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Introduction – Climate Witnessing: Memory, Mediation and the More-than-Human*

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Abstract

This introduction outlines the conceptual framework of climate witnessing, a new approach to memory, testimony and cultural engagement with environmental crisis in the Anthropocene. Building on foundational theories of trauma and testimony developed in Holocaust and memory studies, we trace how witnessing has evolved in response to planetary-scale transformations. Expanding the category of witness to include non-human entities, ecological assemblages and deep temporalities, we nonetheless emphasise the continuing importance of human mediation and ethical responsibility. Situating this special issue within fourth-wave memory studies, we engage with current debates in ecocriticism, posthumanism and environmental justice, while also reflecting on the risks of overly diffusing agency. The introduction explores the

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representational challenges of narrating slow and distributed forms of environmental harm and considers how aesthetic practices and prosthetic memory technologies can mobilise grief and solidarity across species and generations. We propose climate witnessing as both a critical lens and a cultural practice attuned to the urgency and incompleteness of remembering environmental loss amid planetary crisis.

Keywords

climate witnessing – Anthropocene – more-than-human memory – aesthetic mediation – ecological mourning

1 From Holocaust Testimony to Planetary Trauma

Witnessing has a rich theoretical lineage in memory studies, emerging from testimonial discourse around the Holocaust and other traumatic histories. Early scholars such as Shoshana Felman and Dori Laub (1992) emphasised the paradox of trauma testimony – the survivor's compulsion to speak versus the near impossibility of truly conveying extreme suffering. They famously described the Holocaust as "an event without a witness" (1992, p. 75), highlighting the contradiction between the necessity and the impossibility of bearing witness to such catastrophe. In their work on Holocaust survivors, they showed that witnessing is not a solitary act but a relational one: it requires not only a speaker but also an empathetic listener to bear witness to the witness, helping translate private trauma into public memory. Building on this, Giorgio Agamben (1999) reconceived the figure of the witness through a philosophical lens. Drawing on Primo Levi's insight, Agamben (1999) identified the most extreme victims – the *Muselmänner* or "living dead" of the camps – as "the complete witnesses" (p. 33), precisely because their inhuman ordeal marks the limit of what can be testified. For Agamben, the true witness is thus the one who cannot speak; every survivor's testimony tacitly speaks on behalf of an absence or a silenced other, bearing witness to an unsayable horror that lies just beyond the reach of language.

Foundational reflections such as these made witnessing a central concept in memory and trauma studies, establishing the witness as a moral and epistemic figure bridging personal experience and collective understanding. By the late twentieth century, the cultural significance of testimony had grown so prominent that historian Annette Wieviorka (2006) dubbed it "the era of the witness", noting how survivors' stories attained unprecedented public authority as

carriers of memory and history. Scholars like Felman and Laub and Wieviorka showed that the act of bearing witness – whether in courtroom testimonies, video archives or literary memoirs – was crucial for transforming individual trauma into communal memory and ethical awareness. Over time, memory studies further expanded the scope of witnessing beyond the immediacy of the eyewitness. Research on postmemory (for example, Hirsch, 1997, 1999, 2001) explored how children of survivors can "remember" and bear witness to their parents' trauma second-hand, while others examined how mass media and art enable audiences far removed from an event to become "secondary witnesses" to atrocities (Landsberg, 2004). The testimonial paradigm that began with Holocaust survivors thus travelled to new contexts – from truth commissions and human rights tribunals to films, museums and literature – globalising the notion of witnessing as a key practice of remembrance and justice. Today, this paradigm is being radically reconfigured: fourth-wave memory studies has begun to interrogate witnessing from posthuman and ecological perspectives, raising questions about whether and how non-human entities and environments might register and mediate traumatic events (Craps et al., 2018; de Massol de Rebetz, 2024; İbrişim, 2024; Munteán et al., 2017; Richardson, 2024). This expanded approach lays important groundwork for theorising what we call "climate witnessing".

2 Climate Witnessing in the Anthropocene

Climate witnessing, as envisaged in this special issue, both builds on and significantly diverges from earlier witnessing frameworks. Like classic testimony, it involves bearing witness to injury, loss and injustice – but here the "event" in question is the diffuse and ongoing planetary crisis of climate change. Conventionally, witnessing entails directly observing an occurrence and providing testimony or evidence of it, an act that authenticates events and bridges individual experience with collective acknowledgement. We extend this foundational concept to climate witnessing, which we conceive in terms of Anthropocene witnessing – that is, the process of bearing witness to the still-contested new geological epoch defined by humanity's ascendant impact on the planet. We use "climate" rather than "Anthropocene" in the title of this special issue to foreground the immediacy of climate breakdown as lived experience, while treating the two terms as interlinked. Climate change is one of the most salient symptoms of the Anthropocene, and focusing on climate emphasises the tangible, atmospheric and ecological transformations that witnesses encounter, even as those transformations form part of the broader Anthropocene condi-

tion. The essays assembled here engage with various aspects of the Anthropocene's multi-faceted socio-environmental catastrophes, including not only climate change but also biodiversity loss, pollution, habitat destruction, resource depletion and the social injustices entangled with these crises. In doing so, they invite us to rethink witnessing as a practice that not only observes and remembers but also demands accountability and action in the face of unprecedented planetary change.

Arguably, the lack of scientific consensus on whether we have officially entered the Anthropocene makes the task of witnessing all the more urgent. The recent story of geological dissensus is telling: in 2023, the Anthropocene Working Group (AWG) of the Subcommission on Quaternary Stratigraphy (SQS), a constituent body of the International Commission of Stratigraphy (itself the largest scientific organisation within the International Union of Geological Sciences), proposed Crawford Lake in Ontario, Canada as the site of a "golden spike" marking the epoch's inception around 1952, based on sedimentary traces of mid-twentieth-century nuclear fallout and fossil fuel combustion. However, in early 2024 the SQS, followed by the field's governing body, voted not to formalise the Anthropocene, citing insufficient evidence to declare a new epoch (Zhong, 2024a, 2024b). Although the Anthropocene concept has gained enormous interdisciplinary traction since its introduction by Paul Crutzen and Eugene Stoermer (2000), its ultimate rejection by the geological bodies responsible for stratigraphic classification underscores the complexity of defining and witnessing planetary change. This uncertainty in the sciences only heightens the impetus for the humanities to bear witness to the profound transformations underway, even if the epoch remains nameless or contested.

Even if consensus on the epoch were reached, critics point out that a mid-twentieth-century start date for the Anthropocene risks overwriting longer histories of colonial and racialised environmental violence (Lewis and Maslin, 2015; Yusoff, 2018). The geological framing of a 1950s beginning can obscure the fact that colonialism and global capitalism had been terraforming environments and marginalising peoples for centuries prior (for example, the ecocidal impacts of the Columbian exchange, the transatlantic slave trade and Indigenous dispossession). As Kathryn Yusoff (2018) and others argue, the very category of the human in Anthropocene discourse often reflects a Eurocentric universal that ignores how ideas of inhumanity were historically applied to colonised populations to justify their exploitation. The legacies of these geo-logics of colonialism persist in the racialised disparities of today's climate crisis, where those least responsible suffer the most. Furthermore, the AWG's insistence on clear, globally synchronous markers of epochal change overlooks the more diffuse, less legible signatures of these longer histories of extraction

and oppression. In the light of these critiques, there is a need to re-examine the orthodox Anthropocene narrative (with its post-1945 focus on industrial acceleration and future catastrophe) and to integrate deeper temporal and social dimensions that it tends to erase (Davis and Todd, 2017; Whyte, 2017, 2018; Yusoff, 2018). Many of our contributors take up this challenge – for example, Mara van Herpen, Rick Crownshaw, Lucy Bond and Jessica Rapson, and Casey Gray et al. explicitly trace continuities between colonial-era environmental transformations and present-day climate injustices, urging a more nuanced understanding of how the past lives on in the geological present.

3 Rethinking Event, Agency and Scale

Confronting the deficits of Anthropocene orthodoxy, this collection generally conceptualises witnessing as a more-than-human process. In doing so, it positions itself firmly in the fourth wave of memory studies and its recalibrations of what is remembered and how it is remembered, moving beyond the human(ist) scales previously imposed on events and memory (Craps et al., 2018; Gülüm et al., 2024; Knittel, 2023). The ontology of the climate crisis has underscored the necessity of this recalibration by demonstrating the thorough entanglement of human and non-human worlds. Climatic events are never purely "natural" or discrete happenings; rather, they are assemblages of human actions, non-human entities, matter and processes that "intra-act" in complex ways (Barad, 2007). As Jane Bennett (2010) observes, things that assemble do not merely interact as separate elements; they mutually affect and reconstitute each other. What we label an "event" is often just the tipping point when a certain configuration of human–non-human forces reaches critical mass and makes a tangible difference. Memory studies must therefore account for these entangled agencies and extended temporalities if it is to address the climate emergency. The contributions to this issue variously explore the relationship between the human and the non-human in acts of climate witnessing: where agency can be found, how it materialises and what material and discursive forms witnessing and testimony can take. To ground our framework, and by way of introducing some key concepts that inform this special issue, we next briefly survey several theoretical interventions on witnessing, memory and the Anthropocene.

Michael Richardson (2024) reminds us that witnessing is "[n]ecessarily relational", an act that "forges an intensive connection between witness and event, a registering of something happening that forms an address and insists upon a response" (p. 4). In other words, to witness is not merely to see; it is to

implicate oneself in an ethical relationship with the witnessed event, pushing that event "onto the stage of justice" and anchoring it in shared knowledge and responsibility (Richardson, 2024, p. 4). However, as Richardson argues – and as the essays in this collection demonstrate – in the context of the climate emergency, we must extend the space of witnessing beyond the human if we are to adequately respond to planetary trauma. A concept of *non-human witnessing* is needed to admit "nonhuman entities and phenomena" and accord them "an agency otherwise denied or limited by witnessing theory to date" (Richardson, 2024, p. 5). Importantly, expanding witnessing beyond the human does not diminish human responsibility for eco-social harms. Rather, it can help decentre a historically overrepresented kind of witness – what Sylvia Wynter critiques as the genre of Western "Man", the white, Enlightenment-derived figure who long stood as the default subject of humanity (Richardson, 2024, p. 6). Displacing this privileged witness-position makes visible forms of violence that non-human elements register but that complicit human witnesses have often overlooked or naturalised (Richardson, 2024, p. 10; see also Richardson and Zolkos, 2022, 2023). Decentring the human (particularly "Man") as the sole witness thus opens up the possibility of witnessing from the margins: from the standpoint of the more-than-human world and of human communities marginalised by modernity's exploitative systems.

Yet bringing the non-human into the "space of witnessing" raises challenging questions (Richardson, 2024, p. 5). How does a material process or entity witness an event? What is the difference between a tree's rings recording a drought and a witness giving testimony about that drought? In other words, what form would non-human testimony take, or would attributing testimony to non-humans always amount to a kind of human ventriloquism on their behalf? These questions speak to a fundamental tension: the line between raw registration of an occurrence and meaningful witnessing of it. Richardson (2024) suggests that non-human entities (technics, affects, materialities) can indeed register and communicate experience – in a sense, "witnessing" in their own right, prior to and distinct from any human interpretation (p. 6). But even if that is the case, the moment we ascribe meaning or ethical weight to those registrations, we have entered the realm of culture and interpretation. Any act of witnessing that matters socially is necessarily mediated by interpretive communities and cultural frameworks (Richardson, 2024, p. 29). In short, non-human witnessing may precede human notice, but it gains significance only within a social context that recognises it as such. Memory studies has long shown that remembrance is not free from the social frameworks in which it is embedded; it is conditioned by cultural practices, media forms and institutions that authorise and shape what is remembered (Erll, 2022; Halb-

wachs, 1992; Radstone, 2005). Likewise, the traces of environmental change – vanishing glaciers, contaminated landscapes, extinct species – become testimonies only when they are inscribed in cultural narratives and archives of memory. For memory to gain traction and travel across time and space, it must circulate in, and be remediated by, plurimedial networks (Erll, 2011; Erll and Rigney, 2009; Rigney, 2021). The remembrance of ecology (in which eventful human–non-human assemblages form) thus takes place through an ecology of remembrance: a dynamic system of storytelling, media and material signs that collectively bear witness.

A further insight from recent theory is that the events at stake in climate witnessing are inherently traumatic in a more-than-human sense. Richardson (2024) argues that what is witnessed and remembered in the climate emergency results from "the rupturing of relations that compose ecologies as living and changing assemblages of more-than-human entities and processes" (p. 131). This ecological trauma is not the shattering of a single, discrete object or life alone, but rather "the injurious and ongoing effects" of this rupturing of relations among living and non-living elements of an ecosystem (Richardson, 2024, p. 131). In an ever-unfolding ecology, no rupture is isolated; the effects reverberate through intertwined bodies and cycles, and they continue to emerge over time. Although trauma is often thought to sever an experience from normal life – "lodging fragments in bodies" as they carry on – those fragments (be they chemical pollutants in a body, or grief carried in a community) remain active, "affecting and affected by the world as it unfolds" (Richardson, 2024, p. 131). Ecological trauma thus expands the scope of trauma studies beyond the human: it locates violence and wounding in the environment itself, even if human individuals also suffer the consequences. And like human trauma, ecological trauma is haunted by a future dimension – repercussions yet to come. The injuries inflicted on ecosystems (melting ice caps, collapsing biodiversity) portend future catastrophes, meaning today's trauma is also a foreshadowing of tomorrow's losses (Richardson, 2024, pp. 132–133). This complicates witnessing, because one is bearing witness not only to what has happened, but also to what will or might happen as the effects play out.

The conceptual challenges posed by such scenarios are significant. Our contributors grapple with how to make the non-human legible, meaningful and memorable as a generative focal point for knowledge, ethics and action. In other words, how can we articulate materiality, registration, witnessing and remembrance in a coherent way? Meeting this challenge entails reconceiving witnessing itself as a process that unfolds across expanded scales of time and space, and that may blur the line between event and context. We might speak of both the witnessing of ecology (attending to an ever-changing envi-

ronment) and the ecology of witnessing (the networked nature of how witnessing happens). Representationally, this is daunting: the climate crisis confounds our usual narrative structures by entangling past, present and future. The delimitation of an "event" – so critical to traditional witnessing – becomes increasingly artificial in the context of phenomena like coral reef collapse or ocean warming that have no clear beginning or end. Any attempt to isolate an event from its continuum is, as Karen Barad (2007) would say, an epistemological and representational "cut" that we impose on the flux of reality (p. 175). Such cuts are necessary for analysis and storytelling, but they also influence what is understood and remembered. Moreover, representation is always belated: by the time we describe a disaster, the processes have already moved on. As Richardson (2024) notes, the problem of representing ecological trauma "comes into focus" through aesthetics, even though the act of representation is always too late to catch the full dynamism of what happened (p. 114). Jarius Grove (2019) makes a related point: "We cannot catch the becoming of objects or their collaboration as assemblages in the act, so to speak" (p. 143). To represent an assemblage of intra-related things, we must inevitably disaggregate the whole, "pulling apart" relationships and freezing a moment in time to make a diagram or narrative (Grove, 2019, p. 123). But because the identity of ecological components is constituted by their movement and relations, a static snapshot – "a freeze frame of efficient causality" – does not truly exist in nature's continuous flow (Grove, 2019, p. 127). Our representations risk chopping up a web of life that is, in reality, never still.

4 Assemblages of Accountability

The essays in this issue creatively respond to these representational challenges, finding ways to decelerate and disentangle complex events so that they can be witnessed and understood. This often means slowing down our analytic gaze – stretching moments into narratives, tracing connections – to render visible the slow, interwoven disasters of the Anthropocene. It also means asking new questions about agency and significance. If witnessing, as Richardson (2024) puts it, "insists upon a response" and helps determine what matters about an event (p. 4), then what exactly is being witnessed in the context of diffuse crises like climate change? What has the agency to make a difference in a given ecological situation? These questions lead directly to the issue of distributed agency and responsibility. Martin Crowley (2022) argues that without a conception of distributed agency – one that moves beyond the model of the sovereign, individual human actor – our understanding of responsibility for slow,

diffuse violence will remain inadequate. Focusing only on "sovereign, autonomous, self-conscious" human agents (or corporate entities imagined in the same way) obscures the complex, networked nature of causation in phenomena like climate change (Crowley, 2022, p. 93). Environmental destruction often results from countless small actions and interactions across society and nature, rather than a single identifiable perpetrator. If our analytic lens remains fixed on individual actors, much of this diffuse violence is hidden from view and accountability dissipates. Crowley's solution is to map the distribution of agency: to chart how different participants (human and non-human) collectively produce effects, so that responsibility can be assigned in a more nuanced way. This approach does not mean a chaotic free-for-all in which everything is equally causal; rather, it yields "[n]ot less, but *more and better* differentiation" of the roles various actors play (Crowley, 2022, p. 99, italics in original; see also Bennett, 2010; Latour, 2005, 2014). By differentiating the contributions of, say, carbon dioxide molecules, automobile engines, oil executives, government policies and consumer habits to the event of global warming, we get a sharper picture of causality than if we simply say, "humanity did it".

Crucially, Crowley (2022) emphasises that agency is emergent from alliances of actors, not a property that each actor carries in isolation (p. 103). The capacity of any participant (a person, a corporation, a river, a virus) to effect change depends on its position within a larger configuration – what Crowley (2022) calls an "alliance" or an extended network of forces working together (whether intentionally or not) (p. 98). He likens an alliance to a "front": a "mobile alignment of participants" whose combined force is felt along its entire length, even as local parts of the front advance or retreat at different times (Crowley, 2022, p. 113). In this view, it is the alliance as a whole that makes a difference, not any single actor alone. The implication for witnessing is that when we address an event and seek justice (as Richardson [2024] describes), we should be addressing a web of human–non-human alliances rather than isolated perpetrators or victims. This raises the question of where to draw the representational "cut" in depicting responsibility. Barad's insight about cuts is relevant: any account of an event must choose boundaries for analysis. Crowley's framework suggests that if we draw the boundary too narrowly around the human, we miss the diffuse agencies at work; but if we draw it too broadly, we may lose the human ethical focus altogether. He contends that the human is not erased in these alliances – it remains a differential element – yet the human also cannot stand as the sole focal point (Crowley, 2022, pp. 111–113). Not every contributor to this issue would fully agree with Crowley's theorisation, particularly the idea that distributing agency preserves responsibility without reintroducing some notion of human exceptionalism. However, all grapple in

one way or another with the need to modulate the role of the human within a network of distributed agency.

In engaging Crowley's (2022) ideas, our authors also recognise what he describes as the "antagonistic" (p. 90) and even "combative" (p. 92) nature of these alliances. Any alliance of participants is "an encounter between unequal forces" conscripted together, rather than a harmonious assembly of equals (Crowley, 2022, p. 104). This is as true of the act of witnessing as it is of the events witnessed. The process of bearing witness – especially in contested environmental contexts – is not a neutral relay of information but a site of struggle between different narratives, values and power positions. No matter the potential of the non-human to witness, all our contributors foreground that the act of witnessing is ultimately assembled and made to matter through specific epistemological, cultural, political and ethical agendas. In other words, witnessing is always being marshalled by someone or something. Even academic framing (like this introduction) marshals witnessing by shaping how events are perceived and which voices are amplified. Recognising this does not undermine the project of climate witnessing, but it cautions us to be self-reflexive about the contexts and biases that inflect our witnessing practices.

5 The Risks of Diffusion: Critical Responses

While many essays herein (for example, Crownshaw; de Massol de Rebetz; Gray et al.; van Herpen) explicitly wrestle with the question of how and where agency is distributed – the agency of what is witnessed and the agency of witnessing itself – we are also mindful of recent ecocritical critiques of an over-expansive distribution across the human–non-human divide. Some scholars have warned that new materialist thought, in its eagerness to grant agency to non-humans, can end up conflating the human with the non-human in ways that obscure responsibility. When everything is entangled and equally agentic, it can become difficult to distinguish lines of cause and effect and establish human culpability for environmental change amidst the apparently undifferentiated distribution of agency. Andreas Malm (2018) has forcefully argued that if we treat humans and natural forces as indistinguishable actants, we lose the ability to identify deliberate human actions (like burning fossil fuels) as the drivers of climate change. In his view, a strategic anthropocentrism is necessary to hold polluters accountable. Similarly, critics note that if anything – whether human or non-human – can assemble to produce change, then everything is potentially agential, which does not actually help us decide where to focus our attention. As David Farrier (2019) points out, such a view

risks a scenario where we cannot tell what makes the most difference because all things appear equally powerful. We need a sense of relational hierarchy: an analysis of how and why certain things come to matter more in specific contexts. Or, put differently, what are the social relations that make matter *matter* (Lemke, 2018)? In trying to overcome human exceptionalism, ecocriticism thus finds itself negotiating a tension between a critical humanism (which keeps human responsibility in focus) and a non-human turn (which disperses agency across the field). This tension is especially pronounced in fields like African American studies, given a history in which people of African descent were dehumanised and treated as closer to animals or objects. After all, a rush to erase the human–non-human boundary can inadvertently echo that legacy of dehumanisation (Karera, 2019; Leong, 2016; Wolff, 2023). Consequently, the move towards more-than-human memory must be attuned to issues of race, gender and coloniality, ensuring that expanding the category of witness does not flatten crucial ethical distinctions. While these debates did not originate in environmental memory studies, they have certainly informed the emergence of the field's fourth wave and its recognition of more-than-human events and their more-than-human remembrance. Our approach in this issue is therefore one of critical balance: extending empathy and agency beyond the human, but also interrogating who (or what) is being empowered or obscured by that extension.

6 Material Witnessing and Mediated Testimony

Acutely aware of the complexities of conceptualising the non-human as a potential witness, the contributions to this collection explore the mediations of matter that make environmental evidence culturally legible. In practical terms, this means examining the forms and forums through which non-human testimony is presented to us. For example, how is environmental loss memorialised in monuments or public art (de Massol de Rebetz)? How do museum exhibitions curate natural specimens, industrial technology or data as evidence of climate change (Crownshaw; Decroupet; Gray et al.)? How are ice cores, computer simulations or satellite images deployed to bear witness to global warming (Szpunar)? In what ways do films and scientific instruments record ecological catastrophe (Probst and Dürbeck)? And how might performative tribunals or art installations assign voice or agency to non-human entities (van Herpen; Więckowska)? All these questions point to what Susan Schuppli (2020) calls "material witnessing". Material witnessing is a concept that foregrounds how things – materials, objects, technologies – become witnesses by virtue of how

they are represented and interpreted. It elicits the social frames encoded in the medial and material specificity of representation. In other words, an ice core can serve as witness to climate history, but only through specific media (a documentary film, an exhibition) that frame that chunk of ice as evidence and imbue it with narrative. Those media come with their own cultural assumptions and power dynamics. Our contributors find that although witnessing may, in principle, be a more-than-human act, its ethical and political import can only be measured by a return to human agency – namely, the human practices of sense-making and storytelling from which eventfulness and its recognition originate. No matter how centrifugal the notion of witnessing becomes, spreading out to microbes or glaciers, it still matters most where it intersects with human meaning-making and decision-making (Richardson and Zolkos, 2022, 2023). This is a sober finding: it does not deny non-human agency, but it reminds us that without human communities to hear and respond, testimony in the moral sense cannot fully register.

7 Witnessing Deep Time

Another key feature of fourth-wave memory studies is a recalibration of the temporal scales of events and their remembrance. The climate crisis forces us to think in deep time and slow time. Given the intra-active assemblages that cause something to happen, events in the Anthropocene often continue to unfold long after their ostensible start, and their roots often stretch far back. The act of remembrance – always a reconstruction of the past in the light of the present – thus becomes an artificial incision into and segmentation of processes that are still ongoing (Barad, 2007; Grove, 2019). Moreover, what we experience as sudden disasters (a flash flood, a wildfire) may actually be the result of cumulative changes over centuries. The epistemology of "slow memory" (Wüstenberg, 2023) has been proposed as a way to grapple with these long timelines. Just as Rob Nixon's (2011) notion of "slow violence" drew attention to gradual, attritional forms of harm that elude dramatic representation, so slow memory seeks to attune cultural memory to long-duration processes that exceed the habitual horizons of human remembrance. For example, the melting of a glacier is not an event in the explosive sense; it is a slow, continuous event that began with industrial-age emissions and will play out over decades. To remember a vanishing glacier is to remember a process, not just a moment. The fast and slow violence of climate change is ultimately nested within even longer, inhuman temporalities – the time of ice ages and carbon cycles, measured in millennia. Indeed, the very idea of the Anthropocene

has brought with it the need to combine geological and historical scales: it asks us to see our present crisis in the light of earth history. This means fusing what are usually incommensurable frames of reference (millions of years of planetary change versus the few centuries of fossil-fuelled society). An Anthropocene perspective encourages, for instance, a historical consciousness of the Holocene (the epoch of the last *circa* 11,700 years of relatively stable climate in which human civilisation thrived) as a way to imagine the looming end of that stability. By recalling that the Holocene's benign climate made our world possible, we can better appreciate the magnitude of what a hotter, unstable future holds – and remember proactively, using anticipation as a form of memory.

Engaging with deep time, however, presents its own representational impasses. On the one hand, deep time can become what Mark Bould (2021) calls the "Anthropocene unconscious" of culture – an immense backdrop that haunts our narratives without ever being fully brought to light. Literature and art may be suffused with unspoken awareness of planetary change, yet time on the scale of eons remains largely ineffable within human storytelling. On the other hand, attempts to explicitly represent deep time can lead to overgeneralisation. As Wai Chee Dimock (2012) and others have noted, speaking of millions of years in bulk can erase the specific, differentiated events that occurred within those spans. The sheer duration can overwhelm the particulars, flattening history into abstraction. Both of these are pitfalls of abstraction: either our cultural forms cannot accommodate the vastness of geological time and leave it implicit, or we force deep time into view only by sacrificing detail and difference. Against this grain, the contributions in our issue work towards apprehending the inhuman temporalities of the Anthropocene in concrete, situated ways. They demonstrate the cultural mediation and social framing of deep time materialisations. For example, one essay (Gray et al.) analyses how a science museum incorporates ancient water – samples of water trapped underground for millions of years – as part of its collection, thereby bringing deep time into a present-day experiential space. Another (Decroupet) looks at natural history museums and how they represent geologic time through displays and dioramas. We also see studies of creative practices: one contributor (van Herpen) examines performative tribunals where prehistoric fossils and extinct species are staged as evidentiary actors in human legal rituals; others discuss textile art (Sawatzky; Więckowska) that threads together the story of prehistoric life with the story of petrocapitalism, illustrating the deep historical origins of our fossil-fuelled present. Yet another (de Massol de Rebetz) considers how the mineral properties of rocks shape the forms and meanings of memorials that address anthropogenic change. Through these diverse cases,

the authors show deep time not as an amorphous backdrop but as something that can be symbolised and communicated via cultural media.

That said, our collection does not ignore the fact that deep time, as materialised in enduring matter, ultimately exceeds the time frames of human witnessing. There is always an element of the non-human past (and future) that lies outside our narrative capture. The essays remain attentive to how organic and inorganic matter often carry excess meanings – traces of events that are beyond the immediate symbolic regimes of witnessing and remembrance. For instance, a piece of ancient ice displayed in a museum might be intended to symbolise climate change, but that ice is also the product of thousands of years of climatic patterns and contains geochemical information that scientists (or future generations) might read in ways we cannot yet predict. In this sense, such material is in-formed and storied by processes and events outside the scope of what we deliberately commemorate (Oppermann, 2019). Several contributions (Ambers et al.; Crownshaw; de Massol de Rebetz; Probst and Dürbeck) highlight this productive paradox: when we enlist non-human media (soil samples, glaciers, species databases) in acts of remembrance, we also invite unforeseen stories and histories carried by those media into the memorial space. The non-human archives of the planet materialise a constellation of pasts for potential witnesses of the future. In other words, by incorporating deep time materials into our memory practices, we create a bridge to distant pasts and futures that future communities might further interpret, even if today we only grasp a fragment of their significance.

Through all the above explorations, we underscore a central conclusion: witnessing is ultimately a human (and cultural) act, no matter how distributed its material coordinates. The non-human can witness changes in a brute sense (the tree grows rings, the ice core records temperature), but turning those changes into testimony – into moral-political messages that demand response – requires cultural mediation. The non-human must be symbolically encoded to be legible in the process of witnessing. And yet, for all the framings, alliances, encodings and agencies that we identify, the temporal and spatial scales of the Anthropocene, and the complexity of its assemblages, will outstrip what is witnessed, represented and remembered. There is a structural gap in representation that remains. Emphasising human agency and mediation is ethically and politically important for accountability, but we remain humble in the face of what exceeds our stories. We cannot ever tell the whole story of the climate crisis – not because of a failure of will or imagination, but because the crisis is ongoing and multilayered, with aspects that elude any single perspective. This sense of a necessary incompleteness is not a call to despair, but rather a

prompt to seek other avenues – beyond purely discursive or scientific ones – to register what is being lost and changed.

One such avenue is the realm of aesthetics. Perhaps another way of approaching the disjunction between planetary change and human representation is via what Ann Rigney (2021) calls "the agency of the aesthetic". Rigney (2015) suggests that artistic practice, being "attuned to materiality", is uniquely poised to harness the mnemonic power of things (p. 18). Artworks, by virtue of their form and creativity, can engage with material traces of the past in ways that standard scholarly or journalistic accounts cannot. Rigney (2021), drawing on Derek Attridge, emphasises art's "singularity" – its capacity to surprise, disrupt and defamiliarise (p. 14). Art is not wholly reducible to its context; it introduces something new, an inventive reimagining that can reorient our perception. The "power to enchant" through mastery of a medium, as Rigney (2021) puts it, gives art an affective force that often exceeds the sum of its parts (p. 15). Objects and images in art can vibrate with meanings that are not immediately speakable in propositional language (Rigney, 2015, p. 23). At the same time, those mute resonances of things invite storytelling – they "feed back into the desire to tell new stories", creating a feedback loop between material sensation and cultural narrative (Rigney, 2015, p. 18). In this way, art can act as a catalyst for memory: it releases the latent potential of environmental traces by embedding them in evocative forms, thereby extending the field of witnessing.

This special issue features creative works that exemplify this aesthetic agency. It opens with Sandra Sawatzky's epic *Black Gold Tapestry*, a monumental embroidered artwork that visually chronicles the history of petroleum from its fossilised prehistoric origins to the present-day climate emergency and resource wars (see also Więckowska). This massive piece materialises deep time (through the depiction of ancient organisms turning into oil) alongside human history (the industries and conflicts driven by oil), offering a sweeping, tactile narrative of our entanglement with fossil fuels. The issue closes with another artistic contribution: Andrew Ambers, Carey Newman and Jeremy Mendes's conceptual project *The Seedling*, which gestures towards the distant future by creating a "living archive" of digital and material traces intended to endure for centuries. Framed by the Kwakwaka'wakw legal and ethical principle of awi'nakola, the project invites long-term stewardship of memory and climate responsibility. Together, these two featured works bookend the issue and demonstrate how artistic practice can bear witness to ecological transformation and facilitate social and cultural transformation across vast temporal horizons. Other contributions analyse aesthetic responses to the climate crisis, including Marina Zurkow's graphic assemblages cataloguing petrochemical-derived objects (discussed in Więckowska's essay) and Susan Schuppli's

multimedia installations treating Arctic ice cores as testimonial archives (explored by Probst and Dürbeck). Across these examples, art transforms data and history into tangible, affectively resonant experiences, offering modes of witnessing that operate on both visceral and symbolic levels.

8 Mourning the More-than-Human

Finally, we turn to the intimate relationship between witnessing and mourning. The climate crisis confronts us with losses on an unprecedented scale – losses often witnessed indirectly or vicariously, and thus requiring new forms of communal grieving. The witnessing of loss explored in this collection is frequently a highly mediated, second-hand experience, an act of memory akin to what Alison Landsberg (2004) calls "prosthetic memory". Landsberg's theory of prosthetic memory examines how mass media, museum exhibits and other cultural "prostheses" enable people to form affective memories of events they did not personally live through. Such memories are "prosthetic" in that they are attached to us from the outside, via images and narratives, yet they can become part of our identity and ethical outlook. When reconfigured to accommodate more-than-human loss, this concept becomes a useful framework for vicarious environmental witnessing. We can, for example, "remember" the extinction of a species or the disappearance of a forest through museum displays, documentaries or art, even if we never saw the last animal or tree alive. Here we build on Marianne Hirsch's (1997, 1999, 2001) notion of postmemory – the idea that the generation after a trauma can inherit the memory of it through stories and images. In this context, prosthetic memory extends postmemory beyond familial or cultural lines to encompass human–non-human relationships. In fact, we might think of prosthetic memory as a development of postmemory: Hirsch described how fragments of an incoherent, traumatic past are reassembled by those who come after, such that these descendants feel as if they have memories of events they never witnessed. Prosthetic memory similarly relies on affective engagement with mediated traces of the past, and it particularly stresses the visual, experiential nature of that transmission. Crucially, both concepts underline that memory is not just passed down biologically; it is transmitted through cultural technologies – films, images, rituals, narratives – which means it can cross boundaries between communities and even species. In our case, this means people can, through cultural mediation, come to mourn the death of a glacier or the extinction of the dodo as if it were *their* loss, integrated into their own archive of memories.

Whether it be engagement with historical species extinctions in a natural history museum or the digital, mobile commemoration of places and lives lost to extreme weather via a smartphone app, technological prostheses play an intimate role in provoking an environmentally orientated grief. For instance, one contribution (Decroupet) shows how visitors confronting an exhibit of past extinctions are led to reflect on ongoing extinction crises, effectively using the museum space to connect past and present loss. Another (Bond and Rapson) discusses a mobile app that allows users to explore maps and stories of Gulf Coast communities devastated by hurricanes, rising sea levels and petrochemical industrial toxicity and contamination, bringing distant tragedies into the palm of one's hand. Such prosthetic technology is designed to provoke remembrance of southern Louisiana's lost and precarious wetlands, their ecosystems and the local Indigenous, Black and Cajun populations' lives, livelihoods and deep-rooted regional histories. This violence is otherwise overwritten by official tourist narratives and a regional heritage industry sponsored by petrochemical corporations that celebrate a romanticised history of the American South – slavery and its legacies are sanitised and contained – and a regional (and national) modernity made possible by oil.

These mediated experiences can elicit powerful feelings of mourning and solidarity – a sense of being grief-stricken by the injury to worlds we inhabit and care about. However, being grief-stricken by environmental loss should not be confused with adopting the stance of a victim detached from responsibility. As several authors in this issue emphasise, this affective state must be one in which the grieving subject also feels implicated in the unfolding disaster. Michael Rothberg's (2019) concept of "the implicated subject" is instructive here: it refers to individuals who, though not directly perpetrators or victims of a harmful system, nonetheless participate in or benefit from it. In the context of climate change, many of us are neither typhoon survivors nor oil executives; yet we may contribute to emissions through our lifestyles and enjoy privileges built on extractive economies. Implicated grief is thus a mode of mourning that includes a recognition of one's own entanglement in the structures that produce the loss (and often the unequal distribution of that loss). Many of the contributions to this collection (Bond and Rapson; Crownshaw; Decroupet; van Herpen) identify subject positions that are implicated in socio-cultural systems not of the subject's own making. These systems – global capitalism, colonialism, industrial supply chains – confer advantages on some while inflicting harm on others. The people within them are usually neither pure victims nor malicious perpetrators, yet they are part of the problem. Recognising such implicated positions provides a framework that prevents grieving from bracketing off human culpability for environmental loss (Craps, 2023). It in-

sists that we measure our grief against our participation (willing or not) in the systems that led to the loss.

More fundamentally, the essays collected here that examine states of environmental grief push us to rethink mourning as an open-ended and more-than-human process. Classic Freudian theory posited that mourning is a finite task: one gradually detaches from the lost object and overcomes grief, returning to a state of psychic equilibrium. Such an approach, in its orthodox form, not only treats mourning as something to be completed (and the lost object as ultimately replaceable) but is also deeply anthropocentric. The environment, in Freudian terms, was not an object of mourning; only human relationships were. Even if we extend this model to allow mourning for, say, a pet or a landscape, it implies that at some point we "move on" and perhaps find a substitute for what was lost. Our contributors, along with recent work in the environmental humanities (for example, Barnett, 2022; Craps, 2020, 2024; Cunsolo and Landman, 2017), challenge this model. They argue that ecological grief is not about closure or replacement at all. When a species goes extinct or an ancient forest is clear-cut, there is no replacing it. To "work through" such loss in the traditional way would be tantamount to forgetting it ever mattered, which is ethically untenable. Furthermore, the human presumption of separateness – that we can neatly extricate ourselves from the non-human world and recover our intact identity after mourning – is false. The anthropocentrism of the orthodox model overlooks how human subjectivity is itself co-constituted by relations with the non-human; we are always, in Donna Haraway's (2016) phrase, "making kin" with other species and environments. The notion that the non-human is ultimately exchangeable and forgettable rests on an outdated human exceptionalism.

Conversely, the concept of ecological grief at work in this collection embraces the non-human as a genuine object of mourning and acknowledges the imbrication of human and non-human lives in the generation of environmental loss. To grieve ecologically is to be ecologically situated – to understand oneself as part of an entwined community of fate that spans species, generations and physical landscapes. It also squarely faces the human origins of much of this loss: one grieves not only for what is happening, but for what we (as a collective) have caused to happen. Consequently, to be grief-stricken in the climate crisis is to live with the inextricability of loss, whether it belongs to the past, the present or the feared future. Grief becomes an ongoing state, a context for living, rather than a transient emotion. In other words, the condition of grief suggests a form of vigilance over both realised and potential loss. Such "vigilant mourning" (Barnett, 2021) is stubborn: it resists the foreclosure of witnessing. It keeps our eyes open and memory alive when there might be

a temptation to forget, to become numb or to declare the crisis over. In that sense, grief itself becomes a mode of bearing witness. It is a persistent refusal to let the dead die a second death (the death of being forgotten), and a refusal to let threatened beings disappear without testimony.

9 Towards a Practice of Climate Witnessing

This persistent, active grief is an appropriate ethos with which to introduce the essays that follow. In their different ways, all the contributions to this special issue manifest a stubborn resistance to the foreclosure of witnessing in the face of climate and ecological catastrophe. They show how we can remember environmental loss without relinquishing our responsibility to the living world. They challenge us to expand our notion of the witness to include the unheard voices of the non-human, even as they remind us that it is we humans who must listen, interpret and act. Taken together, these essays map out a conceptual and ethical framework for climate witnessing as a practice of memory and justice on a damaged planet. It is our hope that this framework will not only illuminate the entanglements of memory, ecology and power in the Anthropocene, but also inspire further witness – and action – in the face of what is unfolding around us.

Stef Craps is a professor of English literature at Ghent University, where he directs the Cultural Memory Studies Initiative. His research centres on how literary texts and other cultural forms engage with the legacies and ongoing realities of political and ecological violence, drawing on memory and trauma studies, ecocriticism and the environmental humanities, and postcolonial and decolonial theory. He explores the ways in which such works respond to histories of injustice, suffering and loss, and how they participate in processes of witnessing, repair and reimagining. Notable publications include *Postcolonial Witnessing: Trauma Out of Bounds* (2013), *Trauma* (2020; co-authored with Lucy Bond) and guest-edited special journal issues on topics such as ecological grief, climate fiction and transcultural Holocaust memory. His current work examines how contemporary literature and culture grapple with the representational, affective and ethical challenges posed by climate change and the Anthropocene, with a particular focus on ecological mourning as a creative and transformative process.

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