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HOW WILL THE ANTHROPOCENE BE REMEMBERED? GEOLOGICAL TIME SCALES, PRAGMATIC BOUNDARIES, AND THE ULTIMATE CAUSES

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ABSTRACT. This paper addresses the stratigraphical problem of the Anthropocene. How does the observed timing of the event fall within the general context of the geodynamics during the Phanerozoic Eon? So far, the informal "Anthropocene", whose name was fashioned after the traditional epoch names of the Cenozoic, is far too short to be recognized as an epoch. The magnitude of the transition criterion may be sound, but it entirely depends on the future outcomes of the processes initiated by humans. Assuming a possible near-future extinction of our species, the chain of events associated with the Anthropocene would probably appear as a short-term aberration from the point of view of a future geologist. The deepest and most enduring systemic change that will be recognized in the future fossil record will be the transformed composition of the future global biota.

KEYWORDS: Anthropocene, stratigraphy, humanity, evolution, projections.

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KAIP BUS PRISIMENAMAS ANTROPOCENAS? GEOLOGINĖS LAIKO SKALĖS, PRAGMATINĖS RIBOS IR GALUTINĖS PRIEŽASTYS

SANTRAUKA. Straipsnyje nagrinėjama antropoceno stratigrafinė problema. Kokiu būdu stebima antropoceno įvykio/epochos trukmė susilygina su bendru fanerozojaus eono geodinaminiu kontekstu? Kol kas neformalus „antropocenas“, kurio pavadinimas sukurtas pagal tradicinius kainozojaus epochų pavadinimus, yra per trumpas, kad būtų pripažintas epocha. Perėjimo amplitudės kriterijus gali būti pagrįstas, tačiau jis visiškai priklauso nuo ateities procesų, kuriuos pradėjo žmonės, galutinių rezultatų. Įvykus galimam mūsų rūšies išnykimui artimoje geologinėje ateityje, su antropocenu susijusių įvykių grandinė iš ateities geologo perspektyvos veikiausiai atrodys kaip santykinai trumpalaikė anomalija. Giliausias ir ilgiausiai trunkantis sisteminis pokytis, kuris bus atpažįstamas ateities paleontologiniame metraštyje, bus stipriai pasikeitusi (dėl žmonijos sukeltų perturbacijų) ateities pasaulinės biotos sudėtis.

RAKTAŽODŽIAI: antropocenas, stratigrafija, žmonija, evoliucija, projekcijos.

Anthropocene, geological boundaries, theoretical and pragmatic stratigraphy – where is the place for the "human epoch"?

The problem and the concept of the Anthropocene emerged as an unintended side effect of the growing realisation that humans have become a new and significant agent of geological change on our planet – one as transformative (Lewis and Maslin 2015) as past geological events and systemic transitions that were codified as separators of epochs, periods and eras in the International Chronostratigraphic Chart. But where do the "Anthropocene" transitions, detected in the prehistoric and historical archaeological and paleoenvironmental records, as well as directly observable here and now, fit within the larger picture of the pragmatic science of stratigraphy? Stratigraphy is mostly concerned with how to subdivide rocks and sediments for the purpose of correlating formations and mapping of the planet's physical structure – and, more metaphorically, its history. How, then, can the Anthropocene be contextualized? And, more importantly: what are the real consequences of the transformative changes that humanity has brought to its environments for the Earth system and its biota in the context of stratigraphical patterns?

To answer these questions, we should consult the basic features and the procedures of stratigraphy. Additionally, known patterns of evolution, ecological turnover, and environmental change in the deep past should also serve as an important baseline against which we can measure the events and processes produced by our species since its emergence in the Pleistocene. Finally, the peculiar nature of the Anthropocene as a still-happening and "unfinished" candidate epoch invites us to explore counterfactual scenarios and informed projections into the future (grounded thought experiments), which could also serve as guidelines for assessing the *probable significance* of human perturbation in global biotic history.

The International Chronostratigraphic Chart (ICC), as well as other regional or global chronostratigraphic scales that form the basis for subdividing and measuring time in geology, palaeontology and archaeology, reflects a hierarchy of punctuations – sudden events of high significance relative to the duration of the separated intervals. The more severe an event was, the more lasting the effects it produced, leaving a permanent imprint on the unfolding of Earth's and life history and continuing processes on our planet. The hierarchy of eons, eras, periods, epochs, and ages is therefore a hierarchical record of the qualitative and quantitative significance of these transformative events, against which all processes that can be traced in the rock and sediment record are measured and compared. The empirical time scales,

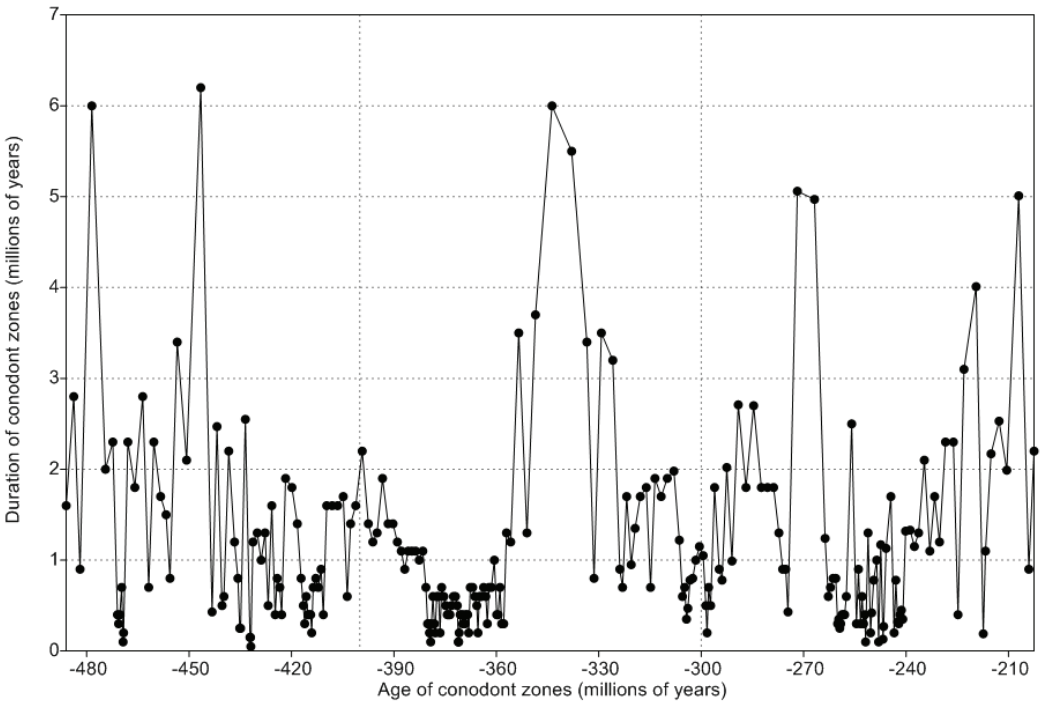

Fig. 1. The relationship between the durations of conodont zones and their age (data taken from the Lovejoy et al. 2025). The zonal time scale, which is based on the appearance and disappearance patterns of conodonts in the fossil record, is characterized by extreme unevenness, inherited from the macroevolutionary process which is responsible for this pattern. Some periods are extremely "calm" and have very slow species turnover (such as the Lower Carboniferous, between 360 and 330 million years ago), while others (such as the Late Permian and the Early Triassic (260 to 240 million years ago) are characterized by clusters of events and therefore can support very high-resolution subdivision of geological time in marine sedimentary records.

including the global standard ICC and biostratigraphical time scales based on the first and last appearances (and thus macroevolution) of zonal index species such as conodonts, graptolites, ammonoids, show great variability across the available range of time scales (Lovejoy et al. 2025). Sometimes intervals are characterized by very few globally important events that serve as easily recognizable boundaries for global stratigraphical subdivision, while other (arbitrarily long) intervals show a pattern that some palaeontologists, mockingly (but undeservedly) call "an event for every occasion". These contrasting patterns can be seen, for example, in the durations of geochronological intervals in the conodont (a kind of primitive jawless fish) zonal time scale (Fig. 1). The figure shows the time series of durations of conodont zones. Each zone represents a regionally (or globally) recognized interval with time-specific faunas, thus showing how long this widespread and easily recognizable taxon existed in the fossil record. If the duration of a zone is long (e.g. five million years), it means little significant change occurred during this interval. On the other hand, if we observe a series of relatively short zones – around 0.5 million years in the late Devonian, around 370 Ma – this signifies that the time interval experienced frequent episodes of significant faunal turnover among globally widespread species. It is no coincidence that two major extinction events (Frasnian-Famenian and end-Devonian) occurred in this interval.

The palaeobiological, palaeoclimatological, sea-level, biogeochemical and tectonic events that are the major factors determining the taxonomic turnover of biota – responsible for sharp shifts in the fossil record and thus the stratigraphical boundaries – have recently been described by the so-called "compound multifractal – Poisson process", which produces a self-similar hierarchy of clusters of events within clusters of events within clusters of events (Lovejoy et al. 2025). This suggests that the concept of an event is "time-scale-free", and that events separating intervals of little change can have a wide range of durations. Within them, we should expect faster events that in turn contain event shorter (and faster) ones. An example of such a hierarchically nested boundary-forming event could be the formation of the Siberian Traps – a Large Igneous Province (LIP) active during the Late Permian and Early Triassic – which is thought to have been the causal determinant of the largest extinction event, the P-Tr event or "Great Dying", where eruptions proceeded in several effusive and intrusive stages (Dal Corso et al. 2022). Each such stage of the LIP eruption likely consisted of numerous volcanic episodes, each composed of separate eruptions. Another boundary-defining Tr-J (Triassic-Jurassic) event occurred due to another LIP eruption, which produced a series of environmental shocks with opposite climatic effects (cooling-warming swings) caused by the countering effects of aerosols and greenhouse gases. It is thought that these episodic eruptions created massive "volcanic winters" on time scales of years to centuries, against the background of a continuously warming (CO2-driven) climate (Landwehrs et al. 2020). Consequently, if we were to view such an event from the perspective of a human lifetime (decadal timescales), each volcanic episode would appear cataclysmic and possibly epoch-defining, even though all were part of a much longer and more persistent higher-order event. These examples remind us that, in contextualizing the significance of the Anthropocene, we should always keep in mind the time scales of the disturbances used as stratigraphic markers – and whether they are isolated stand-alone features (like the asteroid impact that ended the reign of the dinosaurs) or represent longer clusters of connected causes, which are the more typical case for boundary-defining extinctions and biotic turnovers.

Now we can approach the problem of the Anthropocene. As the name of a putative geological epoch suggests, the central role here belongs to humankind – or humanity, to be precise – a now singular species of the genus Homo, *Homo sapiens* itself. The major arguments revolve around the placement of the lower boundary of the Anthropocene series (that's how the geological embodiment of the epoch-scale time unit is called in stratigraphy). Usually, the search for a candidate geological section starts with the evaluation of criteria for the consistent, geographically widespread, and time-specific features in environmental markers or taxonomic changes during a purported transition. One such time-specific feature proposed as the defining marker of the Anthropocene is the appearance, in high abundances against the stratigraphical background, of the artificially synthesized element plutonium (Pu) – which, under natural conditions, could only be brought to Earth by a shock wave following a supernova explosion. This element enriched the atmosphere and other environments and was subsequently sequestered into sediments after the development and testing of nuclear and thermonuclear weapons in the second part of the XX century (Zalasiewicz et al. 2020). Another marker, also related to nuclear testing, is the peak in abundance around the 1950s and 1960s of the radioactive isotope of carbon ^{14}C. This isotope is also produced in the upper layers of the atmosphere during nuclear reactions of cosmic rays with nitrogen atoms. Therefore, in organic records containing carbon, the onset of the Anthropocene is detectable as a positive geochemical anomaly against the exponentially decreasing natural abundance of ^{14}C. Still another marker – this time of a morphological-geochemical kind – is the presence of spheroidal carbonaceous particles (SCPs) which are produced only in high-temperature industrial combustion of oil or coal and are correlated with the spread of the Industrial Revolution (Waters and Turner 2022).

We can ask ourselves: are these definitions of human domination of the planet the best and most objective markers? Was it the Industrial Revolution or the first use of nuclear weapons that heralded the exact moment when humans began exerting a deeply transformative impact on the biota and Earth systems?

Let's start tackling these intertwined problems from the first question. For the unengaged reader it may seem that the presence and the peaks in the abundance of such materials as radioactive radiogenic and radioactive carbon ^{14}C or synthetic elements such as plutonium (Pu) are geologically ephemeral (because of their short half-lives) and will decay after relatively short periods – on the order of tens to hundreds of thousands of years. The durability of SCPs is much higher, and in fine unlithified sediments, these traces of anthropogenic forcing can, in principle, survive for millions of years. On the other hand, the duration of these markers in "absolute" time is rather limited, and given typical sedimentation rates and post-sedimentation diagenesis and compaction of rocks, all these records would eventually be condensed into very thin layers even if they survived all the contingencies of geological processes – a thin, centimeter-scale layer that would, in all likelihood, be missed when studying thicker sections spanning hundreds of meters to kilometers. Sometimes, however, stratigraphically consequential rock layers only centimeters thick are detected and recognized as such. One example is the "fish clay" layer that separates Cretaceous chalk from Paleogene chalk in the seaside outcrops of Stevns Klint in Denmark, on the shores of the Baltic Sea. This rare, iridium-enriched layer (Alvarez et al. 1980) was formed from spherules – secondary meteorites condensed from material ejected by the giant asteroid impact that struck what is now the Yucatan Peninsula. Yet it should be noted that such a minuscule anomalous feature would most likely have been missed if not for the global biotic change at exactly the same level, which spurred interest in searching for unusual features in that particular stratigraphical position. The anomalous layer was recognized as such not because it stood out during routine analysis, but because an abundance of paleontological evidence had already pointed to where we should look for the "smoking gun" of the era-boundary-defining extinction.

We can argue, that the Industrial Revolution caused the appearance of many new materials (ceramics, plastics, other fabricated compounds) and anomalous quantities of existing materials (e.g. the increased abundance of phosphorus due to the use of fossil fertilizers), which together form a distinct boundary marker – similar, in a sense, to the iridium-enriched layer at the K-Pg boundary. And we would be right to identify this as an easily recognizable boundary. The problem arises, however, from the very short duration and thin trace of this boundary in the strata. In the future geological record, even in relatively complete sections, the disappearance of megafauna will appear first, while the increased abundance of alien materials will appear later. Many geological sections will lack this thin layer altogether, since the geological record is full of gaps – and these gaps become more severe at higher resolutions (thus, at increased resolution, the fossil record is more gap than record). Bearing in mind the relatively close temporal proximity of both the extinction of the Quaternary megafauna and the Industrial Revolution, from the perspective of deep time (millions of years in the future), both markers will likely be seen – rightly so – as temporal elements of a single (human expansion) event.

Given the vastness of the geological record and, at the same time, the large numbers and diversity of outcrops around the world that can be explored, exploratory geological studies are necessarily sparse and approximate in their sampling strategies. In large-scale stratigraphic studies usually, sampling is usually done at resolutions of hundreds of thousands to millions of years. Higher-resolution sampling is applied adaptively, when something of scientific interest is detected at broader scales. In deep-time studies, increased sampling intensity can sometimes achieve resolution of several thousand years (Rinkevičiūte et al. 2025). Fortunately for the Earth's stratigraphy, the traces of biological evolution in the rock record – or, as we call them, fossils – allow such effective exploration. We can trace species ranges at a coarse resolution, but if we find that certain groups of species disappear while new ones appear, it may indicate that we are encountering a geologically significant boundary signifying a transition between epochs, periods, or even eras. The search for the exact structure of such transition occurs through progressively denser sampling – equivalent to an optical "zoom-in" with a microscope – except that here, instead of observing protozoa, we are tracing increasingly finer filaments of time as recorded by the accretionary layers of rocks and sediments.

Applying the stratigraphical principles and imagining the *future deep time* perspective on the present past

Here we return to the stratigraphical problem of the Anthropocene, which is partially based on the processes that have already occurred, but we also need to consider the processes that will continue into the future and will produce distinctive pattern, which will be imprinted in sediments and rocks.

Currently, definitions of the geological boundary concentrate on the appearance of specific human-made materials that help discriminate older from newer sediments. However, this approach to defining the boundary – and to conceptualizing the Anthropocene both as an epoch and as a set of dynamic transformations – is a faulty one. First, the materials produced by humans are rather ephemeral, and in the long run of tens to hundreds of millions of years, most will disappear through natural decay, sediment diagenesis, or rock metamorphism, leaving no trace. Second, the duration of the productive interval for all such markers is very short: for instance, the massive burning of coal (and thus the emission of specific aerosol particles) lasted no longer than several centuries, while nuclear weapons testing was even briefer – on the scale of decades. These traces would leave a layer of very small thickness, and given the ever-present erosion, in most parts of the world this short marker of change would be erased or never recorded. Third, the chemical, sedimentological, and isotopic perturbations do not really mark the causal beginning of the great transformation brought upon the Earth and its biota by humanity.

The deepest and most enduring impact of our human species on the biota – and consequently on the fossil record – occurred thousands to tens of thousands of years ago, in the late Pleistocene Epoch and during the transition from the Pleistocene to the Holocene Epoch (the official epoch in which we currently live). The convergence of evidence on the timing of Ice Age megafaunal extinctions shows a coherent pattern matching the spread of *Homo sapiens* from Africa across the Old and New Worlds (Sandom et al. 2014). Even though the megafauna represents only a tiny fraction of all species that occupy our planet's environments, their physical size and the immense fluxes of food and nutrients they processed gave them a disproportionate impact on ecosystem structure and function. Modern elephants – and, as trace fossils show, their relatives wooly mammoths (*Mamuthus primigenius*) – not only destroy woods and thus create and maintain open savannah- or steppe-like habitats, but also disturb sediments and rocks through stomping, digging, and moving soils or scratching substrates, thus forming macro-scale features such as channels or tracks that affected water flow, erosion, plant growth, and the movement of other animals (Haynes 2012). Therefore, the disappearance of giant mammals, birds, and reptiles from continental biotas over several tens of thousands of years had a global and lasting effect on ecosystem structure. The escalation of biotic change continued after the extinction of many large animals, well into the Holocene, when the domestication of wild species and the spread of agriculture occurred across the globe. These processes essentially reshaped the biogeographical structures of large mammalian communities, thus leaving significant biogeographic imprint on the world (Brook et al. 2025).

The paleontological and archeological records show that the Anthropocene is merely another short-term phase in the long sequence of disruptive transformations induced by our species, which evolved endogenously within the biosphere. Earlier phases – though driven by much smaller populations and simpler technologies –

will, in all likelihood, leave a more permanent mark in the fossil record, because they produced not only ephemeral materials but also fundamentally changed the pace of the biotic evolution. This ongoing evolutionary process continuously generates traces of these transformations: the fossils of organic beings, which are among the most robust and persistent markers of change.

Therefore, future explorers of the fossil record we are now producing will probably locate the boundary between epochs near the beginning of the Holocene – or perhaps even deeper, in the Pleistocene – when the first significant extra-African megafaunal extinctions began, around 50 000 years before present. It should be noted that in the far future, many details will be lost, and procedures of correlation and subdivision of time units will likely use the disappearance of megafauna and modern-century geochemical markers, separated by tens of thousands of years, interchangeably – much as we now do for ancient events, where some sections better preserve geochemical patterns and others better preserve fossils. On a larger scale, the "Anthropocene" transition will be recognized through the patterns of first and last appearances of fossil species.

Into the past of the future

While most of the debates on the definition and the nature of the Anthropocene concentrate on "shallow time" or "recent past" records and sometimes consult the deep-time perspective of multiple million years, we cannot ignore a profound peculiarity of this geological interval. The Anthropocene, whatever its exact definition (or even if it is a part of the Holocene), is still ongoing, and is therefore causally incomplete – this creates a procedurally different situation than in the classical cases of all other time intervals of the geological past. The most critical thing that will determine the scope of the Anthropocene – whether it will be a time interval of epochal significance – is the survival of our species and, even more importantly, our technological and domesticated biotal background at large scales. If humans go extinct in a short time, or even if they do not go extinct but decline significantly in numbers, their effects on the Earth system will fall dramatically. Under these new conditions, the re-equilibration of biota and Earth systems will start immediately and will reach a new background condition not so dissimilar to the pre-*Homo sapiens* Quaternary.

A highly popular theme related to the debate of the significance of the Anthropocene in the geological context is the concept of the so called "Sixth Mass Extinction", which is supposedly already underway and comparable in magnitude to the classical "Big Five" mass extinctions of the Phanerozoic Eon, distinguished from the background by Raup and Sepkoski (1982). The environmental degradation – including the fall in abundance and shrinking geographical ranges of many species – related to human activities is rather obvious. On the other hand, the current level of damage to the biosphere is far too small in comparison to the extinction events that happened in the geological past (Wiens and Saban 2025). If such an event were to happen, it would undoubtedly have transformative effects on biota, and consequently on the fossil record and stratigraphical patterns. Everything depends on how things will unfold in the future, and the "Sixth Mass Extinction", although implicitly, is also the conclusion of results about *the future*. Therefore, here we already see a precedent in the analysis and a motivation for the establishment of a new geological subdivisions – motivated not only by historical facts but also by probable, or at least possible, future projections of the key aspects of the world.

The future projections, which are a necessary component in the consideration of this non-classical candidate – the Anthropocene – for a geological epoch, are characterized by the so-called "tyranny of scales" – a generic feature of geosystems which states that they vary across a huge range of space and time scales. This phenomenon is rarely addressed in conceptual discussions on scientific modelling (Bokulich 2021), and in discussions on the nature of the Anthropocene in particular. We can see from the previously presented facts and their discussions that the markers suggested for the separation of epochs have different half-lives and also durations of production. All human-related materials, structures, and biotic components (such as domesticated animals and plants) can be produced only in the presence of humans; therefore, they are predicated on our continuous existence, which is far from guaranteed for geologically significant stretches of time. On the other hand, the changed wild biota or domesticated animals that transition back to a wild state and diversify further will certainly serve as a great fossil marker of the emergence of human domination and its possible (others argue inevitable) demise.

Given the short realized duration of the Anthropocene, and the changes that have already occurred in geochemical parameters (such as stable isotopic ratios of oxygen isotopes and radioactive isotopes of carbon and plutonium), if future scientists of an unknown sapient species, similar in scientific approaches to humans, were to explore the geological record, they would find a sharp but ephemeral spike in almost any monitored quantity or its proxy (e.g. temperature, oxygen saturation of ocean waters, sedimentological features of a core etc.), which could easily be overlooked if sampled at a typical research resolution. The most consequential and longest-persisting patterns — thus best represented by the fossil record — would be the extinctions of numerous taxa, the global dispersal of alien species, and the subsequent evolutionary radiations of newly evolved clades from previously anthropogenically dispersed ancestors (as has happened in other dispersal events in the geological past (Stigall 2019)). These processes will unfold on time scales of thousands to millions of years after the relaxation of the initial anthropogenically caused evolutionary and biogeographic perturbation. If there is a genuine mass extinction, the fossil record suggests that the recovery could take up to 40 million years (Alroy 2008). The greatest "lesson" Earth's biota will remember – by means of selection and genetic heritability of the preserved lineages – will be "how to survive the ecological and climatic effects of a severe, globally abundant generalist". Subsequently, the biosphere will emerge even more resilient as has occurred after past great perturbations (Miller and Foote 2003) but probably appear rather exotic to modern human eyes. Later tectonic and climatic perturbations, which will reshape the face of our planet and the biota that occupies it after tens of millions of years (Spiridonov and Lovejoy 2022), will erase any biogeographic anomalies imposed by human-mediated dispersal of species.

Our current luxury of knowledge of the recent past gives us an opportunity for the definition of an event (at an unprecedented scale in the broader history of the Earth) with high resolution. We can argue where to best place the candidate Anthropocene Epoch boundary: should it be in the deeper past of the Late Pleistocene, when humans expanded geographically for tens of thousands of years, or, alternatively, when large-scale industrial impact took place in a much shorter period of time? In the deep future these events will most probably look nearly synchronous, and there will be questions of causality. If, on the other hand, future scientists have unprecedented time resolution and can decipher causality nearly perfectly, they will come to the conclusion that the process which led to the state shift in the biosphere was diachronous. Innovations (and disturbances caused by them) originate in certain places and times, and it takes time to spread to unoccupied and unaffected places – be it the origins of advanced spear points or industrial technologies. Even a moderately good fossil record, if analyzed properly, will show an escalatory increase in the human impact over time, similar to the epidemiological curves of the number of infected people. The exponential-like rise always has the same shape, but as time progresses, the absolute impact increases proportionately faster – this is essentially the same graph as that of an "explosion". Where to draw the line inside this pattern, separating pre- and post-state, is an arbitrary decision. Future generations of scientists (of whatever species) could decide to accept the entire period from the origin of *Homo sapiens* to the time of the maximal impact of our species (which is currently unknown) as one long – on human lifetime scales – but relatively short on geological time scales – boundary interval.

How future sapient creatures (or perhaps the same humans, if they achieve truly long species duration) will "remember" and imagine the Anthropocene from the known stratigraphical record remains open. No matter where exactly the line separating the Anthropocene from the rest of the Quaternary will be drawn, the onset of a new state, from the rock-record perspective, will look extremely sharp. Even if future "they" decide that the transition happened during the entire geographical expansion of *Homo sapiens*, tens of thousands of years are typically reflected in marine sediments (which are most likely to survive in the long run) by less than a meter of strata in a succession that can span hundreds to thousands of meters in thickness. Even if there is no direct written history in the narrow sense, there will be enough evidence to detect the explosion-like process of human population rise, technological advancement, and all the side effects of these processes – "the Earth system engineering" (Darroch et al. 2025) – which resulted in increasingly anomalous compositions of sediments. Many details of the transitions will be lost in the sands of time and will depend on the duration of the large-scale civilization. Regardless of the exact definition of the boundary – which, if detected in the future, will no doubt be debated, as are currently debated the exact placements and criteria for the K-Pg boundary of the "dinosaur extinction" – we currently live in a "long now" transformative moment, mostly thinking about the destructive and disruptive effects of human and technological activity, since these are the most apparent and objectively important features for our immediate survival and thriving. From the perspective of the deep future, even if the Anthropocene event causes further severe cascades of extinctions and disruptions, these transformations will be compensated, in equal measure, by the much slower evolutionary restructuring of biotas. These future biotas will be the defining features contrasting with the pre-Antropocene past, and they, from the perspective of future scientists, will be understood as *the norm* and *the background* – necessary and sufficient for the functioning of the future biosphere, and thus as a positive state.

The major contrast, no doubt, will be recognized as the change in species – and, more generally, the taxic composition of dominants – of the biosphere. The extinction of dinosaurs changed the landscapes, paving the way for more closed habitats with dense forests and different kinds of hydrological fluvial regimes (Weaver et al. 2025), which were favourable for our primate ancestors and our later emergence in a contingent series of evolutionary events. Similarly, future explorers will, by necessity, find post-Anthropocene adaptation and restructuring of environments into the future-familiar forms as a necessary, although contingent, step in the history of life and their own emergence. Humanity and the Anthropocene (regardless of its duration) will be seen as one of the few endogenous – and thus exceptional – transformative events. If causality is reconstructed in sufficient detail, future sapient natural philosophers will see the expansion of humanity as an internally emerged (endogenous) global-scale long-fuse “biocultural bomb” that steered the wheel of the contingent history of life – a lesson, and a rich record for the preservation of their own future.

The problem of the Anthropocene is rather unique in its unfinished nature for the science of stratigraphy, whose main task is the objective documentation of past (and therefore complete) events. We are living at the boundary between the past and the future, and since the present is never finished, in order to weigh the significance of current events, we need to employ science-informed thought experiments over the whole range of relevant facts, models, projections, and uncertainties surrounding them. The present in such a futuro-paleontological perspective (from the deep-future point of view), is placed on equal footing with all past events, episodes, epochs, and periods. The presented pilot analysis offers new opportunities for scientists and philosophers to engage with the problem of the Anthropocene and thus help us better understand our impacts, self-reflect, and re-evaluate our goals and values across the whole range of time scales.

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