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BOOK REVIEW

Mid-Ocean Ridges

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Mid-Ocean Ridges by Roger Searle, Cambridge University Press, Cambridge, 2013, pp. xii + 318. Scope: monograph, £??, ISBN 978-1-107-01752-8 (Hardcover). Level: undergraduates, graduate students, interdisciplinary researchers.

The Earth's mid-ocean ridges form a single, connected, topological feature which, as Roger Searle points out, is the longest mountain range in the world. They have developed as a result of the sea floor spreading associated with tectonic movements. Although this idea is now very soundly based and almost universally accepted, it is actually of surprisingly recent origin. This reviewer recalls being thrilled by Wegener's (1912) theory of continental drift when he read about it in a book as a teenager in the 1950s, but then being totally squashed by a rather distinguished professor of geology who described the ideas as "absolute rubbish"! Much has happened since then, and most of the advances in understanding have come about through the application of physics, both to the geological measurements and to their subsequent interpretation.

As now envisaged, the continents float on the mantle, and slowly move (typically by a few cm. per year) as a result of its convection. Where continents are moving away from each other, new ocean floor has to be formed in between them, at upwelling sites, and it is the resultant geological activity that gives rise to mid-ocean ridges. Of course there also has to be a mechanism for loss of ocean floor and this happens at subduction zones, usually where the relevant tectonic plate slides underneath another one. For many scientists, the clinching evidence in favour of this general picture was the discovery of magnetic field reversals in the rocks as a function of their distance from mid-ocean ridges. The Earth's magnetic field is known to undergo reversals over geological time, and so the natural explanation was that the rocks were faithfully recording the direction of the Earth's magnetic field at the time when the material was solidifying and cooling.

Mid-ocean ridges are exciting places, where there is a lot going on. Although the rate of plate separation is small, the upwelling asthenosphere (ductile mantle) and shallow ocean floor bring high heat flow, seismic activity, volcanism, and hydrothermal vents where there are unique biological ecosystems. The ridges are arguably the most dramatic and persuasive demonstrations of the non-static, highly dynamical, character of the Earth's surface.

Roger Searle's book aims to provide an accessible, multi-disciplinary, description of mid-ocean ridges suitable for graduate students, advanced undergraduates, and researchers new to the field. The introductory chapters discuss the discovery of mid-ocean ridges and explain in useful detail the mostly physics-based methods that have been developed to characterise them – for example their depth, associated magnetic and gravitational anomalies, heat flow, seismology, and topology. The chapters that follow describe how these techniques have been put to good use and the interesting discoveries to which they have led. Although the emphasis is strongly on the physical processes that occur as the result of the plate tectonics, including rifts and faults, the different ways in which lava can solidify, and hydrothermal processes, the coverage also ranges more widely, e.g. there is an interesting section on hydrothermal vent biology that is unreliant on photosynthesis.

The book is very well-written, and systematically structured with an introduction and summary for each of the nine chapters, and carefully enumerated sections and subsections within them. There is a huge number of black-and-white line drawings and figures together with many

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colour plates. The latter are (slightly inconveniently) clumped together in the middle; but black-and-white versions of the same figures are also included in the relevant chapters close to where they are needed. There is a useful Appendix providing a glossary of terms and acronyms, another one listing the locations of features mentioned in the text, 51 pages of references, and a detailed index.

Roger Searle has provided a detailed and authoritative exposition, accessible to anyone with a knowledge of physics, that is relatively jargon-free, and which includes explanations of the relevant technical concepts and terms used. It is likely to be useful to a wide range of scientists with an interest in the area, probably for many years to come.

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