Urban Granaries, Planetary Thresholds

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In the distance we catch sight of the walls, tall and sheer as escarpments but boasting straight edges such that only a god would dream up. We have come `here' because we no longer have a `there'. … When the rains retreated, we wandered farther and wider, until our cattle grew lean and our own bones showed through our hides. Finally, when hope abandoned us, we rounded up our remaining stock and shouldered what we valued too much to leave to the locusts and the winds. Our bearings we took from the gossip of merchants, our route a spattering of wells strung together by hoof-prints. The last of our livestock and our small treasures we traded along the way, leaving us with only the dwindling strength of our backs. Descending from the plateau to the river valley, we saw for the first time multitudes of stooped bodies worrying at tall golden stems sprung from muddied water …. Finally, we arrive at a break in the wall, a gateway guarded by soldiers whose gaze weighs up our tired limbs as we once eyed the gaunt flanks of our cattle. Though we try to stand tall, fear curdles with the hunger in our bellies. If the guards permit us to pass through, who can say what will happen to us - we who know everything about herding cattle and nothing of tussling with overgrown grass. And we cannot but wonder - have those great walls been built to keep out strangers like ourselves? Or are they intended to keep in the kind of people we may be about to become?

`Thresholds', observes geographer Clive Barnett `are the very scenes for the drama of responsiveness, hospitality and responsibility.'[1] In the opening decades of the third millennium, city life seems once more to hinge upon the timeworn, troublesome presence of walls and gateways, barriers and breaches. Today, it is not only a matter of who is entitled to enter and share our urban spaces but an issue of how cities will cope with critical transitions in climate and the greater earth system. Or rather, it is the

challenge of both of these at once: the question of how to organize our cities `responsively' at a time when transgressing limits in the very operation of our planet looks ever more likely to estrange, unsettle and mobilize large numbers of people. And in this context, for all that the `complete subordination of the agrarian to the urban' may have been accomplished, as Henri Lefebvre proposed[2], we would do well to keep our granaries stocked. For there is neither sharing nor withholding without the stuff of livability.

In the midst of a discussion of the way that social-spatial relations have become not only world-wide but `planetary' in their scale and consequences, Lefebvre paused to meditate on the way so much of the language we still use to make sense of the world has `a peasant and artisan origin'.[3] The term `threshold' clearly invites such a reading. As linguist Anatoly Liberman teases out:

> Most probably, the threshold was a place where corn was threshed (a threshing floor). The word contained a root and a suffix. That suffix has undergone numerous changes, for people tried to identify it with some word that could make sense to them. What remains unclear is not this process but the semantic leap. We are missing the moment at which the threshing floor, however primitive, began to denote the entrance to the room.[4]

I want to take the agrarian origins of the threshold, in all its obscurity, as a provocation to probe the idea of `planetary urbanization'. Elaborating on Lefebvre's notion of `the planetarization of the urban', contemporary theorists have unsettled the idea of cities as discrete objects and explored how urban socio-spatial processes are transforming the entire surface of the earth.[5] In the course of subjecting the concept of the city to a thorough interrogation, however, it is not always so clear what these urban thinkers make of the earth's own boundaries, properties, and dynamics.

While Lefebvre deserves credit for recognizing the environmental significance of the urban, his later writings come just in advance of scientific claims that there are critical thresholds in the functioning of the earth as a whole. The idea that global climate is capable of moving abruptly over a limit into an entirely new regime or state emerged in the 1980s from research into polar ice cores and other proxies of past climate – though it also built on studies of smaller-scale shifts in ecological systems.[6] Over the intervening

decades, geoscientists have been piecing together how the different components of the earth system interact - and exploring how these tight relationships or `couplings' make it possible for the entire planet to shift abruptly from one `operating state' to another.

This possibility is conveyed by the thesis that human activities may be nudging the earth out of the geological epoch of the Holocene – 11,700 years of relatively stable conditions following the last ice age - into a novel state referred to as the `Anthropocene'.[7] The Anthropocene idea raises difficult questions about what kinds of human impact matter most – and about when members of our species first started to have cumulative impacts on earth and life processes significant enough to leave planet-scaled traces. Although currently a minority position, some strands of Anthropocene science propose that the spread of intensive agriculture thousands of years ago –situated deep within the Holocene as currently defined – was already impacting on global climate.[8] Closely associated with Anthropocene science more generally is an approach seeks to identify thresholds in a range of subcomponents of the earth system – including climate, biodiversity and major biogeochemical cycles – delivering in the process stern warnings about abrupt shifts `into states deleterious or even catastrophic to human well-being.' [9]

However is it defined, the `urban' is on the frontline of the transitions in question. Even if earth system change remains gradual, cities can expect rising temperatures, inundation, accelerating rural-urban migration, and significant food security problems.[10] But contemporary geoscience does more than map out potentially hazardous planetary transitions. Increasingly high-resolution data sets of past climatic and other environmental change can help situate urban histories in the *longue durée* of a variable and volatile earth. New ways of thinking with and through the earth can also encourage us to unsettle disciplinary boundaries - by considering the ecological, geological or mineralogical properties and potentialities that human agents share with other terrestrial actors. As geologist Jan Zalasiewicz observes, for example, `(b)oth skyscrapers and coral reefs are basically large masses of biologically constructed rock'.[11] Or as he writes with colleagues elsewhere: `we live in and drive on Anthropocene rock constructions that we call houses and roads.' [12] Though we should not forget that philosopher Michel Serres also initiated a certain geological thinking of the social when he prompted us to view conurbations as `enormous and dense tectonic plates of humanity.' [13]

Alongside new developments, there are precedents for putting formative moments of sedentary human life in a `planetary' context. It has long been understood that the emergence of agricultural societies was bound up with the end of the last Pleistocene Ice Age. More recent inquiry proposes that prerequisites of plant and animal domestication – including species selection through human application of fire - were already well underway during late ice age conditions.[14] It has been proposed that prior to intentional selection of favourable plants, foragers were drawn towards those exceptional plants that did not drop their mature seeds on the ground; in this way – unintentionally – selecting for the kind of plants that would require humans to do the work of seed dispersal but with the benefit of higher yielding, more harvestable grains.[15]

In the Middle East, the warming temperatures and increased rainfall of the waning ice age helped the spread of wheat, oats, barley and other cereals. As these wild – or already partially domesticated - grains needed winnowing, grinding and cooking to render them edible, their consumption required a toolkit of basic agrarian practices. New discoveries indicate that well before full cereal domestication, temporary harvest camps began to embed themselves into villages which included stone or mud-brick structures to both store and process grain.[16] Global climate and the built environment, we might say, passed over a threshold in tandem.

For all that most versions of the Anthropocene thesis accentuate the comparative stability of the previous epoch, it is important to remember that the Holocene was far from tranquil. It was not until 6000 years ago, about halfway through the Holocene – as currently defined, that sea-level rise precipitated by the break-up of the great Pleistocene ice sheets came to halt. Equating to a rise of 120-130 metres since the last glacial maximum, advancing seas would have progressively swamped nutritionally rich coastlands and estuaries – pushing human foraging bands inland and uphill to where the wild grasses flourished. [17]

Further global environmental change was to come: a threshold that has been implicated in the shift from small, relatively egalitarian and subsistence-based villages to large, fortified and stratified urban centres. Climate scientists propose that the Middle Holocene witnessed what is probably the most dramatic climate change of the last 10,000 years. As a result of cyclical changes in the earth's axis of rotation, global climate proceeded through a series of stepwise changes. Then, around 5200 years ago, the

climate system passed over a tipping point resulting in a long-term shift from the warmer, more humid conditions of the early Holocene to a cooler regime characterized by enhanced aridity in the tropical latitudes.[18]

Correlations between the `Middle Holocene Climatic Transition' and the rise of city states have been most fully researched in Mesopotamia, but similar patterns have been documented as far apart as north-central China, the central Sahara, the Indus region and coastal Peru.[19] In Southern Mesopotamia, research suggests, significantly drier conditions led to the abandonment of many smaller farming villages and pastoral communities – and the rapid growth of settlements on the riverine lowlands. Functioning much like `refugia' - the exceptionally fertile sites that ecologists credit with sustaining biodiversity during rapid environmental change, the annually–refreshed alluvial soils of the floodplains could support much more dense human and botanical populations than any other agro-ecosystems. In this way, anthropologist James Scott proposes, alluvium - and crop yields that it can sustain - is a condition of state formation. `It is hard to imagine the early state without grain as a basis for its sinew and muscle,' as he puts it.[20]

This is not an argument for the climatic necessity of grain-fed city-states. Some communities, it appears, adapted to Mid-Holocene aridity not through urban agglomeration but by means of enhanced mobility – and these non-sedentary peoples continued to coexist with their urban neighbours for thousands of years.[21] But where alluvial state formations prevailed, common patterns emerged – a template that included monumental architecture and fortification, pronounced social hierarchy and division of labour, a king-centred polity and centralized administration, recordkeeping and taxation.[22]

For those accustomed to more free-ranging existence, many critical commentators now insist, a life bound to arduous labouring in the fields was rarely taken on willingly. In what was most likely a highly coercive forging of labour, taxation and distribution into a workable assemblage, the materiality and affordances of grain itself were crucial. `(V)isible, divisible, assessable, storable, transportable, and "rationable"', cereal grains were a tax official's ideal object.[23] In this regard, urban built form effects a kind of doubling of containment: a brick and stone-chambered granary to safehold the precious agricultural produce and a city wall to keep the labouring, tax-paying populace in its place. And each with its own threshold.

The recordkeeping that is key to the grain-labour-land nexus of the ancient Mesopotamian alluvial state, Scott contends, signals the inauguration of a new kind of legibility or visualization.[24] `Follow the grain', it could be said, is an imperative around which the city-state formed itself. But there is another side to `seeing like a state' that we might refer to as `geologizing like a state': the city-state increasingly acting as an earth process. Just as the earliest systems of notation record the resources and outputs of agricultural production, so too does the physical act of inscribing clay tablets reiterate the cutting of channels or the plowing of fields. On a grander scale, the increasingly extensive irrigation works at the heart of alluvial grain cultivation can be seen as a human capture and embellishment of sedimentation – one the great geologic forces shaping the earth's crust.

Sedimentary processes involve the transportation and depositing of particulate matter by flowing water - or as geologists quip 'mud moves from here to there and then from there to here'.[25] So important is sedimentation for the earth, Zalasiewicz suggests, that in terms of comparative planetology `one might … denote this planet as the muddy planet, for it is the only one to be encased in a thick shell of mud and mudrock.[26] The irrigation that enabled mid-Holocene urbanization can be taken as a significant moment in the ascending geological agency of our species. As we have seen, the manipulation of mud also had a structural or vertical dimension. Anticipating the idea of `Anthropocene rock constructions', philosopher Manuel De Landa described the durable brick and stone formations of the ancient city as a re-enfolding of geology into the living world. This `sudden *mineralization*', he argues, helped to modulate the unprecedented concentration and mixture of humans and other animals, and especially `the movement of human flesh in and out of a town's walls.' [27]

So too should we heed biogeographer Léon Croizat's much earlier insistence that *`plantlife … is a geological layer of the earth.'* [28] If we acknowledge that terrestrial plants have been a significant force shaping the outer earth for at least 450 million years, then the selective breeding and extensive redistribution of botanical life at the crux of the urban-grain assemblage could itself be seen as a threshold not only in *human* but in *geologic* history. In this regard, we should keep in mind the `early Anthropocene' hypothesis which suggests that intensive agriculture - with its corollary, dense urban settlements - may have already impacted upon global climate enough thousands of years ago to delay the return to glacial conditions that would otherwise have been expected according to

the rhythms of the earth's climate.[29] But even if we settle for the later Anthropocene - it is hard to imagine the contribution made to earth system change by modern industrialized planting, fertilizing, harvesting, processing, transportation and storage of grains without the innovations of the ancient cereal-fed city.

As we consider the growing impact of industrial grain production on atmospheric concentration of greenhouse gases, it's worth remembering that the spread of grasslands across the terrestrial globe 40 million years was in large part a botanical response to carbon dioxide *depletion* in the earth system.[30] Today, the prospect we face is that of human-induced climate change reducing global grain production, with estimates that wheat yields will fall by 6% for each degree of further temperature increase – though this will be highly variable over space and time.[31]

As well as keeping our national stockpiles of `critical commodities' in a healthy state, policy analysts recommend that food-insecure countries should cultivate good relations with cooler nations whose grain production is benefitting from warmer climate. `Ensuring good trading relationships with those countries best positioned to supply wheat and barley in the long term,' we are advised, `will help to offset some of the negative effects that climate change will have as other regions.[32] Meanwhile, current international climate policy promotes the idea that `resourceful' people in less well-resourced regions who are vulnerable to climate change could make a valuable contribution to the international labour force by choosing to migrate to wealthier nations – where they would be expected to perform whatever work is available.[33]

For all that it makes sense to think of the urban as currently passing over a critical point into full `planetarization', I have been suggesting that we might also consider the urban to have been deeply implicated in geological or planetary processes from the outset. Taking cues from the genealogy of the threshold as a means to move from the `fine-grained' to the global, we might see `planetarity' as an originary complication of the city as much as a recent achievement. City formation is intimately connected with planetary dynamics, most notably through the impacts of global environmental change on the other living things upon which human life depends. But so too, from its primordial forms, can urbanization be seen as a geological process - not least because botanical life is itself a planetary force, and one that cities channel, proliferate and transform in directions that are new in the history of the earth. And as the early Anthropocene

hypothesis indicates, we may still be discovering just how much, and for how long, the urban-grain assemblage has been impacting on planetary processes.

There is a great deal that might yet be learned from the *longue durée* of geological and botanical urbanism for coping with earth system change to come, whether gradual or sudden. But perhaps the most troubling lesson is how little the script with which we enact our responses at the threshold has been revised over the course of five thousand eventful years. For there is no urban geology that is not also a sedimentation of ethical and political relating. And a substrate of alternative possibilities.

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[3] Henri Lefebvre, State, space, world: selected essays (Minneapolis and London: Minnesota University Press 2009), 198.
[4] Anatoly Liberman, Our habitat: threshold, OUP Blog, February 11th 2015 https://blog.oup.com/2015/02/threshold-word-origin-etymology/ (accessed 1 August 2018).
[5] Henri Lefebvre, "Dissolving city, planetary metamorphosis," in Neil Brenner (ed) Implosions/Explosions: towards a study of planetary urbanization (Berlin, jovis Verlag GmbH, 2014) 566-570, 569.
[6] See Wallace S. Broecker, "Unpleasant surprises in the greenhouse," Nature 328: 9 July (1987), 123–6.
[7] See Jan Zalasiewicz, Mark Williams, Will Steffen and Paul Crutzen, "The new world of the 'Anthropocene,'", Environmental Science and Technology, 44 (2010), 2228 – 2231.
[8] William Ruddiman., "The Anthropogenic greenhouse era began thousands of years ago," Climatic Change 61 (2003), 261-293; Simon Lewis and Mark Maslin, The Human planet: How we created the Anthropocene (London, Pelican, 2018), 140-2.
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[10] See Stephanie Pincetl, "Cities in the age of the Anthropocene: climate change agents and the potential for mitigation", Anthropocene 20 (2017), 74–82.
[11] Jan Zalasiewicz, The Earth After Us: What legacy will humans leave in the rocks? (Oxford: Oxford University Press, 2008), 171.
[12] Zalasiewicz et al, "The new world of the 'Anthropocene,'", 2230.
[13] Michel Serres, The Natural contract (Ann Arbor: University of Michigan Press, 1995), 16.
[14] See Johan Goudsblom, Fire and Civilization (London: Allen Lane the Penguin Press, 1992), 446.

[15] Lewis and Maslin, The Human planet, 121-122.
[16] See Michael Balter, "Ancient waves of (wild) grain," Science Magazine, June 22 (2009). http://www.sciencemag.org/news/2009/06/ancient-waves-wild-grain (accessed 1 August 2018); Yuval Noah Harari, Sapiens: A brief history of humankind (London: Vintage Book 2011) 95-96.
[17] See Colin Tudge, Neanderthals, bandit and farmers: how agriculture really began (London: Weidenfeld & Nicolson, 1998), 35-8.
[18] See Nick Brooks, "Beyond collapse: climate change and causality during the Middle Holocene Climatic Transition, 6400–5000 years before present," Geografisk Tidsskrift-Danish Journal of Geography 112: 2 (2012): 93-104.
[19] See Brooks, "Beyond collapse"; Douglas Kennett and James Kennett, "Early state formation in Southern Mesopotamia: sea levels, shorelines, and climate change, The Journal of Island and Coastal Archaeology 1:1 (2006), 67-99.
[20] James C Scott, Against the grain: a deep history of the earliest states (New Haven and London: Yale University Press), 134.
[21] See Scott, Against the grain, 222-227; Brooks, "Beyond collapse," 100.
[22] See Scott, Against the grain, 23; Kennett and Kennett, "Early state formation," 79-80.
[23] Scott, Against the grain, 129.
[24] Scott, Against the grain, 139-140.
[25] David Waltham, Lucky planet (Icon Books: London, 2014), 199.
[26] Zalasiewicz, The Earth after us, 22.
[27] Manuel De Landa, A Thousand years of nonlinear history (New York: Swerve, 1997), 26-7.
[28] Leon Croizat, Space, time, form: the biological synthesis (Caracas: N.V Drukkerij Salland, 1962), 90.
[29] See W. Ruddiman, D. Fuller, J Kutzbach et al, "Late Holocene climate: Natural or anthropogenic?," Reviews of Geophysics, 54 (2016): 93-118; Lewis and Maslin, The Human planet, 140-2.
[30] See Iain Stewart and John Lynch, Earth: the power of a planet (BBC Books, London, 2007), 221-223.
[31] See S. Asseng, F. Ewert, P Martre, R P Rotter et al, "Rising temperatures reduce global wheat production," Nature Climate Change 5 (2015),143–147.
[32] Kirsty Lewis and Claire Witham, "Agricultural commodities and climate change," Climate Policy 12 (2012), S53-S61.
[33] See Nigel Clark and Giovanni Bettini "'Floods' of migrants, flows of care: between climate displacement and global care chains," *Sociological Review Monographs*, 65: 2 (2017): 36-54.