RESEARCH ARTICLE

Ice and Concrete: Solid Fluids of Environmental Change

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Abstract

Recent environmental changes have sparked off unprecedented dialogues between practitioners of the earth sciences and the humanities – dialogues which defy some of the basic assumptions underpinning western science. However, a gap still persists between natural scientists and scholars in the humanities in their tendency to concentrate respectively on solid matter and fluid meaning. This article seeks to close this gap by paying attention to glacial ice and concrete, materials often taken to mark, respectively, the onset and culmination of human history. Historically, ice and concrete have been regarded as *solid fluids*. We argue, however, that both are caught in a punctuated understanding of change that turns fluidity and solidity into mutually exclusive properties, thus rendering the solid fluid as an oxymoron. The article concludes by comparing this "oxymoronic syndrome" with the ways in which the Inuit of West Greenland experience their cryogenic landscapes as nurturing environments in constant becoming.

Introduction

Recent environmental changes have sparked off unprecedented dialogues between practitioners of the earth sciences and of the humanities – dialogues which call into

Keywords: Anthropocene, climate change, concrete, ice, solid fluids, stratification, time

question some of the basic assumptions underpinning western science. In particular, they challenge the conventional distinction between geological processes, once thought to be long-term and slow, and what were supposed to be the shorter-term and faster processes that characterize human affairs. However, a gap still persists between natural scientists and scholars in the humanities, insofar as the former tend to concentrate on the material aspects of environmental change whereas the latter are more inclined to attend to the ways human beings attach significance to them. To the scientist, the material world appears already congealed – already to have precipitated out from the processes that gave rise to it – and to be imbued by nature with such properties of obduracy and resistance that define the state of the *solid* (Anderson and Wylie 2009, 319). In its sheer physicality, as archaeologist Bjørnar Olsen has it, this world is perceived to be "hard" (Olsen 2003, 88). Or in the words of another archeologist, Christopher Witmore, it is the "concrete being" of things – and not the forces and flows from which they emerge – that constitutes matter (Witmore 2014, 211). The significances that humans attach to material things seem, by contrast, to be continually in flux as they are constructed and interpreted in currents of discourse and practice – and as such, they are malleable to circumstances (see, for example, Holtorf 2002). Meanings, apparently, are *fluid*. And for the scholar who makes it his or her business to enter into them, they present a soft target.

It is our contention in this article that the parallel distinctions between solid facts and fluid interpretations, and between the "hard" sciences and "soft" humanities, rest on a more fundamental metaphysical division between two worlds, of nature and humanity, which is ultimately unsustainable. We argue that matter and meaning are not opposed but co-constitutive in a world which is continually coming into being (Ingold 2013, 17–31; see also Barad 2007). To help us think through this argument we have chosen to focus on materials that appear anomalous within the conventional dualism of hard and soft, but paradigmatic for the alternative that we propose. These are *solid fluids*. We will seek to show that solid fluids are not exceptions that prove the rule that matter and meaning, belonging respectively to nature and mind, can never meet, but rather exemplify the contrary rule that in a world of becoming, matter and meaning always emerge together.

Fluids against Solids

We start with a poster from a publicity campaign of the Bank of Chile, which opened a branch in the recently inaugurated Centre for Innovation at the entrance of Campus San Joaquín of the Pontificia Universidad Católica de Chile.[1] The monolithic structure of the building – designed by Alejandro Aravena, who in April 2016 was awarded the famous Pritzker prize – not only highlights traditional tropes in modern architecture, but also stands for sustainability, in that its thermal properties are meant to reduce air conditioning by 40% during the summer.

The poster, which was displayed nationally, demonstrates the strength of the bank by showing two concrete buildings, alongside the image of a frozen glacier solidly standing against the passage of time. The selection of images in this cannily crafted poster is

1. The Centre was one of a number of research sites in a project funded by the British Academy that we are leading (see Acknowledgements).

ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

Figure 1. Solid ice and concrete.

certainly powerful, knowing how Chileans have been geologically marked by both ice and concrete. On the one hand, Chile is among the most seismic countries in the world, and adopted reinforced concrete at the turn of the twentieth century as standard in construction, partially in reaction to major telluric events. Glacial ice, on the other hand, dominates Chilean Patagonia, where the Andean mountain range extends all the way into the sea and back out to Antarctica.

The irony of these powerful images is that although they appear frozen in time, neither ice nor concrete actually remains still. Ice is more unstable now than ever before, as glaciers are melting at an unprecedented rate. However, the instability of concrete – after water, the second-most used material for construction in the world today – is less obvious. Although concrete's unique combination of strength and malleability has provided a solid infrastructure for the rapid dissemination of modernity, its permanence is now increasingly questioned (Harvey 2010). What few city dwellers realise, moreover, is that cement production alone is responsible for between 5 and 6 per cent of global carbon emissions (Rodrigues and Joekes 2011); figures that can go up to 10 per cent, depending on the source (see, e.g., Harris and Borer 1998, 151). This contribution, invisible compared to that of other large emitters such as the aviation industry, makes concrete both a friend and

Journal of Contemporary Archaeology 5.1 (2018) 19–31
ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

a traitor to the modern project. While we put our trust in its solidity, behind our backs it is fuelling the global acceleration that is responsible for the melting of glaciers. Yet far from being regarded as coactants in a still-to-be-written history of life in the Anthropocene, ice and concrete are typically placed at opposite ends of a history that is already finished: with ice before it began, and concrete marking its completion in modernity. The loss of ice – and with it, of iconic "pre-cultural" forms of life that depend on its surfaces for hunting, including the polar bear and the Inuit (Carey 2007; Bravo 2009) – fuels public concern that with it will go the last vestiges of the glacial environment which covered much of what is now the modern world before history is supposed to have begun. And for this, concrete – along with oil, the most world-changing product of modern industry – is largely to blame.

The Unresolved Sliding Problem

Both ice and concrete have long been regarded as *liquid rocks*. This combination of solidity and fluidity is precisely what makes concrete and ice such excellent materials for us to think with in the face of the current environmental crisis. However, the history of Western science and engineering provides ample testimony to the difficulties of reconciling these apparently antithetical properties. This is well illustrated, in the case of ice, by a controversy that centred on the movement of glaciers. The principal protagonists were David Forbes and John Tyndall, twin founders of British glaciology in the nineteenth century. Forbes, one of the first to embark on a scientific description of the movements of glaciers, and following an old analogy, suggested that glaciers behave like meandering rivers. The idea was based on the observation that the central part of a glacier moves faster than its edges, while the inner parts of a curve move still more slowly. These variations, Forbes argued, cause ice to deform. At a molecular level, ice was said to have a capillary structure, which allows water to infiltrate, making it plastic. This became known as the *viscous theory* of glacial motion, developed mainly after Forbes's studies of the movements of the Mer de Glace, in the Alps, and in conversation with other pioneering glaciologists, notably Louis Agassiz, the first to propose that the earth had once been subject to an Ice Age.

The young Tyndall, a distinguished Victorian glaciologist and renowned mountaineer, embarked – in the company of his friend, the illustrious T. H. Huxley – on a systematic campaign to tarnish Forbes's reputation, which included serious allegations of plagiarism. Following the masculine tendency in glaciology to validate knowledge through heroism and physical exertion, Tyndall undertook several Alpine expeditions, including a journey to the Mer de Glace, in order to refute Forbes's ideas (Hevly 1996). Tyndall's main target was the viscous theory of glacial motion. It was, in his view, fundamentally counterintuitive. "This theory", he wrote, "is so directly opposed to our ordinary experience of the nature of ice as to leave upon the mind a lingering doubt of its truth" (Tyndall 1871, 353, quoted in Cunningham 1990). Tyndall argued that glacial motion did not result from a semi-fluid condition but from a process of fracturing and regelation.

This debate reveals the paradoxical character that ice, once set in motion, acquired in science. It endures in glacial dynamics in what has been described as the "unresolved sliding problem" (Benn *et al*. 2007, 123). We do not pretend to be able to solve the mystery

ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

of glacial movement. Our more modest hope is to show how the debate surrounding the nature of moving ice bears upon the ways in which change has historically been conceived in western science. This history offers us two alternative models for thinking about change. The first takes the world to be made up of discrete but solid entities, which can nevertheless undergo *changes in position*. It is often associated in physics with Aristotle's discussion of Xeno's paradoxes. The second model takes the world to be comprised of fluids which, in mixing and melding, can undergo *changes in composition*. This model is often traced back to Heraclitus.[2] Unlike solids, fluids can accommodate their shape to their containing surfaces. Accordingly, while changes in position are *punctuated*, changes in composition are *continuous*. Furthermore, changes in position involve a view of space as a *homogeneous* medium, in which things are *simultaneously* located and movements or displacements *reversible*. With changes in composition, by contrast, things are inseparable from their movements; they are *concurrent* rather than simultaneous, and this concurrence is consubstantial with the *irreversible* unfolding of a spatiotemporal field that is both *heterogeneous* and continually in formation.

From Fluidity to Stratification

As Prigogine and Stengers (1984) suggested long ago, physics has moved significantly from classical dynamics to embrace irreversibility. Nevertheless, the tensions between these two models of change are not part of an old and obscure controversy within the field of glacial dynamics, but characterize a number of contemporary environmental debates as well. An example lies in the discrepancy between the direct perception of ever-variable weather phenomena and the scientific modelling of climate change. For most of us, weather is a topic of everyday experience (Ingold and Kurttila 2000): we sense its continuous changes in the quality of the light, in feeling warm or cold, damp or dry, and so on. Climate science, however, will have no truck with experience, which it takes to be subjective and unreliable. It is not enough for weather to be felt or experienced; it has to be objectively measured by means of instruments, yielding numerical records of temperature, humidity and precipitation. According to the World Meteorological Organization (WMO) – and, following WMO criteria, the Intergovernmental Panel on Climate Change (IPCC) – climate is an average of recorded weather conditions taken over a period of 30 years. These averaged data are plotted and displayed on graphs such as those to be found in IPCC reports. Inaccessible to direct perception, climate is thereby rendered visible in retrospect in the form of diagrams and representations.

Even as climate change is represented as a series of static averages plotted on a graph, so climate history is seen to be composed of discrete periods that appear to be layered, each upon the one preceding. On the scale of geological time, these figure as epochs, of which the penultimate – known as the Holocene and only recently overtaken by the

2. The philosopher Michel Serres calls it the "hydraulic model", and finds its *locus classicus* in the poem *De Rerum Natura* ("The Nature of Things") of the Roman author Lucretius. For Deleuze and Guattari, drawing on Serres, the two alternatives correspond to what they call "major" (or "royal") and "minor" (or "nomad") science. While the former tends to solidify the world, often in the name of national interests, for instance through cartographic representations, the latter would follow processes and produce knowledge on the move (Serres 2000; Deleuze and Guattari 2004 [1980], 398).

ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

Anthropocene – coincides with the post-glacial flourishing of the human species over the past 12,000 years. Resisting change, then, means holding to the average. This is what scientists hope to achieve when they campaign to engineer the atmosphere, with a view to keeping it within "planetary boundaries" that they themselves have created (Rockström *et al.* 2009). It is to treat the atmosphere as something like a laboratory writ large (Ingold 2015, 76); as if, in its measurements and calculations, climate science had "brought the weather indoors, in an attempt to tame its material and semiotic unruliness, to subject it to a very particular kind of reading" – one that is "narrowly technological" (Szerszynski 2010, 21). Indeed, it is within such indoor spaces that many of the ideas of scientific meteorology have been produced and tested. Artificially induced, indoor climates, often sealed within concrete walls, can be manipulated at will in accordance with the punctuated parameters of a wall-mounted thermostat (Hulme 2014).

Many examples could be added of this effort to restore environments to an average condition that is supposed to have obtained in some arbitrarily delimited period in the past. One is the proposal to paint mountains so as to bring back glaciers; another is to restore extinct species: both exemplify the nostalgic attempt to revert to a static image of nature at the dawn of civilization. This punctuated understanding of history is also present in contemporary discussions of the Anthropocene, and is evident in the significance attached to data fossilization in marking the onset of the new epoch. According to Zalasiewicz (2015), chair of the "Anthropocene Working Group", only signals already buried in stratigraphic sequences, that are clearly identifiable across the globe, can reliably tell us when the Anthropocene started (Zalasiewicz *et al.* 2011; Lewis and Maslin 2015; Monastersky 2015). Once again, we see how in the dominant discourses of science and history, fluid processes of world-formation have to solidify into hard facts before they can be subjected to human interpretation. The social ascription of meanings to the facts of nature, and the political action that potentially follows, can therefore only be retrospective. We can only look back, scientifically and historically, on a world that has already precipitated out or sedimented into successive strata.

The Dissociation of Time and Space

This retrospective view of climate history is based on a traditional notion of time in the geosciences, according to which earth history can be understood as the vertical superposition of flat horizontal grounds (Simonetti 2013). In this view, time and space are dissociated, and aligned respectively along vertical and horizontal axes. Spatial movements range across homogeneous surfaces that are mapped from a synoptic bird's-eye perspective which surveys space as if it were everywhere at once. Vertical movements, to the contrary, cut across surfaces as if scientists could travel in pure time, in search of the original platforms from which to narrate the histories of earth, life and humanity. These particular platforms would mark disciplinary boundaries for the sciences that excavate their respective objects of study. Archaeology, a discipline particularly well positioned to discuss the encounter of earth and human history, offers a clear example. Archaeologists have recently engaged actively in debates on the Anthropocene (Edgeworth 2014). Figure 2 is taken from Harris (1979), an author recognized for having contributed to the modernization of archaeology through the establishment of stratigraphic methods – the

ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

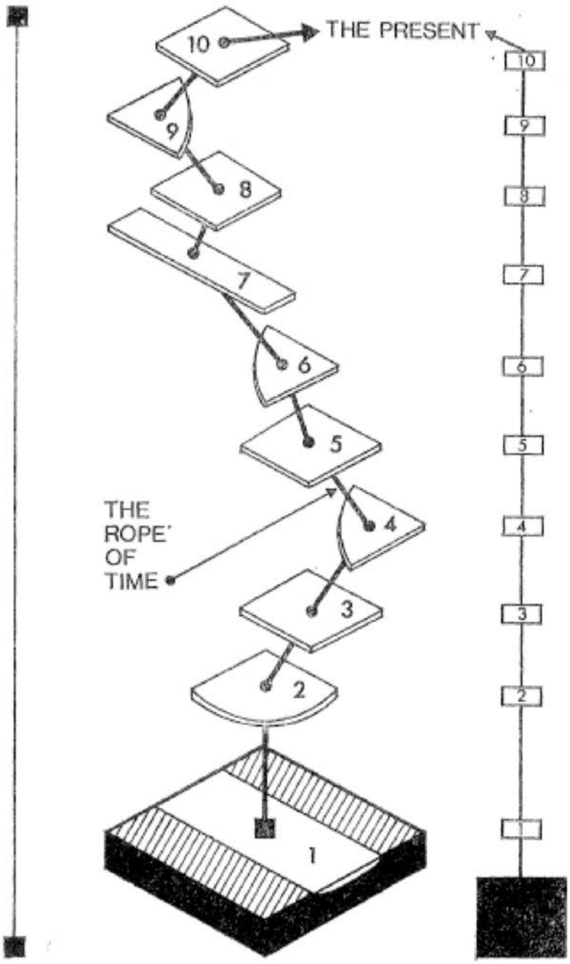

FIGURE 2. **The passage of time in a Harris Matrix. Reproduced from Harris (1979, 116).**

same methods that are currently being adopted to define the onset of the Anthropocene by a number of authors, including Harris himself (Harris 2014).

In this diagram, time is represented as a rope connecting a series of superimposed platforms. Each platform represents a period in the past, a timeless surface on which life was once lived at a particular moment. Like a stage-set empty of furnishing features, objects and people, these perfectly homogeneous platforms resemble cartographic abstractions. Ordered from bottom to top, in upward gravitational accumulation, the sequence of surfaces starts from what, in British archaeology, is known as "the natural soil" (represented in the diagram as a black box). Although followed in its contours, this soil often remains untouched in excavation, as it marks the initial ground from which human habitation is supposed to have started at a site. Anything beneath this point would fall under the jurisdiction of those in charge of studying nature, in this instance geologists. Moving up along the rope of time, we see how the present stands at the top of the sequence, an image matching modern narratives of progress, including those that

ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

granted archaeology its status as a modern discipline through the careful establishment of stratigraphic methods (Schnapp 1996; Trigger 2006).[3]

Concrete and the Building of Modernity

From the ambivalent character of ice, that led us from fluidity to stratification, we can now return to the second of our iconic materials, namely concrete. For if it was the melting of ice on an unprecedented scale that marked the onset of the Holocene, the solidification of concrete, on a scale equally without parallel, has been taken to mark its conclusion. The most important material in the building of modernity, concrete has contributed to a view of progress which places modern values unequivocally above those of tradition. As research on modern uses of concrete suggests, the manufacture of concrete structures is dominated by a desire to craft perfectly smooth surfaces, reminiscent of those that make up a Harris Matrix (Simonetti 2018). The gestures responsible for crafting these surfaces would follow an impulse to create new grounds that lay down modernity's claim on the present, a claim only enhanced by concrete's status as a modern material.

Hydraulic concrete – rediscovered and patented in the nineteenth century by Joseph Aspidin, long after its earlier use in building the monuments of ancient Rome – not only helped Victorian England to renew its ties with Roman civilization but also sustained the illusion that geological processes extending over vast spans of space and time could be artificially compressed in a laboratory. It was as if engineers had managed somehow to get the better of history, mastering the secrets of deep time. As the use of concrete rapidly spread in the name of the sanitization of urban environments, concrete's suffocating surfaces helped to create a sense of lasting control over nature while also distancing modernity, quite literally, from its traditional rural origins. Dumps, skyscrapers, roads and transoceanic channels, to name but a few of the infrastructural elements in which concrete is implicated, have allowed modern people to transcend boundaries, defy gravity and globalize the world.

However, concrete's status as a recent product of modernity has never been secure. Its aura of artificiality is compromised by its dependency on manual labour and its earth-bound origins in ancient volcanic activity (Forty 2012). Furthermore, despite the promise of durability, concrete structures are both prone to decay and permeable (Lucas 2013) – vulnerabilities that the cement industry has been at pains to conceal. Although long portrayed by the industry as a kind of artificial stone, concrete cannot last as natural rocks do. According to Prentice (1990), in his geological account of building materials, this came as a complete surprise to architects and engineers at the turn of the twentieth century. However, the news came as no surprise to geologists, who are profoundly aware of the slow but constant formation processes responsible for the creation of stone.

This awareness goes back at least to what is conventionally taken to be the first treatise in the history of geology, namely Nicolas Steno's *Prodromus*, originally published in 1669, which narrates the geological history of Tuscany through an analysis of marine

3. Stratigraphy has also informed the ways in which time and space are understood in numerous fields outside geology including, for instance, biology, psychology, anthropology and history. Key figures such as Darwin, Freud, Lévi-Strauss and Foucault have stratified life, the mind, sociality and history following geology's traditional dissociation of time and space (Simonetti 2018).

ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

fossils in the rock (Steno 1916 [1669]). As its subtitle suggests, Steno's essay inquired into how "a solid body [can be] enclosed by a process of nature within a solid". Steno's solution was that the constituent particles of the enclosing solid had at one time been held in fluid suspension, but that very slowly they had precipitated or coagulated into a solid mass. So too with the constituents of concrete. But while engineers might strive to speed up or even bypass the passage of time, liquid concrete can no more turn to stone in an instant than can any other potentially petrous material. The process of its solidification is only superficially complete, concealing a residual fluidity. In time, then, concrete must inevitably crack and crumble. Eventually, all concrete structures will return to rubble while only continual practices of care can sustain the impression of their permanence. Indeed, concrete's fluid solidity is a characteristic with which the modern building industry has struggled to come to terms (Harkness *et al*. 2015).

Yet the promise of durability that characterizes modern uses of concrete seems also to have influenced geological thinking, testifying once again to the fact that the material worlds we inhabit furnish us with some of our most deep-seated ways of thinking.[4] Concrete is not only by far the most significant material in the building of modernity. More radically, it is the most obvious candidate for marking the origin of the Anthropocene, bearing in mind the requirement of the Anthropocene Working Group for a single, globally distributed marker in stratigraphic sequences. Think of the vast extension of mega-cities such as Dubai or Los Angeles! Nor should we fail to take into account, as well, all the anthropic rock surfaces humans have created in the landscape, outside of urban areas, as they have sourced the necessary ingredients for the manufacture of concrete (Cathcart 2011). The massive extension of concrete surfaces over the past century, primarily across the Northern Hemisphere, makes concrete not just a suitable marker, but one that works without erasing the historical inequalities between nations in terms of environmental responsibility. The production and consumption of concrete across nations correlates almost perfectly with the World Bank's development indicators (Rodrigues and Joekes 2011).

Regardless of what the Anthropocene Working Group might decide, there is no doubt that concrete holds a unique place in modern Anthropocenic thinking, particularly considering the striking similarity between the manufacture of smooth concrete surfaces and the view of earth's history as composed by the superposition of solid strata. These are the same strata that, from a more explicitly architectonic angle, currently dominate the ways historical processes are understood in the discourses of modernity, as we speak of successive units in the histories of the universe, of life and of humanity.

An Oxymoronic Syndrome

Although we might suppose that the tensions between solidity and fluidity, revealed in ice and concrete, belong exclusively to science and engineering, the humanities have

4. As Bergson wrote, in the introduction to his *Creative Evolution*, "the human intellect feels at home among inanimate objects, *more especially among solids*, where our action finds its fulcrum and our industry its tools" (Bergson 1911, ix, our emphasis). Not for nothing do we tend to speak of "hard facts" as "concrete"! Unsurprisingly, Whitehead – following in Bergson's footsteps – diagnosed the tendency in science to solidify time and space into discrete locations as "the fallacy of misplaced *concreteness*" (Whitehead 1926, 72, our emphasis).

ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

not escaped from them. They resurface in the many ways of thinking about time in the philosophy of the late nineteenth and early twentieth centuries, as in Bergson's distinction between *extension* and *duration*, James's distinction between the *scientific* and *specious present* (which influenced Husserl's phenomenology of time-consciousness), and Heidegger's between *time* and *temporality*. All of them highlight a difference between the punctuality of measurable succession, in a world of solids where all change is of position, and the continuity of experience, in a fluid world where all change is of composition.[5] Generally, too, they offer the latter as an antidote to the former – a manoeuvre still standard among contemporary theorists (Hodges 2008). Space, traditionally time's antagonist, has undergone a parallel reformulation, from the plane of synchronicity, opposed to diachronic succession, to what Massey has called "the simultaneity of stories-so-far" (Massey 2005, 10–12; see also May and Thrift 2001).[6]

It is as if no-one has managed to escape from this *oxymoronic syndrome*. Western minds often seem incapable of comprehending fluid-solid substances that change simultaneously *both* in position and composition – or, more precisely, in compost-action, to borrow a term from Haraway (2015).[7] It feels counterintuitive. What if, instead, we were to start with an ontology in which fluidity and solidity are not mutually incompatible properties? The ways that the Inuit people of West Greenland engage with their cryogenic landscapes offer some clues. Unlike our retrospective view of change, grounded in a nostalgic desire to recover past climates, the Inuit orient themselves primarily towards a future that is anticipated rather than predicted. It is a matter not of determining in advance what will be, but of attending to the ways things are going. Inuit children are brought up from birth to expect the unexpected: they learn to be ready for variations, and find the world to be a constant source of astonishment rather than surprise (Ingold 2011, 74). Accordingly, while western science discovers change retrospectively, using data that have been already gathered to test models which subsequently allow them to predict (and to be surprised if their predictions fail), for the Inuit, weather and climate are, and have always been, intrinsically and imminently variable (see Briggs 1970, 1991; see also Tejsner 2013).

A distinction introduced by Nuttall clarifies this contrast. According to him, coastal hunters and fishers in Greenland "consider the environment to be in a process of 'becoming' rather than 'changing'" (Nuttall 2009, 279–280). To elaborate, we might say that while change in science is perceived in the juxtaposition of *punctuated averages*, becoming for the Inuit is experienced as a feeling of *continuous variation*. With regard to ice dynamics, such variation would be consistent neither with Tyndall's idea of fracturing and regelation

5. Flusser also highlights this difference between punctuality and continuity, in his delightful mini-essay, "Why Do Typewriters Go 'Click'?" (Flusser 1999, 62–65).
6. In her book *For Space*, Massey (2005) liquefies space in response to Bergson's static image, which he borrowed from Kant. According to Bergson (1911), science has a habit of attributing spatial properties to mental processes. He regarded mental processes as *heterogeneous*, *durational* and *internal*, as opposed to the *homogeneous*, *extensional* and *external* properties of measured space. To these contrasting features, Bergson would often add a depiction of mental life as fluid and space as rigid. In an effort to liquefy our thoughts, Bergson sought to free them from the solidity that science attributed to space. This is the image of space that Massey sets out to challenge.
7. Com-position suggests the mere arrangement solid parts (atoms). But in a world of solid fluids nothing stays still. Persistence in life is still subject to flow which, although it might pass unperceived to the naked eye, is inevitable given sufficient time.

ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371

nor with Forbes's idea of flow. Continuous variation is more comparable to rhythm. Following Lefebvre (2004), rhythms result from the concurrence of *difference* and *repetition*, in which time and space are mutually implicated. In a world marked by rhythm there would be neither pure solidity nor pure fluidity. Conversely, a world that was purely solid or purely fluid would be without rhythm. This is consistent with the ways indigenous communities around the circumpolar north have been reporting their experience of climate change as things going out of phase (Ingold and Kurttila 2000; Krause 2013). They may report, for example, that sea-ice recedes or that migratory species arrive earlier than expected, judged in relation to other environmental comings and goings with which they usually coincide. These are not punctuated contrasts but disturbances in the rhythmic fluctuations of a solid-fluid world in perpetual becoming: where nothing is solid or fluid but everything solid-becoming-fluid or fluid-becoming-solid (Serres 2000).

What would it mean to base an entire research programme on such a forward-looking narrative of climate history, one that is anticipatory rather than predictive, based on the rhythmic interrelations of concurrent stories rather than the sequential succession of averages? Adopting Barad's (2007) ideas on the relation between matter and meaning in physics, our point of departure would be an ontology of *entanglement*. The Inuit notion of *sila* perfectly reflects this ontology. Referring interchangeably to both weather and climate, *sila* is translated as the breath of life and the reason things move and change. It also means intelligence, consciousness or mind, and is understood to be a fundamental principle underlying the integrity of the cosmos. In the words of Nuttall, "it is an all-pervading life-giving force connecting a person with the rhythms of the universe, integrating the self with the natural world" (Nuttall 2009, 299; see also Hastrup in Diemberger *et al.* 2012, 227–230, 240–241). Conversely, lack of *sila* can mean that either people or the environment are going crazy. The emphasis on breath here is critical. In breathing we both surrender ourselves to the environment and launch ourselves into it. With every inhalation, the atmosphere enters into and becomes part of us; every exhalation in turn releases part of us into the atmosphere (Ingold 2015, 84–88). No other process matches this continual rhythmic exchange with the environment – one that continues throughout life. Through breathing we are immersed in our surroundings, and our surroundings in us. In a living world of solid-fluids, marked by constant rhythmic transformation, no organism could endure that was not open, through respiration, to its surroundings.

Acknowledgements

The research on which this article is based has been supported by the project *Solid Fluids in the Anthropocene: A Transdisciplinary Inquiry into the Archaeological Anthropology of Materials* (2015–2018), funded by the British Academy for the Humanities and the Social Sciences under its International Partnership and Mobility Scheme. The research has also been supported by the project *Concrete Futures: An Inquiry into Modern Life in the Anthropocene with Materials* (2015–2018), funded by Fondo Nacional de Desarrollo Científico y Tecnológico (FONDECYT), Chile, No. 11150278. We are grateful to the British Academy and to FONDECYT for their support. An earlier version of this article was presented at the workshop "Time of Materials" organized by Gay Hawkins at the

University of Western Sydney. We are grateful to Gay for inviting us to contribute to the event, to Juan Francisco Salazar for making our attendance possible and to Guy Keulemans who, at the workshop, provided detailed comments on the version presented there. We extend our gratitude to two anonymous reviewers, whose generous comments, criticism and suggestions also contributed to the development of our argument.

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ISSN (print) 2051-3429 (online) 2051-3437 https://doi.org/10.1558/jca.33371