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Geo-Fictionalising the Atomic Priesthood: Pazugoo and the Future Relic

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Andy Weir

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ANDY WEIR

GEO-FICTIONALISING THE ATOMIC PRIESTHOOD: PAZUGOO AND THE FUTURE RELIC

Abstract: The paper focuses on deep geological repositories, designed for safe long-term storage of nuclear waste, and analyses the RK&M project, which considers how these sites could be marked and remembered for imagined futures. The project, it is argued, mirrors some of the universalising problems of the term "Anthropocene". Counter to this, the author describes the ongoing art research project Pazugoo, which draws on myths of flight and the earth, local to specific radioactive burial sites, generating digital designs for composite demons, which are figures of personification for the waste, buried for future unearthing, unknown by whom or by what. The addressee of the work differs from the imagined addressee of the RK&M project, offering a speculative viewpoint on the present moment, in its entanglement with deep times past and future.

Keywords: Anthropocene, art practice, deep time, materiality, nuclear waste, Pazugoo.

GEOFICCIONALIZANDO O SACERDÓCIO ATÓMICO: PAZUGOO E A RELÍQUIA FUTURA

Resumo: O artigo foca-se em repositórios geológicos profundos, projetados para armazenamento seguro de longo prazo de resíduos nucleares, e analisa o projeto RK&M, que considera como esses locais podem ser marcados e lembrados para futuros imaginados. Argumenta-se que o projeto espelha alguns dos problemas de universalização do termo "Antropoceno". Em sentido contrário, o autor descreve o projeto de pesquisa de arte em andamento Pazugoo, que se baseia em mitos de voo e da terra, sítio para locais de enterro radioativos específicos, gerando *designs* digitais para demónios compostos, que são figuras de personificação para os resíduos, enterrados para futuras exumações, desconhecendo por quem ou pelo quê. O destinatário da obra difere do destinatário imaginado do projeto RK&M, oferecendo um olhar especulativo sobre o momento presente, no seu emaranhado com profundos tempos passados e futuros.

Palavras-chave: Antropoceno, lixo nuclear, prática artística, materialidade, Pazugoo, tempo profundo.

INTRODUCTION

> The elevator gate was dragged across and locked with a click, triggering a cheery electronic chime. Cramped inside, nervous laughter rippled through the group, evaporating as the chime was drowned in a sharp alarm and the descent began. A Zoom audio recorder extended like an uncertain probe from my hip, recording the strangeness of this sonic environment, a journey 225 metres underground through Boom clay in North Eastern Belgium, to the underground H.A.D.E.S research laboratory.

Back above ground, a few years later, I am listening to that audio recording, captured on a research visit in 2018. I was invited, along with some other artists, to the mythically named HADES, a.k.a. the High Activity Disposal Experimental Site, the underground research laboratory of ONDRAF/NIRAS, Belgium's national agency for the safe storage and monitoring of radioactive waste. The duration of the descent is striking, capturing a physical sense of entering the depths of the Earth, an architecture at a sub-foundational level, geological layers captured in seconds of mechanical hum. There is something appealing in the disjunction of the elevator journey, to close the doors, give in to the lurch then smooth shift with the doors re-opening in another realm perhaps, or at least somewhere uncannily similar but not identical to its starting point. One of many national projects around the world, work at the HADES laboratory tests conditions for long-term storage and monitoring of radioactive waste dangerous and indeed lethal to humans and the environment, with timescales stretching to millions of years. This addresses an ongoing problem. The UK alone, for example, will have likely produced 4.9 million tonnes of nuclear waste by 2125. Research here tests conditions to slow the drift of radionuclides over a range of timescales based on the half-lives of specific isotopes. This includes a range of isotopes such as iodine-123 and cesium-137 from nuclear medicines with half-lives of less than thirty years, through to isotopes from nuclear fuel production such as plutonium-239 with a half-life of 24,065 years and uranium-235 with a half-life of 704 million years (Van Geet and Depaus, 2016: 10). Experiments test the effectiveness of isolating radioactive materials in local Boom Clay, and are extended into the speculated futures projected by the half-life measurements.

It was following these visits that I became interested in a project now known as the Preservation of Records, Knowledge and Memory across Generations, or the RK&M project (NEA, 2011). This emerges from earlier discussions on how to best "mark" underground waste storage sites for future generations, avoiding any potential catastrophe from its intended or inadvertent disturbance. The project now retains this safety element, while also expanding to include a more culturally embedded engagement with issues such as future memory and heritage of the nuclear (NEA, 2015). In recent

years this has led to the expansion of the project to involve artists and designers interested in such processes of memorialising and speculating on the deep futures invoked by nuclear half-lives. I became fascinated by this necessarily interdisciplinary enquiry, involving materiality of the earth, long term future imaginaries and entanglements with current planetary politics, a truly "geo-fictive" project, and it provides the strange and specific context of my investigations presented in this paper.

I start here by tracing a history of the RK&M project back to the late 1980s and early 1990s designs for marking radioactive waste repository sites in the United States, as I go on to argue that some of the assumptions here still haunt the project today. In its proposal of an unquestioned future human addressee, which I name as "the marker subject" – the RK&M project mirrors some of the universalising problems of the term "Anthropocene". Art practices, I claim, can play an important role in both reinforcing and potentially challenging this imaginary.

In the next section, I describe my ongoing art research project Pazugoo as specific intervention into the RK&M project. This combines research on Sebeok's Atomic Priesthood, the "double flight" of Reza Negarestani's Pazuzu to the ends of deep time and back through an excess of wings, Gabrielle Hecht's work on nuclear materiality, and the "gooey" molten plasticity of 3D printing technology. The project uses group workshops, drawing on myths of flight and the earth, local to specific radioactive burial sites, to generate digital designs for composite demons, which are figures of personification for the waste. Printed as artefacts, these objects are buried, forming an underground constellation diagram of 3D-printed demons as markers of toxicity within the earth. They lie in wait for future unearthing, or not, unknown by whom or by what. The addressee of the work differs from the imagined addressee of the marker subject, which offers a speculative viewpoint on the present moment, in its relation to deep time past and future.

1. Imagining Deep Time Futures of Nuclear Waste

1.1. Critique of the Markers

Projects of "marking" buried nuclear waste can be traced back to early 1990s design proposals for marking the site of high-level radioactive waste storage at the Waste Isolation Pilot Plant (WIPP), Yucca Mountain, USA, in association with the US Department of Energy. These designs included monumental sculptures such as giant spikes, which would presumably be seen by future humans as a signal of warning, cautioning against inadvertent disturbance of the land and disastrous consequences. The conceptual and practical demands of such a project have inspired much interest in art and design theory

and practice[1] although the designs themselves have been widely criticised. The curator Julia Bryan-Wilson, for example, has been critical of their lack of consultation with art historians or the critical perspective and "radical uncertainty" of contemporary art (2009: 5),[2] while technology theorist James Bridle, in concluding his 2019 *New Dark Age* book, turns to the WIPP designs to describe them ironically as "sculpture[s] so terrible in form that other species will recognise [their] location as evil" (2019: 251). Such critiques can be expanded, however, beyond these specific designs to the idea of marking sites of nuclear waste in general. Putting aside the more obvious practical problems for the project – would people in the future read visual languages in the same way? Would a monumental sculpture prevent them from digging? My particular interest here is to analyse the whole conceptual framework of the markers. Are they indeed a form of communication, and if so, what is being communicated? Designs such as *Landscape of Thorns* are premised on the idea that action now can safeguard future humans from the toxicity of landscape, so how does this relate to critical discussions around the Anthropocene, capitalism, deep time and a planetary environmental crisis? This paper expands a critique beyond the 1990s WIPP marker proposals into its current ongoing legacies in the RK&M project around the world. It considers the RK&M project not only as more or less bad sculpture but as claim to save the future from the environmental catastrophe of the nuclear.

Considered this way, the premise of the "marker project", as it was known, is problematic in a number of ways. I will go on in this section to outline four connected areas for such problems – the *spatial*, the *temporal* (divided into the *futural* and *deep time*), the *universalised* and the *disentangled.* Firstly, the *spatial* problem is the way that a site marker will restrict an understanding of toxicity to a fixed geographical location. What I mean here is that while a barrel of waste at a European deep geological repository may be secured, monitored and regulated, it can also be understood as existing within broader ecologies of toxicity around the planet.[3] Radioactive waste prepared for long-term storage at European repository sites contains uranium-238, traced to the formation of the Earth's crust. Uranium is mined and imported from elsewhere, specifically from areas of the planet rich in ore deposits such as Kazakhstan, Namibia and Niger.[4] Vital analyses such as sociologist of nuclearity Gabriel Hecht's work on the Gauteng region

[1] See some of the practices represented in Carpenter (2016), for example.
[2] Bryan Wilson's suggestion can be taken further. I agree that the critical strategies of contemporary art can contribute to the RK&M project. At the same time, however, they can also be challenged by its non-human dependent materiality. I analyse this situation through the lens of "the already made" in Weir (2014).
[3] I aim to map some of these processes through tracing a partial material history of plutonium in the video work *The Plureal Deal.* Cf. Weir, Andy (2016) *The Plureal Deal*, single channel video with sound, 9'12" [artwork].
[4] See World Nuclear Association (2022), "Uranium Mining Overview", June. Accessed on 06.04.2022, at https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/mining-of-uranium/uranium-mining-overview.aspx.

of South Africa (2018a) have shown how settlements here are exposed to high levels of radioactivity through leftover toxic tailings, long after uranium mines are abandoned, and waste has been exported to be declared as "dangerous" in other parts of the word. A project of marking something as safely buried "here", in other words, can obfuscate its ecological entanglements in ongoing related harm and vulnerabilities "elsewhere", missing ways that the local is imbricated unequally with the planetary.[5]

Secondly, *temporal* – the *futural* problem refers to how site markers' focus on the future can defer and hide nuclear implications in the present. Ecofeminist theorist Donna Haraway has discussed how "making an imagined future safe" can be a way of avoiding the future's complex and ongoing entanglements in the present, the "staying with the trouble" that she advocates (2018: 1). In a sense, the claim of the markers project to modify future behaviour is an absurd claim to mastery of the future. At the same time, this image of future safety has little agency in questioning continued production of toxic waste products in the present. There are conceptual and practical problems, then, with deferring environmental crisis to an indefinite and distant future, rather than engaging with it now.[6] Alongside this, the *deep time* problem is that the focus on future generations fails to go far enough into the future to consider the radical impact of material timescales of high-level radioactive waste. The half-life of uranium-238, formed in the Earth's crust, is 4.46 billion years. This coincides approximately not only with the 4.6 billion year age of the Solar System, but also with the 4.5 billion years from now predicted by current astrophysics as time of death of the Sun. Bearing in mind the facts of such material timescales, deep geological repositories are designed for "without future maintenance",[7] probing into a future where human engineers and scientists will no longer exist to monitor and control operations.[8] Through this projection of a future without maintenance, such sites invoke a temporality indifferent to human care. This necessitates considering what philosopher Ray Brassier has called "the truth of extinction", "that which *levels* the transcendence ascribed to the human" (2007: 224; italic in the original). Deep times of the future, in other words, unground the privileged position of human experience at the centre of a world that exists solely for it. By contemplating species or planetary extinction, humans are forced to consider their own contingency within a context in which they will not always exist, and so their relations to non-human worlds. Therefore, any project

[5] In this sense, radioactive waste can be understood in terms of what the philosopher Timothy Morton (2013) has described as the "hyperobject" – exceeding sense perception, massively distributed in time and space, impossible to stand outside of and make sense of. This opens questions of what methods could be used to "attune" to it.
[6] See UNDRR (2019).
[7] See Smudge Studio (2010), *Containing Uncertainty* [artwork], §6. Accessed on 16.03.2023, at https://fopnews.wordpress.com/2010/02/24/containing-uncertainity-design-for-infinite-quarantine/.
[8] A situation captured in the radioactive waste management industry term "passive monitoring" (Meyermans, 2019).

bound up with uranium half-lives is insufficient if considered only in anthropocentric terms. I combine these temporal points here to emphasise how they intersect. Images of deep time or extinction as magnificently and seductively elsewhere are problematic as they defer problems of the present. Instead, these generational, futural and ungrounding inhuman scales must be drawn upon as they intersect to impact on thought, agency and environmental politics today. Understanding the marker project solely as communication to future generations stages a double blindness, missing both the ongoing waste production of the present and the timescales at stake in long-term storage, where bounded anthropocentric experience itself is necessarily brought into question.

Thirdly, in an important parallel with criticisms of the term and concept of Anthropocene terminology and concept, claims to represent universal humanity through the appeal to a very specifically imagined "future person" are also very problematic. Consider the architectural "scalie" human figure in the designs above, for example, imagined as embodiment of future humanity. Similarly and more recently, *Into Eternity*[9] the 2010 documentary film on the Finnish deep geological repository Onkalo, which opens with a hushed message to imagined future intruders, whispering "keep away, this is not a place for you", while the issue of who this "you" is remains unexamined. What I call here the *universalising* problem misses both the asymmetrically varied vulnerabilities and economically differentiated causes of harm of nuclear toxicity. The proposed WIPP markers claim to speak for all of humanity, in other words, staging the drama of some humans saving the future for others, while obfuscating questions such as: Which humans? Saved from and for whom or what*?* Radiological deep time highlights the need to think "above" the scale of human species, as the reality of extinction loops back and ungrounds it. At the same time, the universalising problem is a reminder to also investigate "below" the scale of what is claimed as the generic human figure, to the realities of local communities around the planet, affected on the ground in a range of ways. This mirrors problems of universalising for the term "Anthropocene", which fails to capture the unequal origins of causes and effects of global pollution and climate change.

Finally, the designs reflect the narrative that Anthropocene theorist Joana Zylinska has called "rescuism" (2014: 106), where it is imagined that heroic human action can "save" the planet from the threat of apocalyptic disaster. One problem arising here, as artist Kayla Anderson (2015) has discussed, is that it stages an oversimplified relation between problem and solution, evading the complexities of the ecological crisis that demand radical re-imagining. A design such as *Landscape of Thorns* reflects narratives of rescuism uncritically, "Keep away, we have saved you from this danger", it proclaims

[9] Madsen, Michael (2010), *Into Eternity*. Film i Väst. Sweden/Denmark.

to the future. Related to this is an idealised concept of nature. What is imagined as saved, in other words, is nature as romanticised past, untouched by human activity, somehow "returned to" or protected. I call this binary logic of lost innocence / apocalyptic future the *disentangled* problem, as it creates a separation between the terms of humanity and nature, which cannot be sustained in the context of the spatial and temporal contagions of nuclear materiality.

1.2. Aesthetics and the "Marker Subject"

Taken together, these four problematic areas come to define the marker subject, a particular production of subjectivity shaped by the deep geological repository imaginary. This is focalised through the question of who is addressed by these future markers, what kind of imaginary figure is called into being to answer their call, or who is the "you" of the *Into Eternity* opening? This issue seems central to the project, and so to its legacy in waste management discourse on RK&M of nuclear storage sites, where it lacks critical questioning. The marker subject is a bounded individual human subject, transcendent to and unchanged by its environment. It is deferred to an indeterminate future and while imagined no differently to now, claimed as universal while unacknowledged in its privilege and cultural specificity. It is problematic as by creating this imaginary of the secure subject separate from nature, as radically other to thought, responsibilities, and differences in the present, it resists entanglements and implications within broader ecological networks of toxicity. The marker subject in this context can be understood as the formation most amenable to the extractive logic of the Capitalocene.[10] By being universalised and separated from planetary toxic trajectories, in other words, it reinstates a transcendent anthropocentric perspective. It replaces violence specific to historical forms of capitalism and to environmental destruction in specific communities, primarily those of the Global South with a "neutral" human figure. In proposing the marker subject as that which has been saved by the repository project (our children, our future), it adopts a primitivist logic towards the future, where unchanged futures are mastered and controlled against the constant threat of a nuclear apocalypse.

Importantly, I want to emphasise here that these points are not separate from, but rather intimately entwined with aesthetics. The marker subject is produced, reinforced and also potentially contested through aesthetic practices. Monumental designs such as *Landscape of Thorns* reflect and reinforce these problems uncritically, not engaging with present contestations and future transformations of what counts as care and harm, or human. Aesthetically, the designs, overwhelming, awe-inspiring and frightening, draw on

[10] "Capitalocene" (Moore, 2016) captures the unequal nature of environmental destruction against the universalised "Anthropocene", drawing attention to capitalism rather than "all humans" as dominant agency.

a historical language of the sublime. Indeed, such reference is not restricted to this 1990s context nor to spatial scale but is still also a common structure in representing long timescales beyond human experience or species existence. This is particularly relevant in a nuclear context where, as shown in the previous section, durations of uranium half-lives extend not only before the formation of the planet, but also into futures beyond planetary exhaustion. The over-awing magnitude of these scales leads to many problems. It opens up an imaginary, visual language and sensual register of cosmic immensity, separated from its embedding in political realities of the present. Within this scenario, a human subject, confronted by the immensity of long timescales, is left feeling small against deep time, creating vague effects of awe and wonder. Scales seduce through a magnitude that remains ultimately opaque, leading to a kind of stunned indifference, rather than understanding or action. While pointing beyond solely human scales, this aesthetic structure serves actually to reinforce an anthropocentric perspective, emphasising the privileged viewer at a secure distance – a pleasurable dwelling in the drama of human extinction – while real catastrophe is held at bay.

While nuclear catastrophe is staged and marked as "saved", pushed underground and made invisible, many around the world remain exposed to dangerous levels of radioactivity. As current discussions critical of the Anthropocene have shown,[11] humanity cannot so easily be separated from either its waste or its damaged environments, while what counts as care, harm, nature or human in this context are questions for debate rather than assumptions in a message to be passed on. Something lacking in the designs I have outlined is a connector between the local site of the buried waste and its broader ecology. This can be understood both in terms of space, considering spatially distributed ecologies of toxicity around the planet, and in terms of time, where the timescales at stake invite a more critical re-thinking of humanity's relationship to its environments. In unearthing these problems, I aim not to challenge the importance of the RK&M project and the legacy of the marker proposals, nor the important work being done around the world in the development of deep geological repository sites for high-level nuclear waste. On the contrary, I aim to highlight the importance of these as strange and specific sites for this convergence of critical questions of planetary politics, deep time materiality, aesthetics and subjectivity, not confined to a particular disciplinary investigation. It can also be noted that critical debates around these questions are becoming part of the research of the sites, where discussions have largely moved beyond monumental future communication proposals.[12]

[11] See, for example, Yusoff (2018), Haraway (2015) and Hecht (2012).
[12] See the *Perpetual Uncertainty* series of exhibitions, curated by Ele Carpenter, for example, for a range of art practices addressing critical questions of the nuclear, not only relating to waste and future marking, but more broadly. See NEA (2015) and Modern RT (2019) for cultural debates within nuclear industry discussions.

Within this necessarily interdisciplinary framework, my own focus is on art practice as specific investigation within this context. I focus on the potential of art practice to intervene in the RK&M context to open up these critical questions. In challenging existing imaginaries and reshaping them, it is here that art can play an important role.

Rather than being marked as contained in one site, I propose in this paper an imaginary of nuclear waste understood more broadly as connected in a planetary scope, embedded within deep times of past and future, and erupting in multiple localities. Following analyses of the Anthropocene, such as that of Kathryn Yusoff (2018), I understand nuclear waste production and storage as an enterprise that entwines geology, subjectivity, formations of the human and inhuman, colonial geographies of extraction and export of harm. Human waste, its monuments and its ideas are all part of and implicated in this toxic ecology. In this paper, I will build on all of these points, and propose an alternative way that art might draw upon this RK&M context, and thus, other ways it could address the more general critical questions it raises. I ask how art, beyond the sublime, could be a method for connecting localities of site and experience with the expanded and unfinished toxic territories of more-than-human spatial and temporal networks of radioactivity its viewers and works are implicated within. Rather than just "transfer of knowledge" as the RK&M project proposes, how is knowledge itself transformed here in relation to ethics and radiological deep time?

2. Intervening through Art Practice

2.1. Geo-fictions

In order to address the problems I have outlined, I propose in this section a materialist shift to waste in the earth over visual signifiers above ground, and a focus on scale to understand nuclear waste as distributed object. I turn first of all, to the 1984 report for the Office of Nuclear Waste Isolation (U.S. Department of Energy) in consultation with the WIPP. The report, written by commissioned semiotician Thomas Sebeok, asks what visual languages can be devised in the present as readable warnings in an unknown future, in order to avoid intrusion or interference. Interrogating definitions, problems and advantages of images, icons, signs and written languages, Sebeok argues that any message will decay and lose its intended meaning over time. In response to this, he proposes a "relay" system, where 10,000 year futures are broken down into a series of inter-generational messages, reformulated anew by future groups of people. This opens the question of how such a process of recoding would be enforced in the future:

> The first recommendation, to wit: that information be launched and artificially passed on into the short-term and long-term future with the supplementary aid of

> folkloristic devices. In particular a combination of an artificially created and nurtured ritual and legend. (Sebeok, 1984: 24)

Against designs for monolithic markers such as *Landscape of Thorns*, Sebeok's report suggests a different approach. As communication will change over time, then the constant renewing of knowledge through shared performative fictions is necessary. His proposal is an annual ritual, under the guardianship of a self-selected "atomic priesthood", "a commission of knowledgeable physicists, experts in radiation sickness, anthropologists, linguists, psychologists, semioticians, and whatever additional expertise may be called for now and in the future" (*ibidem*: 30). Despite dismissals of the report at the time (Garfield, 1994), it shows that fictions have been inherent to the imaginary of the marker project since its inception. Sebeok's future ritual method highlights the importance of a future-oriented critical renegotiation of meaning, making relevant of the sites to "contemporary" moments of the future. The future is approached as a process bound up in the present, rather than as deferred. It is addressed through performance as method for creating new knowledge or communities of care. Sebeok's proposal also suggests the importance of folkloric tradition in this context. This can be understood both as an existing format for passing knowledge through time, and speculative possibility for building new collective mythologies. In this sense, it has potential shared affinity with Haraway's approach of speculative fabulation, "imagining and narrating collaboratively into the possibility space of the future." (Lemenager, 2017: 477). As myth, this must also be embedded into culture in a way which will survive, passed on and collected through archives, performative enactments or other institutions which must themselves be reflected upon. Rather than transplanting existing conditions to the future, this leads to a call for new modes and structural conditions for instituting knowledge and guardianship.

At the same time, however, Sebeok's report is also problematic. It is anthropocentric in ways undone by the materiality of radiological deep time I outlined above, remaining within the framework of belief in communication with future people. While it avoids the apocalyptic sublime through its focus on intergenerational relay, it still perpetuates a story of salvation, where a small group of people will make the world safe for other humans. Most importantly, these "heroes" of the future are an exclusive group. There is no mention, for example, of inclusion of the local Shoshone and Paiute people, where the WIPP site at Yucca Mountain has significance as place of ancestral bones, and what stake they have in future human/non-human assemblages, or of present folklore. Indeed the creation of new myths for the landscape can be read within a colonial rhetoric of erasing existing histories through imposing the "new" history of the colonisers. Any analysis of which communities have been harmed in the nuclear process is subjugated

to the more politically defused question of abstract communication methods, but this becomes ideologically loaded through its aim to keep knowledge of the site as secret of an elite Western-centric group. In this way, Sebeok's proposals fail to realize the radical potential of their form. They remain embedded within colonial power relations, they restrict an understanding of distributed toxicity, and they are premised on an ultimately unquestioned idea and centrality of "the human" through deep time.

What I propose instead, in this section, is to take from Sebeok the importance of speculative fictions of the future but develop this by rooting these fictions in the materiality and deep timescales of the contaminated earth. I propose what can be understood as a "geo-fictionalisation" of his proposals. It is the atomic priests who are "fictionalised" here, removed as transcendent human figures to become part of the surrounding environment, opened up through conspiracy with the radioactive earth. By fiction, I also mean a mythic narrative, connecting local sites with the universal timescales of deep time, human experience to more-than-human hyperobjects. I call this a geo-fiction as it emerges from the materiality of the buried radioactive waste, its histories and projected futures. This shifts away from the idealist apocalypse/salvation binary, always deferred to a future that circles around an unquestioned present. Instead, it draws on more-than-human futures as a way to undo the present.

2.2 Unearthing Waste

Consider a thought experiment – start not from monumentalising but from unearthing. When visiting laboratories for deep geological repository research, I have seen models of vitrified high-level radioactive waste barrels, intended for public display and education. Ceramic pellets of spent nuclear fuel rods, high tensile coated alloy steel bolts from reactor fittings and domestic appliance fragments, all frozen temporarily in grout according to dimensions of the containing barrel. Imagine thinking these strange objects, beyond safety demonstrations or publicity displays, as a different approach to the existing RK&M imaginary. This staged process of unearthing the barrel acts as a counter-narrative to the sealing of waste away from future intruders, instead drawing attention to the materiality of the waste as specific object. Against marking the triumph of technologies of storage as indefinite postponement of harm, it can be asked what kind of marker the waste itself already is. The barrel stands as a recalcitrant leftover from modern utopian narratives of clean energy. It delineates and equivocates a collection of specific objects, formally arranged according to its dimensions, to meld and leak over very long durations into new formations with the earth. Radioactive materiality penetrates objects and crosses boundaries, connecting narratives through uranium, formed in supernovas 6.6 billion years ago, traced to the formation of the Earth's crust and

distributed globally in uranium ore deposits. Multinational corporations finance development of deposits in exchange for ownership of resources. Ore is crushed and leached in mills to concentrated yellowcake, enriched to be turned to fuel rods. Nuclear fuel powers humans' vast energy demands, including data centres of cloud computing, backing up this document as I write. Fuel rods serve a cycle, are removed from the core, and left over as waste, lying in wait for future storage, half-lives measured to billions of years in the future. It is through an imagined ungrounding of the barrel that these dispersed material histories can start to be connected.[13]

Against the "derangement of scale" of the Anthropocene (Clark, 2012), this is to consider how waste indexes deep time neither as warning nor salvation from an apocalyptic future but as it enfolds through a multiplicity of real local scales, not restricted to the deep geological repository site, but proliferating territories of toxicity across the planet. This thought process challenges the sublime separation of the "whole earth rhetoric" of the Anthropocene (Demos, 2017) by refusing to remain at an awe-inspiring planetary scale away from its differentiated responsibilities and accountabilities. At the same time, it challenges the narrative of nuclear toxicity as a solely "local" problem. Instead it suggests the importance of threading together different scales of political imaginaries and action. The Anthropocene reminds us that there is no "outside position" from which to view humanity or nature. Art cannot claim to make a universalising image or future marker for all humanity. I propose instead that art can become an "interstellar vehicle" within (Hecht, 2018b). This is to suggest it can navigate "outwards" from its encounter along a radiological deep time continuum, reshaping imaginary possibilities and connecting narratives while reflecting critically on scales deployed. I go on to present an example of this over the rest of this paper.

2.3. PAZUGOO

I have so far discussed the stakes of the RK&M project in theoretical terms. In turning to practice in this section, I propose a navigational figure for this journey. Through practice, this becomes constructive of new cultural fictions and mythologies within the deep geological repository imaginary, and, at the same time, a material object buried at sites with the radioactive waste, challenging existing designs by inhabiting the waste itself as a kind of underground marker.

Counter to the sealed and saved imaginary of the marker subject is a conceptualising of radioactivity through its ongoing contagion via particles of dust. The Pazugoo artwork emerges from research on dust, taking philosopher Reza Negarestani's more abstract

[13] See Hecht (2018b) as an example of such specific histories.

focus on dust flow as a connector of local sites to universal currents in his *Cyclonopedia* work, combining it with Gabrielle Hecht's more sociological approach describing dust as overflowing force in her 2012 analysis of the uranium trade in Africa, *Being Nuclear*, which I have previously discussed (Weir, forthcoming).

I was particularly interested in how dust is given agency in Negarestani's work through the conceptual persona of a dust scavenger, poetically connecting local sites to cosmic horizons through picking up dust and spreading it through flight.

Dust in *Cyclonopedia* "contaminates time as well as space" (Negarestani, 2014: 89) and the "double-flight" of Pazuzu can be understood as a mythic navigation between overlapping scales of time and space. As figure of contagion against the fantasy of containment, it draws on traditions of understanding catastrophic climate change through methods of personification.[14] Its flight is a figure for a spiralling journey to the ends of radiological deep time which loops back to unground thought and experience in the present. I draw on this invocation of a ritual navigational figure here, proposing a distributed mythology for nuclear waste, brought into being through producing and burying demon figures at sites of waste storage as a kind of underground marker different to the monuments described at the start of this paper.

These come initially from research at the HADES underground laboratory for research onto long-term radioactive waste management in Belgium, working with ONDRAF/NIRAS and a gallery near to the site, Z33. From this research comes designs of figures for low-level and high-level storage sites here, for the underground laboratory and future museum, and local displays This work has developed through group workshops, which imagine demons for nuclear waste. This has involved, for example, groups close to areas of nuclear waste storage, drawing on local myths in particular of the earth and flight, and gallery workshops relating to nuclear exhibitions.

These workshops become a space to open up critical questions around deep geological repository marking, while designing new composite demons. These demons have no fixed form but are composed from online object scans of museum artefacts, reconfigured according to guiding morphologies, combining Pazuzu's flight with localized traditions and mythologies. Formed through the "gooey", or molten, materiality of plastic, produced through contemporary technology of deep time pestilence, the 3D-printer,[15] I rename these figures *Pazugoo* (see Figures 1-3):

[14] Hulme (2009) for example, discusses non-Western traditions of personification of climate as attuned to cultural practices of climate, not reduced solely to communication through mathematical data models.

[15] The "3D Additivist Manifesto" (Allahyari and Rourke, 2015) draws attention to 3D-printing's deep time origins, the technology shaping plastic "derived from petrochemicals boiled into being from the black oil of a trillion ancient bacterioles" (*ibidem*: §1). Heather Davis has written on plastic as the "substrate of advanced capitalism", proliferating future detritus disseminated around the world as non-biodegradable "recalcitrant matter" (2015: 348-352). The 3D-printer, in other words, becomes an agent for channelling oily prehistory

FIGURE 1 – Workshop Image: *Perpetual Uncertainty*, Umea Bildmuseet, Sweden, 2016

Credits: Photograph taken by the author.

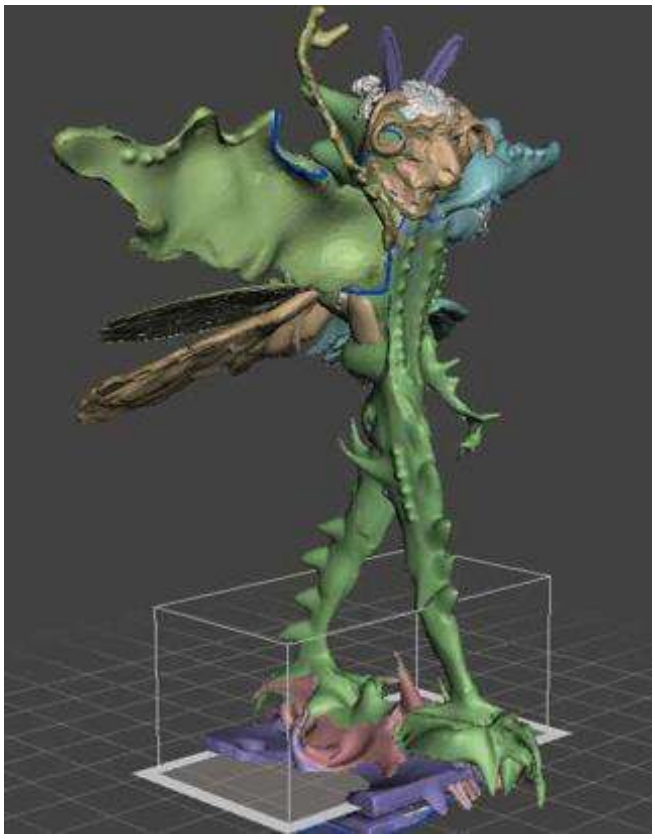

FIGURE 2 – Composite *Pazugoo* Design from the Umea Workshop, 2016

Credits: Image created by the group work.

into polluted deep futures of trash matter, outliving its makers. Consider also Negarestani's description of oil as lubricant for coalescing dust particles (2014: 88), an agency taken up by the printer.

FIGURE 3 – *Pazugoo Prototype S1N1*, 2016, 3D-printed SLS Plastic, 14x10x6 cm

Credits: Photograph taken by the author.

This workshop took place as part of the *Perpetual Uncertainty* series of exhibitions, curated by Ele Carpenter, in Umeå and Malmö in Sweden, as well as Hasselt near to the HADES site in Belgium, emphasising the geographically dispersed nature of nuclear materiality. Developing from the Nuclear Cultures Research group, the series of exhibitions allowed for incorporating a range of artistic responses to aspects of the nuclear. This included other responses to site marking such as artists Thompson and Craighead's totemic *A Temporary Index* project. In one sense, workshops open up participatory processes within RK&M discourse. As art historian Anna Volkmar has argued, "where traditional marker designs envision members of the public as bystanders, *Pazugoo* redefines them as accomplices" (2018: 4), bringing elements of co-design and discussion into the process. But accomplices to what, though? Pazugoo inhabits the composite artefact bodies, the workshop participants, and its technologies as agents to bind its polymers. Workshops become focal points for participants to enter into this more-than-human ecological distribution, lured by the myth of *Pazugoo* to reformulate and distribute its host bodies, or to become its pest seeding machines. From these workshops, while developed as mythic personification, Pazugoo also takes on form through material objects for dissemination. This is where it further intervenes into the RK&M debates, proposed to be buried in the earth with radioactive materials as underground marker. Developing the project, plastic prototypes, bronze and resin casts are produced, designed for different levels of burial, glitched bodies retaining traces of its material process (see Figures 4-6):

FIGURE 4 – Pazugoo Perimeter Marker 1, 2018, polished bronze, 18x9x6 cm

Credits: Photograph taken by the author.

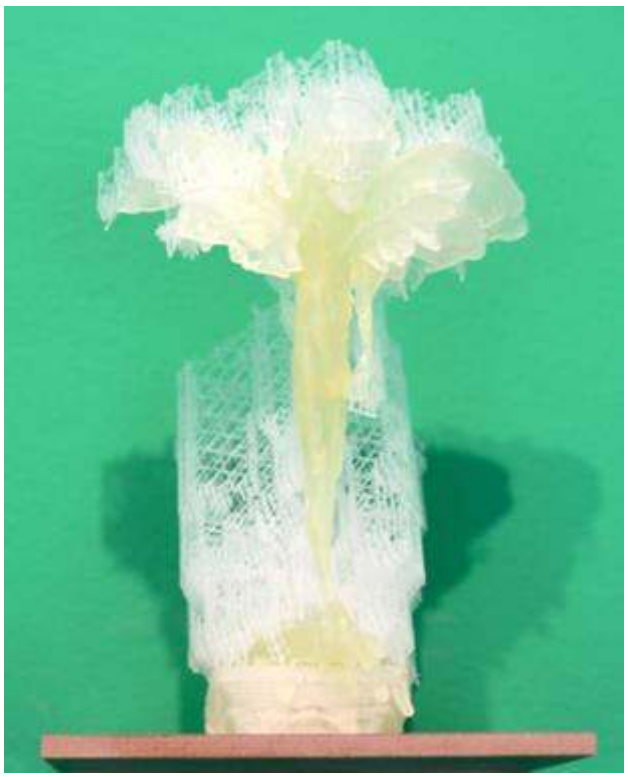

FIGURE 5 – Pazugoo Prototype 3.3, 2018, Epoxy Resin, 28x16x12 cm

Credits: Photograph taken by the author.

FIGURE 6 – Museum Index (Malmo), 2018, Acrylic, SLS-Plastic in Plexiglas Container, 38x16x10 cm. Work for the museum collection, to include the figure and archive material, referencing the distributed buried objects

Credits: Photograph taken by the author.

The work then takes on a specific format. Following the prototypes and objects for burial, museum "index" figures are produced. Hosted in museum collections and exhibitions, these index figures act as a reference point or archive for objects buried around multiple sites. For this work, for example, following the *Perpetual Uncertainty* exhibition, a figure remains in the museum collection as archive, drawing on the nature of the museum collection as an ongoing culturally embedded marker. These aim to operate as "proposals for burial" which draw on the exhibition context to open up the deep time imaginary. Alongside this, through research into the categorising of waste, further histories of mining, production and transport are excavated, opening new potential sites for burial of objects. A collaboration with researcher Jacob Warren, for example, marks UK nuclear testing in Australia. A distributed approach to site marking asks how such stories of energy production, power plant operation, decommissioning nuclear testing and toxic legacies, usually kept separate, can be connected through mythic narratives of the work.

Exhibition installations document this process of distributing buried objects as a mutating material network, alongside other work including objects, videos, drawing and diagrams playing the role of speculative imagining of deep time futures. At the same time through these research processes, the artwork becomes a way into further interdisciplinary and collaborative discussions and projects of nuclear waste storage, marking, and memory (see Figures 7 and 8):

FIGURE 7 – Installation View, *Perpetual Uncertainty*, Malmo Art Museum, 2018

Credits: Photograph taken by the author.

FIGURE 8 – Discussion at "Stakeholders Roundtable: How to Reveal the Underground through Data, over Time and in the Present", chaired by Ele Carpenter, at Modern 2020, 2nd International Conference on Monitoring in Geological Disposal of Radioactive Waste, April 2019

Credits: Photograph taken by the author.

CONCLUSION

Negarestani has described how the relic "confounds chronological time by connecting Now with abyssal time scales" (2008: 242). The relic is ungrounding through its literal exhumation, undermining the order of the strata, "it invokes or resurrects beings before their time comes […] unlocking timescales which cannot be synchronised by chronological time" (*ibidem*: 239). It can be understood as a twisting of past into present, opening a continuum between phenomenal and ancestral realms.[16]

Fossils operate as relic-connectors to the ancestral past, but for radiological deep time this must also be imagined from the future abyss of planetary extinction. Deep geological repositories proposed for long-term storage of radioactive waste will, in the future, consist of radioactive particle-infused clay or rock, indexing residues of industrial nuclear power generation alongside the chemical weathering of silicate-bearing rock. Future archaeologists may unearth formations of sediment as evidence of human-environmental interactions. On the other hand, they may not, as microbiological processes form other assemblages indifferent to an archaeological gaze. Buried *Pazugoo* artefacts inhabit this material, referenced by the museum index. The work becomes an artistic strategy drawing attention to making relics of the future. Through this we are forced to associate he relic not only as an intrusion of the past, but as a relic-to-come, forming a contiguous relation between deep time *futures* and now.

Defined by its potential to be unearthed, by some unknown who or what. the future relic opens to a speculative future perspective, looking back on its moment of encounter today. It becomes an excavation of present culture from an imagined non-determined future space. This shifts the address of the work away from its present viewer, towards an unknown vantage point, for which its viewing subjects and their culture now become the sample. Adopting this shift means understanding the future fossil not only as alien object, but also as *alienating*, a catalyst for ungrounding or making-alien of the present moment of its experience, "being from elsewhere, the relic conveys to the believers their own distance, estrangement and foreignness" (Lukic, 2013: 70). Against the imaginary of the marker-subject, the viewer of the future-relic becomes its object, alienated from the conditions that structure its understanding in the present.

Earthing and Unearthing attends not only to revealing the presence of the past, but also to implications of the present in processes that exceed it, relations between human and non-human processes.[17] The future-relic calls to a subject implicated within this

[16] Philosopher Ben Woodard describes Negarestani's use of the relic object "binding temporalities to phenomenologies" (2013: 53-54) in contrast to Meillassoux's separation of the ancestral and the phenomenal through his concept of the arche-fossil in *After Finitude* (2008). This critique can be taken further through Povinelli's (2016) discussion of the relic.

[17] To place something away from sight into the ground, as Povinelli discusses earlier in *Geontologies*, is not

ungrounding in the present, as the group of scholars and activists interested in collaborative intellectual labour Uncertain Commons have described (2013: 11), as a mode of "affirmative speculation": "a mode of caring about what cannot be anticipated as a future in our present moment"; "what we affirm is something that has the potential to undo us". Encountering the future relic means to enter into these processes – ungrounding its viewer, alienating the self to produce a subject entangled within radiological deep time.

By proposing to bury these figures with nuclear waste rather than mark the above ground site, they enact a crucial shift from marking the deep geological *site* to marking the materiality of the radioactive waste itself. Focusing on the waste itself draws attention to its materiality as already a kind of marker, which *Pazugoo* becomes part of. This challenges the narrative of invisibility around the waste. Rather than it becoming forgotten as it merges into surrounding "nature", in other words, agencies of underground processes are drawn attention to. Against celebrating the triumph of storage, it is the waste itself that is inhabited as interscalar. Further, the work has a distributed format, not just buried at one place but in multiple sites, becoming part of the material network of toxicity distributed on a planetary scale (cf. Carpenter, 2019). This develops a practice-based way of thinking the complexity of radiological deep time at multiple scales. *Pazugoo* is proposed as a method to draw these connections, a kind of diagram through the earth and through time. This includes different localities on the planet, the "localised" experience of encountering the artwork, and the speculated future times evoked by half-life measurements, which are brought together through the installation. Through this format, it aims to go on to map histories including uranium mining, colonial extraction of resources, production processes and future scales of care and harm, tracing expanded territories of toxicity that remain more distributed than in the site alone. To approach the distributed materiality of radioactivity, in other words, the work must itself become formally distributed, attuning to it. Through its focus on myth, contagion and mutation, it aims to challenge the narratives of salvation and communication of the marker subject imaginary. Opening to unknown material futures, it includes the exhibition, the viewer, and artist as part of a deep time ecology of toxicity.

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necessarily a disappearance of knowledge, but its transformation into part of this ground, "something we stood on but did not attend to" (2016: 23), open to future stories or unearthing.

ANDY WEIR

Chelsea College of Arts, University of the Arts London
16 John Islip St, London SW1P 4JU, United Kingdom
Contact: a.weir@arts.ac.uk
ORCID: https://orcid.org/0000-0002-3648-1796

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