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***Global Sustainability* special issue: Polycrisis in the Anthropocene**

***The anxious a priori:* An Essay Concerning Science, Law, and the Temporal Politics of the Anthropocene Polycrisis**

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Non-Technical Summary

This paper examines the recent rejection of the "Anthropocene" as a formal geological epoch to explore how climate anxiety shapes scientific research. While there is broad agreement among scientists about climate change, political and legal action lag behind. Scientists bridge this gap by communicating their findings in ways that influence policy. This effort reflects the broader condition of "polycrisis": multiple overlapping global challenges. I argue that terms like "Anthropocene" and "polycrisis" are not fixed truths, but strategies for taming uncertainty. Scientists, accordingly, are increasingly coming to replace legislators in encouraging certain kinds of present-day action toward more desirable futures.

Technical Summary

This paper examines the Anthropocene Working Group's (AWG) effort to formalize a new geological epoch and interprets its 2024 rejection as a case study in the politics of polycrisis. Drawing on ethnographic research with the AWG, it shows how scientific observation is increasingly driven by anticipatory anxiety and a performative impulse to orient action toward uncertain futures. Through the concepts of the technofossil and procedural precedent, the article illustrates how geoscientific methods both generate and respond to normative

expectations. The paper argues that polycrisis is not merely descriptive, but constitutes a second-order mode of engaging with the future, wherein political urgency animates what and how scientists observe. In the context of climate change, scientific actors are not only producing knowledge but also seeking to shape policy and social response by innovating within disciplinary protocols. Terms like "Anthropocene" and "polycrisis" are powerful abstractions whose utility lies in their imaginative capacity to narrate contingency and complexity, and imagine solutions by orienting action in the present toward desirable outcomes in the future, rather than in any fixed claim to objectivity.

Social Media Summary

Anxiety about the future is reshaping science, law, and the way we understand today's overlapping global crises.

Introduction: Crisis, or the absence of decision

"The question of whether the world will end in fire or in ice, with a bang or a whimper, no longer interests artists alone," explained Christopher Lasch in his best-selling book of 1979, *The Culture of Narcissism*. "Impending disaster has become an everyday concern, so commonplace and familiar that nobody any longer gives much thought to how disaster might arrive."[i] Not only has disaster, or crisis, arrived in some ominous form yet to be fully grasped. It's intrusion is thought to be so commonplace that it has become necessary to pluralise crisis, into polycrisis. The arrival of crisis, leads to a further crisis of its own making. Disaster has arrived, or at the very least, announces itself as it looms on the horizon. But what to do about it?

It is ironic that the term 'crisis' is etymologically derived from the Greek word κρίνο, or *decision*, because crisis, and particularly polycrisis, indicates either the absence of a decision, or the unintended consequences of a decision. Societal complexity means decisions entail the need for further decisions. Decisions are made with an eye toward the future. Under conditions of climate crisis, the future has become a site of scientific attention, representing a site of uncertainty, which, it is hoped, scientific expertise can help alleviate. And yet, attempts that could be broadly construed as scientific encounter their own problems in seeking to alleviate uncertainty. As a separate contribution to this special issue explains:

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"decision-making has always managed a certain level of uncertainty… but the combination of uncertainties linked to climate change, the Anthropocene, and to human activities has evolved into a serious problem for probabilistic approaches."[ii]

This essay argues that polycrisis represents a fundamental shift in how scientific knowledge is produced and communicated, driven by what I term, following Niklas Luhmann, the "anxious a priori."[iii] Anticipatory anxiety about uncertain futures increasingly shapes scientific observation. Under conditions of polycrisis, scientists are increasingly involved not only in observing phenomena, but also in interpreting and communicating the significance of their observations. Scientific observation, is increasingly a second-order phenomenon. Scientists reflect on and frame their research to bridge the gap between near-unanimous consensus among scientists concerning the anthropogenic reality of climate change, and the absence of a consensus with regards to policy and legal action accordingly.

My central claim is that terms like "Anthropocene" and "polycrisis" function not as fixed descriptive truths (although the AWG have provided a rigorous geological description of the Anthropocene), but as performative abstractions that scientists deploy to orient present-day action toward particular futures.[iv] Scientific research takes on a normative authority by virtue of the objectivity associated with scientific truth claims, even where those claims lend themselves to arguments beyond the remit of scientific research. The authority of those scientific truth claims can help advocate for particular interpretations of expertise and responses to crisis.

My argument unfolds through three interconnected analytical moves. First, drawing on the method of second-order observation, I examine how the Anthropocene unfolded a controversy among geologists despite the rigorous approaches of both the AWG and the Subcommission on Quaternary Stratigraphy of the International Commission on Stratigraphy (SQS-ICS). I examine two examples. The "technofossil" reveals how palaeontological methods acquire a juridical quality, making recent history geologically significant. Similarly, the AWG's appeals to procedural precedent demonstrate how scientific truth claims depend not only on material evidence, but on rhetorical strategies that align proposals with institutional expectations.

I then contextualise these strategies within the broader dynamics of polycrisis. The disparity between scientific consensus on climate change and the absence of corresponding policy consensus compels scientists to engage in what I call, following technical vocabulary

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developed by Moeller & D'Ambrosio among others, "authentic" rather than merely "sincere" scientific practice.[v] These gestures facilitate innovation within disciplinary protocols that adhere to prescribed roles, and more.

Finally, while much scholarship on the Anthropocene focuses on its geological validity or cultural implications, this paper examines the process of its proposed formalisation as emblematic of broader transformations in scientific practice under conditions of polycrisis. Rather than addressing whether the Anthropocene should be formalised, I ask what its attempted formalisation reveals about changing relations between science, crisis management, and temporality. Polycrisis constitutes a second-order mode of engaging with imagined futures. Attempts to manage uncertainty through scientific practice generates new forms of uncertainty spanning domains of expertise.

Building on Luhmann's insight that "anxiety is the modern a priori", anticipatory temporalities increasingly structure scientific observation itself. Scientists' perception of urgency resulting from the unfolding climate crisis drives methodological innovations that take effect beyond the strict remit that the AWG stuck to, blurring contours between description and prescription, fact and interpretation. This offers a new framework for understanding how scientific authority functions in an era where expertise must compete with multiple, conflicting sources of knowledge and legitimacy.

Beyond a case study for geological classification in times of polycrisis, the Anthropocene formaliastion effort illustrates how polycrisis conditions are transforming the societal significance of scientific expertise and practice. Scientists are expected to perform as prophetic figures who not only observe the world, but actively shape how it is understood and acted upon.

Methods: observing observers observing.

Observation of any complex begins *from somewhere*.[vi] It starts when a distinction is drawn. This distinction is arbitrary in the mathematical sense: not *random*, but a necessity with compounding effect on subsequent observations or arguments made on the basis of an initial distinction.[vii] To speak of *polycrisis* or the *Anthropocene* is therefore to speak of *our* version of it. Even if geologists have suggested a formal definition for the Anthropocene, in lieu of its approval by the SQS, precisely to synchronise communication[viii], many observers may feel that such definitions fail to capture the term's full complexity—particularly its sociological

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and cultural dimensions, which lie outside a strictly geological scope.[ix] Second-order observation is a sociological method that observes observers choice of distinctions.[x]

First-order observations are based on drawing a distinction, but they do not yet reflect on the observer's own role in choosing that distinction. Such observations use distinctions as a framework for observing the world, without recognising that these distinctions are selected by the observer, and could have been made differently. Many examples of first-order observation arise from the Anthropocene. Initially, Paul Crutzen suggested that the Anthropocene began in the late 18th Century, coincident with the advent of the Industrial Revolution.[xi] This was consistent with how geologists classify time and space: setting a "boundary" in Earth's stratal record, designating when and where change occurred. Crutzen was not a geologist, but acknowledged that his term was coined in opposition to the Holocene,[xii] our present geological epoch of 11,700 years, characterised by climatic stability. Crutzen understood that in order to introduce his distinction, between climatic stability *instability*, it would be necessary to adhere to geological conventions of naming and dating periods within the stratigraphic record.

Consequently, it was not long until scientists and scholars of all persuasions began to suggest their own alternatives to the Anthropocene. These ranged from those seeking consistency with geological practices of classification, such as Lewis & Maslin's Orbis Spike; to those that critically reflect on the epistemological quandaries of geological classification and the implied attribution of responsibility, such as the Capitalocene, Plantationocene, or Cthulucene, to name a few.[xiii]

As an anthropologist of science, I observe others making observations. I do not to judge or question the truth of their claims. My interest is in understanding how truth claims evolve over time. If we are to take second-order observation at face value, then that clearly implicates *me as well*. What I present in this article is a series of discrete accounts of the Anthropocene that were developed between 2016 and 2019, during which time I met regularly with members of the Anthropocene Working Group, whose task it was to gather evidence in support of formalising the Anthropocene as a unit of the Geologic Time Scale. I conducted semi-structured interviews with members of the Anthropocene Working Group, the Subcommission on Quaternary Stratigraphy and the International Union of Geological Sciences. I also conducted participant observation, attending meetings of the AWG in various locations, and locations such as the Haus der Kulturen der Welt, a cultural museum in Berlin

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that devoted much of the 2010's to programming on and about the Anthropocene, entitled *Anthropocene Curriculum*.[xiv]

What I studied, therefore, was not the Anthropocene itself, and certainly not the Anthropocene as a proposed stratigraphic in the strict sense. I studied public deliberations and accounts of the Anthropocene provided by people involved in its formalisation and discussion more generally. My representation of the Anthropocene is mediated by their representations of the Anthropocene, and my representation of their representations. As an example of polycrisis, the Anthropocene cannot properly be accounted for by reference to one version of it.[xv] Rather, it is a question of how we account for the choices distinct observers make in piecing together their version of a complete image.

Formalising the Anthropocene: how decisions are made

The Anthropocene Working Group was commissioned in 2009 by the Subcommission on Quaternary Stratigraphy, following a meeting that was held at the Geological Society of London where a selection of preliminary papers about the novel term were discussed.[xvi] The reason for this discussion arose as a matter, first and foremost, of nomenclature. Ever since Charles Lyell, the word 'cene' has been employed as a suffix to geological terminology.[xvii] We live, according to official geological nomenclature, in the Holocene, derived from the Greek for "wholly new" (όλο καινούριο).[xviii] Prior to the Holocene is the Pleistocene (or *nearer* new), the Oligocene (more new) and the Palaeocene (old new). The ICS maintains a privileged role in determining the formal classification of strata and geological time, insofar as they publish the International Chronostratigraphic Chart, the basis for the Geologic Time Scale, which serves as the formal constitutional document of the discipline of geology.[xix]

Significantly, the Chart, and therefore the Scale, are administered through a deliberative procedure, requiring a formal vote by a select committee of experts who are required to approve any amendment to the Chart by way of a 60% supermajority vote. The fact that geological units are a matter of *political vote* may come as a surprise to some. It would appear to diverge from the traditional preconception of scientific research as an impartial practice whose reliability is a consequence precisely of the absence of politics. And yet, as Lorraine Daston puts it, science and law share a common origin in the "rule that measures and the rule that governs."[xx] This common history has continuing influence on both the production of scientific knowledge, and the implications of scientific expertise in society today.

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In order to be considered by the voting committee of the SQS and ICS, the AWG's proposal would need to demonstrate that their unit is *global* and *synchronous*, meaning that the Anthropocene must arise from material alterations to strata that occurred globally at around the same time.[xxi] And yet, it is acknowledged by the guidelines themselves, that this aspiration is, to an extent, a fiction, insofar as nothing happens everywhere at once, and the ideal type of a single line that circles the Earth that cuts the Earth into what happened before and after an event, is just that, an *ideal type*, existing only in our minds.[xxii] But it is an abstraction of value, insofar as it has been adopted by geologists as a useful way to orient their research, and to direct their values as a community with respect to commonly held standards.

In the 1996 revised guidelines of the International Commission on Stratigraphy, this discontinuity between *ideal types* and the complexity of the material world is acknowledged. "In a world which is not ideal it is most unlikely that all selected Stratotype points can meet all the ideal requirements and stratigraphy must be a practical subject and responsible to the needs of working geologists."[xxiii] The guidelines do not so much mirror the real world, but rather help organise the world by imposing upon it certain assumptions around which the world can be made sense of in particular ways.

A pragmatic approach therefore underlies the pursuit of truth claims in relation to the Geologic Time Scale, understood here in the classical sense associated with Charles Peirce. [xxiv] For our purposes, pragmatism holds that truth is not defined by its correspondence to an objective reality, but by its usefulness in guiding a community of researchers toward shared, productive inquiry. The relationship of pragmatism in Pierce's sense to reality is well stated in his essay 'Some consequences of four incapacities' from 1868:

> *'The real, then, is that which, sooner or later, information and reasoning would finally result in, and which is therefore independent of the vagaries of me and you. Thus, the very origin of the conception of reality shows that this conception essentially involves the notion of a COMMUNITY, without definite limits, and capable of a definite increase in knowledge. And so those two series of cognition – the real and the unreal – consist of those which, at a time sufficiently future, the community will always continue to reaffirm; and of those which, under the same conditions, will ever after be denied.''*[xxv]

When we speak of the truth of the Geologic Time Scale, we therefore speak of a set of warranted assumptions, short-hands, and collectively approved practices and statements, as

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established by a community of practitioners. This is not to suggest these claims are unreliable. They are reliable insofar as we do not possess a better alternative for verifying truth claims about the world. Truth, in this sense, emerges as a historical dynamic, subject to change. An aspiration that is contested and contestable, rather than self-evident. Truth is not relative, but neither is it absolute.

Crucially, furthermore, pragmatism is not the same as relativism. It does not deny the existence of an external, objective reality; rather, it views debates about ultimate truth as unproductive. We cannot access truth in any absolute sense. What we *can* know is what has proven, in practice, to be the most useful framework for generating and advancing knowledge. From a pragmatist perspective, which I would argue is reflected in the ICS's distinction between an idealized model and the practical needs of working geologists, truth is best understood as *consensus*.

Consequently, it is not unreasonable to suggest that the AWG's efforts extended beyond the task of identifying a geological signal of anthropogenic change. Their work also engaged with the challenge of conveying the urgency of a shared planetary predicament in ways that aligned with the procedural norms and expectations of the SQS and ICS. Although their proposal was ultimately not ratified, I argue that the AWG was nevertheless highly effective in adapting existing scientific conventions and institutional frameworks to articulate something genuinely novel: the integration of the contemporary moment, and even projections of the future, into the vast temporal scale of Earth's 4.5-billion-year geological history.

Pragmatism reminds us of an important point as we explore the idea of polycrisis in this special issue. Polycrisis brings together problems that were originally separate, which highlights how scientific claims are shaped by perspective. [xxvi] The Anthropocene, like the Great Acceleration charts, doesn't point to a single fact or data point. Instead, it's about connecting existing information in a way that reveals something new and more complex than the data shows on its own. The Great Acceleration charts weren't created to be grouped together, but their grouping tells a bigger story no single chart could tell alone.[xxvii] In this sense, polycrisis isn't an objective truth. It's a way of associating information, of framing the world. Polycrisis demonstrates how important storytelling and narrative are in both science and public communication; something that can be uncomfortable for some scientists used to separating facts from interpretation. [xxviii]

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As generations of Science & Technology Studies (STS) scholars have shown, the increasing complexity of societal problems, from climate change to global pandemics, is such that scientists are increasingly called on not simply to *inform* policy makers, but to *advocate* for particular interpretations of expertise.[xxix] And yet, despite the fact that a scientific consensus *exists* with respect to anthropogenic climate change, the same cannot be said of a policy or legal consensus.[xxx] As a result, many scientists feel a growing responsibility to help close the gap between knowledge and action. They do this by developing new language, concepts, and frameworks that aim to drive the level of response they believe is necessary.[xxxi] Scientists, in other words, are increasingly practicing second-order observation; not just conducting research, but associating and framing research in ways that are generative of arguments that extend beyond factual content. I will now focus on two specific examples of this dynamic that emerge from my time observing the AWG.

Example 1: The technofossil

There is a distinctly juridical quality to the palaeontological method. The fossil serves as a witness of events and environments that have elapsed, and are otherwise unavailable to the contemporary geological observer. The fossil speaks on behalf of that which is not available to the geologist by way of direct observation. Yet the geologist retains an exclusive privilege to speak on behalf of the fossil; to translate it into something that has meaning for and in the present. As I have explained elsewhere, this capacity of palaeontology led to a remarkable cultural shift, inaugurated by palaeontology as the original forensic science. When Nicolas Steno first found sharks teeth on mountain tops, the question was how these objects of the deep sea arrived so high up. Scripture provided the authoritative explanation, recounting the travails of Noah's Arc in the Book of Genesis, which lifted all matter up into a "great diluvial soup" before repositioning it in unfamiliar places.[xxxii] Steno saw problems in this narrative, because the shark teeth was itself encased in rock, meaning that it must be far older than the ancient rock it was enveloped in. Corroborated by similar investigations from Robert Hooke at the Royal Society, rocks were revealing a far greater temporality than that suggested by scripture. Whereas natural historians had relied on scripture to verify their material environment, with the advent of the fossil as an epistemic concept, this gaze reversed, such that "men of science" began verifying the accounts provided in scripture by reference to the contents of their material environments.[xxxiii]

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The AWG's invocation of the technofossil refers to materials that are very much in sediments already, and which can be correlated globally. These include plastics, Styrofoam, and even the remains of chicken dinners. There is nothing *speculative* about these measurements, insofar as they already exist. Yet these traces are speculative in the sense of pointing to something beyond themselves, because the mere thought of a *trace of humanity* implies something that comes *after* humanity, or that is *left behind* after it is no longer. whereas the fossil traditionally mediates between the present and the past of geological *deep time*, the technofossil reverses this gaze. It speaks on behalf of what *will* be seen. The technofossil is a collective trace of contemporary humanity, implicitly invoking an observer deep in the future. It suggests, in addition to the material reality of technofossils in the present, a further second-order speculation, whereby the geologists views sediments from the perspective of a geologist posited in the future who will see these traces grow in global deposition.

Prior to the advent of radiometric dating, geologists classified strata by correlating bodies of rock across the planet with reference to their material content. Trilobites were used to classify the Cambrian System/Period.[xxxiv] Jawless fish define the Devonian.[xxxv] Invoking fossils therefore has a juridical quality, insofar as it *substantiates* an argument concerning the proper way to classify geological time and space by reference to a particular account of what geological reality *is*, with reference to biostratigraphic markers.

The concept of the technofossil develops this strategy further, employing the hallmarks of palaeontology to make a claim about how human activity is preserved in the Earth. But again, preserved for whom? For someone who needs evidence of our impact. That is both relevant for the future, but it implicitly points to a time beyond humanity. Thinking human activity will be evident in strata for billions of years to come is thinking of a time when humans will no longer be around. Another life form will make sense of what happened, recreate our steps by way of our material remains, which will speak on our behalf, and condemn us to a particular account of our culpability. Peter Sloterdijk remarks that discussion of the Anthropocene only appears to be taking place in a geoscientific seminar, when, in fact, it takes place as a pre-trial hearing, in which the objective is to determine culpability.[xxxvi]

Example 2: Evaluating precedent

Procedure, and not only the procurement of evidence, were a central consideration in the AWG's formalisation effort. The AWG developed much of their proposal not solely by reference to material evidence, but by finding ways to render their proposal procedurally

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consistent with previous decisions issued by the SQS and ICS. This is not unique to the AWG, insofar as all efforts to amend the Geologic Time Scale must take into account the central role of the ICS and IUGS committees in evaluating the proposals they receive and making a judgement through supermajority vote accordingly. The AWG demonstrates the dynamics of this procedure with particular clarity, given that the sediments the Group were considering had not been explicitly analysed by geologists before. Geologists proposing an amendment to the Geologic Time Scale must appeal to the sanctity of the deliberative process of the ICS. Although we now know that this approach was ultimately unsuccessful, in the AWG's case, it is still highly revealing that geoscience owes much of how it produces truth claims to procedures that are rhetorical and political insofar as a supermajority vote is a central component in how geological time comes to be formalised.

In their book *Laboratory Life*, Steve Woolgar and Bruno Latour notice that scientists, above anything else, produce texts.[xxxvii] Yes, scientists do *a lot of other things besides that*, but their primary medium of communication is textual. The AWG were no exception to this general observation of scientific labour. A large part of the AWG's formalisation effort was consequently concerned not just with presenting the evidence of their field work, but also with strategizing how to present that research in a way that would maximise the likelihood of a desired outcome: a formal Anthropocene unit of the Geologic Time Scale. Certainly, the facts speak for themselves, but it is not a given that everyone will interpret those facts in the same way. The AWG had to demonstrate that their interpretation was the most appropriate, which is where recourse to precedent and deliberative procedures associated with the Geologic Time Scale becomes crucial.

One example is the reference the AWG make to the Cretaceous-Tertiary, or K-T, boundary.[xxxviii] Sceptics of the AWG's formalisation effort often referenced the comparably brief duration of the proposed unit. Following an internal vote in May 2019, the AWG agreed that they would pursue a mid-twentieth century start date, which would be confirmed stratigraphically with reference to one of a range of sites they impressively built up through their global network.

During my observation of AWG meetings, discussion was often committed to determining an adequate site for the extraction of a GSSP, or *lower boundary* of the proposed Anthropocene unit, an extensive amount of discussion was devoted to discussing *whether, or how, the AWG's formalisation effort was consistent with the deliberative procedures particular to the*

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GTS. This is not a deviation from any unit formalisation procedure, bound by the rules of the ICS Guidelines.

The AWG inherited from Crutzen the premise that the Anthropocene was a global *event* that had begun within recent history; but it lacked a demonstrable, discrete, material signature in the strata. The AWG subsequently focused on defining material signatures such as plutonium 239/240, or the global spread of technofossils ranging from plastics to chicken bones.[xxxix] Yet this argument was contested out of concern regarding the Anthropocene's placement within the classificatory hierarchy of the International Chronostratigraphic Chart. 'The elephant in the room', commented one Anthropocene-sceptic geologist following a presentation on lower boundaries during the AWG's 2018 meeting in Mainz, 'is whether the Anthropocene can be justified at Series status. I personally think it's pointless to create stages and sub epochs for the Anthropocene.' Subsequent presentations justifying nomination of the potential Anthropocene unit at Series/Epochal level were criticised for not having adequately delineated a set of material attributes.

Since then, publications by members of the AWG explain how the Anthropocene decision is consistent with other units of the Geologic Time Scale.[xl] The K-T boundary is often a prime example, because it is evidenced by reference to a very brief section of strata, amassed during a global and synchronic meteorite impact, leaving a distinct level of iridium otherwise almost entirely absent in the rock record. The same can be said of nuclear weapons detonation, *as well as* Pu239/240 levels,[xli] similarly largely absent from Earth's sedimentary archive prior to the associated event, thereby representing an anomaly of global and synchronous (i.e., geological) significance.[xlii]

This parallel demonstrates not only an objective measurement of something we already know to be the case (human impact on the planet), but frames that difference in a manner that would make it incumbent on the voting committees of the SQS-ICS to approve the Anthropocene, if for no other reason than upholding the sanctity of their deliberative procedures, which underlie the reliability of the Chart and Scale. Political process, and not *only* scientific evidence, underpin what qualifies geological knowledge as scientific, valid, and authoritative.

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The anxious a priori

Why are scientists increasingly engaging in meta-level analysis, i.e. analysis not simply of their object of analysis, but of the manner of its communication and impact? Why, in other words, are scientists increasingly concerned with what comes *after* their basic research? My argument is that this shift reflects the pressures of living in a time defined by *polycrisis*, with climate change as its most pressing example. Scientists perceive an increasing disparity between the urgency of their findings, and the (lack of) action taken accordingly by policymakers, politicians and lawyers. Scientists have a unique understanding of Earth systems, and feel compelled to apply their expertise in ways that provoke action they believe is commensurate to the urgency their findings demonstrate. This is what I call, borrowing from Luhmann, the "anxious a priori."

In his book *Ecological Communication*, Niklas Luhmann quipped that "anxiety is the modern a priori."[xliii] In presenting the technofossil and precedent-review as two strategies of the AWG, I have sought to show how the Anthropocene was pursued as a proposed formal unit of the Geologic Time Scale. But *why* were these strategies pursued? What motivated the development of these strategies to begin with? *Communicating* scientific research is increasingly just as important as *conducting* it. Whereas one might expect that the job of scientists is simply to create data, idioms such as tipping points, the Great Acceleration Charts, and the Anthropocene, are greater than the sum of their parts. The individual graphs of the Great Acceleration charts were created prior to their presentation as part of a Great Acceleration pattern. These are framings of *the relations between data* that have a further effect. This impetus to not simply conduct research but frame its meaning, is perhaps attributable to a peculiar predicament of society today whereby near-unanimous consensus among peer-review scientific articles: climate change is real and anthropogenic[xliv] is not mirrored by a consensus in policy, law, or other areas associated with normative steering of society in response to problems.[xlv]

The future serves as a space to project meaning into, in order to provoke action in the present. Accounts of the future orient action in the present, if for no other reason than to avoid those futures that appear undesirable. Scholars of science & technology studies assert that the future is invoked as a way of constraining the possible avenues of action in the present in ways that render scientific knowledge and expertise *performative*.[xlvi] To say that science is performative means that science does not simply describe an existing, external environment,

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but brings it into being: geoscience performs the environment, creating the phenomena it describes.[xlvii] The technofossil, or the Geologic Time Scale, do not simply record or measure the object of their analysis, but actively construct them as new horizons or trajectories of research.[xlviii]

Luhmann's account of anxiety can be folded into a more general description of how observers describe the future from the perspective of today. The future appears as a contingent set of possibilities about which decisions are demanded, because the future appears as something about which we must do something.[xlix] Yet this anticipatory dynamic within which scientific research is increasingly situated has its own set of effects, or feedbacks, for scientific research. Polycrisis is, consequently, not just a new object of research, but a new *research dynamic*.

We can examine this observation through contemporary discussions that distinguish authenticity from sincerity. Moeller & D'Ambrosio describe sincerity as building one's identity by faithfully committing to socially prescribed roles.[l] Under this paradigm, as Charles Taylor notes in *The Ethics of Authenticity*, 'people were often locked into a given place, a role and station that was properly theirs and from which it was almost unthinkable to deviate.'[li]

Modernity, according to Taylor, emerges with the breakdown of these rigid structures, ushering in an age of authenticity, where identity is crafted by projecting a social persona rooted in a unique, original inner self. In the context of the Anthropocene, the relevance of this shift lies less in individual geologists attempting to express their authentic selves, and more in the application of existing geological methods that, while remaining entirely factual and descriptively accurate, also lead onto establish new observational criteria.

The technofossil becomes a device for linking data, such as plastic accumulation, nuclear fallout in sediments, voting procedures within the SQS/ICS, and chronostratigraphic classification traditions, in order to make a *novel* or *authentic* claim about the recent geological past. Such claims, while factual, provoke calls for stricter adherence to established principles. These geologists could be observed as demanding *sincerity* in the strictly technical sense of the term outlined above. As one vehement opponent of formally recognizing an Anthropocene Series/Epoch put it:

> *'Precise boundaries are the basis for defining geological time, a prerequisite for the correlation of abiotic and biotic events and the understanding of the rates and timing of*

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biological and geological processes on our planet. Earth sciences, through the International Commission on Stratigraphy of the International Union of Geological Sciences, continue to this day to define precise global boundaries, which in turn allows scientists to communicate with each other and with the public alike.'[lii]

This exchange highlights a dynamic in which the AWG could be observed as *authentic* in the strict sense in which Moeller uses the term: applying, frameworks of geoscientific observation, and interpreting factual evidence, in ways that account for the far more recent geological past. The SQS/ICS, on the other hand, could be observed as *sincere* scientists, again in Moeller's terms, dismissing the substance of AWG claims by reference to procedural constraints, which could always be interpreted otherwise. A tautological dynamic emerges, whereby the validty and authority of the committee's interpretation is valid because it is the one they have elected to stand by. The comment also implicitly reinforces the authority of geoscience as rooted in the continuous observation of an established system, wherein scientists earn legitimacy by occupying their prescribed place and by adhering to the mandates of their disciplinary community. Those mandates may evolve over time, but its rootedness in a preference established by a majority of key individuals is what persists despite inevitable changes to the substance of their preference.

As the AWG continued to advance claims about the Anthropocene as a proposed geological unit, they faced increasing backlash from senior voting members of the SQS and ICS, arguing that the Anthropocene was a "political decision"[liii] rather than a scientific statement, or more properly a matter of "pop culture."[liv] The common point that such critiques of the AWG's effort make is that their formalisation effort is a deviation from what is expected of them by virtue of their allegiance to a common method and community. In other words, not only must the facts procured from stratigraphic measurements be interpreted, but the very subjectivity of the geologist itself must be interpreted in line with the expectations of a majority of their peers. Does this represent a breach of the imperative that the scientist remain an impartial observer? One could be forgiven for questioning whether the SQS-ICS dismissed the AWG's proposal on the basis of assertions concerning its members as individuals, rather than on the merit of their proposal.

The two examples provided earlier demonstrate not an ambition to *undermine* the formalisation procedures that characterise the Scale and SQS-ICS, but an attempt to apply those methods to respond to the Anthropocene polycrisis, and climate change more generally.

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This aspiration emerges out of a sense of anxiety concerning the urgency of climate change, and the inadequacy of normative response. Paul Crutzen, who coined the Anthropocene term, invokes the term to advocate for a replacement of lawyers and politicians by scientists and engineers in steering society:

> *"A daunting task lies ahead for scientists and engineers to guide society towards environmentally sustainable management during the era of the Anthropocene. This will require appropriate human behaviour at all scales, and may well involve internationally accepted, large-scale geo-engineering projects, for instance to 'optimize' climate. At this stage, however, we are still largely treading on terra incognita."*[lv]

Crutzen's assertion is authentic in Moeller's sense. It is a proclamation departing from traditional expectation of scientists as impartial observers, raising the question: what is the nature of authority conferred by scientific expertise today?[lvi]

This dynamic characterises much scientific research today. The AWG are neutral in their description of material characteristics of sediment. Yet other scientists from the Netherlands, the UK and the US, recently argued that neutrality in science is a *myth*, which needs to be undone if scientific expertise is to play a role in addressing climate change. The very question of how science ought to intervene in social issues, explains Lydia Walsh, is already a "value judgement in itself"[lvii], echoing generations of science studies scholarship.[lviii]

> *This is particularly true in complex crises like climate change where traditional democratic debate alone cannot ascertain the optimal course of action. Scientists often play a crucial role in such crises, not only through conducting rigorous research, but also through engaging in dialogue with society by framing their research in terms of societal values - which includes rejecting the notion of morally neutral engagement.*[lix]

Climate science is reliable, argues the author of that paper, only insofar as climate scientists are seen to be impartial in political matters.

> *A successful, international climate agenda, including both climate mitigation and adaptation, requires reliable reporting of detailed and trustworthy certainties and uncertainties, whereas any form of scientism and exaggeration will be counterproductive.*[lx]

Scientists observation of their own observational practices sits within a wider ecology of social systems, particularly concerning how policymakers act on the insights and data provided by scientists. The idiom of polycrisis helps us understand why a worldview in

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which scientists describe phenomena, and where policymakers take action accordingly, guided by shared goals, does not always obtain in practice.

Take the recent efforts across Europe to tax diesel fuel as part of climate policy. While scientifically justified and well-intentioned, the policy triggered widespread protests among farmers, who questioned how they were expected to absorb the added costs without passing them on to consumers, thereby worsening inflation.[lxi] The protests revealed the policy's blind spot: a failure to account for socio-economic context. Faced with mounting resistance, governments in France, Germany, and the Netherlands retreated.[lxii] Polycrisis reframes such failures not as poor implementation, but as symptomatic of a world in which crises interact in unpredictable ways. Linear models of evidence-based policy struggle to hold, and the authority of science becomes entangled in contested social realities.

Precisely because we "cannot think without abstractions," as Whitehead explains, "it is of the utmost importance to be vigilant in critically revising your *modes* of abstraction." We remain in danger of taking our abstractions to be more precise and comprehensive than they actually are, a caution that Whitehead calls *the fallacy of misplaced concreteness*.[lxiii] Consequently, the value of terms such as *polycrisis* and the Anthropocene is not what they factually demonstrate, but what new modes of abstraction facilitate. Few would claim that the Anthropocene term is of no value, simply because of the SQS-ICS vote. Indeed, the term continues to be widely used. According to a search conducted on Clarivate's *Web of Science* on the 23rd of May, 2025, the term 'Anthropocene' appears in approximately 1,760 peer-review articles published *since* the rejection of the AWG's proposal in March, 2024.

These ambitions correspond to descriptions of polycrisis provided by Dixon, Tooze, and Albert. Although their respective understandings of polycrisis differ, the theme of polycrisis is advanced as a way of navigating the future. The future is inherently uncertain, if for no other reason than it has yet to happen. And yet, the future largely derives from things that are happening now. How we describe and understand what is happening now, therefore plays a role in how we act in the future. How we imagine the future informs how we act in the present accordingly. This is where polycrisis provides a powerful rhetorical and discursive strategy for steering society in the present.

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Anthropocene polycrisis: contingency and possibility

Remarking on the role of polycrisis in visioning and shaping the future, Albert remarks that "reflection on possible futures is an essential, inescapable dimension of individual and collective agency – particularly in times of crisis when temporal horizons are compressed, the urgency of decision arises, and we must grapple with the possible future that may result from our decisions."[lxiv] Any anticipation about the future, explains Luhmann, is a reflection of the society in which those predictions are made, and that anticipation is acted upon.[lxv] The future may be uncertain, but the proclamations and analysis associated with polycrisis are founded in rigorous research. Yet there remains an element of science fiction in any proclamations of the future.

Precisely as a consequence of having been rejected, the Anthropocene may serve to reveal what is useful about the predictive capacity of scientific research today. A condition of the future is that we cannot know what it will hold in the present. Yet that does not mean there is no agency in the present. The stories we tell about the future, whether through science or fiction, or, as may be increasingly required, some serious and respectful combination of the two, constitute a pragmatic reality in the present. Science fiction's "multiple mock futures serve the… function of transforming our own present into the determinate past of something yet to come," remarks Frederic Jameson in anticipation of the *technofossil*. The present "is offered to use in the form of some future world's remote past, as if posthumous and as though collectively remembered."[lxvi]

What makes both terms, the Anthropocene and polycrisis, effective as discursive idioms is their capacity to generate novel insights by way of unanticipated associations. Both terms encourage critical reflection on the conditions of our own observation: the Anthropocene by situating our perspective not in the unfolding *present*, but in 4.5 billion years of *geological deep time*; polycrisis in echoing what Reinhart Koselleck called *die Gleichzeitgkeit des Ungleichzeitigen*: the overlapping, reciprocal, recursive quality of events.[lxvii]

The precise parameters of polycrisis are yet to be defined, existing more in the vein of what Wittgenstein calls *family resemblances*, or loose categories for grouping objects and events that, like members of an extended family, "have no one thing in common," but display "many different kinds of *affinity* between them."[lxviii] It is precisely this ambiguity of what constitutes a group of crises sufficiently enough to qualify as a *polycrisis* from which the utility or currency of the term derives, demonstrating what Alfred North Whitehead calls the need for

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"imaginative generalization" required to move beyond the "rigid empiricism" of simply describing isolated instances.[lxix]

Polycrisis, consequently, emerges as praxis. For Albert, polycrisis is part and parcel of the "processes and mechanisms" of "concrete utopian destinations." This aspiration builds off scholarship on "counter-hegemonic futures", which understands anticipation of the future as "a necessary part of social action," obliging the social sciences to take a position "about possible and likely futures."[lxx] Precisely because the future is uncertain, and could always be otherwise, it is an opportunity to enact something different; possibly better than the present. "Actions anticipating possible futures," explains Patomäki, "shape the present and thereby also contribute toward the materialisation of a particular line of development in world history."[lxxi]

The question remains *who* decides what "better" means, and *how*. Returning to the etymological relation of *crisis* with *decision*, the case of the Anthropocene demonstrates something important. Sometimes, *decisions*, and not their absence, are what cause *crisis* in the modern sense, as an act that could *steer* society toward something like the "good life" or a resolution of the problem the decision was intended to resolve.[lxxii] What difference would formal approval of the Anthropocene by the SQS, ICS and IUGS have made? The term is already one that exists "in the wild", i.e. beyond the parameters of geological sciences. Paradoxically, whereas a decision is more typically assumed to resolve crisis, the decision of the ICS has been received by some as crisis in the etymological sense: a decision that fuelled uncertainty, by questioning, perhaps generatively, the place of geosciences in society today.[lxxiii]

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