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ANTHROPOGENESIS DEFINATION, ZOOLOGICAL CONCEPTS

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Abstract

The Economist declared "Welcome to the Anthropocene" on its front page, and in 2013 a well-received series of art exhibitions in Berlin explored "The Anthropocene Project." The moods around these discussions range from alarm and urgency, through wistful nostalgia or pragmatic management, to optimistic grasping of opportunity. The Anthropocene has become a scientific and cultural zeitgeist, a charismatic mega-category emerging from and encapsulating elements of the spirit of our age. It may be a passing cultural fad or end up as something more enduring; it is used in different ways by different users, but it is undoubtedly a core aspect of contemporary thinking about the environment.

keywords: Anthropogenesis, Zoological

INTRODUCTION

A new epoch, the Anthropocene, is in the air. Climate scientists, geologists, archaeologists, historians, ecologists, social scientists, and philosophers are debating this concept, and it has been embraced by writers, activists, the arts, and poets. The deliberations of an obscure scientific working group and the conventions of geological stratification are the focus of media and public attention. Prestigious prizes have been awarded to books with titles such as Adventures in the Anthropocene (1) and The Human Age (2), while a plethora of other books or papers muse on, among other things, "freedom," "art," or "learning to die" in the Anthropocene. In 2011, The Economist declared "Welcome to the Anthropocene" on its front page, and in 2013 a well-received series of art exhibitions in Berlin explored "The Anthropocene Project." The moods around these discussions range from alarm and urgency, through wistful nostalgia or pragmatic management, to optimistic grasping of opportunity. The Anthropocene has become a scientific and cultural zeitgeist, a charismatic mega-category emerging from and encapsulating elements of the spirit of our age. It may be a passing cultural fad or end up as something more enduring; it is used in different ways by different users, but it is undoubtedly a core aspect of contemporary thinking about the environment.

There are many versions of the Anthropocene implied by different usages of the term, but amid this melee several common themes do usually emerge. The core concept that the term is trying to capture is that human activity is having a dominating presence on multiple aspects of the natural world and the functioning of the Earth system, and that this has consequences for how we view and interact with the natural world—and perceive our place in it. Unlike previous terms that seek to embody human impacts on the environment, Anthropocene adopts the formal nomenclature of an epoch of the Geologic Time Scale, deriving from the Ancient Greek anthropos ("human") and -cene from kainos ("new" or "recent"). Adoption of this geological term serves to highlight that contemporary environmental changes are planetary in scale and significant on the timescale of Earth history and thereby draws attention to the magnitude and all-encompassing nature of these changes. It is this geological framing—a source of much of the potency of the term—that offers a route to scientific formalization but also causes scientific and interdisciplinary friction. From its origins as a concept in the natural sciences, the term has spilled across disciplines into the social sciences and humanities and into the wider cultural and political discussions surrounding how to live on and respond to the challenges of a human-dominated planet. Much of the vigor of this term now comes from these wider cultural and philosophical debates. Other key features of the Anthropocene often include emphasis on (a) the global and pervasive nature of the change; (b) the multifaceted nature of global change beyond just climate change, including biodiversity decline and species mixing across continents, alteration of global biogeochemical cycles and large-scale resource extraction and waste production; (c) the two-way interactions between humans and the rest of the natural world, such that there can be feedbacks at a planetary scale such as climate change; and (d) a sense of a current or imminent fundamental shift in the functioning of our planet as a whole.

Understanding the debate about the concept of the Anthropocene requires delving across a range of disciplines including geology, climate science, Earth system sciences, archaeology, history, philosophy, political economy, and social theory, as well as a range of timescales from deep Earth history, human prehistory, the dawn of agriculture, the European conquest of the Americas, the Industrial Revolution, the modern era, and the near and far future. Much of the potency of the term results from its embracing and stimulating new thinking across so many intellectual disciplines and cultural spheres. This range of disciplines is a challenge but also makes it such a thoughtprovoking, exciting, and important topic to address, for in trying to define the Anthropocene we try to define the deeper meaning and context of the modern environmental challenge—and the relationship between the human and the natural. This review attempts to pull together and organize some of the key arguments in the voluminous recent literature on the Anthropocene, serving as one possible guide through this forest of disciplines and perspectives.

REVIEW LITERATURE

Shmarko Konstantin (2018) This work examines the main factors of anthropogenesis as an integral part of general biological evolution. As the initial premises, the author relies on the fundamental provisions of the theory of dissipative processes, which allows us to consider the biocenosis as a complex nonequilibrium system. Such a systemic transition to the level of natural sciences reveals the general factors of biological evolution, as well as the features of anthropogenesis and social processes, considered as systemic sublevels. Using the provisions of the theory of self-regulating systems, the author shows that the main factor of human evolutionary superiority is his ability to build up empirical knowledge, created by an algorithmically uncontested method of trial and error. The analysis reveals the importance of social institutions in increasing knowledge and maintaining conditions that create advantages for some types of social systems over others. The proposed approach allows us to supplement Friedrich Hayek's theory of dispersed knowledge with provisions that eliminate its inherent internal contradictions, and also allows us to substantiate, from the standpoint of natural sciences, the philosophical concept of Karl Popper's "third world". It is shown that the obtained theoretical conclusions are in good agreement with modern anthropological ideas about the periodization of the evolution of hominids.

Islam, S.M.R., Islam, M.S., and Hasan, M.R. (2021). Fishing and Livelihood Pattern of Local People Around Ghurdaur Pond, Bangladesh. Journal of Fisheries, 9(2): 612-619. This study examined the fishing practices and livelihood patterns of local communities around Ghurdaur Pond and identified opportunities for sustainable resource management.

Research on the bottlenose dolphin has highlighted its unique adaptations to its aquatic environment. The dolphin's streamlined body shape and powerful flippers allow it to move through the water with ease (Fish, 2016). The dolphin's echolocation system is also a remarkable adaptation, as it allows the animal to locate and track prey in murky waters (Norris & Harvey, 1972). The dolphin's complex social behavior and vocal communication have also been extensively studied, revealing a highly intelligent and socially complex animal (Smolker et al., 1997; Janik & Slater, 2000).

Comparative anatomical analysis of the African elephant and bottlenose dolphin has revealed similarities and differences between the two species. For example, both species have four-chambered hearts and are warm-blooded, or endothermic. However, their skeletal structures are vastly different due to their adaptations to different environments. The elephant's thick, solid skull can support the weight of its massive tusks, while the dolphin's delicate, streamlined skull minimizes drag in the water (Moyà-Solà et al., 2006). Similarly, the elephant's teeth are adapted for grinding tough vegetation, while the dolphin's teeth are adapted for catching and holding onto prey (Fish, 2016).

RESEARCH METHODOLOGY

The term Anthropocene was coined by Paul Crutzen in 2000 (Crutzen, 2002; Crutzen & Stoermer, 2000) during a review of the first decade of research in the International Geosphere–Biosphere Programme (IGBP). The term crystallized the growing realization in the Earth System science (ESS) community that human activities were fundamentally changing the Earth System (Steffen et al., 2020). The ESS focus on planetary processes, including significant global changes to the atmosphere, biosphere, cryosphere, geo- sphere, hydrosphere, pedosphere, technosphere, and the climate, demonstrated that conditions typical of the Holocene (specifically, the last 11,700 years of Earth history) no longer resembled those of the present day. In proposing this new term, Crutzen and Stoermer (2000, p. 17) indicated the onset of the Anthropo- cene as "the latter part of the 18th century … when data retrieved from glacial ice cores show the beginning of a growth in the atmospheric concentrations of several 'greenhouse gases', in particular CO2 and CH4." They, and Crutzen (2002), linked this physical record with the global effects of human activities associated with the onset of the Industrial Revolution in the UK, catalyzed by the development of a greatly improved steam engine by James Watt.

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3.3 THE ANTHROPOCENE FROM AN ESS PERSPECTIVE, AS A NEW STATE OF THE EARTH SYSTEM

As indicated above, the concept of the Anthropocene was born in the ESS community, itself a relatively new development in the natural science research arena. Building on the work of such pioneers as Vladimir Vernadsky (Grinevald, 2007) and James Lovelock (1979), the thrust of ESS is far more integrative and trans-

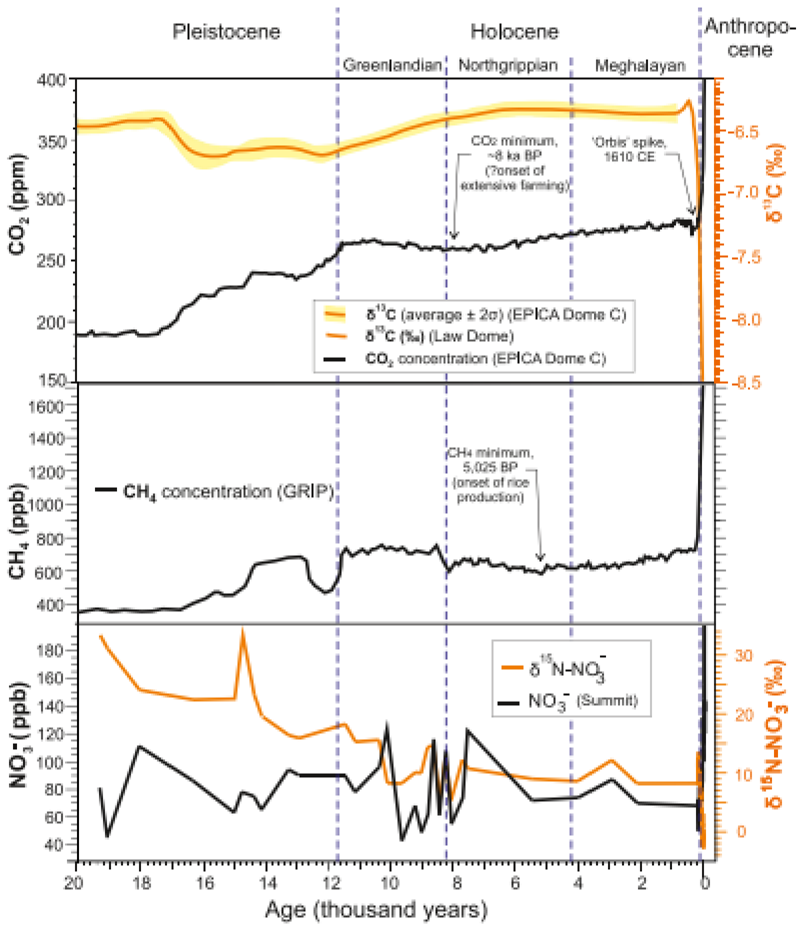

Fig. 3.1 Comparison Of Some Key Trends In The Later Part Of The Pleistocene/Holocene And Anthropocene, Adapted From Figure 2 In Zalasiewicz, Waters, Head, Et Al. (2019). See C. N. Waters Et Al. (2016) For Sources. These Trends

are recorded in polar ice layers, illustrated here because they are a continuous, well-studied stratigraphic record that includes detailed information on key atmospheric components, including greenhouse gases and aerosols. The uppermost panel shows how atmospheric carbon dioxide (black line) rose by ∼80 ppm over ∼6,000 years around the Pleistocene–Holocene transition, a rapid rise in past geological context but dwarfed by the sharp >120 ppm (and continuing) rise to well beyond the Holocene (and indeed Quaternary) ceiling since ∼1850 CE (the greater part since

∼1950 CE); the orange line shows the carbon isotope composition of the gas (a widely used geological measure of the global carbon cycle through Earth history) showing an equally striking inflection toward much lighter isotopic values, the result of burning isotopically light fossil fuels. The middle panel shows the trend of atmospheric methane, which shows an even more pronounced sharp rise in the Anthropocene. The lowest panel, of ice-bound nitrates and the isotopic composition thereof, shows a more irregular latest Pleistocene/Holocene pattern, though with sharp inflections also in the Anthropocene. At a first approximation, the trends for these (and many other) parameters are near horizontal in the Holocene, abruptly changing to near vertical in the Anthropocene.

disciplinary (Figure 3) than occurs in most areas of academia. ESS operates on the premise that "the Earth System behaves as a single, self-regulating system comprised of physical, chemical, biological and human components, with complex interactions and feedbacks between the component parts" (Steffen et al., 2004,

p. 298). The Earth System is defined as having an outer spatial boundary at the top of the atmosphere but a rather fuzzy lower boundary depending on the time scales of interest (Lenton, 2016). A related concept is that of the Earth's Critical Zone, the interdisciplinary and integrated study of the Earth's surficial terrestrial processes (Richter & Billings, 2015). The development of Critical Zone science has extended the importance of soils beyond traditional policy areas of agriculture, into significance in developing water, climate change, biodiversity, energy resource, and cultural policies (Montanarella & Panagos, 2015).

The interaction between the nascent ESS community and the well-established field of geology (Figure 3) was pivotal from the very beginning of ESS. For example, the International Geophysical Year (IGY) in 1957–1958 brought together scientists from 67 countries to study the geosphere in a highly integrated way, creating a step-change in our understanding of meteorology, oceanography, and glaciology—all central to understand- ing the Earth System as a whole (Beynon, 1970). Nevertheless, the IGY largely ignored biology, which was finally integrated with other disciplines during the IGBP, beginning in 1986, and during the

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International Polar Year of 2007–2009 (Summerhayes, 2008). The links between ESS and stratigraphy have been particu- larly important, with the continuous stratigraphic record, as embodied in the GTS, providing insights into the evolution and dynamics of the Earth System throughout its 4.54 billion year history (Steffen et al., 2016).

The stage for the Anthropocene concept was set by the detailed record of Earth System dynamics through the Holocene, based on the multitude of stratigraphic data synthesized by IGBP's PAGES (Past Global Changes) core project. PAGES supports research on the Earth's past climate and environment to obtain better predictions of future trends. In fact, Paul Crutzen, in proposing the Anthropocene, was reacting to a presentation of PAGES research at the annual meeting of the IGBP Scientific Committee, held on February 22–25, 2000 in Cuernavaca, Mexico; Crutzen interrupted the presentation by forcefully asserting that the Earth System was no longer in the Holocene. Thus, in addition to introducing the term "Anthropocene" to the ESS community, Crutzen made the connection between the GTS and, in some cases, state changes in the Earth System, changes in this case clearly driven by human action.

The Anthropocene was quickly adopted by the IGBP as the primary organizing principle when it restruc- tured for its second decade of research in the early 2000s (e.g., Steffen et al., 2004). Projects were organized around the land, ocean, and atmosphere, as well as a strong focus on the interactions between them (e.g., land-ocean). The core of the effort was built around PAGES and Analysis, Integration and Modeling of the Earth System (Schimel et al., 2015), which integrated the work of the individual projects as well as being linked to the World Climate Research Programme, the International Human Dimensions Programme, and Diversitas, a biodiversity-oriented program. The strategy was to build a coherent research effort along a timeline from the geological past through the present and into the future. The overall aim was to understand the changing dynamics of the Earth System as a whole, and in particular the state change in the system that was unfolding as a result of the broad range of human pressures.

As the concept of the Anthropocene became more widely adopted in the ESS community, the focus shifted away from an earlier model of progressive change from Holocene to Anthropocene to that of a clear, rapid transition in the state of the Earth System. This transition occurred in the mid-twentieth century, albeit with many earlier human-driven changes to components of the Earth System (Figure 1) that as a whole remained within the envelope of the Holocene. The transition away from a well-defined Holocene state of the Earth Sys- tem, as embodied in the Great Acceleration, is thus consistent with the definition of the Anthropocene from a geological, chronostratigraphic perspective (Steffen et al., 2016). Where the Earth System trajectory is headed in the Anthropocene is an open question. The Anthropocene is currently characterized by an exceptionally rapid rate of change of the Earth System (Syvitski et al., 2020), whose ultimate state is yet to be determined by a combination of human actions and Earth System responses (Lenton et al., 2019; Steffen et al., 2018).

3.4 THE ANTHROPOCENE AND CONCEPTUAL APPROACHES EMERGING IN SOME OTHER DISCIPLINES

Following the origin and initial use of the Anthropocene in ESS since the early-2000s and the beginning of its geological analysis as a potential addition to the GTS since 2009 (via the "analytical levels" of Figure 3), the Anthropocene began to be used by a much wider range of academic communities, notably within the human- ities and social and environmental sciences, including anthropology, archaeology, history, geography, sociol-

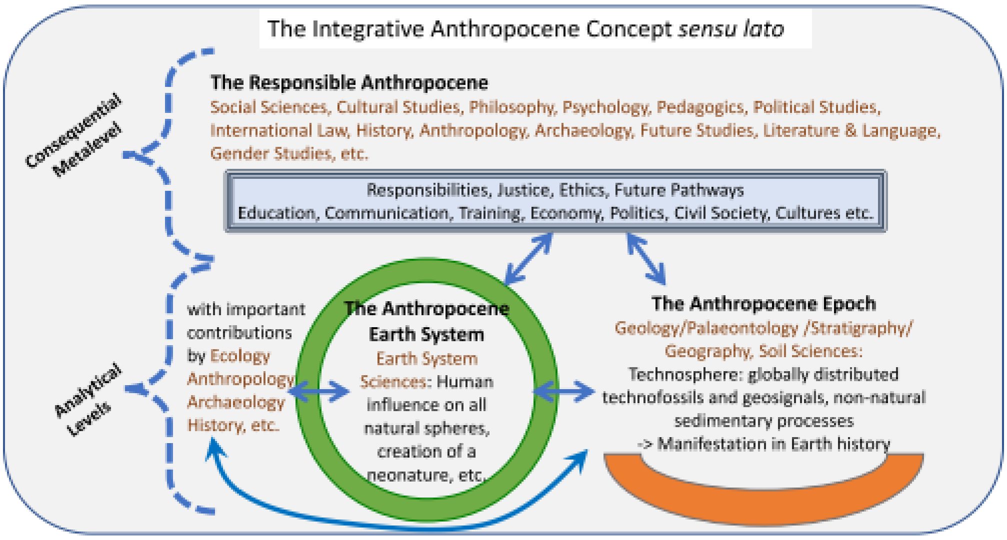

FIG. 3. 2 Opening further discussion: Sketch of a possible integrative and extended multilevel Anthropocene concept, highlighting systemic and interlocking interdisciplinary and transdisciplinary approaches (based on Leinfelder, 2018, Figure 2; see also discussion draft by Leinfelder, 2020). "Anthropocene" in the humanities and social sciences is a synthetic, less precise term that hints at an understanding of human responsibility.

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Instead of being an issue of precise definition, it begets criticism and debate (including the alternative terms) in order to understand more fully the deeper (i.e., political, ethical, cultural, and epistemic) implications of the diagnosis inherent in the scientific term. Formalization of the term is one side of the debate, and it will form an important point of reference for the humanities and social sciences to engage with the science. On the other hand, the humanities/social sciences aim at a more differentiated and thus more flexible understanding of the Anthropocene as a human-influenced state of the Earth System and as a cultural threshold. This wider understanding should be seen as complementary to the very precise, strict understanding in geology/ESS. While the scientific term is descriptive and analytical with regard to a given state of affairs, the humanities term is either normative (what should we do now?) or narrative ("how did we get here?"), or both ("why did we get there?").

DATA ANALYSIS

Many anthropologists and archaeologists consider that the Anthropocene began thousands of years ago, based on differing criteria that typically require a diachronous onset. Smith and Zeder (2013) emphasized key human innovations such as crop domestication representing "environmental engineering" or "niche construction," which for these authors make the Anthropocene essentially coeval and synonymous with the Holocene. Their interpretation, though, emphasizes the early cause (inception of this novel form of human interaction) over the stratigraphic effect (consequence) or the magnitude of planetary alteration and hence reworks the Anthropocene according to archaeological/anthropological criteria, rather than chronostratigraphic (geological) ones in which the correlation potential of stratigraphic signals is key to identifying a time unit. However, a direct causal link between today's stratigraphic effects attributed to the Anthropocene and such early "causes" is difficult to establish, since these human activities are dis- tant precursors of the larger transformations at much later stages in the development of human societies.

OTHER "EARLY ANTHROPOCENE" CONCEPTS

Of the various "early Anthropocene" concepts, only one overtly sought to combine a multimillennial An- thropocene span in concordance with standard procedures in defining a geological time unit (i.e., via a GSSP or "golden spike") (Wagreich & Draganits, 2018). These authors used evidence of early mining and smelting lead anomalies in various "natural" archives to propose a lower boundary for the Anthropocene at one of two significant events:

(1) at around 3000 BP with the first mining-induced spike of pollution, defined by lead enrichment and changes in 206Pb/207Pb ratios or (2) at around 2000 BP associated with more extensive Roman mining.

The signals are widespread, but nonetheless regional. Peat bogs through- out Europe offer clear evidence of Roman atmospheric Pb contamination (e.g., Cloy et al., 2005; Kylander et al., 2005; Le Roux et al., 2004; Monna et al., 2004; Shotyk et al., 2005), but there is no evidence of this sig- nal in peat bogs sampled in North America (Pratte et al., 2017a, 2017b; Shotyk et al., 2016) or southernmost South America (Sapkota, 2006). The Wagreich and Draganits (2018) proposal of a GSSP based upon these far-field, albeit regional, stratigraphic records might be accommodated within the recent tripartite formal subdivision of the Holocene (Walker et al., 2018, 2019). However, the related shifts in Pb isotopic ratio are much smaller than early/mid-twentieth to late-twentieth century isotope shifts observed across Europe due to widespread use of isotopically distinct lead from Australian Precambrian Pb ores in leaded gasoline (e.g., Cundy & Croudace, 2017; Eades et al., 2002; Shotyk et al., 1998). The early Pb enrichments are also substantially smaller than those in the nineteenth and twentieth centuries caused by increased coal burning and leaded gasoline use. An alternative concept, intermediate between the “early Anthropocene” and the one linked with modern industrialization, is that of an Anthropocene associated with the arrival of Europeans in the “New World” in 1492. This event resulted in a major human population loss and replacement, increased globalization of human foodstuffs, regional forest recoveries, and influx of neobiota. This option has raised considerable interest among social scientists given the linkage to European colonization, subjugation and extermination of indigenous peoples, and its contribution to expansion of the slave trade. These authors attribute the small but abrupt decrease in atmospheric CO2 (the Orbis spike) at ∼1610 CE, evident in the Antarctic ice core record, to depopulation and forest recovery across the Americas following the initial colonization. They proposed it as a potential GSSP horizon associated with one synchronous event related to what was in fact a gradual, multidecadal event triggered by human political and economic desires. Certainly, European expansion and the resulting damage to other human societies and ecosystems shaped the course of many diachronous disruptions to both natural and socio- economic realms for centuries to come, many of which can be felt in present societies. The Orbis spike is, however, not correlatable in most geological archives, reducing its potential to define a chronostratigraphic Anthropocene unit, and has questionable linkage to an anthropogenic cause as ice core records of carbonyl sulfide show that a decrease in primary production and ecosystem respira- tion, and not vegetation regrowth, was the primary cause for the spike. In any event, the magnitude of the Orbis spike (or dip) is dwarfed by the later increase in atmospheric CO2, in particular since about 1950 CE.

CONCLUSION

In this work, an attempt is made to identify the reasons that allow some societies to create better conditions for human survival, in interaction with the external environment, in comparison with others. To solve this problem, we used the possibilities of a unified approach to describing complex nonlinear processes in nature from the standpoint of the main provisions of the theory of dissipative processes [Prigogine, Stengers, 1986; Allen, 1988]. This approach allows, in our opinion, to consider anthropogenesis and social processes as successive sublevels of the general process of biological evolution and substantiates the application of general principles for describing complex self-regulating systems developed in the natural sciences. In accordance with this, we used, as a principled approach to identifying conditions conducive to the survival of biological organisms and humans, the provisions of control theory (cybernetics). The theory describing the general laws of adaptation and regulation processes.

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