendered‘仙人造田’into ‘Divinely Crafted Farmland’. In Chinese,‘仙人’, is similar to ‘god’ in English culture, and refers to a person in mythology or traditional tales who is powerful and immortal. The translator transformed the noun (‘仙人’) into an adverb (‘Divinely’) during the translation process. The translation is not only adapted, but also becomes an integral part of the recipient’s culture. This is again in line with the transformation of linguistic and cultural dimensions in Eco-translatology.

In regard to translation problems (TPs), in principle, the PGC was compiled by extensive concordance through function formula: [word=“GF”] [word=“,”] [word=“TP”]. The total frequency of translation problems in GF was 329 including the categories of UCPREW, Mistranslated, NT, and ITSN. After establishing this initial quantitative analysis, the translation categories mentioned above were retrieved respectively in the PGC through function formula: [word=“GF”] [word=“,”] [word=“TP”] [word=“,”] [word=“specific TP”]. The specific statistics resulting are as follows by the table (**Figure 8**) and bar chart (**Figure 9**):

Translation problems	Frequency	Percentage
UCPREW	10	3.16%
Mistranslated	10	3.16%
NT	2	0.64%
ITSN	307	93.31%
Total number	329	100%

Fig. 8 Translation problems in GFs

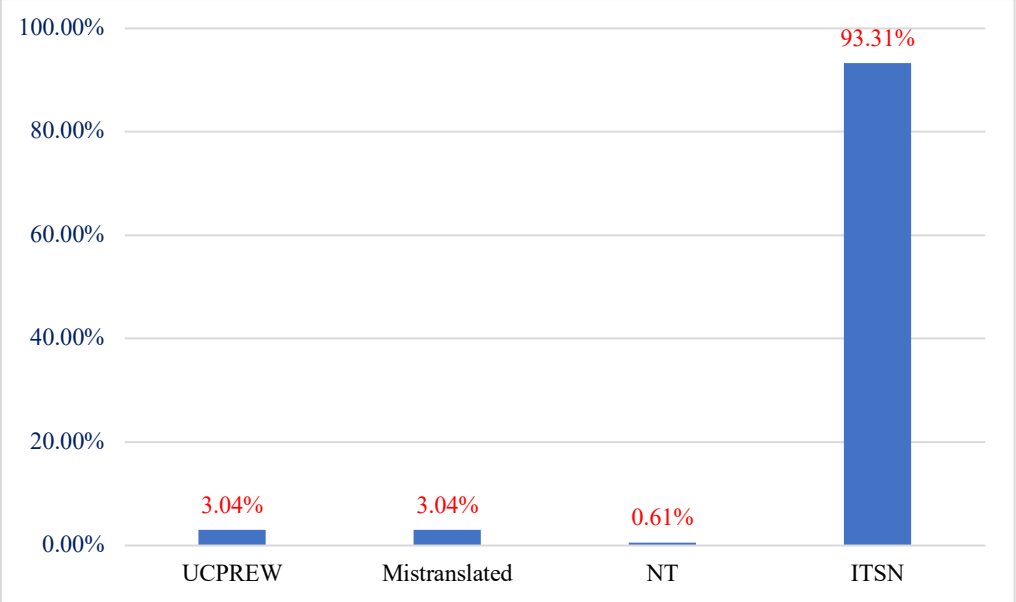


Fig. 9 Percentage of translation problems in GFs

The above table and bar chart illustrate the frequency and percentage of translation problems in GFs. ITSN accounts by far for the largest percentage (93.31%) among these four problems. Coincidentally, UCPREW and Mistranslated share the same proportion, both minutes, at 3.04%. NT accounts for the least, less 1%. Using the search through parallel concordance, quantitative analysis reveals these four translation problems are related to translation of the names of peaks, caves, rocks, rivers, and waterfalls.

To look more closely at the problems of translation in the PGC, examples of ITSN and Mistranslated can be selected to illustrate the challenges of geotourism translation. Firstly, ‘大龙湫’, in the PGC, has been translated into three different versions which are ‘Big Dragon Waterfall’, ‘Giant Dragon Waterfall’, and ‘Dalongqiu’, The second term, ‘小龙湫’, was rendered into ‘Small Dragon Waterfall’ which is categorised as Mistranslated. In traditional Chinese values, ‘dragon’ is the symbol of power, wealth and auspiciousness, and traditionally the Chinese nation is considered ‘the descendants of the dragon’. The emperor of all historical dynasties in China is also known as the true son of the dragon’. However, in the West, in traditional tales such as Saint George and the dragon, the ‘dragon’ is symbol of evil, is possessive and physically portrayed as a fierce and cruel monster. Translation is a cross-cultural activity; the TT can be literally translated but then becomes completely divorced from the original meaning out of the context of the original cultural background. If ‘龙’ was translated into ‘dragon’, it would cause misunderstanding among foreign geotourists in the sense of intimating a negative or threatening quality to the waterfall which is not in the original text at all. The waterfall’s name is intended to cause admiration. Therefore, if a positive outcome is intended by the translation, ‘dragon’ cannot appear in the TT. As discussed above, there are two main strategies translators often adopt (literal translation, and transliteration and free translation). To translate these particular cultural GF terms, the transliteration and free translation strategy was recommended. In this way, ‘大龙’ and ‘小龙’ can be translated into ‘Dalong’ and ‘Xiaolong’. In these two GF examples, the size of the ‘湫’ is different. The transliteration of cultural function words ‘Dalong’ and ‘Xiaolong’ will not carry the sense of their respective sizes, thus the full meaning is weakened in the aspect of size. Therefore, ‘大龙湫’ was simply translated into ‘Dalong Waterfall’ and ‘小龙湫’ was rendered as

'Xiaolong Pool'. Eco-translatology points out that only the TT translation can survive, so the translator should produce the best adaptation and selection. In this case, much original text meaning doesn't survive. Moreover, the translations of '丹霞山' and '昆仑山' are also ITSN in the PGC. '丹霞山' was rendered into 'Danxiashan', 'Mount Danxia', 'Danxia Mountain (Red Colored Rocks)' and 'Danxiashan Mountain'. Similarly, '昆仑山' was translated into 'Kunlunshan', 'Kunlun Mountain' and 'Mountain Kunlun'. Since the subject of this research is related to UNESCO Global Geoparks, it is significant to check the English UNESCO Website (https://en.unesco.org/ 2021a) for these official names to avoid confusion in translation. This means the translation of '丹霞山' and '昆仑山' is 'Danxiashan' (http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/list-of-unesco-global-geoparks/china/danxiashan/ 2021b) and 'Mount Kunlun' (http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/list-of-unesco-global-geoparks/china/mount-kunlun/ 2021c). These are the official names used by UNESCO.

Another problem is that sometimes there is no corresponding vocabulary in English to convey the culture-specific meaning in Chinese, so translators face a challenge and will render GF terms poorly which are labelled as UCPREW, or NT. Some typical examples in the PGC are in the **Figure 10**.

Text	ST	TT	Translation Problems
3	金鞭岩	Jinbianyan	UCPREW
4	雄鹰展翅	Eagle	NT
5	海贝听涛	Shells	NT

Fig. 10 Typical examples of translation problems in GFs

Direct translation such as '雄鹰展翅 (Eagle)', '海贝听涛 (Shell Rocks)', '金鞭岩' in PGC failed to communicate or offered meaningless target cultural terms. When the rocks reflect their own shape, literal translation would be used. For example, '雄鹰展翅' is recommended to be rendered 'Eagle Rocks'. The word '雄鹰展翅' here mainly involves the shape of the rock, and the shape of the rock resembles an eagle spreading its wings. Similarly, '海贝听涛' was recommended to be translated into 'Horizontal Seashell Rocks'. The word '海贝' refers to the shape of the rock that looks like a shell. After a GP (water erosion), the rock was shaped like a shell scattered on the beach, some metaphorical meaning of the original is lost however because the Chinese hints that the ear-shaped rock is listening to the wave. Another complex example of problems in translation can be found in '金鞭岩'. It can be revised into 'Golden Whip Rocks'. However, the '金' here is not the color of the rock, but the color of the sunshine on the rock. '鞭' is translated into 'whip' as those rocks look like whips. The strategies here give revised versions which achieve an improved result through the Eco-translatology transformation of linguistics, culture and communication.

As a result of analyses and Eco-translatology framework, three main translation strategies (literal translation, transliteration and free translation, free translation, and addition) can be identified and recommended for

translating GF jargon. The table (**Figure 11**) below can summarise and clearly demonstrate the successful strategies and some corresponding examples. Exceptionally, in addition, two minor translation strategies (foreignisation and shift) will be considered if the above four cannot be used, such as in Texts 1 and 2. This table points to the foundation of a new model for translation problems and corresponding strategies according to the type of geotourism category. Here it is geological formations (GFs).

Translation strategies	**Categories in GFs**
Literal translation	(1) When translating some GF jargon corresponding equivalent words in English can be found, such as‘熔结凝灰岩’--- ‘welded tuff’. (2) When translating some names of rocks, caves, peaks, and waterfalls equivalent nouns which reflect their shapes can be used, such as‘象岩’--- ‘Elephant Cliff’. (3) When translating Chinese-four-character structures of GF, equivalent descriptive words can be used such as‘险壑幽谷’--- ‘deep and serene valleys’.
Transliteration and free translation	When translating some names of rocks, caves, peaks, and waterfalls, direct translation cannot reflect their name/s meaningfully. So the former part (cultural function characters) can be used with transliteration and the latter part rendered by free translation, resulting in an example such as‘石戟洞’--- ‘Shiji Cave’.
Addition	When translating GF jargon in which there are cultural blocks to direct translation, the cultural difference will prevent the literal meaning and so approximate descriptive terms can be added, such as‘埂’--- ‘banks (the low banks of earth between fields)’.
Official name used by UNESCO	When translating some GFs which are official names, these names were recognised as already available in the UNESCO Global Geoparks, such as‘丹霞山’--- ‘Danxiashan’ and‘昆仑山’--- ‘Mount Kunlun’.
Foreignisation Shift	As exceptional examples and not part of the pattern, foreignisation strategies occurred once only in the PGC such as‘田埂’--- ‘traditional Chinese paddy fields’ in Text 2. Shift strategies only occurred three times in the PGC such as‘仙人造田’--- ‘Divinely Crafted Farmland’ in Text 1.

Fig. 11 Taxonomy of translation strategies in GFs

5.2 Translation strategies and improvements in GPs

Similarly, in order to improve the quantitative and qualitative analysis of GP translation strategies applied in the PGC, the retrieval steps of those in 5.1 were carried out. Thus the function formula: [word="GP"] [word=","] [word="TS"] was used extensively to retrieve targeted GP translations in the PGC. The total frequency of translation strategies in the GP category was 623; four specific strategies (DS Trans, division, Literal Trans, and Shift). These four translation strategies were next retrieved by their category respectively, through the function formula: [word="GP"] [word=","] [word="TS"] [word=","] [word="specific TP"]. The resulting percentage rate of each applied translation strategy are illustrated by the table (**Figure 12**) and bar chart (**Figure 13**).

Translation strategies	Frequency	Percentage
DS Trans	96	15.40%
Division	2	0.32%
Literal Trans	507	81.38%
Shift	18	2.90%
Total number	623	100%

Fig. 12 Applied translation strategies in GPs

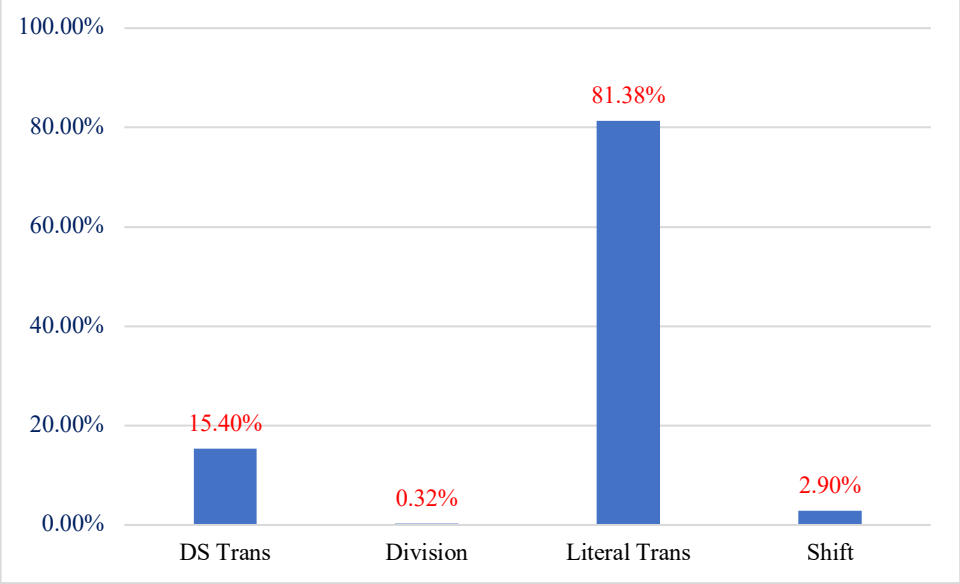


Fig. 13 Percentage of translation strategies in GPs

Literal translation, accounts for the largest proportion. Notably, Division and Shift are so small as to count as exceptional in their use, less than 1% and 2.90% respectively. In the next process, some typical GPs examples, in all four translation categories, were analysed. Firstly, translations in the category via Literal Trans. can be demonstrated by Texts 6 and 7. They are a phrase and collocation that directly corresponds with English. (Most

of the GP Literal Trans are like this.) These translations below show that GP phrases in Chinese can find direct semantic equivalents in English.

ST 6: <s> **河流侧蚀作用** </s>

TT 6: <s>**Lateral Erosion by Rivers** < GP, TS, Literal Trans></s>

ST 7: <s> **河蚀**作用的方向分为**溯源侵蚀**、**下蚀** 、**侧蚀** 。 </s>

TT 7: <s>The direction of **fluvial erosion** < GP, TS, Literal Trans> includes **headward erosion** <GP, TS, Literal Trans>, **down-cutting** <GP, TS, Literal Trans>, and **lateral erosion** <GP, TS, Literal Trans>.</s>

There were two (Text 8 and 9) translations in the PGC that were slightly different in this category and they were sentences describing geological formation. A feature of this kind of GP is that it does not include implicit and explicit passive verbs and is simple and short. They are literally translated which not only retains the language style of the ST, but also makes the TT concise and intelligible.

ST 8: <s> 这块岩石比较靠近山边，受流水冲刷的力度较小而残留下来，最终形成石门槛。 </s>

TT 8: <s>The boulder <GF, TS, Literal Trans> is close to the hill and subject to weaker fluvial action < GP, TS, Literal Trans> and eventually forming a stone gate <GF, TS, Literal Trans>.</s>

ST 9: <s> 其形态是流纹岩断裂、风化剥落塑造而成的。</s>

TT 9: <s>The spectacular shape came into being as a result of faulting <GP, TS, Literal Trans> and weathering <GP, TS, Literal Trans>.</s>

The three translation strategies of Shift, Division and DS Trans can be demonstrated and are found to be mainly used in the formation of GFs. The language in translation is altered at syntactic level. Texts 10 and 11 show the Shift category. The key words are underlined.

ST 10: <s> 岩层受到地质作用**被拉伸**或**挤压**，使得岩层折断形成裂隙，如果它们发生相对运动，就形成了断层。 </s>

TT 10: <s>**Stretched** <GP, TS, Literal Trans> and **squeezed** <GP, TS, Literal Trans> by geological forces, the rock layers <GF, TS, Literal Trans> fractured, and if any relative movements occurred between them, faults may be formed < **GP, TS, Shift** >.</s>

ST 11: <s> 火山以酸性岩浆的爆发**占主导地位**，有大面积的火山碎屑流堆积，形成熔结凝灰岩、流纹岩、凝灰岩等火山岩。 </s>

TT 11: The initial stage **was dominated by** outflow of acidic magma in form pyroclastic flow which eventually turned into welded tuff <GF, TS, Literal Trans>, rhyolite <GF, TS, Literal Trans> and tuff <GF, TS, Literal Trans>< **GP, TS, Shift** >.</s>

Texts 12, 13 show the Division category. In this Division category, GPs were interpreted into wordy and convoluted style in the ST. However, it does not conform to the language style of English. In English style, TT should be direct and concise. Texts 12 and 13 are clear examples to reflect this principle.

ST 12: <s> 流水沿节理裂隙冲刷侵蚀，并向下汇聚，冲刷能力越来越强，宽度变大，从而形成了下大上小的空隙。</s>

TT 12: <s>Flowing water scours and erodes the joints <GF, TS, Literal Trans> of the caves <GF, TS, Literal Trans> and converges downward.</s><s>Its energy accumulates and the water becomes more powerful to widen the joints <GF, TS, Literal Trans> and gaps to produce a narrow top and wide bottom arrangement < **GP, TS, Division** >.</s>

ST 13: <s> 当侵蚀基准面下降时，因基面下降而出露的河床坡度增大，水流侵蚀作用加强，开始在新出露的河段发生侵蚀，然后逐渐向上游发展，导致溯源侵蚀。</s>

TT 13: <s>When the erosion <GP, TS, Literal Trans> base level of the river dropped, gradient of river bed increased and thereby erosion enhanced <GP, TS, Literal Trans>.</s><s>Water started eroding <GF, TS, Literal Trans> the newly exposed surface and gradually receded towards the upstream < **GP, TS, Division** >.</s>

Texts 14, 15 show the DS Trans category. These text examples show the difference between categories in translation of GPs. As well as the Division category mentioned in Texts 14 and 15, these texts also have passive in the TT which may or may not be in the ST explicitly.

ST 14: <s> 来自地下炽热的岩浆携带岩石碎屑、晶体碎屑等在快速堆积过程中形成熔结凝灰岩， **被压扁拉长**， 绕过较硬的碎屑， 形成密集平行排列的假流纹构造， 后来又**被两组近直立相交的节理分割成无数小块**，酷似古代铠甲上的鳞片而得名。 </s>

TT 14: <s>Underground molten magma carried lapilli and crystallized pyroclastic materials to the surface.</s><s>They accumulated and cooled <GP, TS, Literal Trans> to form welded tuff <GF, TS, Literal Trans>.</s><s>The materials inside the tuff <GF, TS, literal Trans> **were pressed** <GP, TS, Literal Trans>, **stretched** <GP, TS, Literal Trans> and **flattened** <GF, TS, Literal Trans> to form pseudo-rhyolitic flow structure <GF, TS, Literal Trans>.</s><s>They **were finally cut into numerous small pieces by two sets of intersecting joints** <GF, TS, Literal Trans> to look like an ancient armor < **GP, TS, DS Trans**>.</s>

ST 15: <s> 最初的石桅岩是高耸的火山岩台地， **被该区三组断裂交汇切割形成破碎带**， 发生崩塌及流水侵蚀， 由边缘向中心不断风化缩小，其蚀余残留突出于地表， 形成桅杆似的柱状孤峰。 </s>

TT 15: <s>Shiwei Peak <GF, TP, ITSN> was originally a volcanic plateau <GF, TS, Literal Trans>.</s><s>The area **was then dissected by three sets of fault and created a shattered zone**.</s><s>The shattered zone gradually eroded <GF, TS, Literal Trans> by weathering <GF, TS, Literal Trans> and fluvial erosion <GF, TS, Literal Trans> to form a mast-like peak <GF, TS, Literal Trans> we can see today < **GP, TS, DS Trans**>.</s>

It is appropriate at this point to again demonstrate the structural and cultural linguistic differences between Chinese and English. According to Xiao *et al.* (2006), Chinese and English have different habits of expression. Passive voice is used quite routinely in English but is not always counted necessary for use in Chinese but intended instead to be understood by the listener. Therefore, it is necessary to carry out this conversion (Voice Shift- Shift category) in Chinese-English translation, In Text 11 there is an implicit passive ‘占主导地位’ in the ST which was translated into ‘was dominated by’ in the TT. In contrast, Texts 10, 14 and 15 include an explicit passive marker ‘被（bèi）’ in Chinese which was translated into the passive form in English.

Another major difference in English is the need to break up a long sentence. Xiao *et al.* (2006) points out that in English, a long complex sentence is often divided into many clauses or phrases with necessary punctuation. This means complicated GPs in Chinese do not match English style. To compensate for this difference, Division strategy is used in translation into English. Division is used in Texts 14 and 15. In a more complex example, in Texts 12, 13 which previously demonstrated Division, there are two further remarkable features in their STs. These GPs both have a complicated process and active narration, no passive markers. Translators generally only use Division with active voice but it necessary in these two Texts 12 and 13, to use a different strategy (DS Trans). Therefore, the ST needs radical linguistic changes for successful translation which again confirms Hu's (2001) theory of Eco-translatology. Thus this is a good example of the theory where the translator must override the linguistic barriers to build wholistic meaning in the TL. In this case, it is by the use of DS Trans strategy for GP category.

As GPs contain technically complex subject matter, there are scientific terms difficult for translators to understand, because they lack specific expertise leading to problems in translating. This could result in categories like NT and Mistranslated. The function formular [word="GP"] [word=","] [word="TP"] was used to retrieve these throughout the whole PGC. There was only NT, and the frequency of NT was 24. This implies that the translator's habit was to ignore the difficulty and omit any reference to it. Eco-translatology was used to guide the improvement of these omissions. Two examples are analysed as below:

ST 16: <s> 仔细观察对岸河流与山崖的交汇处，山崖底部向内凹陷，它是由于湍急的河流以自身的动力及挟带的砂石**对山体进行破坏侵蚀**而形成的。 </s>

TT 16: <s>The concave part of the cliff <GF, TS, Literal Trans> along the river is subject to continual undercutting by water which carried abrasive sand and gravel < GP, TP, NT>.</s>

ST 17: <s> 约 1 亿年前，火山喷出的岩浆冷却后形成火山岩，厚度巨大的火山岩**受断裂影响**，加之流水侵蚀导致岩石不断崩落后退，最终造就了石桅岩的雄伟气势和独特的地质地貌景观。 </s>

TT 17: <s>About 100 million years ago, lava from volcanoes <GF, TS, Literal Trans> flowed <GP, TS, Literal Trans> and cooled <GP, TS, Literal Trans> to form rocks <GF, TP, ITSN>.</s><s>They were later eroded <GP, TS, Literal Trans> and collapsed <GP, TS, Literal Trans> to form the grand and unique looking Shiwei Peak <GF, TP, ITSN>< GP, TP , NT>.</s>

In the above two examples, the missing translation is in bold. These omissions would understate the process and leave the reader ignorant. According to the linguistic and communicative dimensions of Eco-translatology, the example of Text 16 was rendered:

'**Close observation of the cliff, where it meets the river, shows the cliff collapsing inward from erosion by sand and stones carried by the turbulent river.**'.

The translator has added shift strategy (Shift) to make the translation more concise. Similarly, the translator also used DS Trans to supplement and improve Text 17, rendered:

'**About 100 million years ago, lava erupted from the volcano cooled, and formed volcanic rocks. The very thick volcanic rocks were faulted, and subject to water erosion over time, caused them to collaspe. Finally,**

through these immense geological forces the unique geomorphic landscape of the magnificent Shiwei Peak was created.'.

This version makes this GP complete, more logical and the GP more vivid. Thus, through quantitative and qualitative analysis and Eco-translatology, four translation strategies (DS Trans, Division, Literal Trans, and Shift) can be identified, and added to the model for geotourism translation. The table (**Figure 14**) below can summarise and clearly demonstrate the successful strategies and corresponding examples recommended for GP category translation.

Translation strategies	Categories in GPs
DS Trans	When GPs are complex long sentences they are be divided into many simple clauses or sentences. When GPs contain explicit and implicit passive structure, passive voice is to be used in the sub-clause, Texts 14 and 15.
Literal Trans	(1) Translating GP jargon in GPs, such as Texts 6 and 7 (2) Translating sentences of GPs without implicit and explicit expressions in the ST and the GPs were simple and short in the ST, such as Texts 8 and 9.
Shift	When GPs are simple short sentences and contain explicit and implicit passive structure, passive voice was used in translating GP, such as Texts 10 and 11.
Division	When GPs are complex long sentences and do not contain explicit and implicit passive structure, long sentences are be divided into many simple sentences, and active voice was used in the sub-clause, such as Texts 12 and 13.

Fig. 14 Taxonomy of translation strategies in GPs

5.3 Translation strategies and improvements in CEs

To address the cultural translation problems (CEs), a similar process was followed: the function formula: [word="CE"] [word=","] [word="TS"] to retrieve the frequency and character of CEs. Through parallel concordance, the total frequency of translation strategies in CEs was 433 and the types of strategies were TF Trans, Free Trans, Addition and Literal Trans. Further to this, the specific function formula: [word="CE"] [word=","] [word="TS"] [word=","] [word="specific TS"] was used and the frequency and percentage of each strategy is shown below in the table (**Figure 15**) and bar graph (**Figure 16**).

Translation strategies	Frequency	Percentage
TF Trans	129	29.79%

Free Trans	84	19.40%
Literal Trans	148	34.18%
Addition	72	16.63%
Total number	433	100%

Fig. 15 Applied translation strategies in CEs

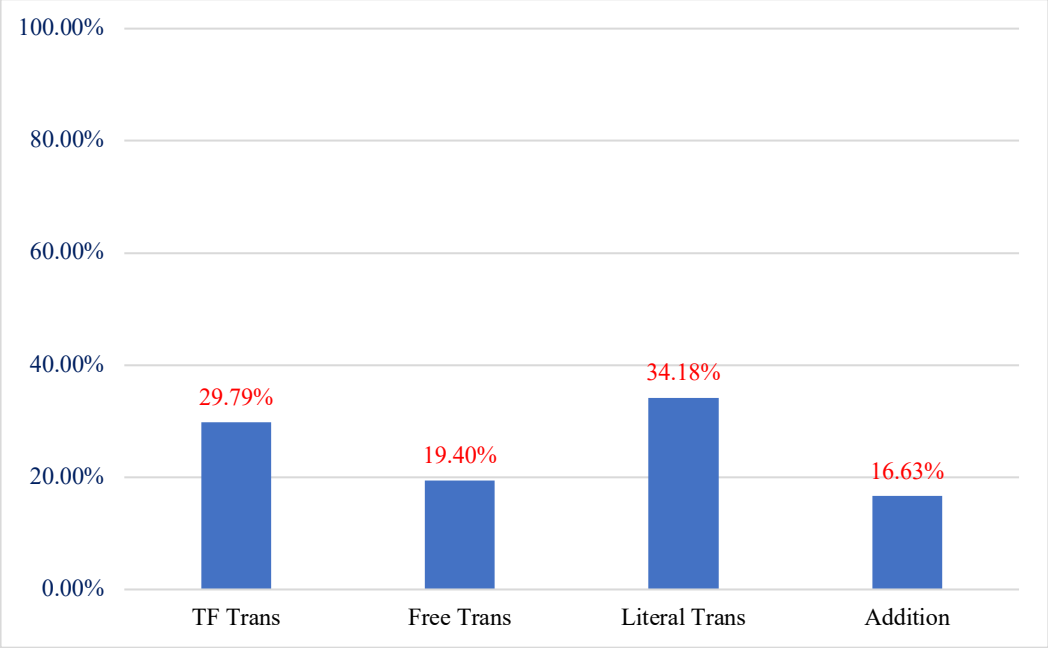


Fig. 16 Percentage of translation strategies in CEs

CEs mainly include unique Chinese historical culture, poetic references, religious terminology, or references to Chinese operas (dramas), or art. Translation of these terms should prioritise principles of correctness, completion, clarity, acceptability and readability (Wang 2017). The analyses show that to achieve these principles, translators of CEs adopted four main strategies and thereby also align with the three dimensions of Eco-translatology (linguistics, communication and culture). As can be seen from the bar chart, Literal Trans (34.1%) accounts for the largest use. Within the Literal Trans category, there are two types, historical and religious. The possibility of the successful use of Literal Trans is due to the fact that equivalent words and sentences in SL can be found that in the TL. For example, ‘耕读文化’ was translated into ‘farming-study culture’; ‘观音’ was translated into ‘Avalokitesvara’, and ‘佛寺’ became ‘Buddhist temple’. If the semantic and pragmatic values are consistent with the ST, the translator can use the corresponding words in the TL to translate the cultural information in the SL. Thus, transformation of the cultural and communicative dimension of Eco-translatology is fulfilled. Another example, in the analysis of the PGC, is two lines of poetry rendered by Literal Trans. These are:

ST 18: <s>此景南宋已发现，有诗句云‘**抱儿爱均于慈母**’，正是说的这处景观。</s>

TT 18: <s>A poem of the Southern Song Dynasty likens this scenery to ‘**Endless love from the mother nursing her baby**.’<CE, TS, Literal Trans></S>

ST 19: <s>雁荡山景区素有‘**海上名山，寰中绝胜**’之誉。</s>

TT 19: <s>Yandang Mountain Scenic District is claimed to enjoy ‘**a famous mountain in the sea, an unsurpassed wonder in the world**.’<CE, TS, Literal Trans></S>

These use literal strategy because the common feature is the non-specific cultural image. The poets have used universal objects in nature to express their thoughts and feelings. This image is intended to evoke the abstract feeling of love. Therefore, when dealing with these universal, culturally neutral images, translators can use literal translation to find equivalent meaning. The line in Text 18 was selected from *The Ode to Yandang Mountain* in the Song Dynasty which was used to describe the‘抱儿峰 (Nursed Baby’s Peak)’. Literal Trans was used to praise the transcendence of maternal love. Similarly, the line in Text 19 was used to interpret the Yandang Mountain Scenic District. The translator also used Literal Trans to praise the magnificence of Yandang Mountain Scenic District

TF Trans (29.79%) also plays a key role in rendering Chinese CEs. In the PGC, mention of local operas and local cultural heritage, was translated by TF Trans. Characteristically here, the former part is a proper Chinese noun, usually a Chinese place name, and the latter part is a common noun. For example,‘昆曲’was translated into ‘Kun Opera’. The former part‘昆 (Kun)’represents the abbreviation of the Chinese place name‘昆山 (Kunshan)’located in Jiangsu Province. The latter part is common noun‘曲 (Opera)’. Similarly,‘上山面制作技艺’was translated into ‘Shangshan Noodle Making Skills’. The former part, a Chinese place name‘上山 (Shangshan)’, is in Zhejiang Province, and the latter part is a common noun phrase‘面制作技艺’. Therefore, when translating these CEs, transliteration was used for the former proper nouns and free translation was used for the common nouns.

Free Trans (19.40%) was employed to translate some historical and poetic terms. Some Chinese CEs and may contain rich complex cultural connotations. Simple transliteration, TF Trans or literal translation, cannot nuance the deeper meaning. For example, the Qing Dynasty’s official personnel selection system‘科举考试’was translated into ‘imperial examination’. Therefore the English translation of the Chinese cultural key word‘科举考试’should be expressed by free translation. It was a system used to select talents in the dynasties from the Sui Dynasty to 1905. This includes English cultural background and expression habits. In addition, Free Trans is also used in the PGC to translate Chinese classical poetry with cultural images. In these poems, the poet uses words with strong cultural colour, such as unique Chinese personal names, place names and allusions, to express their thoughts and feelings and create an original poetic concept. Zhou (2009) explains that generally most cultural images crystallise the historical and cultural wisdom of each nation, and are closely related to the legends and totems at the birth of each nation. For example,

ST 20: <s>愿借灵湫水，一洗**了堂碑**。</s>

TT 20: <s>I would like to borrow the water from the Spirit Pool to cleanse **the Fulfillment Hall Monument** once and for all. </s>

In this line,‘了堂碑’is an allusion. The background to this famous poem is that Qin Hui (1090-1155) was an infamous ancient Chinese official who served as governor of Wenzhou in the fifth year (1135) of the Shaoxing

administration. He travelled to Guanyin Cave on a trip to the Yandang Mountain where he found the cave similar to the stone chamber which had appeared in his dream. He was so impressed that he not only wrote a poem about it but erected the 'Fulfillment Hall Monument' in the Guanyin Cave to increase his own importance. However, Wang Shipeng (1112-1171), a renowned ancient Chinese official, was indignant at Qin Hui's action, thinking that the 'Fulfillment Hall Monument' had tarnished the famous sacred mountain and its cave. Shipeng in his response poem, urged the Elder Hui of the Lingyan Peak to use his authority and eradicate the monument. In the poem, Shipeng expresses his wish for the sacred waters from Dalong Waterfall to cleanse the stains brought by the 'Fulfillment Hall Monument'. By this well-known literary piece (five characters in each line) Wang Shipeng praises the scenery of the Yandang Mountain, criticising Qin Hui's shamelessness and expresses his wish for the restoration of the mountain's dignity.

As the following examples show, Addition is sometimes necessary in CE translation to deal with religious, historical, and artistic culture in the PGC.

ST 21: <s>永嘉出 604 名**进士**， 宋 、明代出**状元** 12 名 。 </s>

TT 21: <s>Yongjia was the birthplace of 604 **Jinshi (successful candidates in the highest imperial examination)** < CE, TS, Addition >in the nearly 1,000 years from the Tang Dynasty to the Qing Dynasty and 12 **Zhuangyuan (No. 1 scholar in imperial examination)** <CE, TS, Addition> in the Song and Ming dynasties.</s>

ST 22: <s> 现存的苍坡村是九世祖李嵩于南宋淳熙五年 (1178 年) 邀请国师李时日按五行**风水**说，重建的村落 。</s>

TT 22: <s>The existing village was reconstructed in 1178 by Li Shiri, teacher of the Southern Song Dynasty, and Li Song, ninth ancestor of the Li family, based on **feng shui (China's five-element and geomantic theories)** < CE, TS, Addition >.</s>

ST 23: <s>东、西两池为'**砚池**'。<s>

TT 23: <s>Two ponds in the eastern and western village are known as **Yanchi Pond, which means an ink stone for making ink** < CE, TS, Addition >.</s>

Texts 21 to Text 23 involve historical, religious and artistic culture respectively that require some kind of Addition. In Text 21,'进士'and'状元'are the grades of imperial examinations in Chinese dynasties. In Text 22,'风水'was related to Chinese Taoism. In Text 23,'砚池'was used, a term which relates to a tool for grinding ink for Chinese calligraphy. It is noteworthy that Text 23 has a small difference because TF Trans strategy is combined with Addition to translate. Generally, it has become evident cultural words can have both implicit (hidden) meaning and no equivalent terms in English. Therefore, in such cases, transliteration or TF Trans should be used to retain the original connotation. Besides this, Addition can supplement the implied meaning of cultural words, and fill the cultural gap. Before summarising the pattern of strategies for CEs and extending the model and recommendations for translators, this paper will examine mistranslation in the PGC.

Due to differences between Chinese and Western culture, translators inevitably encounter translation problems, which can result in confusion. The function formula [word="CE"] [word=","] [word="TP"] was used to retrieve to find translation problems in the PGC in the CEs category. The total frequency was 63 and analysis of the

concordance results showed there were four types of translation problem: ITSN, Mistranslated, UCPREW, and NT. After this, the function formula, [word="CE"] [word=","] [word="TP"] [word=","] [word="specific TP"], was used to count frequency of every specific problem category. The specific statistics resulting are as follows in the table (**Figure 17**) and bar chart (**Figure 18**):

Translation problems	Frequency	Percentage
UCPREW	15	23.81%
Mistranslated	15	23.81%
NT	9	14.28%
ITSN	24	38.10%
Total number	63	100%

Fig. 17 Translation problems in CEs

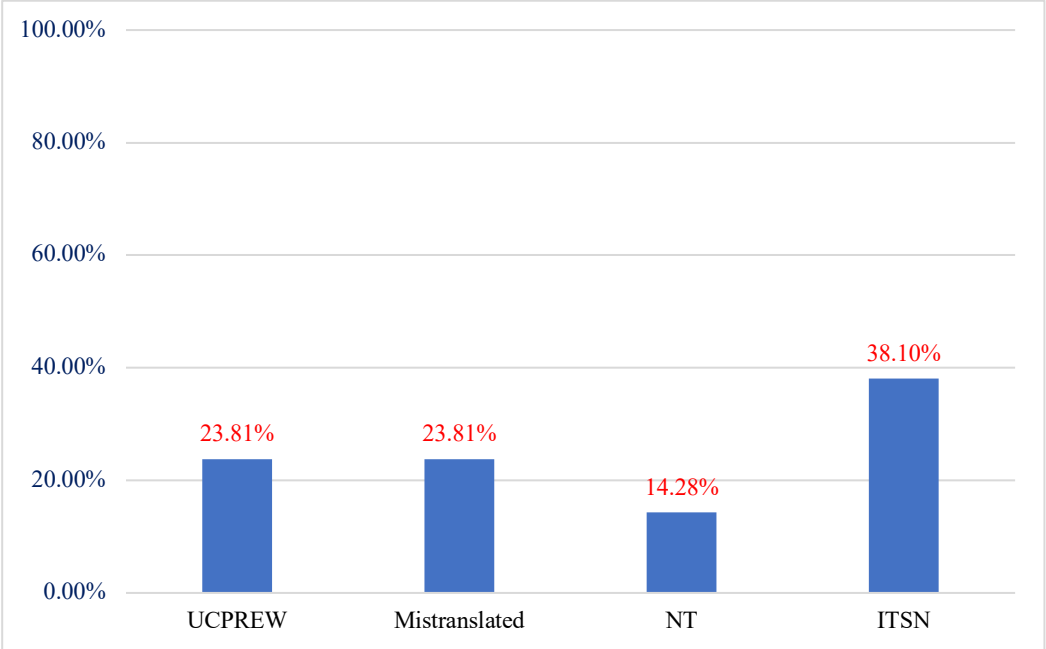


Fig. 18 Percentage of translation problems in CEs

Translation problems mainly focus on historic, artistic, and poetic culture. Historic and artistic culture were mainly ITSN (38.10%), UCPREW (23.81%), and Mistranslated (23.81%). This contrasts with the translation problems of poetic culture, NT (only 14.28%). Some examples below are analysed in **Figure 19**.

Text	ST	TT	Translation Problems
24	<s>叶适是一位大教育家，一生从事教育 30 余	<s>As a notable educator, Ye Shi took up education for 30-odd years.</s><s>He once	UCPREW

	年，曾任**太学正**和**国子司业**。</s>	served as **Taixuezheng** <CE, TP, UPREW> and **Guozisiye** <CE, TP, UCPREW>.</s>	
25	（1） <s>两宋时期，‘**永嘉学派**’、‘**永嘉四灵**’在中国文化史上有着显著的地位。</s>	(1) <s>During the North Song Dynasty and Southern Song Dynasty, ‘**Yongjia School**’ <CE, TP, ITSN>, and ‘**Yongjia Four Poets**’ <CE, TP, ITSN> had significant status in Chinese cultural history.</s>	ITSN
	(2) <s>‘**永嘉学派**’、和‘**永嘉四灵**’是中国文化史上光辉灿烂的篇章。</s>	(2) <s>‘**Yongjia School of Thought**’<CE, TP, ITSN>, and ‘**Yongjia School of Poetry**’<CE, TP, ITSN>are all brilliant chapters in the history of Chinese culture.</s>	
26	(1) <s>**瓯窑文化**</s>	(1) <s>**Ou Kiln** Culture <CE, TP, ITSN></s>	ITSN
	(2) <s>**‘瓯窑’**是楠溪江流域人民智慧结晶的见证，也是永嘉历史文化的代表。</s>	(2) <s>‘**Ou chinaware**’<CE, TP, ITSN> represented the great wisdom of people living on the Nanxijiang River <GF, TP, ITSN>Basin and signified the importance.</s>	
	(3) <s>北宋**瓯窑**青釉</s>	(3) <s>Cyan glaze chinaware of **Ouyao Kiln**<CE, TP, ITSN>which was made in North Song Dynasty</s>.	
27	<s>苍坡古村落至今已有840年的历史，平面上略呈方形，以笔架山为地标，依‘**文房四宝**’布局建设。</s>	<s> With a history of nearly 840 years, it is a square-shaped village constructed through the layout of the **‘scholar’s four treasures**’<CE, TP, Mistranslated> and taking Pen Stand Mountain <GF, TS, Literal Trans>as its landmark.</s>	Mistranslated
	<s>隋唐时期，尤其‘**安史之乱**’，进一步促进人们向楠溪江中游一带扩散。</s>	<s>In Sui and Tang Dynasties, the ‘**Anshi Riot**’<CE, TP, Mistranslated>in particular further pushed people to migrate to the middle reaches of the Nanxijiang.<GF, TP, ITSN></s>	
28	<s>龙湫飞泉洒绝顶，万丝下浣**天孙**机。</s>	<s> The flying spring from the Dalong splashes from a pinnacle. Ten thousand silk-like water	NT

columns rush down to wash a loom. <CE, TP, Mistranslated>.</s>

Fig. 19 Typical examples of translation problems in CEs

In Text 24,‘太学正’and‘国子司业’are UCPREW mistranslations. In Chinese history, these two terms were central government positions which were related to educational status titles. The translator used transliteration to translate them which cannot reflect the cultural implications of the SL. According to the above analysis, for this type of term it is recommended to use Addition strategy. Therefore,‘太学正’should be translated into ‘Taixue zheng (College Supervisor in the Song Dynasty)’ and‘国子司业’should be rendered into ‘Taizi siye (Vice Director of Education in the Song Dynasty)’. In Text 25 and Text 26,‘永嘉学派’,‘永嘉四灵’and‘瓯窑’are ITSN. The feature of term‘永嘉学派’is similar to‘耕读文化 (farming-study culture)’which is in the above literal translation examples. Because‘永嘉学派’is a Chinese school of thought, it was rendered into ‘Yongjia School of Thought’ via Literal Trans to reflect its meaning.‘永嘉四灵’should be corrected and translated into ‘Four Poets of Yongjia (Zhao Shixiu, Xu Ji, Xu Zhao and Weng Juan)’, because the word‘灵(líng)’in‘永嘉四灵’ which was used either in their style or in their literary name. In Text 26, there were three translated versions of‘瓯窑’. As a School of Chinese Art, it cannot express the implicit meaning to target readers through simple and direct translation. Therefore, it should be translated into ‘Ou Porcelain Wares (Chinese Ceramics)’. In Text 27,‘文房四宝’and‘安史之乱’were Mistranslated.‘文房四宝’are unique calligraphy and painting tools in China. The translator used literal translation to translate which also cannot express the implicit meaning. It should use Addition to reveal the implicit meaning. Hence, it should be improved to read ‘The Four Treasures of Study (Brush, Inkstick, Paper, and Inkstone)’. The term‘安史之乱’refers to one of the most famous rebellions in Chinese history. It was a political rebellion in the Tang Dynasty which was initiated by An Lushan and Shi Siming for control of the central government. The features of this term are also similar to‘耕读文化 (farming-study culture)’. Thus, it should be translated into ‘Rebellion of An Lushan and Shi Siming’ via Literal Trans. In Text 28, an allusion‘天孙’was omitted and not translated. In Chinese culture,‘天孙’means‘织(zhī: wave)女(nǚ: girl/woman)’which was a legend that should be translated (Free Trans) into ‘the Divine Spinning Damsel’. Again improvement is reached through the principles of Eco-translatology.

In conclusion when researching the translation strategies in CEs, quantitative and qualitative analysis on the PGC was conducted and various examples have been presented for consideration of the relevant translation strategies. Finally, according to Eco-translatology, mistranslations were analysed and corrected. Hence, accordingly the four translation strategies (Literal Trans, TF Trans, Free Trans, and Addition) are recommended for translating CEs. The table (**Figure 20**) below can summarise and clearly model the successful strategies and their corresponding examples.

Translation strategies	**Categories in CEs**

Literal Trans	(1) Translating CEs which can be found with words of cultural equivalence in English or fixed collocations in English which were accepted by target readers, such as‘耕读文化 (farming-study culture)’and‘安史之乱 (Rebellion of An Lushan and Shi Siming)’. (2) Translating poems with non-cultural image, such as Texts 19 and 20.
TF Trans	Translating CEs which consisted of two parts: the former part is proper noun, and the latter part is common noun. The former part used transliteration and the latter part used free translation, such as‘昆曲 (Kun Opera)’.
Free Trans	(1) Translating highly concentrated Chinese CEs which contain rich cultural connotations. Other strategies cannot reveal the connotation in the CEs, such as‘科举制 (imperial examination)’. (2) Translating poems with cultural images which include strong cultural colours including allusions and personal names, such as‘了堂碑 (the Fulfillment Hall Monument)’and‘天孙 (The Divine Spinning Damsel)’.
Addition	Translating CEs which have two features: implicit meaning and no words of cultural equivalence in English.

Fig. 20 Taxonomy of translation strategies in CEs

6. Conclusion

This paper has argued that more effective translation strategies are urgently required in the field of geotourism and can be employed using this type of research which employs corpus methodology and Eco-translatology theory. All the data were analysed quantitatively and qualitatively to develop effective strategies for translation according to their geotourism category. Finally, these effective strategies in GF, GP and CE were summarised to form a taxonomy of geotourism translation from Chinese to English based on Hu's Eco-translatology. The taxonomy will contribute to Eco-translatology-based translation strategy and to the standardisation of geotourism translation (GF, GP and CE). Meanwhile this new theoretical guidance will provide a reference for translators engaged in geotourism translation in the future. It is hoped the creation of an inaugural taxonomy of geotourism translation strategies, based on Hu's Eco-translatology, will lift the professionalism of geotourism translation from Chinese to English. To summarise the structure of the taxonomy, at GF level: literal translation, transliteration and free translation, addition, official UNESCO names, foreignisation and shift translation were used (Foreignisation and shift as minor translation strategies were employed as well in certain situations). At GP level, DS Trans, Literal

Trans, Shift and Division were employed. At CE level, Literal Trans, TF Trans, and addition were adopted. The structure of the taxonomy clearly emerged through the analyses carried out on the PGC.

The implications of the findings of this research provide, above all, a professional approach to geotourism (a system for future geotourism standards of excellence) that will fulfil the balance of data and engagement that this genre demands. Also there are insights for the broad field of translation (a systematic method of approaching translation through corpus and Eco-translatology), as well as potential material at various levels of translation education (provision of a rich bank of educational resources). It is also intended that this research provides criteria to inform standardisation of geotourism translation choices. The corpus itself (PGC) provides a reference tool for future geotourism and geopark translators. Meanwhile, more broadly, it is hoped the innovative nature of this research will germinate interest and development in future geotourism translation. Moreover, in education, by providing authentic environment data, lecturers can demonstrate more effective translation strategies to teach techniques for translation, quality standards, and consequent respect for geotourism translation into English.

The context of geotourism's recent development means the data is selected in a specific area and time which means in terms of strictly random selection, the data choice is narrow. The researchers attempted to compensate somewhat for this by selecting renowned, well-established geoparks, a range of features and quantitatively representative examples across Chinese geoparks and geoheritage. Based on these research limits, the PGC may not be as large as some may have desired or expected. This size limitation may lead to some errors of assumption in the analysis of patterns, or a lack of representativeness of the breadth of translation challenges. Therefore, it is possible that the proposed new translation theory needs further refinement. In response to the above limitations, further and improvements could be made to meet technical and cultural challenges of translating from Chinese into English.

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Authors' Contributions

Qiang (Jason) Li, as the corresponding author and Author 1, shaped the PGC by using the Sketch Engine including manually aligning the corpus, and tagging translation strategies in the corpus. Jason also wrote the paper. As an expert, Dr Young Ng, substantially contributed to the original corpus data. He also provided background knowledge and helpful suggestions about geotourism to Jason and Ruixue (Rachel) Wu through Zoom meetings. Rachel offered technical supervision to Jason in tagging the corpus, and gave advice through Zoom meetings about the structure and revision of this paper. Before submiting this paper, Young carefully read it and offered many insightful comments. Jason then revised it again, considering comments from two reviewers.

Discourse statement

No potential conflict of interest is reported by the author.

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Appendix: Comprehensive List of Linguistic Terms

NO.	Linguistic Terminology	Comments
1	Addition	Adding some words or a clause in translation to fully explain the information of implicit or cultural meaning of source text to the target readers.
2	Annotation (Tagging)	For control in research, special symbols are used to annotate the translation strategies. They are used to facilitate retrieval in the corpus. (Thus a corpus can easily be used to carry extra linguistic information.)
3	Cultural equivalence	The same value in cultural terms but in words directly meaningful to the target history and social system.
4	Corpus linguistics	A type of research that studies language using repetitions of a category, word, or part of speech. It mainly studies machine-readable natural language texts and is particularly suitable for quantitative language analysis, lexicography, and machine translation.
5	Division	Translation strategy which divides the long sentence into several small parts, which share a connected meaning.
6	Division and Shift	A compound translation strategy combining two strategies, namely Division and Shift, NO.5 and 14.
7	Foreignisation	Translation strategy where the target text is prioritised to align to the reader's own native language so synthesis takes place to deliver the closest approximation which could be phonetic or by other means.
8	Free translation	Translation strategy focused on the content of the original without retaining the form of the source text.
9	Literal translation	Translation strategy rendering the text word by word while maintaining the form and content of the source text.
10	Manually aligned	A research technique where the machine is not programmed to perfectly align the source text and the target text correspondingly in every case. This means some adjustment by hand is required to tidy up the corresponding order.
11	Official name used by UNESCO	Some official names or terms were already available in official use such as UNESCO.

12	Parallel geotourism corpus	Data is arranged in its typical repetitive categories but also has a one-to-one correspondence between English and Chinese geotourism text.
13	Semantic equivalence	Terms of languages are equal in meaning but not necessarily the same forms of grammar.
14	Shift	Translation strategy using change of word/s, sentence structure or voice of the source text in order to fit the target language.
15	Style equivalence	Translation strategy where the appropriate level of language such complex and simple vocabulary/sentences, as well as formal and informal approach is used.
16	Translation theory	This theory is built on recognition of the sound basis for understanding how a language functions, and acknowledgements that various languages have different formats. It directs translators to preserve meaning by using the most appropriate forms for the language.
17	Translation strategy	A method of translating a linguistic unit from one language to another.
18	Transliteration	A special translation method where symbols in one language system are tranferred to express the letter symbols in another language system. For instance, ‘浙江’ in Chinese is translated into ‘Zhejiang’ in English.
19	Transliteration and free translation	Sometimes these two strategies NO. 8 and 18 are combined during translation process because they are both necessary for an effective result.

Linking Statement III – Flora and Fauna in Ecotourism as the B Element in Geotourism

Chapter 5 identified a number of strategies for effective interpretation for the **A**biotic and **C**ultural elements, among which the most commonly used are Literal Interpretation (LI), Transliteration and Free Interpretation (TFI) and Addition. Besides these, I also found distinctive strategies used for each element. For the **A**iotic element, the strategies of Foreignisation, Shift, Division, Official names used by UNESCO, and Division and Shift (DS) are specifically used for various linguistic patterns. For the **C**ultural elements, the strategy 'Free Interpretation (FI)' is specifically used for linguistics patterns such as when highly concentrated Chinese cultural elements contain rich cultural connotations, or when interpreting poems with cultural images. On one hand, these findings provide tangible and specific guidelines for interpreters to choose the appropriate strategies when encountering specific linguistic patterns in the **A**biotic and **C**ultural elements. On the other hand, it is clear that different types of geotourism elements require different processes of interpretation, and each of the element should be investigated separately.

According to Dowling (2013), geotourism focuses on three elements: **A**biotic; **B**iotic; and **C**ultural (or, A, B, and C). Dowling (2013) argues for the primary importance of the Abiotic element, specifically geological features and processes, because they determine flora and fauna (i.e., **B**iotic element). By extension, he claims the interplay between its **A**biotic and **B**iotic components influence the **C**ultural ways in which people have lived in the area both past and present (Dowling, 2013). Therefore, the following chapter complements Chapter 5 to provide a focused analysis of the **B**iotic element of geotourism. The **B**iotic element represents two categories of biotic types: flora and fauna. For both of these biotic types, the **B**iotic element covers common biotic names, local Chinese biotic terms, and ecological processes.

In Chapter 6, I used datasets from Wudalianchi and Jiuhuashan UGGps. I identified nine strategies of effective interpretation strategies for the **B**iotic element, and I manually identified and improved problematic interpretations using the identified strategies. This Chapter is published in the 'Journal of Sustainable Tourism' under the title *Effective Chinese-to-English Biotic Interpretation in Ecotourism Destinations: A Corpus-Based Interdisciplinary Study*.

Chapter 6: Empirical Study 3 – Effective Chinese-to-English Biotic Interpretation in Ecotourism Destinations: A Corpus-based Interdisciplinary Study (*Journal of Sustainable Tourism*)

ABSTRACT

Ecotourism interpretation pertains to vital public education regarding environmental conservation. At present, there is no professional standard or system for interpretation in this domain, which potentially hinders the goals of geoheritage, and species preservation. To address this shortcoming, two categories of ecotourism (flora and fauna), are selected and broken down into the three main interpretation issues: common biotic names, local Chinese biotic terms, and ecological processes. Effective Chinese-to-English interpretation is identified through analysis of interpreted texts and their originals, on the basis of which a taxonomy of reliable interpretation strategies is proposed. The main difficulties confronted were scientific terminology, sentence structure, and culture. This analysis presented adopts a corpus-based approach that systematically investigates the interpretation language used in geoparks, providing representative and comprehensive views into ecotourism interpretation. We found that, generally, literal interpretation can be used. However, other strategies are essential for achieving effective interpretations, particularly regarding textual representations of flora and fauna processes. Informed by Hu's Eco-Translatology, a taxonomy of effective strategies is developed and recommended for use by ecotourism translators and interpreters.

KEYWORDS Ecotourism; ecotourism interpretation; interpretation strategies; Eco-Translatology; corpus-based method.

1. Introduction

Geotourism is emerging as a global phenomenon and an important tool for conservation and regional development. In 2015, the Geological Society of Australia (GSA) defined the three aims of geotourism as: (1) better understanding and appreciation of the Earth; (2) conservation (and more specifically, geoconservation); and (3) better livelihoods for local communities (Li et al., 2022b). Geotourism focuses on abiotic (A) elements of geology and landscape, biotic (B) elements of flora (plants) and fauna (animals), and cultural (C) elements such as past and present human lifestyle (Dowling, 2013; GSA, 2015). Geotourism is closely related to ecotourism in its concern for natural areas and the welfare of local people. Dowling (2013) identifies their close relationship by pointing out that ecotourism is embedded in geotourism with a focus on the B element. The overlap of the two fields can be seen in the Ecotourism Australia's (1994) definition of ecotourism as *'ecologically sustainable tourism with a primary focus on experiencing natural areas that foster environmental and cultural understanding, appreciation and conservation*'.

The development of ecotourism has been accompanied by a demand for quality interpreting in recent years, especially in geoparks. Geoparks are a primary location for many geotourism activities (Dowling, 2013; Li et al., 2022a). The United Nations Educational, Scientific and Cultural Organisation (UNESCO, 2023) defined a geopark as '*a nationally protected area that contains a number of geological heritage sites of particular importance, rarity of aesthetic appeal, and is one element in an integrated concept of protection, education and sustainable development*'. Li et al. (2022a) claim that although China's first UNESCO geoparks (UGGps) opened in 2004, they currently lack systematic and effective interpretation of geotourism. This creates the distinct possibility that geological, biotical and cultural information presented within these sites is not being interpreted as effectively as it should be (Li et al., 2022a). Thus, an investigation of the current issues hindering Chinese-to-English ecotourism interpretation, as well as the identification of solutions to these, is necessary.

Chinese-to-English ecotourism interpretation can be considered to comprise three aspects: linguistics, culture and communication. These dimensions are detailed in Hu's (2003) Eco-Translatology, which is the theoretical framework we adopted in this study to assist in identifying the problems and finding the solutions in geotourism interpretation. At the linguistic level, the Latin names of plants and animals present difficulty for geotourists because they are scientific, technical, and often difficult to pronounce and recall. Moreover, syntactical and structural differences between Chinese and English could also make it difficult to interpret descriptions of ecological processes. Taken together, these obstacles may prevent **S**emantic, **S**tyle, and **C**ultural information equivalence (i.e., SSC equivalence). In regard to culture, the numerous local Chinese names for various species of flora and fauna can also present a challenge to foreign tourists. Li et al. (2022c) note that these local Chinese flora/fauna terms could contain vernacular language which reflects and relies upon a significant amount of cultural knowledge. For example, the appropriate interpretation of the flora term '睡莲' is 'water lily'. Yet, without proper knowledge or the guidance from an interpretation framework, which is Eco-translatology in this study, this term could be easily interpreted into 'sleepy flower', which is the literal word-by-word translation of the Chinese characters. Li et al. (2022c) also point out that there is an additional possibility that interpreters themselves may not have the necessary ecological cultural background to appropriately interpret these local names. The linguistic and cultural aspects of interpretation are foundations for communication, which can be achieved ultimately when

linguistic and cultural transformation dimensions are considered for accuracy of information and effective communication (Hu, 2003).

The goal of this study, with the aid of a rigorous theoretical framework of Hu's (2003) Eco-Translatology, is to provide an overview of strategies that address the aforementioned linguistic, cultural, and communicative challenges facing Chinese-to-English ecotourism interpretation. This study avails the systematic analytical advantages of a corpus-based method. Corpus linguistics means using a large digital collection of empirical data as a resource for translation (Baker, 2019). One of the most significant benefits of using corpus-based method is that a corpus provides ample authentic linguistic evidence to support any investigation of a linguistic phenomenon, which, in our case, is the interpretations of flora and fauna related expressions in geoparks. Thus, this method fits the objective and professional standards necessary for the study. Therefore, in our study, we composed a Chinese-to-English Parallel Ecotourism Corpus (PEC) with 63,248 words containing corresponding Chinese and English expressions related to flora and fauna from interpretative panels, signs, brochures, and geological museum displays in two Chinese UGGps – Wudalianchi and Jiuhuashan. We quantitatively and qualitatively analysed to identify effective strategies of ecotourism interpretation in Chinese-to-English PEC. Hu's (2003) Eco-Translatology, the theoretical framework for the analysis, also provides a professional standard of criteria to assess the ecotourism interpretation. Thus, strategies will be recommended to overcome Chinese-to-English interpretation challenges in interpreting common biotic names, local Chinese biotic terms, and ecological processes. Then, on the basis of the analysis, a taxonomy of ecotourism interpretation strategies based on the Hu's Eco-Translatology was developed to optimise interpretation.

2. Literature background

This section provides relevant literature of research on ecotourism translation and interpretation. In addition to ecotourism interpretation studies, this section also reviews studies that uses literature or other sources for the investigation of interpretation strategies of plants and animal names, paving the ground of the strategies identified in this study. This section aims to point to a gap in ecotourism studies that calls for linguistic methods for systematic interpretation of expressions of flora and fauna in geoparks. To continue the threads of recent debate, only literature published within the last five years is considered.

2.1 Previous ecotourism interpretation studies

Dowling (2020) was the first to point out the overlap between ecotourism and geotourism; that is, that ecotourism focuses on the Biotic element in the ABC elements of geotourism. He points out that geotourism mainly focuses on geology and geomorphology, while ecotourism is primarily concerned with natural environment and biodiversity (Dowling, 2020). In other words, ecotourism is embedded in geotourism and focuses on plants and animals. Due to high public demand for ecotourism interpretation (Beall et al, 2021; Garrod & Fennell, 2023), there are already many independent studies on this topic (e.g., Klitsounnova, 2020; Coghlan, 2021; Lee et al., 2021; Freeman et al., 2023; Moscardo et al., 2023).

For example, Klitsounnova (2020), in the field of ecotourism in Belarus, concludes that interpretive ecotourism products (i.e., wildlife conservation workshop and science popularisation activities in natural reserves) can increase people's concern for the environment, assist them in discovering their own connections to nature and cultural resources, and enhance the value of sustainable development. Lee et al. (2021) examine the relationship

between interpreting services and reflective engagement. Reflective engagement refers to 'the cognitive and emotional involvement of tourists in the learning and interpreting process during their visit to ecotourism destinations'. These authors use systematic sampling to find there is a positively significant and direct relationship between interpreting and reflective engagement. They conclude that to increase reflective engagement, other ecotourism programmes should enhance the quality of their interpretation. Coghlan (2021) investigates the influence of ecotourism interpretation on coral protective behaviours. This author uses virtual reality games (digital interpretation and VR gaming) to immerse tourists in a real-world setting and establish connections with Australia's Great Barrier Reef. The findings illustrate that effective interpretation provides visitors with increased awareness of the Great Barrier Reef, and strengthens their emotional connection with it, ultimately having a positive impact on coral conservation. However, although Klitsounnova (2020), Lee (2021), and Coghlan (2021) conduct research on ecotourism interpretation, none of their studies focuses specifically on ecotourism interpretation using linguistic approaches.

2.2 Translation of biotic expressions in the literature

Complementing prior literature on ecotourism interpretations without employing linguistic methods, an extant body of research demonstrated the application of using linguistic methods to study Chinese-to-English translation of flora and fauna names. Many of these studies focused on literature texts such as the famous first anthology of verse in China – *The Book of Songs* (e.g., Chen, 2019; Jin, 2021; 2022). From the standpoint of Hu's (2003) Eco-Translatology (elaborated in Section 3), Chen (2019) investigates the English translation of animal and plant names in seven translated versions of *The Book of Songs*. According to her analysis, the primary issues with the English translation of animal and plant names are: (1) overgeneralisation, (2) incongruity, and (3) mistranslation. In contrast to Chen (2019), Jin (2021; 2022), through the lens of cognitive linguistics, systematically explores the translation strategies of plant and animal names in the most recent English-translated version of *The Book of Songs* (Xu, 2019). Jin's studies reveal how English translations of flora and fauna names are guided by principles in conceptual metaphor (Lakoff, 1993), which emphasises how certain abstract concepts share properties with more tangible objects, and therefore can be described using the same language. For example, the concept of 'bride' in one verse of *The Book of Songs* was translated using language that are typical for describing peach trees (details see Jin, 2021, p.52). Jin's discussion provides references for future translators in rendering similar literary texts.

Apart from studies using language data from literature such as *The Book of Songs*, Ren (2020) publishes a discussion of translation strategies of flora names using the method of inductive reasoning. He asserts that the occurrence of synonyms and homonyms is widespread and that this poses significant challenges to the translation of plant names. Ren (2020) concludes that when translating plant names into Latin, the translator should use official botanical names, such as the scientific names given to plants according to the rules and guidelines set by the International Code of Nomenclature for algae, fungi, and plants (ICN, 2018). Ren (2020) points out these names follow standardised conventions and are used to ensure accuracy and consistency in the identification and classification of flora species. He advises that the translator of plant names into English must differentiate between translations with and without a counterpart in the target language. In other words, if a Chinese term does not have an equivalent word in English, the translator must then select appropriate translation strategies (Ren, 2020). For example, in translating the cultural specific Chinese flora name '喜树', it is advised for the translator to use the

creative translation strategy and translate the name of this species into 'happy tree', which addresses the connotation of the Chinese name – a tree that brings auspiciousness and happiness (Ren, 2020).

In another study, Cao and Xu (2022) investigate syntactical translation in plant physiology. Merging numerous English texts to analyse syntactic features of the Chinese-to-English translation, the authors found that complex sentences in Chinese are often translated into simple sentences in English. Additionally, they observed a tendency for active voice sentences in Chinese to be transformed into English passive voice sentences. Based on the differences in language style between English and Chinese, Cao and Xu (2022) recommend relevant translation methods, such as shift and division, for increasing the accuracy of plant physiology in English.

The aforementioned studies provide rich information for understanding the significance and processes of ecotourism interpretation. Inspired by prior literature, Li et al. (2022b, 2022c) employ linguistics methods to address the needs for a high-quality interpretation system for eco- and geo-tourism. In order to meaningfully add to previous literature on the Chinese-to-English interpretation of language used in geoparks, Li et al. (2022b) combine corpus linguistics with Eco-Translatology to develop a taxonomy for effective interpretation strategies of Abiotic (i.e. A element in geotourism) and Cultural (i.e. C element in geotourism) aspects, while Li et al. (2022c) explore the interpretive quality of ABC elements. What is missing, in Li et al.'s studies, is a systematic exploration of the B element. As mentioned earlier, there is a high demand for effective ecotourism (i.e. B element) interpretation, yet no previous empirical research focused on it with a systematic linguistic approach. Therefore, the current study aims to fill this gap by providing a comprehensive account of how the use of corpus-based method elucidates the Chinese-to-English interpretation processes for expressions related to flora and fauna. Based on this, we systematically explored the following research questions (RQ):

> **RQ1:** What effective interpretation strategies can be identified from linguistic expressions related to flora and fauna in the two Chinese UGGps?
>
> **RQ2:** How could effective interpretation strategies inform the revision or improvement of ineffectively interpreted linguistic expressions related to flora and fauna?

In these research questions, the term 'linguistic expressions' was used to avoid limiting the linguistic units to lexical or phrasal level. As detailed in the following sections, this study analysed both lexical and syntactical interpretation patterns, using the corpus-based method and Hu's theoretical framework of Eco-Translatology, which is introduced in Section 3. The data and methodological approach are presented in Section 4.

3. Theoretical framework

As a theoretical framework, this study is guided by Hu's (2003) Eco-Translatology, due to its ability to account for all the factors that are likely to influence the effectiveness (or otherwise) of interpretation of ecotourism information. Eco-Translatology incorporates Darwinian ideas of 'natural selection and adaptation' and ancient Chinese philosophical ideas of 'human focus' and 'harmony between nature and humanity'. This, Hu (2003) points out, is because of translation's adaptive nature as a process; translators need to choose effective translation strategies based on the characteristics of the text, as well as linguistic and cultural differences between the source language and the target language. Similar to the way organisms make choices to adapt to their environment, then, translators select between 'adapting' to the source language and the target language in order to create the most appropriate translation for target readers. Moreover, Hu (2003) states that effective translation strategies depend

on the translator's selection of accurate vocabulary and syntactic structure according to the needs of the target audience. Thus, this is another way in which the translator needs to be able to both adapt and select during the process of translating (Hu, 2003). Translation, from this view, operates a like holistic, systematic, and harmonious ecosystem. Hu (2003) highlights that in this system, the primary objective of translation is to cater to people's comprehension and to facilitate the transmission of information. Through this system, Hu (2003) argues that the messages of environmental protection, ecological balance, and sustainable development, can all be effectively transmitted through translation, thus promoting the harmonious coexistence between humanity and nature. Thus, Eco-Translatology and ecotourism interpretation share the same objective of seeking a balance between the ecology of the source and target language. Hu (2008) recommends primary focus on three areas: linguistic, cultural and communicative dimensions. He further explains that 'ecology of the source and target language' means translators must strive to identify accurate words and expressions in the target language that closely correspond to the ecological terms in the source language. This ensures that ecological information remains intact during the translation process and facilitates linguistic accuracy, cultural transparency, and communicative efficiency.

Hu (2008) asserts that at the linguistic level, through accurate word choice, grammatical structure, syntactic logic, and language style, the translator can achieve a successful delivery of information based on a thorough comprehension of the source material. The cultural dimension, meanwhile, requires the translator to mainly focus on the cultural connotations of both the source and target languages, aiming to avoid misinterpretation of the source text (ST) from the perspective of the target culture (Hu, 2011). Finally, at the communicative level, the author urges that translators place emphasis on the communicative intention of the ST to make sure this is reflected in the translation. Therefore, the degree of 'three-dimensional transformations' (i.e., linguistic, cultural, and communicative dimensions) is one of the most essential measures of translation quality. According to Hu (2011), the degree of holistic adaptation and selection in translation is determined by the extent to which translators engage in adaptation and selection across linguistic, cultural and communicative dimensions. In other words, the greater the number of dimensions that the translator adapts to during the translation process, the higher the degree of holistic adaptation and selection that can be achieved. This means that the concept of 'multi-dimensional adaptation' and 'adaptive selection' proposed by Hu (2011) in his Eco-Translatology can ensure a higher quality of translation.

In the present research, Hu's Eco-Translatology (2003) provides a framework for identifying the quality of ST interpretation. By using Hu's three-dimensional transformation (i.e., language, culture and communication), ineffective interpretation can be optimised in ecotourism contexts. Many of the specific instances of inaccurate, confusing, and inconsistent interpretations of information about flora and fauna on interpretive panels in Chinese UGGps, as identified by Li et al. (2022c), can be understood through an Eco-Translatology lens, and indeed might therefore be remedied through the application of an approach guided by the framework. For example, in Taishan UGGp, without the guidance of Eco-Translatology, the flora name '青檀' is unhelpfully only interpreted into Latin '*Pteroceltis tatarinowii*'. This results in semantic inequivalence, since using only the Latin interpretation of biotic names will make it difficult for geotourists to pronounce and, likely, remember those names. According to the linguistic and communicative dimensions of Eco-Translatology, it is recommended that both English and Latin are used to interpret biotical names to achieve semantic equivalence (Li et al., 2022c). Hence, '青檀' should be rendered into '*Pteroceltis tatarinowii* (Blue sandalwood). During the process of interpretation, because 'Blue

sandalwood' already exists in the English-speaking world, it could helpfully be used to correspond to '青檀'. Moreover, complicated ecological processes in the original Chinese texts may result in English style inequivalence without the guidance of Eco-Translatology. For example, the habits and characteristics of '*Anas crecca* (Eurasian teal)' in Leiqiong UGGp, '这些鸟一年换羽两次；雄性在繁殖季节会产生鲜艳的羽毛，羽毛会褪色；幼雏身上有明显的绒羽；雌性通过"逗引"来吸引配偶。' was translated into 'These birds moult twice a year; the male will produce bright feathers in breeding season, and the feathers will fade; young chicks have obvious plumage; females attract their mates by dancing'. According to Li et al. (2022c), ST resulted in a sentence which might be considered inappropriately long for English. To achieve style equivalence, the ST could instead be translated to 'These birds moult twice a year and males produce a bright plumage during the breeding season which then fades. The chicks have a clearly marked coat of down feathers. The females perform a dance to attract a mate'. A further example comes from Yandangshan UGGp in China, where '娃娃鱼' was ineffectively translated into the local Chinese biotical name, 'baby fish', which would be misunderstood by geotourists as newly hatched fish. In alignment with 'three-dimensional' transformations (linguistic, cultural and communicative) of Eco-Translatology, Li et al. (2022c) recommend translating local Chinese biotical terms into the official names recognised by the International Code of Zoological Nomenclature (ICZN, 2022). '娃娃鱼' is a local dialect term mainly used in the Jiangsu and Zhejiang regions of China. The Chinese official name for this amphibian species is '大鲵', which corresponds to 'Chinese giant salamander' in English. Additionally, Li et al. (2022c) emphasise that this transformation also achieves the shift from local dialect in the original language to acceptable target language. Through this transformation of linguistic and cultural dimensions, Eco-Translatology can facilitate the transmission and equivalence of ecological information. Thus, '娃娃鱼' is interpreted into 'Chinese giant salamander', achieving semantic and cultural equivalence.

Therefore, through the processes of Eco-Translatology, it is possible the language, culture and communication issues faced by ecotourism interpretation can be addressed, suggesting the suitability of Eco-Translatology as a theoretical framework for the present study.

4. Corpus and methods

This section provides a detailed overview of the research data and analytical methods. In terms of research data, details relating to access to Geopark data text, data processing, and the process of building the Chinese-to-English PEC are elaborated. Regarding research method, we describe the corpus-based method to analyse the ecotourism data using a corpus linguistics analysis tool Sketch Engine (text analysis software developed by Lexical Computing Limited since 2003).

4.1 Data collection procedure

As mentioned in the introduction section, geoparks serve as ideal destinations for geotourism activities (Dowling 2013; Li et al., 2022a; Li et al., 2022c). Thus, the data analysed in this paper came from two prominent Chinese UNESCO-approved geoparks: Wudalianchi UGGp and Jiuhuashan UGGp. These two geoparks were selected on the basis of the following practical considerations: 1) their status as global geoparks means that their interpretations have been updated recently (i.e., since 2016); and 2) gathering data from these two UGGps was comparatively simpler than from others, as the managers of the geoparks were willing to provide us with all the available Chinese-to-English interpretations used within the parks. This meant that accessing data from these

locations did not require payment of funds or involve any complex procedures to address copyright issues. The parallel Chinese-to-English raw data was provided in the form of Word documents, and included the text from the geoparks' interpretative panels, signs, brochures, and geological museum displays. Because these documents contain information other than texts needed for this research, upon receiving the data, further data processing was performed, which is described below. The purpose of this paper is to explore the effective strategies of ecotourism interpretation which concern with flora and fauna (Dowling, 2013). Thus, during the data cleaning process, all passages identified as relating to other elements, such as the abiotic element (geological features and processes), the cultural (local human lifestyle) and the geoparks' safety regulations, were removed. The resulting dataset therefore contains only the biotic element (i.e., original and interpreted passages relating to flora and fauna). Once the data processing was completed, all documents were consolidated into a single Word file. In this file, the text written in Chinese and English was separated and aligned for analysis. The corresponding Chinese and English passages were presented in alternating paragraphs, with the original Chinese text appearing first, followed by the corresponding English interpretation. The resulting dataset (Chinese-to-English PEC), includes a total of 63,248 words, comprising 23,230 Chinese characters and 40, 018 English words.

4.2 Analytical procedure

4.2.1 Data organisation and data coding

After the Chinese-to-English PEC was composed, the analytical procedure of the data involves data organisation and data coding. For data organisation, the generated single Word document was imported into a tool called Tmxmall (https://www.tmxmall.com/aligner/home). This is an online language analysis interface that allows the users to upload, align, and view two (or more) languages of the same content simultaneously in a parallel format. The 'alignment' is needed before any further dealing of the language data. It is a procedure to ensure that the language data (in our case, the Chinese corpus and the English corpus) are matched by paragraphs. This procedure is the foundation of the identification of interpretation strategies later. After the manual alignment, our next step is to make the language data searchable. To achieve this, we developed a 4-element coding scheme that includes both details regarding ecotourism categories and nuanced categories of interpretation strategies or problems (Appendix B). In linguistic analysis, coding refers to the process of identifying and annotating language data using tags that capture the objectives of the language analysis. In our case, we wanted to identify four elements of language data:

Element 1 in this coding scheme represents the general ecotourism categories – flora (FL) or fauna (FA). For easy conceptualisation, this element should be considered together with Element 3, which include six sub-types of ecotourism categories, according to Dowling (2013): 1) common flora names (CPN); 2) common fauna names (CAN); 3) local Chinese flora terms (CCPN); 4) local Chinese fauna terms (CCAN); 5) flora processes (FLP); and 6) fauna processes (FAP). Element 2 represent the researcher-identified effective interpretation strategies (IS) or interpretation problems (IP). The identification of IS or IP was based on the three-dimensional transformations of Eco-Translatology (2003). Interpretation problems were identified at this step so that they could be analysed later for potential optimisation. Element 2 could be considered together with Element 4, which includes the specific types of interpretation strategies or problems. Using Tmxmall, effective interpretations were tagged according to type of interpretation strategy, which included: Latin and English strategy (LE); Literal interpretation (LI); Creative Interpretation (CI); Foreignisation; Division; Shift; Division and Shift (DS); Combination; and

Restructuring the Word Order (RWO). Interpretation problems were annotated as: Not Interpreted (NI); Misinterpreted; Use Chinese Pinyin (Chinese Phonetic Alphabet) to Replace English Words (UCPREW); and Incongruent Interpretation for Same Name (IISN). Appendix A provides brief definitions and examples of the specific interpretation strategies (see Table A1) and interpretation problems (Table A2). The annotations (i.e., tags) applied to the data are presented in Appendix B.

To maximise replicability, the following sections describe the steps taken to annotate the corpus data, illustrated by examples. In Tmxmall, tags were enclosed within diamond brackets so that the annotation does not interfere with the corpus analysis. As shown in Appendix B, each tag includes four general elements separated by commas, and within each element, multiple tags can be applied to a single effective interpretation. For instance, for the interpretation of '红松' into '*Pinus koraiensis* Sieb. Et Zucc. (Korean Pine)', the interpreter maintained scientific accuracy and effectively communicated a common plant name to the target audience via the Latin and English strategy. This single effective interpretation was tagged with '*koraiensis* Sieb. Et Zucc. (Korean Pine) <FL, IS, CPN, LE>', where 'FL' stands for 'flora' (as opposed to FA for fauna). 'IS' represents effective interpretation strategies (as opposed to interpretation problems). 'CPN' represents 'common plant name' which is one category of flora (CPN, CAN, and FLP). Finally, 'LE' stands for Latin and English strategy, which is a specific interpretation strategy used to interpret common flora names. Similarly, if the interpretation of a common flora name is identified as an interpretation problem instead of an effective interpretation strategy, it will be reflected in the second element of the tag (see Table 3). For example, when the interpreter only used Latin to interpret a common flora like '睡莲' into '*Nymphaea* L.', it led to 'Not Interpreted (NI)' status in English, because only using the Latin interpretation is likely to make it difficult for geotourists to pronounce and remember it (Li et al., 2022a). Thus, the corresponding tag would be '*Nymphaea* L <FL, IP, CPN, NI>', where 'IP' stands for interpretation problems, and NI represents 'Not Interpreted', which signifies a specific interpretation problem of common plant names created by ineffective interpretation. This annotation system enables the retrieval of both effective and ineffective interpretations of flora and fauna across the six subcategories (CPN, CAN, FLP, FAP, CCPN, and CCAN). The tagging method for the five other subcategories of ecotourism (CAN, FLP, FAP, CCPN, and CCAN) follows the same approach as that for common plant names (CPN), described above.

4.2.2 Analysis of coded data

Following the manual coding process, the data were exported from Tmxmall and then imported into Sketch Engine for corpus-based quantitative and qualitative analysis. Sketch engine is a text analysis software that allows for accurate and rapid extraction of tagged data. By extracting all tagged data by categories (examples provided below), we were able to quantitatively and qualitatively analyse the interpretation cases of the different types of biotic elements.

The first step of the quantitative analysis focuses on the effective interpretation strategies. The aim of this quantitative analysis is to ascertain the interpretation norms which characterise the genre of ecotouristic texts. We first retrieved all incidences of the six ecotourism subcategories of effective interpretation strategies (CPN, CAN, FLP, FAP, CCPN, and CCAN). To do this, we: 1) Selected Parallel Concordance on the DASHBOARD page; 2) Selected ADVANCE on the PARALLEL CONCORDANCE page; and 3) Selected English in 'Search in', and then selected Corpus Query Language (CQL) in Query type. The CQL is a special code or query language used

in Sketch Engine to search for complex grammatical or lexical patterns or to use search criteria which cannot be set using the standard user interface.

Then, we counted the frequencies and calculated the proportions of the specific interpretation strategies (i.e., literal interpretation, Latin and English strategy, creative interpretation and shift) within each ecotourism subcategory (CPN, CAN, FLP, FAP, CCPN, and CCAN), the following function formula was entered into the PARALLEL CONCORDANCE page of Sketch Engine (see Figure C1 in Appendix C). Finally, we derived the descriptive statistical data (i.e., frequency and proportion) for the interpretation strategies within each ecotourism subcategory obtained from the Chinese-to-English PEC.

After the quantitative analysis, we zoomed in on each individual occurrence of the interpretation strategies data. Our qualitative analysis focused on how the same types of interpretation strategies are used within each ecotourism subcategory. The parallel concordance in the Chinese-to-English PEC allows us to clearly demonstrate the commonalities and particularities of translations (Laviosa, 2002; Bernardini & Kenny, 2020). To achieve this, we once again used the advanced filtering function of CQL in Sketch Engine, based on the tags, to look at all examples of each type of interpretation strategy employed within each ecotourism subcategory.

After analysing the effective interpretation, the above process was then repeated for cases of interpretation problems. To count the frequencies and calculate the proportions of the specific interpretation problems (UCPREW, NI, Misinterpreted and IISN) within each ecotourism subcategories (CPN, CAN, FLP, FAP, CCPN, and CCAN), the following function formula was entered into the PARALLEL CONCORDANCE page of Sketch Engine (see Figure C2).

We then obtained statistical information (frequency and proportion) regarding the types of interpretation problems that were identified within each ecotourism subcategory from the Chinese-to-English PEC. Figure C2 shows the formula used to retrieve the tagged interpretation problems in the data. As we can see, the difference in this formula is where IP (interpretation problem) was used instead of IS (interpretation strategy).

The overall purpose of our analysis was, as noted, to demonstrate which kinds of interpretation strategies and problems were prevalent within the data, and on the basis of follow-up qualitative analysis to then determine how ineffective interpretations might be optimised using effective interpretation strategies to achieve semantic, style and cultural equivalence. In section 5, we report the quantitative and qualitative analysis of the interpretation strategies and problems within six ecotourism subcategories (CPN, CAN, FLP, FAP, CCPN, and CCAN). Then, based on the analysis, we establish a taxonomy of ecotourism interpretation strategies based on Eco-Translatology (Hu, 2003).

5. Results and discussion

This section presents the various strategies found in the interpretation of common biotic names, local Chinese biotic names, and ecological processes. Each of these strategies is discussed in detail with the support of examples from the PEC. Appendix D provides a total of 66 examples of effective and ineffective ecotourism interpretations. These examples are referred to using their *Text No*. in the following section. For example, ***ST 1*** refers to the 'Source text' of Text No.1 (in Table D1). ***TT 13*** refers to the 'Target text' of Text No.13 (in Table D2).

5.1 Interpretation of common biotic names

5.1.1 Effective interpretation

To analyse the corpus (Chinese-to-English PEC) for strategies of naming or interpreting flora and fauna, we employed the CQL functions [word="FL"] [word=","] [word="IS"] [word=","] [word="CPN"] [word=","] [word="Specific IS"] and [word="FA"] [word=","] [word="IS"] [word=","] [word="CAN"] [word=","] [word="Specific IS"]. The four strategies found are: Latin and English strategy (LE), literal interpretation (LI), creative interpretation (CI) and foreignisation. For the last item in the search function above, 'Specific IS' can be replaced by 'LE', 'LI', 'CI' and 'Foreignisation' to determine the frequency of these strategies. The resulting statistical data is illustrated below in Figure 1. The results demonstrate that literal interpretation is the most frequently used strategy, while creative interpretation and foreignisation are relatively less common for the interpretation of these names. Literal interpretation is used more often when translating the names of flora than it is for fauna, whereas creative interpretation is used more often for flora. The literal interpretation indicates that there are existing names in English to refer to species needing translation, whereas the need for creative interpretation indicates a lack of existing names in English referring to the species in question. The adoption of different interpretation strategies reflects the diversity and complexity of different types of biotic species. The greater use of literal interpretation for common fauna names, along with the fewer cases of creative interpretation strategies, underlines that plants are more complex and diverse than animals (Ren, 2020; Li et.al, 2022c). Unsurprisingly, the Latin and English strategy is common, reflecting adherence to international naming conventions (ICN, 2018; ICZN, 2022).

	Common Flora Names		**Common Fauna Names**	
Interpretation Strategies	Frequency	Percentage	Frequency	Percentage
Latin and English	166	32.86%	73	17.89%
Literal Interpretation	219	43.37%	163	76.96%
Creative Interpretation	98	19.41%	5	3.43%
Foreignisation	22	4.36%	13	1.72%
Total Number	**505**		**408**	

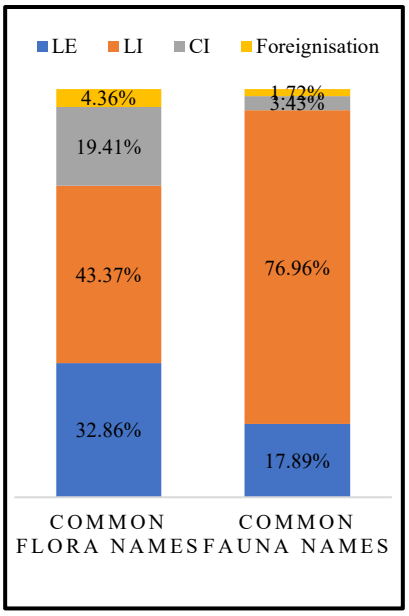

Figure 1. Frequency of Interpretation Strategies for Common Biotic Names in Chinese-to-English PEC

The following discussion of qualitative results elaborates on how our findings illustrate the use of two of Hu's Eco-Translatology (i.e., linguistic and communicative transformations) to achieve semantic equivalence in the SSC model. For Latin and English strategy, the examples mainly focus on English interpretations, because the ICZN (2022) and the latest International Code of Nomenclature for algae, fungi, and plants (ICN, 2018) have respectively provided unique Latin scientific names for fauna and flora. Analysis of the PEC revealed that the English interpretation of flora and fauna names can be divided into two main categories: literal and creative names. The explanation for the distinction between these two classifications pertains to the presence or absence of an

English counterpart. Firstly, there are English counterparts available to effectively interpret common biotic names. For example, the flora name '石竹 (ST 1)' was literally interpreted into '*Dianthus chinensis* L. (Chinese pink)' and the fauna name '鸳鸯 (ST 8)' was interpreted into '*Axi galericulata* (Mandarin duck)' by the interpreter.

If the creative interpretation strategy is used for English interpretation, there are two principles found in the PEC that guide the generation of such interpretations: 1) directly interpreting according to their shape or connotation; and 2) borrowing their scientific names. Firstly, the flora name '青钱柳 (ST 2)' was creatively interpreted into 'Money Willow' according to their shape. The fruit of '青钱柳' bears a resemblance to copper coins and shows a green, willowesque physical appearance. Thus, direct interpretation of the literal descriptive meaning can achieve semantic equivalence. A similar example of this interpretation strategy being used for fauna could not be found in the PEC. This could potentially be attributed to the greater complexity and diversity of plant species in comparison to their animal counterparts (Li et al., 2022c).

The other creative strategy for English interpretation is using Latin scientific names as a bridge. For instance, the plant name '黑龙江百里香 (ST 3)' was creatively interpreted into 'Heilongjiang Thyme shrub'. The Latin name of this plant is '*Thymus amurensis* Klokov'. The Latin '*amurensis*' is related to the original location of the plant, Heilongjiang. The Latin '*Thymus*' is the herb 'Thyme' in English. While the term 'Klokov' signifies the person who assigned the name to the flora. According to the English interpretation, this plant belongs to the shrub genus. Thus, '黑龙江百里香' can be interpreted into '*Thymus amurensis* Klokov' (Heilongjiang Thyme Shrub). Similarly, creatively using the scientific name, the English fauna name of '乌苏里蝮 (ST 9)' can be interpreted into 'Ussuri viper' via creatively borrowing its Latin name '*Gloydius ussuriensis*'. The specific epithet '*ussuriensis*' corresponds to 'Ussuri' and the genus '*Gloydius*' means 'viper' in English. It can also be noted in passing that 'Ussuri' is another location (border river in northern China).

Analysis based on the PEC also revealed that if the term appeared in the main text of an interpretative board, then for the purposes of quick access or fluidity, the common plant and animal names occur only in English and a parallel Latin term was not used. This makes the interpretative boards more concise (Li et al., 2022c). For instance, the interpreter employed the literal interpretation to rendered the flora name '睡莲 (ST 4)' as 'water lily', and the fauna name '长耳鸮 (ST 10)' as 'long eagle-owl', achieving semantic equivalence.

In addition to literal interpretation, creative interpretation is found for common biotic names such as creative physical interpretation used for the endemic Chinese tree '凤凰松 (ST 5)'. Due to the plant's resemblance to a phoenix spreading its wings, its name was directly interpreted into 'phoenix pine', a designation that could hold visual appeal for geotourists. A similar interpretation strategy for fauna cannot be found in the PEC. The orchid flora name '独蒜兰 (*Pleione bulbocodioides* (Franch.) Rolfe)' in ST 6 and the fauna name '乌苏里貉 (*Nyctereutes procyonoides*)' in ST 11, originating in China, were creatively interpreted into 'Chinese Pleione orchid' and 'Chinese raccoon dog' through borrowing from and translating their scientific names, respectively. According to Pridgeon et al. (2006), *Pleione* is 'a small genus of predominantly terrestrial but sometimes epiphytic or lithophytic, miniature orchid'. The interpreted name of this plant uses an English equivalent directly borrowed from the Latin, 'Pleione.' Also note, incorporating the term 'orchid' can facilitate the comprehension of plant taxonomy among ecotourists. English interpretation of 'Chinese raccoon dog' relies on the semantics of the genus

(*Nyctereutes*) in its scientific name. Wozencraft (2005) points out that the taxonomic classification of *Nyctereutes* denotes a group of canids commonly referred to as raccoon dogs. Therefore, 'raccoon dog' was used by the interpreter. The term 'Chinese' was incorporated into both species interpretations as a means of identifying the unique characteristics and of elucidating its provenance.

The above examples illustrate the effective use of linguistic and communicative transformations of Eco-Translatology to achieve semantic equivalence. Similarly, the following examples used all three-dimensional transformations of Eco-Translatology to achieve both semantic and cultural equivalence in the SSC model. The final effective interpretation strategy for interpreting common biotic names is the less frequent, but still at times necessary, foreignisation. The scientific names of species originating in China may contain affixes indicating foreign countries such as '*japoni-*' or foreignerswho discovered these species. In this case, whether the species is the title or in the main text of the interpretive boards, only English is used. As Ren (2020) explains, the nation of origin has a voice in the translation of species names. For instance, the flora '枇杷 (*Eriobotrya japonica* (Thunb.) Lindl.)' in ST 7 was interpreted into 'loquats', and the fauna '丹顶鹤 (*Grus japonensis*)' in ST 12 was rendered into 'Red-crowned crane'. Frequently these are also termed in English, 'Japanese plum' and 'Japanese crane' which would mistakenly indicate the origin as Japan rather than China. Therefore, to effectively convey Chinese ecological culture to geotourists, 'loquats' and 'Red-crowned crane' were chosen and reference to Japan removed.

In conclusion, it was found that Latin and English strategy, literal interpretation, creative interpretation and foreignisation could be used to effectively interpret common biotic names. Using Eco-Translatology, the interpreter specifically can ensure scientific accuracy and semantic equivalence in the use of common biotic terms. The interpreter can preserve the cultural aspects of common biotic names in the source language by using creative interpretation and foreignisation. These interpretation strategies, moreover, provide a point of reference for optimising the interpretation problems of common biotic names. The following sections illustrate how the interpretation strategies can be used to optimise interpretation problems found in the ecotourism data.

5.1.2 Interpretation problems

The problems regarding the interpretation of common biotic names are specifically: Not Interpreted (NI); Misinterpreted; Incongruent Interpretation for Same Name (IISN); and Using Chinese Pinyin Replace English Words (UCPREW). We respectively retrieved these by searching for [word="FL"] [word=","] [word="IP"] [word=","] [word= "CPN"] [word=","] [word="Specific IP"] and [word="FA"] [word=","] [word="IP"] [word=","] [word= "CAN"] [word=","] [word="Specific IP"] in the PEC. The 'Specific IP' in the last tag can be substituted with 'NI', Misinterpreted, IISN, and UCPREW. As can be seen from Figure 2, the most common type of interpretation problem is 'Misinterpreted', followed by cases where names are not interpreted at all, and then IISN. The use of Chinese Pinyin to replace English words was relatively infrequent.

	Common Flora Names		Common Fauna Names	
Interpretation Problems	Frequency	Percentage	Frequency	Percentage
Not Interpreted	129	32.74%	93	32.40%
Misinterpreted	171	43.41%	106	36.93%
Incongruent Interpretation for Same Name	85	21.57%	61	21.25%
Use Chinese Pinyin to Replace English Words	9	2.28%	27	9.42%
Total Number	**394**		**287**	

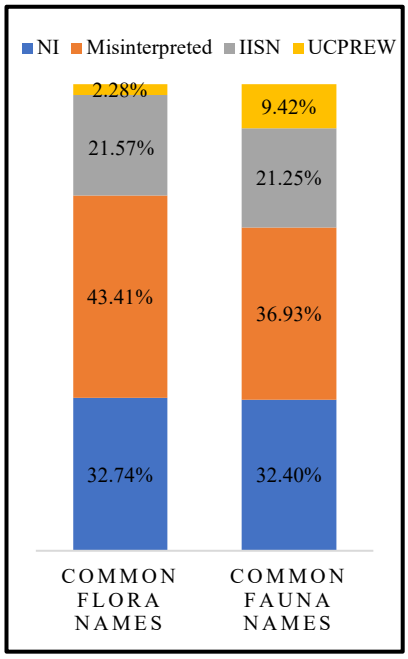

Figure 2. Frequency of Interpretation Problems for Common Biotic Names in Chinese-to-English PEC

Using the interpretation strategies discussed above, the following examples illustrate how linguistic and communicative transformations of Eco-Translatology can be used to achieve semantic equivalence within the SSC model. The category of Not Interpreted can be divided into 'Latin-interpretations only' and 'English-interpretations only'. According to Eco-Translatology (Hu, 2003), the ultimate goal of translation is communication. If the interpretations only use Latin, the target audience may not have ready knowledge of the Latin language, or even though they do, it is difficult to use the Latin names in spoken language. Therefore, only using Latin to interpret biotic names is unhelpful in this regard. Examples solely interpreted in Latin are the flora name '皖杜鹃 (ST 13)' and the fauna name '画眉 (ST 20)', respectively interpreted into their Latin names '*Rhododendron anhweiense* E.H.Wilson' and '*Garrulax canorus*' by the interpreter. The fauna name '画眉' happens to match to a bird with an existing English name called 'Chinese Hwamei'. Thus, the fauna name '画眉' can be interpreted into 'Chinese Hwamei' in English as well as '*Garrulax canorus*' in Latin. Unlike '画眉', there is no existing equivalent term in English to correspond '皖杜鹃' that distinguishes it. Therefore, its Latin scientific name '*Rhododendron anhweiense* E.H.Wilson' can be used as a bridge to establish its English name The species epithet '*anhweiense*' refers to the Chinese location 'Anhui' and the genus '*Rhododendron*' conveys the same meaning as 'rhododendron' in English. Therefore, '皖杜鹃' can be creatively interpreted as '*Rhododendron anhweiense* E.H.Wilson (Anhui rhododendron)'.

In terms of the 'English-interpretation only' problem in the category of Not Interpreted, according to Li et al. (2022c), if only the English interpretation is used, this does not conform to the ICN (2018) or the ICZN (2022) and limits effective communication, such as the interpretations of a plant (马尾松: ST 14) and an animal (猕猴: ST 21). To establish a scientific standard for ecotourism interpretation in accordance with the latest ICN (2018) and ICZN (2022), the Latin scientific name of '马尾松' was identified as '*Pinus massoniana* Lamb', and the Latin scientific name of '猕猴' was designated as '*Macaca mulatta*'. As both '马尾松' and '猕猴' serve as titles of the interpretative panel, we optimised the interpretations of '马尾松' as '*Pinus massoniana* Lamb (Chinese red pine)

and ‘猕猴’ as ‘*Macaca mulatta* (Macaque)’. These optimised versions, guided by linguistic and communicative transformations of Eco-Translaotogy, ensure semantic equivalence.

Another category of interpretation problems is misinterpretation, which can be the result of incorrect interpretation of English or Latin scientific names of common biotic names. For example, the English flora name for ‘蜻蜓兰 (ST 23)’ was ineffectively interpreted into ‘dragon orchid’, where in fact it should be optimised to ‘dragonfly orchid’, native to Wudalianchi UGGp and named after the flower’s visual resemblance to a dragonfly. Similarly, the fauna name ‘狗獾 (ST 23)’ is misinterpreted in English as ‘Meles’, but it should be ‘European badger’. These revised interpretations were aligned with the kinds of linguistic and communicative transformations advocated by Eco-Translatology in order to achieve semantic equivalence. In terms of incorrect interpretation of Latin scientific names, the scientific name of the flora ‘黄山玉兰 (ST 15)’ should be accurately interpreted as ‘*Magnolia cylindrica* E.H.Wilson’ rather than ‘*Yulania cylindrica* (E.H.Wilson) D.L.Fu’. The scientific name of the Chinese bamboo partridge, ‘竹鸡 (ST 22)’ should be ‘*Bambusicola thoracicus*’, not ‘*Bambusicola thoracica*’. It is pertinent here to recall that, generally, in regard to the main text on interpretative boards, the rule is that only English is used. Therefore, in such cases, it is of great importance that the translation given is accurate, since it is the only translation available.

Another problem is interpretation inconsistency; in other words, some of the same Latin scientific and English names of common biotic names are interpreted using different terms. For example, the flora scientific name of ‘毛红椿 (ST 17)’ occurs in three different versions: *Toona* ciliate, *Toona ciliata* Roem. var. pubescens, and *Toona sureni* var. pubescens. The flora scientific name of ‘毛红椿’ should be ‘*Toona ciliata* M.Roem’. Also, the fauna scientific name, ‘短尾猴 (ST 24)’ appears with two Latin versions which are *Macaca thibetana*, and *Macaca arctoides*. Although these two scientific names can be found in ICZN (2022), they belong to two different species. In Jiuhuashan UGGp, the scientific name of ‘短尾猴 (ST 24)’ is ‘*Macaca arctoides*’. Since these species appear alone or as the title on the interpretative boards, they need to be optimised in both Latin and English. To achieve semantic equivalence, in English, ‘毛红椿 (ST 24)’ can be rendered into ‘red cedar’ and ‘短尾猴 (ST 24)’ can be translated as ‘stump-tailed macaque’ via literal interpretation. Thus, the flora name ‘毛红椿’ can be clearly rendered into ‘*Toona ciliata* M.Roem (red cedar)’ and the fauna name ‘短尾猴’ can be fully translated as ‘*Macaca arctoides* (stump-tailed macaque)’. Another example is ‘铁线蕨 (ST 18)’, which is inconsistently interpreted into both ‘Southern maidenhair fern’ and ‘Adiantum’. ‘青头潜鸭 (ST 25)’ is interpreted into three versions: green-headed pochard, blue-headed pochard, and pochard. In English, ST 18 should be optimised into ‘Southern maidenhair fern’ and ST 25 can be revised as ‘Baer’s pochard’ by literal interpretation. Since these final two examples are present in the main text of the interpretative boards, they only need to be interpreted into English. Guided by linguistic and communicative transformation according to the principles of Eco-Translatology, these revised interpretations of common biotic names achieve scientific accuracy and semantic equivalence.

The smallest frequency of problems is found in UCPREW. For example, Pinyin was used to render the flora name ‘山丹花 (ST 19)’ into ‘Shandanhua’. Similarly using Pinyin, the fauna name ‘鹌鹑 (ST 26)’ was interpreted into ‘Chinese anchun’. In both these interpretations there is loss of meaning. Guided by linguistic and communicative

transformations of Eco-Translatology, '山丹花' can be literally interpreted into 'Coral Lily', and the fauna name '鹌鹑' should be interpreted into the English, 'quail', achieving semantic equivalence.

Table 1 below summarises patterns of usage for four interpretation strategies employed for common biotic names informed by the principles of three-dimensional transformations in Eco-Translatology (Hu, 2003).

Interpretation strategies	Patterns of usage for interpretation strategies for common flora names	Patterns of usage for interpretation strategies for common fauna names
Common biotic names appear as the title or stand alone on the interpretative boards.		
Latin and English strategy	The International Code of Nomenclature for algae, fungi, and plants (ICN, 2018) provided the unique Latin scientific name of flora, with the genus and species epithet being italicised. English name: (1) Literal interpretation: Flora names can be found in English equivalents. (2) Creative interpretation: a. There is no English equivalent for endemic Chinese flora. According to their features or connotations, direct interpretation can be widely accepted. b. The native flora of China lacks an English equivalent. In such cases, borrowing the English meaning of their Latin scientific name (genus and species epithet) is used as an alternative strategy.	The International Code of Zoological Nomenclature (ICZN, 2022) provided the unique Latin scientific name of fauna, with the genus and species epithet being italicised. This is similar to interpreting English common flora names. However, the rule of 'a' in creative interpretation is not found in the PEC and needs further research.
Foreignisation	If a species originates from China and its scientific name contains affixes indicating foreign countries rather than China, or foreigners who discovered the species, English will be used exclusively.	
Common biotic names in the main text of interpretative boards		
Literal Interpretation/Creative Interpretation	These two interpretation strategies correspond to the English part of the Latin and English strategy.	

Table. 1 Taxonomy of interpretation strategies for common biotic names

5.2 Interpretation of local Chinese biotic terms

5.2.1 Effective interpretation

The use of local Chinese biotic terms similarly is examined to determine effective strategies and categories of problem that occur. The interpretation of local Chinese biotic terms, similar to the interpretation of common biotic names, is also an important element embedded into the ecotourism interpretation system. In contrast to common biotic names, the interpretation of local Chinese biotic terms incorporates ecological culture, including local dialects. In this case study, we selected Wudalianchi and Jiuhuashan UGGps. This means the specific dialects of the geopark locations were taken into consideration. Wudalianchi UGGp, situated in Heihe City, Heilongjiang Province, China, includes the use of Northeast dialect and Manchu language (one of the important national languages in the Northeast of China). On the other hand, Jiuhuashan UGGp, located in Chizhou City, Anhui Province, China, involves the use of Hui dialect. To effectively interpret local Chinese biotic terms, the interpreter employed three interpretation strategies: Latin and English strategy (LE); literal interpretation (LI); and creative interpretation (CI).

In analysing the PEC for evidence of these three interpretation strategies, we searched for: [word="FL"] [word=","] [word="IS"] [word=","] [word="CCPN"] [word=","] [word="Specific IS"] for local Chinese flora names, and [word="FA"] [word=","] [word="IS"] [word=","] [word="CCAN"] [word=","] [word="Specific IS"], for local Chinese fauna names. The last tag 'Specific IS' can be replaced by 'LE', 'LI' and 'CI'. The results show and can be seen in Figure 3, the Latin and English strategy is the most prevalent for both local Chinese flora and fauna terms, indicating the importance of adhering to the principles of geotourism interpretation: scientificity and accuracy (Li et al., 2022c). Moreover, literal interpretation is more commonly employed when interpreting local Chinese fauna terms compared to flora terms, whereas creative interpretation is more frequently used for local Chinese flora names for fauna names. This is due to the diversity and complexity of plant species (Ren, 2020; Li et.al., 2022c).

	Local Chinese Flora Terms		**Local Chinese Fauna Terms**	
Interpretation Strategies	Frequency	Percentage	Frequency	Percentage
Latin and English	24	58.54%	14	45.17%
Literal Interpretation	5	12.19%	11	35.48%
Creative Interpretation	12	29.27%	6	19.35%
Total Number	41	100%	31	100%

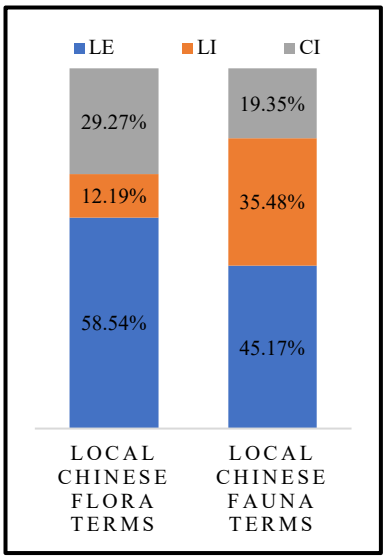

Figure 3. Frequency of Interpretation Strategies for Local Chinese Biotic Names in Chinese-to-English PEC

The following qualitative analysis demonstrates how specific examples align with three-dimensional (linguistic, cultural, and communicative transformations to achieve both semantic and cultural equivalence in the SSC model. Firstly, when local Chinese biotic names are used as the title, or stand alone on the interpretative boards, Latin and English can be used. Note that for the purposes of professionalism, when local Chinese biotic names are interpreted, they should be transformed into Chinese official (common) names (Ren, 2020; Li et al., 2022c). For example, the local Chinese flora name '拖盼儿 (ST 27)' was scientifically and effectively interpreted into '*Rubus corchorifolius* L.f. (Raspberry)'. The term '拖盼儿' is derived from the Manchu language, and it refers to '山莓'. The Latin scientific name of '山莓' is '*Rubus corchorifolius* L.f.'. Its English name can be literally rendered into 'Raspberry' which can be identified in English. Similarly, the local Chinese fauna name '斐耶楞古 (ST 31)' was effective interpreted into '*Tetrastes bonasia* (Hazel grouse)' by the interpreter. In Manchu, locals refer to '花尾榛鸡' as '斐耶楞古'. The Latin scientific name of '花尾榛鸡' is '*Tetrastes bonasia*'. There is an English term 'Hazel grouse' corresponding to it. Other examples are the local Chinese flora terms '老鸭糊 (ST 28)', which is scientifically and effectively interpreted into '*Callicarpa cathayana* C.H.Chang (Chinese beautyberry)' and the local Chinese fauna name, '臭迷子 (ST 32)' is '*Rana amurensis* (Heilongjiang frog)'. These examples, in contrast to the above species, are native to China and lack a direct English equivalent. Therefore, a creative method is required to achieve semantic equivalence (Li et al., 2022c). The botanical term '老鸭糊' originates from the Chizhou dialect (closely related to Hui dialect) and refers to the flora known as '华紫珠'. The scientific name of '华紫珠' is '*Callicarpa cathayana* C.H.Chang'. The specific epithet '*cathayana*' is used in botanical names to refer to plants that are native to or found in China and interpreted into 'Chinese'. The genus '*Callicarpa*' means 'beautyberry' in English which corresponds to '紫珠'. Thus, the English name of '华紫珠' can be creatively interpreted into 'Chinese beautyberry' via using its Latin name. Similarly, the fauna name '臭迷子', in the Northeast dialect, refers to '黑龙江林蛙' whose scientific name is '*Rana amurensis*'. In Latin, the specific '*amurensis*' can refer to 'Heilongjiang' and the genus '*Rana*' means 'frog' in English. Hence, the English name of '臭迷子' can also be creatively interpreted into 'Heilongjiang frog', borrowing from its scientific name.

When local Chinese biotic terms are embedded in the main text of interpretative boards, it is preferred by the interpreter to only use English names to communicate a large amount of information. Literal and creative interpretation strategies can be used to interpret them by the interpreter. For example, in the Chizhou dialect, there is a local flora name, '楼上楼 (ST 29)', which refers to the plant '重楼'. In English, '重楼' can be literally translated as 'Paris root'. Similarly, in Northeast dialect, there is a fauna name '随鹅 (ST 33)' which refers to the bird '鸿雁'. In English, '鸿雁' can be literally interpreted into 'swan goose'. However, when the local Chinese biotic name lacks an English equivalent, creative interpretation is needed. The foundation of the creative change is based on borrowing their scientific names. For instance, in Chizhou dialect, '马褂衣 (ST 30)' refers to the plant '鹅掌楸 (*Liriodendron chinense* (Hemsl.) Sarg.)'. '*Liriodendron*' is the genus and means 'tulip tree', and '*chinense*' means 'Chinese', so '马褂衣' is 'Chinese tulip tree'. Similarly, in the Northeast dialect, '鲤拐子 (ST 34)' is used to denote the species '黑龙江鲤 (*Cyprinus carpio* haematopterus)' whose English name was interpreted into 'Heilongjiang coloured carp'. The term 'Heilongjiang' in this context refers to a specific place in China. In Latin, the specific epithet '*carpio*' means 'carp' in English. The subspecies of carp, 'haematopterus',

indicates that the fish's skin can incorporate multiple hues, such as tawny, grayish white, and golden yellow. Thus '*Cyprinus carpio* haematopaterus' is 'Heilongjiang coloured carp'.

The above examples of interpreting local Chinese biotic terms are in line with the three-dimensional transformations of Eco-Translatology. The translator facilitates the transition from local dialect to official or scientific terminology by precise word selection. This transformation process enables a broader audience, such as non-expert tourists, including people from different linguistic and cultural backgrounds, to understand and recognise these flora and fauna. Such interpretation strategies informed by the three-dimensional transformations of Eco-Translatology not only facilitates effective communication but promotes cross-cultural understanding by making the information accessible. Therefore, three effective interpretation strategies (Latin and English, literal interpretation and creative interpretation) will serve as a reference for optimising the interpretation of local Chinese biotic names in the following part.

5.2.2 Interpretation problems

For local Chinese biotic terms, we collected data on interpretation problems by employing the CQL function formula [word="FL"] [word=","] [word="IP"] [word=","] [word="CCPN"] [word=","] [word="Specific IP"] and [word="FA"] [word=","] [word="IP"] [word=","] [word="CCAN"] [word=","] [word="Specific IP"]. This search located the use of the four interpretation problems (NI, Misinterpreted, IISN, and UCPREW) in the PEC. Then the tag 'Specific IP' can be replaced by the aforementioned four interpretation strategies. In Figure 4, the tabulation of the resulting data suggests that the two major problems in the interpretation of local Chinese biotic terms are Misinterpreted and Not Interpreted, and the remaining problems, IISN and UCPREW, are less common. The proportion of Misinterpretation in local Chinese flora and fauna terms is clearly dominant. IISN includes inconsistent work where the rules are not followed for the same term. UCPREW may be caused by the interpreter's lack of ecological cultural background in the local dialect (Li et al., 2022c). All these problems cause a failure to effectively convey Chinese ecological culture and ensure accurate communication of biotic information.

	Local Chinese Flora Terms		**Local Chinese Fauna Terms**	
Translation Problems	Frequency	Percentage	Frequency	Percentage
Not Interpreted	54	33.13%	29	31.18%
Misinterpreted	85	52.15%	38	40.86%
Incongruent Interpretation for Same Name	16	9.82%	19	20.43%
Use Chinese Pinyin to Replace English Words	8	4.91%	7	7.53%
Total Number	**163**		**93**	

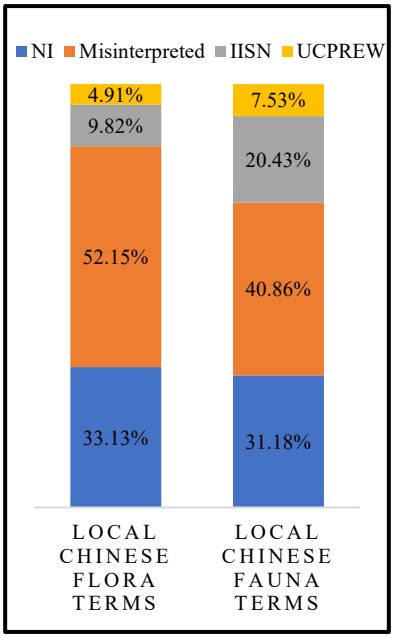

Figure 4. Frequency of Interpretation Problems for Local Chinese Biotic Names in Chinese-to-English PEC

Informed by the principles of three-dimensional transformations in Eco-Translatology, we employed the above-described effective interpretation strategies to amend a series of examples of ineffective interpretation in local Chinese biotic names, with the aim of attaining semantic and cultural equivalence within the SSC model. Firstly, local Chinese biotic names failed to be interpreted in both Latin and English but were instead interpreted in either only one or the other, resulting in NI. For example, the Chinese local flora term '阿尔蒙 (ST 35)' in the Manchu language and Chinese local fauna term '山和尚 (ST 41)' in the Northeast dialect were only interpreted into Latin as '*Phellodendron chinense* C.K.Schneid (TT 35)' and '*Garrulus glandarius* (TT 41)', respectively. Simply using Latin causes a semantic barrier for ecotourists (Li et al., 2022c). Therefore, the English counterparts should ideally be added to the target text. According to Li et al. (2022c), when interpreting local Chinese biotic names into English, the first step is to transform these into Chinese official (common) names. The English interpretation of ST 35 should be 'Chinese cork tree' because its official Chinese plant name is '黄檗'. The official Chinese fauna name of '山和尚 (ST 41)' is '松鸦', which should be interpreted as 'Eurasian jay' in English. Since these two local Chinese biotic names appear as titles on the interpretative board, both Latin and English were used. Thus, ST 35 should be interpreted as '*Phellodendron chinense* C.K.Schneid (Chinese cork tree)' and ST 41 should be '*Garrulus glandarius* (Eurasian jay)'. Additionally, there are two examples where the scientific name has been omitted but should be included to comply with the principles of scientific interpretation of ecotourism (Li et al., 2022c): the Chinese local (Chizhou dialect) flora name '水鳖梨 (ST 36)' and Chinese local (Northeastern dialect) fauna name '山马蛇子 (ST 42)'. The official Chinese flora name of '蓝果树' is '水鳖梨 (ST 36)' and locals refer to '黑龙江草蜥' as '山马蛇子 (ST 42)'. The Latin scientific name of '蓝果树' and '黑龙江草蜥' are respectively '*Nyssa sinensis* Oliv.' and '*Takydromus amurensis*', which should be added in their target text.

Secondly, examples of Misinterpreted cases can also be found in the PEC, which can be optimised using the literal interpretation to achieve both semantic and cultural equivalence, guided by Eco-Translatology. For instance, in the main text of an interpretative board, the local Chinese flora name '八棱 (ST 37)' was inaccurately rendered into 'octagonal tree'. In the Chizhou dialect, it is a common practice for locals to use the term '八棱' as a substitute for the botanical name '银杏', also known as 'Gingko'. Similarly, in the Northeast language, the local Chinese fauna name '水耗子' in ST 43, which is officially known as '水獭', can be interpreted into 'otter' instead of the literal Chinese meaning of 'water rat'.

Thirdly, IISN causes semantic and cultural inequivalence. For example, in the Northeast dialect, the local flora term, '鱼鳞松 (ST 38)', was ineffectively interpreted into two different versions: fish-scale pine and fish-scale spruce. However, local people refer to it as '鱼鳞云杉'. Therefore, it should be consistently interpreted into 'dark-bark spruce' by its literal interpretation. Similarly, in the Northeast dialect, the local Chinese fauna term '柴狗 (ST 44)' was inconsistently interpreted into 'Chaigou' and 'Dholes'. However, local people refer to it as '豺'. Therefore, it is best that 'Dholes' be used all the time, as in English 'Dhole' can correspond to '豺' and this term (and also the previous inconsistently used term) appears as the main text of the interpretive boards which are only interpreted into English (Li et al., 2022c).

Finally, UCPREW can lead to loss of meaning and create/maintain cultural barriers. For example, in terms of interpretations of titles, the local Chinese flora name '八本条 (ST 39)' was rendered into 'Babentiao' and the

Chinese local fauna name '勒付 (ST 45)' was interpreted into 'Lefu'. In the Northeast dialect, locals use the term '八本条' as a substitute for '珍珠梅', whose Latin name and English name of '珍珠梅' is '*Sorbaria sorbifolia* (L.) A.Braun' and 'false spiraea', respectively. Therefore, '八本条' should be interpreted into '*Sorbaria sorbifolia* (L.) A.Braun (false spiraea)'. In the Manchu language, locals use the term '勒付', which refers to the fauna '黑熊'. The scientific name of '黑熊' is '*Ursus thibetanus*' and its English name is 'Asian black bear'. Thus, '勒付' should be interpreted into '*Ursus thibetanus* (Asian black bear)'. Another set of examples involves the interpretations of the main text in interpretive boards, where the local Chinese biotic names were interpreted in Pinyin while they should be interpreted in English. For example, the local Chinese flora name of '翼朴 (ST 40)' is what the Northeast dialect used to refer to '青檀', which has an English name of 'blue sandalwood'. However, it was interpreted using the Pinyin 'Yipu'. In a similar example, the local Chinese fauna name of '五道眉 (ST 46)' is commonly known and referred to as '花鼠', which has an English counterpart of 'chipmunk'. However, it was interpreted using its Pinyin form as 'Wudaomei'.

The above analysis clearly demonstrates that inaccurate interpretation of local Chinese biotic terms can cause semantic and cultural inequivalence, creating communication barriers and likely resulting in cases of cross-cultural misunderstanding. To achieve semantic and cultural equivalence, the inaccurate interpretation has been optimised under the guidance of three-dimensional transformations within Eco-Translatology. Informed by the principles of three-dimensional transformations in Eco-Translatology, the taxonomy of interpretation strategies of local Chinese biotic names can be adopted by the broader taxonomy of interpretation strategies of common biotic names already established in section 5.1.2 (see Table 1).

5.3 Interpretation of ecological processes

5.3.1 Effective interpretation

To identify the translations of terms denoting ecological processes, rather than biotic names, we used the following CQL function formulas: [word="FL"] [word=","] [word="IS"] [word=","] [word="FLP"] [word=","] [word="Special IS"] and [word="FA"] [word=","] [word="IS"] [word=","] [word="FAP"] [word=","] [word="Special IS"]. From the results, we then generated frequency information regarding each of the six interpretation strategies of ecological processes. These are: literal interpretation (LI), division, shift, division and shift (DS), combination, and restructuring the word order (RWO). Thereafter in the search, the 'Specific IS' in the square brackets can be replaced by 'LI', Division, Shift, 'DS', Combination and 'RWO'. The results were tabulated comparatively in Figure 5 which shows that literal interpretation, division, and combination are the three most frequently used strategies for interpreting ecological processes. The results for the remaining interpretation categories of shift, division and shift, and restructuring the word order were much less significant (all less than 10%). Li et al. (2022c) pointed out that since most ecological processes are related to flora and fauna characteristics, active mood simple possessive, and describer verbs, such as '具有/有 (have)' and '是 (is/are)', can be expected in the Chinese ST. This means that the interpreter more often opts for literal interpretation and division strategies (Li et al., 2022c).

	Flora Processes		Fauna Processes	
Interpretation Strategies	Frequency	Percentage	Frequency	Percentage
Literal Interpretation	94	25.13%	64	23.79%
Division	116	31.02%	79	29.37%
Shift	26	6.95%	24	8.92%
Division and Shift	37	9.89 %	26	9.67%
Combination	71	18.98%	57	21.19%
Restructuring the Word Order	30	8.03%	19	7.06%
Total Number	**374**		**269**	

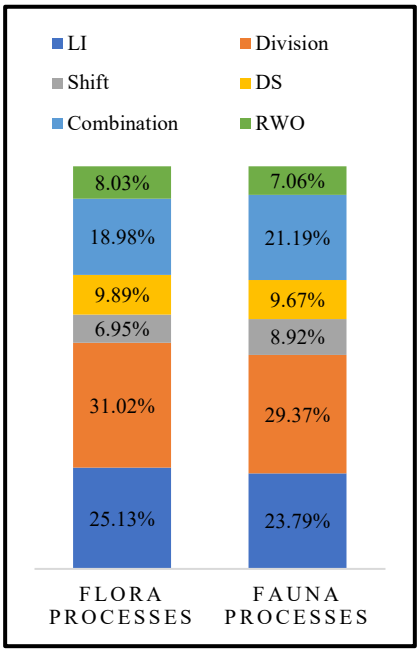

Figure 5. Frequency of Interpretation Strategies for Ecological Processes in Chinese-to-English PEC

The following examples, readily available from the PEC, demonstrate how these instances of interpreting ecological processes were mapped onto linguistic and communicative transformations of Eco-Translatology to achieve style equivalence in the SSC model. Firstly, the interpreter employed literal interpretation to interpret ecological processes described in simple, active Chinese sentences. To achieve style equivalence, the interpreter literally interpreted the characteristics of the 'Korean pine (ST 47)' and the 'Compton Tortoiseshell (ST 55)' into active English sentences of similar length, such as TT 47 and TT 55.

However, if the characteristics of flora or fauna are in complex Chinese sentences that contains multiple subjects and clauses, the interpreter employed the division strategy to separate them into individual English sentences that fits the English syntax while maintaining the same level of information expressed in the original Chinese sentence. For example, the features of 'Chinese ring-cupped oak (ST 48)' and the 'stripe-backed pheasant (ST 56)' were both originally described in one long Chinese sentence. In order to achieve style equivalence during the process of interpretation, the interpreter broke the long Chinese sentence down into multiple short English sentences in TT 48 and TT 56.

Conversely, to match style equivalence, multiple Chinese sentences that share the same subject (either by using the same noun phrase or using a pronoun) can be combined into one English sentence using conjunctions or adjoint adverbials. For example, when describing the characteristics of the 'Chinese tassel tree (ST 49)', the original Chinese text was in two separate sentences with the 'Chinese tassel tree' being the subjects in both sentences. When interpreted into English, the interpreter combined the two sentences using the conjunction 'which' while maintaining the same meaning. A similar example can be found for the interpretation of the fauna features of 'clouded leopard (ST 57)'. The interpreter conveyed the meaning in one English sentence, using the adjoint adverbial 'growing to' to link what was originally expressed in two different Chinese sentences. This strategy yields a more succinct English interpretation (Baker, 2018; Li et al., 2022c).

Although shift, division and shift, and restructuring the word order strategies are less frequently used (each accounting for less than 10% of usage) in interpreting ecological processes, they are important strategies in interpreting ecological processes. The first of these strategies, shift, is necessary when dealing with explicit and implicit passive Chinese words that are embedded in describing simple ecological processes. According to Chu (1973) and Xiao et al. (2006), interpreting or translating passive-voice Chinese sentence into passive-voice English sentence is called equivalence shift. For example, in the interpretation of ecological processes for the 'Chinese yew (ST 50)' and the 'lynx (ST 58)', the structures '被视为' and '被认为' were used. The Chinese character '被' is an explicit passive marker, as seen at the beginning of the two phrases. In the interpretation of these two examples, the passive verb form, 'be + done' was used in English, and because both '视为' and '认为' can be interpreted as 'regard', the two phrases '被视为' and '被认为' were interpreted as the passive 'be regarded as' in TT 50 and TT 58.

It is worth noting that there is a particular case of passive voice in Chinese – the implicit passive voice, where the verb used seems to be in an active syntax structure, but in fact the semantic meaning behind the use is passive (Xiao et al., 2006; Ren, 2020; Li et al., 2022c). In other words, contrary to the previous example where an explicit passive marker can be identified in the Chinese sentence (i.e., '被'), in implicit passive sentences, the passive voice is identified by meaning. For example, the Chinese verb '入' is a common implicit passive word (e.g., in interpreting the characteristics of the 'Manchurian ash', ST 51). Literally, the word '入' should be interpreted as an active verb, but considering the context, it was rendered into 'be used as' in TT 51 to reflect its actual semantic reference in the description. Similarly, in the interpretation of the features of the female 'stripe-backed pheasant (ST 59), the verbs '缀 (cover)' and '具 (decorate)' were respectively interpreted into 'be covered with' and 'be decorated with' in TT 59. Thus, passive voice achieves style equivalence.

The strategy 'division and shift' combines two strategies (the strategy shift, and the strategy division) to achieve style equivalence,as the name suggests. It is used to interpret Chinese ST that has long and complex sentences with the need to convert the voice of the verb. For example, the features of the 'golden birch (ST 52)' and the 'western capercaillie (ST 60)'. The interpreter not only broke down the long sentences into two short ones, but also employed the passive: 'be + done' instead of '被' marker. Besides, '散生 (ST 53)' and '布满 (ST 61)' are implicit passive characters embedded in long sentences that interprets the features of the 'purple Nanmu' and the 'silver pheasant', respectively. In TT 53, '散生' was rendered into the passive, 'is scattered in' and '布满' in TT 61 was translated into 'covered with' by the interpreter. As we can see from these examples, the interpreter aligned with linguistic and communicative transformations of Eco-Transalotology to attain style equivalence.

The last strategy, restructuring the word order, is needed in interpreting text where the theme of the sentence and its supporting details need to be rearranged to make sense in English sentences. More specifically, in English, the theme of a sentence typically appears at the outset of the sentence as opposed to Chinese (Baker, 2018; Li et al., 2022c). For example, in the case of ST 54, where the characteristics of the Chinese sassafras are being interpreted, the phrase '树形挺拔 (upright tree)' originally appeared at the end of the sentence. However, in English, 'upright tree' is the major category description. Thus, in TT 54, the interpreter reordered the sentence to place 'upright tree' at the beginning to achieve style equivalence. Similarly, in ST 62, '自然界的清洁工 (Nature's cleaner)' was initially located at the end of the sentence as the nomenclature of the crow. In TT 62, to achieve style equivalence,

the interpreter also rearranged the English sentence by placing 'Nature's cleaner' at the beginning because of its pivotal role in the context.

The above examples effectively demonstrate how the different interpretation strategies help with achieving style equivalence in interpreting ecological processes given the language differences between English and Chinese. Through the lens of Eco-Translatology, particularly the transformations of linguistic and communicative dimensions, six interpretation strategies (literal interpretation, division, shift, division and shift, combination and restructuring the word order) are observed to accurately convey the meaning of the ST into effective TT for the geotourists, and thus achieved meaningful cross-cultural communication. These six strategies will serve as general guidance in the suggestions developed in the next section regarding how ineffective interpretations of ecological processes might be improved.

5.3.2 Interpretation problems

To identify existing interpretation faults in ecological processes, we used the specific formula patterns, [word="FL"] [word=","] [word="IP"] [word=","] [word="FLP"] [word=","] [word="Specific IP"] and [word="FA"] [word=","] [word="IP"] [word=","] [word="FAP"] [word=","] [word="Specific IP"], to search, respectively, for two interpretation problems (Misinterpreted and Not Interpreted) relating to the communication of flora and fauna processes in the PEC (see Figure 6). Misinterpretation was almost always the problem in concerning ineffective translation of passages about biotic processes. Notably, the proportion of ineffective translations caused by misinterpretation is 10 percent higher for flora processes (83.26%) compared to fauna processes (70.97%). Li et al. (2022c) provided an explanation for this phenomenon, stating that plant features and plant morphology are more complex than those of the fauna; therefore, the interpretation of ecological processes associated with flora are prone to more variations, which increases the chance of misinterpretation.

	Flora Processes		**Fauna Processes**	
Interpretation Problems	Frequency	Percentage	Frequency	Percentage
Misinterpreted	199	83.26%	132	70.97%
NI	40	16.74%	54	29.03%
Total Number	**239**		**186**	

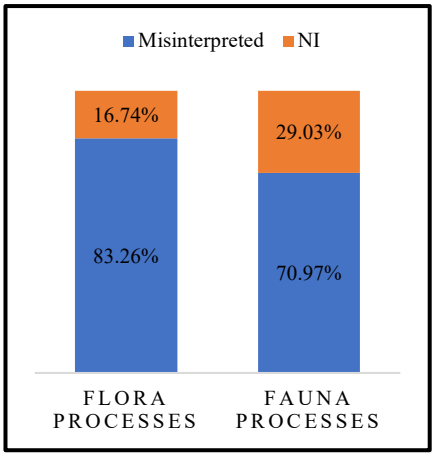

Figure 6. Frequency of Interpretation Problems for Ecological Processes in Chinese-to-English PEC

Guided by linguistic and communicative dimensions within Eco-Translatology, the following optimised examples of (otherwise) ineffective interpretations of ecological processes demonstrate how semantic and style equivalence might have been better achieved through the application of the interpretation strategies discussed above. Most misinterpreted passages fail to communicate information to the English-speaking geotourists at the geopark. A failed interpretation cannot accurately convey the flora and fauna characteristics. For example, in ST 63 where the wild soybean was interpreted from Chinese to English, the interpreter's incorrect use of words and language style leads to semantic and style inequivalence. '叶片锥形' is interpreted 'bracts lanceolate', '裂片锥尖形' is

‘lobes triangular-lanceolate’, ‘内花瓣’ is ‘corolla’, and ‘外花瓣’ is ‘flag petals’. Moreover, the long and complex sentence is not interpreted into passive form. Guided by Hu’s Eco-Translatology in its linguistic and communicative dimensions, ‘叶片锥形’ can be translated into ‘leaves are tapered’, ‘裂片锥尖形’ can become ‘tapered lobes’, ‘内花瓣’ can be rendered into ‘inside petals’, and ‘外花瓣’ can become ‘underneath petals’. Similarly, the implicit ‘密生’ and ‘状’ can be rendered into ‘be densely clustered’ and ‘状 （呈…状）’ into ‘is…shaped with’. Thus, we employed the division and shift strategy to optimise ST 63 as TT 63:

> Racemes are small plants whose tiny flowers **are densely clustered** on yellow stalks. Its decorative **leaves are tapered**, and the calyx **is** bell **shaped with** **tapered lobes**. The **inside petals** are a pale reddish purple or white and the **underneath petals** are round. The pods [inside the flower] are oblong. The seeds [inside pod] are slightly flattened oval shapes. This plant flowers in July-August and fruits in August-October [Northern Hemisphere].

Similarly, in ST 65, when interpreting the features of the stone morok, ‘吻’ was incorrectly rendered into ‘muzzle’, and ‘须’ was inaccurately interpreted into ‘whiskers’. According to the Oxford English Dictionary (https://www.oed.com/view/Entry/124409?rskey=Ns6OBu&result=1#eid0), ‘muzzle’ is the projecting part of the face, including the nose and mouth, of an animal such as a horse and dog. Thus, the fish does not have a ‘muzzle’, but instead has a ‘snout’. The English Thesaurus Dictionary (https://thesaurus.plus/related/barbel/whisker) shows the synonym of ‘whisker’ is ‘barbel’ for fish. According to its definition, ‘whisker’ is a long stiff hair growing from the snout or brow of most mammals as e.g., a cat; and ‘barbel’ refers to a slender tactile feeler on the jaws of a fish. Thus, ‘barbel’ is accurate. Moreover, the two Chinese sentences can be rendered into one (combination), because of the common subject. Therefore, we improved ST 65 by using the combination strategy, resulting in the following interpretation: ‘The snout of the stone moroko is slightly pointed and prominent, with large eyes and thin lips but no barbels.’, achieving both semantic and style equivalence.

Although less frequent, NI may prevent tourists from fully understanding the characteristics of a particular flora or fauna. For instance, in ST 64, ‘具黑褐色膜质’ and ‘末端渐细’ are features of the southern maidenhair fern that were mentioned in the source text but failed to get interpreted into English. Furthermore, in the same example ST 64, ‘具…保护’ in Chinese constitutes an implicit passive structure, which should be interpreted as the passive voice ‘protected by’. However, in TT 64 this structure was not interpreted at all. Guided by linguistic and communicative dimensions of transformations (Hu, 2003), we used the shift strategy to amend ST 64 as ‘The rhizome is short and upward pointing, protected by a dense amount of small dark brown scales that are smooth skinned and tapering at the end.’, thus achieving both semantic and style equivalence. Similarly, in ST 66, the features of silver pheasants, ‘密布黑纹’ and ‘羽冠近黑色’ were not interpreted in TT 66. Also, ‘密布’ the implicit passive should be converted to ‘be covered with’ (see section 5.3). Therefore, according to Hu’s Eco-Translatology dimensions, we employed the division and shift strategy to optimise ST 66 as TT 66:

> Male and female silver pheasants exhibit sexual dimorphism. The males are brightly colored, with white feathers on the upper body, and are **densely covered with black stripes**. They also have a black-blue hair-like crest on the head, bare crimson skin on the face, black-blue lower body, and red feet. In contrast, the females have a brown body **and a nearly black crest**.

After further study of the results through a qualitative analysis guided by the framework of Hu's Eco-Translatology, six interpretation strategies can be identified, and added to the taxonomy of ecotourism interpretation. Table 2 displays the patterns and examples of the six strategies for interpreting ecological processes.

Interpretation strategies	Patterns of usage for interpretation strategies within ecological processes
Literal Interpretation	Interpreting short Chinese ecological processes that are written in active voice directly into active-voice English sentences of similar length, such as in Texts 47 and 55. *using and interpreting of passive voice is categorised as 'Shift', which is explained below.
Division	When the Chinese ecological processes are described in active, complex sentences, these sentences are broken down into shorter active sentences in English, such as Texts 48 and 56.
Combination	When there is a close logical relationship between two consecutive Chinese sentences describing ecological processes (e.g., the subject of the two sentences is the same), the use of conjunctions or adjoint adverbials can be used to make them into one complex English sentence that retains all the information in the Chinese sentences, such as in Texts 49 and 57.
Shift	When the ecological processes are described using passive structures in the Chinese sentence, passive voice was used in interpreting ecological processes into English, such as in Texts 50, 51, 58 and 59.
Division and Shift	When ecological processes are described in long Chinese sentences, they were interpreted into several simple and short English sentences. When passive structure is embedded into ecological processes, passive voice should be used in the TT, such as in Texts 52, 53, 60 and 61.
Restructuring the Word Order	Important information, such as a category or generality of ecological processes, should be placed first in the sentence, followed by supporting details when interpreting ecological processes, such as Texts 54 and 62.

Table. 2 Taxonomy of interpretation strategies in ecological processes

6. Conclusions

The present paper has found that due to the diversity of flora, the interpretations of common flora names and local Chinese flora names are more complicated than those of fauna. In other words, the complexity and diversity of flora make it more difficult to interpret texts describing their processes. This is due to the large number of plant-specific terms included in the description of plant characteristics, such as leaf morphology, root characteristics, and flower structure. However, many of the interpretation challenges posed by such ecological complexity can be addressed more effectively through the taxonomy of ecotourism strategies. At the common biotic names level, the

taxonomy includes using Latin and English, literal interpretation, creative interpretation, and foreignisation strategies. The interpretation of local Chinese biotic terms uses the same strategies as the interpretation of common biotic names. In addition, we found six strategies in interpreting the various ecological processes written in Chinese: literal interpretation, division, shift, division and shift, combination, and restructuring the word order strategies.

This project has meaningful practical and theoretical implications. Practically, this paper established a systematic approach to Chinese-to-English ecotourism interpretation and demonstrated how ineffective interpretations can be optimised by establishing a standardised basis of interpretation. This will deliver a previously unavailable standard of quality interpretation. Thus, ecotourism interpretation of Chinese UGGps will be able to apply a professional standard to interpretation to undergird sustainable tourism. For example, the taxonomy of ecotourism interpretation strategies discussed in this paper can help with systematic training of geopark interpreters and translators to provide high-quality interpretation for geotourists. In this way, geotourists can better understand the ecological heritage and culture of China.

Theoretically, the findings reported in this paper conform with previous literature that Hu's Eco-Translatology is transferable to the field of ecotourism interpretation research (Li et al., 2022a). Li et al. (2022a) have explored and tested A (Abiotic) and C (Cultural) elements in the field of geotourism which means those results can be used to corroborate the current findings on the B (Biotic) element. According to the criteria of the three-dimensional transformations in Eco-Translatology, translators can identify effective and ineffective ecotourism interpretations in Chinese UGGps, and optimise ineffective interpretations into those more appropriate for geotourists. From a perspective of continual research, this paper widens the scope of systematic research on Chinese-to-English interpretation of the biotic element of geotourism.

Nevertheless, the limitations of this paper should be addressed. The ecotourism data has been selected from a specific area and time, thereby naturally limiting the scope of data selection in terms of randomisation. We endeavoured to mitigate this by obtaining data from renowned and well-established geoparks, using a variety of flora and fauna characteristics, and by selecting quantitatively representative examples from the Chinese Wudalianchi and Jiuhuashan UGGps. The limitation on sample size has the potential to result in some erroneous assumptions in the analysis of patterns or an inadequate representation of the broad scope of interpretation difficulties. Therefore, the proposed new taxonomy of ecotourism interpretation strategies may require further research and refinement through application to other data from other Chinese UGGps.

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Authors' contributions

Qiang (Jason) Li is the corresponding author and Author 1. He collected, processed, and annotated the data and shaped the Chinese-to-English PEC. He also wrote the paper. As an expert in his fields, Dr. Young Ng provided essential background knowledge on ecotourism and data from Chinese UGGps, along with suggestions for addressing reviewers' comments.

Discourse statement

No potential conflict of interest is reported by the author.

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Appendices

Appendix A. Interpretation strategies and problems

Table A1. Definitions and examples of interpretation strategies

Interpretation Strategies	Definition	Example
Latin and English Strategy	The translation strategy for interpreting common biotic names when they appear as the title or stand alone on interpretive boards in (geo)parks (Ren, 2020; Li et.al., 2022a).	The translator interpreted the fauna name '小嘴乌鸦' into '*Corvus corone* (carrion crow)', with the Latin name written in italics.
Literal Interpretation	The translation strategy of rendering the text word-by-word or using equivalent words or phrases in target language. This strategy aims to maintain the form and structure of the source text (Baker, 2018).	The translator literally translated the flora process '灯台树的属于落叶乔木，高 12-20 米' into 'The wedding cake tree is deciduous tree growing to 12-20 metres.' Additionally, in this sentence, the flora name '灯台树' was directly interpreted into 'wedding cake tree', as it has an equivalent term in English.
Creative Interpretation	During the interpretation process, translator may encounter situations where there is no direct equivalence word or phrase in target language for a particular term or concept. In such cases, the translator often employs creative strategy to effectively convey the intended meaning (Ren, 2020)	According to the intended flora connotation, the translator creatively rendered the native flora '喜树' as 'happy tree', since there is no direct English counterpart available.
Foreignisation	The translation strategy that emphasises the preservation of the source language's cultural and linguistic characteristics in the target language (Venuti, 1995).	The translator solely used English and omitted the Latin translation for the unique flora species '山茶' found in China, which is translated into 'Camellia', because the Latin term for 'Camellia' is '*Camellia japonica*'. In Latin, 'japonica' means 'Japanese'.
Division	The interpretation strategy which divides the long sentence into several small parts, each sharing a connected meaning (Baker, 2018). This strategy aims to enhance clarity and readability by breaking down complex sentences into smaller, more manageable units (Li et al., 2022a; Li.et.al., 2022c).	When rendering the flora process, it is common to divide a long Chinese sentence into simpler and shorter sentences to achieve style equivalence (Li, 2022c). For example, the translator divided the growth habits of Moutan penoy '牡丹喜欢温暖湿润的气候，适宜生长在阳光充足、排水良好的土壤中。' into two sentences: 'Moutan penoy prefers warm and humid climatic conditions. It thrives in well-draining soil with ample sunlight.' This strategy helps to maintain a similar style and ensures better readability in English (Li et al., 2022c).
Shift	The interpretation strategy that involves using change of word/s, grammatical structure, or voice of the source text (Baker, 2018).	The flora process '向日葵的花朵在夏季盛开，吸引了许多蜜蜂和蝴蝶来采蜜。' was interpreted by the translator as 'Many bees and butterflies are attracted by blooming flowers of the sunflower in summer' by translator. In this sentence, the term '吸引' was translated into the form of 'be+done' (be attracted).
Division and Shift	A compound interpretation strategy that combines two strategies, namely division and shift (Baker, 2018; Li et.al, 2022a).	The translator accurately interpreted the flora process '肉桂的树皮呈黑色，香气浓郁，用作芳香调味品，此外还可提取桂皮油，为食品工业之重要香料，亦入药。' into 'The bark of Chinese cassia is black and fragrant, thus used as an aromatic spice or to extract cinnamon oil, which is an important spice in the food industry. It is also used as medicine.' The translator divided the long Chinese sentence into two simpler English sentences to improve readability. Moreover, the use of passive voice 'be used' accurately conveys the meaning of '用' and '入'.

Combination	During the translation process, when there is logical connection between two or more sentences, a combination strategy can be applied to merge them together (Baker, 2018). The purpose of this strategy is to ensure coherence between the sentences, maintain consistent style, and effectively convey the intended meaning of the original text (Baker, 2018; Ren 2020; Li et.al., 2022c).	To achieve conciseness, reduce redundancy, and improve overall coherence in English interpretations of ecological processes, the translator often employs the combination strategy (Li et. al., 2022c). For instance, the fauna process '红嘴相思鸟的额、头顶及后颈等均为带黄的橄榄绿色。它的嘴呈赤红色。' was interpreted into 'The top of the red-billed leiothrix's head, forehead and nape are dull olive green, and it has a bright red bill.'
Restructuring the Word Order	The translation strategy that involves altering the order of words or phrases in the target language to achieve a more natural and grammatically correct sentence structure (Baker, 2018).	In English, it is common to place important information at the beginning to allow readers to quickly grasp the main point (Li et. al. 2022c). Thus, to achieve style equivalence, the translator rendered '环颈雉是一种以谷类浆果、种子及昆虫为食的动物，主要栖息于林中和灌丛中。' into 'The ring-necked pheasant primarily lives in forests and low woods, where it feeds on grains, berries, plant seeds and insects.' through changing word order.

Table A2. Definitions and examples of interpretation problems

Interpretation Problems	Definition	Example
Misinterpreted	Incorrect interpretation of the intended meaning during interpretation (Wang, 2018).	The flora name '栀子花 (gardenia)' was interpreted into '月季 (rose)' by the translator.
Not interpreted	A failure to provide any interpretation for a particular word, phrase, or segment of text (Wang, 2018).	The translator rendered the flora process '山柿属落叶乔木，树冠钝圆锥形，树皮淡灰褐色，**叶浓绿**。' into 'The persimmon' is a deciduous tree with obtuse conical crowns, light greyish-brown barks.' However, '叶浓绿 (dense green leaves)' was not interpreted in English.
Using Chinese Pinyin to replaces English Words	The translator uses the phonetic representation of the Chinese characters instead of translating the English words in the target language (Wang, 2018).	The fauna name '布谷鸟' was interpreted into 'bugu' rather than 'cuckoo'.
Incongruent Interpretation for Same Name	Instances where different interpretations are given for the same name or term, resulting in inconsistencies or discrepancies (Wang, 2018).	The fauna name '香鼬' was interpreted into two English versions 'ferret' and 'mustela' by the translator.

Appendix B. Tags applied to the English targets in Chinese-to-English PEC

Label elements				Label Example
Element 1	**Element 2**	**Element 3**	**Element 4**	
Flora <FL>	Interpretation Strategies <IS>	Common Plant Names <CPN>	Latin and English <LE>	<FL, IS, CPN, LE>
			Literal Interpretation <LI>	<FL, IS, CPN, LI>
			Creative Interpretation <CI>	<FL, IS, CPN, CI>
			Foreignisation <Foreignisation>	<FL, IS, CPN, Foreignisation>
		Chinese Cultural Plant Names <CCPN>	Latin and English <LE>	<FL, IS, CCPN, LE>
			Literal Interpretation <LI>	<FL, IS, CCPN, LI>
			Creative Interpretation <CI>	<FL, IS, CCPN, CI>
		Flora Processes <FLP>	Literal Interpretation <LI>	<FL, IS, FLP, Division>
			Division <Division>	<FL, IS, FLP, Shift>
			Shift <Shift>	<FL, IS, FLP, DS>
			Division and Shift <DS>	<FL, IS, FLP, DS>
			Combination <Combination>	<FL, IS, FLP, Combination>
			Restructuring the Word Order <RWO>	<FL, IS, FLP, RWO>
	Interpretation Problems <IP>	Common Plant Names <CPN>	Not Interpreted <NI>	<FL, IP, CPN, NI>
			Misinterpreted <Misinterpreted>	<FL, IP, CPN, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<FL, IP, CPN, IISN>
			Use Chinese Pinyin to Replace English Words <UCPREW>	<FL, IP, CPN, UCPREW>
		Chinese Cultural Plant Names <CCPN>	Not Interpreted <NI>	<FL, IP, CCPN, NI>
			Misinterpreted <Misinterpreted>	<FL, IP, CCPN, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<FL, IP, CCPN, IISN>
			Use Chinese Pinyin to Replace English Words <UCPREW>	<FL, IP, CCPN, UCPREW>
		Flora Processes <FLP>	Not Interpreted <NI>	<FL, IP, FLP, NI>
			Misinterpreted <Misinterpreted>	<FL, IP, FLP, Misinterpreted>
Fauna <FA>	Interpretation Strategies <IS>	Common Animal Names <CAN>	Latin and English <LE>	<FA, IS, CAN, LE>
			Literal Interpretation <LI>	<FA, IS, CAN, LI>
			Creative Interpretation <CI>	<FA, IS, CAN, CI>
			Foreignisation <Foreignisation>	<FA, IS, CAN, Foreignisation>
		Chinese Cultural Animal Names <CCPN>	Latin and English <LE>	<FA, IS, CCPN, LE>
			Literal Interpretation <LI>	<FA, IS, CCPN, LI>
			Creative Interpretation <CI>	<FA, IS, CCPN, CI>
		Fauna Processes <FAP>	Literal Interpretation <LI>	<FA, IS, FAP, LI>
			Division <Division>	<FA, IS, FAP, Division>
			Shift <Shift>	<FA, IS, FAP, Shift>
			Division and Shift <DS>	<FA, IS, FAP, DS>
			Combination <Combination>	<FA, IS, FAP, Combination>
			Restructuring the Word Order <RWO>	<FA, IS, FAP, RWO>
	Interpretation Problems <IP>	Common Animal Names <CAN>	Not Interpreted <NI>	<FA, IP, CAN, NI>
			Misinterpreted <Misinterpreted>	<FA, IP, CAN, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<FA, IP, CAN, IISN>
			Use Chinese Pinyin to Replace English Words <UCPREEW>	<FA, IP, CAN, UCPREW>
		Chinese Cultural Animal Names <CCPN>	Not Interpreted <NI>	<FA, IP, CCPN, NI>
			Misinterpreted <Misinterpreted>	<FA, IP, CCPN, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<FA, IP, CCPN, IISN>
			Use Chinese Pinyin to Replace English Words <UCPREW>	<FA, IP, CCPN, UCPREW>
		Fauna Processes <FAP>	Not Interpreted <NI>	<FA, IP, FAP, NI>
			Misinterpreted <Misinterpreted>	<FA, IP, FAP, Misinterpreted>

Appendix C. Sketch Engine Formula

Search in

English

Query type

CQL

CQL

[word="one of two categories of ecotourism"] [word=","] [word="IS"] [word=","] [word="one of six subcategories' name"] [word=","] [word="Specific IS"]

Default attribute: word

Subcorpus: non (the whole corpus)

Fig. C1 Sketch Engine Formula Used to Retrieve Effective Interpretation Strategies

Search in

English

Query type

CQL

CQL

[word="one of two categories of ecotourism"] [word=","] [word="IP"] [word=","] [word="one of six subcategories' name"] [word=","] [word=" Specific IP"]

Default attribute: word

Subcorpus: non (the whole corpus)

Fig. C2 Sketch Engine Formula Used to Retrieve Interpretation Problems

Appendix D. Examples of Effective and Ineffective Interpretations

Table D1. Effective interpretation of common biotic names

Categories	Text No.	Source Text (ST)	Target Text (TT)	Interpretation Strategies
Common Flora Names	1	石竹	*Dianthus chinensis* L. (Chinese pink)	Latin and English
	2	青钱柳	*Cyclocarya paliurus* (Batalin) Iljinsk. (Money Willow)	
	3	黑龙江百里香	*Thymus amurensis* Klokov (Heilongjiang Thyme Shrub)	
	4	**睡莲**是多年水生草木，根状茎肥厚。	The **water lily** is a perennial aquatic plant with thick rhizomes.	Literal Interpretation
	5	**凤凰松**的树龄约 1400 年，其造型奇特让人联想到凤凰展翅。	The **Phoenix pine**, estimated to be approximately 1,400 years old, exhibits a unique shape reminiscent of a phoenix spreading its wings.	Creative Interpretation
	6	**独蒜兰**属于半附生草本植物，喜凉爽且较耐寒。	The **Chinese Pleione orchid** belongs to a semi-epiphytic herbaceous family that can grow in a cooler climate showing a higher tolerance of cold.	
	7	枇杷	Loquat	Foreignisation
Common Fauna Names	8	鸳鸯	*Axi galericulata* (Mandarin duck)	Latin and English
	9	乌苏里蝮	*Gloydius ussuriensis* (Ussuri viper)	
	10	**长耳鸮**叫声深沉。	The **long eagle-owl** has a deep call.	Literal Interpretation
	11	**乌苏里貉**背部毛色较深，呈青灰色。	The dorsal fur of the **Chinese raccoon dog** exhibits a dark and bluish grey hue.	Creative Interpretation
	12	丹顶鹤	Red-crowned crane	Foreignisation

Table D2. Ineffective interpretation of common biotic names

Categories	Text No.	Source Text (ST)	Target Text (TT)	Interpretation Problems
Common Flora Names	13	皖杜鹃	*Rhododendron anhweiense* E.H.Wilson	NI
	14	马尾松	Chinese red pine	
	15	黄山玉兰	*Yulania cylindrica* (E.H.Wilson) D.L.Fu (Huangshan magnolia)	Misinterpreted
	16	**蜻蜓兰**的植株高 20-60 厘米。	The plant of **Dragon orchid** stands 20-60 cm.	
	17	毛红椿	*Toona ciliata*	IISN
			Toona ciliata Roem. var. pubescens	
			Toona sureni var. pubescens	
	18	**铁线蕨**具有两羽状到三羽状的复叶，刚硬纤细的茎轴。这些茎轴明显呈拱形至下垂状态。	**Southern maidenhair fern** features bipinnate to tripinnate fronds with wiry, black stems that are distinctively arching to pendent.	
		铁线蕨属陆生中小型蕨类植物。	**Adiantum** is a terrestrial medium and small fern.	
	19	**山丹花**是一种多年生百草本球茎植物，茎叶多，高约 15-60 厘米。	**Shandanhua** is a herbaceous perennial bulbiferous plant that produces a stem with leaves, reaching a height of about 15-60 cm.	UCPREW
Common Fauna Names	20	画眉	*Garrulax canorus*	NI
	21	猕猴	Macaque	
	22	竹鸡	*Bambusicola thoracica* (Chinese bamboo-partridge)	Misinterpreted
	23	**狗獾**是一种鼬科哺乳动物。	**Meles** is a species of mammals in the Mustelidae family.	
	24	短尾猴	*Macaca thibetana*	IISN
			Macaca arctoides	
	25	**青头潜鸭**是雁形目鸭科潜鸭属的鸟类。	**Green-headed Pochard** is a bird of the genus Pochard of the Anatidae family.	
		2021 年 2 月 14 日下午，观鸟爱好者在腾冲北海湿地进行观鸟拍摄时，发现一只类似**青头潜鸭**的鸟。	On the afternoon of 14 February 2021, bird watching enthusiasts spotted a bird resembling a **blue-headed pochard** while taking a birdwatching photo in the Beihai Wetland of Tengchong.	
		青头潜鸭为全球及危物种，数量不足 1000 只。	**Pochard** is a critically endangered species across the world, with a population of less than 1,000.	
	26	**鹌鹑**体长 18 厘米，体小而滚圆。	The **Chinese Anchun** is characterised by a small and round body reaching 18 cm in length.	UCPREW

Table D3. Effective interpretation of local Chinese biotic terms

Categories	Text No.	Source Text (ST)	Target Text (TT)	Interpretation Strategies
Local Chinese Flora Terms	27	拖盼儿	*Rubus corchorifolius* L.f. (Raspberry)	Latin and English
	28	老鸭糊	*Callicarpa cathayana* C.H.Chang (Chinese beautyberry)	
	29	**楼上楼**味苦，性微寒，常用于蛇虫咬伤和咽喉肿痛。	**Paris root** is characterised by a bitter taste and has a cooling effect and is frequently employed in the treatment of snake and insect bites as well as sore throats.	Literal Interpretation
	30	**马褂衣**生长快，耐寒，对病虫害抗性极强。	**Chinese tulip tree** grows fast, tolerates drought, and is extremely resistant to pests and diseases.	Creative Interpretation
Local Chinese Fauna Terms	31	斐耶楞古	*Tetrastes bonasia* (Hazel grouse)	Latin and English
	32	臭迷子	*Rana amurensis* (Heilongjiang frog)	
	33	**随鹅**的体长 90 厘米左右，体重 2.8-5 千克。	The **swan goose** is about 90 cm long and weighs 2.8-5 kg.	Literal Interpretation
	34	**鲤拐子**属于底层鱼类，喜欢活动在水体的下层。	**Heilongjiang coloured carp** is a demersal fish, active in the lower levels of water.	Creative Interpretation

Table D4. Ineffective interpretation of local Chinese biotic terms

Categories	Text No.	Source Text (ST)	Target Text (TT)	Interpretation Problems
Local Chinese Flora Terms	35	阿尔蒙	*Phellodendron chinense* C.K.Schneid	NI
	36	水鳖梨	Chinese tupelo	
	37	**八棱**是第四纪冰川遗留的最古老的裸子植物之一，植物界的“活化石”，世界珍贵树种。	The **octagonal tree** is one of the oldest gymnosperms surviving from the Quaternary glacier, and as a rare species is hailed as “Living Fossil” in the plant kingdom.	Misinterpreted
	38	**鱼鳞松**树皮细腻而汕亮，枝条滑腻富有弹性。	The bark of **the fish-scale pine** is delicate and shiny, and its branches are smooth and flexible.	IISN
		鱼鳞松生于海拔 600-1800 米气候温寒和凉润的地带。	**Fish-scale spruces** germinate 600-1800 metres above sea level in warm and cool climates.	
	39	八本条	Babentiao	UCPREW
	40	**翼朴**为中国特有的单种属。	**Yipu** is a monotypic genus endemic to China.	
Local Chinese Fauna Terms	41	山和尚	*Garrulus glandarius*	NI
	42	山马蛇子	Heilongjiang grass lizard	
	43	**水耗子**主要栖息于河流和湖泊一带，尤其喜欢生活在林木繁茂的溪河地带。	The **water rat** mainly inhabits rivers and lakes, especially likes to live in lush forests on both sides of the rivers and rivers.	Misinterpreted
	44	**柴狗**全身多呈赤棕色，背中部毛尖黑色。	**Chaigou** is mostly reddish brown in colour with black hackles.	IISN
		柴狗捕食各种哺乳动物，一群通常 30 只。	**Dholes** hunt a variety of animals, typically in packs of up to 30 individuals.	
	45	勒付	Lefu	UCPREW
	46	**五道眉**因体背有数条明暗相间的平行纵纹而得名。	**Wudaomei** is named for several light and dark parallel vertical stripes on its back.	

Table D5. Effective interpretation of ecological processes

Categories	Text No.	Source Text (ST)	Target Text (TT)	Interpretation Strategies
Flora Processes	47	红松的树干通直结实，树冠呈圆锥形。	The truck of the Korean pine is straight and stout, and its crown is conical in shape.	Literal Interpretation
	48	细叶青冈属常绿乔木，叶互生，卵状披针形，长圆状披针形，顶端渐尖，叶基楔形，叶上半部有浅锯齿，叶柄细。	Chinese ring-cupped oak is an evergreen tree with alternate leaves. Leaves are ovate-lanceolate to oblong-lanceolate, with an acuminate apex and a cuneate base. The upper margin is serrulate and petiole slender.	Division
	49	香果树属于茜草科落叶大乔木，古老孑遗植物。它是中国特有单种属珍稀树种。	The Chinese tassel tree is a large, deciduous tree in the family Rubiaceae, which is a unispecific ancient relict species native to China.	Combination
	50	红豆杉**被**视为优良的建筑、桥梁、家具和器材的用材。	The Chinese yew **is regarded as** excellent material for house, bridges, furniture, and tools.	Shift
	51	水曲柳的树皮可入药，是传统的治疗结核、外伤的药物，还可作为驱虫剂。	The bark of the Manchurian ash **is used as** traditional medicine for tuberculosis and traumatic injuries, and as an insect repellent.	
	52	枝条红褐色，无毛；幼枝暗绿色，密**被**长柔毛，稍有树脂腺体；芽鳞密被白色绒毛。	Its branches are reddish brown, without tomentum. Its newly grown branches **are densely covered with** dark-green villous twigs with resinous glands. The bud scales are densely covered with white tomentum.	Division and Shift
	53	紫楠木高 8-10 米，喜温暖湿润的气候且有一定的耐寒性，一般**散生**在九华山海拔 900 米以下阴湿的山谷中。	The purple Nanmu stands 8 to 10 metres. It prefers a warm and humid climate and has a certain degree of cold tolerance. This plant **is usually scattered in** shady, wet valleys below 900 metres on Mount Jiuhua.	
	54	檫木高约 10 米，胸径 20-30 厘米，枝繁叶茂，**树形挺拔**。	The Chinese sassafras is upright, heavily branched with a diameter of 20-30 cm at breast height and reaching as high as 10 metres.	Restructuring the Word Order
	55	白矩朱蛱蝶为蛱蝶属中等大小的蝴蝶，展翅 50-70mm。	The Compton Tortoiseshell Butterfly is a medium-sized butterfly in the Nymphalis genus, with a wingspan of 50-70 mm.	Literal Interpretation
	56	雄鸟头部暗褐色；后颈和侧颈灰白色；颏、喉及前颈黑色；上背和胸栗色，散有黑	The male has a dark brown head, a greyish-white nape, and a black chin and throat. It is white on the sides of its neck and black in the front. Upper back and chest are chestnut-brown,	Division

Fauna Processes		斑；下背和腰黑而闪蓝，有白色横斑和羽缘。	lower back is glossy bluish-black, with white horizontal stripes and feathers at the edges.	
	57	樟豹为哺乳纲食肉目猫科动物。它的体长 70～106 厘米，肩高 60～80 厘米，尾长 70～90 厘米。	The clouded leopard is a feline of the Mammalia class and Carnivora order, growing to 70-106 cm long and 60-80 cm at shoulder height, with a 70-90 cm long tail.	Combination
	58	猞猁耳尖生有黑色耸立簇毛，**被**无知的宗教信徒认为是撒旦魔鬼的象征。	The lynx has tufts of black hair on the ear tips which **are regarded as** a symbol of Satan, the Devil, by ignorant religious believers.	Shift
	59	雌鸟体羽大部棕褐色，上体满**缀**以黑斑纹，背部**具**白色矢状斑。	The female is largely brown, upperparts **covered with** black stripes and back, **decorated with** white arrow-shaped stripes.	
	60	松鸡体结实，喙短，呈圆锥形，适于啄食植物种子；翼短圆，不善飞；鼻孔和脚均有**被**羽，以适应严寒。	The western capercaillie is stout and has a short conical beak, suitable for picking seeds. Given its short, stubby wings, flying is quite limited. Its nostrils and feet **are covered in** feathers to withstand intense cold.	Division and Shift
	61	白鹇体长约 1 米，体重 1.5 公斤，翅长约 26 厘米，嘴峰约 3.2 厘米，雄性上体与两翅均白色，**布满**整齐的“V”状黑纹。	It is 1m long, with a total body mass of 1.5kg. Its wings are roughly 26cm in length, and it has a culmen about 3.2cm. Male birds have white upperparts and wings, **covered with** V-shaped black stripes.	
	62	杂食性鸟类不仅取食植物的种子和果实，亦以腐肉和垃圾为食，是**自然界的清洁工**。	The omnivorous bird is ‘Nature’s cleaner’, feeding not only on seeds and fruits but carrion and trash.	Restructuring the Word Order

Table D6. Ineffective interpretation of ecological processes

Categories	Text No.	Source Text (ST)	Target Text (TT)	Interpretation Problems
Flora Processes	63	总状花序通常短，其小花**密生**在黄色的花茎上；**叶片锥形**；花萼钟状，**裂片锥尖形**，**内花瓣**淡红紫色或白色，**外花瓣**近圆形，花中荚果长方形，荚果种子椭圆形，稍扁，7-8 月开花，8-10 月结果。	Racemes are usually small, with tiny flowers, dense yellow stalks; bracts lanceolate; calyx campanulate, lobes triangular-lanceolate, corolla light reddish purple or white, flag petals nearly round, pods oblong. The seeds are slightly constricted, oval, slightly flat, flowering in July-August, fruiting in August-October.	Misinterpreted
	64	根状茎短小，直立，先端**具黑褐色膜质**小鳞片保护，全缘，**末端渐细**。	The rhizome is short, erect, and the apex is protected by small scales; the scales are entire.	NI
Fauna Processes	65	麦穗鱼的**吻**略尖而突出。其唇薄，无**须**。	The muzzle of the stone moroko is slightly pointed and prominent. This kind is without whiskers.	Misinterpreted
	66	白鹇雌雄异色；雄鸟羽毛鲜艳，上体银装素裹，**密布黑纹**。头上有状如发丝的蓝黑色羽冠；脸裸露，赤红色；下体蓝黑色，脚红色。相比之下，雌鸟通体褐色，**羽冠近黑色**。	Male and female silver pheasants exhibit sexual dimorphism. The males are brightly colored, with white feathers on the upper body. They also have a black-blue hair-like crest on the head, crimson bare skin on the face, black-blue lower body, and red feet. In contrast, the females have a brown body.	NI

Linking Statement IV – Validation and Further Exploration of the SSC Model and the Taxonomy

So far, I have established a benchmarking model, the SSC model, to access the quality of Chinese-to-English geotourism interpretation (Chapter 4), based on which I developed a taxonomy of interpretation strategies of the ABC elements in geotourism (Chapter 5 & 6). As a review, the SSC model refers to the benchmarking model that focuses on **S**emantic equivalence, **S**tyle equivalence, and **C**ultural equivalence. The Taxonomy refers to a comprehensive list of effective strategies for Chinese-to-English geotourism interpretation of the ABC elements.

The SSC model and the Taxonomy altogether provide a useful and practical system for guiding further interpretation practices in geotourism, especially in geoparks involving Chinese-to-English translation. A highlight of my method used in the previous three empirical studies (i.e., Chapter 4 to 6) lies in the use of authentic geotourism data collected from six Chinese UGGps, not only providing the resource on such topic, but also complementing previous translation studies that only use limited text data. However, although data from six geoparks covers a wide range of linguistic landscape of geotourism, the resulting Taxonomy would benefit from further validation and refinement by using additional geotourism data from three different Chinese UGGps. In general, because of the indefiniteness of linguistic data, it is always encouraged for researchers to reduplicate completed empirical studies for validating its results (Markee, 2017; Peels, 2019). Therefore, the following chapter is set to accomplish this aim, by using additional data to validate and further complete the Taxonomy established in the previous two chapters (i.e., Chapter 5 and Chapter 6).

In chapter 7, I used newly acquired geotourism data of ABC elements from Mount Kunlun, Fangshan and Xiangxi UGGps. I found that the SSC equivalence Model and the taxonomy for Chinese-to-English geotourism interpretation strategies were effective. In other words, this part of the research endorsed the use of the interpretation strategies to achieve SSC equivalence. In addition, I found a new effective strategy (Combination) for interpreting geological process.

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Chapter 7: Empirical Study 4 – A New Approach to the Interpretation of Geotourism Texts (*Geoheritage*)

Abstract

The importance given to geotourism reflects public awareness of the urgency of environmental conservation that includes geomorphological, ecological, and cultural knowledge. The recent growth of geotourism has increased the demand for high-quality geotourism interpretation to ensure accurate data communication. Nonetheless, the lack of systematic theoretical guidance has meant interpreters frequently resort to haphazard and ineffective interpretation strategies. Therefore, to enhance interpretation, Li et al. (2022b; 2022c; 2024) established the **S**emantic, **S**tyle and **C**ultural (SSC) equivalence Model and the taxonomy of geotourism interpretation strategies (hereafter, Taxonomy) based on a corpus-based method and the theoretical framework of Hu's (2003) Eco-Translatology. Since this research is so recent it remains untested in the field. This paper aims to evaluate the effectiveness of these models using new geotourism data concerning **A**biotic, **B**iotic and **C**ultural elements from three Chinese UGGps (Fangshan, Xiangxi and Mount Kunlun), the corpus-based method, and Eco-Translatology.

Quantitative and qualitative analysis findings support the validity of both the SSC Model and the Taxonomy. Firstly, we found that most of the geotourism interpretation strategies employed to interpret geodata were derived from the Taxonomy in alignment with principles of Eco-Translatology to attain the SSC equivalence. Secondly, with the new data, we were able to find usage patterns that were previously missing in Li et al.'s (2022b; 2024) Taxonomy. Thirdly, we identified a completely new strategy used in interpreting geological processes. Finally, this paper further illustrated how potentially ineffective geotourism interpretations can be optimised by effective interpretation strategies from Li et al.'s Taxonomy (2022b; 2024) to achieve SSC equivalence.

Keywords: Geotourism interpretation; SSC Model; Interpretation strategies; Corpus-based method; Eco-Translatology

1. Introduction

Geotourism is a type of tourism which focuses on geology and landscape as the basis for providing visitor engagement, learning, and enjoyment (Geological Society of Australia 2015; Dowling and Newsome 2018). It prioritises the exploration of the earth's geomorphology (geological features and processes) to promote appreciation and preservation of both ecological (flora and fauna) and cultural (people's lifestyle) aspects of geotourism. According to Dowling (2013), geotourism focuses on three elements: **A**biotic; **B**iotic; and **C**ultural (or, A, B, and C). Dowling (2013) argues for the primary importance of the **A**biotic element, specifically geological features (GF) and processes (GP), because they determine flora and fauna (i.e., **B**iotic element). By extension, he claims the interplay between its **A**biotic and **B**iotic components influence the **C**ultural ways in which people have lived in the area both past and present (Dowling 2013).

Geoparks are the ideal destination for geotourism activities, as these provide access to a wide range of features of landscape, as well as to living creatures, in mostly pristine geological condition (Dowling 2013). The United Nations Educational, Scientific and Cultural Organisation (UNESCO 2006) defines a geopark as 'a nationally protected area that contains a number of geoheritage sites of particular importance, rarity or aesthetic appeal'. In the past few years, the rapid growth in geotourism has created a need for effective geotourism interpretation. In geoparks, interpretation can be carried out through interpretive signage, display boards, brochures, and geological museum displays, all of which provide sources of geotourism data related to the ABC elements noted above. Unfortunately, the majority of interpreters involved in servicing geotourism interpretation seem not to be equipped to effectively interpret all Chinese-to-English (C-E) geotouristic texts. As Ng (2017) highlights, the lack of a systematic approach to interpretation not only impedes the accurate transfer of geotourism data and therefore the objectives of learning, education, and conservation, but also impedes the development of geotourism research. Both Ng (2020) and Li et al. (2022a) emphasise that the establishment of a systematic interpretation system is of utmost urgency to optimise the C-E interpretation process, and to provide guidance to interpreters working with geotourism data.

To address this issue, Li et al. (2022b; 2022c; 2024) have developed a rigorous system for the interpretation of the ABC elements in geotourism contexts. This system comprises: 1) the SSC (Semantic, Style and Cultural) equivalence Model for evaluating the quality of C-E geotourism interpretation; and 2) the taxonomy of effective geotourism interpretation strategies (hereafter, Taxonomy; see Appendix A). The Model and Taxonomy were developed through quantitative and qualitative analysis of a corpus representing C-E interpretations of informational texts found in Chinese UGGps. The analysis used Hu's (2003) Eco-Translatology as a guidance to evaluate the effectiveness of interpretations of the ABC elements and to improve the ineffective interpretations identified in the data. Although the SSC Model and Taxonomy have great potential to enhance interpretation quality of geotourism expressions, their utility has not yet been validated by empirical research. Therefore, in this paper, we use interpreted geotourism data from three Chinese UGGps (i.e., Mount Kunlun, Fangshan and Xiangxi) to examine the effectiveness of the Model and the Taxonomy described above.

2. Literature Review

The interpretive concept of the ABC (**A**biotic, **B**iotic and **C**ultural) elements, first proposed by Dowling (2013), is gaining wider acceptance because of its geographical adaptability and application across many fields of study, including geotourism. For example, using the ABC concepts, Pásková et al. (2021) conducted a comparative

analysis of interpreted geotouristic texts pertaining to two locations: the Colca canyon and volcanoes in Andagua, Peru; and Muroto in Japan. The researchers in Muroto observed a high level of quality in their interpreted texts which employed audio and visual images on interpretive boards. In contrast, Andagua depended only on a minimum amount of text on interpretive boards (informational display boards), resulting in substantial omission of local cultural information. Later research by Migoń and Pijet-Migoń (2022) explored interpretation of the relationships between Cenozoic volcanic activity and host sedimentary rocks (mainly Cretaceous sandstones). They used a three-tiered framework (i.e., field work, website resource, and literature survey) to review and evaluate the interpretation of ABC elements and found that the accurate adherence of complex geological relationships in interpretations preserve the essence of biodiversity and sources of mineral wealth. Migoń and Pijet-Migoń (2022) concluded that effectively interpreting these geological and biological relationships to geotourists can create significant opportunities for the popularisation scientific education. Meanwhile, Rohaendi et al. (2022) applied the ABC concept to investigate geodiversity, biodiversity, and cultural diversity in the mining landforms (anthropogenic landforms) of Sawahlunto National Geopark in Indonesia. They found that providing effective interpretation to managers of tourism development promoted a balance for conservation against unchecked mining activities in the geopark.

Although previous studies (i.e., Pásková et al. 2021; Migoń and Pijet-Migoń 2022; Rohaendi et al. 2022) applied the ABC concept for the purposes of evaluating interpretation of geotourism, their research did not use linguistic methods (Li et al. 2022a). To fill this research gap, Li et al. (2022c) pioneered the use of linguistic methods in the C-E interpretation of Chinese UGGps. Specifically, Li et al. (2022c) created a corpus of text interpretations of the ABC elements used in two Chinese UGGps (Taishan and Leiqiong). These linguistic data were manually identified and categorized into effective and ineffective interpretations based on Hu's Eco-Translatology (2003). Through careful qualitative and quantitative analysis, the author eventually established the SSC Model used for benchmarking the quality of geotourism interpretation. Thus, they concluded the following the SSC Model can help to minimize ineffective interpretation of C-E geotourism expressions and ensure precise transmission of geotourism information in Chinese UGGps. They revealed eight interpretation criteria in all of the SSC categories. For semantic equivalence, these are linguistic accuracy, scientific accuracy of terminology, reader acceptability of terminology, and semantic completeness of information. For style equivalence, these are logical syntax, concise syntax, and appropriate voice syntax. The final criterion pertains to accurately conveying the connotation of the original cultural elements. Along the same line of research, Li et al. (2022b, 2024) empirically demonstrated that the SSC model would serve as an effective tool for constructing a taxonomy of interpretation strategies pertaining to geotourism. Using different Chinese UGGps, Li et al. (2022b) recommended effective strategies for interpreting various elements in A (GF and GP) and C (local human lifestyle), while Li et al. (2024) discussed six subgroups of interpretation in B (flora and fauna). Appendix A provides a detailed description of each of the interpretation strategies with examples.

Therefore, Li et al. (2022b; 2022c; 2024) contributed to the establishment of a quality assessment model (i.e., SSC) and a taxonomy of effective interpretation strategies for geotourism. However, without any empirical evidence to test their SSC model and taxonomy in the innovative field of geotourism interpretation, their work remains a theory and still leaves important aspects unvalidated. Therefore, this paper aims to validate the use of geotourism interpretation strategies using data from three other Chinese UGGps to determine whether the Model

and the Taxonomy can be applied to broader context. Specifically, we propose the following research question (RQ):

> **RQ:** Would the Chinese-to-English geotourism interpretation data in three Chinese UGGps (Mount Kunlun, Fangshan and Xiangxi) align with the SSC model and taxonomy of interpretation strategies based on Eco-Translatology?

If it is aligned, that means the SSC Model and the Taxonomy, developed using geotourism interpretation data in other UGGps can be generalised and applied to new dataset. More specifically, this means that the C-E geotourism interpretations in the new dataset should be able to successfully categorised and identified into the Taxonomy developed by Li et al. (2022b; 2024) to achieve SSC equivalence, and if problematic interpretations are identified in the new dataset, the Taxonomy should be able to help with systematically improving the interpretation problems as well. If the empirical evidence show alignment, it should solidify the validity of the existing model; meanwhile, if misalignment is identified, it may signify a need for modifications of the existing model.

To address this research question, we follow Li et al. (2022b; 2022c; 2024) and apply the corpus-based method with the guidance of Eco-Translatology for quantitative and qualitative analysis of geotourism expressions obtained from the above mentioned three Chinese UGGps: Fangshan, Xiangxi and Mount Kunlun. In the next section, we proceed to discuss in detail the theoretical framework of Eco-Translatology. More details of the research data and method are described in Section 4.

3. Theoretical Framework

As mentioned above, this study uses a corpus-based method to examine geotourism interpretation in geoparks. We employ the Hu's (2003) Eco-Translatology as the theoretical foundation. Hu's approach (2003) emphasises the fluid role of the translator to 'adapt' and 'select' using a multi-dimensional process of interpretation. His concept of 'multi-dimensional adaptation' refers to prioritising the language and cultural needs of the audience. These adaptations aim at the optimal translation outcome for the target readers. This theory applied to geotourism interpretation means interpreters are required to adapt their approach to accommodate the language proficiency, cultural background, and age groups of geotourists. Embedded in this theory of adaption is flexibility. For instance, when interpreting the formation of GF, in complex Chinese sentences, the interpretation must be linguistically changed into the simpler English syntax. Effective adaption and flexibility in interpretation ensures high quality of information transmission among the general public, as well as, the geotourism researchers; therefore, it facilitates the purposes of geotourism - appreciation, learning, and contribution to the preservation of the Earth.

Eco-Translatology highlights a three-dimensional transformation which is considered in the interpretation process: linguistic, cultural, and communicative. The linguistic dimension of transformation concerns the language in word choice and language style (Hu 2003). The cultural dimension of transformation focuses on communicating the connotations of the source culture (Hu 2003). The communicative dimension of transformation emphasises the effectiveness of communication outcome between texts and audience (Hu 2003). The more dimensions are met, the higher the quality is of the interpretation.

Therefore, Eco-Translatology provides a framework that allows for the identification of effective interpretation. It also provides a process of removing and optimising ineffective interpretation in all ABC categories. As an example of effective interpretation at the **A**biotic (GF and GP) level, the interpreter literally interpreted the GF

‘熔岩流’ into ‘lava flow’, choosing accurate words in Leiqiong UGGp. This interpretation aligns with the linguistic and communicative dimensions of transformation (Hu 2003). An ineffective example of interpretation at the **A**biotic level can be found in Shilin UGGp, where the GP ‘在 2.7 亿年前的早二叠纪时代，石林地区为海洋环境，海底沉积形成了数百米厚的石灰岩，后经地壳抬升, 石林地区处于湿热古海岸边缘，溶蚀形成了最早期的石林。’ was ineffectively interpreted into ‘In the early Permian era 270 million years ago, the Shilin area was a Marine environment, and hundreds of meters of thick limestone was deposited on the seabed, the crust lifted up, and the Shilin area was at the edge of the hot and humid ancient coast, and the earliest stone forest was formed by dissolution.’ This English interpretation falsely adhered to the Chinese sentence style where multiple subject-verb structures are combined into one long complex sentence, making it a run-on sentence in English. While in reality, an accurate English interpretation should have been altered into a more simplistic style with clauses or shorter sentences to achieve style equivalence. Thus, guided by the Hu’s (2003) linguistic and communicative dimensions of transformation, we could revise it into ‘In the early Permian period, 270 million years ago, the Shilin region was a marine environment. The sedimentation on the seabed created a layer of limestone hundreds of meters thick. After the uplift of the earth’s crust, this region shifted to the edge of the hot and humid ancient coast where the forces of corrosion formed the early stone forest landscape.’

As an effective interpretation example at the **B**iotic level, the interpreter employed the Latin and English strategy to interpret the common flora name ‘香榧树’ into ‘*Torreya grandis* (Chinese nutmeg tree)’ in the Yandangshan UGGp. The simultaneous use of both English and Latin is an illustration of linguistic and communicative transformation, which preserves the scientific essence of flora name interpretation while aiding geotourists in remembering the specific plants (Li et al. 2022c). On the contrary, the following case of fauna process interpretation at the **B**iotic level can be seen as an ineffective example of interpretation that failed to meet style equivalence. When describing the features of ‘*Buteo Buteo* (Common Buzzard)’, the following Chinese description ‘体色变化较大，上体主要为暗褐色，下体主要为暗褐色或淡褐色，具深棕色横斑或纵纹，尾淡灰褐色，具多道暗色横斑。’ was ineffectively interpreted into a very long English sentence ‘The body colour changes greatly; the upper body is mainly dark brown, and the lower body is mainly dark brown or light brown, with dark brown horizontal spots or longitudinal stripes; the tail is light grayish brown with multiple dark horizontal spots.’. As mentioned before, the Chinese syntax allows multiple subject-verb structures to be in the same sentence where a comma is applied at the very end of a long combination of clauses. However, it is rarely so in English. The English sentence style is typically more concise where main ideas are separated by sentences, rather than piling up short clauses. Therefore, when a long Chinese sentence of the source text (ST) was interpreted into a long English sentence, it violates the style equivalence.

At the **C**ultural level, in Zhangjiajie UGGp, the interpreter successfully employed a cultural interpretation according to Buddhist culture that aligns with principles in Eco-Translatology: the term ‘送子观音’ was interpreted as ‘Songziguanyin, a Goddess in Chinese folk religion, who is believed to send children to people who piously worship her’. This Buddhist fertility goddess, ‘送子观音’ was worshipped by Chinese people in the feudal era. There is no equivalent name for such a cultural character in English, so the ‘addition’ strategy (providing additional information of a term) was used to achieve semantic and cultural equivalence. As an ineffective example, in Taishan UGGp, ‘小篆’, a form of Chinese calligraphy, was ineffectively interpreted as ‘Xiaozhuan’ via using

Chinese Pinyin to replace English words without providing additional information. This results in communication failure with geotourists because it failed to convey the connotation of such a term. Guided by Hu's Eco-Translatology, we effectively revised it into 'Xiaozhuan (an ancient Chinese calligraphy style) through the 'addition' strategy.

These examples of the three elements (ABC) in geotourism, demonstrate that Eco-Translatology is an effective solution for the challenges encountered in geotourism interpretation. It addresses the issues related to language, culture, and communication and provides effective strategies to overcome them.

4. Corpus and Methods

4.1 Data collection

In this present study, we selected three Chinese UGGps (Mount Kunlun, Fangshan and Xiangxi) as a case study for data analysis. These parks were chosen because their interpretation systems were recently updated by an advanced CATTI (China Accreditation Test for Translators and Interpreters) certified interpreter in 2023. Thus, the interpretation of geotourism expressions is of a superior quality. The managers of the three Chinese UGGps provided us with all the interpretation materials, such as geoparks' interpretative signs, brochures, and data from geological museums in the form of Word documents (The Chinese and English geotourism data are stored in parallel format in these Word files.).

The purpose of this paper is to test the effectiveness of the SSC model and the taxonomy of geotourism (ABC) interpretation strategies; therefore, irrelevant information in the original texts (e.g., geoparks' route indication and safety regulations) was removed prior to the composition of the corpus. As a result, the dataset specifically includes passages related to the A (GF and GP), B (flora and fauna) and C (human lifestyle) elements. Once the data cleaning for all documents was completed, the datasets were consolidated into a single Word document. In this single document, we performed a manual check to ensure the accurate correspondence between the geotourism data in Chinese and its English interpretation. The original Chinese interpretation was displayed first, followed by the corresponding English interpretation. The final C-E parallel geotourism corpus (PGC) includes 31,679 Chinese characters and 50,686 English words, totaling 82,365 words.

4.2 Analytical procedure

Following the composition of the C-E PGC, a sequence of procedures was undertaken to analyse the corpus using corpus software tools. First, we imported the generated document containing ABC elements into Tmxmall, which is a tool that allows alignment of the parallel texts in both languages to ensure accurate correspondence between Chinese and English interpretation. Secondly, according to the categorisation of Dowling (2013), we further identified and labelled the ABC data into subcategories. A element has geological feature (GF) and geological process (GP); B element has flora (FL) and fauna (FA), plus common plant names (CPN), common animal names (CAN), local Chinese plant names (CCPN), local Chinese animal names (CCPN), flora processes (FLP), and fauna processes (FAP); the C element has people's lifestyle (PL). PL category includes: both past and present such as local religion, art, and architectural culture (Dowling 2013). After this identification of data into subcategories, we proceeded to linguistically identify (i.e., tag) the effective and ineffective interpretations based on three-dimensional transformations of Eco-Translatology. The tags are based on the appropriate types of interpretation strategies proposed by scholars (Li et al. 2022b; Li et al. 2024), such as literal interpretation (LI) or creative

interpretation (CI). In the same way, ineffective interpretation (i.e., interpretation problems) were labeled as Misinterpreted or Incongruent Interpretation for Same Name (IISN) for potential optimisation. The annotation scheme used in this paper is given in Appendix B.

With the help of Tmxmall, we tagged effective and ineffective geotourism interpretation incidences. For example, the interpretation of the GF '单面山' as 'Cuesta' was tagged as an effective interpretation, because 'Cuesta' is a direct English equivalent to the Chinese word '单面山'. The use of literal interpretation (LI), based on linguistic and communicative dimensions, ensures that the meaning is accurately conveyed in the target language. The label we used for this effective interpretation was <AE, IS, GF, LI>. The four tags in this label respectively represent 1) its main elements in geotourism ('AE' stands for the 'Abiotic Element'), 2) its category of effectiveness (IS represents interpretation strategies as opposed to interpretation problems), 3) sub-categories of the main element ('GF' stands for 'geological feature' which is one of sub-categories of the Abiotic element), and 4) interpretation strategy ('LI' represents a specific interpretation strategy, literal interpretation). In another example, the interpreter ineffectively interpreted the GF '银狐洞' into 'Yinhu Cave'. This fails to capture the semantic meaning and communicative purpose of the GF. The name '银狐洞' derives from its resemblance to a fox, emphasising its distinctive shape. Therefore, we annotated this ineffective interpretation as <AE, IP, GF, Misinterpreted>. This tagging system allows for the retrieval of both effective (i.e., IS) and ineffective interpretations (i.e., IP) within the corresponding subcategories of ABC elements. Following this process, we imported the annotated data into Sketch Engine for quantitative and qualitative analysis. Sketch Engine is a language processing tool with a wide range of features such as extracting and counting target linguistic features using corpus query language (CQL).

After importing the C-E PGC in Sketch Engine, we first performed the quantitative analysis of the effective interpretations within each subcategory of ABC elements (A element: GF and GP; B element: CPN, CAN, CCPN, CCAN, FLP and FAP; C element: PL). We counted the frequency of interpretation strategies occurred in the corpus to determine the interpretation norms of geotouristic texts. To do this: We provided the function formula (see Figure C1 in Appendix C) to Sketch Engine (on the PARALLEL CONCORDANCE page) to accurately identify the different types of interpretation strategies, as well as, calculate their frequencies and proportions in the C-E PGC. After the quantitative analysis, based on the annotations, we returned to the individual examples of each interpretation strategy and qualitatively examined the similarities and differences in the application of the same type of interpretation strategy, across each subcategory in ABC elements (Laviosa 2002).

Although the CATTI-certified translator translated the geotourism information of three Chinese UGGps (Mount Kunlun, Fangshan and Xiangxi), it is possible to encounter ineffective interpretations that have been identified through the three-dimensional transformations of Eco-Translatology. We first entered the function formula into the PARALLEL CONCORDANCE page of Sketch Engine to retrieve interpretation problems in each subcategory of ABC elements (see Figure C2). As evident from the comparison with the formula employed to retrieve the effective interpretation strategy, the difference in this formula lies in the utilisation of IP (interpretation problem) rather than IS (interpretation strategy). We then identified the interpretation problems that arose in each subcategory of ABC to optimise them. After this quantitative analysis, we proceeded to use the CQL to look at all the examples of each type of interpretation problem within each geotourism (ABC) subcategory for qualitative analysis.

To review, the overall purpose of our analysis is to show: 1) which types of effective interpretation strategies and problems were prevalent in the geotourism data; 2) whether interpretation strategies used align with the Taxonomy proposed by Li et al. (2022b; 2024); and 3) how the ineffective geotourism interpretations are optimised by the strategies proposed by Li et al. The following section reports the results of both quantitative and qualitative analysis of each subcategory and the type of interpretation strategy or problem that appeared.

5. Results and Discussion

This section reports the results of the quantitative and qualitative analysis of the PGC dataset. The following subsections are arranged according to the ABC elements and their subcategories. All of the examples for the following section are presented in Appendix D for the nine geotourism sub-categories. For ease of reference, the source text of a specific example is ST followed by its number (e.g., ST 18 for '山茶'), and the target text are referred to as TT followed by its number (e.g., TT 18 for 'camellia').

5.1 Interpretation strategies and SSC equivalence in Abiotic element

5.1.1 Interpretation strategies and SSC equivalence in geological features (GFs)

Results of the GF subcategory in the A element showed an unsurprising tendency to literal interpretation, given the relative simplicity of its nature, that of naming a physical object. In this category, the interpreter was able to use a straightforward literal interpretation (LI) while employing two other interpretation strategies, namely Transliteration and Free Interpretation (TFI) and addition (Addition). To calculate the frequency and proportion of these three interpretation strategies, we used the CQL function formula [word="AE"] [word=","] [word="IS"] [word=","] [word="GF"] [word=","] [word="Specific IS"], where the 'Specific IS' within the last square brackets could be replaced by 'LI', 'TFI' or 'Addition' depending on which interpretation strategy was being analysed. Figure 1 shows that LI comprises by far the largest percentage among the three strategies, accounting for 83.74%, followed by TFI (12.38%). The proportion of addition strategy is minimal, at less than 4%. All of the LI examples of GFs from the PGC can be mapped onto dimensions of linguistic and communicative transformations in Hu's (2003) Eco-translatology to achieve semantic equivalence.

Interpretation Strategies	Frequency	Percentage
Literal Interpretation	1427	83.74%
Transliteration and Free Interpretation	211	12.38%
Addition	66	3.88%
Total Number	**1704**	

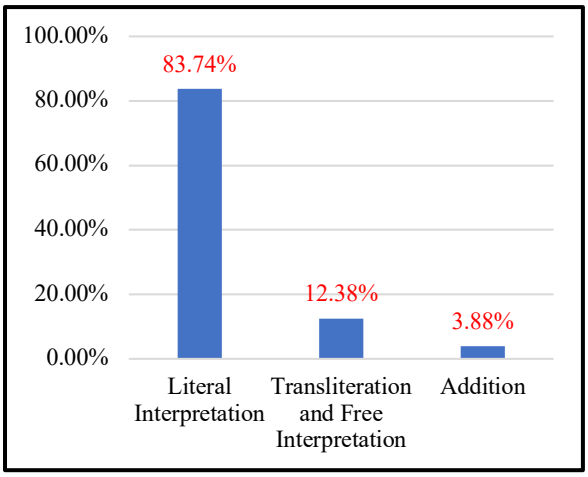

Fig. 1. Frequency of Interpretation Strategies for Geological Features in Chinese-to-English PGC

As shown in the results, LI was used to effectively handle most terminology related to GFs. Through a closer qualitative analysis of the GF terms in the PGC, we identified three distinct patterns to which the LI strategy can

be applied. The first pattern is where there exists a corresponding English equivalent. For example, the interpreter literally rendered '夷平面' into 'planation surface' using the English equivalent. The second pattern is where interpretation of rocks, caves, and peaks reflects their shapes. For instance, the shape of '鳄鱼石' resembles a crocodile so the interpreter provided a direct interpretation of the Chinese character description '鳄鱼石 (crocodile-shaped rock)', thus aiding geotourists' visualisation. The last pattern is where GFs are described using the Chinese-four-character structure. The 'four-character structure' in Chinese refers to a traditional linguistic form in which a complete phrase or idea is expressed using only four characters (Xiao 2010). For instance, through choosing precise and dramatic English terms, the interpreter effectively captured the landscape of '山谷陡峻' into 'steep cliffs and narrow gorges'. These patterns of literal GFs are consistent with Li et al.'s (2022b) research findings.

The two strategies, TFI (12.38%) and Addition (3.88%), account for less than 20% of the total. These strategies, although much lower in frequency, are important for tackling nuanced cultural meanings that cannot be resolved through LI. The TFI strategy was used when the source text of Chinese cultural elements is composed of proper nouns and common nouns, with both noun elements containing cultural references that require the interpreter to make explicit. As a result, the interpreted texts do not conform neatly to the **style** of the source texts, but convey the most accurate cultural meaning. Addition is a strategy used to provide additional information that was not originally contained in the source texts. This strategy is used when the terminology of a GF has implicit cultural connotations behind its literal wording, but unlike TFI, Addition typically that need explanatory information in a parenthesis that does not interfere with the style of the source texts.

In our analysis of 211 specific examples of TFI within the PGC, we identified a pattern indicating that GFs consist of two parts: the former part being cultural function characters, and the latter part being common nouns. Direct interpretation cannot adequately reflect the complexity of this combined meaning. In such cases, the former part can be transliterated, while the latter part can be interpreted by free interpretation. For instance, '灵洞天窗群' was effectively interpreted into 'Lingdong cave karst window groups' by aligning it with three dimensional transformations to achieve semantic equivalence. In this example, the former part '灵洞' is the sound change of '利洞嘎 ($li^{35}tuŋ^{35}ka^{53}$)' in Tujia language, which belongs to Chinese cultural function characters (Chen and Xiang 2019). Thus, it was interpreted into 'Lingdong cave' by transliteration, which closely resembles the original. The literal meaning of the latter part '天窗群' is 'skylight group', which, through free interpretation, was interpreted into 'karst window groups'. This interpretation accurately expressed that the GF of '天窗' corresponds to the karst landform, thereby avoiding any ambiguity in meaning that could arise from a literal interpretation. The pattern of this strategy matches Li et al.'s (2022b) Taxonomy. Meanwhile, the interpretation strategy 'Addition' was used in 66 occurrences in the PGC. For example, to achieve to semantic and cultural equivalence, '圣米' was effectively interpreted into 'Holy rice (Quartz grains)'. As a GF, the quartz grains appear as small rice shapes. Quartz grains are caught and deposited in cave fissures during the long process of geological filtration. The quartz crystals are clean and shiny. By adding the explanation of 'Quartz grains' to the interpretation, the interpreter facilitates geotourists' understanding the GF of 'Holy rice'. The pattern of this strategy also corresponds to Li et al.'s (2022b) Taxonomy.

Further analysis reveals there are two types of GF interpretation problems, IISN and Misinterpreted. Firstly, there is only one example of IISN found in the PGC. IISN refers to the phenomenon where same terms were interpreted into multiple different versions of English (Li et al. 2022b). For example, the interpreter inconsistently rendered '昆仑山' into three versions: 'Mount Kunlun', 'Kunlun Mountains' and 'Mt. Kunlun'. Li et al. (2022b) highlighted that when GFs have official names already recognised by UNESCO, the interpreter should use the official names. Thus, we selected the term 'Mount Kunlun', the UNESCO official name (https://en.unesco.org/global-geoparks/mount-kunlun). In terms of Misinterpreted examples, we only found two in the corpus. The first example is the interpretation of a geographical marker between the strata of two different global geological eras: '金钉子', which was literally interpreted into 'Golden Spike'. This interpretation is misleading as it is not a spike nor does it resemble the shape of one. Thus, in this case a literal interpretation results in the loss of semantic meaning. This is confirmed by Li et al. (2022b) emphasising that by adding descriptive words to interpret GFs, the function and characteristics of these features can be better understood. Thus, we revised 'Golden Spike' into 'Golden Spike (Global Standard stratotype section and point)' to achieve semantic equivalence. The other example of Misinterpreted is the GF '斩云剑', which is vertical joints formed by spherical weathering. Originally, it was ineffectively interpreted into 'cutting cloud sword'. In Chinese, '斩云' is a verb-object construction where the verb is used attributively. However, in the structure of English, verbs cannot be used as attributives to modify nouns, whereas adjectives can. Therefore, in this case, we can use the shift strategy to revise it. Part-of-speech conversion (shift) is necessary to adapt to the grammar and expression habits of target readers to achieve semantic equivalence (Laviosa 2002). Thus, guided by linguistic and communicative transformations, we interpreted '斩云剑' as 'Cloud-cutting sword'. The verb phrase '斩云' in Chinese was converted into the English adjective 'cloud-cutting' to modify the noun 'sword'.

It is worth noting that, in Li et al.'s (2022b) Taxonomy (see Table 1 in Appendix A), although the Shift strategy employed in the interpretation of GFs was included, the specific pattern for its use was not established due to the limited sample size (N=3) at the time of the research. One of the three examples in Li et al.'s (2022b) study was the interpretation of the GF '仙人造田'. This Chinese ST was effectively interpreted as 'Divinely Crafted Farmland' using the shift strategy. '造田' is a verb-object construction similar to the verb phrase in the previous example. Thus, the verb '造' needed to be converted into an adjective (i.e., 'Crafted') using the Shift strategy, and the noun '仙人' should be converted into an adverb (i.e., 'Divinely'). Considering both examples found in Li et al. (2022b) and those found in the current study, we can establish a pattern for the Shift strategy: when interpreting GFs, the interpreter should select the appropriate part of speech based on English grammar rules.

5.1.2 Interpretation strategies and SSC equivalence in geological processes (GPs)

GPs by their complex nature were found to demand more diverse interpretation strategies. In fact, five strategies were identified in the PGC: Division and Shift (DS), Combination, Literal Interpretation (LI), Shift and Division. The calculation of interpretation strategies for GPs followed a similar process to those of the GFs[1]. Figure 2 demonstrates that the top two most frequently used strategies (i.e., DS; Shift) account to more than 50%. What is

[1] We applied the function formula [word="AE"] [word=","] [word="IS"] [word=","] [word="GP"] [word=","] [word="Specific IS"] in CQL to search the entire C-E PGC, where 'Specific IS' in the last square brackets can be replaced by 'DS', 'Combination', 'LI', 'Shift' and 'Division'.

significantly different from the Shift strategy used in GFs is that, in interpretations of GPs, the shift often occurs to convert voice, rather than part of speech. This is because GPs involve the action of natural forces, such as crustal movement and sedimentation, which lends itself toward the use of passive voice for description of inanimate processes (Li et al. 2022c). In the Chinese language, many phrases need to be contextually identified for the correct use of voice (i.e., active voice and passive voice can appear in the exact same wording). For that reason, C-E interpretations of GPs need to take into consideration the appropriate conversion of voice. In addition, compounded sentences are commonly used in Chinese where chunks of meaning are expressed in the same sentence only separated by comma, but if this form of sentence is directly borrowed into English, it is incoherent in English.

Interpretation Strategies	Frequency	Percentage
Division and Shift	461	32.91%
Shift	337	24.05%
Literal Interpretation	266	18.99%
Division	183	13.06%
Combination	154	10.99%
Total Number	**1401**	

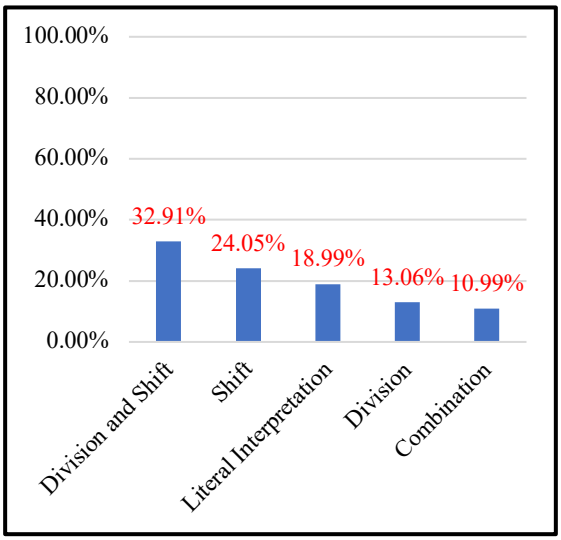

Fig. 2. Frequency and Interpretation Strategies for Geological Processes in Chinese-to-English PGC

As shown in Figure 2, DS strategy (32.91%) is the most frequently used of the five interpretation strategies. The analysis of PGC reveals that the Chinese GPs contain long complex sentences with explicit and implicit passive structures. Explicit passive structure in Chinese means it uses the passive marker (i.e., 被), and the implicit passive structures can vary in their forms but can only make sense when interpreted contextually as passive voice. The process of shifting either of these two passive structures into English passive voice is simply labelled 'Shift'. As noted in Chu (1973) and Xiao et al. (2006), the process of interpreting or translating a passive-voice Chinese sentence into a passive-voice English sentence is called an 'equivalence shift'. For example, ST 6 (see Appendix D) was interpreted into TT 6, where the interpreter divided the long Chinese sentence into two simple sentences. The explicitly marked phrase '被抬升' was rendered into the English passive verb phrase 'were uplifted' while the implicit passive '形成' was interpreted into 'was formed'.

The second most frequent strategy of this subcategory is Shift (24.05%). In the PGC, we found that explicit and implicit passive structures were embedded into a short Chinese sentence used to describe GPs, so the Shift strategy without the step of division was sufficient. For example, ST 7 was interpreted into TT 7, where the interpreter achieved style equivalence by respectively rendering the explicit passive '被不断侵蚀' as 'are continuously

eroded' and the implicit passive '形成' as 'are formed'. This strategy is also part of the Taxonomy proposed by Li et al. (2022b).

The next two strategies, namely LI (18.99%) and Division (13.06%) are primarily used in interpreting the formation of GFs. Through the qualitative analysis of the PGC, we identified two patterns for interpreting GPs using LI: 1) GPs consisting of jargon that has its equivalent in English; and 2) GPs that are described in short sentences without implicit and explicit passive structures. For instance, ST 8 was literally interpreted into TT 8, whereas the terminology (GP) '拔蚀、磨蚀和冻融风化' was directly interpreted into 'plucking, abrasion, and free-thaw weathering'. This interpretation aligns with the linguistic and communicative transformation to achieve semantic and style equivalence. In terms of division, we examined 183 examples and discovered that they shared a common pattern: GPs were described in long Chinese sentences without explicit ('被' marker) and implicit passive structures. For instance, ST 9 was interpreted into TT 9, where the interpreter divided the long Chinese sentence into two short English sentences, in alignment with linguistic and communicative transformations to achieve style equivalence. Up to this point, the four mentioned strategies (DS, Shift, LI, and Division) are consistent with the Taxonomy proposed by Li et al. (2022b).

The last strategy is the Combination strategy, accounting for 10%. The PGC revealed that all 154 examples shared a common pattern of close logical relationship between two consecutive Chinese sentences describing GPs. The Combination strategy is employed to avoid repetition by using conjunctions or adverbial phrases to link clauses with a shared subject. For example, in the original text ST 10 which contains two separate sentences, the subject of the first sentence and second sentence is the same, which is '白云岩 (Dolomite)'. As we can see in TT 10, the interpreter thus used clause structures to combine the meaning in both Chinese sentences into one coherent English interpretation. The Combination strategy creates coherent English sentences with the same meaning using an adverbial phrase. The Combination strategy is a new approach which was not previously included in the Taxonomy proposed by Li et al. (2022b). This is a valuable new strategy and will be included in future taxonomy of geotourism interpretation strategies as shown in Appendix E.

Finally, in GPs through qualitative analysis, we found nine cases of interpretation problems where implicit passive sentences were not effectively interpreted. For instance, ST 14 was ineffectively interpreted into TT 14 where the Chinese implicit passive structures '形成' and '变成' were not effectively shifted into English passive voice. Guided by linguistic and communicative transformations of Eco-Translatology, better style equivalence could be achieved by revising it into 'The greyish-green andesite with pores is formed by the cooling of erupted magma from volcanoes. After undergoing long-term weathering and erosion, the rock is transformed into various colours.'

5.2 Interpretation strategies and SSC equivalence in Biotic element

5.2.1 Interpretation strategies and SSC equivalence in common biotic names

Element B refers to flora and fauna, which have far different interpretation strategies. After initial analysis, four interpretation strategies were found which reflect expectations of literal and parallel Latin/English interpretation dominance. The four strategies found in the PGC --- Latin and English strategy (LE), Literal Interpretation (LI), Creative Interpretation (CI) and Foreignisation --- were used by the interpreter to interpret common biotic names. It is worth noting that for LE, the flora and fauna names are respectively interpreted using the official scientific names of the International Code of Nomenclature for algae, fungi, and plants (ICN 2018) and by the International

Code of Zoological Nomenclature (ICZN 2022)[2]. Figure 3 summarises the quantitative results of interpretation strategies found in the PGC. As we can see, LI and LE are the most frequently used strategies in interpreting common biotic names, while CI and Foreignisation are used much less frequently. The most used strategy is LI in interpreting common biotic names (45.34% for flora, and 57.31% for fauna). This is because that many common biotic names in Chinese already have existent corresponding English names (Li et al. 2024). Fauna names, have a slightly higher frequency of LI suggesting that plants exhibit more complexity and diversity compared to animals (Li et al. 2024). Next is the LE strategy, which involves using Latin names and English names to interpret common biotic names in Chinese. In this strategy, the Latin interpretation conforms to the principle of using Latin scientific names for flora and fauna by the International Code of Nomenclature for algae, fungi, and plants (ICN 2018) and the International Code of Zoological Nomenclature (ICZN 2022). The English interpretation in the LE strategy shows other interpretation patterns that are discussed in detail in the qualitative examples below. CI and Foreignisation are used but not as frequently in interpreting common biotic names in the PGC.

	Common Flora Names		**Common Fauna Names**	
Interpretation Strategies	Frequency	Percentage	Frequency	Percentage
Literal Interpretation	345	45.34%	349	57.31%
Latin and English	255	33.51%	170	27.91%
Creative Interpretation	107	14.05%	56	9.20%
Foreignisation	54	7.10%	34	5.58%
Total Number	**761**		**609**	

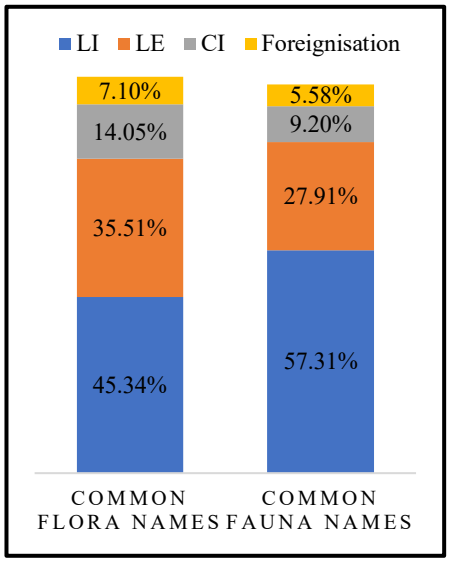

Fig. 3. Frequency and Interpretation Strategies for Common Biotic Names in Chinese-to-English PGC

The LI strategy is used when flora and fauna names are embedded in the text of interpretative boards and have direct English equivalents. For example, the Chinese phrase '翠雀' in ST 15 was literally interpreted as 'Chinese Delphinium' in TT 15. Similarly, the term '黑鹳' in ST 19 was literally interpreted into 'black stork' in TT 19. Both these Chinese terms have existent counterparts in English. This set of examples aligns with linguistic and communicative transformations to achieve semantic equivalence and Li et al.'s (2024) Taxonomy.

The CI strategy is used when dealing with plants and animals originating in China whose names did not have existent English counterparts. In these cases, the interpreter needs to creatively interpret either by borrowing the meaning of their Latin scientific names or by providing details about their appearance and connotation. For

[2] We respectively used the CQL function [word="BE"] [word="."] [word="IS"] [word="."] [word="CPN"] [word="."] [word="Specific IS"] and [word="BE"] [word="."] [word="IS"] [word="."] [word="CAN"] [word="."] [word="Specific IS"] to obtained the frequency and proportion of the above four strategies used in interpreting common biotic names. The 'Specific IS' can be replaced by 'LE', 'LI', 'CI' and Foreignisation.

example, the term '唐古拉点地梅' in ST 16 was interpreted as 'Tanggulashan rock jasmine' in TT 16. In this text, the flora name was creatively interpreted by borrowing its Latin name. The scientific name of '唐古拉点地梅' is '*Androsace tanggulashanensis*'. The specific epithet '*tanggulashanensis*' means a place, 'Tanggulashan' in China, and the genus '*Androsace*' means 'rock jasmine'. Similarly, '藏管尾犁胸蝉' in ST 20 describes an insect and was interpreted as 'Tibetan treehopper' in TT 20. In this case, the scientific name of '藏管尾犁胸蝉' is '*Darthula xizangensis*'. The specific epithet '*xizangensis*' refers to 'Tibetan' indicating its origin from Tibet, a region in southwestern China, and the genus '*Darthula*' means 'treehopper'. Thus, it was creatively interpreted as 'Tibetan treehopper' by borrowing the meaning of its Latin scientific name. These examples adhere to the principles of Eco-Translatology, and the CI strategy is validated in Li et al.'s (2024) Taxonomy.

The LE strategy is only used when common biotic names are stand-alone titles or captions. It entails a two-step process: Latin usage, followed by English. As the result of this strategy, Latin scientific names followed by English in parentheses (Li et al. 2024). For example, the fauna name '野牦牛' was interpreted as '*Bos mutus* (Wild yak)' in the title above the explanatory text on the interpretive boards, where the Latin name '*Bos mutus'* is provided in front of its English interpretation 'Wild yak' in parentheses. Another example, the flora name '独花兰' was interpreted as '*Changnienia amoena* S.S.Chien (Beautiful Changnienia)', where the Latin name was provided in front of its English name in parenthesis. In the LE strategy, the interpretation of the Latin names follows the guidelines provided by the ICN (2018) and ICZN (2022), while interpretation of the English names follows the strategies of CI and LI, as discussed above. As an illustration, in the examples provided above, the Latin interpretation '*Bos mutus'* of the fauna name '野牦牛' is provided by ICZN (2022), and its English interpretation 'Wild yak' used the strategy of LI. For the example of the flora name '独花兰', its Latin name was provided by the ICN (2018), and its English interpretation uses the strategy of CI.

Finally, the strategy of Foreignisation is used with the purpose of respecting the Chinese cultural origin or meaning of the interpreted terms. It refers to the interpretive process of selecting the appropriate English interpretation for certain common biotic names, even though there may be available Latin names for them. These Latin names are not chosen because they may contain affixes that indicate foreign origins (rather than China), which is typically a result of naming a species under colonisation by the person who discovered it rather than where the species is actually from. For example, the flora of Chinese origin '山茶' was interpreted into 'camellia' in the PGC, instead of its Latin scientific name '*Camellia japonica* L.' In this case, the specific epithet '*japonica*' means 'Japanese', and in many cases it was also referred to as 'Japanese camellia' because of this Latin interpretation. However, to avoid confusion in the interpretated name regarding its origin, the PGC documented its name as 'camellia'. Similarly, the Latin scientific name of '中华对角羚' was '*Procapra przewalskii*', where the specific epithet '*przewalskii*' refers to a Russian geographer, Noeolei Przewalski, who discovered this fauna native (gazelle) in China in 1875. Although this naming convention was conventional in honoring the discoverer, it may cause confusion about the origin of the fauna itself. Therefore, '中华对角羚' was interpreted as 'Chinese gazelle', providing an origin to the species. According to Ren (2020), the country of origin plays a significant role in determining the interpretation of biotic names. Thus, in a step towards authenticity of meaning, 'camellia' and 'Chinese gazelle' were chosen to effectively convey their Chinese origins to geotourists, and their Latin scientific names were omitted as unnecessary to identification. These two examples of interpreting local Chinese biotic

terms can be justified according to the three-dimensions of Eco-Translatology. The general pattern of Foreignisation of flora and fauna names is identified in Li et al.'s (2024) Taxonomy.

All of the above discussed strategies (i.e., LI, LE, CI, and Foreignisation) conform to Li et al.'s (2024) Taxonomy of effective geotourism interpretation strategies. The LI, LE, and CI strategies align with Hu's (2008) linguistic and communicative transformation to achieve semantic equivalence, while Foreignisation aligns with all of Hu's (2003) three dimensional transformations to attain semantic and cultural equivalence. Among all, we found one case that enhances Li et al.'s (2024) described patterns for the CI strategy because it is a fauna example. In Li et al.'s (2024) Taxonomy, the CI strategy was described as either 1) using Latin names as a bridge for English interpretation or 2) providing details about appearances of the flora or fauna. However, Li et al. (2024) only found examples for describing appearances of flora but not fauna names. In this research, we found the fauna name '阳彩臂金龟', which can be interpreted as 'Chinese varicoloured beetle'. Since the entire body of '阳彩臂金龟' shines in metallic green, metallic copper green and gold colour, therefore it was interpreted as 'Chinese varicolored beetle'.

So far in this section, although we have regarded strategies for interpreting common biotic names, we also discovered examples of their misinterpretation from the PGC[3]. For instance, the flora name '槭叶铁线莲' as the title on the interpretative board was inaccurately interpreted as '*Clematis acerifolia* Maxim. (clematis)'. In this example, the English name of '槭叶铁线莲' was simply interpreted as 'clematis'; however, there are hundreds of varieties of clematis, simply using 'clematis' to interpret this very specific type of flora is not loyal to its meaning. Moreover, since '槭叶铁线莲' is a unique type of flora native to China with no corresponding English term, which necessitates a creative strategy (Li et al. 2024). Thus, guided by Eco-Translatology, the English name of '槭叶铁线莲' should be optimised into 'maple-leafed clematis' through borrowing its Latin scientific name, '*acerifolia*' which means 'maple-leafed' (Li et al. 2024). Then, we searched for the misinterpretation of common fauna names[4]. We discovered seven examples. For example, the fauna name '中华奥锹甲' as the title on the interpretative board was interpreted as '*Odontolabis cuvera sinensis* (Chinese beetle)'. The English name of '中华奥锹甲' was ineffective interpreted as 'Chinese beetle', because there are many species that could be categorised as Chinese beetle. Li et al. (2024) have highlighted that the strategy of CI can be applied to interpreted English names of fauna that originate in or are native to China. Thus, a creative strategy can be employed from the Latin scientific name (Li et al. 2024). The Latin scientific name of '中华奥锹甲' is '*Odontolabis cuvera sinensis*'. In Latin, 'sinensis' indicates 'Chinese', while '*Odontolabis* cuvera' signifies 'Golden stag beetle'. Thus, guided by the linguistic and communicative transformations of Eco-Translatology, we revised '中华奥锹甲' as 'Chinese golden stag beetle' to achieve semantic equivalence.

5.2.2 Interpretation strategies and SSC equivalence in local Chinese biotic terms

The interpretation of local Chinese biotic terms largely parallels the interpretation of common biotic names as discussed in section 5.2.1. The difference lies in how the interpretation of local Chinese biotic terms encompasses

[3] We used the function [word="BE"] [word=","] [word="IP"] [word=","] [word="CPN"] [word=","] [word="Misinterpreted"] to retrieve the misinterpretation of common flora names. Eleven examples of native plants were found.

[4] The function [word="BE"] [word=","] [word="IP"] [word=","] [word="CAN"] [word=","] [word="Misinterpreted"] was used

local dialect and other elements of ecological culture. The choice of the three particular Chinese UGGps (Mount Kunlun, Fangshan and Xiangxi) used in this study allowed us to focus on local varieties of Chinese dialects to denote their local plants and animals, such as the Tibetan language, Fangshan, and Xiangxi dialects. The main patterns found in this subcategory were Literal Interpretation (LI) and Creative Interpretation (CI)[5]. In the PGC, all local Chinese biotic terms interpreted using these strategies conform to the three-dimensional transformations of Hu's (2003) Eco-Translatology to achieve semantic and cultural equivalence. Figure 4 illustrates that LI is the at least three times more frequently employed as an interpretation strategy for both local Chinese flora and fauna names. This indicates that the English names of most local Chinese biotic terms have direct equivalents in English. Therefore, the usage of CI is less prevalent.

	Local Chinese Flora terms		**Local Chinese fauna terms**	
Interpretation Strategies	Frequency	Percentage	Frequency	Percentage
Literal Interpretation	112	76.19%	78	87.64%
Creative Interpretation	35	23.81%	11	12.36%
Total Number	**147**		**89**	

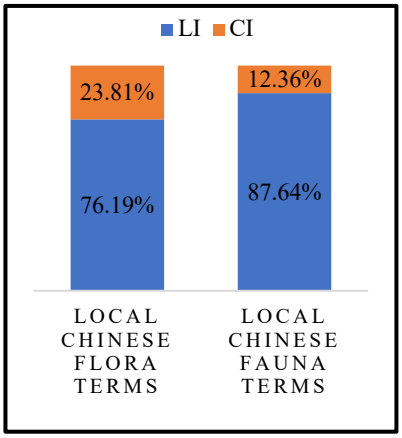

Fig. 4. Frequency and Interpretation Strategies for Local Chinese Biotic Terms in Chinese-to-English PGC

Firstly, the dominant pattern is LI. It was used when local Chinese biotic terms are embedded in the main texts of interpretative boards with English equivalents. For instance, the term '扯丝皮' in ST 24 was interpreted into 'Chinese rubber tree' in TT 24. In this text, the local Chinese flora terms was originally in the Fangshan dialect, which refers to '杜仲' – a common biotic name whose interpretation has an English counterpart 'Chinese rubber tree'. Similarly, '黄鸭叫' in ST 27 was interpreted into 'yellow head catfish' in TT 27, where '黄鸭叫' signifies '黄颡鱼' in the Xiangxi dialect, and its English counterpart is 'yellow head catfish'.

When there is no English equivalent for the local Chinese biotic terms in the main text of the interpretative boards, the CI strategy was used. As mentioned above, when using the CI strategy, the interpreters could either use a Latin term as an interpretation bridge for English interpretations of the local Chinese biotic term, or they could describe the appearance or connotations of the species. In terms of the former, for instance, the Tibetan used the flora term '阿仲尕布' to refer to the native Chinese flora '雪灵芝' for which there is no English equivalent. The Latin scientific name of '雪灵芝' is '*Arenaria bryophylla*'. The specific epithet '*bryophylla*' means 'mossy' in English, and the genus '*Arenaria*' means 'sandwort'. Therefore, using the CI strategy, the term '阿仲尕布' in ST 25 was effectively interpreted into 'mossy sandwort' in TT 25. Similarly, '泥雀儿' in ST 28 was interpreted into 'Xiangxi

[5] We employed specific functions [word="BE"] [word=","] [word="IS"] [word=","] [word="CCPN"] [word=","] [word="Specific IS"] and [word="BE"] [word=","] [word="IS"] [word=","] [word="CCAN"] [word=","] [word="Specific IS"], with the option to replace 'Specific IS' with 'LI' and 'CI', to obtain the data of literal and creative interpretations used in interpreting local Chinese flora and fauna names in the PGC.

high-plateau loach' in TT 28. Since in the Xiangxi dialect, '泥雀儿' signifiers '湘西盲高原鳅' whose Latin scientific name is '*Triplophysa xiangxiensis*'. '*xiangxiensis*' refers to Xiangxi (a place in China), and '*Triplophysa*' means 'high plateau loach'. The interpreter used the creative approach to include both the origin of the species and the English name derived from their Latin interpretation as a bridge. In terms of describing the appearance or connotations of local Chinese biotic terms using the CI strategy, for example, '猴欢喜' in ST 26 is a term in Xiangxi dialet for an indigenous Chinese flora called '仿栗'. This flora is a tree with many chestnut-like fruits on its top; therefore, it was interpreted as 'chestnut-like tree' in TT 26. Similarly, '杂咕' in ST 29 was interpreted into 'stippled-pattern carp' in TT 29. In the Tibetan language, '杂咕' refers to a Chinese native fauna '石花鱼'. Because '石花鱼' is a type of carp with stipple on its skin. Thus, the interpreter interpreted '杂咕' as 'stippled-pattern carp'. What is worth noting is that '杂咕' was found in this study in the PGC corpus, but the use of appearance description in the interpretation of fauna name was not found in Li et al.'s (2024) previous Taxonomy. This example provides an extension of interpretation of local Chinese fauna terms in Li et al.'s (2024) previous Taxonomy and can be added for future interpretation.

In the PGC, we also found cases of misinterpretation of local Chinese biotic terms[6]. These misinterpretations can be attributed to a lack of familiarity with dialects. For example, the interpreter interpreted '阿不夜那' in ST 42 as 'Kudzu vine' in TT 42. In Chinese, 'Kudzu vine' means '粉葛', but the Xiangxi people used '阿不夜那' to refer to '葛根' rather than '粉葛 (Kudzu vine)'. Li et al. (2024) pointed out that an essential step for interpreting local Chinese biotic terms is to first interpret them into appropriate common biotic names. When the English names of the local Chinese flora name was found in English, the interpreter should interpret them via using literal interpretation. 'Kudzu root' can corresponds to '葛根'. Thus, we shall revise the interpretation of '阿不夜那' as 'Kudzu root'. Similarly, '齐哇' in ST 43 was misinterpreted as 'Tibetan dwarf hamster' in TT 43. In Tibetan language, '齐哇' signifies '喜马拉雅旱獭' rather than '西藏侏儒仓鼠 (Tibetan dwarf hamster)'. In English, because 'Himalayan marmot' can correspond to '喜马拉雅旱獭', LI should be used (Li et al. 2024), and this fauna term should be interpreted as 'Himalayan marmot'. Guided by Eco-Translatology, these revised versions eventually achieve semantic and cultural equivalence.

5.2.3 Interpretation strategies and SSC equivalence in ecological processes

This section pertains to the ecological processes (i.e., characteristics and functions) of flora and fauna. Five interpretation strategies were identified[7] in interpreting ecological processes: Literal Interpretation (LI), Division, Shift, Division and Shift (DS), and Combination. As seen in Figure 5, LI, Division, and Combination are the dominant interpretation strategies in interpreting both flora processes and fauna processes. The application of Shift and 'DS' strategies are less frequent, with both being below 10%. Li et al. (2022c) noted that because ecological processes are mainly related to flora and fauna characteristics, the Chinese source text can be anticipated to contain

[6] We respectively employed the function [word="BE"] [word=","] [word="IP"] [word=","] [word="CCPN"] [word=","] [word="Misinterpreted"] and [word="BE"] [word=","] [word="IP"] [word=","] [word="CCAN"] [word=","] [word="Misinterpreted"] to retrieve examples of misinterpretation in local Chinese flora and fauna terms. Through this process, we found 13 examples of misinterpretation in local Chinese flora names and nine examples in local Chinese fauna terms.

[7] We respectively employed the function [word="BE"] [word=","] [word="IS"] [word=","] [word="FLP"] [word=","] [word="Specific IS"] and [word="BE"] [word=","] [word="IS"] [word=","] [word="FAP"] [word=","] [word="Specific IS"] to retrieve the above five interpretation strategies used in interpreting flora and fauna processes. The last item 'Specific IS' can be substituted with 'LI', Division, Shift, 'DS' and Combination.

active voice, simple possessive, and descriptive verbs like '有 (have/has)' and '是 (is/are)'. This implies that Division and DS strategies are employed much less frequently compared to the other three strategies (LI, Division, and Combination).

	Flora Processes		Fauna Processes	
Interpretation Strategies	Frequency	Percentage	Frequency	Percentage
Division	114	36.31%	67	32.06%
Literal Interpretation	92	29.30%	59	28.23%
Combination	68	21.65%	51	24.39%
Division and Shift	25	7.96 %	19	9.10%
Shift	15	4.78%	13	6.22%
Total Number	**314**		**209**	

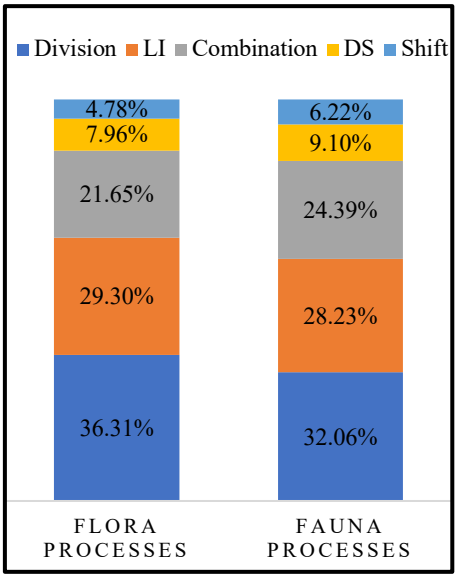

Fig. 5. Frequency and Interpretation Strategies for Ecological Processes in Chinese-to-English PGC

A detailed qualitative examination revealed that, in the PGC, the strategy of Division is the most used strategy in interpreting both flora processes and fauna processes. When the Chinese ecological processes are described in active voice and complex sentences that are relatively long, these sentences are broken down into shorter active sentences in English using the strategy of Division. This strategy may result in more numbers of English sentences than the original Chinese source text. Because in Chinese, a long and complex sentence can be joined with commas without a clear clausal structure or linking words; however, in English, sentence structures are governed by more strict syntax rules. Therefore, the strategy of Division ensures that the English interpretation maintains their grammatical integrity while including all the information expressed in the original Chinese sentence. The interpretation of the characteristics of the barrenwort (ST and TT 30) and giant salamander (ST and TT 35) illustrates this pattern. According to Li et al. (2022c), Chinese and English exhibit distinct linguistic styles. Thus, informed by linguistic and communicative transformations within Eco-Translatology, and while adhering to the English language style, the interpreter divided lengthy Chinese ecological processes (ST 30 and ST 35) into multiple English sentences (TT 30 and TT 35), aiming to attain style equivalence. This strategy aligns with Li et al.'s (2024) Taxonomy.

The second most used strategy is LI. When Chinese ecological processes are expressed using active voice and relatively short sentences, they were interpreted into active voice English sentences of similar length. In these cases, a literal interpretation of both the voice and the words in the source texts were directly interpreted into the target texts. For example, the flora (purple spear grass) processes in ST 31 and the fauna (male Tibetan antelopes) processes in ST 36 (Appendix D, Table D3) illustrate this pattern, where the source texts were literally interpreted to source texts while retaining the style and meaning of the source texts. Thus, interpretation using this strategy aligns with linguistic and communicative transformations to achieve style equivalence. This interpretation strategy was also documented in Li et al.'s (2024) Taxonomy.

The strategy of Combination is employed when there is a close logical relationship between two or more independent and consecutive Chinese sentences describing the same ecological processes (i.e., the subjects of the sentences are the same). For situations like this, sentence length of the source text does not play as important a role in deciding the strategy as the logical connections of the meaning between sentences. The Combination strategy uses conjunctions or adjoint adverbials to connect meaning in multiple Chinese source sentences into one complex English sentence that retains all the information in the Chinese sentences. For example, the two sentences in ST 32 share the same subject '紫树 (Chinese tupelo)', and the rest of the information in the Chinese sentences can be logically and relatively concisely interpreted into the same English sentence using clauses. We can see that in TT 32 the interpreter used a relative clause linked by the conjunction 'which' to link all the information into the same complex English sentence to avoid repetition and redundancy. Similarly, in ST 37, the two sentences that describe the same subject '金凤蝶 (The Old-World swallowtail)' was interpreted into one English sentence using the linking adverbial 'with' in TT 37. These two examples were mapped onto linguistic and communicative transformations of Eco-Translatology to achieve style equivalence. This strategy corresponds to Li et al.'s (2024) Taxonomy.

While the Shift and the DS strategies are relatively infrequent in PGC compared to the other strategies, they play important roles in achieving style equivalence. As mentioned in section 5.1.2, the strategy of DS is in fact a sequential combination of the strategy Division and the strategy of Shift. The only difference is that when only using Shift, the source texts are relatively short and do not require additional division. In the interpretation of ecological processes, DS and Shift all together counts for 12.74% for flora processes, and 15.32% for fauna processes. The DS strategy can be illustrated by the examples of the flora processes described in ST 33 and the fauna processes described in ST 38. Both examples used explicit passive voice with the Chinese marker '被', and there were first broken down into multiple English sentences, and then interpreted into passive voices respectively (see TT 33 and TT 38 in Appendix D, Table D3). Another case of using DS is where the passive meaning in the source texts was not expressed using an explicit marker (i.e., when the marker '被' was absent). ST 34 and ST 39 illustrate such situations. In ST 34, the implicit passive '排列而成' and '酷似…状' were respectively interpreted into 'formed by' and 'be characterised by' in TT 34, because of their implicit passive meaning. Similarly, in ST 39, '布' and '饰' were respectively interpreted into 'be banded with' and 'be marked with' in TT 39. Thus, these English interpretations correspond to linguistic and communicative transformations to achieve style equivalence. The 'DS' strategy is consistent with the research findings of Li et al. (2024).

Using the discussed effective interpretation strategy, the misinterpreted examples of flora and fauna processes in the PGC can be improved systematically, once identified[8]. For example, when interpreting the flora process described in ST 44, the interpreter used a long English sentence (TT 44) that structurally resemble the original Chinese sentence, but with run-on elements and failed to convert the implicit semantic passive meanings ('盖' and '具') into English passive voice. This example can be optimised using the DS strategy (Li et al. 2024) into:

[8] we used the function [word="BE"] [word=","] [word="IP"] [word=","] [word="FLP"] [word=","] [word="Misinterpreted"] and [word="BE"] [word=","] [word="IP"] [word=","] [word="FAP"] [word=","] [word="Misinterpreted"] to search and found ten misinterpreted examples in flora processes and seven in fauna processes.

The sporangia are tiny balls borne on small veins on the underside of the leaf. The sporangia may form sacs that **are covered with** a membrane and are kidney-shaped with some serrated edges. At maturity, the sacs are large and close together, even extending over the edge. The glands **are situated on** the underside of the leaf.'

Guided by linguistic and communicative transformations of Eco-Translatology, '盖' and '具' were respectively interpreted into 'be covered with' and 'be situated on' and the long Chinese sentence is broken down into an appropriate target style. Similar interpretation problems can be found in fauna processes as well. For example, ST 45 was written in two separate Chinese sentences and was interpreted into two English sentences in TT 45. However, the two sentences in ST16 share the same subject (i.e., '麦穗鱼', 'stone moroko') and can be logically combined into one English sentence to avoid redundancy. The clarity of the interpretation, thus, can be improved by using the combination strategy (Li et al. 2024). Guided by linguistic and communicative transformations, we revised the English interpretation into 'The snout of the stone moroko is slightly pointed and prominent, with large eyes and thin lips but no barbels.' to achieve style equivalence.

5.3 Interpretation strategies and SSC equivalence in Cultural element

For cultural elements, in addition to strategies mentioned in previous categories (i.e., Addition in section 5.1.1; TFI in section 5.1.1; LI in section 5.1 & 5.2), the strategy Free Interpretation (FI) was also identified in the PGC[9]. The results illustrated in Figure 6 serves to describe the interpretation norms of cultural elements. Unsurprisingly, direct interpretation provided by the LI strategy (32.24%) is insufficient to effectively convey the breadth of Chinese civilization involved in the interpretation of cultural elements (Li et al. 2022c). Therefore, we see the frequent use of Addition (42.86%), FI (13.86%) and TFI (11.04%) in bridging the cultural gap to supply additional cultural information for geotourists.

Interpretation strategies	Frequency	Percentage
Addition	501	42.86%
Literal Interpretation	377	32.24%
Free Interpretation	162	13.86%
Transliteration and Free Interpretation	129	11.04%
Total Number	**1169**	

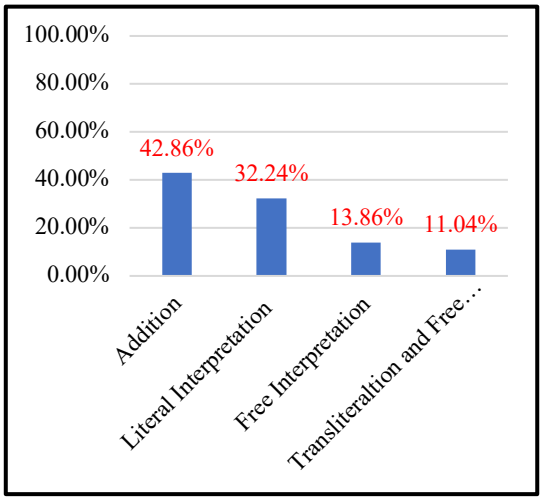

Fig. 6. Frequency and Interpretation Strategies for the Cultural Element in Chinese-to-English PGC

Firstly, we observed that the strategy Addition (42.86%) is frequently used for cultural communication where Chinese terms with cultural references or implicit meanings do not have direct equivalents in English. Among the

[9] To analyse the data from the four interpretation strategies, we put the function formula:[word="CE"] [word=","] [word="IS"] [word=","] [word="PL"] [word=","] [word="Specific IS"], into CQL, where 'Specific IS' within the square brackets represents 'LI', 'Addition', 'FI', and 'TFI'

501 cases we identified for instance, the interpreter rendered '云居寺', as a Buddhist temple, into 'Yunju Temple (a Buddhist temple)' to realise semantic and cultural equivalence. The explanatory text 'a Buddhist temple' was added to the name 'Yunju Temple' to provide explicit cultural reference of the temple. This pattern of addition of supplementary information aligns with the findings of Li et al.'s (2022b) Taxonomy.

LI (32.24%) was the next most frequently used strategy. In the PGC, through the observation of 377 examples, we identified two patterns in interpreting cultural elements using the LI strategy: 1) cultural elements can find equivalent words in English; and 2) The interpreter could translate poems literally because there are no deeper cultural references. For example, the interpreter rendered the name of an ancient Chinese book '《山海经》' as '*The Classics of Mountain and Sea*'. The book is related to treasured cultural Chinese classics concerning geography, mythology, and religion. This interpretation has English equivalents that correspond to the suggested breadth of geography and history. Another example is the interpretation of poems with a non-cultural image: Du Qing's poem '独爱昆仑风韵壮，骋眸苍莽巨龙蟠。' was literally interpreted into 'Dearest to my heart is the magnificent Mount Kunlun; Where I see no mountain but a crouching loong under the sky.' LI is effective in capturing the author's deep admiration and reverence for the magnificent Mount Kunlun. These two examples align with the theoretical guidelines to achieve semantic and cultural equivalence and concur with Li et al.'s (2022b) Taxonomy.

FI (13.86%), as a complement to Addition and LI, assists geotourists understand the connotation embedded in cultural words. In other words, FI was used when the source text conveys deeper cultural meanings that could not be simply interpreted with English text that matches the original style of the Chinese text. We performed a qualitative analysis of the PGC and identified two patterns for interpretating cultural elements using FI. The first pattern is interpreting highly concentrated Chinese cultural elements carrying rich cultural connotations, which cannot be adequately conveyed through alternative strategies. For instance, '赶秋节' is an annual harvest festival for the Hmong people at the beginning of autumn. It was effectively interpreted into 'Autumn Harvest Festival of Miao Ethnic Group' mapped onto three-dimension of Eco-Translatology to achieve semantic and cultural equivalence. The second pattern involves interpreting poems with cultural images such as allusions. For example, Jingting Yang's poem , '最怕人情红白事，知单一到便为难。', was rendered into 'Thus attending weddings and funerals is most dreadful, For with the invitation often comes unavoidable cost.' by the interpreter. In English, the literal meaning of '红白事' is 'red and white events'. In this poem, however, '红白事', is a specific cultural allusion to weddings and funerals. The interpreter considered the connotation of the source language, ensuring the accuracy of the interpretation. Additionally, in traditional Chinese culture, '红白事' shares similar cultural connotations with weddings and funerals in English. Hence, according to Hu's (2003) Eco-Translatology, this interpretation achieves both semantic and cultural equivalence. These two patterns of free interpretation applied to cultural elements align with the Taxonomy proposed by Li et al. (2022b).

The TFI strategy is the least frequently used at 11.04% with 129 cases. For example, '磕长头礼' was effectively interpreted into 'Kowtow worship'. '磕长头礼' can be divided into two parts. The former part '磕长头' is a proper noun referring to one of the sincerest ways for followers of Tibetan Buddhism to pay respect to Buddha. Using transliteration, the English interpretation preserves the phonology of the cultural words from the source language and enables geotourists to gain an understanding of the sound characteristics inherent in the source language. The

latter part '礼' is a common noun which literally means 'ceremony' or 'etiquette' in English. However, because the source text refers to a specific worship of Tibetan Buddhism, it was interpreted as 'worship' to convey the most accurate cultural meaning. The utilisation of the TFI strategy in interpreting cultural elements. This aligns with Li et al.'s (2022b) Taxonomy.

Regarding misinterpretation of cultural elements, seven examples were found in the PGC[10]. These examples share a common feature: they contain implicit meaning that lacks a direct English equivalent and was typically misinterpreted using literal interpretation. For example, '猴儿鼓' was ineffectively interpreted into 'Monkey drum dance', which was a word by word interpretation of the source text. This interpretation fails to grasp the cultural meaning of the dance. '猴儿鼓' is a traditional Hmong folk dance with drumming, where multiple dancers imitate various behaviours of the monkey, such as nibbling on corn or swinging. Considering the characteristics of the '猴儿鼓', the Addition strategy proposed by Li et al. (2022b) for interpreting cultural elements suggests revising into 'Drum dance imitating monkeys' to achieve semantic and cultural equivalence.

6. Conclusions

In this paper, we used geotourism data from three Chinese UGGps (Xiangxi, Fangshan and Mount Kunlun) to examine the effectiveness of the benchmarking model (SSC equivalence) for C-E geotourism interpretation and the Taxonomy based on Hu's (2003) Eco-Translatology proposed by Li et al. (2022a; 2022c; 2024). The data from the three Chinese UGGps were analysed quantitatively and qualitatively, with the aim of using field data processed through a corpus to validate the SSC Model and Taxonomy. The method of research was framed by Eco-Translatology and the systematic ABC elements of geodata organisation.

Methodologically, we started coding the raw corpus data from the PGC by identifying the effective and ineffective interpretation, guided by Eco-Translatology. After all text data were tagged, we developed CQL functions to extract the frequency of each interpretation strategy occurring in the C-E PGC. This quantitative step confirms the interpretation norms of ABC elements within geotourism. Qualitatively, we extracted incidences of interpretation text examples to test whether they supported the Taxonomy (Li et al. 2022c). At the same time, guided by Eco-Translatology, we optimised the interpretation problems using the Taxonomy (Li et al. 2022a; 2024) to determine whether it could be effectively used to attain SSC equivalence. Additionally, we discovered new usage patterns and new strategies to add to the original Taxonomy proposed by Li et al. (2022a; 2024). The revised Taxonomy was included in Appendix E. Thus, this research validated the rigour of the Taxonomy and the reliability of the SSC Model in interpretation purposes of C-E geotourism data. Furthermore, our methodology systematically investigates the language of interpretation used in geoparks, delivering a reliable and comprehensive perspective on geotourism interpretation. This was possible because our computerised approach efficiently processed and analysed a vast amount of geotourism data related to ABC elements from Chinese UGGps. Thus, in other words, the large amount of data validated the specific effective interpretation strategies and interpretation problems; therefore, the size of the analysed data sample undergirds the robustness of the SSC Model and Taxonomy framework for translators or interpreters.

[10] The function formula, [word="CE"] [word=","] [word="IP"] [word=","] [word="PL"] [word=","] [word="Misinterpreted"], was applied to retrieve all instances of 'Misinterpreted'.

The implications of this specific study mean the Taxonomy and Model can be upheld as useful and reliable for geotourism interpretation. In practice, this would enable geotourism interpreters to identify problems of geotourism interpretation and formulate strategies for optimisation. The wider implications are in the fields of interpretation in Chinese and other languages, several aspects of education including linguistic and scientific, and in other scientific aspects of geotourism. Therefore, the proposed evaluation model (SSC model) and the Taxonomy (Li et al. 2022b; 2022c; 2024) provide valuable theoretical guidance or standardisation for future geotourism interpretation practices. Moreover, the results from this study provide practical implications for the field of science education and interpretation training. For example, the qualitative results where we optimise problematic interpretations in the data can be shared with popular science education centers in Chinese UGGps, so that new generation interpreters have access to data-driven pedagogical materials that could enhance their skills and the quality of geotourism interpretation. A final implication is that the enhanced interpretation quality provided to Chinese UGGps helps to facilitate the expansion of the geotourism sector, given that effective geotourism interpretation promotes better geomorphological, ecological, and cultural communication.

For future research, scholars can employ the corpus-based method presented this paper, as described in Section 4, to investigate geotourism interpretation in other languages. To be more specific, researchers can draw insights from the approach to corpus tagging and the procedures of quantitative and qualitative analyses to construct a benchmarking model (i.e., similar to the SSC model) and the Taxonomy for languages other than Chinese to English.

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Authors' Contribution: Qiang (Jason) Li, the corresponding author and Author 1, undertook the collection and processing of data, constructed the parallel corpus, authored the entire paper, and conducted revisions based on reviewers' comments. Dr. David Wei Dai, as Author 2, primarily focused on refining grammar and conciseness, and provided structural suggestions for the paper. Dr. Young Ng, as Author 3, offered valuable insights and literature related to geotourism to support Jason's work.

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Declarations

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Appendices

Appendix A. Taxonomy (Li et al. 2022b; 2024) based on Hu's Eco-Translatology

Geotourism categories	Geotourism subcategories	Interpretation strategies	Usage patterns for interpretation strategies for ABC elements
Abiotic (A) element (AE)	Geological feature (GF)	Literal Interpretation (LI)	(1) When interpreting GF, there are existing equivalent words in English corresponding to the Chinese expressions.
			(2) When interpreting some names of rocks, caves, peaks, and waterfalls, equivalent nouns which reflect their shapes can be used.
			(3) When interpreting Chinese-four-character structures of GF, existing equivalent descriptive words in English can be used.
		Transliteration and Free Interpretation (TFI)	When interpreting some names of rocks, caves, peaks, and waterfalls, direct interpretation cannot reflect their name/s meaningfully. So, the former part (cultural function characters) can be used with transliteration and the latter part interpreted by free interpretation.
		Addition	When interpreting GF jargon in which there is cultural difference that hinders comprehension from literal interpretation, approximate descriptive terms can be added.
		Official Name Used by UNESCO	When GFs have official names given by the UNESCO Global Geoparks, these recognised names are used.
		Shift	The shift strategy only occurred three times in the Chinese-to-English parallel geotourism corpus.
		Foreignisation	When there are no existing English counterparts, the interpreter chose to interpret the GF that may contain foreign words or cultural references that preserve the uniqueness of the original Chinese texts. *The foreignisation strategy occurred once only in the Chinese-to-English parallel geotourism corpus (Chapter 4).
	Geological process (GP)	Division and Shift strategy (DS)	When GPs are described in long Chinese sentences, they were interpreted into several simple and short English sentences. When passive structure is embedded into the Chinese GP expressions, passive voice is to be used in the target interpretation.
		Literal Interpretation (LI)	(1) When GP jargons exist in English, Chinese GP jargons are interpreted literally.
			(2) Interpreting short Chinese GPs that are written in active voice directly into active-voice English sentences of similar length. *using and interpreting of passive voice is categorised as 'Shift', which is explained below.
		Shift	When the Chinese GPs are simple short sentences that contain either explicit or implicit passive voice structures, passive voice was used in the English interpretations.
		Division	When GPs are complex long sentences and do not contain explicit or implicit passive structures, the original long sentences are divided into simple clauses, and active voice is used in the clause.
Biotic (B) element (BE)	Common biotic (flora and fauna) names (CPN; CAN)	**Common biotic names appear as the title or stand alone on the interpretative boards.**	
		Latin and English strategy (LE)	**Latin part:** Use the scientific names for flora and fauna provided by latest International Code of Nomenclature for algae, fungi, and plants (ICN 2018) and the International Code of Zoological Nomenclature (ICZN 2022).
			English part: **(1) Literal interpretation:** Use the English equivalents if common flora and fauna names can be found in English. **(2) Creative interpretation:** a. There is no English equivalent for endemic Chinese flora. According to their features or connotations, direct interpretation can be widely accepted. However, this pattern used to interpret native Chinese fauna names in creative interpretation is not found and needs further research. b. When the native flora and fauna of China lack an English equivalent, borrow the English meaning of

			their Latin scientific names (genus and species epithet).
		Foreignisation	If a species originates from China and its scientific name contains affixes indicating foreign countries rather than China, or foreigners who discovered the species, English will be used exclusively.
		Common biotic names in the main text of interpretative boards.	
		Literal Interpretation (LI)/ Creative Interpretation (CI)	These two interpretation strategies correspond to the English part of the Latin and English strategy.
	Local Chinese (flora and fauna) terms (CCPN; CCAN)	The interpretation strategies of local Chinese biotic names can adopt the broader taxonomy of interpretation strategies of common biotic names above.	
	Ecological processes (FLP; FAP)	Literal Interpretation (LI)	Interpreting short Chinese ecological processes that are written in active voice directly into active-voice English sentences of similar length. *using and interpreting of passive voice is categorised as 'Shift', which is explained below.
		Division	When the Chinese ecological processes are described in active, complex sentences, these sentences are broken down into shorter active sentences in English.
		Combination	When there is a close logical relationship between two consecutive Chinese sentences describing ecological processes (e.g., the subject of the two sentences is the same), the use of conjunctions or adjoint adverbials can be used to make them into one complex English sentence that retains all the information in the Chinese sentences.
		Shift	When the ecological processes are described using passive structures in the Chinese sentence, passive voice was used in interpreting ecological processes into English.
		Division and Shift strategy (DS)	When ecological processes are described in long Chinese sentences, they were interpreted into several simple and short English sentences. When passive structure is embedded into ecological processes, passive voice is to be used in the target interpretation.
		Restructuring the Word Order (RWO)	Important information, such as a category or generality of ecological processes, should be placed first in the sentence, followed by supporting details when interpreting ecological processes.
Cultural (C) element (CE)	People's lifestyle (PL)	Literal Interpretation (LI)	(1) When the C elements in Chinese have existing English counterparts, the counterparts are used directly.
			(2) When the poems do not have specific cultural images, the poems can be interpreted literally.
		Transliteration and Free Interpretation (TFI)	Interpreting the C element which consisted of two parts: the former part is a proper noun, and the latter is a common noun. The former part use transliteration and the latter part use free interpretation (explained below).
		Free Interpretation (FI)	(1) When highly concentrated Chinese cultural elements contain rich cultural connotations, the target English interpretation focuses on communicating the sense and cultural connotations rather than word-to-word meanings.
			(2) When interpreting poems with cultural images which include strong cultural connotations including allusions and personal names, the target interpretation adheres more to the sense and meaning rather than the original wording.
		Addition	When interpreting C elements with implicit cultural meanings or with no English equivalence, additional explanation is added.

Appendix B. Tags Applied to the Targets in Chinese-to-English Parallel Geotourism Corpus

Label elements				Label example
Element 1	**Element 2**	**Element 3**	**Element 4**	
Abiotic Element <AE>	Interpretation Strategies <IS>	Geological Features <GF>	Literal Interpretation <LI>	<AE, IS, GF, LI>
			Transliteration and Free Interpretation <TF>	<AE, IS, GF, TF>
			Addition <Addition>	<AE, IS, GF, Addition>
		Geological Processes <GP>	Literal Interpretation <LI>	<AE, IS, GP, LI>
			Division <Division>	<AE, IS, GP, Division>
			Shift <Shift>	<AE, IS, GP, Shift>
			Division and Shift <DS>	<AE, IS, GP, DS>
			Combination <Combination>	<AE, IS, GP, Combination>
	Interpretation Problems <IP>	Geological Features <GF>	Misinterpreted <Misinterpreted>	<AE, IP, GF, Misinterpreted>
			Incongruent Interpretation for Same Name <IISN>	<AE, IP, GF, IISN>
		Geological Processes <GP>	Misinterpreted <Misinterpreted>	<AE, IP, GP, Misinterpreted>
Biotic Element <BE>	Interpretation Strategies <IS>	Common Plant Names <CPN>	Latin and English <LE>	<BE, IS, CPN, LE>
			Literal Interpretation <LI>	<BE, IS, CPN, LI>
			Creative Interpretation <CI>	<BE, IS, CPN, CI>
			Foreignisation <Foreignisation>	<BE, IS, CPN, Foreignisation>
		Common Animal Names <CAN>	Latin and English <LE>	<BE, IS, CAN, LE>
			Literal Interpretation <LI>	<BE, IS, CAN, LI>
			Creative Interpretation <CI>	<BE, IS, CAN, CI>
			Foreignisation <Foreignisation>	<BE, IS, CAN, Foreignisation>
		Chinese Cultural Plant Names <CCPN>	Literal Interpretation <LI>	<BE, IS, CCPN, LI>
			Creative Interpretation <CI>	<BE, IS, CCPN, CI>
		Chinese Cultural Animal Names <CCAN>	Literal Interpretation <LI>	<BE, IS, CCAN, LI>
			Creative Interpretation <CI>	<BE, IS, CCAN, LI>
		Flora Processes <FLP>	Literal Interpretation <LI>	<BE, IS, FLP, LI>
			Division <Division>	<BE, IS, FLP, Division>
			Shift <Shift>	<BE, IS, FLP, Shift>
			Division and Shift <DS>	<BE, IS, FLP, DS>
			Combination <Combination>	<BE, IS, FLP, Combination>
		Fauna Processes <FAP>	Literal Interpretation <LI>	<BE, IS, FAP, LI>
			Division <Division>	<BE, IS, FAP, Division>
			Shift <Shift>	<BE, IS, FAP, Shift>
			Division and Shift <DS>	<BE, IS, FAP, DS>
			Combination <Combination>	<BE, IS, FAP, Combination>
	Interpretation Problems <IP>	Common Plant Names <CPN>	Misinterpreted <Misinterpreted>	<BE, IP, CPN, Misinterpreted>
		Common Animal Names <CAN>	Misinterpreted <Misinterpreted>	<BE, IP, CAN, Misinterpreted>
		Chinese Cultural Plant Names <CCPN>	Misinterpreted <Misinterpreted>	<BE, IP, CCPN, Misinterpreted>
		Chinese Cultural Animal Names <CCAN>	Misinterpreted <Misinterpreted>	<BE, IP, CCAN, Misinterpreted>
		Flora Processes <FLP>	Misinterpreted <Misinterpreted>	<BE, IP, FLP, Misinterpreted>
		Fauna Processes <FAP>	Misinterpreted <Misinterpreted>	<BE, IP, FAP, Misinterpreted>
Cultural Element <CE>	Interpretation Strategies <IS>	People's Lifestyle <PL>	Literal Interpretation <LI>	<CE, IS, PL, LI>
			Transliteration and Free Interpretation <TF>	<CE, IS, PL, TF>
			Free Interpretation <FI>	<CE, IS, PL, FI>
			Addition <Addition>	<CE, IS, PL, Addition>
	Interpretation Problems <IP>	People's Lifestyle <PL>	Misinterpreted <Misinterpreted>	<CE, IP, PL, Misinterpreted>

Appendix C. Sketch Engine Formula

Search in

English

Query type

CQL

CQL

[word="one of three main elements of geotourism"] [word=","] [word="IS"] [word=","] [word="one of subcategories in ABC elements"] [word=","] [word="Specific IS"]

Default attribute: word

Subcorpus: non (the whole corpus)

Fig.C1 Function Formula Used to Retrieve Effective Geotourism Interpretation Strategies in Sketch Engine

Search in

English

Query type

CQL

CQL

[word="one of three main elements of geotourism"] [word=","] [word="IS"] [word=","] [word="one of subcategories in ABC elements"] [word=","] [word="Specific IP"]

Default attribute: word

Subcorpus: non (the whole corpus)

Fig.C2 Function Formula Used to Retrieve Ineffective Geotourism Interpretation in Sketch Engine

Appendix D. Examples of Effective and Ineffective Geotourism Interpretations

Table D1. Effective Interpretation of the Abiotic (GF and GP) Element

Categories	Text No.	Source Text (ST)	Target Text (TT)	Interpretation Strategies
Geological Features (GF)	1	夷平面	Planation surface	Literal interpretation
	2	鳄鱼石	Crocodile-shaped rock	
	3	山谷陡峻	Steep cliffs and narrow gorges	
	4	灵洞天窗群	Lingdong cave karst windows groups	Transliteration and free interpretation
	5	圣米	Holy rice (Quartz grains)	Addition
Geological Processes (GP)	6	火山岩造型石**形成**于距今约2.05～1.44 亿年的侏罗纪，经过漫复杂的长地质演化，它**被**抬升到现在的位置。	The landscape-forming volcanic rocks **were formed** during the Jurassic period 205 to 144 million years ago. Through a long and complicated geological evolution, they **were uplifted** to the current location.	Division and Shift
	7	因为河流凹岸的岩石**被不断侵蚀**破坏导致河岸崩塌，所以**形成**了陡壁。	The rocks on the concave bank of the river **are continuously eroded** until damage can result in a collapse of the riverbank, so steep cliffs **are formed**.	Shift
	8	冰川不断地通过拔蚀、磨蚀和冻融风化作用侵蚀底床和谷壁。	The glacier continually erodes the bed bottom and valley walls by plucking, abrasion, and free-thaw weathering.	Literal interpretation
	9	河弯不断向两侧扩展，又向下游移动，使河谷展宽，并在山谷中积聚了大量的砾石和沉积物。	The river bends continuously, expanding on both sides. It moves downstream widening the valley and accumulating a large amount of gravel and sediment in the valley.	Division
	10	**白云岩**是长期通过沉积作用形成的。**其**底部又受到侵入岩浆的烘烤，逐渐变成了白色的大理岩。	Dolomite is formed through long-term deposition, with its bottom subject to intruding magma, gradually transforming into white marble.	Combination

Table D2. Ineffective Interpretation of the Abiotic (GF and GP) Element

Categories	Text No.	Source Text	Target Text	Interpretation Problems
Geological Features (GF)	11	昆仑山	Mount Kunlun	IISN
			Kunlun Mountains	
			Mt. Kunlun	
	12	金钉子	Golden Spike	Misinterpreted
	13	斩云剑	Cutting cloud sword	
Geological Processes (GP)	14	带有气孔的灰绿色安山岩是火山喷发的岩浆冷却后**形成**的，经过长期的风化和侵蚀，岩石**变成**了各种各样的颜色。	The greyish-green andesite with pores results from cooling of erupted magma from volcanoes. After undergoing long-term weathering and erosion, the rock would become various colours.	Misinterpreted

Table D3. Effective Interpretation of the Biotic (CPN, CAN, CCPN, CCAN, FLP and FAP) Element

Categories	Text No.	Source Text	Target Text	Interpretation Strategies
Common Flora Names (CPN)	15	**翠雀**椭圆形的萼片呈蓝色。	The elliptical sepals of the **Chinese Delphinium** are blue.	Literal interpretation
	16	**唐古拉点地梅**的主根呈棕色。	The taproot of the **Tanggulashan rock jasmine** is brown in colour.	Creative interpretation
	17	独花兰	*Changnienia amoena* S.S.Chien (beautiful Changnienia)	Latin and English
	18	山茶	camellia	Foreignisation
Common Fauna Names (CAN)	19	**黑鹳**的头、颈、脚均甚长。	The **black stork** has a particularly lengthy head, neck, and legs.	Literal interpretation
	20	**藏管尾犁胸蝉**的前翅狭长，呈红褐色。	The forewings of the **Tibetan treehopper** are narrow and reddish-brown in colour.	Creative interpretation
	21	野牦牛	*Bos mutus* (Wild yak)	Latin and English
	22	阳彩臂金龟	*Cheirotonus jansoni* (Chinese varicoloured beetle)	
	23	中华对角羚	Chinese gazelle	Foreignisation
Local Chinese Flora Terms (CCPN)	24	**扯丝皮**的花不显眼，小而呈绿色。	The flowers of the **Chinese rubber tree** are inconspicuous, small, and greenish.	Literal interpretation
	25	**阿仲尕布**枝叶密集，花白色，寒冬盛开。	The **mossy sandwort** has dense branches and leaves, with white flower blooming in the cold winter.	Creative interpretation
	26	**猴欢喜**的叶片簇生于枝顶。	The leaves of the **chestnut-like tree** are clustered at the top of the branches.	
Local Chinese Fauna Terms (CCAN)	27	**黄鸭叫**的头大且扁平。	The **yellow head catfish** has a large and flat head.	Literal interpretation
	28	**泥雀儿**的鼻孔很大，鼻瓣膜发育良好。	The nostrils of the **Xiangxi high-plateau loach** are large, and the nasal valve membrane is well-developed.	Creative interpretation
	29	**杂咕**头锥形，吻突出。	The **stippled-pattern carp** has a conical head with a prominent snout.	
Flora Processes (FLP)	30	淫羊藿根状茎粗短，暗棕褐色；二回三出复叶基生和茎生，叶缘具刺齿；圆锥花序，花白色或淡黄色，5-6 月开花。	The dark brown barrenwort root is short and thick. Basal and stem leaves are compound, that is, with two or three serrated edged leaflets. This plant has a conical inflorescence with white or pale-yellow flowers, blooming from May to June.	Division
	31	紫花针茅叶膜质，披针形，长 3-6 毫米。	The leaves of the purple spear grass are membranous, lanceolate, and measure 3-6 millimetres in length.	Literal interpretation
	32	**紫树**高达 13 余米，小枝有短柔毛。**紫树**小枝上的叶呈椭圆形，长 8-15 厘米，表面暗绿色，背面淡绿色，侧脉上有短柔毛。	The Chinese tupelo stands over 13 metres with villous branchlets and has oval leaves 8-15 cm long, **which** are dark green, have light greabaxial surface piloseen facing abaxially, and are pubescent on lateral veins.	Combination
	33	歪头菜通常数茎丛生，具棱，疏**被**柔毛，老时渐脱落，茎基部表皮红褐色或紫褐红色。	The two-leaf vetch usually grows in clumps. Its edges **are** sparsely **covered with** soft hairs that gradually shed as it ages. The base of the stem is reddish or purplish, brown.	Division and Shift
	34	地上部分为半球形的垫状体，由极多的根出条紧密**排列而成**；根出条**酷似**莲座**状**叶，覆瓦状排列。	The part exposed above the ground is a hemispherical cushion-shaped body, **formed by** multiple roots spreading densely. The root spread **is characterised by** an imbricated leafage in a withering rosette shape.	
Fauna Processes (FAP)	35	大鲵头部扁平、钝圆，口大，眼小；身体前部扁平，至尾部逐渐	The head of the giant salamander is flat and bluntly rounded, with a large mouth and small eyes. The front part of the body is flattened, gradually becoming laterally	Division

		转为侧扁；体两侧有明显的肤褶。	compressed towards the tail. There are distinct skin folds on both sides of the body.	
	36	雄性藏羚羊有垂直向上的角，尖端稍向前弯曲，雌性无角。	The male Tibetan antelopes have long horns that point almost vertically upward, with tips bending slightly forward, while the females have no horns.	Literal interpretation
	37	**金凤蝶**是一种大型蝶。**它**的双翅展开有8-9厘米宽，体翅金黄色，有光泽。	The Old-World swallowtail is a large, ornamental butterfly **with** glossy yellow wings and a wingspan of 8-9 cm.	Combination
	38	野牦牛四肢强壮，身**被**长毛，胸腹部的毛几乎垂到地上，可遮风挡雨，舌头上长有肉齿，凶猛善战。	The wild yak **is covered with** long fur and has powerful legs. The long fur on its chest and abdomen almost reaches the ground and provides protection from wind and rain. Additionally, there are extra teeth on its tongue, making it a fiercely equipped opponent in combat.	Division and Shift
	39	大灵猫的侧颈和下颈**布**黑条纹，与白色毛皮形成对比，尾巴上**饰**多个黑白相间的环。	The side and lower neck of the large Indian civet **are banded with** black stripes contrasting against white fur. The tail **is marked with** several black and white rings.	

Table D4. Ineffective Interpretation of the Biotic (CPN, CAN, CCPN, CCAN, FLP and FAP) Element

Categories	Text No.	Source Text	Target Text	Interpretation Problems
Common Flora Names (CPN)	40	槭叶铁线莲	*Clematis acerifolia* Maxim. (clematis)	Misinterpreted
Common Fauna Names (CAN)	41	中华奥锹甲	*Odontolabis cuvera sinensis* (Chinese beetle)	Misinterpreted
Local Chinese Flora Terms (CCPN)	42	**阿不夜那**是藤本植物的可食用部分。	The **Kudzu vine** is an edible part of a climbing vine.	Misinterpreted
Local Chinese Fauna Terms (CCAN)	43	**齐哇**是大型陆生啮齿动物，四肢粗壮，尾巴短。	The **Tibetan dwarf hamster** is large terrestrial rodent with stout limb and short tail.	Misinterpreted
Flora Processes (FLP)	44	孢子囊群是生长在叶片下部小脉上的小球；孢子囊可形成囊群，囊群**盖**膜质，呈肾状，边缘疏具锯齿，成熟时，囊状物大，彼此靠近，甚至延伸到叶外，叶下**具**腺体。	The sporangia are round, borne on the small veins on the back; the sacs are membranous, round to round kidney-shaped, with sparsely serrated edges, large, close to each other after maturity and often extend beyond the edge of the leaf, with glands on the back.	Misinterpreted
Fauna Processes (FAP)	45	**麦穗鱼**的吻略尖而突出。**它**的唇薄，无须。	The snout of the stone moroko is slightly pointed and prominent. This kind of fish has large eyes, thin lips, and no whiskers.	Misinterpreted

Table D5. Effective interpretation of the Cultural (PL) Element

Categories	Text No.	Source Text	Target Text	Interpretation Strategies
People's (Human Lifestyle (PL)	46	《山海经》	*The Classics of Mountain and Sea*	Literal interpretation
	47	独爱昆仑风韵壮，骋眸苍莽巨龙蟠。	Dearest to my heart is the magnificent Mount Kunlun; Where I see no mountain but a crouching loong under the sky.	
	48	云居寺	Yunju Temple (a Buddhist temple)	Addition
	49	赶秋节	Autumn Harvest Festival of Miao Ethnic Group	Free interpretation
	50	最怕人情红白事，知单一到便为难。	Thus attending weddings and funerals is most dreadful, For with the invitation often comes unavoidable cost.	
	51	磕长头礼	Kowtow worship	Transliteration and free interpretation

Table D6. Ineffective Interpretation of the Cultural (PL) Element

Categories	Text No.	Source Text	Target Text	Interpretation Problems
People's (Human Lifestyle (PL)	52	猴儿鼓	Monkey drum dance	Misinterpreted

Appendix E. Future Taxonomy based on Hu's Eco-Translatology

Highlighted in yellow are new emerging patterns found in this paper compared to previous project (Appendix A)

Geotourism categories	Geotourism subcategories	Interpretation strategies	Usage patterns for interpretation strategies for ABC elements
Abiotic (A) element (AE)	Geological feature (GF)	Literal Interpretation (LI)	(1) When interpreting GF, there are existing equivalent words in English corresponding to the Chinese expressions.
			(2) When interpreting some names of rocks, caves, peaks, and waterfalls, equivalent nouns which reflect their shapes can be used.
			(3) When interpreting Chinese-four-character structures of GF, existing equivalent descriptive words in English can be used.
		Transliteration and Free Interpretation (TFI)	When interpreting some names of rocks, caves, peaks, and waterfalls, direct interpretation cannot reflect their name/s meaningfully. So, the former part (cultural function characters) can be used with transliteration and the latter part interpreted by free interpretation.
		Addition	When interpreting GF jargon in which there is cultural difference that hinders comprehension from literal interpretation, approximate descriptive terms can be added.
		Official Name Used by UNESCO	When GFs have official names given by the UNESCO Global Geoparks, these recognised names are used.
		Shift	When literal translation of Chinese verbs and nouns do not conform to intelligible English grammar, a shift in part of speech is performed.
		Foreignisation	When there are no existing English counterparts, the interpreter chose to interpret the GF that may contain foreign words or cultural references that preserves the uniqueness of the original Chinese texts. *The Foreignisation strategy occurred once only in the Chinese-to-English parallel geotourism corpus (Chapter 4).
	Geological process (GP)	Division and Shift strategy (DS)	When GPs are described in long Chinese sentences, they were interpreted into several simple and short English sentences. When passive structure is embedded into the Chinese GP expressions, passive voice is to be used in the target interpretation.
		Literal Interpretation (LI)	(1) When GP jargons exist in English, Chinese GP jargons are interpreted literally.
			(2) Interpreting short Chinese GPs that are written in active voice directly into active-voice English sentences of similar length. *using and interpreting of passive voice is categorised as 'Shift', which is explained below.
		Shift	When the Chinese GPs are simple short sentences that contain either explicit or implicit passive voice structures, passive voice was used in the English interpretations.
		Division	When GPs are complex long sentences and do not contain explicit or implicit passive structures, the original long sentences are divided into simple clauses, and active voice is used in the clause.
		Combination	When there is a close logical relationship between two consecutive Chinese sentences describing GPs (often involving shared subject agreement), the sentences can be combined into one.
Biotic (B) element (BE)	Common biotic (flora and fauna) names (CPN, CAN)	**Common biotic names appear as the title or stand alone on the interpretative boards.**	
		Latin and English strategy (LE)	**Latin part:** Use the scientific names for flora and fauna provided by latest International Code of Nomenclature for algae, fungi, and plants (ICN 2018) and the International Code of Zoological Nomenclature (ICZN 2022).
			English part: **(1) Literal interpretation:** Use the English equivalents if common flora and fauna names can be found in English. **(2) Creative interpretation:** **a.** When there is no English equivalent for endemic Chinese flora and fauna, English names are interpreted according to their features or connotations. **b.** When the native flora and fauna of China lack an English equivalent, borrow the English meaning of

			their Latin scientific names (genus and species epithet).
		Foreignisation	If a species originates from China and its scientific name contains affixes indicating foreign countries rather than China, or foreigners who discovered the species, English will be used exclusively.
		Common biotic names in the main text of interpretative boards.	
		Literal Interpretation (LI)/ Creative Interpretation (CI)	These two interpretation strategies correspond to the English part of the Latin and English strategy.
	Local Chinese biotic (flora and fauna) terms (CCPN, CCAN)	The interpretation strategies of local Chinese biotic names can adopt the broader taxonomy of interpretation strategies of common biotic names above.	
	Ecological processes (FLP, FAP)	Literal Interpretation (LI)	Interpreting short Chinese ecological processes that are written in active voice directly into active-voice English sentences of similar length. *using and interpreting of passive voice is categorised as 'Shift', which is explained below.
		Division	When the Chinese ecological processes are described in active, complex sentences, these sentences are broken down into shorter active sentences in English.
		Combination	When there is a close logical relationship between two consecutive Chinese sentences describing ecological processes (e.g., the subject of the two sentences is the same), the use of conjunctions or adjoint adverbials can be used to make them into one complex English sentence that retains all the information in the Chinese sentences.
		Shift	When the ecological processes are described using passive structures in the Chinese sentence, passive voice was used in interpreting ecological processes into English.
		Division and Shift strategy (DS)	When ecological processes are described in long Chinese sentences, they were interpreted into several simple and short English sentences. When passive structure is embedded into ecological processes, passive voice is to be used in the target interpretation.
		Restructuring the Word Order (RWO)	Important information, such as a category or generality of ecological processes, should be placed first in the sentence, followed by supporting details when interpreting ecological processes.
Cultural (C) element (CE)	People's lifestyle (PL)	Literal Interpretation (LI)	(1) When the C elements in Chinese have existing English counterparts, the counterparts are used directly.
			(2) When the poems do not have specific cultural images, the poems can be interpreted literally.
		Transliteration and Free Interpretation (TFI)	Interpreting the C element which consisted of two parts: the former part is a proper noun, and the latter is a common noun. The former part use transliteration and the latter part use free interpretation (explained below).
		Free Interpretation (FI)	(1) When highly concentrated Chinese cultural elements contain rich cultural connotations, the target English interpretation focuses on communicating the sense and cultural connotations rather than word-to-word meanings.
			(2) When interpreting poems with cultural images which include strong cultural connotations including allusions and personal names, the target interpretation adheres more to the sense and meaning rather than the original wording.
		Addition	When interpreting C elements with implicit cultural meanings or with no English equivalence, additional explanation is added.

Chapter 8: Discussion and Conclusion

As mentioned at the beginning of this thesis, the main objective of this thesis is to develop a comprehensive system to standardise geotourism translation from Chinese to English. To achieve this goal, authentic translation materials for the three elements (i.e. **A**biotic, **B**iotic, and **C**ultural elements) from nine geoparks in China were examined through empirical linguistic analysis using corpus linguistics methodology. In this chapter, I first revisit the overall background to better contextualise the motivations for each chapter within the bigger aims of geotourism translation and the needs for an efficient translation system. The second section synthesises the research findings, bringing together the empirical findings about the benchmarking model and translation strategies to the ultimate objective of high-quality geotourism translation. The third section of this chapter discusses the main contributions of this thesis in terms of its methodological innovation as well as its contribution to different stakeholders. To end this chapter and the thesis, I discuss the limitations and future directions of the project.

1. Revisiting the research background and motivation

Geotourism has attracted global popularity as it provides a platform for the exchange of knowledge and experience of geology, ecology, and cultures. As we are moving towards a more mobile and flexible lifestyle in the age of globalisation, the needs for open platforms of knowledge expression and knowledge exchange are rising, reflected in the growing number of geoparks across the globe. The geoparks aim to expand the tourist aspect of geotourism by imbuing the visitors with socio and historical significance of the sites, therefore raising awareness about environmental conservation, cultural heritage preservation, and the connection between geological phenomena and human history for future generations. However, these goals of geoparks bring about various issues in the process. On one hand, geoparks are the ideal destination for geotourism activities, as these provide access to a wide range of features of landscape, as well as to living creatures, in mostly pristine geological condition (Dowling, 2013). But as geoparks attract more international audience, the translation of geopark displays become increasingly pertinent to maintaining the quality and a fair standard of cultural communication. As the demand for high-quality geotourism translations grows to promote awareness and responsibility for geoconservation, geoparks must adopt effective and systematic translation strategies. This endeavour involves multiple stakeholders beyond practitioners in geotourism, extending to academic fields such as translation and linguistics. In the latter part of this chapter, I discuss the contribution of this thesis in these areas in detail.

Accompanying the needs for a coherent system for translation strategies is the presence of a large number of problematic translations in geoparks. As discussed earlier, the purpose of geotourism is to promote cultural exchange and transmission. Any inaccurate translation would cause confusion, misrepresentation, or even distortion of geological and cultural information, hindering the healthy development of geotourism or the successful extending of its impact. Therefore, the main objective of this research is to develop a taxonomy of effective strategies to standardise geotourism translation system, focusing on the Chinese-to-English translation.

Logistically, the development of effective translation strategies should follow a suitable benchmarking model that provides guiding principles specifically for effective translation of geotourism terms and expressions. Although there are many theoretical frameworks for the identification of effective translations, very few focused on the specific field of geotourism. A highly relevant translation framework is Hu's Eco-Translatology. The Eco-portion of the name refers to a metaphorical sense of 'ecology of translation'. This framework allows translators to make

flexible and principled decisions in choosing translation strategies, providing a suitable approach for the complex nature of geotourism translation. However, although this general framework has been adopted widely in the translation of subtitles, hospital signs, and advertising language, it has not been used in the genres such as geotourism texts, and its efficacy not tested for the context of geotourism. Geotourism translation is a growing field that demands careful consideration of its complex components (i.e., the ABC elements). These terms require translators to account for language, culture, discipline-specific content, and socio-historical influences. Additionally, the evolution of biology and geology has led to distinct terminologies for the same species across languages, complicating accurate translation. Current models like Hu's Eco-Translatology overlook such complexities. Therefore, a new benchmarking model is essential to guide translators in selecting appropriate strategies that addresses the specific needs for geotourism, ensuring systematic and scientifically accurate translations for geotourism texts.

The proposed model in this project, the SSC (**S**emantic, **S**tyle and **C**ultural) equivalence Model, sets up a benchmark that guides the goals of translation to focus on the accuracy of meaning while allowing certain fluidity in the translation of communicative styles and cultural references to maximise communication efficacy across cultures and languages. This model was then used to develop a taxonomy of effective Chinese-to-English geotourism translation strategies (i.e., the Taxonomy, details in Chapter 5, 6). A unique feature of this thesis is the use of authentic language data from several Chinese geoparks to develop the SSC model and the Taxonomy. The use of real language data provides the most relevant empirical evidence and offers realistic insights into various linguistic patterns and challenges in geotourism translation, which is a key contribution of the corpus linguistics methodology employed in this research (see a detailed discussion in Chapter 3). However, it is important to acknowledge that, although large amounts of language texts can serve as representative samples of real-world use and provide insights into linguistic systems like translation patterns, they may not capture every possible scenario in geotourism translation. In other words, despite the use of substantial real language data from six different geoparks, further validation and refinement of the SSC model and the Taxonomy remain necessary. This constitutes the motivation behind Chapter 7, where data from three additional geoparks were used to test the comprehensiveness and accuracy of the SSC model and the Taxonomy.

2. Effective translation of geotourism – the SSC model and translation strategies for the ABC elements

The empirical chapters in this thesis respectively report on the SSC model (Chapter 4), the Taxonomy of effective translation strategies used in the A and C elements (Chapter 5) which together are typically referred to as 'pure geotourism'. The B element (Chapter 6) is separately referred to as ecotourism (Dowling, 2013). In this section, regardless of the order they appear in previous chapters, I synthesise how each of the element as well as their respective translation strategies map onto the different dimensions of the SSC model, providing an overarching argument for the effectiveness of the benchmarking model as well as the fitness of the translation strategies.

First of all, both the SSC model and the types of effective strategies were closely related to the specific sub-categories of the ABC elements. The three dimensions represented by the SSC model, *Semantic*, *Style*, and *Culture*, are the ultimate evaluating standards for identifying the effective translations for each subcategory in the A, B amd C elements. In other words, each of the subcategories of the ABC elements map onto at least one of the three

dimensions of the SSC model based on their content and structural features. Therefore, the following paragraphs synthesise the findings of this thesis in terms of the A, B, C element.

The **A**iotic element includes two subcategories: geological features and geological processes, respectively mapping onto the *Semantic*, *Style* and *Cultural* dimensions of the SSC model. Geological features are mostly translated at a lexical level. For this reason, the effective translation strategies adopted for these translations typically focus on achieving the *semantic* and *cultural* equivalence as governed by the SSC model. The *semantic* equivalence ensures that all words used for translating geological features accurately represent the referent, while the *cultural* dimension regulates that the translation respectfully reflects the cultural structure of the source language, such as the four-character-structures in the Chinese language. To ensure accurate translation, six strategies were used in translating geological features, constituting the largest set of strategies to match the nature and needs of translation in this category. For example, the most frequently used strategy is literal translation, delivering a straightforward target expression that semantically matches the source text. When the direct match is absent, which typically occurs when cultural connotation is involved, the next most frequently used strategy is activated, which is transliteration and free translation. This strategy allows translators to explain cultural meanings of a specific term that cannot be literally translated into the target language. The geological processes in the A element mostly contains longer phrases or sentences that describes the formation processes of geological features. For these translations, effective translation strategies should aim to achieve *style* equivalence in addition to *semantic* equivalence. The *style* dimension in the SSC model has the most to do with syntactical structures. This guiding principle does not regulate specific strategies to be used, but encourage a higher quality in 'style' - a principle to help translators flexibly translate longer stretches of source language into coherent and authentic sounding target language.

The **B**iotic element contains common and local Chinese biotic names as well as ecological processes. Similarly to the A element, the translation of subcategories in the B element also map onto all three dimensions of the SSC model. The translation of the first subcategory, common biotic names, mainly concerns with the accuracy of word choice which is governed by the *semantic* equivalence of the SSC model. Common biotic names typically refer to flora or fauna that can find common origins in Latin or in English, so the most used strategies are Literal Translation and Latin and English. In rare cases it also requires creative translation or foreignisation, which also aim to achieve *semantic* equivalence by using the most appropriate terms for the accurate representations of the source terms. An interesting case in the B element is its second subcategory: local Chinese biotic names. This category specifically focuses on terms that are unique and local to the Chinese cultural and linguistic context. These biotic names are only used in specific Chinese regions and dialects, untranslatable unless first mapped onto a common biotic name or a descriptive expression. Therefore, in translating these terms, the *cultural* dimension in the SSC model should first be activated. In most cases, after the Chinese local names are mapped onto the common biotic names, the translation strategies are the same from those used for the common biotic names. The last subcategory in the B element has to do with longer stretches of texts. The 'ecological processes' mainly contains detailed descriptive phrases or sentences, which require careful consideration of syntactic features in both the source language and the target language. Thus, this subcategory is closely related to the *style* dimension in the SSC model, ensuring that the translated texts are coherent and familiar to the target audience in terms of linguistic style.

Finally, the **C**ultural element is mainly governed by the *semantic* and *cultural* dimension of the SSC model. The C element includes local people's lifestyles, which are expressed in very culturally-loaded linguistic expressions. These expressions can only be understood by combining accurate descriptive translations and appropriate cultural annotations. To achieve the *cultural* equivalence in the SSC model, translators can use strategies such as addition, providing additional cultural references in addition to translating the terms originally presented in the source text. Another frequently used strategy is free translation, which deviates linguistically from the literal source text but provide extended and clear cultural translation of the meaning of the source text.

As indicated by the above discussion, we can see that the *Semantic* dimension in the SSC model has more to do with lexical level equivalence, focusing more on appropriate word choices to represent the referent accurately through strategies such as literal translation, part of speech shifts, addition of cultural reference, and foreignisation for source audience. The *style* dimension is typically achieved by focusing on longer stretch of texts, involving syntactical and structural changes to align the meaning of source texts with the natural style of the target language. Strategies involved in achieving *style* equivalence typically include shift, division, combination, and restructuring the word order. Finally, the *cultural* dimension has more to do with any source expressions that are loaded with cultural connotations or references, and it typically requires strategies such as addition, free translation, which allows translators to provide needed cultural reference in translated texts.

3. Research contributions

3.1 Methodological contributions

In addition to establishing the benchmarking model and the Taxonomy for translation strategies, this thesis makes a significant contribution to the field of translation through its innovative and interdisciplinary methodology. It is the first study in the field to combine corpus linguistics with real geotourism data for a comprehensive analysis of translation strategies. The empirical design process involved multiple aspects of careful consideration, which I outline here hoping to provide a reference for future studies.

3.1.1 Selection of linguistics data – geoparks

The data selection and data collection methods used in this thesis constitutes a unique contribution of this thesis. To ensure authenticity and representation of data used for studying geotourism translation, it is important to choose the most relevant language dataset that represents realistic linguistic patterns that cover the target categories of geotourism texts (i.e., the ABC elements). In addition, because this thesis focuses on the translation between Chinese and English, the selected data should also be contextualised in these languages. Furthermore, as mentioned, the quantity of the data should be large enough for the three empirical studies on Taxonomy building as well as at least one study for validation. Therefore, to accomplish these goals, I collected data from nine Chinese UGGps (i.e., Taishan, Leiqiong, Yandangshan, Danxiashan, Jiuhuashan, Wudalianchi, Mount Kunlun, Fangshan and Xiangxi). These datasets primarily consist of three elements: abiotic (geological features and processes), biotic (flora and fauna) as well as those related to culture (human lifestyles: both historical and contemporary). I specifically selected the above nine UGGps for three reasons. Firstly, geoparks provide an ideal destination for the geotourism activities owing to their geological and ecological diversity, educational value, integration of cultural and natural heritage, and emphasis on sustainability. Secondly, the nine aforementioned Chinese UGGps are globally renowned, and their translation systems have undergone updates since 2016. Thirdly, the data

pertaining to the above nine Chinese UGGps is easily accessible and does not raise copyright concerns. This is because the managers of these geoparks directly provided me with all the geotourism datasets containing the ABC elements of the geoparks.

3.1.2 Corpus linguistics method

The second methodological contribution lies in the interdisciplinary application of corpus linguistics in processing, typically referred to as Corpus-Based Translation Studies (CBTS) (Baker, 1993). Chapter 4 to 7 of this thesis all used similar steps for analysing translation data from the mentioned geoparks. As a common practice in dealing with translation data in corpus linguistics, I used parallel data annotation, which views and compares both languages simultaneously (see a detailed description of parallel corpus in Chapter 3). This methodology facilitates efficient identification of translation strategies as well as their corresponding linguistic patterns. With the help of Tmxmall and Sketch Engine, my use of corpus linguistics method represents a novel and comprehensive case for translation studies.

Corpus linguistics as a field provide vast potential for text translation, incorporating features of both quantitative and qualitative methods. In my study, for each of the A, B, C element in geotourism translation, I presented both frequency information and qualitative text examples. The frequency information shows which translation strategies are most frequently used for a specific geotourism element, providing guiding patterns for translators to adopt. The qualitative information helps to illustrate the variety and complexity of each translation situation, providing concrete examples for translators to learn and use.

3.2 Contributions to different stakeholders

In addition to the methodological contributions, this project mainly provides a professional approach to geotourism translation (a system for future geotourism standards of excellence) for different stakeholders such as researchers, linguists, and experts in various related fields. With the insights for the broad field of translation (a systematic method of approaching translation through corpus and Eco-Translatology), I hope to initiate a conversation around benchmarking translation strategies for specific contexts, in my case, the geoparks in the field of geotourism, for the pursuit of high-quality information communication across cultures.

3.2.1 Contribution to research on translation studies

From a perspective of continual research, this study widens the scope of research on Chinese-to-English translation of the biotic element (i.e., flora and fauna) of geotourism and beyond. In this sense, both experienced and novice researchers can benefit from referencing or adapting this project into their own research on similar topics. For example, although the focus of this thesis is Chinese-to-English geotourism translation, scholars in other language varieties could apply my methodology to develop new frameworks in their own specific languages or fields. For instance, scholars whose research involves quality control of translation may follow similar steps to develop a benchmark model demonstrated in this project. As mentioned above, the use of corpus linguistics methodology in this project provides a guideline for translation research. Novice researchers seeking to understand the methods of the corpus-based analysis for translation purposes could benefit from my description of the techniques as well as the practical use of the software. They can adopt the same or similar corpus linguistics research tools to tag translation types and identify effective and ineffective translations. In the case where researchers use their own tagging scheme or construct corpora differently than the parallel corpora mentioned in

this study, their findings may add to this thesis to expand and further refine the taxonomy of translation strategies for geotourism or other fields.

Another contribution of this project in the realm of research lies in its theoretical contribution in demonstrating the applicability of Hu's (2003) Eco-Translatology in geotourism translation. Hu's Eco-Translatology is a versatile and effective approach to Chinese-to-English translation in various genres (see a detailed description in Chapter 2, section 3.5). This project provides novice researchers with a comprehensive example of applying Hu's (2003) Eco-Translatology to a specific area, illustrating the process of applying such framework to practical research areas. In addition, my project adopts a corpus-based method, which is an approach that has gained increasing popularity in the field of translation.

In summary, this project provides a rich supply of method and material for educators in the field, an enhancement of current Chinese-to-English and other linguistic scholarship, and a platform for further scholarship in the future for geotourism translation and other connected fields. Primarily for researchers in the field of translation, the methodology adopted in this thesis provides a robust precedent for exploring translation benchmarking and taxonomy of strategies in a specific field. It offers practical guidance and a field-specific professional benchmark for practitioners, especially translators, in their translation work in practice. By integrating Hu's Eco-Translatology, the corpus-based method, and Dowling's (2013) ABC interpretative concept, the research brings useful tools to enhance the quality of translation and thereby facilitate sustainable tourism and thus better cross-cultural communication. In light of the complexity of the field of Chinese-to-English geotourism translation, this research launches the field on a firm foundation which supplies standards, systematic approach, and literature. It underlines the importance of effective translation for both the environmental conservation message to the public, and the health of UGGps' local community and its preservation of culture.

3.2.2 Contributions for practitioners

For practitioners such as translators, this project provides an immediately applicable stand for meaningful and accurate translation of information that underlies sustainable tourism. First of all, following the SSC equivalence Model proposed, translators can test their translations to ensure that their content comprehensively and faithfully covers the three aspects of the **A**biotic, **B**iotic, and **C**ultural (ABC) elements. Meanwhile, the translation strategies and linguistic patterns discussed in this thesis provide the practical foundation for practitioners to reference for their own translation processes. The detailed framework helps practitioners to systematically integrate the ABC interpretative concept while preparing their materials, which saves time and energy for further translation as well as providing consistency and guidance. The Taxonomy proposed in this thesis also helps with optimising ineffective translations into those more appropriate for geotourists.

In addition to the practical guidance for translation, this thesis also provides ample examples that can be used for teaching and training of geotourism translation. The discussions of each translation in this thesis provide a pedagogical foundation for translation education (provision of a rich bank of educational resources). The examples from the corpus are real-life language references useful for future geotourism and geopark translators or educators. By providing authentic environment data, lecturers can demonstrate more effective translation strategies to teach techniques for translation, quality standards, and consequent respect for geotourism translation into English.

4. Research challenges and limitations

Most of the challenges of this research fall in two aspects. First, as an interdisciplinary project, the mastering innovative corpus linguistics alongside interdisciplinary knowledge of geotourism poses a unique challenge. For the corpus linguistics method to be valid, a comprehensive understanding of goetourism terminologies in both languages against different cultural backgrounds was essential. To achieve this, many hours were spent on learning about and exploring both fields in terms of content as well as research conventions. It, however, remains an area for improvement especially after learning from the comments provided by the dedicated reviewers of journals in the field of geotourism in the process of publishing chapters in this thesis.

A second type of challenge pertained to the data collection process for my research. As research data is the cornerstone of scientific discoveries (Dowling & Newsome, 2018), I strived to select the most representative and authentic data to reflect the language phenomenon under study, in this case, the Chinese-to-English translation of geotourism expressions. The primary sources of my research data are geological museum displays, interpretative boards, and published brochures from Chinese UGGps, including photographed interpretative panels and collected brochures. However, the global COVID-19 pandemic, along with China's strict epidemic prevention and control measures impacted the process, resulting certain delays and complications, posing challenges in the advancement, and staging of the research process.

In terms of limitations of this research, it is advisable to consider the theoretical nature of this project, which may lack certain empirical elements that involves actual human stake holders in the process of understanding, translating, and using the translated information in geoparks. This limitation calls for cautious approach when using data discussed in this project, possibly with supplement of contextualized modification. In other words, while the corpus-based method and theoretical framework of Hu's Eco-Translatology (2003) described in this project were successfully used for achieving the SSC equivalence in Chinese-to-English geotourism translation, it might lack the empirical element enriched by human translators with their experience and knowledge of their own local contexts. Specifically, for practical purposes, this target language level of this research was targeted at the middle or high school student level of translation, which is equivalent to, and sometimes termed, 'Plain English', in general governmental policy. For example, the term '断层' in Chinese geological terminology corresponds to 'fault' in English. Yet, I opted to translate '断层' into 'break', a term that is more widely and easily understood. This choice achieves semantic equivalence and also increases the likelihood that the geological jargon will be widely understood. However, practical focus group research, for example, may be necessary to validate this choice of word. As a broad suggestion for this, individuals from diverse educational backgrounds could take the findings and methods of this research and modify it for their own use according to their use contexts.

Another limitation of this study is the coverage of representative data for its objectives. This project only collected textual data from Chinese UGGps. While geoparks are ideal for geotourism translation, my study has not fully accounted for the variety of geotourism destinations in China, which includes nature reserves and destinations where ancient villages are closely connected to local history and geology. Moreover, considering the fact that Chinese translations are also adopted in geoparks in destinations outside of China, this project has not taken into consideration the global varieties of these translations. It is strongly encouraged for future work to validate the framework and taxonomy established in this project with a wider variety of data. In addition, data used in this project do not cover other modalities of translation activities (e.g., oral, audio, or visual). As a result, the outcomes of research, such as the SSC Model for evaluating the quality of Chinese-to-English geotourism translation and

the Taxonomy for translating geotourism materials from Chinese to English, may not be directly applicable to non-textual forms of geotourism translation.

Last but not least, because one of my research objectives was to provide resources for the management of Chinese UGGps, an ideal output would be materials suitable for the managers and translators at their own levels without professional linguistics training or knowledge. However, as it stands, the current SSC equivalence Model and the Taxonmy are not tailored specifically to the stated target audience, primarily for the reasons of preserving research integrity and comprehensiveness. Therefore, further refinement of the materials may be needed. Currently, this proposal has garnered support from several geopark managers including Danxiashan, Yimengshan, and Leiqiong UGGps and organisations like the Global Geoparks Network. With their support, it is hopeful that this limitation can be addressed in the near future and hopefully resulting in more widely applicable materials for geoparks.

5. Directions for future studies

For future research, my thesis lays the groundwork for further exploration into geotourism translation for languages beyond English and Chinese. My thesis primarily focuses on corpus-based Chinese-to-English geotourism translation within Chinese UGGps, I explored the benchmarking SSC Model and developed the Taxonomy from Chinese to English guided by the theoretical framework of Hu's Eco-Translatology (2003). Researchers can adapt the methodology from my study to explore corpus-based geotourism translation from English to Chinese, as well as between other language pairs. For instance, in recent years, Australia's geological heritage—highlighted by sites like the Blue Mountains, Uluru, and Wave Rock—has attracted a considerable number of Chinese geotourists and geologists for both visits and research (Geological Society of Australia, 2020; Tourism Australia, 2021; Li et al., 2022). This trend has led to a growing demand for high-quality geotourism translation from English to Chinese. Thus, translation scholars or linguists can apply a corpus-based quantitative and qualitative method, incorporating Eco-Translatology, which this project employed or others (e.g., Skopos theory and Relevance theory), to develop a quality evolution model and effective strategies for English-to-Chinese geotourism translation. To facilitate future researchers to reference or use my research methods and theoretical framework for promoting geotourism translation, I have dedicated a separate chapter (Chapter 3: Framework and Methods) to describe them in detail.

Secondly, the initial findings, as discussed in the limitations section, tend to lean more towards theoretical insights rather than practical usage. This theoretical nature might not resonate well with a diverse audience, including but not limited to different age groups or audience with different cultural or educational backgrounds. The overarching goal of geotourism translation is to facilitate better communication and understanding, making it imperative to test these theories in real-world settings. For example, focus group research may present a viable method for bridging this gap. Participants from different backgrounds can be segmented into groups based on their educational level (i.e., primary, secondary and university) or whether they possess geoscience knowledge. Each group would consist of ten candidates. By organising meetings to comprehensively collect feedback on the effectiveness of the SSC Model and the Taxonomy. Organising such meetings not only serves to collect diverse perspectives but also to refine and enhance the research findings, ensuring they are more aligned with practical realities and diverse needs. This iterative process of feedback and improvement could significantly bolster the utility and acceptance of the research, making it more relevant to a wider array of stakeholders. By engaging directly with the end-users of this research through structured focus group sessions, scholars can adapt and evolve

the theoretical models to better meet the practical challenges of geotourism translation, ultimately achieving a broader impact and fostering a deeper understanding across all segments of society. This approach underscores the importance of not just theoretical knowledge but also practical application in enriching the field of geotourism.

Thirdly, as mentioned in the limitation section, my research primarily engages with the translation of geotourism texts from Chinese UGGps, such as interpretive signs, brochures, and geological museum displays. This may lead to a research gap in the linguistic study of geotourism interpretation for other modalities, such as oral and audio. To bridge this gap, scholars are encouraged to extend their research to encompass these non-textual interpretation forms, thereby exploring both benchmarking models and diverse effective interpretation strategies beyond written texts. Researchers could conduct further investigations focusing on the behavioural distinctions across different modes of interpretation and study tour groups. For instance, researchers could investigate how the same interpretation style affects behaviour or understanding differently across various study tour groups, or how different interpretation styles influence behaviour or understanding within the same tour group. This broader approach to research could reveal insights into optimising geotourism experiences, thus enhancing educational impact and geotourism visitor satisfaction.

Apart from research of geotourism translation mentioned above, scholars can expand the topic to other related fields, such as the translation and interpretation of geo-cultural foods in geoparks. Although this project includes a vast majority of terms and expressions covered in the ABC elements, it does not cover sufficiently culinary nouns or verbs that may also occur in various parks of geoparks. Because many geo-cultural foods are displayed in multimodal venues, researchers could adopt a multimodal approach that emphasises the visual metaphor perspective of interpretation. For example, many Chinese UGGps, such as Fangshan and Hong Kong UGGps, launched its unique 'geo-cultural foods' program as an innovative move to make geological knowledge available to a larger part of society. Geo-cultural foods use crops grown locally in the geopark to create geological features unique to the geopark which is to combine geo-culture with culinary culture so that visitors can learn more about geology while employing the delicacies. Geo-cultural foods can inspire visitors to cherish the Earth and our happy life, and that it can increase the popularity and reputation of geoparks' food and beverage industry, thus driving the growth of tourism revenue and overall local economy. In the geoparks' restaurant, effectively conveying the geological or geomorphological knowledge embedded in geo-cultural foods to geotourists using complementary graphics and texts poses a challenge. This approach requires integrating visual representations of the foods with textual interpretations that popularise their geo-cultural significance. Currently, this specific intersection of geotourism and culinary interpretation lacks substantial academic research.

6. Final words

This research has achieved its research aims and contributed to the theoretical, methodological, and practical discussion of translation for a specific area - geotourism. Five out of the eight chapters have been published in various journals on geotourim. Chapter 2 (the literature review) is a complete publication in the 'International Journal of Geoheritage and Park' (Li et al., 2022a). Chapter 4 established the SSC model to assess the quality of Chinese-to-English geotourism translation of the ABC elements. This chapter can be accessed in the journal 'Geoheritage' (Li et al., 2022c). Chapter 5 and Chapter 6 together established the taxonomy for effective Chinese-to-English geotourism translation strategies. These chapters were published respectively in the journal

‘Geoheritage’ (Li et al., 2022a) and ‘Journal of Sustainable Tourism’ (Li et al., 2024). Finally, Chapter 7 validated the SSC equivalence Model and the Taxonomy. This chapter is published in ‘Geoheritage’.

This thesis is contextualised against the broad social and ecological trend of growing popularity of geotourism translation. As the demand of knowledge exchange increases within geoparks, providing accurate information in their interpretive displays become increasingly crucial, as effective translation is essential in promoting geoconservation awareness and prevent mistranslation of information. Therefore, this thesis focuses on developing a taxonomy of translation strategies to standardise Chinese-to-English translations in geotourism. The SSC Model developed in the thesis provides a structured approach to geotourism translation by ensuring accurate meaning while allowing fluidity in communication styles and cultural references. Based on the SSC Model and the use of authentic linguistic data from Chinese UNESCO Global Geoparks, I developed and validated a comprehensive taxonomy of effective strategies for geotourism translation, which contributes to different stakeholders in both theoretical and methodological aspects. Looking forward, employing my research findings to further explore geotourism translation from various angles, including translations in different languages and styles, promises significant potential.

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