# `Primordial Wounds': Resilience, Trauma, and the Rifted Body of the Earth

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## Introduction: Fantastic Voyages

The widening rift between the two superpowers in the post-war decades gave a boost to Earth science research. Cold War projects generated novel understandings about the integration of the atmosphere and hydrosphere, advanced the study of the planet-wide cycling of the major chemical elements, and provided the evidence of sea-floor spreading at mid-ocean ridges that helped confirm the theory of plate tectonics (Masco 2010; Davis 1996). Laypeople, in the west at least, may have struggled to get their heads around the global scale of these `geophysical' and `geopolitical' forces. But Hollywood stepped up to assist. The 1966 science fiction film *Fantastic Voyage* rescaled superpower rivalry and the adventure of the abysmal depths to a decidedly intimate level: the now iconic storyline involving a deep ocean submarine miniaturised to make life-saving medical interventions within the body of a scientist who has suffered brain injury in the course of a Cold War assassination attempt.

Fast-forward fifty years and another, less fictional, fantastic journey is underway. Marine scientists, it was announced in 2007, were venturing into the deep Atlantic – using sonar and robotic seabed drills seabed to investigate what they described as an `open wound' in the planetary body (Than 2007). As the submarine geology of the late 50s and early 60s revealed, new crust is formed as magma rising up from the inner Earth pumps out along mid-oceanic plate junctures – where it quickly hardens into basalt rock. But researchers have identified an anomaly on the floor of the mid-Atlantic. Here, in a zone covering thousands of square kilometres, rocky crust has failed to form - and the Earth's interior mantle layer remains exposed. As a science reporter explains, citing one of the marine geologists taking part in the expedition: `MacLeod likens this process to stretching a person's skin until it ruptures, exposing the flesh underneath. "You take the crust and you stretch it and you pull it and pull it until it breaks," he said' (Than, 2007: unpag).

Natural scientists often deploy tropes of cuts, gouges, gashes, and other bodily injury in this way to help audiences empathize with inhuman vastness of violent Earth processes.

Social thinkers, on the other hand, have long borrowed geologic imagery – rifts, ruptures, chasms, seismic shifts – to portray events so momentous that that they effect our very ability to make sense of the world. In the context of the Anthropocene – with its scale-bending narrative of diminutive beings inflicting grievous injury on an astronomical body – it is not always clear which direction such traffic in signifiers is travelling. Ethical philosopher Clive Hamilton and science historian Jacques Grinevald describe the Anthropocene as `a new anthropogenic rift in the natural history of planet Earth' (2015: 9). Extrapolating on Marx's proto-ecological understanding of metabolic rifts between city and countryside, Marxist political ecologists John Bellamy Foster, Brett Clark and Richard York diagnose `an extreme "rift" in the planetary system' (2010: 15). With the coming of the climate change and Anthropocene, literary theorist Tim Morton contends, the geosciences confront 'an abyss whose reality becomes increasingly uncanny, not less, the more scientific instruments are able to probe it' (2012: 233).

How we approach the concept of resilience, I will be suggesting, is closely associated with our imagining of injury, vulnerability and trauma. But in turn, how we think about our own exposure – our fleshy and psychic susceptibility - is bound up with the different ways in which we conceive of the rifting and rumbling of our geophysical environment. In the midst of the Anthropocene event this exchange between tropes of planetary and bodily perishability is not only more complex than ever, I contend, but embodies a fundamental tension. Is harm largely generated *within* a body or system - or does it come from a potentially hostile *exterior*? To put it another way, is the pursuit of resilience a question of responding to the threats of self-inflicted injury – or is it more about coming to terms with a basic perviousness and exposure to outside forces? The weighting we put on these two options matters, I argue, and it is closely tied to differences within the geoscience community who are exploring the Anthropocene thesis.

Addressing possible precursors to Anthropocene thesis, Hamilton and Grinevald (2015), are insistent that only the newish interdisciplinary field of Earth system science can provide the requisite understanding of the human capacity to disrupt the great flows and cycles that compose our planet. Through its definitive concern with global biogeochemical cycles and their interactions, Earth system science demonstrates how it is possible for the planet to generate its own transformations at every scale – from the localized ecosystem right up to the total planetary systemic. As leading Earth system scientist Will Steffen puts it: `the forcings and feedbacks within the Earth System are as important as the external drivers of change, such as variability in solar energy input' (2006: 1). In this context, the thematic of resilience is primarily focused on the capacity

of any system to resist pressure for change – and in this regard is considered the `antonym' of vulnerability (Folke in Steffen et al, 2004: 287; Steffen et al, 2004: 205). Whereas in a vulnerable system even small changes may nudge the system over a threshold into a new operating state, a resilient system is one with the capacity to maintain its existing state by absorbing stresses or bouncing backing from perturbations (Folke in Steffen et al, 2004: 287).

While a formative influence on Earth system science was the idea that life itself has played a key role in planetary dynamics for billions of years – as proposed in the Gaia hypothesis (Steffen et al, 2004: 3), it is important to keep in mind that the field came of age focusing on `contemporary global change' – which is to say, change primarily induced by our own species (Zalasiewicz et al, 2017: 3). However, when it comes to gathering evidence to formalize the Anthropocene as a geological epoch, the responsibility falls largely on the older field of stratigraphic geology – whose definitive concern, as Anthropocene Working Group chair Jan Zalasiewicz and his colleagues sum up, is `with ancient, pre-human rock and time' (Zalasiewicz et al, 2017: 3). Perhaps the signal achievement of Anthropocene science thus far has been the way that it has brought these two formerly distinct geoscience fields together – in particular to collaborate over the question of what traces human-triggered transformation in the present Earth system will likely leave in the lithic strata of the distant future (see Zalasiewicz et al, 2017; Steffen et al, 2016).

Promising though this alliance is, we need to be as attentive to the differences between stratigraphic geology and Earth system science as we are to their convergence. And to attend to this distinction, I would add, for reasons other than those most critical social scientists have thus far alighted upon when they have taken Anthropocene science to task. Earth system science has frequently come under fire for presenting a unified, undifferentiated figure of `the human' and for insufficiently specifying the socio-economic processes that underpin planetary change (see Clark and Gunaratnam, 2017). However, the interdisciplinary field's axiom that `social-ecological systems act as strongly coupled, integrated complex systems' has been more broadly accepted by social scientists, most likely because of the way it endorses and extends the sphere of influence of social thought (Folke 2004: 287, see also Bai et al, 2016: Lovbrand et al, 2015). Conversely, with its foregrounding of great temporal and spatial reaches where no human presence is to be found, stratigraphic geology is more likely to be targeted by critical thinkers for its exteriorization of nature - and the unreconstructed duality of subject and object this is said to imply (see Clark and Gunaratnam, 2017).

It is my aim here to invert – or pervert – this logic. Looking more closely Earth system science's investment in the co-extensiveness and mutuality of human and biogeophysical systems, I ask what is excluded by the depreciation of radical exteriority – and what the implications of this might be for understanding resilience. Turning to `older school' geology, I pick up on its thematizing of a planetary surface that remains constitutively – and asymmetrically - open to the forces of the inner Earth. It is this holding open of the space-times of life to the unliveable, unassimilable powers of the planetary body, I propose, that can and should implicate geological imaginaries in a vision of resilience that is less sharply distinguished from or opposed to vulnerability. Drawing on Sigmund Freud's prefigurative linking of psychic and somatic trauma, and its wild extrapolation by philosophers Nick Land and Reza Negarestani, I gravitate towards a notion of resilience that cannot be separated from an inaugurating and on-going `geotraumatic' exposure to the violence of the Earth and cosmos. More than a matter of negotiating between different scientific framings of the vulnerability-resilience nexus, I suggest, this has profound implications for the way critical social scientists might view the relationship between human collectives and our geocosmic abode.

**Closure and Opening in the Earth System**

The self-understanding of Earth system science is of a bold embrace of complexity and dynamism in the physical world. Turning away from the gradualism that reigned in the Earth and life sciences since the early 19th century, and moving beyond the ideal of equilibrium or steady states that prevailed in mid 20th century systems thinking, the interdisciplinary geoscience that came of age in the 1980s coalesced around the idea that `the Earth is never static and …variability abounds at early all spatial and temporal scales' (Steffen et al., 2004: 295). The key to this sense of constant potential for change lies in the way that dense interconnections within complex systems organize themselves into feedback loops. Feedbacks – which involve the recursive cycling of inputs or effects through a system - can serve either to absorb and dampen down pressures for change or to amplify them: they can be `healing' or `hurting' as Anthropocene progenitor Paul Crutzen puts it (2004: 72). By this logic, complex systems are in a constant process of responsiveness and self-adjustment - but if pushed beyond certain threshold they have the capacity to shift rapidly from one overall operating state to another.

It is this thematizing of inherent changeability that informs Earth system science's preference for notions of resilience over sustainability. Whereas sustainability is seen to rest on assumptions that at any moment we can identify what it is we are trying to

protect, the concept of resilience acknowledges the uncertainty that is the essential correlate of the system's constant flux and on-going transmutability (Folke in Steffen et al, 2004: 287; Benson and Craig, 2014). The challenge then is not only a matter of how to reduce the pressures that might nudge a system out of a `desirable state', but how to protect and reinforce the system's own capacity to adapt to stress.

What the Anthropocene thesis brings into relief is that these imperatives apply at the scale of the total Earth system. But this also has profound implications for how `we' conceive of ourselves. As a source of `stressors' or pressures to change, humankind is conceived as part of the overall system: an increasingly forceful subcomponent *within* dynamic interactions of the various cycles and fluxes of the Earth system. In this light, the onus is not only on us to modulate our impacts on the various components of the Earth system – but also to cultivate our own adaptive capacities in the face of an increasingly uncertain global environment.

It is the apparent resonance between this `scientific' imperative to enhance human resilience and the demands foisted on disaggregated social actors by the current phase of the global capitalism that has aggravated critical social thinkers. I want to take a different approach, however, which is to ask what is stake in binding social systems so tightly into the systemicity of the Earth that the human and the nonhuman are rendered co-extensive. Such a concern means that rather than pushing forward and zooming in on the internal differentiation of the `Anthropos', we step back and consider how Earth system scientists define the object of their inquiry – prompting us to ask what is included in the Earth system, what is excluded, and what the implications of these `cuts' might be.

It is telling that when it comes to one of the most basic categorizations of a system – is it open or closed? – it is difficult to get a clear-cut answer about our planet from Earth systems scientists. The formal definition of closed system that it is open to energy flows but has no exchange of matter, by which logic the Earth - powered by the sun but with limited extra-planetary transfer of matter – largely fits the description. Such a classification justifies prioritization of the interacting circulations, fluxes and reservoirs *within* the Earth system. As Earth system scientist Tim Lenton puts it in *Earth System Science: A Very Short Introduction*: `(i)t is the thin layer of a system at the surface of the Earth - and its remarkable properties- that is the subject of my work' (2016: 17).

Philosopher and science studies scholar Bruno Latour cites this passage from Lenton approvingly (2014: 8). Latour likewise announces his focus on the `envelope of the biosphere' - which he follows up through his engagement in the study of `critical zones',

a way of applying Earth system science to vertical slices of that section of the Earth where living things interact with the inorganic world. As he explains: `critical zones define a set of interconnected entities in which the human multiform actions are everywhere intertwined' (2014: 3).

At this point it's worth recalling Earth system science's formative interest in human-induced global change. For there is a question here of whether prevailing construction of the Earth system reflect an `impartial' appraisal of planetary functionality or whether the constitutive concern with human-nonhuman coupling is itself a marker of what counts as systemicity. To put it another way, in the processes of reimagining the social as one more component of the Earth system, might a certain cutting of the Earth processes to fit the measure human be taking place? For if we look more closely at what precedes Lenton's selection of that section of the planet that happens to support life, the self-evidence of the definitive cut is rather less obvious. As Lenton elaborates:

> What is less clear is whether and where to put an inner boundary on the Earth system…. The longer the timescale we look over, the more we need to include in the Earth system … material in the Earth's crust becomes part of the Earth system, and we must recognize that the crust also exchanges material with the Earth's mantle (2016: 16).

As he goes on to say: `For many Earth system scientists, the planet Earth is really comprised of two systems - the surface Earth system that supports life, and the great bulk of the inner Earth underneath' (2016:17). And this implies that at some point the logic of coupling - or Latour's `interwining' or `interconnection' – reaches a limit. As a current hypothesis would have it, the lithosphere – the relatively rigid outer layer of the Earth – is *decoupled* from the underlying Aesthenosphere – the upper layer of the Earth's mantle in which hot viscous rock slowly cycles in vast convection currents (Self and Rampino, 2012: unpag, my italics). But `decoupling' here doesn't imply separation. What it means is that there an asymmetrical relationship, a grounding or subtending relation rather than the tightly-configured interdependence that characterizes the `envelope' of biogeochemical cycles which is of most interest to Lenton and the majority of his Earth system science colleagues.

For the older school `pre-human rock and time' geologists, this underpinning of the crustal structure by the forces of the inner Earth is pivotal for understanding how rocky strata are formed, deformed, and rearranged. As Zalasiewicz points out, compared with other astronomical bodies in this solar system – our planet has extraordinarily rich and

diverse lithic strata (2008: 17). While the constantly moving envelope of gaseous, liquid and biotic processes on and around the planet's surface play a crucial role in stratal formation, it is the Earth's exceptionally mobile plate tectonics that propel this process. In turn, it is the convection of the mantle layer that drives tectonic plate motion – all ultimately powered by heat dissipating upwards from the planet's core (Zalasiewicz, 2008: 46-51).

Mantle activity, in this way, constructs the sea floor, shifts continents and oceans around, builds mountains and valleys, and generates new lithic strata. As paleontologist Richard Fortey would have it, the power of the inner Earth `is the deep unconscious of our planet, the hidden body whose bidding the continents obey' (2005: 414). It is not only a matter of motive force, of driving the construction of planetary topography, however. The ongoing upward surges of mantle rock rendered molten in the course of tectonic plate movement also provide many of the materials upon which biological life depends. `(F)rom the secret storehouses of the inner earth,' observes science writer Simon Winchester, come `the elements that allow the outer earth, the biosphere, the lithosphere, to be so vibrantly alive' (2004: 302).

To the idea that the life–sustaining envelope of the outer Earth is open to the forces of the inner Earth we must add the thesis that inbound astronomical bodies – meteor impacts – played a formative role in the making of the planet's crust and periodically add their mighty perturbations to the trajectory of life (see Davis, 1996; Brooke, 2014: 26-37). Such a vision of combined endogenous and exogenous planetary `forcings', however, has very different implications from the assumption that most of the significant planetary action takes place in the slender inter-zone where humans and other life forms are entangled with inorganic processes. By prising open the systemic closure in which Earth systems scientists – and a great many social scientists – are increasingly invested, geologists and geophysicists with a `deeper' purview remind us of earthly life's fundamental exposure to an unbound, unassimilable exteriority. Such an opening, I want to suggest, draws the concept of resilience in directions other than Earth system science's ideal of well-managed planetary boundaries and elastic, adaptable human agents. But so too does it trouble the relegation of the resilient subject to the demands of neoliberal capitalism – or any other critical appraisal that would consign vulnerability and its enframings to a self-contained sphere of sociality.

**Bodily Vulnerability, Planetary Trauma**

Acting as both disequilibriating shocks and sources of nourishing elements, periodic mass-eruptions of matter-energy from the inner Earth have increasingly been viewed by Earth and life scientists as stimuli of major evolutionary changes of direction. Currently dated at around 66 million years ago, the vast Deccan Traps flood basalt outpouring at the boundary between the Cretaceous-Paleogene periods is implicated in the demise of non-avian dinosaurs and the subsequent proliferation of birds, fish and mammals (Fortey, 2004: 272-283). In turn, the monstrous Siberian Traps eruptions some 250 million years ago that mark that the Permian and Triassic boundary played a part in the die-off of an estimated 90% of the Earth's species –creating opportunities that eventually saw dinosaurs dominating terrestrial ecosystems. Still further back, Earth scientists have identified massive bursts of magma that spewed across the Columbia supercontinent around 2 two billion years ago. Providing an abundance of bioessential elements as it gradually eroded, this mineral rich magmatic effusion has been linked to the rise of eukaryotes – micro-organisms with complex cell structures that are the ancestors of all multicellular life, including algae, plants, fungi and animals (Parnell et al., 2012; see also Clark et al., 2018).

If these are amongst the more momentous junctures in evolutionary history, so too is the permeability of the crust to the planet's seething interiority implicated in a multitude of lesser re-routings, including the volcano-strewn rifting of the eastern African continent that played its part in the emergence of the genus *Homo*. More than stimuli or excitations, the susceptibility of the surficial Earth to the forces of an unliveable outside is a reminder, to borrow from literary theorist Clare Colebrook, that `(n)o living body is the author of itself' (2010: 45). And in this way we begin to get a sense that, however vital a sustaining network of connections or entwinings might be in the enduring of stressful events, earthly life is conditioned by forces over which it has little or no influence.

Philosopher and literary theorist Gayatri Chakravorty Spivak, in a more general vein, describes this basic structural condition of openness to spatio-temporal otherness `as the primordial wound of living-in-time' (1999: 333). Or as cultural theorist Pheng Cheah would have it, likewise writing in a deconstructive register: `(i)t is precisely this internal vulnerability of any present being to alterity – its pregnancy with the movement of altering – that allows something to alter, change, or transform itself …or to be changed, transformed, or altered by another' (1999: 191). If such a logic begins to unsettle the opposition between vulnerability and resilience, to acknowledge a constitutive exposure or susceptibility along these lines is not to idealize a complete openness, for a being or system that lacks any capacity to regulate the exchange between itself and its outside is

one that invites total dissolution (see Clark 2017: 10-11).

In *Beyond in the Pleasure Principle* (1920), his post World War I essay on trauma, Sigmund Freud explored the tension between exposure to excessive stimuli and the establishment of a defensive barrier. He did not, however, restrict his analysis to psychic responses, and neither did he stop at the *human* body. In what he confesses to be `far-fetched speculation' (1961[1920]: 18), Freud reflected on the way that all living organisms construct a skin, shell or crust to modulate the potentially overwhelming forces of their environment:

> This little fragment of living substance is suspended in the middle of an external world charged with the most powerful energies; and it would be killed by the stimulation emanating from these if it were not provided with a protective shield against stimuli (1961[1920]: 21).

In this process of self-defence, observes Freud, the individuating organism – like the similarly susceptible human psyche - must sacrifice some of its sensitivity by hardening itself at the zone of contact with its milieu. An experience can be considered `traumatic' when stimuli or excitations from the outside break through this protective barrier (1961[1920]: 23). At the same time, Freud continues, the developmental process of erecting a boundary between self and world is itself experienced by the living being as a loss, a severance, a scarring – giving rise to deep-seated impulse to return to pre-individuated continuity with the outer world (1961[1920]: 30-31). This is much the same logic that deconstructive thinkers will later deploy: the idea that a `decision' has consequences, that the cut – for all that it may be inaugural and generative - will bleed further on (see Spivak, 1999: 332 -5, fn 31, 33).

Remarkably, having proceeded from the battle-scarred or developmentally-damaged human psyche to the generalized condition of the biological organism, Freud extrapolated still further. As if deferring making the final cut in his own schema, he gestured towards a constitutive tension between boundedness and exposure that extended all the way to the geocosmic scale (1961[1920]: 496-7). `In the last resort', mused Freud, `what has left its mark on the development of organisms must be the history of the earth we live in and of its relation to the sun' (1961[1920]: 32).

It has taken the better part of a century for the truly `far-fetched' aspects of *Beyond the Pleasure Principle* to be fully appreciated. Embellished in conversation with Deleuze and Guattari's geophilosophy, Freud's abyssal extension of trauma was elaborated into quasi-

fictional theory of `geotraumatics' by philosopher Nick Land in the same millenium-closing year that saw the announcement of the Anthropocene. As Land puts it: `Fast forward seismology and you hear the earth scream. Geotrauma is an ongoing process whose tension is continually expressed – partially frozen – in biological organization … Evolution presupposes specific geotraumatic outcomes' (2011: 499). Developed by fellow philosopher Reza Negarestani in the following decade, the concept of geotrauma is systematized into a schema involving a succession of `nested' levels of existence, each one at once vulnerable to and painfully severed from the forceful milieu that gives rise to it. `Since there is no single or isolated psychic trauma (all traumas are nested)', observes Negarestani, ` there is no psychic trauma without an organic trauma and no organic trauma without a terrestrial trauma that in turn is deepened into open cosmic vistas' (2011: 1-2).

This is a great deal more going on here than metaphorical to-ing and fro-ing between the injuries afflicting human flesh and the rifting of the geobody of the Earth, though the profusion of figurations of organic-planetary wounding that we touched upon earlier are themselves suggestive of an intuition that goes deeper than wordplay. Both Land and Negarestani are talking about cuts in the real – consequential cisions in the stuff of existence whose legacy is an enhanced capacity for `survival' – if that is not too organic a term – but whose price is the permanent scar of partition. While far from identical, psychic barriers to excessive excitation, the skin or husk of the organism that divides bodily interior from environment, and the planetary crust with its biospheric envelope that separates inner Earth from impinging cosmos, follow a similar structural logic. In this regard, Freud's mental apparatus `flooded with large amounts of stimulus' (1961[1920]: 23) belongs to the same chain of nested traumatic irruptions as the flood basalts that periodically breach the Earth's crust. And in both cases – the maintenance of the `membrane' - the negotiation between interior and exterior – is essential and ongoing; endlessly enabling and perpetually fraught (see Derrida, 2005: Clark 2017a).

The Earth system science framing of resilience, as we have seen, is oriented towards pressures or excitations generated *within* the system. The sources of change to which Earth systems or ecosystems must respond arise out of the coupling of anthropogenic, atmospheric, hydrospheric and biospheric forces: a largely bounded set of interactions we might characterize as a kind of auto-affection. But this way of viewing terrestrial existence – according to the structural logic of traumatics - itself rests upon a decisive intervention. By severing the sphere or envelop of the outer Earth system from the perturbations of both the cosmos and the inner Earth, it becomes possible to imagine a certain self-authorship of life - which under Anthropocene conditions foregrounds auto-

affective human life. In insisting that the generic category of the human or Anthropos is sub-divided, differentiated, rigorously re-socialised, `progressive' social science advances rather than questions this logic of self-enclosure. Through their shared disavowal of a radical exteriority to the domain of liveability, I contend, Earth system science and critical social thought are ultimately complicit in the dream of collective, human-guided planetary authorship or `governance'. However timely aspects of this vision may be, the cut upon which it depends – in the final instance - severs radical or revolutionary social intervention from the very `excitations' of geocosmic existence that may be its most deadly weapon.

**Resilence and the Primordial Wounds of Living-in-Geological-Time**

Attuned to the relentless dynamics of our planet's surface and near-surface, Earth system science promotes a concept of resilience befitting a world that pulses with potential for change – at every scale. There is much to agree with in the ensuing assertion that minimizing the shocks of the Anthropocene calls for every effort to avoid further degradation of vital systems along with the cultivation of new social support mechanisms and crisis-ready institutional forms. And neither should psychic resilience be too hastily dismissed as anti-social individualization. Freud, it is worth remembering, advanced his own version of resilience in the mental and somatic apparatus, though he was also quick to acknowledge its limits:

> In the case of quite a number of traumas, the difference between systems that are unprepared and systems that are well prepared … may be a decisive factor in determining the outcome; though where the strength of a trauma exceeds a certain limit this factor will no doubt cease to carry weight (1961[1920]: 25-6).

Freud is talking about *external* shocks or excitations here. With analogies to contemporary Earth system thinking, however, he also explored the possibility of psychic-somatic systems generating their own internal excitation – in which case he recognised that barriers erected by the organism to defend against threats from the outside would have implications for the way internally-generated stimuli were dealt with (1961[1920]: 22-3). So while we should not underestimate the importance of the transformative possibilities that any complex system – psychic, somatic, ecological, geophysical - can generate though its own forcing and feedbacks, so too must we be attentive to the constitutive role of exteriority and to the lasting repercussions of mechanisms that have evolved to shield impingements from outside. It is in this regard

that the speculative notion of geocosmic traumatics draws our attention to the succession of cuts or severances from which any actual system has composed itself – and to the ways in which it must work across or through the resultant `scars' in order to maintain itself. In short, to paraphrase Spivak, there can be no resilence that is not a reckoning with the primordial wounds of living-in-geological-time.

Although reflection on suffering - the search for its meaning – might be a peculiarly human vocation, literary theorists Tim Matts and Aidan Tynan observe that `(s)uffering is, essentially, *not* a human problem, but primarily a *geological* one, a concern of the earth (2012: 102, 95). With their detailing of the upheavals that distinguish one stratum from the next and their meticulous archiving of life's perishability – it is the `old school' hard rock geologists who beckon us into the wrenching depths of the Earth: the stratigraphers and paleontologsits who remind us that our planet is at once a treasury and a cemetery of fossil-laden strata. Likewise, we can read the human body – any organismic body – as a repository of geological and climatic upheavals that have been ridden out. `(T)he time of the earth is recorded, accreted, knotted up inside us,' as philosopher Robin Mackay puts it (2012: 20-21): a reminder that the traces of a fantastic voyage through the planet's the abyssal depths are always already within us - or rather, that those traces are `us'.

So too might the very thought processes by which our species strives to make sense of its predicament be seen as a series of attempts to cast lines across the rifts opened by an injurious Earth and cosmos. Is Morton's 'abyss whose reality becomes increasingly uncanny …the more scientific instruments are able to probe it' the condition of the Anthropocene, we need to ask, or is it more generally the condition of human learning and thinking? For as Jacques Derrida would have it, reflecting upon the otherness that our very existence opens us up to: '(t)his incomprehensibility is not the beginning of irrationalism but the wound or inspiration which opens speech and then makes possible every logos or every rationalism' (1978: 98).

For all its aura of novelty – and many of its techniques and concepts are indeed new – the Anthropocene thesis is not western thought's first sustained encounter with the perishability threatened by planetary upheaval. In the work of the most influential 18th and early 19th century European philosophers, what appears again and again – if we look past the veneer of enlightened self-assurance - is the anguish of dwelling on a violently discontinuous Earth. Fully engaged with the geological discoveries of their time, Kant, Hegel, Schelling and many of their contemporaries confronted the amassing evidence of life-extinguishing `revolutions of the Earth' that were inscribed in the geologic strata

(Clark, 2017b: 217-19). Each thinker in their own way responded to the threat of the globe being `dissolved into chaos', as Kant put it (1993 [1796-1804]: 66-7), by seeking some enduring principle and schema that would insulate human freedom from a menacing geocosmic exteriority

In this regard, we might conceive of the physical threat of a revolutionary Earth as a primary incitement to the very idea of an autonomous, self-directed, social being: the discovery of deep, cataclysmic geological time as the wound or inspiration that propelled modern European thought toward the consolations of a bounded of `human' or `social' science (see Clark and Yusoff, 2017: 3-4). If this is the case, then every attempt of contemporary critical thought to contain and reclaim the shock of the Anthropocene in exclusively `social' terms is a re-enactment of 18$^{th}$ - 19$^{th}$ century geotrauma, a fortifying of the protective shield behind which the thinking of the social established its self-identity.

Is Earth system science, by this reasoning, a breakthrough in coming to terms with the inherent variability and volatility of our planet? Or is it the latest and most grandiose of western thought's successive efforts to bind and assimilate exteriority into a spherical totality: a final surge of the project of self-enclosure through which the cosmos is downsized and the domain of life amplified until they appear co-extensive and interdependent? These are questions we must also ask of any critical narrative that imputes such force to capitalism or EuroAtlantic modernity or colonialism that they end up mapping onto the planet without remainder.

While caution must taken not to simply reduce Earth system science and its directives to a ruse of capital, we should also consider Negarestani's point that capitalism has proven a powerful vehicle for reaching out into geological (and incipiently, cosmological) depths - and drawing what was once extraneous into its own orbit. `In binding the exorbitant register of exteriority', Negarestani observes, ` capitalism is able to present its dynamism as an intrinsic planetary system' (2011: 16). In this sense capitalism itself needs to be construed as a response to the greater geocosmic predicament, though it is a response that seeks always to appropriate and monopolize the geotraumatic impulse for its own interest - which ultimately means in ways that deepen and exacerbate life's exposure to the rifting of the Earth (see Negarestani, 2011: 17)

Whether couched in terms of geotrauma - or any other approach that confronts the constitutive exposure of humans and other terrestrial life forms to an enabling and threatening exteriority - the provocation is one of how to find ways to meet a

`revolutionary' Earth and cosmos on its own terms. Any exploration of `resilience', any means of extending our improbable and fantastic journey through the repeated upheavals of an exceptionally unstable planetary body, must pass through the scars of planetary, organismic and psychic upheaval and not over or around them. If this raises some fundamental doubts about critical tactics that aim to contain the incitements of Anthropocene geoscience in conventional social categories and concepts, too does it raise questions about the current wave of initiatives for `governing' Earth systems that quickly settle on familiar strategies of transnational co-operation and institution-building (see for example, Biermann, 2012; Wijkman and Rockstrom, 2011: 174).

More than a problem of facing up to its inadequate attention to *socio-cultural* differences, the trouble with recent strategies to protect planetary boundaries is their ideal of smoothing the socio-political sphere into a seamlessly, inter-connected globality that insufficiently acknowledges its *geological* rifts, differentials and divisions (Clark, 2016; 2017b). And in this way, the path towards resilience remains the extension and consummation of the existing *socius*, rather than the probing of the social field in search of the deep history of shock, damage, repression, deflection, adaptation and acclimatization out of which it has been assembled. For as Negarestani suggests, it is in the very experience or trace of exposure to the unassimilable forces of the Earth and cosmos that we are likely to find our most potent provocations, powers, and tactics for effective change. `The revolutionary subject restlessly searches for alternative syntheses or modes of traumatic inflection ….' he proposes. ` It improvises out of its traumas, or to be more exact, out of traumas which mediate between its regional horizon and the outside (2011:11).

Clearly, we are not going to be provided with a manual for step-by-step geotraumatic insurgency. We might, however, think in terms of a productive conversation with philosopher Elizabeth Grosz's call for to experimental `involution' of terrestrial and cosmic forces: her to invitation to find creative and expressive ways to calve off, isolate and downscale an otherwise overwhelming exteriority to a scale at which we can more safely work with these powers (2008: 3; 2011: 38). Though in the process we ought to heed Grosz decidedly geotraumatic cautioning that `art is also capable of that destruction and deformation that destroys territories and enables them to revert to the chaos from which they were temporarily wrenched' (2008: 13). Here too we should consider geographer Stephanie Wakefield's (2017) injunction to inhabit the back loop of newly liberated matter-energy in the wake of ecological catastrophe, keeping in mind that the loop also spirals abysally through the succession of improvised reorganizations that have followed cosmic, geologic and evolutionary upheaval. And we need to think in

terms of the great rifts gouged by Euro-modern colonialism in the physical and experiential worlds of others - though such deep and pervasive chasms of socio-eco-geotrauma demand their own full accounting (see Yusoff, 2018).

With its awkward if productive tension between an ascendant Earth system science and an older stratigraphic geology, the scientific discourses of the Anthropocene serve at once to bind biogeophysical processes to the world-making efforts of our own species and to remind us of the inhuman abyss that yawns beneath every anthropic endeavor. How Anthropocene science and the related field of global change are constructing resilience reflects this equivocation, though the current trend seem to be favoring the assumption that the Earth system is contiguous or co-extensive with the spheres of human collective agency.

But Steffen's genre-defining assertion that `the forcings and feedbacks within the Earth System are as important as the external drivers of change', I have been suggesting, can and should be read the other way round. As variations played on the theme of geotrauma remind us, and by sciences' own estimates, these external forcings have a head start on us of at least 13 billion tumultuous years. An uneasy amalgam of extrapolative readings of the natural sciences, pyschoanalysis, continental philosophy and genres of fantasy and science fiction, geotraumatics prompts us to think of resilience as a reckoning with scar tissue, an opening of old wounds that may help us to endure fresh injury, a sensitivity towards an inescapable exposure to new shocks and rumblings. It provokes imaginings of resilience that put `coping' or `adaptation' into confrontation with `revolutionary' upheavals that belong as much to the Earth as to any recognizably social domain. What we might make of geotrauma as an incitement to terrestrial revolution remains to be worked through, as does the question of what further cuts made by geocosmic realities will make of us.

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