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Unfree radicals: geoscientists, the anthropocene, and left politics

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Keywords

geoscientists, unfree, anthropocene, left, politics, radicals

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Unfree radicals: Geoscientists, the Anthropocene and Left politics

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Abstract Neil Smith's writings about capitalism and what we call 'nature' were insightful and influential. This paper asks what Smith would make of the 'radical turn' today occurring in the world of international geoscience. If we 'think with' Smith, how should we view Naomi Klein's recent statement that geoscientists can act as fifth columnists calling the capitalist way of life into question? In the first half of the essay I address these questions. I summarise and apply the insights of Smith's writings to recent developments in international geoscience. Smith wrote about science in most of his published statements about capitalist ecology and I show that he would ultimately have regarded Klein as hopeful, even naïve. I then go on, in the second half of the essay, to 'think against' Smith. I suggest his views on science bespeak a wider, unhelpful separation between Left scholarship in the social sciences and humanities and the STEM subjects (science, technology, engineering and medicine). Recalling earlier attempts to radicalise science politically, and highlighting the radical potentials of geoscience today, I make the case for forms of interdisciplinarity that might render geoscience more political. Though this case opens space for perspectives beyond the Marxism Smith did so much to develop, he would – I hope – see it as a legitimate part of the Left's long war against capitalism's rule over society and environment.

Keywords: Neil Robert Smith; capitalism; science; nature; the Anthropocene; inter-disciplinarity

Introduction

According to leading geoscientists, humanity is entering a new geological epoch of its own making. We are profoundly altering not just parts of the Earth but *all* of it. What should we make of this claim that the Holocene will soon be over? In her new book *This Changes Everything* (2014) Naomi Klein points to its proto-revolutionary character. She highlights numerous climate experts who acknowledge the momentous socio-economic implications of their scientific evidence and predictions. Ever the Marxist, towards the end of his life Neil Smith felt compelled to consider whether revolution is on the horizon. "We have, almost all of us", he opined in these pages, "lost the political imagination of a different future" (2009: 52). His essay 'The revolutionary imperative' went on to lament the broad Left's organisational incapacity and imaginative inability to reckon with the post-capitalist openings capitalism periodically creates. If Neil Smith were alive today, would he share Klein's conviction that international geoscience might not only inspire, but actually be part of, a root-and-branch assault on the capitalist way of life? Would he applaud her pragmatic belief that geoscientists might act as fifth columnists? Or would he, instead, consider her naïve at best and counter-revolutionary at worst?

With these questions in mind, in this essay I want to explore the relationships between two things. One is the radical claims issuing from international networks of geoscientists about anthropogenic environmental change.¹ The second is a style of critical analysis issuing from the academic Left, both Marxist and non-Marxist. My core concern is whether, and in what ways, geoscience can both invigorate and be energised by a renascent anti-capitalist movement. As Klein notes, the scientists who study global environmental change (GEC) enjoy two privileges few on the contemporary Left can claim to. First, they speak – through their instruments, measurements, data and concepts – for the Earth as a (complex) biophysical whole. They thereby make claims *about* the world that stand to become claims *upon* all those inhabiting that world. This sort of epistemic universalism is rare in any walk of life, cross-cutting as it does worldly differences of society and situation. It comes with obligations and risks. Second, they speak with an authority that is recognised by reformers and revolutionaries alike, whatever their particular political persuasion. Though geoscience has suffered repeated attacks by climate change sceptics, its perceived integrity remains high among those with more than passing scientific literacy. Like other areas of contemporary science it therefore commands attention in ways few other present-day institutions do.

As we will discover, its leading practitioners are calling for a new *modus operandi* in response to the evident failure of political-economic elites to close the yawning ‘sustainability gap’. In itself, this does not make them radicals in the sense Klein intends it. But it does, I will argue, hold real potential in this regard. To realise this potential I believe the academic Left needs to do a much better job of building bridges between what Jerome Kagan (2009), adapting C. P. Snow (1959), calls ‘the three cultures’ of academic life. As part of this, it will be timely to rethink the relationships between ‘critical’ thinking in the social sciences and humanities, and the practices and claims of biophysical science. A certain ‘interdisciplinarity’ is called for, though not the sort usually touted by research funding bodies or in mainstream policy circles.

Neil Smith, I believe, would endorse these arguments ... but only up to a point. In what follows I ‘think with’ and ‘think against’ him in equal measure. Never afraid of an argument, he would surely approve of my willingness to take issue with his ideas – even if he might disagree with my reasoning and conclusions were he still with us. On the one hand, I take inspiration from Smith’s many writings about what we by convention call ‘nature’, in which he made numerous references to science. As well as influencing me heavily over the years, these writings continue to shape the thinking of many on the

¹In this essay I use the term ‘geoscience’ to describe a large and wide field of research and teaching that covers a number of disciplines and which encompasses the study of Earth surface phenomena (e.g. rivers, ecosystems) and, to a lesser extent, sub-surface phenomena (the focus of geology).

academic Left in the wider social sciences and humanities.² They counsel us to look for the ways science is harnessed by capitalism to both engender and cope with socio-ecological change – even when as it is ultimately irreducible to the profit motive. On the other hand, I believe Smith too readily cleaves science (except the Marxist version³) from his sense of what constitutes progressive politics. He would therefore, in my view, have us look (too) sceptically at Klein’s claim that geoscience is taking a radical turn that should be of interest to all erstwhile revolutionaries.

This is unfortunate, yet hardly unique. Among Leftists in human geography and beyond, science (including geoscience) is these days often seen in two opposed ways. Either it is subsumed to the imperatives of capital accumulation, or else perceived as a merely accidental ally of critics of capitalism. What is usually not considered is that science might be deliberately conducted in the service of something more just, egalitarian and imaginative than the rapacious capitalist world whose perpetuation it is so deeply implicated in. As a result the Left stands aloof from contemporary science, variously critical or grateful but rarely involved.⁴ It thereby fails to realise its own capacities to help make science something other than it currently is. This distance exists in microcosm in Smith’s home discipline of Geography, notwithstanding the ‘environmental turn’ undergone by its human ‘half’ this last 25 years. Indeed, for all this writing about nature (and about science, as part of this), Smith showed little direct interest in the kind of physical geography whose analysis, at the global scale, now inspires epochal claims that we are entering the Anthropocene. This essay, I hope, will give us pause for thought about what follows if we too presume to speak about natural science without seeking to engage (at least some of) its practitioners.

²Indeed, one of my first publications focussed on Smith’s writings as a means of exploring how both ‘nature’ and the claims of science might be simultaneously rethought from a Marxist perspective (Castree, 1995). In the subsequent years many younger researchers in human geography and cognate fields were, like me, drawn to Smith’s arguments about ‘capitalist nature’. A prime example is Alex Loftus, whose book *Everyday Environmentalism* (2012) takes considerable inspiration from Smith’s writings. The substance of these writings remained very consistent over the years in my view, though was rearticulated in light of the changing political economy – evident, for example, in Smith’s contribution to *The Socialist Register* (Smith, 2007a) and his afterword to the third edition of *Uneven Development* (Smith, 2008).

³Smith declared Marxism’s universal pretensions in an early essay critical of positivism, humanism and a nascent ‘radical geography’ (Smith, 1979). However, that essay did not really address how practicing scientists who study such things as rivers or rocks would have their practice altered by the Marxist theory he advocated. His essay was addressed more to human geographers than their physical counterparts.

⁴Even Science and Technology Studies (STS), the main area of contemporary scholarship where social scientists and humanists directly touch physical science, is guilty of this charge. As Steve Fuller has pointed out on many occasions (e.g. Fuller, 2007), it is studiously non-normative in the main, preferring to *report* on ‘science in action’ than *engage* with scientists in creative and political ways. Though STS does have some normative leanings – expressed clearly in criticisms some practitioners have made of initiatives in ‘public understanding’ of and ‘public engagement’ with science – most STS scholars steer clear of ‘dirty hands’ interactions with the scientific world. This was not always so. Early on, some contributors like Steven and Hilary Rose were outspoken critics of the way modern science was made to serve the ‘military-industrial’ complex. Later, criticism in STS took a more ‘academic’ form and was largely contained in monographs and peer review papers like this one.

Geoscientists as spokespeople for an unstable Earth

Global environmental change: evidence and concepts

The detection of anthropogenic climate change (ACC) is perhaps the most important contribution geoscience has ever made to human understanding.⁵ As the recent working group I report of the Intergovernmental Panel on Climate Change (2013) makes clear, the human 'signal' is now unmistakable. Looking ahead, the continued failure of the world's largest economies to reduce greenhouse gas emissions is utterly reckless. The key question many are posing – analysts, activists, concerned citizens and others – is how a future of 4 degrees Celsius rise in average atmospheric temperature (or more) can be avoided. This question is hardly new, but is now taken more seriously than before across the ideological spectrum as the 'organised denial' that precipitated the 'Climate-' and 'Glacier-gate' affairs of 2009-10 slowly weakens.

If ACC is an all too familiar subject of the age, more recently geoscience has given us some other things to fret about. Though first proposed back in 2000 by atmospheric chemist Paul Crutzen and freshwater biologist Eugene Stoermer, only in the last five years has the idea of 'the Anthropocene' began to circulate outside the world of international geoscience. It describes a new geological epoch that will run its course for centuries and millennia. Uniquely, this era – unlike all those past – has been triggered (unintentionally) by human actions. We are the first living species said to act as a 'planetary force', remaking the Earth's surface at all points of the compass. This goes well beyond ACC. It suggests nothing less than the fusion of collective human agency with aspects of 'nature' long thought to be well beyond human influence (such as ocean currents). Though geoscientists – like most scientists – are taught to keep 'value judgements' out of their research, Crutzen and his various co-authors make a strong 'is-ought' link. Their refrain, in a string of publications, has been the urgent need for 'global stewardship'.⁶

These claims intersect with those made about so-called 'planetary boundaries' since 2009. According to Johan Rockström and an international group of geoscientists (including, once more, Paul Crutzen and leading climate scientist James Hansen), there are nine biophysical domains that together have offered humanity a 'safe operating space' during the Holocene epoch (Rockström *et al.*, 2009; Steffen *et al.*, 2015). Transgressing the limits of any of these domains – for example, the levels of ocean acidity – could, it is argued, set-off irreversible, cascading changes across the others. This brings to mind the concepts of 'tipping points' and 'thresholds'. While scarcely novel, both have been used frequently in association with the planetary boundaries idea and the

⁵With the exception of early geologists' discovery that the Earth was not made by a deity and is more than a few thousand years old.

⁶See Steffen *et al.* (2007, 2011).

notion of ACC.⁷ They denote geologically rapid, qualitative, one directional shifts in major Earth sub-systems. Though sometimes phrased in ‘rational’ scientific language – such as terrestrial biologist Anthony Barnosky and colleagues’ major *Nature* paper on a ‘state shift’ in the Earth’s biosphere (Barnosky *et al.*, 2012) – some geoscientists are using ‘hotter’ terminology too. Notable here is the idea of the ‘sixth mass extinction’ cited more and more in studies of species loss and biodiversity decline (see, for instance, Dirzo *et al.*, 2014). Where previous mass extinctions were due to natural internal and external forcings, the present one is almost wholly anthropogenic.

In sum, in recent years numerous geoscientists across the disciplines have used their institutional authority to sound the environmental alarm louder than at any time since the early 1970s – the period when the likes of Barry Commoner and Paul Ehrlich became notable (and, in different ways, controversial) spokespeople for an ‘Earth in crisis’.⁸ It is precisely this willingness to speak-out from respected universities within the heartlands of political economic power – places like the US and the European Union – that leads a Leftist like Klein to applaud their (apparent) radicalism.

A new modus operandi for ‘global change science’

Added to the long-standing idea of ACC, the recent emphasis on the Anthropocene, planetary boundaries, tipping points and thresholds are all notable developments in the world of international geoscience. But it is important to understand that geoscientists are not only making large claims about the Earth. They are simultaneously reflecting critically on their own professional practices. Read the journals (*Nature*, *Science*, *Ambio*, *BioScience* and others) or attend the major conferences and it is clear that there’s a real appetite for change. This has three aspects, all born out of a frequently voiced frustration that societal decision-makers are not acting strongly or quickly enough to arrest GEC.

First, some leading geoscientists argue that the (alarming) evidence about the scale, scope and magnitude of present and future environmental change needs to be better communicated to non-academics. On the one hand, some suggest that geoscientists have pulled their punches, cowed by politicians and

⁷This is evident, for instance, in the writings of Earth system scientist Timothy Lenton, who has used both ideas to talk about both subjects. See Lenton (2013), among other publications.

⁸This is the proper context in which to understand the real significance of attempts by geologists to ascertain if ‘the Anthropocene’ meets the exacting criteria normally used to define a geological epoch. The Anthropocene is an invention of environmental scientists, especially those involved at the inception of the International Geosphere-Biosphere Program. Yet because of its epochal meaning, geologists have found themselves obliged to consider it seriously – with Leicester University’s Jan Zalasiewicz an enthusiastic bridging character between geology and environmental science. The International Commission on Stratigraphy (ICS) – which is ultimately responsible for identifying geological epochs – has established an Anthropocene Working Group and made Zalasiewicz its chairman. The Commission will report in 2016, if not sooner. If (it seems most unlikely) it recommends adopting the Anthropocene as a formal definition of our epoch, this will be felt most in the wider geosciences rather than geology. After all, it is the ‘concerned synthesists’ like Crutzen and Rockström who will be able to use the imprimatur of the ICS to bolster their arguments for ‘planetary stewardship’.

business interests who want to believe that environmental change is a manageable ‘problem’. Climate science is the model example, with Kevin Anderson and Alice Bows arguing strongly that researchers have a responsibility to communicate their insights “clearly, honestly and without fear” (2012: 640). On the other hand, inspired by such injunctions, other geoscientists are purposely trying to engage directly with decision-makers while thinking hard about how the scientific messages are framed. A case in point is the recent ‘Scientific Consensus Statement on Maintaining Humanity’s Life Support Systems in the 21st Century’ authored by Berkeley’s Anthony Barnosky and fifteen other colleagues (Barnosky *et al.* 2014). Released in May 2013, it was targeted at policy makers – with former California Governor Jerry Brown a willing intermediary to get the Statement taken seriously elsewhere.

Second, many geoscientists now realise that, while further basic research into Earth surface dynamics is vital, it is also insufficient. They argue that it is time that disciplines on the ‘other’ side of campus, be centrally involved. As Walter V. Reid and colleagues put in the pages of *Science*, environmental “[r]esearch dominated by the natural sciences must transition towards research involving the full range of [social] sciences and humanities” (2010: 917). This represents a high-level acknowledgement that what are too bloodlessly called the ‘human dimensions’ of GEC are now as important as the biophysical dimensions. After all, if people are in various ways altering the boundary conditions of their own existence it is essential to change their institutions, relations, values and practices. Such change includes, but goes beyond, the decision-makers whose evident unwillingness to act makes a mockery of even the tamest definitions of ‘sustainable development’. As Hackmann, Moser & St. Clair recently put it in a recent *Nature Climate Change* article, “... people and societies are no longer viewed [by geoscientists] as external to ... the Earth system but as an integral and differentiated part of it – creating the problems and holding the key to their solution” (2014: 645). Since one of the problems is many people’s ignorance of geoscience, social scientists who research how people process information are seen as allies in achieving a new social literacy about GEC (Rapley & De Meyer, 2014).

Third, and finally, many respected geoscientists are calling not only for more interdisciplinary inquiry across the ‘nature-society’ divide, but for ‘actionable knowledge’ as its outcome. For instance, Ruth DeFries and co-authors recently enjoined global change scientists to explore ‘planetary opportunities’ with decision-makers, influential organisations and communities. They “propose ... proactively focussing on solutions that are tractable and specific to particular circumstances” such that a new, more applied global change science can enter into a ‘new social contract’ with the world’s nations (DeFries *et al.* 2012: 604). Similar arguments are made by Margaret Palmer (2012), head of the National Socio-Environmental Synthesis Center in the US.

Taken together, these three developments tell us two important things about contemporary geoscience. First, unlike the era of Commoner and Ehrlich, the scientific concern being expressed about humanity's impact on Earth is collective and widespread. It goes beyond a few prominent individuals like Jim Hansen or the Nobel Prize winner Crutzen. Second, this collective concern is deliberately being directed towards decision-makers and publics who do not necessarily share it in a bid to make them take real notice. More broadly, the recent evidence and concepts broadcast by geoscience are so profound in their implications that they have amplified existing root-and-branch critiques of the present socio-economic order. Think not only of Klein's new book, but also recent titles by Australian philosopher Clive Hamilton (2010) and American environmentalist Bill McKibben (2010).

Against this background, geoscientists and other researchers seeking to address the challenge of GEC are now repurposing and reformatting their inquiries. Most of the existing transnational GEC research programmes – like the International Geosphere-Biosphere Program – are ending after 25-30 years existence.⁹ 'Future Earth' is the new global institutional vehicle for geoscientists and others to have their claims about the planet heard and acted on (see Gaffney, 2014; and <http://www.futureearth.info/>). One of its three organising themes for research and engagement is 'Transformations towards sustainability'. While not exactly the language of revolution Naomi Klein claims to hear in parts of geoscience, it is nonetheless a sign of a more-than-nominal commitment to a change-agenda for society and environment.

Neil Smith on nature and physical science

What would Neil Smith make of these recent developments in international geoscience? Would he share Klein's conviction that many of today's geoscientists are, willingly or not, proto-revolutionaries calling into question the fundamentals of our socio-economic order? In his absence, what resources are offered by his influential published writings about capitalism and nature to help us construct answers to these questions?

These writings began in the late 1970s and ended not long before his life was cut tragically short. When re-reading them in preparation of this essay I was struck by their consistency. As with his doctoral adviser and life-long friend David Harvey, Smith's most formative thinking occurred during his initial encounter with Marxism. Thereafter he both replayed and finessed key ideas without ever abandoning them. For all the differences in style between his first and last writings (spanning 30 years), there is an essential unity between the early *Antipode* paper on nature (with Phil O'Keefe, 1980) and his 2008 Afterword to the third edition of *Uneven Development*, where he discusses GEC and

⁹The IGBP was launched in 1987. It followed the World Climate Research Program, created in 1980. It was followed by the International Human Dimensions Program (1990) and Diversitas (launched in 1991 and focussing on global biodiversity and biogeography).

its management at some length. Since Smith's ideas about nature have been summarised and evaluated at length elsewhere by myself (e.g. Castree, 2015) and others (e.g. Loftus and Ekers, 2013), I will deliberately cut to the chase. It seems to me that he made five essential claims, originating in his earliest publications. These animated his final writings on 'nature', where he began to talk about GEC more than he had previously.¹⁰ Understanding all this allows us to produce a plausible Smithian interpretation of the geoscientific developments recounted in the previous section of this essay. That interpretation will be presented towards the end of this section. But first those five key claims.

Nature, science and ideology

First, Smith argued that in Western capitalist societies what we call 'nature' is routinely understood to be separate from 'society'. They are, he argued, conventionally regarded as ontologically discrete domains that, while they necessarily interact, have distinct properties and affordances. This nature-society dualism, as he saw it, takes two contradictory forms. Nature is seen either as 'external' to society (as in the idea of 'the natural environment') or as a 'universal' (in insofar as humans are evolutionary products and biological entities). The common factor, Smith argued, is the belief that nature entities 'essential' characteristics that are irreducible to any social shaping, be it deliberate or accidental.

Second, while capitalists did not invent the nature-society dualism, Smith maintained that it has long been (and remains) functional for the mode of production whose dynamics govern their activities. In chapter I of *Uneven Development* he talked about 'the ideology of nature'. Ideology is, of course, a core and complex concept in the rich history of Marxist scholarship and socialist politics. Smith said surprisingly little about it in *Uneven Development* or elsewhere. However, it is clear that for him it referred to ideas that enjoyed widespread currency and which fostered a *misrecognition* of people's conditions of existence. By achieving the status of 'common sense', Smith argued that the nature-culture dualism blinded people to the social relationships structuring their collective engagements with their own 'nature' and the non-human world alike. In the case of capitalism, these are contradictory relationships based on social inequality, manufactured scarcity, exorbitant demands on 'natural resources' and endless waste. At worst, the ideology of nature is counter-revolutionary, as David Harvey (1974) famously argued in a seminal critique of neo-Malthusian 'limits to growth' talk in the early 1970s.

Third, Smith wrote on several occasions that the institutions of modern science (and technology) are instrumental in perpetuating the ideology of nature and thus the survival of capitalism. This has two aspects. First, by positing 'nature' as a domain to be variously studied, altered or conserved,

¹⁰Though Neil published a reflection on *Uneven development* in 2011, he barely discussed the question of nature in it (see Smith, 2011), so one needs to look at rather earlier publications for insight.

science has solidified the idea of its ontological separateness from society. Second, Smith also noted how science and technology are directly harnessed by business to make new goods and services as part of capitalism's imperative to 'accumulate for accumulation's sake'. As he and O'Keefe noted back in 1980, science is a commodity used to make other commodities (*op. cit.* 35).

Fourth, in order to oppose science, the ideology of nature and the perpetuation of capitalism Smith argued that we need to embrace alternative ideas and act together on their far-reaching implications. Among these ideas was the 'production of nature' concept, one of his most celebrated intellectual innovations. Presented most fully in chapter 2 of *Uneven Development* (Smith, 1984) he returned to it time-and-again in subsequent years (see Smith, 1996, 1998, 2007a). At base, it is the idea that what we call 'nature' is *internal* to capitalism not a wholly separate domain that serves as resource, waste sink or – in the case of our own bodies – the corporeal 'base' of our economy, society and culture. As he noted back in 1984, in a much quoted passage, this idea is 'jarring' because "it defies the conventional, sacrosanct separation of society and nature, and it does so with abandon and without shame" (Smith, 1984: 7).

Fifth, while the concept of 'production' suggests a certain Promethean tendency in Smith's thinking, his point was not that capitalists – or, in future, socialists – can or should treat nature as a *tabula rasa*. Nor was his intention to deny the 'reality' of the biophysical world that, in his view, capitalism brought into contradictory relations with modern societies. As he made clear in chapter 2 of *Uneven Development* (1984: 79-81) and in other writings, what we call nature is real enough. "If we now live in the midst of 'social nature'", he wrote in 2007, "none of this in any way denies the power or existence of 'natural' processes" (2007a: 8). His key point was that the nature we see, use and (de)value is thoroughly *mediated* by the whole apparatus of capitalist production, science and technology. There is thus – contra the ideology of nature – no 'outside' from which to view the 'inherent qualities' or, as environmentalists would have it, the intrinsic beauty, value or rights of the natural world. He thus enjoined us to fully acknowledge the physical distinctiveness and efficacy of 'nature', while also recognising that it never enables or constrains our lives *sui generis*.

Environmental science and anthropogenic environmental change

With these five claims in mind we are close to being able to 'think with' Neil Smith about geoscience's radical potentials. I say close because we need also to note arguments contained in his final two commentaries on nature, those appearing in *The Socialist Register* (2007a) and the third edition of *Uneven Development* (2008). Both pieces sought to link Smith's earlier ideas to the changing particularities of the historical-geographic conjuncture. They commented on the immediate context out of which recent changes in

geoscience have emerged, and are thus especially relevant to our concerns here.

In 'Nature as an accumulation strategy' Smith trained a critical eye on capitalists' concerted new attempts to internalise the so-called 'externalities' of making, moving, selling and disposing of commodities. He rightly saw this process not so much as a 'greening' of capitalism as a new frontier for its *expansion*. Noting the new financial markets in everything from carbon emissions to weather futures to wetland credits, he argued that "... these commodities are simultaneously excavated (in exchange value terms) from pre-existing socio-natural relations and as part of their production ... reinserted in socialized nature – the more 'natural' the better" (2007a: 2). The production of nature is thus expanded both 'vertically' and 'horizontally'. Yet, Smith argued, the ideology of nature deceives us that this is precisely *not* what is happening. Here he reprised his earlier arguments about natural science:

Nature is [still] broadly conceived as a repository of biological, chemical, physical and other processes that are outside the realm of human causation ... and the repository too of identifiable objects – subatomic and molecular,, specific organisms and species ... and so forth. Modern science serves-up such objects conceptually as discrete targets of instrumental social labour and simultaneously ratifies this purview of an external ... natural world (p. 7)

As an example Smith cited Morgan Robertson's (2000, 2004) studies of how wetland science was adjusting its categories and accounting measures to make them compatible with the commercial demands of trading wetland credits across space and through time. Scientists' "lack of reflexivity", he concluded, "has not only facilitated a massive industrial transformation of nature but fostered a broad-based social blindness about the destructive results of this process" (Smith, 2007a: 9). Wittingly or not, those sciences now involved in harnessing (e.g. plant biotechnology) or protecting (e.g. restoration ecology) non-human nature are thus part of the problem not the solution.

In his 2008 'Afterword', composed just after 'Nature as an accumulation strategy' appeared in print, Smith rehearsed these same arguments. But he also added another memorable concept to our analytical lexicon, that of 'nature washing'. As he vividly expressed it,

... this is the process by which social transformations of nature are well enough acknowledged [by elites], but in which that socially changed nature becomes the new super-determinant of our social fate ... The dichotomy of nature and society is maintained rather than weakened: 'nature washing' accumulates a mountain of social effects into the causal dustbin of nature" (Smith, 2008: 245).

Again, Smith was clear that contemporary science is enrolled in all this, helping to oil the new wheels of 'eco-capitalism'. Here he was particularly critical of the way talk about the 'global environmental crisis' is being used to limit rather than open-up the politics of societal change. A perceived crisis, he argued, can

pressure people to reach for ready-to-hand ‘solutions’ that comport with the present order of things – such a recycling household waste or offsetting plane journeys. Far from challenging ‘neoliberal environmentalism,’ he argued that the environmental sciences (and the wider ecological movement) have been co-opted by it. To the extent that they reify ‘nature’ and talk of things like ‘mass extinction’, the sciences of environment are today a depoliticising force (an argument Erik Swyngedouw (e.g. 2010) has made powerfully in recent years). Accordingly, in his essay on revolution – mentioned in my introduction – Smith makes no mention of science as a possible vector of progressive change.

Smith on Klein and international geoscience: an imagined critique

If my interpretation of Neil Smith on capitalism, nature and science is correct, then it is not at all hard to guess how he might have reacted to Klein’s recent gloss on developments in geoscience. He would probably have acknowledged the radicalism of their evidence and their informed predictions. He might also have admired the courage of individuals like James Hansen and Kevin Anderson in leading by example, thereby helping to galvanise their (initially) more circumspect scientific peers. Finally, I am confident he would have recognised the sincerity of current attempts to alter geoscience in the three ways identified earlier.

However, Klein’s hope that geoscientists can act as fifth columnists would surely, for Smith, be a case of misplaced optimism. If we consider geoscientists’ current determination to communicate their messages better, to collaborate with non-scientists and to produce ‘actionable’ knowledge, Smith’s writings arguably steer us towards the following interpretations. First, the messages – while alarming – serve to hypostatise ‘natural’ phenomena and limit the analytical ‘frame’ so that the complex, unstable unity of our capitalist condition is concealed. Current discussions about using ‘high leverage’ geotechnologies like stratospheric aerosol injection are symptomatic if this, bracketing as they do a new political economy as the best solution to climate warming. Second, the aspirations to interdisciplinarity only favour collaborations between geoscientist and other scholars who share the ‘scientific’ norms of objectivity and rationality (e.g. most environmental economists). Finally, ‘actionable knowledge’ really means knowledge and associated practical measures that focus only on means, not values or goals. Geoscientists thus side-bar questions of social power, social disagreement and social conflict to focus only on what is considered ‘achievable’ in light of perceived opportunities and constraints in society. Above all they ignore science’s direct implication in sustaining the current, unjust and ecologically mindless political economy.

In light of this, would Smith consider Klein’s judgement not only hopeful but positively misguided? As it turns out, I suspect not. More than once he

lamented the complete lack (as he saw it) of an effective Left in *all* walks of contemporary life – academic, political, the third sector, and so on (Smith, 2005; 2007b; 2008 ‘Afterword’). Given this gloomy (or, perhaps, coldly realistic) assessment, I like to think he would have been thankful for any developments that might better allow radical sections of the Left to keep the fires of opposition burning.

Critique, affirmation, history and politics: the academic Left and geoscience

Having used Neil Smith’s ideas to contrive an interpretation of the apparent radicalism abroad in international geoscience, I want now to ‘think against’ him. There’s something at once inspiring and comforting about Smith’s unwavering critique of ideology and reformism and his belief that, as he once memorably put it, “revolution is a future fact” (2007: 193). It guards against ‘cynical reason’, that is “the conviction that fundamental change, however desirable, will not be forthcoming” (Rethmann, 2013: 230). Even so, it comes close to a style of Left analysis whose ills anthropologist James Ferguson once diagnosed in these pages. To quote him at length:

[O]ver the last couple of decades, what we call ‘the Left’ has come to be organized, in large part, around a project of resisting and refusing harmful new developments in the world. This ... has left us with a politics largely defined by negation and disdain. ... But what if politics is really not about expressing indignation or denouncing the powerful? What if it is, instead, about getting what you want? ... This is a quite different question (and a far more difficult question) than: what are we against?

... [T]here’s much to be said [here] for focusing ... on mundane, real world [developments] ..., even if doing so inevitably puts us on the compromised and reformist terrain of the possible, rather than the seductive high ground of revolutionary ideals and utopian desires (Ferguson, 2009: 166-167, 181).

In the present context, and following Ferguson, I want to ask: can the academic Left – that is, people like me and readers of *Antipode* – work with geoscientists towards progressive ends ‘on the compromised and reformist terrain of the possible’? If posing this question appears to put me firmly in Naomi Klein’s camp, then appearances deceive. Klein is, I think, right to look beyond (i.e. not exclusively at) the anti-capitalist movement as a locus of opposition. She’s also right to refrain from the view (still common on the Left) that even the best intentioned scientists are wolves in sheep’s clothing. However, her upbeat reading of geoscience’s ‘new radicals’ actually has something in common with Neil Smith’s understanding of science more generally.

That something is *distance*. Just as Smith looked at science from the outside, as a critic, Klein looks at it from the outside as a writer-activist

searching for allies in the critique of contemporary capitalism. As we will now see, this distance is typical of the latest reactions to geoscience among a broad spectrum of academic Leftists. It thus instantiates the nature-society dualism in academic inquiry Smith was (and others today still rightly are) at pains to challenge. As I will explain, this is problematic: what's needed is active *engagement* across disciplinary lines so that geoscience can be thoroughly 'socialised' in both an analytical and political sense. It might then become *substantively* radical not just *formally* so by bracketing key 'human dimensions'.

A new Earth in the making: reactions to geoscience on the academic Left

Since around 2009, the two new epochal concepts emanating from international geoscience – the Anthropocene and planetary boundaries – have inspired a steady and growing stream of reactions among Leftists ranged across the social sciences and humanities. I cannot itemise them all here. I simply mention an illustrative set of studies in order to comment on wider patterns of thinking.

On the one hand, many have been inspired to 'think big' about the huge implications of taking seriously geoscientists' plenary claims about Earth surface change. These big thoughts are, in the main, radical both analytically and normatively when compared to what passes for mainstream thinking in the world at large. For instance, here is literary critic and philosopher Tim Morton writing in the *Oxford Literary Review*:

What is happening to reality in the Anthropocene is that it is becoming more vivid and unreal. Without a world, without Nature, non-humans crowd into human space, leering like faces in a James Ensor painting or the faces of Butoh dancers ... Without presence, habitual, optically given coordinates of meaningfulness dissolve... (2012: 236).

Cultural critic Paul Alberts (2011) is similarly moved by the Anthropocene concept. He suggests that it reconfigures the idea of human responsibility such that it means being more deeply 'responsive' rather than, as we normally conceive it, 'taking responsibility'. Within Geography, if one looks at recent writings by Nigel Clark (2011) or Kathryn Yusoff (2013), or the 'Forum' on the Anthropocene published in *Progress in Human Geography* (Johnson *et al.*, 2014) one also there sees a similar enthusiasm for breaking new analytical and normative ground.

On the other hand, this enthusiasm is not shared by all on the academic Left. For instance, Andreas Malm and Alf Hornborg note of the idea of the Holocene's eclipse that "regrettably, many a social scientist and humanist has swallowed it lock, stock and barrel, oblivious to its anti-social tendencies, attracted by the idea of the *Anthropos* as centre or master of the universe (be it productive or destructive) ..." (2014: 63). Though they acknowledge the unprecedented magnitude of Earth surface change, Malm and Hornborg point to a potential warping of the analytical imagination by geoscience. Coming at

the issues from a similarly critical but more deep green perspective, STS scholar Eileen Crist (2013) regards geoscience's 'Anthropocene narrative' (as she calls it) as perilously reformist, instantiating a "human supremacy complex" (p. 133) it is ostensibly calling into question. For her we should "blockade the word Anthropocene" (p. 141) because it squeezes-out other conceptions of Earth that better acknowledge the devastation being wrought upon it.

These reactions to geoscience's epochal claims mirror the Klein-Smith contrast I have drawn so far. Yet, despite their differences, they separate Leftists in the social sciences and humanities from the geoscientists they are either inspired by or critical of. This is doubly ironic. On the one hand, the critics agree that geoscience ultimately risks distorting rather than illuminating, societal understandings of Earth present and future. Yet the criticisms are not accompanied by positive ideas about reforming geoscience in ways more radical than those geoscientists are themselves now advocating for. On the other hand, those inspired by geoscience's large claims suggest that the nature-society dualism no longer holds at the planetary scale. This means that the division of intellectual labour between geoscientists, social scientists and humanists can no longer remain in-tact either. Yet, these arguments are not being directly communicated to geoscientists, at least if the favoured publication outlets of the likes of Morton or Alberts are anything to go by. As a result, geoscience's emergent new *modus operandi* (recounted earlier) is not being informed by either the criticisms or positive theses of academic Leftists.

Of course, one might argue that there has not yet been time or opportunity for geoscientists to really hear what 'people like us' have to say about their research. However, I suspect there is something else going on. What are called STEM subjects (science, technology, engineering and medicine) have been phenomenally successful means of discovery and invention. They form a heavily resourced, complex and esoteric world that the vast majority of social scientists and humanists are simply not equipped to understand properly. The very existence of STS as a field arguably evidences this: it now takes a cadre of specially trained, full-time analysts to get to grips with 'science in action'.

Beyond this, I suspect that Leftists outside the STEM subjects have, in recent years, allowed the commercialisation of many areas of science to colour their view of science *tout court*. Private enterprise has heavily conditioned basic research and subsequent inventions in areas ranging from pharmaceuticals to metallurgy to computation to plant science. While this has always been the case, there has undoubtedly been a concerted attempt since the mid-1980s to harness science as a means to make money (Mirowski, 2011). Yet it is important to remember that 'public science' is not dead, and that geoscience possesses 'logics' that are not (yet) subsumed to the dictates of capital accumulation. This is clearly something Klein recognises, even if Neil Smith – in

his final writings – could not see much beyond those dictates. The question then becomes: can geoscience, or least some sections of, have its public functions more deeply radicalised?

Left to its own devices, geoscience will almost inevitably move in lock-step with tame reform efforts by well-meaning or cynical governments. Strong reform is preferable, never mind more profound interventions. The empirical (or formal) radicalism of current geoscience could, I believe, be turned to more richly radical ends. But first Leftists in universities need to believe that they can help effect this turn.

Learning from the past

This might seem ludicrously hopeful, especially to geographers. Over the years we have done a pretty lousy job at articulating physical and human geography so that they are both meaningfully altered by the encounter. As I noted earlier, for all his talk about the ‘unity’ of socio-nature, Smith said precious little of substance about physical geography.¹¹ Nor, more generally, did he consider how critical scholars in the social sciences and humanities might make common cause with practitioners in the STEM world. His 1998 essay ‘Nature at the millennium’ offers a clue as to why. In it he reflected on the ‘science wars’ of the mid-1990s that pitted STEM researchers against scholars like Andrew Ross who were (and remain) interested in the wider societal effects of scientific discourse and technology. Understandably, given the intensity of the conflagration, Smith could see no space for a *rapprochement*. This gave the lie to his otherwise intriguing, closing observation that “we will have to find a way of playing with science and political economy and ... living to tell ... the ... tail” (p. 281).

Yet such ‘play’ may not be out of the question. Two previous periods in modern history show us why. Though hard to believe it could happen these days, the 1930s witnessed leading voices in the scientific community – notably in Britain – take a sharp leftward turn. The decade was, of course, unusually febrile in a political economic sense. It saw younger and established scientists like J.D. Bernal, Lancelot Hogben, Hyman Levy, Joseph Needham, J. B. S. Haldane and P. M. S. Blackett (a future Nobel Laureate) gravitate towards Marxism. These scientist-activists inserted their profession directly into wider movements to supersede, or at least substantially reform, capitalism. This much was explicit in Bernal’s much discussed *The Social Function of Science* (1939). They formed what Gary Werskey (1978) later called a ‘visible college’ that for 20 years tried to connect science to ‘progressive’ politics as it was then defined.

¹¹And nor, despite it being written in the late 1970s, did his Marxist critique of positivism (Smith, 1979) make any real mention of the two ‘radical science movement moments’ I will be summarising in this sub-section of the paper.

In the late 1960s there was a second attempt to reconfigure modern science in more progressive ways, this time centred on the United States and well as Britain. As part of the ‘events’ of 1968, there were protests against the way scaled-up science had been central to America’s post-war ‘military-industrial complex’. The Union of Concerned Scientists (UCS) sprang into life after a rally at MIT in 1969, so too the more left-leaning Science for the People. Reacting to state-led uses of science, the British Society for Social Responsibility in Science (BSSRS) was founded the same year, with Steven and Hilary Rose among its membership. Its magazine was entitled *Science for People*. Both the UCS and BSSRS were less overtly political than the 1930s project to radicalise science, and this led to the Roses (among others) escaping the BSSRS’s embrace. But radical science agitation operated in other arenas in Britain – for example, with the efforts of American émigré Robert Young and others in founding the *Radical Science Journal* (RSJ) in Britain (now *Science as Culture*, published by Routledge). Young helped to pioneer an explicitly Marxist analysis of science as a modern enterprise and a normative account of how it might be decoupled from capitalism (Young, 1977). There were coincident attempts in *RSJ* to interpret science in feminist and anti-racist ways. Meanwhile, *Science for the People* attracted the likes of Anne Fausto-Sterling, Richard Levins and Richard Lewontin.¹²

In the detail two thousand and fifteen is nothing like 1968 or the 1930s, though as profoundly tumultuous in its way. And even if it was similar, one might say that history only offers the Left lessons in failure. For instance, the fact that mainstream STS carries forward virtually none of the radical science arguments or ethos that were alive in the field’s early years tell us much.¹³ More locally, the fact the most physical geography has barely been affected by the long-standing debates about the social role or potential of science also tells us a great deal.¹⁴ Yet, in the world of geoscience at least, there is today a genuine opportunity to do what the likes of Bernal and the Roses sought to do in their time. The difference, now, is that the absence of a strong Left outside the university world places a premium on the Left within academia to make its voice heard on the other side of campus. We academics may all now work in a ‘sausage factory’ (Smith, 2000), but there is nonetheless capacity to make a difference. Criticising or praising geoscience from a distance may be necessary, but it is surely no longer sufficient.

This last claim chimes with recent efforts to rethink the role of social scientists and humanists in relation to the sciences at large. For instance,

¹²All went on to have stellar academic careers without losing their commitment to radicalising science. For an absorbing, albeit rather personal, history of the two ‘radical science movement moments’ see Werskey (2007).

¹³In this sense, the careers of Donna Haraway, Richard Levins, Steven and Hilary Rose, and Richard Lewontin have been relative exceptions. It is also telling that all but Haraway are often not thought to be part of the STS story, even though much of their work shares the central preoccupations of STS practitioners.

¹⁴Recently, this has been subject to challenge: see Tadaki *et al.* (2014).

writing in *Critical Inquiry* Bruno Latour (2004) asks if it's "really possible to transform the critical urge" so as to "add reality to matters of fact and not subtract reality?" (p. 232). Latour is here challenging critics of modern science to go beyond debunking in order to actively contribute something to a new constitution for organised inquiry. To adapt Albert Hirschmann's (1970) well-known typology of responses to matters of shared concern, Latour is urging 'voice' rather than 'exit' while avoiding compliance ('loyalty'). If Leftists inspired by geoscience risk too much loyalty and if its critics risk exit ('geoscience is too compromised to bother engaging with positively'), is there a way of 'adding to' geoscience through a set of closer encounters?

Towards a more radical geoscience

Playing on the title of Naomi Klein's new book, we might say that geoscience's radical implications, alarmingly, 'change virtually *nothing*'. Why have decision-makers and the societies they govern been able to ignore these implications for so many years? How is it possible for two countries deeply implicated in runaway environmental change – namely Australia and Canada – to now be following the sorry example of the United States and kicking GEC into the long grass as a public and policy issue? The reasons are many and varied. But part of the explanation rests with the nature-society, fact-value, is-ought dualisms that continue to structure peoples' perceptions of science and the self-understanding of most of its practitioners. If we can think past these dualisms (something Neil Smith did, in his distinctively Marxist way), we can begin to imagine geoscience as key to a more radical critique of our current social order.

Dualisms real and duplicitous

Consider how business-funded climate change sceptics for years pursued their political arguments by stealth, using the rhetoric of 'sound science' to persuade many decision makers and citizens that ACC is not yet a proven 'fact'. Consider too how many geoscientists believe that the way to address societal ignorance is through better communication of the evidence. The assumption is that more forthright and savvy messaging will torpedo facts and predictions into the worlds of politics and beliefs so that people will simply *have to act*. However, this is as naïve as the tactics of climate change sceptics are cynical. Among other things, it pretends that geoscience is value-free, a mouthpiece for an otherwise mute (fast disappearing) nature. Not only does this invite critics to dwell never-endingly on the epistemological uncertainties written-into the analysis of complex biophysical systems. It also decontextualizes science as if its moorings in state, commerce and society are somehow contingent and anterior.

This is dishonest, and perpetuates the unhelpful myth that nature's 'truths' come to society from the outside via science. As numerous critical STS

scholars have shown, biophysical science always already contains contestable value judgements about what in the world is worth knowing about (and how).¹⁵ These judgements, once committed to, entrain resources and close-off other potential lines of inquiry. In turn, science's representations and inventions are political even before entering the realms of policy making, commerce or the public domain. For instance as Brian Wynne (2014) notes, biotechnologists who frame GMOs in terms of 'risk' to human health and terrestrial ecology are attempting "hermeneutic imperialism" (p. 62). By this he means the high public authority of science is used to foreclose on what GMOs might mean outside science. Such foreclosure was graphically evident in a recent apologia for science by leading French biologist Marcel Kuntz (2012) in the prestigious journal *EMBO Reports*. At one point, he implies that opponents of GMOs are 'irrational' and declares them 'anti-science' because they ignore the evidence. So it is that he conflates a legitimate defence of science's methods with an implausible defence of its right to thereby author meanings in the wider society.

In this light, the limitations of some geoscientists' recent calls-to-arms are plain enough to see. They simply reinscribe existing dualisms in the guise of arguing for a new dispensation for geoscience such that it can better serve society in the face of momentous GEC. For instance, some geoscientists' calls for interdisciplinary inquiry with social scientists presumes 'society' to be a domain every bit as amenable to objective inquiry as ocean currents or forest regeneration. The idea seems to be that once people's habits, preferences, beliefs and resources are properly accounted for empirically, geoscientists will better know how to deliver 'actionable' evidence and feasible technical interventions. This is well evidenced in a recent *Nature* article, where Paul Palmer and Matthew Smith (2014) propose to "collect behavioural statistics on a grand scale" (p. 366) so as to represent humans *within* (i.e. as a component of) future Earth system models. This will, they argue, allow politicians and planners to better track the success/failure of various adaptation measures to ACC.

The arguments of Palmer and Smith bespeak a worldview in need of challenge and reformation. They extend ontological assumptions about 'the natural' and apply them to 'the social'. In employing the metaphor of 'system' they frame the resulting knowledge for managerial use towards ends such as economic efficiency and social stability. They thereby instantiate certain beliefs and leave little or no space for key aspects of the social to be explicitly addressed – things such as power, value conflicts, emotion and affect, aspirations for new ways of living, and so on. These are taken, implicitly, to be *outside* geoscience (and thus someone else's business). These things are, of course, precisely what preoccupy Leftists (and others) interested in

¹⁵For a recent example see Uhrqvist & Oels (2014) on Earth system research.

environmental issues across the full spectrum of social sciences and humanities (especially once one looks beyond business studies, economics and political science). As Sheila Jasanoff (2012) has persuasively argued, science and any prevailing social order are ‘co-produced’. This being so, what sort of social orders might eventuate if a new sort of geoscience gained some traction?

Alternatives

It seems to me that the Left of environmental social science and the environmental humanities possess a repertoire of extraordinary insights and arguments that stand to change the way many geoscientists might think about their claims and aims. The practical question is: how might that repertoire be broadcast to geoscientists, especially when many have a stunted sense of what non-positivist non-scientists do? The intellectual question is: what sort of ‘interdisciplinary’ inquiry might follow and what ends would it aim to serve?

In a practical sense, many and varied efforts would be required to help geoscientists better approach what Heide Hackmann *et al.* (2014: 653) call “the social heart of global environmental change”. These would have to range from the mundane (e.g. new joint seminar series) to the grand (e.g. lobbying the heads of the major geoscientific societies worldwide). They would span local, on-campus actions to global, off-campus interventions (such as expanding the United Nations’ and World Bank’s senses of what ‘environmental expertise’ looks like). It would be pointless to speculate on whether such efforts will be forthcoming next year or in ten. All one can say is that such efforts would be extremely timely, given (i) the appetite for change evident in the top levels of international geoscience and (ii) the current unwillingness of political economic elites to seriously entertain the idea of a ‘green new deal’, never mind anything more far-reaching.

In an intellectual sense, it is essential that conventional – that is to say dominant – understandings of interdisciplinary investigation be challenged. Metaphorically, such understandings see the world as a gigantic jigsaw. Disciplines are seen as focussing on separate pieces such that combining their expertise will paint a more complete, accurate picture of the real. “The presumption”, writes Jasanoff (2012: 16), is “that there are stable, self-contained [analytical] ... packages that can be moved without difficulty across branches of scholarship”. Consequently, it is not enough for geoscientists to be persuaded that we can no longer “keep perceiving problems that are caused by humans, that inflict harm on humans (and the life support systems on which they depend) and that can only be [addressed] ... by humans in terms of their biophysical nature, as a matter of molecules, shifts in atmospheric dynamics or ecosystems interactions ...” (*ibid.* 65). That is also needed is a new hegemony of currently subordinate conceptions of research between the disciplines, and especially across the ‘three cultures’ divide separating natural science, social science and the humanities. In the present case, such conceptions can take

geoscientists away from an ontological holism and monism that imagines ‘one world’ waiting to be revealed through suitably wide-angle analytical lenses (see Sarewitz, 2010).

Once we examine the ‘social heart’ of GEC carefully it becomes clear that there is not one world but many actual and possible ones. ‘The Anthropocene’ is not a universal condition for the human actors involved, and nor are things like ‘planetary boundaries’ and ‘biophysical thresholds’ registered the same the world over. We live in a world of worlds defined by pervasive political economic structures, varied cultural conventions, plural histories, myriad inequalities and diverse biophysical life conditions. Relatedly, the futures that people aspire to vary greatly, especially when they are offered the chance to think well beyond the given and the known. Only certain of these futures can come into existence, locally and globally, given suitable commitment, resources and struggle. What is important is that they first have a chance to be considered by those for whom they are novel or even unsettling.

In this light, we begin to see that the particular phenomena, ‘problems’ and ‘solutions’ different geoscientists address should and could emerge relative to different social framings of our present and future world. This relativity is currently implicit, as Jasanoff, Wynne and others have shown. It needs now to be made explicit. The sort of evidence geoscientists assemble, the predictions they make and the ‘actionable ideas’ they now want to generate cannot emerge through value-free observations of a socially changed nature or an environmentally impacted society. Instead, they must make overt reference to varied worldviews, ideologies, faiths and political programs that currently enjoy unequal visibility in any society, and on the world stage.¹⁶ Only in those contexts can geoscience’s contribution to avoiding a planetary ‘crisis’ make social sense. Geoscience can thereby play a central role in ‘opening-up’, rather than ‘closing down’, substantive discussions about feasible and desirable socio-environmental futures (Stirling, 2008). But it would be a geoscience proceeding in lock-step with diverse voices from social science and the humanities, themselves articulating arguments and ideals variously subordinate or more dominant in society at large. This will involve a ‘deep and plural inter-disciplinarity’ wherein science’s predominantly cognitive concerns (evidence, reason, truth, practical efficacy) are married in varied ways to the political, moral, affective and aesthetic concerns of ‘non-scientific’ disciplines.¹⁷ Overly tidy, and misleading, distinctions between facts and values or realities and

¹⁶As Roger Pielke (2007) rightly argued, only in what he called ‘tornado politics’ situations where social actors agree on the ‘problem’ they face and the necessity of a common response can science trump differences of norms, values, goals etc. in a society.

¹⁷There are hints of this in some parts of the recent *World Social Science Report: Changing Global Environments* (ISSC and UNESCO, 2013). Though hardly a radical document in one respect, in places it does challenge the geoscience community to deep and broaden its conceptions of how its work might address ‘human dimensions’.

aspirations are relinquished.¹⁸ Immersion in what Marx famously called the ‘struggles and wishes of the age’ would be a key part of the academic agenda.

Objections

These proposals are, of course, likely to be seen as either too radical or too tame by some. In the first case, I suspect most geoscientists would worry about the apparent relativism/anti-realism being advocated here. One can almost hear Marcel Kuntz (2012) complaining over my shoulder that yet another one of ‘those’ academics is trying to make ‘his’ and colleagues’ science a play-thing of people’s values, beliefs and ‘biases’. But this is, of course, a misconceived response. What has made science in all its forms so effective in modern life is that its insights and applications *work*. Yet they do not simply work ‘in themselves’ but only when the social contexts into which they are inserted are hospitable ones (ethically, institutionally, economically etc.). Given the profound questions GEC raises about people’s rights, ir/responsibilities, duties, and so on, the virtues of science need to be retained but operationalised in (or towards) varied actual and possible forms of human life. This will, clearly, make geoscience more expressly political and normative than heretofore. However, recognising that it has *already* become politicised – especially climate change research – it is not just the likes of Kevin Anderson who acknowledge the folly of trying to deny geoscience’s immersion in the social. As long as a decade ago, respected commentator on environmental science not known for being outspoken (Tim O’Riordan) identified the need for “interlocking scientific analysis to political and social contexts so that a more politicized science emerges. The notion of ‘politicization’ should be regarded as positive, not frightening or threatening” (2004: 239). Sadly, the brilliant efforts of the likes of Donna Haraway and Evelyn Fox Keller offer a sobering lesson here. Their illumination of how gender relations structure biological science have, it seems, done little to alter the working practices of biologists.

In the second case, radical social scientists (like Neil Smith) and far Left humanists might detect a none-too-radical pluralism in my arguments for a new kind of geoscience.¹⁹ Why not, say, a Marxist geoscience or a geoscience respectfully hooked-into indigenous peoples’ life-ways after centuries of murderous engagement with oppressive settlers? Why settle for anything less

¹⁸In making these arguments about ‘alternative interdisciplinarity’ I’m inspired by the arguments of Des Fitzgerald and Felicity Callard (2014) about neuroscience and Bron Szerszynski & Maialen Galarraga (2013) about geoengineering. Andrew Barry and Georgina Born’s (2013) edited book *Interdisciplinarity* offers rich food for thought about thinking beyond the ‘additive’ conception of the ‘inter’ commonly believed to define interdisciplinarity as such.

¹⁹Here I can come clean and declare that I find Steve Fuller’s (2000) republican conception of science in democracy persuasive, though acknowledge that in practice its commitment to plurality and agonism will always be enormously stymied by prevailing social inequalities of class, gender and so on. Even so, it is hugely preferable to a liberal conception which pretends those inequalities are mere accidents or inevitable results of individuals ‘finding their level’.

unlikely and yet necessary? Here it's important to respect the differences between our own time and the two periods when radical science movements sprung forth (ultimately to little effect). My own reading of the words of today's leading geoscientists – in places like *Nature*, *Science*, *PNAS* and elsewhere – suggests that the 'politicisation' of their work will only occur if it is initially cautious and catholic. It could only happen in the names of 'democracy' and 'the public interest'; anything more partisan and narrow would surely see them retreat behind the shield of value-free science that remains such a barrier to progressive change.

Beyond this, decision-makers and societies will find it extremely difficult to embrace the idea of geoscience (or any science) as an explicit mechanism of politics, government and change. They would certainly recoil at the idea that it be harnessed largely to 'extreme' agendas. However, in many countries there is, at least, an awareness that science at large needs to serve its host societies in distinctly new and better ways (European Science Foundation, 2013; Owen *et al.*, 2012). In this context, it seems to me that environmental analysts on the Left of a field like human geography can work towards changing the intellectual climate by supporting a broad-based project to politicise geoscience in a reasoned and passionate way. In our own discipline, it would involve rethinking the underlying assumptions governing previous attempts to stage 'conversations across the divide' between human and physical geography. Some recent manifestos for a 'critical physical geography' usefully point us in this direction (e.g. Tadaki *et al.*, 2014).

Conclusions

Neil Smith, appalled throughout his life at the misery and destruction wrought by the prevailing political economy, wrote in his final years about what seemed (still seems) a most unlikely event: the revolution against capital. Smith was arguably a true realist rather than a utopian. As Terry Eagleton once memorably noted, "It is the hard-nosed pragmatists who behave as though the World Bank and cafe latte will be with us for the next two millennia who are the real dreamers ..." (2005: np). Revolution is both the belief in something better and the application of the emergency brake. It may turn out to be a very long revolution, even if momentous biophysical events create social turbulence sooner rather than later. In the meantime, it's well worth heeding the advice of Rebecca Solnit. In *Hope In The Dark*, she wrote that "It's always too soon to go home. And it's always too soon to calculate effect" (2004: 3). We might hope that a concerted attempt to infuse geoscience's formal radicalism with something more substantive can, in time, challenge a capitalist system it will otherwise leave in-tact. Neil Smith might have regarded that as naively hopeful, even foolhardy, were he here. However, as with his organisational efforts to make critical geography international, maybe – just maybe – he'd have fancied

the challenge, rolled-up his sleeves and got stuck in. If so, others would surely have followed. In his absence let's get stuck in anyway.

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