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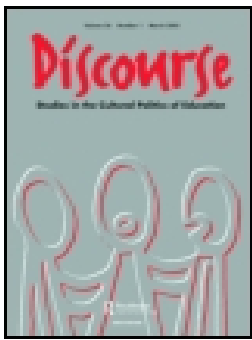
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Children and young people as geological agents? Time, scale and multispecies vulnerabilities in the new epoch

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ABSTRACT

In this paper we frame children as geological agents, very much part of epoch and biospherical processes, enfolded in Earth system changes. We draw on the experiences of Indian childhoods in a context where the land, water, animals, children's bodies and forests are being shaped by a politics of corporate city building. We analyse how children and young people contribute to Earth system changes and consider the everyday, multispecies consequences of living with anthropogenic urbanism. The paper shows how children's bodies are entangled with human and non-human forces; they are geological agents which challenge, negotiate and have cyclical and rhythmic relationships with land and resources. We argue that time, scale and multispecies vulnerabilities are important reference points in our thinking through anthropogenic processes and thus contribute to a more nuanced understanding of the place of children and young people in the new epoch.

KEYWORDS

Children; young people; geological agent; multispecies; anthropogenic urbanism

Introduction

It is in the context of neoliberal Indian urban transformation that we uncover children and young people's everyday encounters with earthly changes. In the Indian state of Maharashtra, a large scale urban development is currently under construction (in 2019). The new development is set within the Sahyadri mountain range, a greenfield site in the lush environment of the Western Ghats. The building of Lavasa is symptomatic of the neoliberal urban agenda being pursued in the name of 'smart', 'technical' and often privatised endeavours to urban change. At the time of fieldwork (in 2015) this was a new urban development under construction. Dasve, the first town, was near completion (with housing, public spaces, shops, schools, higher education, hotels and tourist attractions) and the second town, Mugaon, was in the early planning and construction phase (for further insight into the case study development, see Hadfield-Hill & Zara, 2017, 2018a). This space exemplifies anthropogenic urbanism with blasting of mountains, clearance of trees and vegetation and the construction of large-scale transport and built environment infrastructures. Humans have, in a relatively short time scale, made their mark on this environment. It is this context of 'fast' anthropogenic development that we uncover

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children and young people's experiences of such significant human-induced change. Dalby (2017) argues that closer attention is needed on the corporations that are shaping Earth system geologies and shifts in land formations. Our research focuses on Indian childhoods in a context where the land, water, animals, children's bodies and forests are being shaped by a politics of corporate city building.

The Anthropocene is on the agenda, with mounting evidence that the world is now in the latest, human-induced, geological epoch (*Nature Geoscience*, 2015). It is now widely acknowledged that biophysical assets of the Earth's system have transformed as a result of the 'folding in' of destructive human activities, including overconsumption, the dependence on fossil fuels, and the pouring in (literally) of man-made infrastructures, objects and materials to shape human life and experience (Castree, 2017; Taylor & Pacini-Ketchabaw, 2015). Scientists and social scientists across the spectrum argue that this 'new epoch' or Anthropocene, raises important questions about what it means to be human (Johnson & Morehouse, 2014), indeed, the nature of nature (Taylor, 2011, 2013).

It is in this context that we use evidence from our research with children and young people living in a site of urban transformation in India, to contribute to this scholarly discussion. In doing this, we frame children and young people as geological agents (Bauer & Ellis, 2018). Not only do Bauer and Ellis acknowledge the co-agency of humans with other non-human agents in affecting geologic processes, they go beyond this by questioning the confining of human geological agency solely to the Anthropocene. They argue that the *anthropos* – along with other species – has never been external to earthly formation and transformation in any geological epochs. They urge scholars to question the 'Anthropocene divide' and to historicise geological agency by

... provid[ing] theory, critique, and empirical accounts of the historical entanglements of social relationships, cultural practices, and material conditions that recursively shape socio-environmental outcomes embedded within the Earth system. (Bauer & Ellis, 2018, p. 215)

With this in mind, we theorise the folding in of children and young people's bodies into Earth system changes. Here we use Castree's (2017) language of *folding in* to acknowledge the capacity of humans to 'alter biophysical' ... 'boundary conditions' across 'multiple large-scale environmental systems' (n.p.). In doing this, we acknowledge that the theorising of agency is gaining new momentum within critical social science debates on the Anthropocene and thus contribute to discussions of geological agency through a lens on children and young people's participation in anthropogenic change. Through extensive, in-depth, ethnographic research, we show that children and young people's bodies are in many ways involved in biospherical processes – their everyday routines, knowledges, relationships and habits are wrapped up in escalating environmental destructions. In line with the underlying concept of geological agency that views the assembled interactions of *geo* and *bio* as 'crucial to modes of subjectification in the Anthropocene' (Yusoff, 2013, p. 780), we refer to the 'biospherical' as the interconnected entirety of ecosystems through which Earth's life is generated. In this sense, the geological is intended as a component of biospherical, which is used to show the wider scope of human impact on different spheres, from the geosphere, to the hydrosphere and the atmosphere. In this context a more nuanced discussion of the relationship between children and young people and anthropogenic change is needed. Through the following analysis we argue that they are witnessing, coping with, and indeed contributing to epoch changes,

growing-up and going-on (Horton & Kraftl, 2006) as geological agents. Our analysis uses time, scale and multispecies vulnerability as anchor points in theorising children and young people as geological agents.

The arguments that we make in this paper push thinking in three new ways. First, we challenge and extend much of the existing literature and public discourse which positions children and young people as predominantly victims of Earth system change, notably in relation to climate (from 'worrying about' to 'experiencing' extreme weather events) (Bartlett, 2008; Ojala, 2012a, 2012b). Second, we find that in many of the *sustainability* debates, young people are positioned as protagonists of the Anthropocene, leading the charge as *agents of change* in their homes, neighbourhoods and schools (Haynes & Tanner, 2013) – here we extend and complicate this perspective by suggesting that in some ways young people themselves are complicit in Earth system changes. Third, our positioning of children and young people as geological agents contributes to the growing literature about children's everyday, material connections with naturecultures (Taylor & Pacini-Ketchabaw, 2015).

We draw on post-human and new materialism perspectives in arguing that children and young people (at least in the context of our research) were geological agents. We further contribute to the undoing of the binary constructions of agentic and non-agentic subjects by repositioning agency within assemblages of, and interactions among, human-material-multispecies actants (see also Hadfield-Hill & Zara, 2018b). We argue that young people themselves are only geological agents in the context of a much wider assemblage of actants and forces. Our research is situated in a site of urban transformation where change is both bio and geo (Nxumalo, 2017; Povinelli, Coleman, & Yusoff, 2017). In positioning children and young people as geological agents we contribute to a broader agenda of *geotheorising* (Nxumalo, 2017) which 'rethink[s] children's multispecies pedagogical relationships in ways that pay close attention to the real situated common worlds that children co-inhabit with human and more-than-human others' (p. 560). A common world perspective (Pacini-Ketchabaw & Kummen, 2016) encourages us to be attentive to the non-human 'forms, forces and entities' (Pacini-Ketchabaw & Kummen, 2016, p. 432) which shape the multi-temporal, multi-scalar goings-on of the Anthropocene. Children and young people thus become part of the narrative of the geostories (Latour, 2013). It is through framing children as 'geological agents' that we extend new materialism and post-human approaches, challenging 'the maintenance of a difference between life/being (*bios*) and nonlife (*geos*)' (Povinelli et al., 2017, p. 171, emphasis in original), and repositioning children and young people within 'this traffic between *bios* and *geos*' (p. 172).

We begin with a review of literature on the Anthropocene. If we are positioning children as geological agents, then we must draw on a range of perspectives in understanding how scientists and social scientists are thinking through anthropogenic change. In doing this, we review literature which addresses young people and Earth system changes in providing a framing for our research and critical addressing of the place of the child in anthropogenic processes. This is followed with a section which thinks through the potential of children as geological agents with reference to time, scale and multispecies vulnerability, important points of theoretical nuance. A brief overview of the methodology is given before moving on to the analysis. Here we address two aspects: first, young people's experiences of growing-up, going-on and contributing to

Earth system changes; and second, the everyday, multispecies consequences of living with anthropogenic change.

Thinking through geological agency: children and young people as geological agents?

In the following section we draw on cross-disciplinary perspectives (i.e. Children's Geographies, Anthropology, Earth Science) on the Anthropocene to provide the conceptual grounding for this paper. First, a note on what we mean by the Anthropocene, here Lovbrand et al. (2015) explain that it has

become a powerful narrative of human resource exploitation, planetary thresholds and environmental urgency ... [where the] ... Cartesian dualism between nature and society is broken down resulting in a deep intertwining of the fates of nature and humankind. (p. 211)

Coined by Crutzen (2002) at the beginning of the millennium, the Anthropocene signifies a geological shift, a shift in human-induced, Earth system change (Crutzen, 2002; Veland & Lynch, 2016). Himself an earth system scientist and Stoermer, an atmospheric chemist, popularised the term and scientifically linked the human impacts on the planet with environmental destruction (Ellis & Ramankutty, 2008), ranging from 'acidification of oceans, the depletion of the ozone layer, fundamental changes to the Earth's carbon, phosphorous and nitrogen cycles, climate change, and the rapid loss of biodiversity' (Taylor & Pacini-Ketchabaw, 2015, p. 4). In quantifying this human-induced impact, Ellis and Ramankutty (2008) use population density to show the coverage of anthropogenic biomes, ranging in severity, from hunter-gatherers to large-scale man-made infrastructures. They argue that this approach of mapping anthropogenic biomes 'clearly show[s] the inextricable intermingling of human and natural systems almost everywhere on Earth's terrestrial surface' (p. 445). For the purpose of this paper, it is in the context of urban transformation and the building of large-scale infrastructures that we are interested in anthropogenic change.

In conceptualising the Anthropocene, Yusoff and Clark (2017, n.p.) argue that we need to 'think with and through the Earth'. By this they mean that we should acknowledge the importance of *geosocial formations*, that is 'thinking the becomings of earth and society together' (p. 6), thus acknowledging the entangled physical and social processes that shape spatio-temporal transformations of the Earth. In reflecting on the concept of geontopower Povinelli et al. (2017) argue that

... if human existence is currently impinging upon earth systems and strata, this agency must itself be seen as an expression of planetary properties, processes, potentialities ... [which] ... has implications both for the beings we might yet become and for what might become of the earth itself. (p. 17)

In essence, geontological power is 'the maintenance of a difference between life/being (bios) and nonlife (geos)' (Povinelli et al., 2017, p. 171). Povinelli argues that power is exercised in restricting existence to the ontologies of the *bios*, that is 'to the sequential problems of birth, growth, reproduction and death' (p. 171), which is contrasted with the inanimate *geos*. In so doing, Povinelli problematises what counts as life and, by the same token, what counts as nonlife, questioning the governance of life which is based upon the confining of existence exclusively to the bios.

On the one hand, critical inquiry of the Anthropocene prompts us to look away from the human to acknowledge the agency of things and other species. On the other, importantly, it calls for a radical rethinking of what the human is in the first place, encouraging more critical, relational understanding of what it means to be human (Taylor & Pacini-Ketchabaw, 2015). In a sense, the human remains a point of departure, especially given the scientific interest around detrimental 'human activity' (*Nature Geoscience*, 2015, p. 81). However, in line with scholarly exhortations to expand understanding of the human in relation to Earth system changes, it is crucial to unpack such human activity and ask 'who' these humans are in the first place and who is counted as 'human' in discourses of human geological alteration. For us, as childhood scholars, children and young people are vital members of the Earth community. Thus, it is important to more fully understand the place of children in the discussion of the Anthropocene.

In this paper, we position children and young people as geological agents in three senses: first, that they are forces capable of geomorphic changes; second, that they are themselves 'inextricably materially and discursively co-constituted within fossil-fueled genealogies' (Nxumalo, 2017, p. 559); and third, that they are to be understood as geological subjects 'not only capable of geomorphic acts, but as beings who have something in common with the geologic forces that are mobilised and incorporated' (Yusoff, 2013, p. 718). Referring back to Povinelli's theorisation of geontology, which extends life and vitality beyond the biological into the geological, we claim that children and young people are folded in to 'new modes of geologic subjectification' (Yusoff, 2013, p. 781) which reconfigure the human as a 'past-present' (Nxumalo, 2017, p. 560), transient and unbounded 'mode of existence' of the Earth. Conceptualising children as geological agents works to unsettle the dualistic bio-/geo- ontologies (Povinelli et al., 2017) by re-theorising children as constituted through processes of geosocial formation (Clark & Yusoff, 2017) that weave together the domains of life/nonlife. Children's lives are entwined and enfolded in mineralogical processes (such as mud and land erosion), geologic changes of the Earth (Yusoff, 2013). Thus we are sympathetic to a lens on the 'geological turn that takes seriously not just our biological (or biopolitical) life, but our geological (or geopolitical) life, as crucial to modes of subjectification in the Anthropocene' (Yusoff, 2013, p. 780). We are open to the multiple interactions, overlaps, encounters and goings-on with non-human agents to move towards a more nuanced understanding of how children's bodies are wrapped up in Earth system changes.

It is important to review existing literature which addresses children and young people's interactions and perceptions of Earth system processes. This body of research is scant, however, we can draw on three separate, but relevant strands of social science research to extend knowledge of children's bodies, lives, relationships and mobilities being folded in to Earth system processes. First, we acknowledge the body of literature which addresses children and young people's experiences of, and responses to, climate change. We find that much of this research presents young people as victims of Earth processes and focuses on the coping strategies which young people put in place (Bartlett, 2008; Ojala, 2012b). In response to this, there is a plethora of literature that argues for young people's agency in being protagonists of climate change resilience (Haynes & Tanner, 2013; Tanner, 2010), exploring the role of hope in relation to pro-environmental behaviours (Ojala, 2012a) and the place of environmental education in facilitating this agenda (Cutter-Mackenzie & Rousell, 2018). However, we find that much of the research

on young people and climate change is too abstract from their everyday lives, we need to get much closer to understanding their lived experiences of weather, soils and the materiality of Earth systems. Rooney's (2019) recent work on children's weathering encounters is a step forward in this regard, exploring children's entanglement with the weather, as is Merewether's (2019) piece on 'murmurative diffractions'. Our research also revealed interesting insights into young people's emotional and embodied experiences of rhythms, depths, capacities and flows of water in the context of living with the monsoon in India (Hadfield-Hill and Zara, *In Press*).

The second reference point is the literature which addresses children and young people's experiences of, and relationships with, earthly processes and materials. In working with undergraduate students, Roemmele (2017) sought to 'unearth geological blindness' in their perceptions and experiences of geological landforms and processes. Here geological blindness is framed as (i) a lack of knowledge of rocks and geological structures; (ii) lack of awareness of the importance of geology for human life; and (iii) unawareness of Earth system cycles (to name a few examples). Other work has sought to get closer to young people's everyday, explicit experiences of geological processes and forms. Clary and Wandersee (2006) developed a writing template to 'encourage secondary and post-secondary students to reflect upon their previous interactions with the Earth' (p. 52). The questions they use to prompt students to uncover their geological attachments to place are particularly insightful, asking young people to reflect on play, form, touch, and sound. The authors argue that this process was an effective way of probing students' prior relationships with the land. They report that the approach enabled young people to 'reconnect to their experiences with the Earth in their youth ... [and] reactivate past emotions associated with geological processes' (p. 57). In the context of an early years, educational setting, we are particularly drawn to the work of Nxumalo (2017) who geotheorises children's relations with a mountain, a geological body which children frequently visit and interact with. This paper argues that the mountain is very much folded in to the children's learning and provides critical moments of pedagogical reflection:

...as children learn with rocks and rock-moss entanglements and affectivities, tensions emerge amongst educators in relation to whether children should be provided with information that conflicts with their theories that rocks are alive. (p. 562)

The third influence we take from the literature is the mounting body of work which acknowledges the multispecies world which children inhabit and the everyday interconnections and influences. In this vein, Taylor and Pacini-Ketchabaw (2015) are committed to uncovering the entanglement of children's everyday lives with other species, arguing that 'we do not just belong to our own human-kind, but that we are members of interconnected and interdependent multispecies common worlds' (p. 7). We do not have the space to review this approach and literature in depth (see Taylor & Pacini-Ketchabaw, 2015); however, if we are going to propose children and young people as geological agents, it is the relationality of the common world perspective which is important. Theoretically then, we are driven by an approach which draws on new materialisms and post-human entanglements with anthropogenic processes. We are inspired by the work of Bennett (2010) in uncovering vital matters, Haraway's (2008) theorising of the human in the wider context of a multispecies world, and Taylor and Pacini-Ketchabaw (2015) through their focus on children's multispecies relations. In combination then, this work prompts

us to see children and young people as part of the geologic assemblage, where agency is distributed across the bios and geos (Nxumalo, 2017; Pacini-Ketchabaw & Kummen, 2016). We see children and young people as constituted through, and of, diverse elements and modes of existence of the Earth, from air, to water, to plants, animals, rocks, concrete and land. We build on this aforementioned research to get closer to children and young people's everyday experiences of earthly changes, proposing that young people themselves are active geological agents in the Anthropocene era.

New theoretical directions – time, scale and multispecies vulnerabilities

Through our analysis, we argue that time, scale and multispecies vulnerabilities are important reference points for thinking through the co-participation of children and young people as geological agents in earthly processes. The Anthropocene prompts us to engage with diverse temporalities as deep time is entwined with everyday life. As Clark and Yusoff (2017) argue, 'the recent scientific discovery that the climate and other Earth systems have inherent capacities for rapid, irreversible change' (p. 9) has altered our (as humans) perception of the duration of the speed and scale of transformation. In essence, this has posed serious questions as to the capacity of the much more short-lived time span of the *anthropos* to affect and be affected by the *longue durée* of earthly processes. Increasingly, scholars have begun to resonate with a much more dynamic Earth whose temporalities and rhythms interact with 'the eventful "microhistory" of everyday life' (Braudel, 1980, p. 74, quoted in Clark & Yusoff, 2017, p. 12). In acknowledging these microhistories, Clark and Yusoff (2017) argue that 'the emerging geoscience post-gradualism of the last half century has brought the temporalities, intensities and magnitudes of geologic processes into the patterns and durations of everyday human life' (p. 11). In this sense then, thinking of children and young people as geological agents means to acknowledge that, just as (and with) any other companion species, they are part of the ongoing production of the Anthropocene. They are participants in the goings-on of everyday life, they partake in the process of producing anthropogenic environmental change while simultaneously experiencing the effects of these changes on their own lives. It is important to stress the significance of *everydayness* as it mitigates against exteriorising the Anthropocene as 'the big planetary event' as if it was detached from the micro spatio-temporalities of human and non-human life.

The Anthropocene also provokes an attunement to the diverse temporalities of our common world companions, engaging with the time and rhythms of minerals, fossils, tigers cows, plants trees and water (as we will show in our analysis). Pacini-Ketchabaw and Kummen (2016) encourage us to step away from privileging 'clock time' and be open to the 'entanglement of children's life worlds with mycological time, forest time, termite time, metallic time, moss time and crow time' (p. 433). An attention to scale is also necessary in our theorisation of children as geological agents. As Grosz (in Grosz, Yusoff, & Clark, 2017) argues, 'the geological is always moving, always transforming, even if it is not always impacted by catastrophic events, it is continuously marked by the events that occur below and near the surface of the earth' (p. 133). We should not position children and young people as geological agents without a consideration of the multiscale of geological processes. In thinking through scale, Palsson and Swanson (2016) encourage us to think about *geosocialities* and the 'co-minglings of the geological and

the biologic and the sensibilities involved' (p. 150). This work draws on a visual experiment by Ben Hayoun to domesticate Earth system processes, in essence to 'explore the volcanoes in our living rooms, the geologies that are part and parcel of our daily lives' (p. 150). It is thinking through geosocialities that gives an attention to scale, recognising the 'intertwining of bodies and biographies with earth systems and deep time histories' (p. 155). In our research then we consider the place of scale in thinking through the ways in which children and young people's bodies are folded in to earthly changes. Finally, we argue that an attention to multispecies vulnerability (Taylor & Pacini-Ketchabaw, 2015) is necessary. By this we mean the multiple ways in which destructive anthropogenic actions impact on diverse geos and bios. In spaces of large-scale infrastructure change, it is the children, the wild animals and indeed the mountain itself which are vulnerable bodies; a common world perspective sheds light on these interconnected vulnerabilities, living with and alongside each other.

Methodology: children and young people's everyday experiences of neoliberal city building

The research context for this paper is Lavasa, a space of urban transformation in India, located in the state of Maharashtra (approximately 130 miles from Mumbai and 40 miles from Pune); a site of four towns (to house up to 300,000 people) being developed in the Sahyadri mountain range. The region receives heavy rainfall during the monsoon, alternated with long dry spells, making it a region rich in water, with significant seasonal flow variations, populated by a varied flora and fauna. At the time of the fieldwork in 2015, town one, Dasve was near completion and the other three towns were in various stages of building and planning.

We draw on data from 170 interviews with children, young people and their families living, learning, working, and playing in Lavasa. As researchers, we lived in the case study site for an eleven-month period in 2015, getting to know our participants and experiencing, first hand, life in a space of urban change. A primary aim was to uncover a diversity of children and young people's everyday experiences, thus 40 core families participated from diverse social and economic backgrounds. It is important to note that in this paper we present children and young people's experiences as a collective, rather than uncover differences in their experiences of anthropogenic change (we attend to this elsewhere). The data presented in this paper is representative of the diversity of young people that took part in the research. Many of the participants had previously lived on the land; others were from the families of migrant workers who were contracted to work on the build; some were students who had moved to pursue higher education, others were young workers supporting the tourism industry, from hotel staff to restaurateurs and shop keepers. Empirical evidence draws primarily on young people's narratives; however, in places we also draw on parents' accounts, particularly those who lived on the land prior to the development. This was done to convey a sense in which young people were folded in to the extended temporalities of their families' stories, with parents having witnessed significant changes in the environment over time. In the analysis we focus on data from the interviews. Other project methodologies included guided walks, the use of a mobile application, 'Map My Community', drawings and community-based workshops (for further detail see Hadfield-Hill & Zara, 2017, 2018a).

Children's bodies folded in to earthly changes

Our analysis positions children and young people as geological agents which challenge, negotiate and have cyclical and rhythmic relationships with the land and resources. There are two parts, first, young people's experiences of living with and contributing to earthly changes and second, the everyday, multispecies consequences of anthropogenic urbanism. It is through this analysis that we show how children's bodies are entangled in a 'web of interconnectedness among human and non-human forces' (Joseph & Varino, 2017, p. 152) and suggest that children's bodies are folded into earthly changes and are indeed themselves *geological agents*. In the context of Nxumalo's work on children's relations with a mountain and *geotheorising* these encounters, the authors move beyond viewing the 'mountain as a passive object of geological knowledge ... [towards] ... more generative mode of inheritance and that entangle children in more inclusive connections with the more-than-human world' (p. 560). This work offers a starting point to think of children and young people's relations with the Earth. In our research, children and young people were very much implicated in anthropogenic change, vital actors within a geo-bio assemblage.

Children and young people growing up, going-on and contributing to earthly changes

As identified, all young participants were living, learning, working and playing in a space of urban transformation – a space akin to Ellis and Ramankutty's (2008) anthropogenic biomes which have seen significant eco-system destruction with the introduction of city-building infrastructures – notably, concrete.

The materialities of construction were enmeshed with the goings-on of young people's lives. Our field site was a space of anthropogenic urbanism where children lived alongside and indeed *with* bricks, mud, water pumps, concrete and wires. Young people's routines were sometimes obstructed, diverted, but also creatively reinvented through and around new configurations of land and buildings. On the one hand, these anthropogenic configurations were regarded as 'positive' changes to young lives; young participants spoke about the benefits associated with stronger shelters, tarmacked roads and clean water supplies. However, on the other hand, young people also experienced the harsh side of anthropogenic urbanism, where their houses were damaged, or worse, washed away by landslides, habitats destroyed and watery relations changed. Nxumalo (2017) in reflecting on borehole drilling at Burnaby Mountain, argues that 'humans [are] a geological, mineralogical force (Yusoff, 2013) irreversibly altering mountain strata' (p. 561). Thus the children were 'materially and discursively entangled in these past-present 'geologic logics' of mountains and mountain matter' (p. 561). Building on this, we focus on young people's accounts of living in a space of anthropogenic urbanism – here we can see how their everyday routines and relationships were entangled in anthropogenic change.

It is useful to use water as a medium to narrate the shifts which were experienced by young participants. We have written elsewhere about children and young people's watery relations and fluid inequalities in living through a monsoon (Hadfield-Hill & Zara, *In Press*) and drawn on watery literatures in relation to: its multiple affordances (Strang, 2014); the

hydro-social potential of water as a 'time-substance' (Clark et al., 2017); its liminal status between nature and culture (Attala, 2016); and its hydro-logics (Neimanis, 2013). There is not the space to delve into these literatures here, so we use water as a lens through which to more fully understand the potential of children and young people as geological agents. It was young people's routines with water which give insight into their entanglement with anthropogenic urbanism. Young people were acutely aware of the multi-temporal (e.g. daily, seasonal, folkloric, climatic), multi-species (e.g. humans, cattle, aquatic plants), multi-matter (i.e. water, food, grass, mud) and socio-technical (e.g. pipelines, wells, dams, tankards) elements which were involved in water transformations. It was through young people's everyday routines with watery assemblages that their accounts of entanglement came alive. In the account below, one young female participant spoke of her morning routine, describing how she and her siblings collected the water from the well; they played and used the water to wash themselves and their non-human counterparts. The routineness of this entangled encounter with the children, the pots (which we know are made from earthen clay), the water and the animals is evident in the description. The rhythm of water collection seems predictable. However, from our ethnographic work, we know all too well how these routines were far from predictable – the rise and fall of water levels in the region (an impact of human interference) had an everyday impact on children's watery routines. It is important to note that the first town to be constructed in Lavasa, Dasve, was built around a reservoir (or water body, after Neimanis, 2013) – this had significant consequences for water supply in the region, on the quality, flow and condition (based on discussions with a range of stakeholders). The impacts of human-induced ecosystem change had significant day-to-day impacts for children and their families. With the shifts in land and water allocation, at certain times of the year, the wells dried up. During this time participants had to rely on water being delivered in tankards – which added further complexity to the goings-on of life. It is from our ongoing, ethnographic work with this young person that we came to know of her entangled relations with Earth system changes – changes to the flow of waters which impacted on her routines. In the account below we see a further tension with anthropogenic change (the shift in land allocation) - here the young person describes a situation where her family's cow had difficulty in finding food. This excerpt is a good example of the multiplicity of life which is experiencing anthropogenic change – the children – the buffalos – the water – the cows – the forest:

We need twenty minutes to go and twenty minutes to come ... we take two pots; one pot and we fill water and take it and come. It is easy for us because we have filled water from our childhood ... we feel very nice bringing water, we play and enjoy ... for taking bath, for washing clothes, for our cow, to drink her, to wash her... we don't let her go anywhere in forest because she don't know this kinds of forest and in this forest, there is no more food. Some cows and buffalos, they are dying. Because there is no more food. (CH15, female, 11)

Young people were acutely aware of the changes which were occurring to the land on which they lived. They were aware of the temporalities of change which impacted on their everyday relations and experiences. Whilst young people spoke about the changes to infrastructures which were emerging on a daily, weekly and monthly basis, it was their attention to the flow, capacity and quality of the water which is of interest (building on our argument above). Earlier we mentioned Pacini-Ketchabaw and Kummen (2016) and

their attention to diverse temporalities of common-world companions, being open to other 'times' whether it be the termite time or forest time. To this we can add water time, recognising the power of water to act as a thing (Bennett, 2010) and the multiple impacts which the temporalities of depth, capacity and flow have on young people's experiences of place. Not only is the temporal an important consideration in young people's accounts but so too is scale – the temporal and scalar are inextricably linked in their watery observations and encounters. In the first quote below, the young person, speaks of 'messed up weather patterns' and her observation of the depth of the water in the reservoir. In the second, the young participant, again, refers to the depth of the water in the lake, makes a temporal reference to the festival of Rakshabandhan. We found that certain festivals in the Hindu calendar were significant reference points in noting the shifts in weather patterns. The third account speaks of the water availability, according to seasonal variations, showing some knowledge of geological processes:

Not even 25% filled up ... probably destroyed this year ... so things like that going on ... messed up weather patterns. (SH55, female, 15)

There are many changes ... earlier it used to rain a lot ... around the festival of *Rakshabandhan*, it used to get full. (YR91, male, 18)

In [the] rainy season, it rains ... then cold water flows. Half of the water remains of the surface of the Earth and it dries and goes down and it's collected. And in summer season, [there is] a little hole ... and from that very cold water comes. We can drink it. It is good for drinking. (CH04, male, 11)

These excerpts show how everyday embodied practices like drinking and collecting water were temporally and materially shaped by hydrological processes of water infiltration, folkloric rhythms of religious festivals and the ebb and flow of climatic processes. Young people were also acutely aware of the local scale impacts of urban development on the quality of their local water sources. Many spoke about the large-scale infrastructure changes which had a negative impact on water availability and quality. Whilst parents were able to articulate the longer-term changes, given their prior relationship with the land, young people too, witnessed changing water patterns and conditions. The reservoir (a site of contestation around shifting water allocations) featured in many young people's accounts, hypothesising that the human induced changes to the land had a negative impact on the quality and condition of the water. In the first quote, the young participant makes reference to the shifting colour of the water; his observations were over a year period, having moved to Lavasa for Higher Education he believed the sediments from construction were to blame for the shift. The second account makes reference to the same body of water; the participant observed 'Hydrilla growing around on the water', she goes on to say that this is an indicator species for pollution. These quotes show how young people living in a site of anthropogenic urbanism are very much entangled in watery changes:

I'll tell you something that has changed, is the waters in the promenade ... it used to be blue, pristine blue ... maybe it's sediments ... maybe it's just a pollutants of the water. (EC23, male, 18)

... it was pretty clean before and now I think it's getting polluted a little ... I saw Hydrilla growing around on the water ... It's an aquatic plant ... known as Hydrilla ... so it's a pollution

indicator ... if you go around the bridges and you peek down, you can actually see Hydrilla growing almost everywhere ... it's like an indicator of water pollution. (SH55, female, 15)

We argue that these temporal and scalar watery knowledges and observations are an important constituent of young people's geological agency. In essence we have shown that many of our participants were attuned to the Earth system, anthropogenic changes – but what does it mean for children and young people to grow up and go-on with these shifts? In our research, we found that young people very much went on with life, living with the shifts in land and water availability. Our ethnographic data also showed the agency of water itself (Bennett, 2010) in transforming the shape and structure of the land. The land itself sliding, moving, rolling and collapsing impinged on young people's everyday routes, movements, places and feelings – once again showing how young lives are enveloped in anthropogenic change. Young people spoke vividly about the instability of the land, associated dangers and everyday frustrations, particularly during the monsoon. The two quotes below show that when the Earth shifts, in response to the weight of anthropogenic processes, mud and stones infiltrate houses and interrupt their routines:

... we are living at the foothills of the mountain. When the rain comes ... the stones sometimes fall down ... then all the mud, rain and dust comes down to our houses. (CH04, male, 11)

... there is mud everywhere and also because I don't get to play. (YR75, female, 10)

In contrast to these experiences, where anthropogenic processes are interrupting the flow of everyday life, there were numerous examples of young people using the earth, the soil and clay as part of their play, cooking practices and for health benefits. Here we draw on Pacini-Ketchabaw *et al.* (2017) in thinking through children's interactions with clay and the benefit of a new materialisms perspective. In their work in an early years setting, they 'follow the shapes that emerge as clay intra-acts with the children ... follow[ing] clay's unexpected movements [and interactions]' (p. 18). In the context of our participants lives and their interactions with clay, it is clay as an earthen substance which is of interest. Children and young people as geological agents were perceptive to the properties of the Earth and the ways in which they could work with these earthen materials for the benefit of human bodies. In the first example, the young participant explains how she uses components of the Earth, the mud and the water to make vessels for use in the home. In the second, the young person describes how she used soil and turmeric to make a paste to apply to a wound – using the Earth to restore the human – an entanglement of mud, child, stone, leaf:

I make earthen vessels ... I mix clay ... I take water ... and I make a vessel ... then I let it dry. (YR 70, female, 9)

... earlier [we] put some soil on the wound so we first cleaned that up and then applied turmeric powder ... there is a herbal tree, we took its leaves and ground it. We kept a large stone and kept the leaves on it and started grinding. Then we applied that paste on her wound. (YR69, female, 9)

In these examples, children's hands are scooping, mixing, moulding and grinding substances from the Earth in their going-on as geological agents. Here we return to scale. Young people in these examples are extracting, digging and taking away materials from

the surface of the Earth, so perhaps we relate to Taylor and Pacini-Ketchabaw's (2015) notion of 'tiny earth movers' (p. 525). In their analysis, they were referring to ants and worms as actors in 'literally reshaping, shifting and making the earth'. Thus, in our theorisation of children and young people as geological agents we argue that their bodies are part and parcel of the shifting and moulding of Earth substrates. However, children and young people's interactions with the Earth surface is multi-scalar and indeed far more destructive than digging for clay pots or playing with soils. We find in our analysis that children and young people's bodies are subsumed by the neoliberal vision for urbanity.

There are three specific examples that we want to draw attention to. These are based around physical building and everyday articulations of the city. First, many of our young participants whose families lived on the land prior to the development, spoke about physically being involved in the changes to the land and infrastructures. It was common for young people to speak about being 'mixed in the atmosphere' of the new urban landscape, being folded in to the infrastructure changes taking place. Many of the families who took part in this research, including the young people themselves, were intrinsically part of *building* the urban vision. Families gave up their land, cut down the forests, blasted the mountains, laid the foundations and poured in the concrete. A father of one of our participants explains his role in building the vision, whereby a technological fix (erosion control netting) is used to prevent soil erosion, in spaces where the land has been disturbed in the name of urbanism:

[The] company needs to dig up the land so that it can construct buildings on one level ... so it leads to a slope like the one you see there, can you see that? Can you see green cloth spread on it? There is some soil, over there, that green cloth is known as "GeoMat". We spread them on the slope and use bamboo to fix its position. This prevents soil erosion. (PA82, male, 44)

Young people also spoke about their involvement in physically building the vision. One young participant, aged 11, said 'we take part in building these buildings' and thus 'have ideas how to make the city more attractive'. Indeed, in speaking to young people more generally about the development and this space of urban change, they were often quick to make suggestions for additional infrastructures in the city building process. Another young participant speaks of the muddy roads and the need for cement – this vision shows the entanglement of children's lives with anthropogenic futures:

It shouldn't be this muddy ... put cement on it ... where there's mud, it should be removed ... they should pour cement on it. (YR74, male, 10)

Countering Ellis and Ramankutty's (2008) view of cementification as a major threat to ecosystems, young participants often expressed enthusiasm about tarmacked roads and concrete housing. Ironically, such need for more 'solid' and stable infrastructures was voiced particularly by those more exposed to the threats of anthropogenic Earth alterations like landslides, flooding and water insecurity. We found that young people were part of a geosocial assemblage of tarmac, cement, bodies, soil and aspirations that was transforming the particular ecosystem of the case study site whilst also resonating with anthropogenic Earth changes at a more global scale. With reference to forests, other scholars have emphasised the role that children and young people play in witnessing others in the forest assemblage (i.e. the coming together of children's bodies, cedars, plastic and rocks) (Pacini-Ketchabaw & Kummen, 2016). However, we argue that a focus on children

as geological agents takes us beyond young people being witnesses to a more complex geosocial entanglement of earthly change, where children's bodies are active in geosocial work, participating in entangled human/nonhuman assemblages. It is important to recognise the temporalities at play here, where on the one hand children are part and parcel of the 'microhistory of everyday life' (Clark & Yusoff, 2017, p. 12), touching, changing and shifting earthly matters, and on the other hand they are folded in to the *longue durée* of the dynamic Earth.

In this section we have seen how children and young people are folded into earthly processes, part of multiple temporalities of anthropogenic change. From our interviews with those who have been on the land for generations, a slow-moving temporality of environmental change unfolds. The relationships that many of our participants had with the land prior to urban development would be akin to Ellis and Ramankutty's (2008) classification of 'hunter-gathers' as a low-impact anthropogenic biome. Indeed, the changes which our participants spoke about over the generations of their families living on the land were minimal in terms of their impact. However, we find a faster temporality with the process of urban transformation and the building of Lavasa. Children and young people's narratives reflected neoliberal acceleration and shifts (Harvey, 1989) not only in terms of the physical infrastructures of place, but also the new rhythms of life which emerged. Everyday life of human and non-human others (from children, to tigers and the forest) was shaped by the timescales of the construction work, this was a fast-changing landscape where trees were cut down and new buildings and city infrastructures emerged. As we will come on to show in the following section, children and young people share a vulnerability with the tigers, the land and the forest. With the construction of new buildings, comes new routines. A new school signals a new way of life, new timings, mobilities and rhythms. Young participants experienced a speeding up of time with the neoliberal rhythm of corporate schedules, rules and procedures their lives were temporally bound by the new clock of the Anthropocene, a speeding up of life itself; indeed they themselves contributed to this with their own everyday routines and responsibilities. Our young participants were folded into anthropogenic processes, with their lives organised around the temporalities of anthropogenic urbanism and the going-on with life in a space of 'fast paced' change.

We have also reflected on the importance of scale in constructing children and young people as geological agents. It is through young people's experiences that we can complexify the framing of anthropogenic ecological threats as a global issue (Haraway et al., 2016). First, we have shown that the Anthropocene has context-specific configurations and impacts. Using the example of water, we have shown a multi-scalar reading of anthropogenic change. Water use and availability was bound to specific, intersecting circumstances: i) monsoon rhythms; ii) the geomorphic configuration of the Sahyadri mountain range; iii) the human exploitation of water sources through reservoir and dam building; and iv) young people and their families' mundane interactions with water. Children and mud, cows and hydrillas, parents and water were some of the actual agents through which the Anthropocene materialised in this particular Indian biome. Thus, we challenge global narratives of the Anthropocene by showing how this involves humans – especially children and young people – and non-humans differently in diverse contexts. Second, the multispecies approach that we have taken highlights the multiscale through which ecosystem changes happen. In this paper we have

focused on children and young people's bodies and their everyday experiences as part of wider, entangled human/non-human assemblages (from water and land to bacteria and microorganisms) of geological agency to offer a micro-scalar perspective of the impacts of anthropogenic change. These scales were continually implicated in the subjectification of children and young people as geological agents. Indeed, our analysis also found that young people were not only victims of anthropogenic change, they too were part and parcel of the increasing threat to and destruction of the Earth. It is through looking at the multiple interactions at different scales of the human and non-human that the workings of the Anthropocene can be unravelled and new geontologies (Povinelli et al., 2017) and geopowers (Grosz et al., 2017) can be scrutinised.

The everyday, multispecies consequences of living with anthropogenic change

The analysis now moves on to uncover a multispecies narrative which was articulated by children and young people in their response to anthropogenic change. We find these narratives are sympathetic to a relational understanding of earthly changes. Building on Taylor and Pacini-Ketchabaw (2015) we seek to get closer to 'the relational and co-shaping learning that occurs when children and animals physically encounter each other in their common worlds' (p. 3). We find that children and young people live with, and contribute to a hybrid world of multispecies companionships, each actor encountering the messy materialities of urban change. Our focus here on hybridity, and showing children's narratives of a multispecies vulnerability, seeks to decentralise the *anthropos* in the Anthropocene (Haraway et al., 2016). What then do we mean by a multispecies vulnerability? On one hand, we find that children and young people position themselves as victims of anthropogenic urbanism, victims of the actions of 'other' humans. Young people spoke vividly about their bodies being confused by changes to the physical environment. However, it is children's concern with animal vulnerabilities which is important to note here. So children recognise that these shifts and confusions are happening to them and to their bodies, but they are also happening to diverse species who also inhabit the land. There is one powerful example which is emblematic of other children's narratives. In the first account below, the young person describes that prior to the building of the development, the animals were able to move with relative ease; however, since the major infrastructural changes, the animals are confused. In the second, the same young person speaks specifically of the tigers and the challenges they faced with the construction of roads and infrastructures which humans had put in place:

... and animals were more here ... earlier the animals used to roam around anywhere ... now since these buildings are constructed, animals are confused [by] what have these humans built here. (YR49, male, 18)

When Lavasa came here for the first time, the tigers used to sit here on the roads, even the tigers couldn't understand that they started cutting down trees, and then they formed new Lavasa roads, there were no tar roads, there was only mud and soil roads so the tigers used to sit right in front of the cars. (YR49, male, 18)

From these examples we can see how young people's narratives are sympathetic to the vulnerabilities of animals, their co-residents, also experiencing confusion and bodily impacts as a result of anthropogenic change. Yet, as we have shown previously, children

and young people also have a role to play in this change, they are not simply bystanders. The buses which take them to school, the motorbikes which they use to travel to work, the new roads that bring connectivity in their daily routines, the buildings that lodge the students, the more solid housing that some of the children are able to live in – these are all components of those assemblages of bodies, technologies, soils, materialities (tarmac; fossil fuels; concrete) that are all part of anthropogenic change.

There was another ‘body’ which appeared in the narratives of vulnerability – that of the land. The first quote below exemplifies many of the young people’s narratives about the destruction to the land, with the cutting down of trees, the growing of buildings and the impact on air quality. The second, from a parent, more explicitly shows how the land is seen as a body which can also hurt and feel – in this example, the participant speaks of the impact of the construction of houses in the mountain side:

Ma’am, there are no trees ... and there are now growing only buildings more. That is why, the trees are cut and the air is very less in Lavasa. (CH03, male, 12)

... they have hollowed out a mountain. Just like we lose all our strength during illness, the same is applicable to a mountain. The mountain has become very weak now. Due to such construction, the trees died. Tree roots hold the soil together. Now since there are no trees, soil will flow away with the rain and everything will get washed away just like what happened in [name] village. (PA48, male, 53)

The extracts presented in this section convey a sense of the co-participation of children and young people in earthly changes alongside other human and non-human agents. Participants recognised that it is not only the humans that are experiencing a shifting landscape. They also voiced animals sense of confusion (such as tigers grappling with the new urban setting) and were sympathetic to the ‘construction-illness’ embodied by mountains and the land. A strong sense of multispecies vulnerability was expressed through a metaphorical conflating of human, animal and earthly body-feel. Whilst narratives tend to position children as co-victims of geological alterations impacted by invasive, fast-paced urban change, we have also seen how young people partook in anthropogenic urbanism, ultimately contributing, to some extent, to these destructive impacts. Whether going-on with changing water flows and shifting land, or physically building the urban vision, children, young people and their families were significant co-agents in the growing human biomes.

In this section we have drawn attention to why a focus on multispecies vulnerability matters in the conceptualisation of young people as geological agents; in being geological agents children and young people are at once both active in the process of anthropogenic change but part and parcel of a multispecies vulnerability. This perspective complicates our understanding of vulnerability in this epoch of neoliberal acceleration and technological anthropogenic urbanism. Young people articulated diverse vulnerabilities to anthropogenic processes – importantly these were expressed in the context of both young people’s bodies but also the bodies of others. We have opened up the discussion of the Anthropocene to show the diverse vulnerabilities which impact on a range of human and non-human bodies in the name of urbanism. We agree with Taylor and Pacini-Ketchabaw (2015) who argue that in the framing of the Anthropocene, whilst being aware of the critiques, it prompts us to ‘interrupt business-as-usual, radically reimagining what it means to be human, revisiting the crucial question of agency, and risking

finding new ways to relating to the world that we inherit and inhabit along with other species' (p. 7). In a similar vein, Loveless (2013), drawing on Barad, prompts us to 'reposition the human' and it is in doing this that we consider children as geological co-agents, experiencing, contributing to and being aware of the multispecies vulnerabilities associated with anthropogenic urbanism.

Conclusion

In this paper we have drawn on our ethnographic research with children and young people in India, who at a particular moment in time were experiencing and living with anthropogenic urbanism. Their bodies were attune to the speeding up of changes to water flows, soils, forests and landscapes. It is in this context that we position children and young people as geological agents – participants in the goings-on of neoliberal urban change. So what does it mean to be a geological agent? Our conceptualisation is grounded in three key observations. First, that their young bodies are folded in to these changes. Second, that they play an active role (at a range of scales and through various temporalities), and third, that they are part and parcel of a multispecies vulnerability. Our participants were not simply innocent bystanders and victims of geo-bio earthly changes; in the diverse ways in which they live and participate in life they are, at once, witnesses to and producers of anthropogenic change. Our focus on children and young people's everyday lives has shed light on the diverse ways in which they shape and go-on in the Anthropocene. Taylor and Pacini-Ketchabaw (2015) reminded us to look 'beyond the radar of the spectacular "big action" we partake in on the surface of the planet' (p. 525); here they were referring to ants and worms as 'earth movers' which operate in the shaping of the Earth below its surface. However, this also prompts us to think about children and young people as themselves 'earth movers' – in the living in and going-on with urban transformation. Urban change is occurring at rapid rates across the planet, landscapes are shifting, concrete is being poured and new scapes are emerging. Urban transformation is a key feature of anthropogenic change and this paper has evidenced children and young people's role in this – as geological agents.

Through our analysis we have paid attention to time, scale and multispecies vulnerability. These we argue, are important reference points in understanding anthropogenic processes and the place of children and young people as geological agents. Young people were attuned to both the temporalities of urban change itself (i.e. the comings and goings of construction workers) and the impacts on the rhythms of others (both geo and bio), including the shifting dynamics of water bodies and the negotiated routines of tigers. Our geological agents were acutely aware of the land's faster movements induced by human intervention (through excavation; hollowing out and the resulting landslides) and the changes in the capacities, depths and flows of water in their community. Our research has also shown that young people's bodies are folded into to Earth changes at diverse scales – ranging from small scale digging in search of clay (to make earthenware), to destructive activities related to the building of urban infrastructures, and the everyday ways in which multiple young people, as a collective, are folded in to a vision for neoliberal urbanism and thus complicit in earthly transformations. Finally, we have shown that young people were sensitive to the multispecies vulnerabilities of which they are part – a core component of being a geological agent.

To conclude, we destabilise common perceptions about the Anthropocene and highlight children and young people's place in witnessing, contributing to and being folded-in to earthly changes. In focusing on children's lives in a site of urban transformation we can see how they are entwined in a wider geo-politics of urban development. Young people's bodies were subsumed in a process of neoliberal city building, they are at once victims and contributors to anthropogenic change. It is in this context that we have made a contribution in overcoming the 'restricted understanding of the entangled relations between natural, social and cultural worlds' (Lovbrand et al., 2015, p. 212). In our analysis, young people had the capacity to be affected by, themselves affect and be aware of multispecies vulnerabilities in response to anthropogenic change. We have shown how children and young people are growing up and going-on in this shifting landscape, with significant changes to the land and water which they encounter in their everyday lives. It is important to remember that this paper has focused on young people's lives in a particular place, in a particular moment in time – by using this as our focus, we argue for more nuanced appreciations of the impacts of the Anthropocene on people and place. We argue that attention to time, scale and multispecies vulnerabilities complicate what it means to be a child in the Anthropocene. Children and young people are geological agents which challenge, negotiate and contribute to anthropogenic processes. Our paper offers a new way of thinking about children's lives as part of the hybridity of Earth system ecologies.

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