Earthing the *Anthropos*? From `Socialising the Anthropocene' to Geologising the Social

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Responding to claims of Anthropocene geoscience that humans are now geological agents, social scientists are calling for renewed attention to the social, cultural, political and historical differentiation of the *Anthropos*. But does this leave critical social thought's own key concepts and categories unperturbed by the Anthropocene provocation to think *through* dynamic earth processes? Can we `socialise the Anthropocene' without also opening `the social' to climate, geology and earth system change? Revisiting the earth science behind the Anthropocene thesis and drawing on social research that is using climatology and earth systems thinking to help understand socio-historical change, we explore some of the possibilities for `geologising' social thought. While critical social thought's attention to justice and exclusion remains vital, we suggest that responding to Anthropocene conditions also calls for a kind of `geo-social' thinking that relates human diversity and social difference to the potentiality and multiplicity of the earth itself.

Anthropocene, Holocene, earth science, geology, climate change, deep time, social difference, geo-social futures

'The Earth is one but the world is not' (1987: n.p.). So opens *Our Common Future*, the 1987 report of the UN World Commission on Environment and Development. Although ecological issues at the time had already begun to chafe against disciplinary boundaries, for that small minority of social scientists drawn to the environmental field, the Commission's premise most likely seemed unproblematic. The earth — whole, integrated, singular — was the domain of the natural sciences. Social *worlds* — multiple, divided, contested — were the realm of the social sciences. Thirty years later, things are more complicated. Social worlds are no less fractious, but something is shifting in the way the earth is understood. As stratigrapher and Anthropocene Working Group chair, Jan Zalasiewicz recently put it: '…the Earth seems to be less one planet, rather a number of different Earths that have succeeded each other in time, each with very different chemical, physical and biological states' (cited in Hamilton, 2014: 6).

For most of the last two centuries, with some exceptions, social thought has not given serious attention to the earth sciences. While the social sciences and humanities have conversed productively with biology, linguistics, psychoanalysis, complexity studies and even mathematics, the geosciences seem to have offered less fertile ground for engagement (Clark, 2011: 7-11). One reason for this may be that our planet - as presented by the scientific disciplines specialising its study - has appeared to change so gradually that it can largely be taken for granted as the static backdrop of social existence. Perhaps more importantly, in its very obduracy the earth has generally signified inertia and stability - such that any association with social life has usually been taken to imply a

limitation or closure of the possibilities open to collective social action.

These assumptions are now under serious revision. With a nod to Donna Haraway (1991: 152), it might be said that our earth now looks disturbingly lively, and we ourselves frighteningly inert. First came the threat of human-induced climate change - which soon developed to into the abrupt climate change thesis. Shortly afterwards, expanding on the notion of thresholds in global climate, came the idea of human-triggered transitions in the overall state of the earth system – the crux of the Anthropocene thesis. And in this way - through the proposition that humans have become geological agents - the Anthropocene thematic has drawn earth scientists into making substantive claims about the behavior, dynamics and trajectory of humankind: terrain that social thought has historically considered its own. Unsurprisingly, this move is attracting considerable interest from the social sciences and humanities.

This reception of the Anthropocene already covers a broad spectrum, much of it endorsing the urgency and severity of the global environmental problems that physical scientists have been highlighting. There has also been a growing tendency, especially in the arts, architecture, literary studies and philosophy, to engage more speculatively with material generated by the earth sciences. Social scientists, on the other hand, have been more likely to cleave to a critical agenda, probing the political implications of Anthropocene science, particularly with regard to the way it constitutes `the human' or `the social'. Confronting the inclination of geoscientists to frame humanity as an undifferentiated whole, they have responded by affirming a vital role for critical social inquiry in interrogating the social, cultural and historical differences and the uneven power relations that divide the *Anthropos*

Taking this reception and these reactions as our starting point, this paper asks what is at stake in reasserting the conventional terms of analysis of social thought in the face of the challenges of the Anthropocene. Just as critical social science and humanities scholars are cross-examining the themes and concepts of Anthropocene science, we take a discerning look at the conceptual frameworks and categories that social thinkers themselves are employing in their critique of the earth sciences. The question we are interested in is what happens to our own disciplinary assumptions and investments when social inquiry engages fully with a mobile, forceful and dynamic earth. What becomes of the categories of the social, the cultural, the historical, the political, we ask, if we open social thought to climatic, geologic or geophysical processes in a deep and sustained way? Or to put it another way, is it possible – or desirable - to `socialise' and `politicise' the Anthropocene without also `geologising' the social or the political.

After reviewing some of the receptions of Anthropocene science in critical social thought, we turn to a heterogeneous body of social science, humanities and environmental studies scholarship that is doing something different with the findings of the earth sciences. Though not necessarily in less of a critical fashion, these researchers are setting the theories, concepts and evidence of contemporary geoscience to work in ways that cast new light on crucial moments in social history by taking account of their geophysical context. Though this work is not necessarily focused on the Anthropocene – indeed, it tends to be more concerned with the Holocene - what it *is* doing is engaging, in its own way, with the broader developments in the earth sciences that inform the Anthropocene thesis. Extrapolating from this research, and especially from what it says about the long history of human interaction with climate and related earth processes, we come back to the possibility of opening social thought – critically, creatively, speculatively – to the dynamics of the earth. In this way, we circle back on the question

of what it might mean, at the current geo-historical juncture, to put social worlds — multiple, fractured, contested — into articulation with an earth that is in its own way multitudinous, heterogeneous, divided.

Socialising the Anthropocene

In this section we offer a brief overview of responses by social scientists and humanities scholars to the Anthropocene thesis, focusing on the way that critical social thinkers are countering what they see as a unified and totalising framing of the *Anthropos* by geoscientists. We then step back and take a broader view of the earth science that underpins the Anthropocene concept and begin to ask what the shoring up of existing social sciences disciplinary strengths might mean for our encounter with earth science.

The social science reception of the Anthropocene, we suggest, should be viewed in the context of several decades of intensifying engagement with environmental issues. Initially viewed by some social scientists as marginal to received disciplinary priorities and by others as an unwelcome incursion by natural science, the environmental problematic has come to be seen both as matter of political urgency and as opportunity for extending the critical social science imaginary. However, it still rankles social scientists that we missed the opportunity for formative input into the discursive framing of the anthropogenic climate change problem. Left largely in the hands of the natural sciences, with the vacant niche of social analysis partially and unsatisfyingly filled by the narrow economism of cost benefit analyses, the climate change issue offers a lesson to social sciences about the need to mobilise around emergent global environmental concerns (see Szerszynski and Urry, 2010).

Closely related to the climate question but even more inclusive, the Anthropocene thesis

offers something of a second chance for social thought, with the very foregrounding of the human in the formulation adding to the incitement. The comprehensive and explicitly *critical* Anthropocene research agenda proposed by the interdisciplinary social science team of Lövbrand *et al.* offers a useful distillation of themes prevalent in responses to date:

> When linking environmental change to social categories such as class, race, gender, power and capital we thus find that the challenges of the Anthropocene are far from universal. Rather, they emerge from different socio-political settings, produce different kinds of vulnerabilities and precariousness and will therefore most likely generate different kinds of political responses …. (W)e suggest that a critical Anthropocene research agenda will resist unified accounts of 'the human' and instead work to situate people and social groups in the rich patterns of cultural and historical diversity 'that make us into who we are' (2015: 214-6)

It is worth teasing out these claims. A key point here and in related literature is that Anthropocene science, in its central thesis that `human' agency has reached geological magnitudes, is propounding a unified or universalistic account of the *Anthropos* or the human. This critique is linked to the idea that the natural sciences in question fail to acknowledge their own social and historical positioning, and the necessary partiality that accompanies this. Or as historian Christophe Bonneuil puts it: `Anthropocene science offers `a single grand narrative from nowhere, from space or from the species' (2015: 29).

A second point is the assumption that conventional social categories – class, race, gender

and so on - have lost none of their explanatory or heuristic force in the Anthropocene context. Reassertion of the pertinence of these categories is generally made in the course of stressing the gross inequalities in the contribution of different social groups to the destabilisation of earth system and the marked differences in vulnerability to the anticipated changes. This is closely related to the charge that the linking of quantifiable economic, technological and demographic changes to increased pressure on earth system marshalled by Anthropocene scientists fails to identify the specific causal processes that drive socio-material change. Unsurprisingly, Lovbrand *et al.* refer to capital. Others have been still more emphatic, decisively attributing the coming of the Anthropocene to the dynamics of the global capitalist system, and charging any approaches which fail to recognize this with `occlude(ing) the historical origins of global warming' and related earth system changes (Malm and Hornberg, 2014: 67; see also Malm, 2015).

Thirdly, following on from the previous two points, social critics have insisted upon the need for the Anthropocene thesis to make room for a multiplicity of perspectives. Anthropocene discourses will need to embrace `a plurality of narratives from many voices and many places' (Bonneuil, 2015: 29), it is being argued, if it is to avoid the setting itself up as a new master narrative. To undercut the abstraction and univocality to which the natural sciences purportedly still aspire, these multiple voices must be construed as `embodied' `situated', and `contextualised' (Lövbrand *et al.*, 2015: 214-6). Recognising the diversity of viewpoints and experiences is a matter of bearing witness to the profound unevenness of exposure to global change. But it is also seen to be vital that multiple constituencies are engaged and brought together in order to move beyond the kind of technocratic and managerialist responses that are currently on the table and to set in motion the radical change that the coming of the Anthropocene demands (see Bonneuil and Fressoz, 2016: 71). As human geographer Karen O'Brien sums up:

> a deeper understanding of the role of human beings and their socio-cultural, political and economic relations is needed to foster the large-scale transformations in human attitudes, behaviors, and systems necessary to respond to what scientists consider to be an 'overstepping of planetary boundary conditions' in a complex, interconnected Earth System (2010: 542).

Overall there is a concerted effort in critical social thought not to perpetuate what is seen as the prevailing techno-scientific framing of climate change and to make sure that the Anthropocene thesis and practical responses to it are multivocal, negotiable and open to contestation - to such an extent that deep-seated causal questions make it on to the agenda. Theoretically or conceptually `socializing the Anthropocene', in this way, is held out to be a necessary condition of the drive to `re-politicize the Anthropocene' (Lövbrand *et al.*, 2015: 213, 216).

Surveying this emergent field of critical and interpretive scholarship, there is much that we would affirm. If the pronouncements of Anthropocene science are not to re-inscribe the injustices and inequalities that currently divide human populations, it is vital that existing power relations are explicitly and rigorously challenged - which also requires an incessant contestation of science's own privileged position in articulating the global predicament. There are however, details with which we are less comfortable. In particular, most of these authors have insufficiently acknowledged the way that geoscience Anthropocene advocates have themselves underlined that earth system change is profoundly uneven in its causes and its effects (see Crutzen, 2002: 23; Steffen *et al.,* 2011: 746, 739). There are also aspects of the drive to `socialise' the Anthropocene -

with its insistence on reinforcing inherited disciplinary concerns – over which we have more serious misgivings. What we would see as the restrictively *reactive* side of social Anthropocene scholarship is most visible when fellow social science or humanities scholars are seen to have engaged with earth sciences in ways that overstep the bounds of the critical project.

Such `disciplining' has been most conspicuous where the theorists in question have engaged with geological phenomena whose temporal scope exceeds the historical span in which the social asymmetries central to critical thought are discernable or relevant. Notably, when historian Dipesh Chakrabarty (2008) makes the claim that climate science confronts us with earth processes whose timescales render them indifferent to collective social agency, he is quickly taken to task by Bonneuil, for whom `this "indifferentialist" view re-enacts precisely the modern divide between the `natural' and the `social' that the Anthropocene disproved' (2015: 28-9). Likewise when Chakrabarty and others follow through on the idea that geological time-scales call for a deep temporal engagement that pushes beyond recorded history they are chastised for telling a story `that yields to the Anthropocene's official and naturalistic grand narrative of an undifferentiated humanity uniformly concerned by and responsible for global climate change' (Bonneuil, 2015: 20). Or as Andreas Malm and Alf Hornborg put it, also singling out Chakrabarty, `species-thinking on climate change is conducive to mystification and political paralysis (2014: 67).

It is revealing that Chakarabrty is one of few social thinkers who has paused, taken stock of his critical inheritance and confessed to finding it seriously wanting. In his own words:

> As the crisis gathered momentum in the last few years, I realized that all my readings in theories of globalization, Marxist analysis of capital,

> subaltern studies, and postcolonial criticism over the last twenty-five years, while enormously useful in studying globalization, had not really prepared me for making sense of this planetary conjuncture within which humanity finds itself today (2008: 199).

It is worth dwelling on the distance between this kind of self-questioning and the emphatic reassertion of conventional social categories that we have been observing in other critical engagement with the Anthropocene. Ironically, it is by insisting on the *situating* of social existence within an extended geophysical field that Chakrabarty exposes himself to the charge of ontologically privileging nature. For is critics, we would suggest, the insistence that pre-existing conceptualisations of the social, the political, the cultural and the historical suffice to make sense of the Anthropocene rests on the premise that is possible to dissect the humanisation of geology without any corresponding `geologising' of the social or the human. That is, they are working on the assumption that geoscience concepts such as climate, the earth system, or the Holocene-Anthropocene boundary should be opened up and reconstructed through their exposure to social science concepts. At the same time, however, social science concepts and theories appear able to be deployed as if they are immune to any reciprocal `contamination'. To put it another way, we are required to identify the social processes that have configured the contemporary climate or earth system, but we seem to be prohibited from inquiring about the geologic or climatic processes that might have shaped human collectivities or social formations.

We suggest that what sustains this asymmetry is a predilection amongst critical social thinkers for engaging with the Anthropocene epoch without affording similar attention to other geological epochs or eras. More broadly, this involves a preference for focusing

on the provocations of the Anthropocene thesis at the expense of the more expansive set of developments in earth science that have made it possible to conceive of human-triggered geophysical threshold events. The Anthropocene thesis, we contend, is not the full story, perhaps not even the culmination of this work. It has come to involve serious scientific research, but the idea itself emerged as a cry of alarm and frustration by geoscientists who faced what they believe to be a looming planetary crisis (see Zalasiewicz *et al.*, 2010; Clark, 2014). In this regard, the science of the Anthropocene might best be viewed as the public-facing and explicitly politicized outcrop of a much deeper and heftier body of work. And this very *lack* of disinterestedness, it should be added, has earned Anthropocene scientists considerable opprobrium from geoscience peers.

In summary, the social science responses we have been discussing may have chosen to unleash their `sophisticated critical conceptual apparatus' (see Bonneuil, 2015: 20) on a comparatively soft and sympathetic target. In the process we argue, they have passed over opportunities to engage more substantively with the five decades-plus of earth science research that gave rise to the Anthropocene thesis as but one of numerous `outputs'. Much more could be said about this, but our preference is to turn to another kind of social science and humanities scholarship: to address a body of research that seeks to understand social and historical change by setting to work theories, concepts and data from the geosciences. In the process of establishing a working relationship with recent developments in earth science, we suggest, these researchers start to open up core categories of social thought to their geologic or geophysical context - though they do so most often in a collateral rather than explicit fashion.

Geologising the Social

It is worth recalling that in one of the first publications on the topic, Paul Crutzen and Eugene Stoermer noted the `somewhat arbitrary' nature of attempting `to assign a specific date to the onset of the "anthropocene"' (2000: 17, see also Zalasiewicz *et al.,* 2008: 7). To which it should be added that geoscientists are not set on the idea that a putative starting date needs to involve humans at all – some proposing that 1815, the year of the Tambora volcanic eruption in Indonesia, might be as good a marker as any (Zalasiewicz *et al*., 2008: 7; Waters *et al*., 2014: 5). In short, for earth scientists, human agency – collective or specific – is not intrinsically different from any other kind of physical agency, and however consequential it might be for exiting human populations, they tend to see the coming the Anthropocene as simply one more set of changes in a vast and eventful earth history.

The more important point here is that conceiving of human agency as capable of impacting on the earth system is a part of the much bigger picture of a complex, dynamic earth with a propensity for nonlinear shifts between a range of possible states. And this in turn is the outcome of a still more encompassing set of transformations in the way earth scientists conceive of the earth that have taken place over the last half century. As historian John Brooke recounts, the years 1966-73 alone saw the emergence of four major new perspectives on the dynamics of the earth: the confirmation of the theory of plate tectonics, a new appreciation of the role of extra-terrestrial impacts in shaping earth history, the thesis that evolution is punctuated by catastrophic bursts linked to major geophysical events, and the beginnings of the idea the different components of the earth function as an integrated system - as expressed in the Gaia hypothesis and earth systems theory (2014: 25-28).

What these convergent paradigms succeeded in doing, Brooke and others argue, was both shaking up the idea of gradual change that had reigned in the earth sciences since the mid 19th century and overcoming the separation between different disciplinary fields studying the earth (2014: 25-8; see also Davis, 1996). One of the crucial breakthroughs, hinging on a wealth of empirical evidence and a deepening appreciation of the way feedback operates in complex systems — was the discovery that climate change in the past has often been abrupt rather than incremental. Based on a developing understanding of these dynamics and boosted by global warming concerns, geoscientists have been producing ever more detailed data sets of past climate. For researchers in a range of social science and humanities sub-disciplinary fields, this reconstruction of the earth's climatic history has opened up possibilities for considering the impact of climate and related environmental change on social and history change.

This work is by no means incommensurate with the critical scholarship on the Anthropocene that we discussed above. Indeed, much of it resonates with the abiding concern with inequality, injustice and exploitation that characterises this approach. A paradigmatic example is cultural historian Mike Davis's *Late Victorian Holocausts* (2001), a powerful analysis of the formation of the global divide between the 'first' and 'third' worlds, published just as the Anthropocene idea was breaking. In a scathing rejoinder to any assumption that the agrarian peoples of monsoonal regions are destined to poverty by environmental conditions, Davis demonstrates that both the economic marginalisation and the climatic vulnerability of tropical peasantries are inseparable from the processes through which they were forcibly incorporated in the globalising capitalist economy of the late 19th—early 20th centuries. But significantly, Davis does not stop with an indictment of colonial regimes and the inequities of capitalism.

At the core of his argument is the claim that the enforced exposure of the peasant producers of the monsoonal belt to market forces coincided with a series of severe droughts. Only recently, with the scientific deciphering of the planet-girdling El Niño Southern Oscillation weather system, has it been possible to understand the intense and irregular rhythms of rainfall that affect monsoon lands. As Davis cites oceanographer Richard Barber, locating this breakthrough firmly in the earth science advances we have speaking about, `El Nino-Southern Oscillation variability is the first great coupled atmosphere-ocean-biota puzzle that humankind has solved' (2001: 234). The message of *Late Victorian Holocausts* is unequivocal: the succession of devastating famines and the enduring economic marginalization of the agrarian monsoonal regions they set in train cannot be explained by either the critique of capitalism or by climatology alone. To grasp `the making of the third word' requires a fusion of critical social analysis and the geoscientific understanding of the nonlinear dynamics of the earth system.

If Davis is bearing witness to the unnecessary deaths of tens of millions of people and the long-term consequences of mass destruction of traditional livelihoods, so too is he declaring that we cannot fully comprehend global injustice without accounting for `the hitherto unnoticed environmental instability in modern history' (2001: 279). Davis, it is worth recalling, is not the first critical historical thinker to incorporate earth processes into social history. In his mid-twentieth century writings, Annales School historian Fernand Braudel repeatedly implored fellow social and historical researchers to look past the eventfulness of socio-economic life to the deep geophysical processes operating beneath. But Braudel's earth was still very much that of early 20th- late 19th century `gradualist' geoscience. His geology provided an `almost motionless framework' (1972: 102), so enduring and ponderous that its impacts on social existence remained at a deep,

basal level. Davis' geology, by contrast is the outcome of what he himself has enthusiastically described as a `permanent revolution in the earth sciences' (1996) — the turn towards complex, integrated systems capable of reorganizing themselves at relatively high velocities.

Other social scientists and humanities scholars are joining Davis in acknowledging that the new sciences of the dynamical earth and the increasingly comprehensive data sets they are generating can help us make sense of decisive moments in world history. Anthropologist Julie Cruikshank (2005) recounts how early European contact with indigenous peoples in the Pacific Northwest overlapped with the latter stages of the Little Ice Age — a period of cooler and more erratic temperatures manifest in the region as rapid glaciation. `A time of significant geophysical change', she notes `…coincided with dramatic social upheaval causing both readjustments and realignments among resident peoples and the permanent problem of powerful strangers who came to stay' (2005:10).

Cultural historian John Brooke (2014) develops the broader point that the 15—19th century Little Ice Age — perhaps the most climatically unstable conditions for several thousand years — contributed significantly to the ecological, social and physiological vulnerability of indigenous peoples worldwide at the time of European contact and colonial advance. Extended drought and famine during the 16—17th centuries, Brooke adds, fragmented once powerful West African states. This fragmentation generated conditions that did not cause but certainly exacerbated the rise of the slave trade, at the same time contributing to an exceptionally intense wave of war, famine and epidemic across much of the Eurasian continent (2014: 443-7). While northwestern Europe did not escape this climatic turbulence unscathed, Brooke notes that, amongst other effects,

cooler summers during the latter Little Ice Age had the advantage of helping suppress recurrent outbreaks of plague (2014: 458).

Brooke takes us back to the Medieval Climate Anomaly that brought several centuries of warm stable climate to the Northern latitudes while visiting megadrought on much of the equatorial belt (2014: 359, 370-1). And still further, through a Classical Climatic Optimum back to an episode of abrupt climate change around 4200 BP (before present) whose rainfall deficits destabilised Bronze Age polities around the Mediterranean and pulsed a havoc-strewn pathways across South and East Asia, West Africa and MesoAmerica, (Brooke, 2014: 299, 306-25). Push back another thousand years and we reach the Mid-Holocene Climatic Transition. Perhaps the most significant episode of abrupt climate change of the last 10,000 years, the period between 6400 BP and 5000 BP saw a global shift from the warmer, more humid conditions of the early Holocene to a regime characterized by cooler high latitude temperatures and enhanced aridity in the lower or tropical latitudes (Brooke, 2014: 154-164; Brooks, 2012: 94-5). One of the effects of acute climate stress – most apparent in the Middle East – was the migration of people away from drying areas and the rapid growth of population on the floodplains of river valleys. Paleo-environmental and archaeological research has identified strong correlations between mid-Holocene aridification and the transition from small, relatively egalitarian villages to much larger urban centres characterized by intensified social stratification and administrative hierarchies (Brooks, 2006; 2012; Kennett and Kennett, 2006).

Paleoclimatic records identify another significant cold-arid event around 8000 years ago - although it is not as severe as that of the Mid-Holocene (Brooks, 2006: 31). Holocene episodes of abrupt climate change, in turn, are mild compared with the vicious climatic

oscillations of the Pleistocene. While temperature changes were more pronounced closer to the poles, the flip from a warmer interglacial into a cooler glacial state — switches that climatologists now believe may have occurred in less than a single human generation — would have had severe impacts right across the planet's surface, resulting in declining rainfall, fierce winds and dust storms, vast forest fires and collapsing animal populations (Calvin, 2002: 3-4; Muller *et al*., 2011: 278). With each transition, paleoclimatic and genetic analysis suggests, human populations suffered catastrophic crashes (Ziegler *et al*., 2013: 6), resulting in the attenuation of numerous waves of migration and bringing about extinction of multiple branches of the genus *Homo*. 'Our ancestors lived through hundreds of such episodes — but each became a population bottleneck, one that eliminated most of their relatives' intones evolutionary psychologist William Calvin. `We are the improbable descendants of those [who] survived — and later thrived' (2002: 3).

There has been much speculation about the role of climate change and other upheavals, such as major bouts of volcanicity and seismic activity, on human evolution, though geophysical instability has been so intense and recurrent that it remains difficult to relate directly to specific changes in behavior or physiology (Gamble *et al.,* 2004: 243-4). Sooner or later, the question of the role that planetary dynamics have played in the shaping of our genus and species takes us back to human origins. Paleoclimatologists and paleoanthropologists currently link the divergence of the genus *Homo* from fellow 'great apes' in East Africa some 2.4 million years ago to changes brought about by a convergence of powerful 'forcing' mechanisms: regional tectonic uplift, orbital forcing (changes in the earth's orbit and the tilt of its axis) and global climate change triggered by reductions in atmospheric carbon dioxide (Maslin and Christensen, 2007). As anthropologist Yves Coppens concludes 'We are partly the fruit of an astronomic event,

helped by a tectonic one, which produced a dramatic drought in periequatorial eastern Africa' (1999:17; see also Gunaratnam and Clark, 2012).

At each of the junctures we have touched upon - from Davis's late-Victorian famines to the emergence of the genus *Homo* – new perspectives are emerging from the conversation between the scientific research into the complex dynamics of earth systems and historical or archeological inquiry into human development and social change. While the relative contribution of different variables is often hotly contested, for our purposes the details are less important than the basic idea that understanding social history has much to gain from the deciphering of *geo*history. While critical social thinkers rightly insist that all forms human agency should be socially, culturally and historically `situated' the approaches we have been looking at in this section each demonstrate in their own way the value of extending the idea of situatedness or positionality to the geological or planetary context. Or what we refer to, in shorthand as the geologisation of the social.

Differential Forces of the Earth

In this section, in three stages, we develop the idea of the re-embedding of social categories in earth processes in order to show in more detail what is at stake in opening the social to the geologic. Our first point is that while none of the researchers whose work we addressed above claims a determining role for geophysical or climatic events, each of them makes reference to aspects of the earth system that are constitutively *outside* the social. In Davis's case, there are alternatives to exposing climatically stressed peasant farmers to the added volatility of the global economic markets. When Brooks makes connections between the Mid-Holocene Climatic Transition and the emergence of complex, urban, state-level societies, he is emphatic that is not an inevitable outcome of

increased aridification (2006 34, 44). Likewise none of paleo-archeologists or evolutionary theorists engaging with the geoclimatic or environmental context in which the genus *Homo* emerged imply any sense of a necessary trajectory leading to our own species. Yet, in each of these cases the decisive physical forces or events are treated as independent or exogenous variables. Especially for those researchers engaging with the more extreme episodes of climate change, there is a pronounced sense in which climatic and related environmental change is viewed as setting the broad parameters or conditions of possibility of social life. Brooke, in this regard, describes climate change during the four millennia BC as `establishing the boundaries within which life was conducted' (2014: 317), while paleo-environmental researcher Nick Brooks speaks of `environmentally embedded cultural trajectories' (2006: 40).

Clearly something has changed in the Anthropocene. However, if there is a sense in which specific social processes are altering the conditions or boundaries within which life is conducted, we would suggest that it is just as vital to recognise that crucial earth-shaping forces remain outside the sphere of human influence. Look beyond the immediacy of Anthropocene debates into the encompassing field of contemporary geosciences and we are soon reminded that such processes as cyclical changes in the planet's orbit and axis, the openness of the earth to the solar radiation and astronomical events, magma-driven movements of tectonic plates, the stratal composition of the earth's crust, the deep structures of biological life and functioning of the biosphere continue to set the broad parameters for the functioning of the earth system (see Clark 2016).

In this regard, recent convergence between paleo-environmental science and human `deep history' seems to fully endorse Chakrabarty's position: any sustained encounter of

socio-historical analysis with geoclimatic or earth processes leads us into the unequivocally inhuman reaches of the earth and cosmos (see Clark, 2011; xv-xvii; Gunaratnam and Clark, 2012). Only when the human signature of the Anthropocene is severed from broader geophysical dynamics and from every other geological era is it anywhere near possible to imagine that the `social' or the `cultural' or the `historical' might be self-supporting and disembedded from its geological context. And it hardly needs to be said that the Anthropocene itself as distinctive epoch and stratum only makes sense within the relational context of a succession of geological periods.

Our second point develops the claim that we need to account for the traces of a constitutive geologic outside in the very categories of social thought. Here, Davis has shown the way. No less than political ecologists, climate justice advocates or social Anthropocene critics, Davis is morally and politically incensed by the way that the effects of climate change impact unevenly across the socio-structural fault lines of global inequality (see Davis, 2008). But the point of *Late Victorian Holocausts*, as we have seen, is to insist upon a reciprocal movement: to demonstrate that the very existence of a `third world' bears the irreducible trace of climatic variability. A similar, but even more far-reaching case for the originary complication of climate in key `social' categories arises out of research into the Mid-Holocene Climatic Transition. As Brooks broaches the issue: `we may be justified in viewing civilization as a form of adaptation to climate change' (2006: 46). Though the arguments remain contested, evidence that urbanization, intensified social stratification, enhanced divisions of labour, centralization of political power, and the state-territory conjunction are all tied up with an episode of abrupt global climate change clearly raises the possibility that core concepts of social thought may be geophysically `contaminated' from the very outset.

The same can be said about evoking of `cultural' or `historical' difference as a self-evident way of breaking up the purported totality of the *Anthropos*. Brooke proposes that much of the broad contouring of modern cultural and linguistic diversity bears the imprint of `climate-driven dispersals of people' — especially during the mid-Holocene transition. As he explains: `agriculture expanded, carried by small colonizing movements that left signatures buried in the geography of the human genome and that probably built the basic linguistic structure of the modern world' (2014: 157). Again, the causal chains are open to debate, and it is likely that crucial details will remain irrecuperable. But what is at issue is the broader point about how we conceive of human difference. If we are interested in Lövbrand *et al's* `rich patterns of cultural and historical diversity "that make us into who we are"', then the very categories of culture and history that are being activated here themselves call out for the destabilisation by the geologic - no less than the idea of a generic human geologic subject demands the complication of the cultural or the historical.

This is not going to be easy or straightforward. If, for example, we take seriously evidence from the earth sciences that the main driver of the Mid-Holocene Climatic Transition was variability in the earth's axis and orbit, then there may indeed be a trace of `universality' woven into the fabric of human cultural-historical difference. Which is to say that even in the very throes of socially and culturally differentiating events `species thinking' may have a habit of returning on us – and in this sense may need to be accounted for rather than summarily disavowed.

There is a more general question here about how thinking *with* or t*hrough* the pivotal geoscientific notion of multi-state earth systems might help us reimagine human difference and diversity (Clark and Gunaratnam 2013; Gunaratnam, 2014). This brings us

to our third point. Most of the examples we have looked at focus on critical junctures at which environmental stress emerges as a driver of social or cultural transformation. While this serves to highlight the way that earth systems function as a condition of possibility of social life, it can put too much weight on moments of extremity or crisis. It is important, as Davis's work suggests, to bear witness to the suffering and loss that occurs when vulnerability is exacerbated by unjust or exploitative social relations. It is equally vital, however, to fully appreciate the potentiality — the possibilities for dwelling in different ways or living otherwise — that the geological richness and geophysical variability of the earth makes possible. If social scientists can accept that there is more at stake than reclaiming disciplinary terrain from the earth sciences, opportunities arise for us to think about the multiplicity inherent in the earth and the multiplicity constitutive of the human *togethe*r – rather than in competition. While these are possibilities that can be drawn out of the paleo-environmental-archeological work we have been looking at, they are also being explored by social scientists and humanities scholars who have chosen more collateral or `speculative' modes of engagement with the earth sciences.

We would suggest that social critics of Anthropocene science may themselves have been insufficiently discriminating in their unmasking of totalising or abstracting tendencies in contemporary geoscience. For much of what animates the new earth science hinges around investigations of what is specific to our planet relative to other astronomical bodies and what defines particular states of the earth system. These concerns increasingly mesh with, and revitalize an older stratigraphic concern with the distinguishing characteristics of different geological formations (Zalasiewicz *et al.*, 2016 forthcoming, Clark, 2016). As Zalasiewicz notes in his more popular writing, the earth's crust comprises by far the most richest lithic strata of any planet in the solar system, a form of geological diversity that has a lot to do with both the peculiar mobility of plate tectonics

and the dynamism of the coupled atmosphere-ocean-biota system (2008: 15-18). So too does our planet have an exceptional richness of mineral `species': much of which has to do with the interaction of geophysical processes and biological life (Hazen *et al.*, 2013) - one of the key themes of post 1960s developments in the earth sciences.

There are precedents in the humanities for working with and through this kind of scientific thinking. Already in the late 1970s - taking inspiration from new scientific ideas about complex, self-organizing systems - philosophers Giles Deleuze and Félix Guattari were beginning to conceptualize human potentiality in terms of the ways in which different collectivities tapped into the material flows and transformations of the earth (1987: 407-12). With this in mind, we can revisit the Mid-Holocene Climatic Transition not only as moment of extreme environmental stress, but a critical juncture at which certain populations learned to combine the channeling of available water and the dynamical formation of alluvial soils in the transition to new socio-material orders. So too, following Deleuze and Guattari, it can be noted lowland urban centres rich in soil and water took advantage of the way that the peoples in neighbouring highlands had learned to tap into the subsurface: in this way adding a range of novel metallic elements to the composition of the social (1987: 410-15; see also Clark, 2015).

To think in terms of how human collectivities forge and transform themselves through their channeling of geologic potentiality, in this way, is relevant far beyond those social formations rather unsatisfactorily described as `complex'. So too might we consider how more nomadic responses to geoclimatic conditions involve a kind of flexible composing of social life around fluctuating and flows of rainfall, plant and animal life (Deleuze and Guattari, 187: 410; Brooks, 2006; di Lernia, and Palombini, 2002.). To this we can add Cruikshank's insights on the ways in which indigenous peoples in the Pacific Northwest

learned to mobilise themselves around dynamic seasonal and long-term movements of glacial ice, and the now extensively documented ways in which collectivities in many parts of the world use fire as a means to adjust to shifting climatic and ecological conditions (Pyne, 1997; Clark and Yusoff, 2015). It is also important to recall that it was nomadic rather than sedentarised peoples who were most likely responsible for the invention of metallurgy (see Deleuze and Guattari, 1987: 412-3; Clark, 2015) - one of the most momentous shifts in the social relation to the geologically stratified earth to have occurred over the course of the Holocene.

In summary, we suggest that one of the main provocations of contemporary earth science – within and beyond the Anthropocene thesis – is to push critical social thought's own insistence on locatedness, positionality and contextualisation to its logical conclusion (see Gunaratnam and Clark, 2012). From this perspective there are no societies that do not bear the trace of the geoclimatic conditions in which they emerged, no social formations that are not in some significant way shaped by the geological formations in which they are embedded, no cultures that are impervious to the flows or strata they tap into. What this means more generally for how we as critical and speculative social thinkers might imagine the relations between the social and the geologic and why this might be particularly important at the current juncture are questions we open up in the final section.

Geo-Social Futures

Critical thinkers, as we have seen, insist that Anthropocene inquiry needs a strong social science contribution in order to make sense of the socio-structural, cultural and historical differentiation of the *Anthropos* and the social dynamics that have generated and sustained

these differences. If this a matter of giving voice to marginalised, excluded and exploited others, it is also about ensuring that Anthropocene science itself does not perpetuate the knowledge-power asymmetries that currently fracture global humanity. In short, it demands a critical politics of geoscience knowledge production. Vital though these imperatives are, we have been arguing that they call for a double or reciprocal movement. If geoscience is to be pressured to recognise the *historical* and *social* condition of possibility of its truth claims, it is no less important that social scientist and humanities scholars acknowledge that their own core concepts and categories have *geophysical* conditions of possibility. In short, if social thinkers are going to insist on a socialisation of the Anthropocene, as indeed they should, it is no less necessary that they also countenance a geologisation of the social. And it is in this regard that human geographer Kathryn Yusoff challenges fellow critical social thinkers to `use the Anthropocene as a provocation to begin to understand ourselves as geologic subjects, not only capable of geomorphic acts, but as beings who have something in common with the geologic forces that are mobilised and incorporated' (2013: 781).

This proposition that the social is constitutively open to the geologic needs to be disassociated once and for all from any sense that earth and its forces serve as a stable ground for the social worlds constructed upon it. With some half a century of developments in the geosciences converging on the idea of earth systems with multiple possible operating states, the very nature of `the ground' needs major overhauling. What we are beginning to see, particularly in more philosophical and aesthetic-cultural engagements with contemporary earth science is a move towards conceiving of the geologic as a dynamic and excessive subtending of human life - a direction we have been moving in throughout this paper. Such an ontological framing draws upon the new geoscience notion that the earth system has, at any stage, the potential to shift into other,

not yet actualized states – though we should be mindful that, as a philosophical or cultural thematic, this is an extrapolation from scientific findings that may exceed the concerns or priorities of these sciences themselves. Along these lines the now familiar idea that social identities are multiple, fractured, and heterogeneous – rather than coming hard up against unified an singular conception of the earth – now encounters an earth that itself looks ever more divided, multitudinous and non-self-coincident.

The idea that the potentiality inhering in the geological or geophysical earth is always in excess of its actualised forms – whether these are mineral, biotic or socio-cultural – informed our discussion in the last section of the manifold ways that different human collectivities select, channel and express the geologic possibilities of their milieu. As we suggested, with help from paleo-archeological evidence, any specific social formation only ever takes up and develops some of the geophysical or geologic potential available to it. Through the examples we touched upon, we have sought give an impression of the multitude of ways different collectivities have tapped geophysical flows and geologic strata over the 10,000 years of the Holocene –itself but a small section of our species' history and an eye-blink in geological time. Our objective in the first instance has been to expose limits in contemporary critical social engagement with earth science and with the earth itself. But more importantly, we have tried to give a sense of the breadth of possible ways of tapping into and elaborating upon geologic forces that lie behind us and still lie before us.

There is at once a pragmatic and a political imperative behind this exercise. While the Mid-Holocene Climatic Transition may be the closet historical proxy we have for the speed and magnitude of climatic changes predicted in the coming century, it is vital to remember that the predicted 3 °C-plus warming we now face has as its nearest analogue

the conditions of the mid-Pliocene. And this juncture, currently dated at some 3.3 million years BP – is beyond the lifespan and experience of both our species and our genus (Brooks, 2012: 94; Hayward *et al.*, 2013). Under the geo-climatic conditions to come, modes of social critique that dissect and contest existing power relations and regimes of truth will be as urgent as ever. But just as important is a capacity to imagine, experiment with and elaborate upon geo-social possibilities that have never yet been tried. This too is political, though it is a politics of speculation and invention as much as a politics of agonism and contestation (see Clark, 2014; 2015). Ultimately our intention in this paper has been to help open social thought to the idea of playing multiple and rapid variations on the theme of geologic potentiality, and in this way to proliferate geo-social futures. As well as subjecting Anthropocene geoscience to rigorous critique, we have been suggesting, social scientists would do well to approach earth science as itself a site of potentiality that exceeds its own truth claims and self-understanding.

As with any opening, drawing on the natural sciences to help imagine the earth as a multiple and excessive ground of social formation comes with risks and vexations as well as opportunities. The idea that there are aspects of earth systems that operate more-or-less geosynchronously - meaning that they have implications for all human collectivities - could be used to conceptually and politically weave together spatially distant or culturally disparate populations. It potentially introduces a universal trace or hinge. By the same token there is a risk that an overarching geo-story - however generative - could be taken as a master narrative into which local knowledge is slotted when deemed appropriate or discarded when it fails to measure up. With this in mind, it is reassuring to see how the concept of the Anthropocene is being picked up and reworked by different theorists, different constituencies, and in different places. From the Gynocene, Capitalocene, Chthulucene, Plantationocene, Ecocene, and on to the `Thousand Names of Gaïa"[i], the

Anthropocene thesis is itself becoming a theme upon which numerous variations are being played. We hold out hope that such proliferations - the exuberant crafting of *Anthropocenes* - portend a willingness to elaborate on the multiple forces, process and properties of the earth itself.

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