Earthing the *Anthropos*: Anthropocene Science and the Geology of the Social

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Introduction

'The Earth is one but the world is not' (1987: n.p.). So began *Our Common Future*, the 1987 report of the UN World Commission on Environment and Development. Although ecological issues at the time had already begun to chafe against disciplinary boundaries, for that small minority of social scientists drawn to the environmental field, the Commission's starting premise might have seemed relatively unproblematic. The Earth – whole, integrated, singular — was taken to be the domain of the natural sciences. Social *worlds* — multiple, divided, contested — appeared as the realm of the social sciences. Thirty years later, things are rather more complicated. As Anthropocene Working Group chair, stratigrapher Jan Zalasiewicz recently concluded, '…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). The hypothesis that the latest of these planetary state-shifts is possibly being brought about by cumulative human impact draws the conventional concerns of the social science into the heart of the Earth sciences. And so, the Anthropocene hypothesis has set the scene for a confrontation between `our' understandings of a dynamic and differentiated social world and a geoscientific framing of `anthropic' agency.

With inevitable over-simplification, we detect a series of key — and necessarily not simultaneous — points in the reception of the Anthropocene thesis in critical social thought. The first is the claim that the scientific evidence of human impact on the Earth system delivers a final blow to the modern Western divide between nature and society. Once the cumulative effects of human agency have a documented influence at the planetary scale, it is argued, what was formerly referred to as `nature' now has an irredeemably social component. The second point is that the uneven culpability for and vulnerability to anthropogenic changes in the workings of the Earth system makes of the Anthropocene a profoundly political and ethical problem. The third, anticipated above, is the insistence that Anthropocene inquiry is greatly in need of social science contributions in order to make sense of the socio-structural, cultural and historical differentiation of the *anthropos* and the social dynamics that have generated and sustained these differences. Human geographer Karen O'Brien expresses this perspective, in ways that build on the previous two points:

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

The fourth, related, issue is the claim that the diagnostics of the natural sciences tends to hinge on modes of abstraction, instrumentality and techno-managerialism — dispositions that are themselves implicated in the genesis of the current planetary predicament. To this point, science studies scholar Eva Lobrand and colleagues

respond: We believe that the social sciences are well equipped to address this tension by further socialising the Anthropocene concept (Lovbrand *et al.,* 2015: 213).

In this paper we respond to these discussions and contentions by posing two main questions: what if the provocation of the Anthropocene is as much about the behavior of the Earth as it is about what humans have done? And what if the social sciences, in our haste to reclaim disciplinary propriety over the interpretation of climatic data and narratives of a diverse and fractious humankind, are missing the significance of an Earth that is beginning to appear every bit as multiple, fractured, and discontinuous as our own species?

In beginning to frame and offer tentative responses to these questions, we provide a brief survey of recent social scientific responses to the Anthropocene and consider why social theory has been so reluctant to afford geological processes an active role in accounting for human difference. This line of inquiry takes us into the heart of European philosophical modernity and its anxious grappling with newly emergent scientific understanding of the deep temporal dynamics of the Earth, a milieu that was foundational for the modern social sciences. In search of ways to move beyond the disavowal and displacement of the geoclimatic `trauma' of an earlier modernity, we return to the present, and consider the work of those social science and humanities scholars who have begun to incorporate the differential forces of Earth processes into their accounts of global social life. Taking these works as a point of departure, we discuss what we might have to learn from recent moves to reassess human history and prehistory in the light of increasingly comprehensive climatic data. Finally, we circle back on the quest for ecological, climate and earth systemic justice that we find so appealing in critical social Anthropocene studies. Here, we open up the question of what a deeper recognition of the role of dynamic earth processes might bring to progressive ethico-political imperatives.

Socialising the Anthropocene, Humanising Difference

In the context of escalating environmental issues, social scientists have drawn attention to the unequal distribution of vulnerability to environmental harms and the uneven responsibility of different social groups or strata for triggering these problems, a logic that has also been applied to `natural' hazards (Clark, Chhotray and Few, 2013). `As is often the case', Schneider and Lane observe of global climate change `environmental injustice is but an aspect of deeper socioeconomic injustice (in Adger *et al*., 2006: 24; see also Barnett, in Adger). Playing to the strengths of critical social inquiry, these scholars at once advocate for marginalised, disempowered or subjugated peoples and seek to authorise a distinctive social science contribution to fields traditionally dominated by natural science and techno-managerial actors. With a track record in demonstrating that there is no such thing as a natural disaster or a purely technical environmental hazard, such approaches have also provided a well-rehearsed strategy for the reception of the Anthropocene thesis.

Inheriting the broader remit of critical environmental studies to rigorously dissect the relationships of power, wealth and knowledge that link the culpable to the vulnerable, social inquiry into the Anthropocene has mobilised around perceived occlusions in the geoscience framing of `human' agency. It has moved quickly to counter these with more discriminating accounts of the composition and capacities of the social. In the words of Lovbrand *et al*.:

> When linking environmental change to social categories such as class, race, gender, power and capital we thus find that the challenges of the Anthropocene are far from universal. Rather, they emerge from different

> socio-political settings, produce different kinds of vulnerabilities and precariousness and will therefore most likely generate different kinds of political responses …. we suggest that a critical Anthropocene research agenda will resist unified accounts of 'the human' and instead work to situate people and social groups in the rich patterns of cultural and historical diversity 'that makes us into who we are' (2015: 214- 6)

In this context, it is assumed that `socializing the Anthropocene' is the necessary condition of any project that aims to `re-politicize the Anthropocene' (Lovbrand 213, 216). If the pronoucements of Anthropocene science are not to reinscribe the injustices and inequalities that currently divide human populations, what is required is an explicit challenging of existing power relations, which also implies the contestation of science's own privileged position in articulating the global predicament. Which is to say: `We need a plurality of narratives from many voices and many places, rather than a single grand narrative from nowhere, from space or from the species' (Bonneuil 2015: 29). To undercut the abstraction or univocality to which the natural sciences still aspire, these multiple voices or voicings of multiple worlds must be construed as `embodied' `situated', and `contextualised' (Lovbrand, 2015: 214-6).

Taken broadly, we do not disagree. But in the light of the as-yet-inchoate understanding of compounding human and geological agency, we ask, do we still have a clear sense of what is meant by a `body', `situation' or `context'; of what constitutes bodies, contexts and situations; of where their contours and limits lie (see also Puar, 20xx)? To put it another way, when we are summoned to help `socialise' the Anthropocene, are we confident that we still know what the `social' stands for — or against. For as the same texts that would reassert the probity of what social, cultural and historical categorisations are telling us, the message of Anthropocene science is that we now inhabit a hybrid social-natural world, one in which the ontological splitting of the natural and social have irredeemably lost their purchase (Bonneuil 2016: 28-9; Lovbrand et al 2015: 215; O'Brien, 2010: 547). Indeed, the assumption would seem to be that it is this very blurring or erasure that undermines the privileged position of the natural sciences, and in this way, authorises critical thought in its socialising of the Anthropocene and in its reiteration of the social, cultural and historical constitution of human difference.

There is, we would hazard, a certain incongruence in critical-interpretive Anthropocene studies between the re-affirmation of conventional social categories and the concurrent celebration of the collapsing nature/society binaries. There are also complications in the very notion of `dominant scientific discourses of the Anthropocene'. However, where fellow social science commentators have tended to take this as an opportunity for a critical supplementation of scientific narratives from the *outside*, we prefer to acknowledge the contests, negotiations and shifts taking place *within* the Earth sciences.

Geoscientists presenting the Anthropocene thesis are well aware that they walk a tightrope between the scientific objectivity required to convince the guardians of the Geologial Time scale that this is a worthy concept and their own commitment to publicising a predicament that they find genuinely terrifying. They believe that the former will assist the latter; that formal recognition from International Commission on Stratigraphy could constitute `an acknowledgment akin to the IPCC consensus statements on climate change' (Zalasiewicz et al .2010: 2230). And they know that this balancing act courts controversy. `The concept of Anthropocene' reflect Zalasiewicz *et a*l., `has the capacity to become the most politicized unit, by far, of the Geological Time Scales and therefore to take formal geological classification into uncharted waters (2010: 2231)

Although their conceptualisation of global social difference may lack some of the nuance of specialist social scientists, Anthropocene geoscientists recognise the profound political-ethical challenges of the problems of intergenerational equity (Steffen *et al*., (2011: 750). They have repeatedly drawn attention to the divided responsibility for triggering shifts in the Earth system. As atmospheric chemist Pual Crutzen insisted in his terse, canonical announcement of the Anthropocene `these effects have largely been caused by only 25% of the world population' (2002: 23). In a paper that explicitly takes issue with `neoliberal economic principles and assumptions' (p751), Earth system scientist Will Steffen and his colleagues extend Crutzen's argument:

> …the world's wealthy countries account for 80% of the cumulative emissions of CO2 since 1751…The world's poorest countries, with a combined population of about 800 million, have contributed less than 1% of the cumulative emissions… The pathways of development followed by today's wealthy countries …. cannot be followed by 75–80% of the human population (Steffen et al 2011: 746,739)

Social scientists do not have monopoly on the moral condemnation of these glaring inequities and the suffering they bespeak. And arguably, we have much less to risk than natural scientists by making our feelings known. Perhaps those of us who rarely venture onto polar ice caps or alpine glaciers need also to be mindful that our own interventions on behalf of the world's poor and marginalised depend precisely on evidence painstakingly assembled by our geoscience counterparts. Indeed, there may even be grounds for conceiving of the science of the Anthropocene as a kind of overture towards the world of social thought and action, `something in the nature of a rift-bridging offering or gift' (Clark, 2014:27).

To do justice to a gift, to deal with its strangeness and unpredictability, philosopher Jaques Derrida contends, is a troublesome and demanding task (1992: 122-3). Gifts, he adds, have a habit of unhinging our experience of lived time, of opening the present to deep, unmasterable temporalities (1992: 147; 1994: 25-8). Care needs to taken by social scientists in receipt of the Anthropocene thesis, we suggest, so as not to foreclose on its potentially disruptive impact on the times, spaces and agencies with which we are most heavily invested. Already, we detect rebound effects of the critical `disciplining' of Anthropocene science of fellow social science and humanities scholars who are choosing to do less conventional things with the resources offered by the earth sciences. Contra those social theorists whose reading of recent geoscience is restricted to its pronouncements on extensively humanised earth systems, some social scientists and humanities scholars have been drawn to those reaches of earth history that greatly exceed any human presence or imprint.

Yet when historian Dipesh Chakrabarty (2009) makes the claim that climate science confronts us with earth processes whose timescales render them indifferent to collective social agency, he is quickly taken to task. In the rejoinder of fellow historian Christian Bonneuil, `this `indifferentialist' view re-enacts precisely the modern divide between the `natural' and the `social' that the Anthropocene disproved' (2016: 28-9). Likewise when feminist philosophers Elizabeth Grosz and Vicki Kirby consider the role of physical processes that are antecedent to and thus the precondition of socio-cultural processes, they are charged with contravening the cherished commitments to the ontological relationality of the natural and the cultural: `Consequently, rather than getting at the interimplication of nature and culture—both Kirby and Grosz produce an account that is ultimately dominated by one side: nature' (Jagger 2015: 335).

One of the reasons why Chakrabrty, Grosz and Kirby expose themselves to the charge of ontologically privileging nature is that they each seek in some way to unsettle the purely socio-cultural constitution of the human by situating social existence within a radically extended geophysical field. Making such a manoeuvre

explicit, human geographer Kathryn Yusoff proposes that we take the incitement of the Anthropene to be as much about the geologisation of the human as it is about humanisation of geology. Yusoff challenges fellow critical social thinkers to `use the Anthropocene as a provocation to begin to understand ourselves as geologic subjects, not only capable of geomorphic acts, but as beings who have something in common with the geologic forces that are mobilised and incorporated (2013: 781).

Commending that we open the bodies, situations, or contexts that compose the `social' to the forcefield of the geophysical is not the same thing as affirming the mutual entanglement of the natural and the social. For as Chakrabarty, Yusoff and others make clear, to venture into the deep temporalities and expansive spatialities of the earth and cosmos requires a provisional departure from the times and spaces of the social, and thus breaks with the structural logic of the society-nature co-constitution. To recognise fully inhuman or unsocialised domains, in this way, does not spell the end of a critical composure, though it does invite a certain openness or fidelity to the findings of the earth sciences — or other traditions of apprehending or experiencing an expansive earth and cosmos. But the current critical climate, with its investment in tight onto-political suturings of nature and society, we have been suggesting, can be less than hospitable to approaches that stray beyond these couplings. Where an autonomous or antecedent agency seems to be being afforded to nonhuman forces, it is usually not long before allegations of the reversion to modernist European binaries are made or the spectre of environmental determinism is invoked (Obrien 547; Leichenko and O'Brien, in Adger, 2006).

Such disciplining and foreclosure, we would insist, have the best of intentions. In most contemporary critical-interpretive thought, the project of advancing the political — enhancing the powers of collective agency — is assumed to be inseparable from the shoring up or the opening up of the social. In this regard, investment in the co-construction of nature and society equates with an expansion of the domain of the social and of social thought — and thus, potentially, with an extension of the range of political. For us, it is this commitment to prise and hold open the political in the face of the menacing prospects of Earth system change that discourages hospitality to the fully inhuman and to those who would acknowledge its traces in human or social being.

But these fidelities are also an inheritance. And inheriting, like receiving gifts, is a fraught and exacting task (Derrida, 1994: 54). With this in mind, we now turn to an earlier stage in European modernity, to the conjuncture at which critical philosophical and social thought first fully confronted the challenges of deep time and geological transformation. Here, the quest to advance human freedom came up against Earth processes capable of stopping us in our tracks. A consideration of how Western thinkers dealt with these threats — how they processed, or failed to process, the perils of geophysical forces — we propose, is crucial to an understanding of our inheritance as contemporary social thinkers.

Moral Climatology and Modern Geotrauma

As we have been suggesting recent attempts to reclaim the `social' from Anthropocene science, may be unwittingly immunising key Western socio-cultural categories against any originary complication by geological forces. But such a complicity with the `inhuman', we have noted, is already spirited into the critical politics of climate and Earth system change through its reliance on scientific evidence — the use of data sets that only make sense in the broader context of deep Earth history. In a very different context, scholars committed to justice may also encounter a radically extended physical forcefield when they bear witness to those who are living at the sharp edge of climate or ecosystem change. In such situations, what is demanded is not simply that universal rights, entitlements and laws are

recognised, but that singular, non-substitutable experiences of suffering and loss are acknowledged.

Especially, but not only, in the case of traditional or indigenous communities, such appeals often invoke a political present that is `non-contemporaneous with itself' – a here and now conditional upon connections or identifications that overflow individual beings, that may well exceed the living altogether and reach deep into earthly or cosmic anteriority (see Derrida 1994: xix; Gunaratnam and Clark, 2012). In other words, the commitment to justice at the very heart of progressive social thought can find itself divided between a will to universality and a fidelity to unfathomable singularity, between political co-presence and an abyssal temporality. It is with such an aporetic logic in mind that literary theorist Gayatri Spivak affirms 'the internationality of ecological justice in that impossible, undivided world of which one must dream, in view of the impossibility of which one must work, obsessively' (1999: 382).

In this section, our concern is with the specific social and historical inheritances that tend to insulate this `impossible' quest for climate or earth system justice from its broader geologic or geophysical context, with special attention to the way human difference is and has been constructed. If critical social thinkers have some good reasons for a shoring up of the social against incursions by geoscience, they have even better reasons to be suspicious of accounts of human diversity that are based upon climate or geophysical positioning. Slavery, conquest and colonisation have long been authorised by crude distinctions between self and other, but such typologies attained new levels of systematisation in the age of European maritime and imperial expansion. European thinkers grounded the virtues that they imagined best defined themselves in the geographical regions they inhabited and projected less favoured traits onto other zones - with particular disparagement of the tropics.

Human geographer David Livingstone describes these geographical determinisms as `moral climatology', a discursive formation he sees as characterised by 'both a widespread tendency to deploy moralistic language in depicting climatic conditions *and* a conviction that it is entirely reasonable to read moral order straight off patterns of global climate' (2002: 160, see also Clark and Gunaratnam, 2013: 161-2). A crucial aspect of moral climatology's repertoire was the heavily racialised conversion of spatial distance into temporal or developmental difference. Europeans and their new world progeny arranging self and others into an invariant evolutionary sequence: `a temporal slope, a stream of Time – some upstream, others downstream' in the words of anthropologist Johannes Fabian (2002: 17). This brutalising arc helped legitimate an entire world system of expropriation and exploitation.

The broad current of European `critical' thought itself, postcolonial scholars remind us, was by no means immune to such practices of global climatic-chromatic hierarchization. From Kant's claim that only the cultured were susceptible to the uplifting encounter with the sublime, through Hegels' assertion that Spirit's ascendance over nature was the privilege of exceptional peoples, and on to Marx's dismissal of the transformative potential of the Asiatic mode of production, the modern quest for enlightened self-awareness and action has been subject to severe geographical circumscription (Spivak 12-13, 50 ff 72, , (Chakrabrty),), . Aware that the cultural-intellectual milieu from which modern social thought emerged was rife with such imaginaries, and attentive to the frequent, unseemly resurfacing of such visions ever since, contemporary progressive intellectuals remain justifiably on their guard. Critical Anthropocene scholars may have even more reason to be vigilant as they survey a world whose emergent climatic and earth systemic vulnerabilities uncannily retrace the contours of colonial era racial-climatic typologies (see Clark and Gunaratnam, 2013: 161).

But is critical thought's moral climatological stain cause enough to steer permanently clear of accounts of human difference or social distinction that would re-establish contact with the variability of the Earth? When it comes to the forecefulness of the Earth and cosmos, we would suggest, the inheritance with which contemporary social thought must tussle is still more complex than it first appears. For if we look more closely at the intellectual milieu that spawned modern variants of geoclimatic determinism, what is also present - alongside and within these determinisms – is a vigorous *disavowal* of the significance of the geological or the geophysical. A confronting and recoil from the geologic, that is, which turns out to have much in common with the contemporary critical reaction to the Anthropocene thesis.

It is important to recall that the rise of European modernity was conterminous with an irruption of interst in the dynamical foramtions of the Earth every bit as intense as the current Anthropocene conjunction. In the late 18th-early 19th centuries `geology' was not just intellectually fashionable, it was increasingly part of lived experience – as intensifying extractive industry, infrastructural excavations, and a vogue for visiting `wild' landscapes made the inner architecture of the Earth ever more tangible (Toulmin and Goodfield, 1964: 150-1, 162-3; Rudwick 2005: 88). Europe's most illustrious savants were frequently involved in the nascent geological sciences practically as well as conceptually. Kant - impelled both by geological curisty and the shock of the 1755 Lisbon earthquake - helped found the science of seismology; Goethe successfully managed silver and copper mines; Hegel – familiar with the pioneering biostratigraphic work of Cuvier and with the geological controversy between the Neptunits and Vulanists - was the assessor of the Jena Mineralogical Society (kant, Rudwick 2005: 26; Kolb, 4, Ferrini 94).

In little more than a human lifetime, the estimated age of the Earth lurched from a few biblically-sanctioned millennia to a mind-bending millions of years (Rudwick, 2005: 124-6; Toulmin and Goodfield, 1964: 133). But this discovery of the deep time had a dark side. An Earth whose history greatly preceded Adam was one largely bereft of a being in God's image, raising anguishing questions about whom or for what purpose the Creator's handiwork had been intended. As Stephen Jay Gould notes, amidst the successive decentrings of humanity effected by the modern sciences – as couched by Freud – the shocking diminution of the human presence exacted by geohistory is oddly neglected (1987: 1-2). Amassing geological evidence – especially in the form of fossils – told a story of a succession of past ages populated neither by humans nor by other extant creatures. For geohistorians and *philosophes*, the pronounced stratification of these presences and absences signalled that great transformations must have occurred over the course of our planet's history, what Kant referred to as `revolutions of nature' (1993, 1st 1938: 570)

In this regard, the `trauma' of the deep time was not simply the disclosure of a yawning humanless prehistory, it was the likelihood that geological changes of similar magnitude and consequence were still to come. As Kant anxiously inquired: `How many such revolutions (including, certainly, many ancient organic beings no longer alive on the surface of the earth) preceded the existence of man, and how many …are still in prospect, is hidden from our enquiring gaze (1993, 1st 1938: 66-7). Hegel, with even more geophysical evidence at his disposal, contemplated not only `tremendous revolutions belonging to a remote past', but even `profounder revolutions caused by alterations of the earth's axis' (citedin Kolb 5)

If `revolutions' in this sense did not necessary imply abrupt or catastrophic change (rudwick 2005: 102-3), the implication was nonetheless was human life was not immune to the kinds of event that had extinguished so many other forms of life. While many social and cultural theorists have pondered the shock to Europeans of encountering the diversity of human life in the course of their global, less seems to

have been made of this confrontation with great reaches of the temporal Earth utterly devoid of any human trace. Whereas, as Peter Sloterdijk reminds us, global circumnavigation implied a hopeful return home, albeit a home unsettled by encounters with otherness, the traversal of the Earth's constitutive strata offered no such comforting circularity. Here, we might say, the problem was not so much human difference but an Earth that had begun to appear indifferent to humankind in any of its guises.

For Kant, the idea of a cosmos deprived of its only known moral being was literally unthinkable. His response, breaking decisively with the Cartesian nature/culture divide, was to construct a fool-proof system that sutured human subjective capacities so tightly to the structure of the cosmos that it ruled out any serious consideration of nature or culture in isolation from one another. Hegel, just as unwilling to countenance `mind' being derailed by geological catastrophe, convinced himself that nature's formative convulsion belonged only to bygone phases of terrestrial and cosmic evolution - leaving the further ascent of Spirit untouchable by geocosmic force. The result was hegel's famous disavowal of geology: his pronouncement that the upheavals of the earth `are … hypotheses in the historical field, and this point of view of a mere succession in time *has no philosophical significance whatever*. (Hegel in Kolb 5 E 339a our italics).

For all that Hegelian idealism has become a routine target of critical disapproval, we need to be careful with this `geologic' legacy. For if we substitute `political', `cultural' or `social' for `philosophical' in Hegel's renunciation of any geological contribution to the trajectory of human freedom, we may well find ourselves in the position social and philosophical thought has held for the intervening two centuries. And arguably, still holds. But what is vital to remember is that when Hegel turned his back on geological agency, and when Kant found a way to elevate his subject above the revolutions of the Earth, this by no means expressed a lack of consideration for geological processes. Rather, the very endeavour to escape the convulsions of the Earth, to insulate the human subject, reflects a profound knowledge of, respect for, and foreboding over, the dynamical formations of the planet. In short too much geology was the problem, not too little.

what could be termed early modern `geotrauma' (see Land), invites a reconsideration of the era's characteristic racial-climatic imaginaries. To what extent, we would ask, might the Europe's counterposing of its own equability and temperateness with `other's' geoclimatic exposure manifest a projection or displacement of its own deep-seated geophysical fears? Viewing other people's vulnerability as confirmation of their enduring miredness in nature appears also to have provided a baseline from which to gauge Euro-Atlantic success in elevating itself above geophysical endangerment. We need to be cautious however, as the connection between climatic variability and more generalised geological transformation was much less systematic in the 18th-19 cneturies as it is now. Nonetheless, it seems important to keep in mind that the European disparagement of its geocliatic others may as much reflect a profound geophysical anxiety or as much as its does a moment of confidence and self-assertion

The more genral point we would make s is that key themes in today's social theoretic grappling with the Anthropocene thesis – in particular the desire to recuperate human `freedom' or collective possibility from geophysical threat – may be as much originary complications of western modernity as they are emergent impulses. What critical social thought seems to have inherited from European philosophical modernity is the recoil from the geologic along with the conceptual architecture that was assembled in order to for evade or defuse the threat of geophysical dynamism. But at the same time, we have left behind, or chosen to forget, the deep enthrallment with geology that engendered this disavowal. This needs to be taken

into account, we would insist, during any reassertion of the probity of conventional s categories of the social, cultural, historical or political - for the very absence of a geophysical complication or suplemtnation of these terms calls for interrogation. Just as we need to be mindful that in the past, the purifying of the climatic, the geologic or the cosmic from of the thematization of human or social agency may have resulted in displacements that we many not wish to repeat.

But what directionss might social thought take if we were to revisit our `modern' inheritance with different criteria in mind: if this time we `stayed with trouble' of geophysical or climatic endangerment and loosened up on the injunctions against the social and philosophical significance of the geologic? In the following section, we set out in the pathway of recent inter-disciplinary work that has begun to bring social and historical formations into proximity with climatic and geophysical history.

Geologizing the Social

Philopshical modernity, we have argued, was remarkably successful in bequeathing to modern social science a notion that societies, cultures and polities worthy of the name are unmoored from the Earth and its paroxysms. But the very capacity of a modernising west to imagine – provisionally - its transcendence of the earth, can itself be seen as a partially geological process – enabled by the tapping of mineral substrata and the appropraton of distant lands (Pomeranz –see Brooke 464). If modern extractive industry can be construed as a dramatic intensification of the interchange between geological surface and subsurface (Bridge 2013), so too has the suturing together of the Eurasian and American landmasses been interpreted as an event that re-enacts the contintal convergence not seen since the breakup of the Pangaea supercontinent some 200 million years ago - though in ways that `probably have no geological analogue' (Lewis, and Maslin, 2015: 172).

Such a geological supplementation, we stress, by no means devalues the human suffering involved in these social upheavals. But what thinking through the earth has begun to do, in the provocative writing of political scientist Timothy Mitchell (2011), is to encourage us to see the formative contribution of certain concetrations of matter-energy and their uptake into new socio-material orders to shaping modern political modalities. For Mitchell, the assemblage that formed around coal was `a machine that enabled large numbers of people to exercise novel forms of political power' (2011: 39); a reading that helps us to comprehend why the more diffuse distribution of oil, as the subsequent axial energy source - has hindered or undermined `mass' political mobilizations. Viewed in this way, the very contours of modern democracy cease to be expressions of straightforwardly social or political forces – and begin to materailise as constitutiely `geo-social'.

But what of those whose lands, collectivties, bodies found themselves in the path of the west's geo-social irruption? In a searching inquiry into the successive famines that devastated the monsoonal lattitudes in the latter 19th century, cultural historian Mike Davis sets out in paradigmatically critical fashion by empahsising , that drought-induced food scaricties that recurrently struck agrarian communities across India, China, Brazil and neighboring regions in the late Vicorian era were not simply manifestations of enviro-climatic determinacy . `We are not dealing … with "lands of famine" becalmed in stagnant backwaters of world history, but with the fate of tropical humanity at the precise moment … when its labor and products were being dynamically conscripted into a London-centered world economy (2001, 9). Though scathing in his condemnation of the dynamics of capital and the ideologies that legitimised it, Davis demonstrates that it is no less important to account for dynamics of global climate. Drawing on also newly avalible reconstructions of climatic history he identifies to Symergies of monsoonal periodicities and the el Nino southern oscialltion that the enhanced vulnerability of the agrarian tropics at specific

historical moments to the no-less pernicious rhythms of globalising capitalism. So momentous was damage inflicted by this collision of global socio-economic and cliamtic extremity, Davis insits, that they gouged out the foundations of the enduring thrird-world-first world divide.

The implication of Davis's account is that we can no longer take global structural divisions as self evidently `social' or `economic', but must also acknowledge their irreduccle geocliamtic trace. With the availability of increasingly high resolution and cross-referenced records of the climate history, it is becoming easier to track the `geosynchronous' footprints of significant events across multiple regions. And as blanket injunctions against environmental or climatic `determinism' soften, other social scientists are joining Davis in the acknowledgement that decisive moments in world history might have significant geophysical components. Anthropologit Julie Cruikshank
recounts how early European contct with indigenous peoples in the pacific northwest overlapped with the latter stages of the Little Ice period of cooler and more erratic temperatures manifest in the region as rapid glaciation. `A time of significant geophysical change', she notes `…coincided with dramatic social upheaval causing both readjustments and realignments among resident peoples and the permanent problem of powerful strangers who came to stay (2005: 10).

Cultural historian John Brooke develops the broader pointhtat the 15-19th clittle ice age, the most climatically unstable conditons for several thousand years contributed signicantly to the ecological, social and physiological vulnerability of th indigenous peoples worldwide at the time of European contact and colonial advance. Extended drought and famine During the 16 -17th c, Brooke adds, fragmented once powerful west African states, generating condition that did not cause but certainly eaxxerbated the rise of the slave trade (443), at the same time contributing to an exceptionally intense wvae of war, famine and epidemic across much of the Eurasian contient (444-7) . While north western Europe did not escape this climatic turbulence unscathed, Brooke notes that amongst other effects, cooler summers during the latter little ice age had the advantage of helping suppress recurrent outbreaks of plague (458)

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these multiple voices or voicings of multiple worlds must be construed as `embodied' `situated', and `contextualised' (Lovbrand, 2015: 214-6). This is as much an ethical political imperative as an empirical or cogntiv endeavour.

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Philopshers had every right to be perturbed, traumatised by evidence
These too are moral cimatologies –bearing witness

It is not that geological, climatic and ecological vriables alone explain or the course of world history. But increasingly high resolution and cross-referenced records of the major events in the Earth system - with their tracking `geosynchronous' footprints across a the globe – are fast encroaching on unreconstructed `social' or `historical' accouts. While such geo-socially composite narratives still have work to do to prove their worth in recent history, their contribution to explaining the ebb and flow of earlier empires, patterns of settlement, and waves of human migration is more widely affirmed. A kind of see=sawing Counterpart to the Little Ice Age, the

Medieval Climate Anomaly running from the tenth to the late 13 century brought several centuries of warm stable climate to the Northen latitudes, intensified the Asian monsoon and visited megadrought on much of the equatorial belt – with profound impacts on cental and north amercian polation cetres (Brooke 359, 370-1). An intervening `Dark Age; global cold spell leads back to what has been six to eight centuries of reltively stable and warm climate that at least for the Mediterranean and Europe has been described as a `Classical optimum' (322-5). The time between 3000-500BC has been described as another drawn out climatic optimum, with a vital qualification, an episode of abrupt climate change aroud 2200 BC that brought catstrophci drought: `Quite suddenly, over perhaps a half century, the Bronze Age palace polities that surrounded the Mediterranean collapsed, and never recovered their ancient form' (Brookes 299). But the pulse of preClassical climate crisis – possibly El Nino related wreaks simultaneously havoc right actoss the South and East Asia, West Africa and mesoAmerica, (Brookes 306-312)

Uneasy over the haste with which critical social thinkers are moving to wrest the theorization of the `social' back from perceived encroachment by Anthropocene geoscience, we are suggesting that it might be prudent to try and think human sociality through the geologic – though it's worth recalling that convergence of the sceicnes of dynamical earth systems with the study of human history and prehistory precedes the Anthropocene problematic. To borrow a phrse from Donna Haraway, we want to `stay with the trouble', to broaden our sense of what both the earth and our own species or genus might be capable of. And in this regard, even the civilisation shattering geoclimatic oscialltions of the Holocene pale by comparison with the vicious fluctuations of the Pleistocene. Moving out of the ten-thousand year span of current interglacial epoch, we encounter a succession of extreme claimte changes, swtiches that climatologists now belive may have occurred in less than a single human generation (Muller et al 278). While temperature changes would have been more pronounced closer to the poles, the flip from a warmer interglacial into a cooler glacial or `stadial' state would have had severe impacts right across the planet's surface, resulting in declining rainfall, fierce winds and dust storms, vast forest fires and collapsing animal populations.
(Calvin, (Wilson et al, 2000: 3). With each transition, paleoclimatogical and genetic analysis suggests, human populations suffered catastrophic crashes (Ziegler et al 2013: 6), which resulted in the attenuation of numerous waves of migration and brought about extinction of multiple branches of the genus Homo.

'Our ancestors lived through hundreds of such episodes – but each became a population bottleneck, one that eliminated most of their relatives. We are the improbable descendants of those [who] survived – and later thrived' (Calvin 2002, 3).

There has been much speculation about the role of climate change and other upheavals – such as major bouts volcanaicty and sesismic activity – in the human evolution, though geophysical instability has been so intense and recurrent that it remains difficult relate directly to specific changes in behavior or physiology. (gamble et al 2004: 243) So extreme are the transformations associated with successive climate shifts that they can be summoned to explain just about any human achievement - from linguistic skills to tool use, social cooperation through to inter-group aggression.
Indeed, paleoclimatologists and Paleoanthropologists currently locate the divergence of the genus *Homo* from fellow 'great apes' in the east of Africa some 2.4 million years ago to changes brought about a convergence of powerful 'forcing' mechanisms: regional tectonic uplift, orbital forcing (changes in the tilt of the earth's axis and orbit) and global climate changes brought about by reductions in atmospheric carbon dioxide (Maslin and Christensen 2007). As anthropologist Yves Coppens describes the emergence of the earliest humans: 'We are partly the fruit of

an astronomic event, helped by a tectonic one, which produced a dramatic drought in periequatorial eastern Africa' (1999, 17).

This still novel sense of the precariousness of the human lineage offers a poignant counterpoint to any lingering assumption that some branches of humanity have an innate capacity to make something of themselves not shared by others.

It is perhaps revealing that social scientists who take Anthropocene earth scientsts to taks for failing to adequately account for socal difference are themselves reluctant to address events that go back further than the last few centuries. Such foreclosure not only precludes consideration of the major geocliamtic events that Homo sapiens have weathered, but shies away from any recognition that for the vasr majority of human terrestrial tenure, multiple lineages of the genus homo shared the planet. For around 99% of the time span currently attributed to the genus *Homo*, multiple species have made up the human family In this regard, not only do most critical social thinkers steer clear of physical forces that have left differential forces, they also potential greater human diversity that may more unified than most deconstructons of identity acknolwege.

The work of weaving back together

Far from the rigidity of biological essentialism, what we need to account for is the social and cultural capacity of bands of human beings to enter unfamiliar environments, endure new kinds of bio-material challenges, and forge novel sets of alliances – and to hold their ground long enough for this new constellation of forces to leave its mark on corporeal and social identities. Whether it is a case of varying facial features, composition of intestinal flora, pigmentation of skin, skeletomuscular proportions, sites and rates of fat deposition, resistance to pathogens, or efficiency in metabolizing nutrients, physical differences between human populations might be seen as the tribute that biology pays to successful socio-cultural performances (see McEvoy et al. 2006, Burroughs 2005, 147–148)

'Life on Earth retains a memory of its past', proclaims biologist Lynn Margulis. 'Living bodies store in their complex chemistry memories of past environmental limitations they overcame' (2001, 18). Our species, we would prompt, is no exception.

Who can yet say how such pressures will play out in a world whose average surface temperatures may be 2, 3, 4, 5, or 6 degrees warmer than at present?

'The role of climate in the origin and adaptations of humans relates not only to our past', paleobiologist Anna Behrensmeyer reminds us, 'but also, potentially, to our future' (2006, 476).

In the concluding section, we

Geosocial Futures and the Adventure of Care

For the last 10,700 years, the sole surviving species of the genus *Homo* has been spared the climatic extremes that tested, shaped, pulled apart, threw together and often extinguished our predecessors over the preceding two and half million years. Anthropogenic climate change – the predicament some would diagnose as the Anthropocene - is now looking increasingly likely not merely to deliver us back into the climatic instability that reigned in the Pleistocene, but to generate atmospheric compositions, temperatures and tipping points whose nearest analogue is the mid-Pliocene (currently calibrated at 3.29–2.97 million years ago (Hayward et al., 2009).

Conditions, in other words, that no member of our genus, let alone our species, has ever experienced. Reassuringly, plaeoclimatologist William Burroughs adds '[h]umans … are capable of adapting remarkably well to hot conditions' (2005, 295). But he goes on to stress just how vulnerable we remain to abrupt climate change. When we consider the fragility of urban infrastructures, the standardized and finely-tuned nature of modern agricultural production, and global human population that will likely reach 10 billion at the time when the risk of climate destabiliation s, there is every reason for anxiety

Recent history – modern in the sociological rather than the biological or geological sense, offers mixed messages of fear and hope. Hope in the sense that global connectivity can bridge regional enhance food and provisioning security as well as emergent forms of transnational cooperation. Fear, not only in the magnitude of planetary change, but also that existing socially-structured precariousness, that we have suggested might better be seen as geosocially engenderd. The accelerated suturing together of dispersed human populations into a world system – driven primarily by demands empire and capital - `Europeans track famine like a sky full of vultures' as one 19th c African observer succetly put it. (cited in Davis, 2001: 139). Far from the first and unlikely to be the last expansive poluations to take advantage of enhanced vulberity during times of geo-bio-cliamtic stress.

If crude chromatic-chronological imaginaries played their part in the tragedy of transcontinetal Euro-Atlantic expansion, so too did failure to comprehend fundamental regional differences in geo-social conditioning. Europeans, genrally, did not understand that their own reduced but rslient post-glacial biota differed from patterns of biological diversity non-glaciated biomes, they rarely gleaned that glacially-revitalised soils had very properties than unrenwed soils, they failed to grasp that the regularity of temperate seasonal variation differed profoundly from the definitive inter-annual variability of the monsoonal and El-Nino lattides; they misconstrued that their own continually well-watered lands had a natural fire regimes very different from those with more distinct rainy and dry seasons. Just as similar misconstruals punctuate the much longer and more mult-directional history of human trans-geographical encouters.

In short, we would argue that the critical demolition of moral climatology ought not to prohibit other fusions of socio-historical and climatological thinking, that disavowal of environmental-cliamtic determinisms should not discourage more nuanced understanding of the geo-bio-climaatic subtending of social possibility.. If critical-interpretie social scientsits are to demand of geoscience colleagues that they fully account for the sociostructural conditioning of the current global conjucture and consider the socio-political enframing of their own epistemic commitments, so too do we need to reflect on the limits and foreclosures of our own planetary imaginations. If social researchers are to share the `impossible' dream of global ecoogucal justice, or embrace the even more-far fetched fanasy of just and generous geocliamtic coexistence, we weill ned to do our Earth systemic homework. Or in Clive Hamilton' terse injunction: `social scientists in the Anthropocene have no choice but to become geophysicists' (2015: 36)

We very much share the concerns of fellow critical social thinkers that the gradn planetary scale and level of abstraction of contemporary Earth system thinking is rarely condiucive to what science studies scholar Sheila Jasanoff refers to as `the mundane rhythms of lived lives and the specificities of human experience' (2011: 238). As Lovebrand and her colleagues advise, citing feminst theorist Karen Litfin: . ,

T_o_ _r_e_c_o_g_n_i_z_e_ _t_h_a_t_ _p_e_o_p_l_e_'s_ _e_x_p_e_r_i_e_n_c_e_s_ _o_f_ _n_a_t_u_r_e_ _d_i_f_f_e_r_ _m_a_y_ _h_e_l_p_ _u_s_ _t_o_ _r_e_p_o_s_i_t_i_o_n_ _'t_h_e_ _h_u_m_a_n_' _a_s_ _a_

_h_e_t_e_r_o_g_e_n_e_o_u_s_ _s_o_c_i_a_l_ _a_n_d_ _p_o_l_i_t_i_c_a_l_ _s_u_b_j_e_c_t_ _a_n_d_ _h_e_r_e_b_y_ _r_e_-_c_o_n_n_e_c_t_ _t_h_e_ _A_n_t_h_r_o_p_o_c_e_n_e_ _t_o_ _'t_h_e_ _r_e_a_l_m_ _o_f_ _i_m_m_e_d_i_a_c_y_ _w_h_e_r_e_ _m_e_a_n_i_n_g_f_u_l_ _a_c_t_i_o_n_ _i_s_ _p_o_s_s_i_b_l_e_ _a_n_d_ _m_o_s_t_ _l_i_k_e_l_y_ _t_o_ _b_e_ _e_f_f_e_c_t_i_v_e_' (Lovbrand 2015: 216)

But no less would we heed the prescient advice of sociologist Barbara Adam, who encouraged social scietists to weave the intiante tempos and patternings of social life into a more expansive canvas:

A symphony of rhythms and temporalities … underpins our development as humans and as living organisms. It marks us as creatures of this earth, as beings that are constituted by a double temporality: rhythmically structured within and embedded in the rhythmic organization of the cosmos. (1998, 13)

Such a sense of the living through the rythms – or the revolutions – of the planet draws us into an appreciation of what Jacques Derrida referred to the 'non-contemporaneity with itself of the living present' (1994: xix); or what we might see as the profoundly inhuman traces within every human being or collectivity. On a planet which Earth system science prompts us to see as non-contemporaneous with its own living present, we are all creatures whose current being is premised on a chain of events not of our own making (Cheah GC 308). Read through the body, as Adam and others have counselled, each of us might be seen as the inheritors of a vast lineage of other bodies who have somehow, against the odds and in irretrievable ways, lived on through waves of ecological, geocliamtic, and astronomical volatility (Grosz, 2004, 2). Gunaratnam and Clark). As philosopher Judith Butler puts it, in another context: `Although we struggle for rights over our own bodies, the very bodies for which we struggle are not quite ever only our own'

If the struggles, appeals, mobilisations, constive of the political indeed, require a certain copresence, an arena of potential reciprocities – we need also to keep in mind what it is that motivates a concern with justice. As Derrida would have it for justice to come anywhere near to attainment it must, above all, be *desired* (1992, 25). Even the most assiduous tallying of rights and wrongs, he urges, is never enough: whoever is in the position to pursue justice must care – deeply, passionately – for those who suffer injustice. But as Derrida and fellow ethico-political thinkers have also insisted, such care or passion or desire to be just to others does not arise primarily from a sense of our sameness with those who turn to us in times of need. Rather, it takes off from our intimations that the others whose suffering or injustice we wish to relieve are different from us in vital ways: that their experience, their story, their pathway though life has not been the same as ours. Jean-Luc Nancy contends that the quest for 'equality of all has for its very condition the nonsameness of "humanity". And along with this equality, the curiosity of each about the other' (1997, 158). Which means that a sense of imagined or perceived difference is not so much an impediment to justice, as its very incitement. Care, responsibility, the quest for justice, in the words of Emmanuel Levinas, is '(t)he adventure separation opens'

On a planet rifted by periodic changes of state, one on which `variability abounds at nearly all spatial and temporal scales' , the human genus has faced wrenching separations again and again: events so trying they have left Homo sapines bereft of near relatives. reflects evolutionary psychologist William Calvin We are the improbable descendants of those [who] survived – and later thrived' (2002, 3). When European scholars initially confronted the amassing empirical evidence of the Earth's tumultuous past, we noted earlier, the experience seems to have been profoundly unsettling. Kants sublimation of quaking anxiety into moral improvement

and Hegel's conjuring of Spirits exponential ascent out of nature's rumbling baseline might be seen as attempts to outmanoeuvre the the catatrophic time of the earth, leaving a legacy of avoidance or displamcent of geological threat to future phislpohicla an social thikers.

By staying with the geophysical trouble, by digging deeper into the long human tussle with planetary turbulence, we hope to find not only practical resources for survical, but provocations for future ethical encounters over the emergent rifts, junctures and thresholds in the body of the Earth. In the irresolvable quest for ecological or geoclaimtic justice, we suggest, no simple reassertion of social, cultural, political or historical difference will suffice. To begin to bridge the gulf between Earth systemic abstraction and lived, embodied or affective experience calls for an greater understanding of the geophysical otherness within. It summons us to attend not only to the socialisation of the geologic, but to the abyssal and incessant geoogization of the socius and of the bodies that compose it.

In complex ways these traces both draw us together, and tease us apart, binding us as the sole-survving hominds on aplanet whose cataclysms reach the global scale, distinguishing as the memebrs of populations wh have frequently taken disparate routes acroos the fractured surface of the earth. Each of us derives our current capacities and capabilities from a miraculously unbroken relay of ancestors, `a chain of bodies' to whom we might see ourselves as being profoundly indebted - if in ways which we can never fully bring to light (Grosz, 2004: 2). At the same time, Human cultural and physiological diversity signals we have survived and thrived differently. Where-ever the scene in which we address each other, whatever its other socio-cultural interpretations, perceptible difference can also be viewed as a marker of distance, of a geographical and deep historical sundering. Our cultural and corporeal publicity announces that your people and mine, at some point, parted company, endured different conditions, made different choices, or had alternative trajectories imposed upon us. It hints, if often in ambiguous and misreadable cues, that our predecessors faced different biogeophysical provocations, found different solutions to the challenge of vacillating climate, variable food supply, forged different assemblages with outher life forms.

The role of climate in the origin and adaptations of humans relates not only to our past', paleobiologist Anna Behrensmeyer reminds us, 'but also, potentially, to our future' (2006, 476). Aa world that looks to be heading towards an operating state entirely new to our species, will likely foment new injustices, as well as more inscribing existing lines of injustice still deeper. ahead of the appeals which we may face or find ourselves making, None of us can know, just what on earth will incite foster the new intensities of care and responsibility our novel geosocial predicamnts will call out for. `I cannot offer a formulaic access to planetarity' cautions Gayati Spivak. `No one can' (Spivak P76). Affiming this very unfathomably, we sugest, An enhanced `curiosity of each about the other', a more profound, more informed respect for the trajectoris others have taken through the disjoint history of the earth.

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