

Anthropocene, Capitalocene, and Other “-Cenes”

Why a Correct Understanding of Marx’s Theory of Value Is Necessary to Leave the Planetary Crisis

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The perception that we are living in a critical historical period regarding the conditions of habitability on Earth—not only for humans but for many other living organisms too—is gaining more and more adepts among common people, academics, politicians, and social movements. This critical period has been typified as the planetary crisis of the Anthropocene Epoch and studies undertaken in the present century show that habitability on Earth is progressively deteriorating.¹ There is an increasing perception too, though more restricted, of the close relation between the ongoing habitability crisis and today’s global capitalist society. This perception is based more on intuition and on the historical correspondence of planetary crisis indicators with the capitalist mode of social production than on scientific studies showing that the crisis is a structural necessity of capital reproduction. As a result, a number of alternative terms to the Anthropocene have been coined to name the present historical period. Although terms such as *Plantationocene*, *Chthulucene*, *Growthocene*, *Econocene*, *Pyrocene*, *Necrocene*, and so on may have a provocative scope, it is also true that they are based on an incomplete understanding of the ongoing crisis. Among the alternatives to the Anthropocene, Capitalocene is the term



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¹ ↪ Johan Rockström et al., “A Safe Operating Space for Humanity,” *Nature* 461, no. 24 (2009): 472–75; Will Steffen, Wendy Broadgate, Lisa Deutsch, Owen Gaffney, and Cornelia Ludwig, “The Trajectory of the Anthropocene,” *The Anthropocene Review* 2, no. 1 (2015): 81–98; Corey J. A. Bradshaw et al., “Underestimating the Challenges of a Ghastly Future,” *Frontiers in Conservation Science* 13 (2021).

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that has undergone a deeper conceptual unfolding. However, the concept of the Capitalocene is not devoid of important misconceptions regarding the crisis and its relation with the fundamentals of the capitalist mode of social production based on the reproduction of capital.

Leaving the planetary crisis behind requires a scientific understanding of Earth’s functioning as an integral natural system, and for this purpose many disciplines of the natural sciences need to be involved. In addition, a scientific understanding of different modes of social production through history—particularly the capitalist mode—and of their specific impacts on the planet’s functioning is also required. Today, the profusion of terms and the different conceptualisations underlying them—usually reflecting only partial aspects of the planetary crisis—have created some confusion, which hampers both a proper understanding of the role of humans and our ability to undertake the right strategies to leave the crisis behind. Because concepts are verbally expressed by terms (although not all terms are concepts), it becomes clear that the Anthropocene-Capitalocene debate is not just a terminological issue. It is a debate about the underlying conceptual content of the crisis and about different approaches in facing it, and this has important implications regarding the future of humans on Earth, as well as the earth’s future. The debate extends into the manifestation of the planetary crisis in strata and into its possible formalisation in the Geologic Time Scale (GTS).

In this contribution, I undertake a critical analysis of the current terms for the ongoing planetary crisis, and of the different conceptualisations underlying these terms. The focus is mainly on the Anthropocene versus Capitalocene dispute both because these are the more widespread terms and because they have undergone deep theoretical development. I show that the flaws in these terms are based on a misunderstanding of both the planetary crisis and the fundamentals of the capitalist mode of production, and of their mutual intertwining. These shortcomings are reflected in the proposals to formalise the planetary crisis in the GTS and they are discussed in this context. Emphasis is put on the methodological and epistemological limitations of the Anthropocene and Capitalocene approaches, which are ultimately responsible for the weaknesses of their political proposals to leave the crisis behind.

The Stratigraphic Form of the Planetary Crisis and its Formalisation in the Geologic Time Scale

The term Anthropocene became popular at the beginning of this century, when it was introduced by Nobel Prize winner Paul Crutzen and his colleague Eugene Stoermer. The Anthropocene was conceived as a new time in Earth history, in which human action drives changes in Earth’s dynamics comparable to those driven by natural forces. Research undertaken after the introduction of the Anthropocene showed that the perception that human action is able to drive significant changes on Earth could be traced back to the nineteenth century. A number of precursors to the Anthropocene proposal—such as Anthropozoic, Anthropogene, Technogene, and others—had been coined earlier to describe the time of Earth’s history characterised by such human impacts. The Anthropocene and its precursors are closely related to the unfolding of natural science disciplines—particularly geology—since the eighteenth century, and to the attempt to build a practical tool that could be used to refer to Earth history based on the stratigraphic record. Today, this tool is the GTS, a work-in-progress project that undergoes periodic review and improves along with our understanding of Earth’s history. Launching the concept of the Anthropocene within so-called Earth System science

disciplines prompted research on its possible formalisation in the GTS. This research has crystallised in a preliminary proposal to officially establish the Anthropocene as a geological epoch of the GTS.²

The GTS aims to provide a standardised instrument to Earth scientists of many different sub-disciplines, and has an eminent practical and pragmatic character. Ideally, the GTS should provide a globally correlated, continuous stratigraphic record of Earth with accurate age estimates so that orogenic processes, greenhouse episodes, mass extinctions, glaciations, and many other events in Earth history—like human action in the Anthropocene—can be related to specific chronostratigraphic units, which are hierarchically organised. The GTS has rules for the acceptance and revision of units that are internally agreed upon within the International Commission on Stratigraphy (ICS) and the International Union of Geological Sciences (IUGS).

These rules have been modified in accordance with the progress of our understanding of Earth history, but it is worth mentioning that the international organisations in charge of the GTS (much like many organisations worldwide, such as

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the World Health Organization, the International Monetary Fund, and others) reflect the respective weight of the appointed countries in the global scientific and political scene. Because Western countries in general and Anglo-Saxon countries in particular are dominant in these organisations, most of the agreements reached usually correspond to the dominant Western view.³ Overall, the Western view on Soviet society has

been somewhat biased. For example, Soviet environmental history has been often described as “ecocide,” although the USSR was a pioneer in fields like ecology and climatology, and in environmental conservation measures.⁴ Terms like the Tertiary Period or the Secondary Era have been progressively abandoned in the GTS nomenclature in favor of other terms that reflect the earth’s history more accurately. However, the Quaternary Period still persists as the last period of the GTS—though an alternative term, the Anthropogene, suggested in 1922 by Soviet geologist Alexei Pavlov, was quite popular in the USSR.⁵

Notwithstanding the possible technical flaws of the Anthropogene as a unit proposal, the fact that Quaternary was firmly consolidated in the Anglophone world—and that the official proposal was presented during the Cold War by Soviet geologists, who had little weight in international geological organisations—may have contributed in the rejection of the Anthropogene and subsequent abandonment of any research on the topic. It is quite a commonplace among natural scientists to believe that research within a particular discipline constitutes pure science, and that science can and should be removed from politics, ideology, and any sort of historical determination that might structurally condition the development of science. In fact, this is only partly true: science is always performed under structural conditions that usually limit the possibilities of science and the general path of scientific research. For example, such structural

² ↪ See P. J. Crutzen, E. F. Stoermer, “The Anthropocene,” *Global Change Newsletter* 41 (2000): 17–18; Clive Hamilton and Jacques Grinevald, “Was the Anthropocene Anticipated?,” *The Anthropocene Review* 2, no. 1 (2015): 59–72; Valenti Rull, “The ‘Anthropocene’: Neglects, Misconceptions, and Possible Futures,” *Science & Society: EMBO Reports* 18, no. 7 (2017): 1056–60; Helmuth Trischler, “The Anthropocene: A Challenge for the History of Science, Technology, and the Environment,” *T. M.* 24 (2016): 309–35; and *The Anthropocene as a Geological Time Unit*, ed. Jan Zalasiewicz, Colin N. Waters, Mark Williams, and Colin P. Summerhayes (Cambridge: Cambridge University Press, 2019).

³ ↪ As reported in the website of the ICS, the IUGS has recently frozen all activity with the Russian Federation due to the Ukraine War.

⁴ ↪ See John Bellamy Foster, “Late Soviet Ecology and the Planetary Crisis,” *Monthly Review* 67, no. 2 (June 2

⁵ ↪ See Innokenti P. Gerasimov, “Anthropogene and its Major Problem,” *Boreas* 8, no. 1 (1979): 23–30; E. V. Shanster, “Anthropogenic System (Period),” in *Great Soviet Encyclopedia*, vol. 2 (New York: Macmillan, 1973), 140.

conditions—which are historically determined—regulate what is to be studied and what is not. The Anthropocene is a good example of these conditions placed on science, but there are many others.⁶

Because the Anthropocene names a time in the earth’s history characterised by a human-induced planetary crisis, it is no longer an issue concerning only Earth sciences and natural sciences. It is closely related to the forms of human social metabolism, which are in turn related to the historical modes of social production. In this regard, the debate about the starting date of the Anthropocene is not merely a technical question about the internal hierarchy of the GTS, but has important implications for the conceptualisation of the ongoing crisis and for the political strategies needed to exit it. The

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proposal of the Anthropocene as the most recent epoch of the GTS—following the previous Holocene Epoch—is strictly based on stratigraphic criteria and argues for a starting date around the mid-twentieth century. According to this proposal, the best stratigraphic marker for the onset of the Anthropocene in the GTS would be plutonium radionuclides derived from nuclear weapons detonations and deposited by fallout processes in a number of settings like deep

marine basins, ice sheets, lakes, and coral bioherms. This would allow reasonable synchronisation and correlation on a global scale, which are two of the basic requirements for the formalisation of GTS units. Although the imprint of human activity on strata predates the last century, it did not have a roughly synchronous and global scale-correlated stratigraphic signal before the mid-twentieth century.⁷

Beyond strata, the human imprint on the earth ecosystem is also much older than the mid-twentieth century, but previous human activity did not yield a change in Earth dynamics with the magnitude, intensity, and velocity of the

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present-day planetary crisis. This change is actually not dissimilar to other changes in Earth’s history, except for its anthropogenic character and for the accelerated rates of the degradation processes. For example, the increase in atmospheric carbon dioxide over the 6,000 years prior to the industrial era was 20 parts per million (ppm), while in the last

200 years, carbon dioxide has increased by about 100 ppm, most of it during the twentieth century. Similarly, methane in the atmosphere increased 150 parts per billion (ppb) during the 3,000 years prior to the Industrial Revolution, and 1,000 ppb during the last two centuries; most of the increase corresponds to the last century.

Taken together, the bulk indicators of the planetary crisis show a trend with an abrupt increase during the last century, and in particular since about 1940–1950. However, considered individually, a single indicator may show an abrupt increase differing from that of the bulk indicators. This depends on the physical and chemical properties of the particular parameter considered, on its role in Earth dynamics and relation to other parameters, and on human activity. For example, atmospheric carbon dioxide had already increased abruptly by the mid-nineteenth century, most likely due to fossil fuel combustion in industrial processes, whereas atmospheric temperatures increased sharply at the beginning of the twentieth century, mainly due to the greenhouse effect of carbon dioxide. Similarly, the abrupt increase of species extinctions from the background level might have started in the eighteenth century—or possibly much later, depending on the sensitivity to environmental degradation for the taxon considered (mammals, vertebrates, fishes, and so on), as

⁶ ↪ For example, for the cultural and historical determinations affecting Earth science during the Cold War period, see Matthias Heymann and Amy Dahan Dalmedico, “Epistemology and Politics in the Earth System Modeling,” *Journal of Advances in Modeling Earth Systems* 11, no. 5 (2019): 1139–

⁷ ↪ See Colin N. Waters et al., “Global Boundary Stratotype Section and Point (GSSP) for the Anthropocene Series,” *Earth-Science Reviews* 178 (2018): 379–429.

well as on pressure from human activity, which until recently has been larger for terrestrial species than for marine species.

Overall, one would expect to find the stratigraphic manifestation of the planetary crisis after its manifestation in environmental indicators, including biota. In any case, the planetary crisis, expressed in the trend of environmental indicators and in strata, marks a quantitative jump in the human impact on Earth with no historical analog. This surge must be related to the historical modes in which humans are socially and economically organised, and to the corresponding modes of social metabolism.⁸

Pinpointing the onset of the planetary crisis and its manifestation on strata to the mid-twentieth century might be roughly correct, but the term Anthropocene for this crisis and for the corresponding unit in the GTS, poses some problems and has been intensely debated. With regard to the GTS, Anthropocene does not follow the recommendation to give an “-ian” or “-an” ending for ages/stages and epoch/series. More importantly, it is a term with a strong conceptual content, while most GTS terms are descriptive. The name Anthropocene for an epoch of the GTS not only describes a globally correlated stratigraphic signature, but conceptualises a well-defined event in Earth history in terms of causality, origins, and magnitude—an event that has turned out to be a planetary crisis. Ages, epochs, and periods of the GTS usually borrow the names from the rock types that characterise the chronostratigraphic unit (for example, the Cretaceous or Siderian periods); from the stratigraphic position within the GTS (Upper, Middle, Lower, in case of series); and most of all, from geographic features near the stratotype area of the unit, which is the current recommendation of the ICS. Only the names of eras and erathems in the Phanerozoic Eon were chosen to reflect major changes in the history of life on Earth.⁹ Hence, names of chronostratigraphic units are essentially descriptive and do not usually allude to the events in Earth’s history occurring during the time interval of a unit, and even less to the causes underlying the events. This is because the GTS is a correlation tool, but not Earth’s history as such—though this does not mean that the criteria used to name chronostratigraphic units cannot be changed, as long as the criteria are based on consensus. However, an agreement to name chronostratigraphic units according to the principal event appears to be problematic at the current level of our understanding of Earth’s history, at least for hierarchical units lower than eras. As a matter of fact, members of the Anthropocene Working Group (AWG), which has the official mandate by the ICS for submitting a proposal on the Anthropocene, disagree with the dominant view within the AWG and have proposed to define the Anthropocene as an informal geological event, rather than as a formal epoch.¹⁰

The Anthropocene inaugurates a new methodological procedure in our understanding of Earth’s history and in the formalisation of units in the GTS. Before the Anthropocene, units were formalised once the stratal content, through which events in Earth’s history were inferred, were reasonably known. From an epistemological perspective, knowledge proceeded from data observed in local strata to global phenomena, whereas in the Anthropocene, knowledge proceeds in the opposite direction: from global phenomena to their expression in local strata. In other words, in the Anthropocene, the human-induced planetary crisis is not known from strata but from global environmental indicators; that is, the planetary crisis has not been inferred from strata, but is being sought in strata. The logic underlying this procedure is that if we know about previous planetary crises similar to the present one from the geologic record, the hypothesis that a stratigraphic signature of the ongoing planetary crisis may be found is reasonable. Though looking for

⁸ ↪ Compare Figure 1 in William F. Ruddiman, F. He, S. J. Vavrus, and J. E. Kutzbach, “The Early Anthropogenic Hypothesis,” *Quaternary Science Reviews* 240 (2020): 106386; and great acceleration charts in Steffen et al., “The Trajectory of the Anthropocene.”

⁹ ↪ These eras are the Paleozoic (old life), Mesozoic (intermediate life), and Cenozoic (recent life), see stratigraphy.org/guide/chron.

¹⁰ ↪ See Anthropocene Working Group, “Results of Binding Vote by AWG,” May 21, 2019, available at quaternary.stratigraphy.org; and Philip L. Gibbard et al., “A Practical Solution: the Anthropocene is a Geological Event, not a Formal Epoch,” *Episodes* 67, no. 2 (2021): 1–9.

empirical evidence of theoretical knowledge is not unusual in science, it poses some problems in terms of formalisation in the GTS. Historically, events in Earth’s history were inferred from the geological record, and so formalisation in the GTS reflects this methodology.

In terms of the GTS, there are two major implications of accepting the Anthropocene as a formal epoch. First, it leaves open the possibility of defining units at a lower rank level than epoch; second, it leaves open the possibility of renaming units in the GTS so that they refer to the geological events that occurred, rather than using descriptive names. For

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example, the term Quaternary could be replaced by Pavlov’s Anthropogene, based on the appearance and evolution of the genus Homo on Earth. These criteria could serve as the basis to reformulate Italian geologist Antonio Stoppani’s Anthropozoic and define it as an era following the Cenozoic Era and starting at

the base of the Gelasian Age.¹¹

The Anthropocene, as proposed by the AWG, marks the onset of a global-scale stratigraphic record suitable for correlation and could be formalised in the GTS. The Anthropocene designation identifies human activity in general as the cause of the global record, but does not single out the particular type of human activity causing it. On the one hand, the term introduces human history into the GTS for the first time by using a genetic term that accounts for the causes of the global stratal record. On the other hand, this leaves some ambiguity regarding the concrete historical time in human history, which is structurally linked to a particular form of human production and, therefore, to the particular mode of human social metabolism that is responsible for such a global stratigraphic imprint.

An attempt to amend the ambiguity of the AWG proposal has been recently formulated and consists of defining a geological age named Capitalian, or Capitalinian, as a lower hierarchical unit of the Anthropocene Epoch. In this way, the capitalist mode of social reproduction is identified as the concrete historical form of social metabolism underlying the planetary crisis and its manifestation in strata. In other words, Capitalian/Capitalinian identifies the concrete historical form of Anthropos, namely, capitalist Anthropos, whose activity has led to a planetary crisis and its stratal expression. The name Capitalocene has also been proposed for the new epoch of the GTS in order to solve the ambiguity of Anthropocene. However, defining Capitalocene as an epoch poses some problems regarding the lower-ranked units of the GTS. For example, an age named Capitalian/Capitalinian would be somewhat redundant in the terminology. In addition, the subdivision of a Capitalocene Epoch into ages corresponding to non-capitalist production modes and human social metabolisms, which would have supposedly qualitatively and/or quantitatively different stratigraphic signals, then becomes problematic.¹²

In summary, although the stratigraphic record of the planetary crisis is clear, its formalisation in the GTS is more complex for two main reasons. First, because human activity is the driving mechanism of the crisis, and such activity is historically determined and, second, due to the specific rules for formalisation of the GTS. If the IUGS should choose to name chronostratigraphic units according to main geological events, there are several options to do so in relation to human history by, for example, combining units at different hierarchical levels. If the preferred choice is giving the name of a geographic location to the stratal record of the planetary crisis, the location of the Global Boundary Stratotype

¹¹ ↪ See Valenti Rull, “The Anthropozoic Era Revisited,” *Lethaia* 54, no. 3 (2020): 289–99.

¹² ↪ The term *Capitalian* or *Capitalinian* was independently proposed by Carles Soriano, “On the Anthropocene Formalization and the Proposal by the Anthropocene Working Group,” *Geologica Acta* 18, no. 6 (2020): 1–10, and by John Bellamy Foster and Brett Clark, “The Capitalinian: The First Geological Age of the Anthropocene,” — The Jus Semper Global Alliance, October 2021; see also Andreas Malm, *Fossil Capital* (London: Verso, 2016).

Section and Point (GSSP) could be used for this purpose. In any case, it is worth remembering that the GTS is an agreed-upon, standardised reference for Earth history and that, as a general principle, the rules and criteria necessary to formalise chronostratigraphic units should be as consistent as possible throughout the GTS.¹³

The Anthropocene and Capitalocene as Concepts of the Planetary Crisis

Anthropocene and Capitalocene are not just names for the planetary crisis in the GTS. They imply particular conceptions of the planetary crisis and as such, particular approaches aimed at confronting the crisis of habitability on Earth. For these reasons, Anthropocene and Capitalocene as names of chronostratigraphic units cannot be fully disentangled from the conceptual content underlying these names. To a large extent, the disputes on formalisation arise from this conceptual content. Therefore, research on the concepts of the Anthropocene and Capitalocene from a gnoseological perspective—beyond their use as names in the GTS—is needed.

The Concept of the Planetary Crisis within Earth System Science

The concept of the Anthropocene is closely related to the development of Earth System science since the late twentieth century. Earth System science is a “transdisciplinary endeavour aimed at understanding the structure and functioning of

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the Earth as a complex, adaptive system,” and has “the grand challenge...to achieve a deep integration of biophysical processes and human dynamics to build a truly unified understanding of the Earth System.”¹⁴ I will show that Earth System science is not only far from meeting this “grand challenge,” but that it is moving in the wrong epistemological

direction. As a result, the conception of the planetary crisis by Earth System science is incomplete, and proposals to face the crisis are insufficient, to say the least. The main reason is because the studies led by Earth System scientists have failed to identify the concrete anthropogenetic causes driving the planetary crisis, thus, the crisis is assigned to humans in general—to the Anthropos—and not to a particular, historical Anthropos. In this way, Earth System science erases any history regarding the forms of social production and reproduction, and does not consider that there are different historical modes of social production, with different social metabolisms and different impacts on Earth. It is a paradox that the empirical evidence built up by Earth System science studies, which clearly correlates the planetary crisis to the capitalist production mode and not to prior modes, is systematically ignored by Earth System science. All of the environmental indicators of the planetary crisis reveal a clear departure from their historical background level within the last two centuries, as shown above, depending on the indicator considered. This marks an undeniable historical correlation with the capitalist mode of production.

Although the historical coincidence of the planetary crisis and the capitalist mode is not evidence by itself of a structural

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or immanent link between the two in terms of essence, necessity, and causality, it indicates the correct direction to be followed for any research aimed at understanding the planetary crisis, and at leaving this crisis behind. In other words, if the crisis is historically correlated to the capitalist mode of social organisation, any research that claims to be scientific should investigate the possible link between this mode

¹³ ↪ See Eugenio Luciano, “Is ‘Anthropocene’ a Suitable Chronostratigraphic Term?,” *Anthropocene Science* 1 (2022): 29–41.

¹⁴ ↪ See Will Steffen et al., “The Emergence and Evolution of Earth System Science,” *Nature Reviews: Earth and Environment* 1 (2020): 54.

and the ongoing emergency. However, Earth System science ignores the astonishing empirical evidence built upon its own studies; the possibility of such a structural link in Earth System science studies is not even mentioned. The question is: why?¹⁵

There is not a simple answer to this question. Earth System scientists are certainly aware of the unequal contribution to the habitability crisis of different countries, depending on the development of the capitalist mode and of the contributions of different social classes. Therefore, Earth System scientists may suspect that the crisis is somehow related to the capitalist mode of production, in a similar way that workers suspect that someone else is being enriched by their work.

Like the historical correlation between the capitalist mode and the planetary crisis, empirical data on the differential contributions of classes and countries to the crisis do not show why and how this is a direct result of capitalist production related to the commodification and division of labor at a local and global scale. Scientific research aimed at

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unfolding the objective processes by which the planetary crisis is necessarily linked to capitalist production—and why there is a differential class contribution—is needed to turn these intuitions into scientific evidence. Earth System scientists have not undertaken such research. There might be a rather prosaic reason for this: research needs funding. It is possible that Earth System scientists are not confident in their ability to raise funds for investigating the relationship of the

planetary crisis with the capitalist mode, and that they have decided to remain in their comfortable field of knowledge without exploring this possibility. On the contrary, Karl Marx was able, scientifically, to demonstrate that the planetary crisis is inevitable under capitalist production by revealing the causal concatenations of the metabolic rift, as a potential planetary crisis, with the particular form of labor exploitation under the capitalist mode in the context of his labor theory of value.

Earth System scientists are generally unaware of the scientific character of Marx's theory of value. Studying the

Earth System scientists claim that an “integration of biophysical processes and human dynamics” is needed for a scientific understanding of the Earth System and of the planetary crisis. However, they reject incorporating the only truly scientific corpus available regarding the capitalist system, which is Marx's theory of value. By unfolding the essential contradiction of the value system, Marx is able to show the finite nature of the capitalist mode.

fundamentals of the capitalist mode in order to investigate whether the planetary crisis is inherent or not to this production mode is certainly outside of the realm of the natural sciences, and often of the expertise of Earth System scientists. In fact, many scientists from the natural and social disciplines believe that social production in general, and capitalist production in particular, do not proceed under deterministic—if nonetheless historical—laws that are analogous to those of nature. Marx's theory of value demonstrates the opposite. Earth System scientists claim

that an “integration of biophysical processes and human dynamics” is needed for a scientific understanding of the Earth System and hence, of the planetary crisis. In practice, however, they reject incorporating the only truly scientific corpus available regarding the capitalist system, which is Marx's theory of value. By unfolding the essential contradiction of the

¹⁵ ↪ For an extended critique of this epistemological thrust, see Carles Soriano, “Epistemological Limitations of Earth System Science to Confront the Anthropocene Crisis,” *Anthropocene Review* 9, no. 1 (2022): 111–25. For the role of essence, necessity, and causality as categories of dialectical materialism, see M. M. Rosental (also Rosenthal) and G. M. Straks, *Categorías del materialismo dialéctico* (Mexico: Editorial Grijalbo, 1960).

value system—that is, the contradiction between value and use value, and the concrete mediations intervening in its phenomenological expressions (for example, in the profit rate and in the capitalist population)—Marx is able to show the finite nature of the capitalist mode. He concludes that under this production mode, human social metabolism is not only mediated by the reproduction of capital, but also the reverse: the social metabolism is an alienated mediation insofar as it becomes a mere means for capital’s metabolism.¹⁶

The planetary crisis expresses this fundamental contradiction in the form of a final dilemma—the capitalist system or the

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human system. However, the finitude of the capitalist mode appears to be somewhat inconceivable for Earth System scientists, and they seem to adhere only to the first part of the famous Fredric Jameson quote, “Someone once said that it is easier to imagine the end of the world than to imagine the end of capitalism. We can now revise that and witness the attempt to imagine capitalism by way of imagining the end of the

world.”¹⁷ As a result, the current understanding of the earth’s “functioning” by Earth System science incorporates the earth’s “biophysical processes,” but excludes those views of the “human dynamics” that seriously question the validity of the capitalist mode and its seminal role in the crisis. This is outside Earth System science’s agenda. Claims that “collective human action is required” to stabilise Earth in habitable conditions and that “such action entails stewardship of the entire Earth System—biosphere, climate and societies—and could include decarbonisation of the global economy, enhancement of biosphere carbon sinks, behavioural changes and technological innovations, new governance arrangements and transformed social values” is not much more than a collection of vague statements. It is clear from this and other statements—and from the affinity between Earth System scientists and the field of ecological economics,

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which is strongly influenced by the neoclassical school—that the so-called global economy is nothing more than the capitalist economy, and that any other socioeconomic order than capitalism is automatically discarded.¹⁸ While stewardship of the earth based on science will likely be necessary to mitigate the planetary crisis, it is easy to imagine that a stewardship determined by the reproduction of capital,

in which profit is the only goal, could devolve into a kind of green-technological fascism.

As stated above, scientific research on any topic develops under certain determining factors in a given society, including ideology, moral values, and technological means. Although these factors are themselves historical, they mark the structural trends and boundary conditions of research and only after long and arduous periods can they be overcome. Studies on the planetary crisis have mainly developed after the demise of Soviet-type societies and during a time of pompous proclamations about the “end of history” or that “There Is No Alternative” to the capitalist mode.¹⁹ These

¹⁶ ↪ On natural laws and social production laws see Soriano, “Epistemological Limitations of Earth System Science”:

¹⁷ ↪ Fredric Jameson, “Future City,” *New Left Review* 21 (2003): 76.

¹⁸ ↪ For such vague statements regarding “collective human action,” see Will Steffen et al., “Trajectories of the Earth System in the Anthropocene,” *Proceedings of the National Academy of Sciences* 115, no. 33 (2018): 8252—59; and for examples of neoclassical-style ecological economics, see Robert Costanza et al., “Developing an Integrated History and Future of People on Earth (IHOPe),” *Current Opinion in Environmental Sustainability* 4, no. 1 (2012): 106–14. It is quite useful to have a look at initiatives like IHOPe ([available at ihopenet.org](http://available.at.ihopenet.org)) and Future Earth ([available at org](http://available.at.org)), which involve Earth System scientists, and do some research on the provenance of funds.

¹⁹ ↪ See Francis Fukuyama, *The End of History and the Last Man* (New York: The Free Press, 1992). “There Is No Alternative” (TINA) was a slogan coined by Margaret Thatcher.

In any class society, “the ideas of the ruling class are in every epoch the ruling ideas, i.e. the class which is the ruling material force of society, is at the same time its ruling intellectual force,” and Earth System scientists—whether they like it or not, and whether they know it or not—are structurally conditioned in their research by dominant bourgeois thought.

narratives are firmly established in Western societies, to which most Earth System scientists belong. Following dominant Western thought, Earth System scientists have assumed the failure of these socialist experiences as an empirical demonstration of the impossibility of any mode of social organisation other than the capitalist one. After all, in any class society, “the ideas of the ruling class are in every epoch the ruling ideas, i.e. the class which is the

ruling material force of society, is at the same time its ruling intellectual force,” and Earth System scientists—whether they like it or not, and whether they know it or not—are structurally conditioned in their research by dominant bourgeois thought.²⁰

Hence, not only Earth System scientists, but most thinkers and scientists in the West, have equated the failure of certain socialist experiences to the general failure of the only scientifically based alternative—which, paradoxically, bourgeois society itself historically gave rise to—aimed at overcoming the insurmountable contradictions of the capitalist mode. Without even performing a serious “concrete analysis of the concrete situation,” which would reveal the internal political decisions in the early 1970s that led to the restoration of the capitalist mode in the former Soviet Union (among other things), Earth System scientists have uncritically followed dominant thought, assuming the impossibility of socialism and communism. Despite undeniable advances in our current understanding of Earth dynamics, thanks to the development of Earth System science during recent years, this discipline has failed to account for the most crucial element in the ongoing planetary crisis—that is, humans and their history, and in particular, the most recent form of human social organisation based on commodity production and the reproduction of capital. Regarding human history and historical modes of social organisation, Earth System scientists consider the capitalist mode ahistorically, as the sole mode with which society can be organised and the necessary means with which social reproduction can be generated.

From a gnoseological and methodological perspective, this is a non-scientific approach, and accordingly, the resulting conceptualisation of the planetary crisis by Earth System science is fallacious. This critique of Earth System science is in some ways similar to V. I. Lenin’s critique of Ernst Mach and M. M. Rosental’s critique of Werner Heisenberg, Max Born, and other physicists for their idealism and positivism when facing problems regarding the epistemology of science and the relationship between thought and nature. In the words of Evald Ilyenkov: “Not every artist has a well-developed concept of art, by any means, although he may create magnificent works of art. The present author is not ashamed to admit that he has a rather vague notion of the atom, as compared to a physicist. But it is not every physicist that has a concept of the concept.” Earth System scientists do not have a proper concept of what social production is. However, in defence of Earth System science, it can be said that not all Marxists have a well-developed concept of nature, for nature has been largely considered non-dialectical in most Western Marxism, including the so-called philosophy of praxis.²¹

²⁰ ↪ Karl Marx and Frederick Engels, *The German Ideology* (Moscow: Progress, 1975), 67.

²¹ ↪ Georg Lukács, *Lenin: A Study on the Unity of His Thought* (London: New Left, 1970); Evald Ilyenkov, “Concrete Unity as Unity of Opposites” in *Dialectics of the Abstract and the Concrete in Marx’s Capital* (Delhi: Aakar, 1960). On the rejection of the dialectics of nature by Western Marxism and the philosophy of praxis, see Rogney Piedra, *Marxismo y dialéctica de la naturaleza* (La Habana: Editorial de Ciencias Sociales, 2017); John Bellamy Foster, “Marx and the Metabolic Rift in the Universal Metabolism of Nature,” *Monthly Review* 65, no. 7 (December 2013): 1–19.

The Concept of the Planetary Crisis in Capitalocene Narratives

The Capitalocene was originally proposed by Andreas Malm as a substitute for the Anthropocene as the name of the geological epoch in the GTS. Later on, the term underwent subsequent conceptualisations; now it has gained some popularity in social science and the humanities. Here, I will focus on the conceptual unfolding of the Capitalocene by Jason W. Moore and Donna Haraway, for these represent the characteristic epistemic views provided not only for the Capitalocene, but for other “-cenes” proposed within the humanities and social science disciplines.

According to these authors, the Capitalocene names capitalism “as a system of power, profit and re/production in the web of life. It thinks capitalism as if human relations form through the geographies of life.” The Capitalocene is thus “a key conceptual and methodological move in rethinking capitalism as ‘a historically situated complex of metabolisms and assemblages.’”²² Based on these conceptualisations of the Capitalocene, an immediate question arises: What do they add to the classical Marxist concept of capitalism as a mode of production based on the reproduction of capital? Does this conceptualisation of the Capitalocene improve anything in our scientific understanding of the general laws of social production and capitalist production, as formulated by Marx? Does it add anything to Marx’s labor theory of value, an organic theory articulated through a number of general laws accounting for the material and ideal reproduction of capitalist society? What is capital as an automatic fetish, if not an expression of bourgeois idealism, of a system of power governing social production, and of the alienated form of social metabolism under capitalism?²³

Abstraction and “Cartesian Dualism”

A recurrent issue in the Capitalocene move is that the Anthropocene and Earth System science approach to the planetary crisis is biased with a so-called Cartesian dualism, a “Cartesian Divide” by which humans and nature or society and nature are conceived as separate, unrelated realities that are treated as distinct analytical categories. In the concept of the Capitalocene, the Cartesian dualism attributed to Earth System science is methodologically and epistemologically incorrect. Not only this, but modern science in general, in this perspective, is based on Cartesian dualism and has become a so-called geopower that ultimately lies at the core of the planetary crisis. According to the Capitalocene discourse,

*Recognising humans as part of nature whilst separating Humanity from Nature, troubles Anthropocene thinking at every turn. On the one hand, humans become Humanity, a singular human enterprise. They act upon, or are subject to, the “great forces of nature.” On the other hand, Humanity—the upper case is deliberate—remains a geophysical force.... Practically speaking, Society is independent from Nature (Two Systems). For the earth-system scientists behind the Anthropocene, Social Factors—again, decidedly in the upper case—are added; for scholars in the humanities and social sciences, Nature is added.*²⁴

Rather than this supposed dualism, the Capitalocene narrative proposes approaching the planetary crisis from a holistic-monistic perspective in which society and nature are not abstracted from each other as different categories of particular study. As Moore puts it: “The Capitalocene therefore contests social as well as environmental reductionism, and resists

²² ↪ See Jason W. Moore, “The Capitalocene, Part I: On the Nature and Origins of Our Ecological Crisis,” *The Journal of Peasant Studies* 44, no. 3 (2017): 594–630; Jason W. Moore, “The Capitalocene, Part II: Accumulation by Appropriation and the Centrality of Unpaid Work/Energy,” *The Journal of Peasant Studies* 45, no. 2 (2018): 237–79, quoting from Donna Haraway, “Staying with the Trouble,” in *Anthropocene or Capitalocene?*, ed. Jason W. Moore (Oakland: PM, 2016), 34–76. For an unfolding of bourgeois idealism as a form of fetishism, see Evald Ilyenkov, *Dialectics of the Ideal* (Boston: Brill, 2012).

²³ ↪ For the alienated social metabolism under capitalism, see István Mészáros, *Beyond Capital* (New York: Monthly Review Press, 1995) and John Bellamy Foster, “Marxism in the Anthropocene,” *International Critical Thought* 6, no. 3 (2017): 393–421.

²⁴ ↪ Moore, “The Capitalocene, Part I,” 597.

Earth System science specifically asks for a “deep integration of biophysical processes and human dynamics to build a truly unified understanding of the Earth System.”

any periodisation of capitalism derived from the mythic category of Society (humans without nature),” while “the Capitalocene argument consequently trods a different path from the governing procedures of global environmental change research: it is not a quest for ‘underlying [social] causes’ of environmental change, nor for connecting ‘social organisation’ to environmental consequences.”²⁵

However, Earth System science specifically asks for a “deep integration of biophysical processes and human dynamics to build a truly unified understanding of the Earth System.”²⁶ These are not just beautiful words, but a reliable goal as

The Capitalocene and other “-cenes” propose approaching the Earth System as a totality, without distinguishing between the social and the natural, humans and nature, in order to study the particularities of these realms and their mutual interactions. This is methodologically incorrect.

shown by the evolution of the Bretherton Diagram, which is aimed at providing an integral view on the complex earth’s functioning. Hence, accusing Earth System science of such Cartesian dualism is not correct. As shown above, the problem of Earth System science is that until now, it has failed to achieve integration because it proceeds on a incorrect theoretical basis regarding human dynamics.

However, I will show that the Capitalocene discourse is unable to provide a comprehensive and integrated understanding of nature and humanity because it navigates on even worse theoretical grounds than those of Earth System science.²⁷

Substantially, the Capitalocene and other “-cenes” propose approaching the Earth System as a totality, without distinguishing between the social and the natural, humans and nature, in order to study the particularities of these realms and their mutual interactions. This is methodologically incorrect and prevents any understanding of the Earth as a dynamic system.

The problem “of the relation of thinking to being, the relation of the spirit to nature—the paramount question of the whole of philosophy” has had different formulations through the history of philosophy, including the classic body-and-soul division by René Descartes, and the relation of the material to the ideal by Ilyenkov.²⁸ The question of the relationship between thinking and being could not be solved by modern philosophy, until Marx and classical Marxists addressed it from a dialectical and materialist perspective. Neither the theorists of the Anthropocene nor those of the Capitalocene have been able to solve the concrete bonds between human society and nature, which, under the capitalist mode, are expressed as a planetary crisis stemming from the ontological incompatibility of humans and nature. In the case of Anthropocene theorists, this is because they have approached the natural side of the problem with an unconscious dialectic and materialist basis, but their approach to the social side is idealistic and non-dialectical. As a result, they consider capitalism as the only mode of production, and therefore believe there may be some compatibility of humans and nature under capitalism. Capitalocene theorists fail because they are not able to approach either side of the problem on a materialist and dialectical basis.

²⁵ ↪ See Jason W. Moore, “Anthropocenes and the Capitalocene Alternative,” *Azimuth* 9 (2017): 71–79.

²⁶ ↪ Will Steffen et al., “The Emergence and Evolution of Earth System Science.”

²⁷ ↪ Compare the Bretherton Diagram in 1986 and the latest version (2020) in Steffen et al., “The Trajectory of the Anthropocene”; see also Soriano, “Epistemological Limitations of Earth System Science.”

²⁸ ↪ See Frederick Engels, *Ludwig Feuerbach and the End of Classical German Philosophy* (Moscow: Progress Publishers, 1941), 21; Ilyenkov, *Dialectics of the Ideal*.

In the process of acquiring knowledge, humans face a material reality external to the human mind that is itself objective and independent of the way in which it is thought. Reality, no matter whether social or natural, appears to us as a concrete totality shaped by the synthesis of multiple determinations, and understanding reality is only possible through a number of mediations. First, the concrete totality has to be sensorily perceived; then, it must be processed through concrete forms of thought: concepts, categories, judgments, and so on; and finally, practice determines whether the apprehension of reality by thought is correct or not. This has been long acknowledged by classic idealist philosophers such as Immanuel Kant and G. W. F. Hegel. According to Kant's transcendental logic, the human mind formulates concepts from the sensory perception of a material reality that is diverse and contradictory. However, for Kant, diversity and contradictions are attributes of pure reason rather than of reality itself, and concepts are forms of the Kantian a priori knowledge of reality. This means that human knowledge of reality is not a historical process; it is non-dialectical and what is historical, if anything, is the revelation of such a priori knowledge, but not knowledge itself. Hegel's dialectical logic also acknowledges the occurrence of an objective reality external to the human mind. With Hegel, contradictions as the driving force of change are explored to a level that was only preliminary in Kant. However, Hegel considered the real contradictions of nature to be bestowed by humanity's absolute spirit, and this idealist conception hampered his dialectics.²⁹

Understanding reality is a never-ending social and historical process that, as a very general trend, proceeds from a lack of knowledge to the discovery of general and particular laws, principles, and rules governing reality. From a gnoseological perspective, the process of understanding proceeds first through the perception of the studied object as a concrete totality from which some general features are extrapolated from phenomena and fixed in thought. The concrete totality is then dissected into its constitutive elements, which are abstracted from other elements in order to undertake a static analysis of their particularities; finally, the elements are reassembled to investigate their mutual concrete interactions and the history of the object.

In this process, knowledge proceeds from the immediate understanding of phenomena to the conceptualisation of concrete generalities conforming to the essentials of the object, its origin, and evolution. Formal logic—or intellectual logic, according to Hegel—plays a major role in the static analysis of the constitutive elements that are abstracted from the concrete totality. Intellectual understanding is a necessary step in order to reassemble the analysed components and investigate their interconnections and transformations. This then allows a comprehensive understanding of reality that includes the history or movement of the studied object based on dialectical logic.³⁰ Understanding the essentials of the studied object is not possible without analysis of its constitutive parts, for which abstraction is necessary, or without subsequently reassembling these parts to investigate their mutual interactions—although, in the immediate process of knowledge, static and dynamic analyses are usually performed simultaneously.

This is the general trend of human cognition throughout history, by which knowledge proceeds from abstract and idealist-based forms of thought to concrete and materialist-based forms, from mythological and religious conceptions to a scientific understanding of reality. This is roughly the path followed by children in their process of apprehension of reality, as well as the historical and logical evolution shown by most modern sciences.

Earth System science is now a discipline integrating studies from a wide spectrum of fields, such as geology, biology, chemistry, and physics; a discipline that is able to provide a comprehensive understanding of not only Earth—its origins,

²⁹ ↪ For a historical and logical evolution of the forms of thought, see M. M. Rosental, *Principios de lógica dialéctica* (Montevideo: Ediciones Pueblos Unidos, 1962).

³⁰ ↪ See Rosental, *Principios de lógica dialéctica*.

dynamics, and possible future scenarios—but also of other planets. This includes a comprehensive understanding of the differentiation of matter on Earth, from inorganic to organic matter, and from this to “simple cells to more sophisticated single cells to multicellular life and eventually to intelligent life.”³¹ Each of the former disciplines underwent its own logical and historical evolution, abstracted from Earth’s concrete totality and from other disciplines, before being integrated into an understanding of Earth’s dynamics. In turn, each discipline also underwent a similar cognitive path in relation to its studied object. For example, botany and zoology were independent sub-disciplines of biology abstracted

The Capitalocene narrative cannot provide an understanding of the concrete interrelations of society and nature that have spurred the planetary crisis because it rejects the abstraction of nature and society as particular objects for study.

from one another in order to facilitate a systematic analysis of their particular subjects—an analysis that was static in regard to the wider field of life on Earth, but less static regarding their respective fields. Only later were these subfields integrated into a more dynamic view of life on Earth. Earth System science has not transcended the

necessary formal abstraction of nature and society, leading to a dialectical and materialist understanding of the earth, an understanding in which the particular relation among capitalist Anthropos and nature—as shown by the planetary crisis—is revealed.

The Capitalocene narrative cannot provide an understanding of the concrete interrelations of society and nature that have spurred the planetary crisis, either. This is because it rejects the abstraction of nature and society as particular objects for study. But it is not possible to conduct successful research on the modes of social organisation in general, and on the capitalist mode in particular, without abstracting society from nature, just as it is not possible to develop a successful understanding of Earth’s dynamics without abstracting nature from society. Only after nature and society have been independently investigated and social production laws and natural laws—that is, the general principles of social reproduction and of capitalist reproduction, and the general principles of nature and its evolution—have been understood is it possible to integrate both realms into a comprehensive understanding of the human impact on Earth and of the planetary crisis. For this reason, Marx consciously abstracted capitalist production from nature in order to investigate the universal laws of this particular mode of social reproduction, although he was completely aware of the fact that nature always has the last word in everything:

*The use values, coat, linen, &c., i.e., the bodies of commodities, are combinations of two elements—matter and labour. If we take away the useful labour expended upon them, a material substratum is always left, which is furnished by Nature without the help of man. The latter can work only as Nature does, that is by changing the form of matter. Nay more, in this work of changing the form he is constantly helped by natural forces. We see, then, that labour is not the only source of material wealth, of use-values produced by labour. As William Petty puts it, labour is its father and the earth its mother.*³²

The historical precursors of the Anthropocene designation in the GTS cannot be traced back before the late eighteenth century because the planetary crisis was not a reality with noticeable phenomenological manifestations before that time. This is why neither Aristotle nor Galileo had any consciousness around a concept like the planetary crisis. Today’s conceptualisation of the planetary crisis is possible because it is a global reality with evident phenomenological expressions. Notwithstanding the fact that the planetary crisis started to be only an incipient reality in the nineteenth century, Marx’s concepts of social metabolism and metabolic rift identified the concrete causes underlying the early

³¹ ↪ See Toby Tyrrell, “Chance Played a Role in Determining Whether Earth Stayed Habitable,” *Communications Earth and Environment* 1 (2020).

³² ↪ See Karl Marx, *Capital* 1 (New York: International Publishers, 1967), 43.

manifestations of the crisis, like the rupture of the nutrient cycle and the impoverishment of soil fertility. In doing this, Marx abstracted society from nature and then reassembled the common understanding of natural sciences and natural processes available at the time with his own research on capitalist production. As a result, Marx’s social metabolism and metabolic rift are concepts of his labor theory of value, and are fully integrated with other concepts, such as the proletarian and capitalist classes, the industrial reserve army, profit, the concentration and centralisation of capital, and so on. All of these concepts and many others are articulated within and by the general laws of capitalist production, including the law of capitalist accumulation, the law of capitalist population, and the law of the tendency of the rate of profit to fall, showing their concrete mutual determinations and concrete relation to the incipient phenomena of the planetary crisis, as revealed by the natural sciences of the nineteenth century. In summary, Marx’s approach is scientific, dialectical, and materialist, and he deliberately took nature as a given to reveal the laws of capitalist production, and then investigated the particular relations of capitalist production with nature by considering the early manifestations of the planetary crisis in the nineteenth century. From a gnoseological perspective, it is impossible for Marx or anybody else to develop a scientific understanding of Earth, or any other real, material object, without abstractions and without proceeding through formal logic and dialectical logic.³³

However, the Capitalocene and other “-cene” discourses reject the operational abstraction of nature and society to understand the Earth System as it plunges into crisis. Regarding the historical evolution of the cognitive processing of reality and the concomitant evolution of logic, all these “-cene” approaches place themselves before Descartes and before modernity. They are closer to medieval scholasticism and various forms of mythological thought that see reality as

Economy, understood as the material production that all societies must undertake to reproduce themselves, needs to be abstracted from nature for its particular study if the concrete interactions between any socioeconomic organisation and nature is to be understood.

an ideal totality in which the constitutive parts need not be distinguished through particular and formal analysis in order to carry out research on the concrete interactions among them. Because “-cene” theorists specifically deny abstracting nature and society, they are unable to undertake a critique of political economy, much less a critique based on materialism and dialectics as in the case of Marx. Economy, understood as the

material production that all societies must undertake to reproduce themselves, needs to be abstracted from nature for its particular study if the concrete interactions between any socioeconomic organisation and nature is to be understood.

By rejecting such abstraction—and despite the references to Marx and other Marxist authors—the Capitalocene proposal lacks a proper understanding of Marx’s theory of value. This is a narrative with a profusion of new terms and concepts—apparently radical—that are juxtaposed without concrete determinations of causality and necessity among them. Such radical conceptualisation is brought together with Marxian categories usually conceived of in an upside-down manner relative to Marx’s own analysis. In this way, the Capitalocene discourse ends up with a simplistic view of the interaction between capitalist humans and nature that, paradoxically, is more reductionist than the supposed reductionism of the Cartesian dualism that this narrative attributes to Earth System science. From an epistemological perspective, the “-cene” approach is today a form of bourgeois idealism regarding the issue of the planetary crisis.

Actually, “-cene” theorists themselves consider the Capitalocene a narrative, a move, a discourse, but it is a discourse filled with plenty of apparently radical neologisms that leaves untouched a fundamental problem: the material reproduction of society (that is, the economy) upon which the planetary crisis is based. In this way, the “-cene” approach

³³ ↩ The concept of metabolism and metabolic rift in Marx has been explored by the *Monthly Review* Dialectical logic deals with the expression of the movement or evolution of reality in forms of thought; see Rosental, *Principios de lógica dialéctica*.

is closer to postmodern idealism and linguistic turns than to any materialist-based understanding. Hence, it is not surprising that some of the proposals to overcome this crisis seem naïve. It is also not surprising that the scientific understanding of nature and its fundamental laws by positive sciences—physics, chemistry, biology, geology, and so on—during modernity is seen by the Capitalocene narrative as a “geopower,” “aimed at ‘discovering’ and appropriating new Cheap Nature” in general, and particularly the “Cheap four” (labor, food, energy, and raw materials). In this view, the sole purpose of a scientific understanding of nature is to serve capitalist appropriation. Nature is abstracted from society and an “abstract social nature” is socially constructed, with the only function being to secure capital’s access to “Cheap Natures.” In other words, “abstract social nature” is an ideal created on the basis of Cartesian dualism and the abstraction of nature and society that is aimed at allowing “geo-managerialism” of nature for profit.³⁴

Since these unilateral and reductionist views dissolve any objective relation between society and external nature—even as a necessary abstraction—they nullify science’s ability to reflect the reality of nature in thought. This is the case (1) because nature and thought are not treated as distinct analytical categories, and (2) because science is seen as an ideal creation for the profit of capital, and not as a historically determined human universal, like labor. According to the Capitalocene discourse,

*geopower emerges at the nexus of big science, big states and “technologies of power that make territory and the biosphere accessible, legible, knowable, and utilizable.” If geopower enforces Nature, it also renders Nature a motor of accumulation through the production of abstract social nature. This is accumulation by appropriation, the process of creating surplus profit via geopower and its production of abstract social nature.*³⁵

There cannot be any doubt about the role of science in the unfolding of capitalist production on Earth, for science is a productive force in the capitalist mode, as it is in any other mode of social reproduction. Building the pyramids required knowledge of basic physics, as does designing mills to grind grain. In general, the material reproduction of society acts as the structural conditioning for the development of science at a given historical time. The reproduction of capital and competition for profit upon which the capitalist mode is based have certainly triggered the transformation of science as a productive force at an unprecedented level in human history. Labor is the specific human activity, the teleological character of which is the basis for human evolution. In the practical activity of transforming an external object, humans have to ideally prefigure the results to be obtained and the means necessary to achieve this purpose. This is the basis of a materialist understanding of knowledge, consciousness, and ethics, understood as the ability to select what is needed and what is the most suitable procedure to get the desired results. Labor is the practical activity that requires a decision-making process based on knowledge, in which knowledge and ethics reinforce one another and practice is the ultimate criterion of truth. On this basis, knowledge—including scientific knowledge—is a human universal shared by all forms of social organisation.

The development of positive sciences during capitalist modernity—despite the moral reproval of some practical applications of this scientific knowledge—is an approach toward a true understanding of nature. Labor and scientific knowledge are universals that mediate the human metabolism with nature, regardless of their particular historical forms. Universal forms are in a dialectical relation with historical forms, labor with abstract social labor as the substance of capitalist commodity value, and science with science as determined by capital reproduction. But dialectics requires

³⁴ ↪ For example, see Donna Haraway, “Anthropocene, Capitalocene, Plantationocene, Chthulucene,” *Environmental Humanities* 6, no. 1 (2015): 159–65. Also see Moore, “The Capitalocene, Part I,” 610.

³⁵ ↪ See Moore, “The Capitalocene, Part II,” 245, quoting Christian Parenti, “Environment-Making in the Capitalocene,” in *Anthropocene or Capitalocene?*, 171.

The unilateral and non-dialectical view of science as a “geopower” and the pre-modern epistemological grounds of the Capitalocene narrative regarding the history of cognition leads to nihilism and prevents undertaking positive strategies aimed at confronting the planetary crisis.

investigating the dominant moment of dialectical unity, that is, the subsumption relation of the investigated pair. The reductionism of the Capitalocene narrative prevents such dialectical research and thus, any positive proposal to transcend the historical form. Undoubtedly, leaving behind the planetary crisis will require implementing a scientific understanding of Earth’s dynamics, as achieved by Earth

System science. The unilateral and non-dialectical view of science as a “geopower” and the pre-modern epistemological grounds of the Capitalocene narrative regarding the history of cognition leads to nihilism and prevents undertaking positive strategies aimed at confronting the planetary crisis.³⁶

“Accumulation by Appropriation” and Accumulation by Labor Exploitation

Theorists of the Capitalocene and other “-cene” theorists have contributed to a better description of the “so-called primitive accumulation” explored by Marx in *Capital*, with research on the coercive and violent mechanisms by which non-proletarian societies are dispossessed of their means of production and subsistence, and are forced to alienate not only their labor, but significant aspects of their life.³⁷ Humans have to appropriate and elaborate upon nature through labor in order to undertake the process of social metabolism with nature. This is a human universal, regardless of the mode of historical production considered. In class societies, humans’ universal appropriation of nature is based on private property. It is thus better characterised as robbery or expropriation, in which universal appropriation appears as estrangement.³⁸ Thus, the expropriation of nature, goods, lands, and even humans of non-proletarian societies is a necessary moment for capital to accumulate—a moment that precedes the specific form of capital accumulation by labor exploitation, and that accompanies the unfolding of capital on Earth at any time, provided there is something left to proletarians and commodify.³⁹ Although the particular mechanisms of capitalist expropriation can be formally different, more subtle and refined than those of former production modes, they are not essentially dissimilar to the forms of expropriation of all class societies.

The capitalist exploitation of labor requires that labor force be a commodity, the value of which is exchanged with the equivalent value of those commodified means of subsistence necessary to reproduce labor force as such, an equivalent value that takes the form of wages. However, in capitalist expropriation there is no exchange of commodities according to the principle of equivalent values.⁴⁰ Because the goal of Marx’s *Capital* is to “lay bare the economic law of motion of modern society,” “so-called primitive accumulation” is only a secondary and mainly descriptive part of *Capital*, while most of the book is devoted to the specific form of capitalist accumulation. As long as labor is the only activity able to

³⁶ ↩ See Frederick Engels, *Dialectics of Nature*, trans. Sally Ryan, Marx-Engels Archive, 2001. The term *capitalist commodity value* is borrowed from John Bellamy Foster and Paul Burkett, “Value Isn’t Everything,” *Monthly Review* 70, no. 6 (November 2018): 1–17. Also see Elke Pirgmaier, “The Value of Value Theory for Ecological Economics,” *Ecological Economics* 179 (2021), for the misunderstanding of the concept of value by ecological economics and the Capitalocene discourse.

³⁷ ↩ Marx, *Capital*, vol 1, 713.

³⁸ ↩ “In relation to the worker who appropriates nature by means of his labor, this appropriation appears as estrangement, his own spontaneous activity as activity for another and as activity of another, vitality as a sacrifice of life, production of the object as loss of the object to an alien power, to an alien person” (Karl Marx, *Economic & Philosophic Manuscripts of 1844* [Moscow: Progress Publishers, 1959], 35). See also John Bellamy Foster and Brett Clark, “The Expropriation of Nature,” — The Jus Semper Global Alliance, August 2020; and John Bellamy Foster and Brett Clark, “The Robbery of Nature,” The Jus Semper Global Alliance, August 2021.

³⁹ ↩ Strictly speaking, nature is not commodified, but expropriated. What is commodified is the use value obtained *from* nature by the living activity of labor. For this to occur, nature has to first be expropriated. Once expropriated, nature may have price, but nature can only be a commodity and have value once it is processed by human labor. That is why nature is a *source* of use-values, but in the absence of labor it remains just nature.

⁴⁰ ↩ Certainly, labor force is a commodity with the unique particularity in the commodity realm in that it produces more value than it costs.

produce value, the problem of capital accumulation has to be addressed from the perspective of labor, in particular, from the specific form of labor exploitation by capital.⁴¹

Once non-proletarian societies are alienated from their means of production, the particular form of labor exploitation that characterises capital accumulation is the obtaining of surplus value by the two different mechanisms shown by Marx: absolute surplus labor and relative surplus labor. Surplus labor is not only specific to the capitalist mode, but it is the constitutive form of capital accumulation. In fact, obtaining surplus value by labor exploitation is the process commanding expropriation, proletarianisation, and commodification, and not the opposite. Hence, it is the driving mechanism for the expansion of the capitalist mode on Earth. Certainly, there have been historical periods in which the sum of capital amassed through expropriation may have eventually prevailed over capital accumulated through surplus labor; for example, in periods of “so-called primitive accumulation,” or, more recently, during the expropriation of public resources by capital following the collapse of Soviet-style economies. However, expropriation is only the first moment for capital to begin accumulating in non-proletarianised and non-commodified scenarios, a moment that rapidly fades once accumulation by surplus labor emerges as the dominant form.

The question is what are the mutual determinations between these two moments, and how can such determinations evolve and explain the history of the capitalist mode. For Capitalocene and some primitive accumulation theorists, the driving mechanism of capital accumulation is the so-called “accumulation by appropriation,” while for Marx, it is surplus labor resulting from labor exploitation. The Capitalocene discourse highlights “capitalism as a history in which islands of commodity production and exchange operate within oceans of Cheap—or potentially Cheap—Natures.”⁴² Although this might be formally correct, it is a rather incomplete understanding of the unfolding of capitalist production, and does not account for the intrinsic forms of capital accumulation or the history of capital accumulation.

Put simply, stating that the premise for proletarians are non-proletarians and that the premise for commodification is non-commodification is not saying much. Capital expropriates non-commodified spheres and accumulates through labor exploitation once these are commodified. In the history of capital there certainly may have been initially commodified “islands” in non-commodified “oceans.” However, this is merely descriptive and does not grasp the

Marx’s conclusion regarding the dialectics of expropriation and labor exploitation is opposite to that of Capitalocene theorists.

essentials and causalities of the dialectical relationship between “accumulation by appropriation” (in fact, expropriation) and accumulation by labor exploitation. A dialectical and materialist understanding of capital accumulation requires knowing the

concrete mutual determinations of these two processes and how these determinations evolve. This is Marx’s procedure, which has nothing to do with that of the Capitalocene discourse, despite its claims about dialectics. For this reason, Marx’s conclusion regarding the dialectics of expropriation and labor exploitation is opposite to that of Capitalocene theorists.

In summary, the Capitalocene narrative conflates appropriation without exchange of equal value (that is, expropriation) and accumulation with exchange of equal value (that is, exploitation) without a proper distinction of the two processes.

⁴¹ ↪ See Marx, *Capital* 1, 179. Marx is very explicit about the fact that value is only created by the living activity of labor and not by past labor contained in commodities, which enter the production process as constant capital. That is, value is not created by dead or past labor contained in constant capital, the value of which can only be activated and transferred into successive commodities by the action of living labor. Actually, Marx is very precise and, quoting Benjamin Franklin, defines the labor activity of making tools as the human concrete universal (Marx, *Capital* vol. 1, 179).

⁴² ↪ Moore, “The Capitalocene, Part I,” 606.

Therefore, it is not able to understand the causal concatenations throughout the history of capital accumulation, in which the first is a necessity for the second, and the second is the determinant moment over the first.

The Capitalocene narrative amalgamates Marx's categories in Capital in an apparently radical discourse, but these categories are not interrelated in terms of necessity and causality within an articulated and organic theory of capitalist production like Marx's theory of value. This is particularly noticeable when connecting the concrete relations of capital accumulation to other capitalist laws and to the capitalist crisis; for example, when categories such as the rate of surplus value, the rate of profit, socially necessary labor-time, capital accumulation, and others are mixed in a disjointed discourse aimed at understanding the recurrent crisis and the cycles of capital reproduction. From the Capitalocene perspective,

The world-historical essence of advancing labor productivity—understood in surplus value terms—is the use of Nature's unpaid work relative to labor-power.

Capitalist technology works through a simple principle: advance the rate of surplus value. The rate of surplus value turns on many qualitative and quantitative factors and conditions. But since the basic feature of rising productivity is a rising quantum of energy and raw materials (circulating capital) per unit of socially necessary labor-time, the global rate of profit depends on a threefold process: (1) material throughput must go up within the circuit of capital; (2) the necessary labor time in the average commodity must go down; (3) the costs of circulating capital (which also affect fixed capital) must be reduced (if a boom is to occur) or prevented from increasing (if a crisis is to be averted). The rate of surplus value therefore bears a close relationship to accumulation by appropriation. Accumulation crises occur when capital's demand for a rising stream of free—or low-cost—work cannot be met by human and extra-human natures.⁴³

Capitalism is a production mode based on commodified interpersonal relationships spontaneously developed throughout a historical process. Its overall functioning is not subjected to any planning, and, for this reason, it has autonomous dynamics and deterministic laws similar to the laws of nature, which describe the system and its history. This is Marx's goal in Capital. Capitalist production is commodity production, and the production process is seen by

These are the concrete concatenations that determine the accumulation of capital in society, its periodic crises, and the necessity of capitalist expansion on Earth. These are the fundamental mechanisms that ultimately lead to the overpopulated world, the capitalist systemic crisis, and the planetary crisis.... However, the Capitalocene view understands these concatenations upside-down and/or remains ambiguous regarding the mutual determinations of categories.

capitalists through the lens of the cost-benefit equation, in which benefit or profit is the surplus value supplied by labor exploitation and cost is the capital invested to obtain profit. Every single commodity obtained from the production process contains a fraction of the total profit supplied by labor exploitation. The global profit rate is directly proportional to the total surplus value or profit and is inversely proportional to the global capital invested to obtain such profit. Capitalists only produce for profit and if there is no profit, there is no production.⁴⁴ As long as living labor is increasingly expelled from the process of capitalist

production in favor of dead or past labor, which does not create surplus value, profit is obtained at a decreasing rate, which is best expressed over the long term. Hence, capitalists have to overproduce commodities not only to overcome

⁴³ ↪ See Moore, “The Capitalocene, Part II,” 269.

⁴⁴ ↪ “The rate of profit is the motive power of capitalist production. Things are produced only so long as they can be produced with a profit” (Marx, *Capital* 3, 178).

the decreasing rate of profit, but also to increase their own fraction of profit with respect to the total profit produced in society; that is, they have to compete with other capitalists for a global profit, the rate of which decreases. Essentially, these are the concrete concatenations that determine the accumulation of capital in society, its periodic crises, and the necessity of capitalist expansion on Earth. These are the fundamental mechanisms that ultimately lead to the overpopulated world, the capitalist systemic crisis, and the planetary crisis. Marx's Capital unfolds all these concrete concatenations in his labor theory of value in terms of logical categories such as causality, phenomena-essence, necessity-contingency, and through articulation of the different capitalist laws: the law of capitalist accumulation, the law of capitalist population, and the law of the tendency of the rate of profit to fall, all of them derived from the law of value.⁴⁵

However, the Capitalocene view understands these concatenations upside-down and/or remains ambiguous regarding

From a Marxian perspective, capitalist competition for a global profit with a long-term decreasing rate requires more and more capital to be accumulated to overcome this tendency, which means more and more consumption and eventually exhaustion of “human and extra-human natures” on a planet with finite resources.

the mutual determinations of categories. First, the rate of surplus value in Marx's own conception is essentially related to labor exploitation and not to “accumulation by appropriation” (that is, expropriation). Second, if the “material throughput” is the physical material from nature entering the production process, stating that the profit rate depends on a rising “material throughput” is a tautology, for it is obvious that the more capital is invested the more

“human and extra-human natures” are needed. Nothing is said here about why more and more capital has to be invested and how this is related to the profit rate, and the concrete and reciprocal relations among profit rate and capital accumulation remains ambiguous. From a Marxian perspective, capitalist competition for a global profit with a long-term decreasing rate requires more and more capital to be accumulated to overcome this tendency, which means more and more consumption and eventually exhaustion of “human and extra-human natures” on a planet with finite resources. Additionally, the more nature is consumed, the more waste material is returned to nature, which might end up being toxic not only due to the particular physical and chemical properties of the waste material itself, but because of the quantity returned. So here we have Marx's metabolic rift, articulated in relation to capital accumulation and in line with the tendentially decreasing rate of profit, and thereby connected to the underlying causality and necessity embedded in the framework of Marx's theory of value. Finally, stating that the rate of profit depends on decreasing “the necessary labor time in the average commodity” is correct—but what is the concrete relation between the rate of profit and a decrease in the necessary labor-time of commodities or, in other words, an increase in labor productivity?

As a matter of fact, underlying the Capitalocene narrative is a misunderstanding of capitalist crises and their relation to capital accumulation and to the profit rate. Capitalocenists conceive of capitalist crises as driven by scarcity of natural resources: when capital's demand of human and extra-human natures cannot be met. But it is exactly the opposite: crises are the result of an excess of natural resources, crystallised in commodities by an excess of human labor; that is, an excess of capital. When the over-accumulated capital reaches a threshold, it cannot be assimilated into the production processes or by individual consumption any longer. The reproduction of capital then faces a barrier that can only be surmounted by destroying the over-accumulated capital through periodic crises, which point to the autonomous and out-of-control character of the capitalist production. This is the law in Marx's theory of crisis, not “Marx's important

⁴⁵ ↪ There is an increasing amount of literature on these topics. Some examples are Carles Soriano, *Antropoceno, reproducción de capital y comunismo* (Madrid: Maia Ediciones, 2021); Murray E. G. Smith, Jonah Butovsky, and Josh J. Watterton, *Twilight Capitalism* (Halifax: Fernwood Publishing, 2021); and Andres Piqueras, *La Tragedia de nuestro tiempo* (Barcelona: Anthropos Editorial, 2017).

but rarely discussed ‘general law’ of underproduction,” which does not exist in Capital.⁴⁶ In other words, this is the characteristic form of capitalist crisis, in which a bad harvest or lack of raw materials are contingencies affecting the general law. If the bad harvest is related to the ongoing climate change, this has to be understood within the overall dynamics of capital reproduction. Equally, if the scarcity of raw materials is related to the necessity of capital accumulation at a decreasing rate of profit or to one monopolistic strategy or another, this has to be understood within the context of capital reproduction under deterministic laws. Capitalocenists are not able to undertake this kind of research due to their poor understanding of Marx’s theory of value. There is not even a need to say that when such contingencies become structural, they may become the dominant moment of capital accumulation and crisis themselves.

What is important for developing the right strategies to surmount the planetary crisis is knowing the particular interactions of the mechanisms of capital accumulation that have led us to the ongoing planetary crisis. The present-day systemic crisis of the capitalist mode that we are increasingly facing is anchored in a long-term decreasing rate of profit as the background causative mechanism by which each crisis unfolds with its own particular expression, but all of them showing common regularities and common essentials. The accumulation of capital with these background determinations leads to a systemic crisis of capital valorisation. When the analysis of the reproduction of capital in terms of value is considered in terms of the physical and chemical properties of nature, the planetary crisis appears as a necessary manifestation of capital’s valorisation and of its systemic crisis. On the contrary, misleading claims about nature depletion or the difficulties of accessing “Cheap Natures” as the pivotal determinations of capital accumulation and of capitalist crisis relies on a misunderstanding of Marx’s theory of value and does not allow undertaking the right strategy to leave the planetary crisis behind.

Conclusion

The planetary crisis involves the whole earth, including humans. It is a profound alteration of Earth’s functioning that affects living organisms and inert matter. Therefore, a scientific and comprehensive knowledge of Earth System dynamics based on the classical natural science disciplines is needed to understand Earth’s responses to the crisis, and to orient

The Capitalocene approach is methodologically and gnoseologically flawed by disregarding the necessity of abstracting nature and society for their particular study prior to undertaking research on the concrete interactions between these categories, which would reveal the capitalist origin and evolution of the planetary crisis.

any possible actions aimed at mitigating the crisis. The planetary crisis is not just specifically human, but it is specifically capitalist. It is a necessity of the capitalist production mode. Therefore, any action aimed at not just mitigating, but leaving this crisis behind, requires a scientific understanding of the capitalist mode of social production and of the capital reproduction upon which this mode is based. Unfortunately, neither Anthropocene nor

Capitalocene conceptions of the planetary crisis have undertaken a critique of political economy based on Marx’s theory of value, which until today, is the only scientific theory of the capitalist mode. Therefore, none of these approaches to the planetary crisis is complete.

⁴⁶ ↪ See Moore, “The Capitalocene, Part I,” 606. On the concept of law in dialectical logic as the concrete abstraction that grasps the essence of the multiple phenomena shaping the studied object in terms of causality and necessity, see Rosental and Straks, *Categorías del materialismo dialéctico* and Rosental, *Principios de lógica dialéctica*.

Nature is matter and the movement of matter, and it is intrinsically dialectical; thus, Earth System science must be dialectical and materialist if a scientific understanding of nature is pursued.⁴⁷ However, the approach of Earth System science is non-dialectical and non-materialist regarding the study of social reproduction modes, and this renders the whole understanding of the planetary crisis not only incomplete but idealist, for the capitalist mode is assumed as absolute rather than historical. The Capitalocene approach is methodologically and gnoseologically flawed by disregarding the necessity of abstracting nature and society for their particular study prior to undertaking research on the concrete interactions between these categories, which would reveal the capitalist origin and evolution of the planetary crisis. Finally, the Capitalocene approach lacks a proper understanding of Marx's theory of value and its constitutive laws and ends up with an idealist conception of the causative relations among the capitalist systemic crisis and the planetary crisis that is opposite to Marx's materialist and dialectical understanding.

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⁴⁷ ↩ See Engels, *Dialectics of Nature*.

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