Geosocial Formations and the Anthropocene

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Earth and Society

A favourite trope of science fiction is to imagine other planets that are similar to Earth in many respects but distinguishable by one or more significant variables. This allows for `what if' scenarios to be played out while maintaining a degree of familiarity and identification on the part of terrestrial audiences. For some two centuries, western social thought has been pursuing just such a strategy. Successive theorists have constructed complex, plausible worlds on an astronomical body much like our own that differs in one vital respect: the planet in question is inert, immutable, obdurate. Upon this platform, whole schools of thought have imagined worlds of our own collective construction that are free from the shocks, threats and incitements of an eventful earth and cosmos.

Over much of this time earth science has abetted such projects by telling stories of a planet so slow moving it could just about be ignored - give or take an occasional, inopportune shudder. It is vital to recall, however, that the decisive stilling of the earth in social and philosophical thought was not a response to our planet's inertia - but to amassing evidence of its propensity for violent self-transformation. Exactly two centuries ago, Georg Hegel declared the earth safe for the further ascent of the self-conscious and collective subject. Like many contemporary *philosophes*, Hegel was an avid reader of geological science. Consequently, he was familiar with the idea that the earth has been shaped by `tremendous revolutions' - convulsions momentous enough to have reduced entire worlds of biotic life to fossilised remnants in the lithic crust. In the 1817 *Jena Encylopedia*, however, Hegel made it clear that such upheavals belonged to a deep past – now fully superseded by subsequent developments. And in this way, besides being matters of academic curiosity, they had no relevance to contemporary or future human existence. `(T)his temporal succession of the strata, does not explain anything at all…' Hegel insisted:

> One can have interesting thoughts about the long intervals between such revolutions, about the profounder revolutions caused by alterations of the earth's axis, and also those caused by the sea. They are, however, hypotheses in the historical field, and this point of view of a mere succession in time has no philosophical significance whatever (1970[1817]: 283).

Read no *philosophical* significance as no *social* or *political* significance, as Hegel surely intended, and we have a reasonable summation of the role ascribed to geophysical processes in mainstream social thought for the last two centuries.

This injunction now looks decidedly shaky. The closing decades of the last millennium saw the emergence of the abrupt climate change thesis - the idea that global climate was capable of passing over a threshold into a new regime in just a handful of years. Coming close behind, the Anthropocene thesis extended this scenario to a range of earth subsystems. `Revolutions of the earth', it appears, are back in vogue - only this time around they refuse confinement to a primordial past. If the question of what to do about imminent or actually occurring shifts in the operating state of the earth are not already at the top of global agenda this is most likely because their complexity and scale vastly exceeds existing political repertoires and imaginaries. With a nod to Donna Haraway (1991: 152) it could be said that our earth now looks disturbingly lively, and we ourselves frighteningly inert. Or as Angela Last puts it in this issue, we increasingly appear `geophysically active but politically passive' (2017: 17).

This special issue asks what it might mean for accounts of social life and political possibility to engage head on with the idea that this is a planet on which `variability abounds at nearly all spatial and temporal scales' (Steffen et al., 2004: 295). With its widely circulated claim that humans have become geological agents, the Anthropocene thesis provides an important point of departure – though the issue of the relationship of social existence to the forces of the earth is more deep-seated than diagnoses of the current geophysical conjuncture. As we have been suggesting, questions of what it means to inhabit a deeply stratified, self-transformative and potentially catastrophic planet may be as constitutive of western modernity as they are signatures of contemporaneity. Which means in turn that the trace of our circuitous, evasive encounters with planetary dynamism may already run deep in the conceptual frameworks and categories that we social thinkers reach for when novel challenges summon us.

Understandably, social science and humanities scholars have responded to the `humanization of geology' advanced by Anthropocene geoscience by raising questions about the constitution

of the *anthropos* – its variations, divisions, exclusions. But as some theorist rush to reclaim responsibility for the multiplicity, the heterogeneity, the non-self-identity of the human, others are beginning to ask what it means for our thinking of `the human' that the very earth increasingly appears to be multiple, divided, not self-same. For as stratigrapher – and chair of the Anthropocene Working group - 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). At the same time, critical social thinkers are calling for geoscience claims of emergent human agency to be thoroughly contextualized within the socio-structural dynamics, geographical disjunctures and historical trajectories that have shaped our species life. Others, however are asking where the lines should be drawn on such contextualization, and are beginning to push on and ask how planetary dynamics, geological disjunctures and earth-historical trajectories may themselves have left their mark on the social beings we have variously become.

In short, wherever questions are being posed about the particular socio-historical processes that configure `human geologic agency' not far behind is another set of problems. What is it about the earth that makes it responsive to different kinds of social `forcing'? With what specific geological processes or properties have different social actors joined forces in order to acquire their geologic agency? And what manner of planet is this that gives rise to beings such as us in the first place? Along with the insistence that contemporary geoscience should be prised open to make a place for critical and interpretive social thought, so too are moves underway to open the very categories of the social, the cultural, the political, the historical to the forces of the earth. Just as there are calls to thoroughly `socialize the Anthropocene' (Lövbrand et al, 2015), so too are there rumbling pressures to `geologize the social'.

With this in mind, we offer the idea of *geosocial formations* as a kind of minimal staging ground for earth science-social science encounters, playing off the rather obvious sense in which both disciplinary groupings deploy notions of formations to refer to the specific or concrete manifestations of dynamic spatio-temporal processes. Noting the dual meaning of `formation' as process and outcome, we find a certain incitement in the way that geosciences and social sciences share a sense that the emergence of the new is made possible by the compositions or orderings that have materialised at previous junctures. This might be of interest, we hazard, not only in the diagnosis of the current global environmental predicament, but in helping us think about social futures that engage with the geologic in ways other than at present. In brief, thinking the becomings of earth and society together might help us probe the richly layered formations we have inherited for the overlooked, marginalized or as-yet unactualized geosocial possibilities murmuring within them.

This collection itself builds on a substrate of previous *TCS* special issues. The 2005 issue on *Complexity* explored the continuity of self-organizing processes across the physical and social sciences, with particular attention to `critical thresholds' in the systems in question (see Urry, 2005). This theme was further developed in the 2010 *Changing Climates* special issue, which in the process of presenting a strong case that climate change `should be a, or even perhaps the, crucial topic and policy domain for social science' (Szerszynski and Urry, 2010: 3) tracked the shift from more gradualist approaches to an appreciation of abrupt, nonlinear transitions in global climate. Most recently, the 2014 *Energy & Society* collection asked how the dependence of modern societies on the stratum of fossilized hydrocarbons might play a part in the very `social, temporal and spatial organization of societies' (Urry, 2014: 5) – in this way anticipating our own concern with the way geological strata might be seen to condition and enable specific social formations.

Provocations of the Anthropocene

By the time this special issue is out the Anthropocene Working Group – convened by the Subcommission on Quaternary Stratigraphy - will have delivered its evidence to the International Commission on Stratigraphy, who will in turn make recommendations to the International Union of Geological Sciences. To prove the point that the earth has shifted out of the 10,700 year-old interglacial epoch known as the Holocene, guardians of the Geological Time Scale require evidence of a `geosynchronous' shift: a transformation significant enough to leave concurrent imprints in the lithic crust across the planet. Assembled in meticulous detail at multiple sites and globally cross-referenced, such storying of epochal change looks to be a strong candidate for Bruno Latour's notion of a `globalism (that) is constructed one step at a time' (2004: 3).

While the case for a post-Holocene epoch is exceptional in the sense of its future perfect orientation– it requires projection about the signature current or recent activities *will have left* in the geologic column – so too do its political implications diverge from the intra-disciplinary tussling typical of stratigraphic boundary work. From the outset, the Anthropocene has been part geoscience hypothesis part global alarm. As with most scientists working in the narrower field of climatology, Anthropocene advocates are well aware of the tension between producing empirical evidence up to the standards of their epistemic communities and seeking to secure `protection' of earth systems on international political agendas. And it is in the very attempt to negotiate these demands that researchers can find themselves doubly exposed: at once open to

the charge of earth science peers that their research is not sufficiently disinterested and to censure from critical social thinkers that the same pronouncements fall short of desired political nuance and incisiveness.

It's worth keeping in mind that attributing culpability for anthropogenic impacts is not a prime concern of earth scientists - though for the record we should note that in his canonical announcement of the Anthropocene, atmospheric chemist Paul Crutzen insisted that `these effects have largely been caused by only 25% of the world population' (2002: 23). Moreover, not only have geoscientists alluded to the 'somewhat arbitrary' nature of attempts 'to assign a specific date to the onset of the "anthropocene"' (Crutzen and Stoermer, 2000: 17), they are not even set on the idea that a starting date must be centred on humans at all – some proposing that Tambora volcanic eruption of 1815 is as handy a marker as any (Zalasiewicz et al., 2008: 7; Waters et al., 2014: 5). All of which we might take as indicative that the earth scientists in question, while appreciative of the polemical force of the `Anthropocene' appellation, tend not to view human agency – collective or specific – as intrinsically different from other kinds of physical agency.

What are we to make, then, of the insistent call of progressive or left-leaning social thinkers that Anthropocene science offers `unified accounts of "the human"' (Lövbrand et al., 2015: 216), that it 'occludes the historical origins of global warming' (Malm and Hornberg, 2014: 67) and that it woefully overlooks the fact that `(t)he human species' geological action is the product of cultural, social and historical processes' (Bonneuill and Fressoz, 2016: 66)? Clearly, such responses are animated by a deep, exacting concern with overcoming injustice, inequality and oppression, though there is also a sense that critical social thought has itself been unfairly excluded from formative discussions of climate change and related global environmental challenges. It is not only earth scientists but fellow social thinkers who have been taken to task – most notably Dipesh Chakrabarty, whose influential `Climate of History' (2008) paper has been singled out for its `anti-social' lapse into `species-thinking' (Malm and Hornberg, 2014: 66)

Responding to his critics in this issue, Chakrabarty explains why thinking in terms of the inequities of capitalism and other structural differentiation of humankind should not be opposed to thinking at the species level, whether this looks back to common human evolutionary trajectories or forward to a shared planetary fate to which even the most privileged will not be immune. Such `scaling up' reflects a willingness on Chakrabarty's part not only to apply the critical apparatus of social and historical thinking to the pronoucements of geoscience - but to allow the inherited concepts and categories of social thought themselves

to be opened to the forces, magnitudes, durations with which the earth sciences work (see also T. Clark, 2015: 20). Indeed, for all the contributors to this special issue, each in their own way, it is the thresholds where the social meets the geologic, the inorganic, the inhuman - that are up for negotiation – and this implies trafficking in both, or multiple, directions. As Claire Colebrook puts it (this issue), the Anthropocene problematic `gives us the opportunity to think about the forces that entered into the composition of the current stratification of the earth, and how something like 'man' as a hyper-consuming but also self-universalizing life-form came into being' (2017: 3).

In this sense, what exactly the provocations of the Anthropocene might be defy easy reading. On the one hand, the idea that `humans and their activities are fully part of the Earth System' (Rockström et al., 2009: 32) complicates certain (already compromised) notions of human-nature duality. On the other – Chakrabarty's point - the very idea of an epoch, regime or stratum marked by the *anthropos* only makes sense amidst the much broader of sweep of epochs, regimes, strata devoid of similar impingement. In itself, the idea that humans, or part thereof, have become geological agents ought not to be especially shocking – for it is pretty much where we arrive with any concerted ascent of the modern linear curve of improvement, development, accumulation. In this regard Marx was fully in synch with his own era when he noted, some 170 years ago that, ` the nature that preceded human history .... is nature which today no longer exists anywhere (except perhaps on a few Australian coral-islands of recent origin)'(2004 [1845]: 63). Likewise, the unintended consequences of modernization have themselves been so widely experienced and so thoroughly thematized throughout the 20th century that the idea of the social reconstruction of the physical world going awry now seems almost routine. Is there anyone left on earth who actually believes geoengineering would go according to plan, should it come to that?

Perhaps more disturbing has been the recent scientific discovery that climate and other earth systems have inherent capacities for rapid, irreversible change. Since the 1970s there has been growing interest in the behaviour of complex physical systems. In such systems, pressure for change can be absorbed – up to a certain point – beyond which stability gives way and positive feedback kicks in – amplifying the effects of stresses and shocks to trigger rapid, cascading systemic change. Although `sudden drastic switches to a contrasting state' were already well documented at the ecosystem scale (Scheffer et al., 2001: 591), it was a shock to climate scientists examining polar ice cores and related proxies of past climate to discover that the entire global climate had, over the course of the Pleistocene, frequently transformed itself in less than a decade (Alley, 2000: 115-22). What enabled scientists to start making sense of such nonlinear transitions at the planetary scale was a sophisticated ability to model the `operation

of the joint hydrosphere-atmosphere-biosphere-cryosphere system' (Broecker, 1987: 123). It is this same coupling of sub-components of that is behind the extension of the logic of `large-scale reorganization' beyond climate to other aspects of the planetary body.

But the Anthropocene thesis involves more than just the scaling up of the nonlinear dynamics of complexity theory. As Zalasiewicz and his colleagues explain in this issue, what defines Anthropocene earth science is a combination of the study of coupled, self-organizing processes at work at the earth's surface and the older, more `conventional' geological inquiry into the formation of the lithic strata. Kathryn Yusoff (this issue) speaks of the need for social thinking to critically and speculatively elaborate on the Anthropocene and kindred earth science concepts but also to engage substantively - `meticulously' – with the geological strata and processes that the geosciences disclose to us (see also Yusoff, 2013). In short, both the disciplinary innovations and the substantive evidence of the Anthropocene thesis ought to matter to social thought - not least because if `the past produces the resources for multiple futures' (Grosz, 2004: 253) we are finally learning how far and deep we need to go to make sense of that past. And this one reason why it is important for us to have earth scientists and social or philosophical thinkers conversing in the same volume.

The current convergence of earth systems thinking with the insights of stratigraphic geology can in turn be contextualised within a broader series of developments in the earth and life sciences that have occurred over the last half-century. As historian John Brooke recounts, the pivotal years of 1966–73 saw the emergence of four major new perspectives on the shaping of the earth - each of which built on dissident hypotheses from the earlier 20th century. The breakthroughs in question being the confirmation of the theory of plate tectonics, the thesis that biological evolution is punctuated by catastrophic bursts linked to major geophysical events, a new appreciation of the role of extra-terrestrial impacts in earth history, and the idea that the different components of the earth function as an integrated system – as expressed in the Gaia hypothesis and early earth systems theory (Brooke 2014: 25–8).

As these approaches converged, and as disciplinary divisions that had separated the efforts of geologists, biologists and atmospheric scientists began to erode, so too waned the gradualist orthodoxy that had prevailed since the late 18th century. It is important to grasp, however, that there is more going on here than the conceptual `unification' of the earth. Social thinkers have spoken eloquently of `whole Earth' images taken from space - and their complex implication with the social processes that have sutured woven a disparate worlds in a single, interconnected globality. But we have been slower to grasp the paradox that very configuration of the earth into a single, integrated system in the newly dynamic earth sciences has been the condition of a

more dis-integrated, fractious and multiple vision of the planet (N Clark, 2016). For it is from out of the idea of an earth whose subsystems are tightly coupled – while also open to cosmic and deep earth processes - that has given rise to the idea of a unstable, multistate earth that is at the core of the Anthropocene thesis: Zalasiewicz's `different Earths that have succeeded each other in time'.

Such a planet is capable of being nudged into an alternative operating state by one of its sub-component species, contemporary earth science suggests, only because it already has a multiplicity of possible states - and the potentiality to shift between them. For as philosopher Isabelle Stengers observed of major anthropogenic ecological change some years ago: `From the viewpoint of the Earth itself, this will be one more "contingent" event in a long series 2000: 145). What earth scientists now offer, as Stengers observes, is increasingly indeterminacy and contingency: `Scientists, here, are no longer those who bring stable "proofs" but uncertainties' (2000: 144). Most perturbingly, the emerging geoscience post-gradualism of the last half century has brought the temporalities, intensities and magnitudes of geologic processes into the patterns and durations of everyday human life. Not simply back on the agenda, the `revolutions of the earth' that haunted Hegel, Kant and their contemporaries are now supported by models, metrics, predictions. And in this way, the time of the earth – evolutionary, glacial, epochal – potentially outruns the tempo of collective decision-making, sociotechnical innovation, even cultural expression. If it is understandable under such situations that critical-analytic social thought should defend its terrain, so too are we in urgent need of more speculative and less orthodox modes of inquiry.

Thus far we have begun working up the idea of a social thought that might think *through* the geologic as if this was something new. In the following section, we return to the theme of `formations' to offer some reminders that the thinking of the social, the political, the historical has in fact been articulating with earth science for some time: perhaps from its very outset. For it is important to keep in mind, we suggest, that theorising a dynamic planet – no less than other aspects of its inhabitation - tends to be as much a matter of working with an inheritance as it is of tangling with the novel or the emergent.

Geosocial Formations

We have seen how critical social thinkers who take issue with interventions seen to be making recourse to species being or a `pre-socialized' earth have insisted that recent geological change be viewed as a manifestation of its concrete socio-historical context. Or it might be said, with the help of a canonical critical theorist, that any such novelty is `a product of historic relations'

(Marx, 1973 [1857]: 105). But such a conceptual manoeuvre – and its all its critical-analytic kin - may itself be a more complexly layered historical product than it first appears. Moreover, if we critical social thinkers are to be so sharply attuned to the nomenclature and vocabulary of Anthropocene science, so too should we attend to our own grammar.

One of geology's basic ideas is that the upper earth is composed of bands of rocky material, with more recently formed strata superimposed on older ones. As Zalasiewicz explains: `These layers can be subsequently tilted, crumpled, dislocated, even turned upside down, but their relative original order forms the proxy for time' (2008: 29). It was around the turn of the 19th C – the time of Foucault's transition from classical to modern epistemes – that geologists underwent a shift from classifying rocks as `natural kinds' to categorizing them on account of the processes of historical formation they shared. What mattered, proposed German geologist Abraham Gottlob Werner, was `mode and time of formation', a distinction for which he introduced the term *Gebirgformation* - `rock formation' (Laudan, 1987: 94-5).

It takes no great powers of detection to see that social thinkers adopted a similar logic for understanding the historical shaping of social worlds. `Relics of bygone instruments of labor possess the same importance for the investigation of extinct economic formations of society as fossil bones do for the determination of extinct species of animals' observed Marx in *Capital* (1976 [1867]: 286). Clearly, he knew his geology. At high school in Trier the young Marx studied under renowned geologist Johann Steininger, a follower of Werner. Marx would have received a refresher course in Wernerian geology through his readings of Hegel, who in the *Philosophy of Nature* singled out Werner's `geognosy' for establishing that the earth `…has had a history, and that its condition is a result of successive changes' (cited in Foster, 2000: 119-120).

Like today's critical thinkers, Marx took to task contemporaries who treated labour and cognate activities as `abstract categories' - on the grounds that they were divorcing social processes or constituencies from the specific historical relations in which they had been formed (1973 [1857]: 104-5). That is, he saw `mode and time of formation' as crucial. More than metaphor, this is about a common structure-forming logic – the idea that, through dynamic processes, new formations emerge of out antecedent formations in ways that inherit and rework the material provided by these earlier compositions. Or as Hegel famously put it: `the earlier are preserved in the later; but subordinated and submerged' (cited in Braver, 2007: 68).

As Marx advised in the *Grundrisse,* the study of contemporary bourgeois society `allows insights into the structure and the relations of production of all the vanished social formations out of

whose ruins and elements it built itself it, and whose partly unconquered remnants are carried along with it' (1973 [1857]: 105). Again, in the work of Louis Althusser just over a century later: `Every concrete social formation is based on a dominant mode of production…. The dominated modes are those surviving from the old social formation's past or the one that may be emerging in its present' (2014: 19). Or in the words of Gilles Deleuze - conversing with Foucault: `when a new formation appears … it never comes all at once, in a single phrase or act of creation, but emerges like a series of `building blocks', with gaps, traces and reactivations of former elements that survive under the new rules' (1988: 21-22).

Its one thing to put into play - explicitly or implicitly - a kind of organizational logic or `diagram' shared by the earth and its human inhabitants through which the pre-existent gives rise to the new, but what about more `concrete' relations between geological formations and social formations? While for Marx `a specific *mode of production'* is made up of both the relationships between individual human beings and their `specific active relation to inorganic nature' (1973 [1857]: 495), his sense of how different formations of the earth influence these relations is at best suggestive. This is a question in which Althusser, along with most 20th century readers of Marx, was even less interested. It was Althusser's Annales School contemporary Fernand Braudel, focusing on the Mediterranean, who explicitly brings social formations into articulation with the geological formations that underlie them.

Though he pays dues to Marx for his `genius' in being `the first to construct true social models, on the basis of a historical *longue durée'* (1980: 51), there is little precedent for Braudel's detailed, systematic layering of the eventful `microhistory' of everyday life over the slower rhythms of material life, and in turn over the deep-seated, `ever-present skeleton' of geological processes (1980: 74; 1972: 26). For Braudel these are the three main levels at which history operated - each with its own definitive speed. But even that, he conceded, was a simplification: `There are ten, a hundred levels to be examined, ten, a hundred different time spans (1988: 74). From here it is not a great leap to the Deleuze and Guattari of *A Thousand Plateaus* (1987) for whom there are also three main groupings of strata, each with their own `concrete' historical formation: the inorganic or geological, the organic or biological, and the `alloplastic' stratum of human culture and language. However, this too is a simplification, for they speak of multiple substrata, and - more importantly - of endless possible combinations between materials that compose the various strata.

If there is a certain prescience to Braudel's understandings of multi-layered, self-organizing processes at work in the socio-economic domain, it is important to recall that when it came to geological processes - `this almost timeless history' (1972: 20) his earth was still very much

that of the mid 20th century gradualist orthodoxy. Deleuze and Guattari on the other hand, are catching the beginnings of that other earth science of we have been speaking – the emerging idea of a dynamic earth with multiple possibilities beyond its `actual' state. *A Thousand Plateaus* tells of self-organization at every level: each stratum having its own ability to gravitate toward critical thresholds where momentous changes occur. While there is still a sequence or hierarchy to Deleuze and Guattari's stratigraphic thinking, they constantly draw attention to operations that traverse different strata and bring their productions into novel arrangements. For them, as for so many of their predecessors, social formations have a distinct `historical' layering – based around the way they organize themselves and make use of available materials. Only now there is an explicit and substantive sense that vital components of any social form are biologic and geologic: that every social formation is to some degree constructed through its own specific `machinic processes' of tapping into the flows and stratifications of a complex, eventful earth (Deleuze and Guattari, 1987: 88, 435).

Without assuming that science has all the answers, Deleuze and Guattari draw us towards an empirical understanding of physico-material processes. Already in 1992, Manuel De Landa was calling for thinking that engaged closely with the study of self-organizing geologic processes - for social and philosophical thought that was prepared to learn from what he referred to as `the wisdom of the rocks' (see also De Landa 1997). Drawing heavily on Deleuze and Guattari, he also urged us to extend and deepen their rather conjectural take on earth science (see Yusoff, this issue). As far back as the early 1990s, however, the promise of a renewed engagement with the inorganic, the geological, the inhuman was already considerably more-than-Deleuzean. 1992 saw Michel Serres proposing a `geopolitics in the sense of the real Earth' in *The Natural Contract* (1995 [1992]: 44), while Nick Land (1992) activated the cosmic-scaled general economy of Georges Bataille to expound on the constitutive exposure of the human to the catastrophic forces of earth and cosmos. A few years later, Elizabeth Povinelli drew on ethnographic evidence to unsettle western assumptions that agency and intention belonged only to the human domain, introducing her audience to non-western ontologies in which land demonstrates its sentience and rock is experienced `as a semiotic agent' (1995: 506). Around the same time Elizabeth Grosz in her explorations of the human body in terms of `open materiality' (191) urged us to conceive of our embodiment as being `in continuity with organic and inorganic matter' (1994: 22), while Bruno Latour began to look to the Gaia thesis as the way to invoke earthly conditions that are more–than-human but less-than-whole (1998[1995]).

It was also in the mid-1990s that Stephen Pyne (1995) developed his fire-centred approach to environmental history into a paradigmatic demonstration of how to think social existence

through the elemental forces of the earth. While Mike Davis, in the pioneering 'Cosmic Dancers on History's Stage?' (1996), exhorted critical humanities scholars to heed recent findings of geophysical science on the role of extra-terrestrial influences in the dynamical history of the earth system, Barbara Adam expanded upon her earlier explorations of more-than-human temporalities to offer a full-bodied account of human social actors as `creatures of this earth … constituted by a double temporality: rhythmically structured within and embedded in the rhythmic organization of the cosmos' (1998, 13).

And yet, if strong gravitational forces seemed to be pulling the `socio' and the `geo' together into new discursive formations, there were other forces – subtle, tacit, pervasive – that served to hold them at safe distance. In spite of these generous and generative overtures, even in the context of a generalised uptake of `materialist' concerns in the social sciences and humanities, it was to be almost two decades before the `geologic' would incite anything like a turn of its own.

Political Geology

The last quarter century has seen an increasing willingness to take the nonhuman, inhuman, or more-than-human into account in the theorization of social life: a move now familiar enough to have migrated toward the mainstream. If this turn has been a response to the challenge of intensifying techno-scientific intervention into life and matter, ever more life-like machines and new kinds of ecological endangerment - it is also a reaction against a putative over-investment in culture, language and signification in other styles of theory. Linked by epistemological and ontological commitments to ways of relating that extend beyond the inter-subjective domains of sociality, these new materialisms, corporeal feminisms, political ecologies and multi-actor approaches have been busily expanding the range of agencies permitted to play a part in the construction of social worlds.

In the main, this work has hinged around themes of life, vitality, the organic. In the reckoning of a recent review of the field: `There is something unprecedented about our contemporary situation in which the prefix "bio-" proliferates' (Coole and Frost 2010: 15). This predilection for equating materiality with the living or the life-like has much to do with the ways in which ontologies of more-than-human entanglement have sought to evidence their political relevance – and in particular with the imperative to unsettle and open what counts as politics (Coole and Frost 2010: 15; Fraser et al., 2005). For several decades now, we have been offered colourful and convincing demonstrations of the way that power or agency overflows the category of

deliberating human subjects, how it courses though collectivities that include other entities, how it gathers in the knots and chains of complex, heterogeneous networks. While bodies, ecologies and assemblages have been shown to be objects upon which power operates, so too have they been presented as sites of resistance: as vital reservoirs of `freedom' to act or become otherwise.

Certain types or loci of matter, however, have turned out to be more amenable to inclusion in this expanding ethico-political register than others. While no exclusionary measures were intended, in the quest to bring ontologies of agential materialism into alignment with progressive, anti-essentialist politics, some things seemed to make better exemplars, catalysts or co-conspirators than others. While the fleshy exuberance of biological life and the `spooky' indeterminacy of sub-atomic particles were roundly enrolled in efforts to reimagine collective life (see Papoulias and Callard: 2010), the basal depths and *lumpen* masses of the inorganic, the mineral, the geologic have proved rather more recalcitrant.

Undoubtedly, the Anthropocene thematizing of human geologic agency has helped spark a re-consideration of the political valence of the `geo', though as we suggested above, it has been rumbling in the background of more-than-human materialisms ever since their resurgence. But in what has loosely been termed the `geologic turn' of recent years, there are no easy answers to the question of how matter might figure in the reimagining of social or collective possibility – for the stuff of geology cannot suddenly be recuperated on the same grounds that it was previously passed over. In important ways, the contributors to this special issue heed Bruce Braun and Sarah Whatmore's call for `closer attention to the *specificity* of the matter at hand' in the reimagining of political orderings (2010: xxix), though even then, what can be most perturbing about elemental, geologic or cosmic orders are those aspects that are decidedly not at hand. To put it another way, what is at issue is not only how to extend or enrich the composition of shared worlds but what to make of forces capable of interrupting, undermining or overwhelming the very conditions of doing politics or being social.

As Simon Dalby observes (this issue) the question of how to secure `the conditions for particular forms of collective life' (2017: 3) are difficult enough when we take account of *ecological* problems. These demands, he suggests, are even more intense and fraught when we consider unstable geological and geophysical processes – for which the Fukushima crisis - with its conjuncture of inhuman forces we ourselves have assembled and earth processes that are still far beyond our control - might be considered paradigmatic. Looking at subterranean waste disposal, Myra Hird (this issue) explores the political challenges that arise when heterogeneous materials we have generated and compiled are introduced into geological strata that have their

own ecologies, their own thresholds, their own unknowable potentialities. In this context, Hird argues, whatever regulatory measures we can achieve through our collective mobilizations are susceptible to subsurface processes whose spatio-temporal dimensions inevitably exceed our powers of surveillance or containment. In a more general sense, Nigel Clark (this issue) proposes that if all collectivities or social formations derive their material possibilities form tapping into specific geological formations then all politics is to some degree concerned with the negotiation of strata – to the extent that we might view the politics of strata as being as originary as the politics centred on territory.

In each of these accounts, as with Chakrabarty's framing of climate change, what is at stake in trying to imagine new *political geologies* is an inhuman agency that is not and cannot be fully co-extensive with the human domain, however inclusively this is imagined. Whereas the political traction of the more-than-human in new materialist ontologies has tended to be bound up with relations of interconnectedness, reciprocity and mutual affectivity between human and nonhuman actors, taking stratified orders of existence seriously implies a before, a beneath, a beyond to the human presence that draws our attention to other modes of relating. Or as Kai Bosworth puts it:

> Ecological or geologic dangers, threats or catastrophes impinge upon us not due to a *lack* of understanding or thought by humans, but due to a *surplus* of potentiality exhibited by the Earth. In order for this surplus to exist, it must *not* be essentially connected to every other part of the earth system (2013: fn 4).

While Bruno Latour is well known for advancing a politics characterised by careful collective construction of association and networks, it is notable that his escalating interest in `geostories' has been drawing him into a consideration of certain modes of existence that `*precede* the human, infinitely' (2013: 203), or what he refers to as the ``metamorphic zone' … where 'metamorphosis' is taken as a phenomenon that is antecedent to all the shapes that will be given to agents' (Latour 2014: 13; see also Conway, 2016). Accordingly, his reflection on the earth as Gaia in this issue neither begin nor end with human attempts to recompose our relationships to the planet, but rather dwell on the formative, ground-building activities of vast multitudes of unequivocally *inhuman* agents. If there is indeed a connectivity between the organisms who compose the biosphere, Latour insists it is one that cannot be predefined in terms of whatever systemicity or commonality might ultimately have emerged from the diffuse action of so many earthly beings.

Elizabeth Grosz (this issue) explores the implications for collective action of conceiving of the `geo' as the very condition of existence of political life, and indeed of all life. Ultimately, as Grosz would have it, it is what she has come to call *geopower* – the energizing, excessive and differential forces of earth and cosmos – that provokes humans and other living beings into new forms of collective expression and thus makes political power possible (see also Yusoff, this issue). By the same logic, however, this trace of the geo within the bio, of the inhuman within the human, also imports into the very heart of the political a kind of power and potentiality that cannot be straightforwardly presented as an object of collective deliberation. The question of how dominant institutions seek to govern the juncture or traffic between the domain of life and its others is also taken up by Elizabeth Povinelli (this issue). While critical attention has generally alighted on biopower and biopolitics - governance of the life-death interface, she posits a deep-seated and less explicated problematic of *geontopower* – governance of the life-nonlife interface. While Povinelli draws on the very different ontological framing of living-nonliving junctures of Australian aboriginals to probe disclose the workings of geontopower, Angela Last (this issue) identifies a from of materialist thought and politics that emerged among both continental European and African Caribbean scholars in the mid-twentieth century, where it is precisely the refractory forces of geological matter that reveals the limits to dominant orders

In each of these contributions, in their own ways, the contemporary planetary predicament is taken as a call for the politicization of the geologic. But at the same time it also incites a kind of geologization of the political – an acknowledgement that relevant collective action must be understood as being not only about or towards the earth but emerging with or through the earth. In other words, if human existence is currently impinging upon earth systems and strata, this agency must itself be seen as an expression of planetary properties, processes, potentialities. And this in turn has implications both for the beings we might yet become and for what might come of the earth itself.

Planetary Futures, Other Worlds

O*ur Common Future* – the 1987 report of the UN World Commission on Environment and Development – opened with the proclamation 'The Earth is one but the world is not' (1987: n.p.). The assumption being that a differentiated global populace interprets and constructs its realities in multiple ways while the planet itself was unified and singular. Thirty years on, however, things are not so clear. As we have seen, one of the paradoxes of contemporary earth science is that the more that is understood about the complexity, interconnectedness and sub-structural coupling of the earth system, the more it appears that our astronomical body is

fractured, multiple, non-unitary - or we might say, ex-orbitant. The *anthropos* is not one, as critical social thinkers are keen to remind geoscientists. But as geoscientists – and quite a few of the social thinkers in the current issue - might now reply, neither is the earth.

How then might this multiplicity of the earth itself articulate with the manifold ways in which the earth and cosmos are apprehended, conceptualised, elaborated upon by different social collectivities? Many of the papers in this issue affirm ways of knowing – ontologies, cosmologies, geostories - that are other to those of `modern' scientific discourses, while also probing the strangeness and contrariety within science itself. As Povinelli recounts (this issue), recent ethnographic work engaging with Amazonian thought makes a strong case that the understandings of nature or the earth in question ought to be seen as ontologies in their own right – and not simply expressions of cultural difference that can measured off against western ontologies (2017: 6). At the same time, speculative readings of these very western ontologies have found fertile material from which to extrapolate in directions or registers that may exceed the remit of their authors.

In Last's geopoetics, Hird's transcultural waste ontologies, Yusoff's geomorphic ethics and politics, Szerszynski's geospiritual formations, Colebrook's sexual and spiritual Anthropocene genealogies (all this issue) we see not so much a seeking of immediate onto-political affinity with earth science as a self-conscious setting to work, a conceptual crafting and experimentalism incited by uncommitted geoscientific potentially. Or perhaps uncommitted *geologic* potentiality. For as Grosz proposes, we might conceive of creative processes in the broadest sense - artistic, intellectual, or even organic – as a taking up and extending of `the excess of colors, forms, materials' generated by the earth itself (2008: 9). If the throes of a volatile earth provoke us and other life-forms to undertake a sort of ongoing creative experimentation, so too it could be added, does the current ecological-geoclimatic predicament prompt an especially intensive quest for new ways of inhabiting strata, of tapping terrestrial flows, of probing geomorphic possibility.

In this light, Bronislaw Szerszinsky's (this issue) explicitly post-secular reading of the current geosocial conjucture does more than simply set out to unsettle western discourses by counterposing them with non-western ontologies. Not only surveying but enacting spiritual innovation as generative response to the Anthropocene plight, he brings existing globally-sourced spirits and deities into association with the concepts and grammar of earth system science in a kind of non-totalizing geospiritual improvisation apposite to a precarious epoch. With a scope that spans the sedentarism of the Holocene, Claire Colebrook (this issue) posits human creativity is at once a generative and a potentially catastrophic geological force. If

sexuality – desire that exceeds necessity – is the primary driver of urban growth, she suggests, such excessiveness is not limited to humans, not even to individuated organic being – and might be tracked back as far as pre-organic forces that mingled in order for life to emerge. Such disrupting of the received ontological life-nonlife distinctions resonates with writer Anne Michaels, who observes in the novel *Fugitive Pieces*: `It is no metaphor to witness the astonishing fidelity of minerals magnetized, after hundreds of millions of years, pointing to the magnetic pole, minerals that have never forgotten magma whose cooling off has left then forever desirous' (1997: 53).

No simple effacement of the living-nonliving distinction, trafficking across bio-geo junctures – as we glimpsed earlier – also compromises the familiarity or fathomability of fleshy existence. `Life is a kind of higher order 'minerality" observes Grosz (this issue, 2017: 2), recalling Lynn Margulis and Dorian Sagan's riffing off the early 20th century geochemist Vladimir Vernadsky that `We are walking talking minerals' (1995: 45). Or in the words of Povinelli (this issue) `we were also rocks and sediment before we settled into this mode of existence' (2017: 4). It is precisely this dispersal, this slippage and leakage across orders of existence, she continues, that makes it so hard to settle on what defines or delimits the human or even the living, and makes it so difficult to anticipate where (or what) `we' might end up.

A sense of urgency animates this collection, as do feelings of care and responsibility for those most exposed, exposed in any way, to the planetary changes clouding the horizon. So too are there intimations that cleaving too compulsively to life as we know it – to imperatives of organismic survival at all costs - may actually exacerbate the gathering forces of endangerment – though this by no means implies that alternative desires or attractions come with any assurance of safety (Colebrook, this issue). In seeking to loosen the hold of biopolitics – both as mode of governance and object of critical inquiry – a number of papers in this issue begin to work up alternatives to the prioritization of organismic life in western thought and to ontologies that hinge around bounded notions of embodiment, vitality, sentience. In the process some of the hard edges that have kept western thought apart from its ontological others seem to be softening, a move for to which some recent turns in earth and life science may not be inhospitable – even if it is some way from their prime concern.

There is undoubtedly joy as well as duty for social thought in the discovery of the planet from whose geomorphic folds and forces it has ultimately emerged. `In attempting to uncover the deepest strata of Western culture, I am restoring to our silent and apparently immobile soil its rifts, its instability, its flaws; and it is the same ground that is once more stirring under our feet' mused Foucault of his own stratigraphically-inspired efforts to explain the appearance of man

as an object of inquiry of modern thought (1994[1966]: xxiv). Writing in 1966, he could not have known that at the very moment he was speaking the earth sciences were embarking on their own dramatic mobilisations of soil and ground, their own literal prising open of the rifts, flaws and instabilities of the spherical earth. Half a century later, as the ascent of the Anthropocene thesis would suggest, the sciences may still be processing and elaborating upon the upheavals in the thinking of the earth that issued from the generative years of the late sixties-early seventies.

If ecological and geophysical evidence makes it plain that prevailing articulations of global social life with geologic processes cannot be sustained, what is not so clear is the shape of the geosocial formations that will take its place – or how they will come into being. The question also remains open as to the role social thought - having previously missed several geological turns - will play in these transformations. While the grammar of western social and philosophical inquiry is already replete with reference to the geological formation of the earth, the contributors to this special issue begin the task of putting social thought into an explicit, sustained and speculative interchange with its terrestrial origins.

References

Adam B (1998) *Timescapes of Modernity: The Environment and Invisible Hazards*. London: Routledge.

Alley R (2000) *The Two-Mile Time Machine: Ice Cores, Abrupt Climate Change, and Our Future*. Princeton: Princeton University Press.

Althusser L (2014) *On the Reproduction of Capitalism: Ideology and Ideological State Apparatuses*. London: Verso.

Bonneuil C and Fressoz J-B (2016) *The Shock of the Anthropocene: The Earth, History and Us*. London: Verso.

Bosworth K (2013) Notes towards a geological uprising by way of a dark feminism. *Society and Space*. Available at: http://societyandspace.com/reviews/reviews-archive/woodard-2013-kai-bosworth/ (accessed 27 January 2015)

Braudel F (1972) *The Mediterranean and the Mediterranean World in the Age of Philip II. Vol. 1*. London: Collins.

Braudel F (1980) *On History*. London: Weidenfeld and Nicolson.

Braun B and Whatmore S (2010) The stuff of politics: An introduction. In Braun B and Whatmore S (eds) *Political Matter: Technoscience, Democracy and Public Life*. Minneapolis, MN: University of Minnesota Press. ix- xl

Braver L (2007) *A Thing of this World: A History of Continental Realism*. Evanston IL: Northwestern University Press.

Broecker W (1987) Unpleasant surprises in the greenhouse. *Nature* 328: 123-6.

Brooke J (2014) *Climate Change and the Course of Global History: A Rough Journey*. New York: Cambridge University Press.

Chakrabarty D (2008) The climate of history: four theses. *Critical Inquiry*, 35: 197–222.

Chakrabarty D (2017) The politics of climate change is more than the politics of Capitalism. *Theory, Culture & Society* (this issue)

Clark N (2016) Anthropocene incitements: Toward a politics and ethics of ex-orbitant planetarity. In van Munster R and Sylvest C (eds) *The Politics of Globality since 1945: Assembling the Planet*. Abingdon, Oxon: Routledge. 126-44.

Clark N (2017) Politics of strata. *Theory, Culture & Society* (this issue)

Clark T (2015) *Ecocriticism on the Edge: The Anthropocene as a Threshold Concept*. London: Bloomsbury.

Colebrook C (2017) Sex and the (Anthropocene) city. *Theory, Culture & Society* (this issue)

Coole D and Frost S (2010) Introducing the new materialisms. In: Coole D and Frost S (eds) *New Materialisms: Ontology, Agency, and Politics*. Durham and London: Duke University Press. 1-43.

Conway P (2016) Back down to Earth: Reassembling Latour's Anthropocenic geopolitics."

Global Discourse 6 (1–2): 43–71.

Crutzen P (2002) Geology of mankind. *Nature* 415(6867): 23.

Crutzen P and Stoermer E (2000) The 'Anthropocene'. *IGBP Newsletter* 41: 17–18.

Dalby S (2017) Anthropocene Formations: Environmental Security, Geopolitics and Disaster. *Theory, Culture & Society* (this issue)

Davis M (1996) Cosmic dancers on history's stage? The permanent revolution in the earth sciences. *New Left Review* 217: 48–84.

De Landa M (1992) Nonorganic life. In Crary J and Kwinter S (eds) *Incorporations*. New York: Zone.

De Landa M (1997) *A Thousand Years of Nonlinear History*. New York: Swerve

Deleuze G (1988) *Foucault*. Minneapolis MN.: University of Minnesota Press.

Deleuze G and Guattari F (1987) *A Thousand Plateaus: Capitalism and Schizophrenia*. Minneapolis: University of Minnesota Press.

Foster, J B (2000) *Marx's Ecology: Materialism and Nature*. New York: Monthly Review Press.

Foucault M (1994[1966]) *The Order of Things: An Archaeology of the Human Sciences*. New York: Vintage Books.

Fraser M, Kember S and Lury C (2005) Inventive life: Approaches to the new vitalism. *Theory, Culture & Society* 22(1): 1–14

Grosz E (1994) *Volatile Bodies: Toward a Corporeal Feminism*. St Leonards, NSW.: Allen and Unwin.

Grosz E (2004) *The Nick of Time: Politics, Evolution, and the Untimely*. Durham and London: Duke University Press.

Grosz E (2008) *Chaos, Territory, Art: Deleuze and the Framing of the Earth,* Durham, NC: Duke University Press.

Grosz E (2017) Geopower, inhumanism and the biopolitical: Interview with K Yusoff and N Clark, *Theory, Culture & Society* (this issue)

Hamilton C (2014) Can Humans Survive the Anthropocene? Available at: http://clivehamilton.com/can-humans-survive-the-anthropocene/ (accessed 4 October, 2015)

Haraway D (1991) *Simians, Cyborgs, and Women: The Reinvention of Nature*. New York: Routledge.

Hegel G (1970[1817]) *Philosophy of Nature*. Oxford: Oxford University Press.

Hird M (2017) Waste, environmental politics and dis/engaged publics. *Theory, Culture & Society* (this issue)

Land N (1992) *The Thirst for Annihilation: Georges Bataille and Virulent Nihilism*. London: Routledge.

Last A (2017) We are the world? Anthropocene cultural production between geopoetics and geopolitics. *Theory, Culture & Society* (this issue)

Latour B (1998[1995]) To Modernise or Ecologise? That is the Question. In: B. Braun and N. Castree (eds) *Remaking Reality: Nature at the Millenium*. London and New York: Routledge. 221-242.

Latour B (2004) *Politics of Nature*. Cambridge, MA.: Harvard University Press.

Latour B (2013) *An Inquiry into Modes of Existence: An Anthropology of the Moderns.* Cambridge, MA: Harvard University Press.

Latour B (2014) Agency at the time of the Anthropocene. *New Literary History* 45 (1): 1–18.

Latour B (2017) Why Gaia is not a god of totality. *Theory, Culture & Society* (this issue)

Laudan R (1987) *From Mineralogy to Geology: The Foundations of a Science, 1650-1830*. Chicago and

London: University of Chicago Press.

Lövbrand E, Beck S, Chilvers J, et al. (2015) Who speaks for the future of Earth? How critical social science can extend the conversation on the Anthropocene. *Global Environmental Change* 32: 211–18.

Malm A and Hornberg A (2014) The geology of mankind? A critique of the Anthropocene narrative. *The Anthropocene Review* 1(1): 62–9.

Margulis L and Sagan D (1995) *What is Life?* New York: Simon & Schuster.

Marx, K (1973 [1857]) *Grundrisse*. London: Penguin.

Marx, K (1976 [1867]) *Capital Vol 1*. Harmondsworth: Penguin.

Marx K and Engels F (2004 [1845]) *The German Ideology Part 1*. New York: International Publishers.

Michaels A (1997) *Fugitive Pieces*. London: Bloomsbury.

Papoulias C and Callard F (2010) Biology's gift: Interrogating the turn to affect. *Body & Society* 16(1): 29–56.

Povinelli E (1995) Do rocks listen? The cultural politics of apprehending Australian Aboriginal Labor. *American Anthropologist* 97(3): 505-518.

Povinelli E (2017) Geontopower, biopolitics, and the Anthropocene: Interview with M Coleman and K Yusoff. *Theory, Culture & Society* (this issue)

Pyne S (1995) *World Fire: The Culture of Fire on Earth*. New York: Henry Holt.

Rockström J, Steffen W, Noone K *et al* (2009) Planetary boundaries: exploring the safe operating space for humanity. *Ecology and Society* 14 (2): 32

Scheffer M, Carpenter S, Foley J, Folkes C and Walker B (2001) Catastrophic shifts in ecosystems. *Nature* 413: 591-6.

Serres M (1995[1992]) *The Natural Contract.* Ann Arbor: University of Michigan Press.

Steffen W, Sanderson A, Tyson P *et al* (2004) *Global Change and the Earth System: A Planet Under Pressure*. Berlin: Springer-Verlag.

Stengers I (2000) *The Invention of Modern Science*. Minneapolis: University of Minnesota Press.

Szerszynski B (2017) Gods of the Anthropocene: geo-spiritual formations in the Earth's new epoch. *Theory, Culture & Society* (this issue).

Szerszynski B and Urry J (2010) Changing climates: introduction. *Theory, Culture & Society.* 27(2–3): 1–8.

UN World Commission on Environment and Development (1987) *Our Common Future.* Available at: http://www.un-documents.net/ocf-01.htm (accessed 6 March 2016).

Urry J (2005) The complexity turn. *Theory, Culture & Society* 22 (5): 1-14.

Urry J (2014) The problem of energy. *Theory, Culture & Society* 31 (5): 3-20.

Waters C, Zalasiewicz J, Williams M, Ellis M and Snelling A (2014) A stratigraphical basis for the Anthropocene? *Geological Society, London, Special Publications* 395: 1–21.

Yusoff K (2013) Geologic life: prehistory, climate, futures in the Anthropocene. *Environment and Planning D: Society & Space* 31: 779– 95.

Yusoff K (2017) Geosocial strata. *Theory, Culture & Society* (this issue)

Zalasiewicz J (2008) *The Earth after Us*. Oxford: Oxford University Press.

Zalasiewicz J, Williams M, Smith A *et al* (2008) Are we now living in the Anthropocene? *GSA Today* 18: 4-8.

Zalasiewicz J, Steffen W, Leinfelder R, Williams M and Waters C (2017) Petrifying Earth process: the stratigraphic imprint of key Earth System parameters in the Anthropocene. *Theory, Culture & Society* (this issue).