

Geological Filmmaking: Seeing Geology Through Film and Film Through Geology

AUTHOR BIO

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ABSTRACT

In this article, I consider the aesthetic dimension of cinema in conversation with the material dimension of the geology that subtends it, in order to propose the concept and the practice of “geological filmmaking” as a strategy for tackling the perceptual challenges posed by the ecological crisis and the Anthropocene. Geological filmmaking emerges from the understanding that the form and content of any film, and thus the perceptual and durational experience it engenders, are rooted in geological materiality. Geology concerns itself with matter as much as process, dealing with mountains and molecules as much as with sedimentation and erosion and, thus, with time itself. In this way we can already think of geology as a film in slow motion, and of land formations as films of their own making: what they are in the current moment also includes the trace of their making. Expanding the material side of this metaphor we can triangulate geology as being constituted simultaneously by land formations as they are in the current moment, the mineralogical materials that they are formed of, and the ongoing processes that have formed them and are forming them. A film can itself be triangulated as constituted by all the images and sounds that it consists of, its material form of storage (be it analogue or digital), and the temporal experience it engenders when watched. Both geology and film are thus contained in the contingency of form, materiality and temporality. With geological filmmaking, the imperative becomes to think all three aspects of geology through all three aspects of film. This imperative shapes the structure of this article, which progresses by an analysis of two of my practice-research film projects: one on sinkholes and one on asbestos.

KEYWORDS

Anthropocene; asbestos; film; geology; materiality; practice research; sinkholes; temporality

In 1923, in the era in which cinema started to test and define its own boundaries, the critic and filmmaker Jean Epstein wrote that “if we wish to understand how an animal, a plant or a stone can inspire respect, fear and horror, those three most sacred sentiments, I think we must watch them on the screen, living their mysterious, silent lives, alien to the human sensibility” (22). To Epstein, the camera eye is in its essence non-human and unburdened by the knowledge of the meaning of the objects it captures, and it is for this reason that it is able to not only represent but also to reveal the world of non-human agency. Today, at the time of ecological crisis and what is being called the Anthropocene – a newly postulated geological epoch in which the human is said to have made irreversible changes to the geophysics of the earth – what kind of cinematic encounter with the non-human could engender, as Epstein would have it, respect, fear and horror, or, perhaps more pressingly, understanding? In this article, I consider the aesthetic dimension of cinema in conversation with the material dimension of the geology that subtends it, in order to propose the concept and the practice of “geological filmmaking” as a strategy for tackling the perceptual challenges posed by the ecological crisis and the Anthropocene.

Our perceptual experience of the ecological crisis is limited by the invisibility of many of its material factors, such as climate change and nuclear radiation. The temporality of both radiation and the rising CO₂ in the atmosphere also operates on geological scales that far exceed human lifespans. Rory Rowan suggests that “it is perhaps [most] urgent and fruitful to address how to live *with* and *through* seemingly inevitable catastrophic environmental change” (para. 3). Doing so requires a creation of tools that help to grasp, imagine, navigate and traverse the *naturecultural* world-in-transformation that we inhabit (Haraway, “Situated Knowledges”). It is therefore crucial to engage with the perceptually elusive and unimaginably vast aspects of the ecological crisis, defined by Timothy Morton as *hyperobjects*, in order to envision futurity within it. Both the present and the future need to be able to be imagined, for “we cannot make the future [...] without also thinking it” (Ingold 6). T.J. Demos argues that the ecological crisis is in fact a crisis of political will to imagine and enact alternatives, and he suggests that it requires “an immense project of imaginative thinking and practice” (16). Art practice, conceived as “experimentation, imaginative invention, and radical thinking,” can become a key strategy “of initiating exactly these kinds of creative perceptual and philosophical shifts, offering new ways of comprehending ourselves and our relation to the world differently than the destructive traditions of colonizing nature” (Demos 18–19). While the editors of *Making the Geologic Now* write that, in the face of the temporal and spatial immensity of the Anthropocene, which nevertheless often retreats from view, artists are beginning to create “works that do not simply take up the geologic as a theme,” but that “activate formats, methods, models, ideas, and aesthetic experience in ways that seek to recalibrate ‘the human’ in relation to ‘the geologic’” (Ellsworth and Kruse 9). Geological filmmaking aims to do so in the medium of moving image.

Moving image has long been understood as a medium that, as Siegfried Kracauer observed, “in recording and exploring physical reality [...] exposes to view” our material environment that had lain “before our eyes” and yet “remained largely invisible to us” (299). Picking up on Kracauer’s claim that

cinema is “the medium particularly equipped to promote the redemption of physical reality” (300), Adrian J. Ivakhiv in *Ecologies of the Moving Image* stresses the contemporary urgency of a cinema that can redeem “the material reality of the world, a world that is shared by humans and non-humans, and shaped by both, at a time of precarious relations between them” (23). Moving image, thus, provides an avenue for a potential engagement with, and a reclaiming of, the imperceptible yet highly material aspects of the Anthropocene. Ivakhiv further calls for accounting for “the relationship between the worlds produced *by* cinema and the world(s) *from* and *within* which they are produced” (22) and, in the case of approaching geology through film, this would mean also accounting for the geological terrain from which the film emerges.

So how to think geology through film and film through geology? Geology concerns itself with matter as much as process, dealing with mountains and molecules as much as with sedimentation and erosion and, thus, with time itself. In this way we can already think of geology as a film in slow motion, and of land formations as films of their own making: what they are in the current moment also includes the trace of their making. Expanding the material side of this metaphor, we can triangulate geology as being constituted simultaneously by land formations as they are in the current moment, the mineralogical materials that they are formed of, and the ongoing processes that have formed them and are forming them. A film can itself be triangulated as being constituted by all the images and sounds that it consists of, the material support it is stored upon (analogue or digital) and the temporal experience it engenders when watched. Both geology and film are thus contained in the contingency of form, materiality and temporality. With geological filmmaking, the imperative becomes to think all three aspects of geology through all three aspects of film.

To engage in a reciprocal discussion of geology and film, where both provide insights that can be read through each other, I borrow the diffractive methodology proposed by Haraway and further developed by Karen Barad. In optical physics “diffraction patterns record the history of interaction, interference, reinforcement, difference” (Haraway and Goodeve 102). Methodologically, Haraway and Barad mobilise it for reading a number of disciplines from the humanities and the sciences “through one another” in order to think “the cultural and the natural together in illuminating ways” (Barad 135). In this methodological spirit, the rest of the article is structured in sections that read geological and filmic materiality, form and temporality through each other. Specifically, these sections are divided under the auspices of filmic materiality, form and temporality, each of which is read through geological materiality, form and temporality. Equally reciprocally, I approach the relationship of theory and practice in the development of this research; or, more accurately, the relationship of writing and filmmaking. Theory and practice are always and already inextricable from each other as doing can be a way of thinking (Haraway, “Anthropocene” 261) and conversely theorising is itself a kind of doing (Barad 54). The concept and practice of geological filmmaking was developed in tandem with the making of two film projects, one on sinkholes and one on asbestos, which I discuss further in this article. While the practical challenges encountered in the making of these films helped to flesh out the conceptualisation of geological filmmaking, the term in no way

excludes existing or future work of other artists, many of whom tackle similar questions or engage in similar methodologies. Within the scope of the present article, my focus remains largely on my films by way of introducing geological filmmaking. I present it as a concept that can be used to theorise existing film practices of others; and as a practice that can be taken up by other artists and developed and transformed in infinite ways.

The Geology of Film Materiality

I begin with materiality to build from the ground up, so to speak, and to establish the inextricable reliance of all technical images on the geology that subtends them, before moving on to the specific qualities and potential of such images in the following sections. In her *The Cinematic Footprint: Lights, Camera, Natural Resources*, Nadia Bozak considers the dual relationship between moving images and the geology that enables them, which they in turn depict. She argues that photographic images, whether still or moving, “directly and indirectly formulate landscape as both an aesthetic category and a physical reality, both representing and contributing to the decay of the environment” (13). Jussi Parikka comes up with a term for this interdependence in his *A Geology of Media*, which introduces geology into media scholarship as both a conceptual tool and an urgent physical reality. Parikka’s proposition is just this: to consider the geology of media, that is, the mineralogical and metallic materiality of media, all the way down to the fate of the materials after the death of the media themselves, as toxic residue and electronic waste. He writes on the double bind between the earth that shapes our media, “provides for [it] and enables it,” and the media that, in return, shape how we see the earth (13). In other words, it is media technologies that allow us to perceive, image and analyse the world in order to understand climate change and, thus, have the capacity to alter our relationship to the earth. In order to function, media also require the natural resources and fossil fuels that interfere in the earth’s geophysical order. Parikka names this double bind of the mutual reliance of our understanding of the earth on the media that is materially subtended by the earth’s geology *medianatures*, riffing on Haraway’s concept of naturecultures.

Just like naturecultures point to the linguistic, conceptual and theoretical impossibility of the nature/culture divide, medianatures point to the impossibility of considering media technologies or media content without accounting for their material conditions and ties to natural resources. As Ivakhiv writes, this is not to say that all “technological mediation is more a part of the world’s ecological problem than its solution” (12), for it is “vital to communicating any kind of political or social awareness about environment in the first place” (Bozak 95). In *Finite Media: Environmental Implications of Digital Technologies*, Sean Cubitt argues that the political question of building an alliance of humans and non-humans, and of avoiding environmental catastrophe, will ultimately have to be an aesthetic question. Aesthetics is understood here as “concerning both perception (the root meaning of *aesthesis*) and art, the techniques of mediation and communication in which we construe our relations with one another and the world” (15). Neither economic nor technological fixes would suffice, as both are part of the machinery that perpetuates the crisis. An aesthetics that contributes towards a shift in the

understanding of politics would need to take into account the existing economic and environmental implications of the media that make perception and communication possible. Indeed, it is precisely by accounting for the matter and energy of which the media consist that the media come to matter: “only because they are matter can they mediate between fallen nature and fallen humanity” (Cubitt, *Finite Media* 186). Considering the geological materiality of digital media then becomes a crucial node in making the future thinkable.

Geological materiality ties media, including analogue and digital moving image technologies, to a planetary spatial perspective and the temporal expanse of deep time. Media technologies are entangled in the history of colonialism and an ever-advancing extractive frontier. Today, some of the most ubiquitous moving-image-making tools – smart phones – contain minerals and metals from around the world, from lithium mined in Chile salt flats to rare earths from Inner Mongolia. As well as being tied to innumerable locations, the temporality of contemporary technical images encompasses the deep past of the formation of the mined materials and fuel required to power the production and use of the technologies that enable them, as well as the deep future of the material persistence of these technologies. In this sense, every cinematic image opens up to the billions of years required for the earth’s crust to form. Each film frame is also able to narrate the entire history of industrial capitalism that made it possible through its continual prospecting of natural resources. As Bozak writes, all it takes is a single cinematic image “in order to gain a purchase on what has become the Anthropocene epoch” (30), as “each film frame is a measure of our civilization’s control of the sun, in the form of fossilized sun or carbon that we have captured, refined, and duly exploited” (29).

Not merely bound to the earth, every cinematic image is doubly bound to the sun: the sun, or more specifically captured sunlight reflected off objects hitting a photochemical substrate or a CCD sensor, makes cinematic images possible, while energy derived from fossil fuels, formed by millions of years of sunlight captured in decomposing prehistoric critters, makes the cinema industry and cinematic technology possible. Cinema can then be understood as “a form of captured, organized, and released light-heat-energy-movement,” and if “the universe is made up of a kind of moving-morphing image-substance-stuff [...] then cinema is a vehicle for reorganizing that stuff” (Ivakhiv 338). But the cinematic intersection with material geology does not only happen in the disruptive sense of extractive interventions into geological formations in the earth, but also comprise the creation of geological formations on the smaller scale of image capture. As Cubitt writes in *The Practice of Light*, both analogue and digital photographic or cinematic capture happen as a chemical exchange on a molecular level, as photosensitive materials enable a “chemical conversion of light” (244). In the case of celluloid film, light oxides grains of silver halides, and, in the case of digital capture, electrons are gathered by the crystal lattice of a CCD sensor. Meanwhile the CCD sensor crystal lattice itself is fabricated through a process of geological formation: starting from a seed crystal, it is *grown* on the chip, with the molecular structure pre-empting the distribution of the pixels (Cubitt, *Practice* 105). Moving images are thus inherently tied to geology on both planetary and molecular scales. While accounting for how this

is true of every cinematic image, the question remains: how can we develop moving images able to depict geological materials and processes operating on imperceptibly vast or imperceptibly small scales?

Geology Through Film Form

In this part of the article, I use two of my own film projects as case studies through which to read geological materiality, form and temporality through film form. The two films deal with a geological material, asbestos, and a geological formation, a sinkhole, and issues of perception and depiction, respectively. Asbestos is a fibrous mineral whose submicroscopic molecular structure makes it able to become airborne and, when inhaled, to pierce a biological cell like a needle, which triggers the cancer-causing process. Approaching asbestos cinematically, and, specifically, through a practical investigation, becomes a challenge of imaging an invisible and latent atmospheric threat: a challenge in line with the difficulties in attempting to visually depict climate change. Further, far from abstracting the submicroscopic toxicity and the global spread of asbestos, this project channels the imperative, as written by Jason W. Moore, to adequately grasp “the intimacy, porosity, and permeability of humans and human organizations within the web of life” (7). The thousands of sinkholes forming on the shores of the Dead Sea likewise become a perfect microcosm through which to study the mutual co-emergence of geological landscapes and their human habitation and exploitation. The sinkholes are the result of anthropogenic interventions into the hydro-geophysical cycles of the environment, and, in turn, are shaping the present and future possibilities for life, industry and agriculture in the area. The sinkholes also present an example of what Rob Nixon terms *slow violence*, “a violence that occurs gradually and out of sight, a violence of delayed destruction that is dispersed across time and space,” and thus presents “formidable representational obstacles that can hinder our efforts to mobilize and act decisively” (2). Film is a photographic and durational medium, and therefore comes with visual and temporal constraints. Working with material phenomena, such as asbestos and sinkholes, whose appearance is either largely hidden or dispersed through space and time, challenges a filmmaker to think beyond available formal tools. What follows is an account of such efforts.

The history of the use and disuse of asbestos is tied up with the history of the advance of scientific visualising technologies. Mined since the time of the Ancient Greeks, its industrial use expanded dramatically in the first half of the twentieth century. Its applications ranged from filters in early gas masks and fireproof fireman suits, to the more broadly known architectural uses in insulation and roofing. Both the industrial use and the toxicity of asbestos are derived from the same material properties at the molecular level. Asbestos is a fibrous mineral that is “formed through polymerization, the repetition of a chemical unit in a linear array,” meaning it can be broken down into fibres of merely one molecule thick (Skinner, Ross and Frondel 11). This molecular structure makes it highly malleable, durable and able to be woven into any other industrial material. It also makes asbestos able to become airborne, impossible to detect without very specialised equipment, and, in contact with a cell, piercing it like a needle and triggering mutation. The understanding of

its molecular structure, and thus a turning point in the history of its use, arrived with the invention of the transmission electron microscope (TEM). Unlike optical microscopes, which, like cameras, register light reflected off objects, transmission electron microscopes send a beam of electrons *through* the object of study, haptically sensing its structure on a molecular level. The industrial use, toxicity and visibility of asbestos are thus all defined by material entanglement and the breaching and renegotiating of the boundaries of inside and outside. Herein lies one potential approach for a filmic engagement with asbestos: not attempting to make that which is unavailable to optics visible, but instead attempting to follow the traces of its material entanglements and to traverse the boundaries it has traversed.

Naturally occurring in enough quantities to mine economically in only a few locations, including Canada, Russia and South Africa, asbestos was exported all around the world, and continues to be used in developing nations to this day. The revelations made by TEM triggered the still ongoing process of reversing the history of its use. Yet the asbestos industry is far from over: as well as relocating out of developed nations, asbestos mining has been replaced by the asbestos removal industry. In the making of the film *Asbestos* (2016), made collaboratively with Graeme Arnfield, we aimed to follow the logics of these two types of extraction – extraction from the earth and equally industrialised extraction from the walls – by juxtaposing them through the use of filmed footage of the town of Asbestos, Quebec and found footage of removal. In order to channel the specificity of Asbestos, home to one of the world's biggest asbestos mines, and the specificity of the historical moment, now past, when the promise of asbestos inspired the naming of the town, we document it through static and composed tripod shots (figs. 1 and 2). The disintegrating material traces of the pride and hope that inspired the town's naming are visible throughout it – from the mural depicting the history of asbestos in the supermarket parking lot to the bowling alley called after it. We contrasted this material with found footage of removal, which has no spatial or temporal constraints, originating from around the world and across decades (figs. 3 and 4). We aimed to let the succession of film and video formats – from 16mm to magnetic tape to HD – to itself stand as testament to the persistence of asbestos and the unceasing practice of mitigating the history of its use. Some of the footage is amateur and some professional, yet the activities remain the same: men put on protective gear, they peel the walls, they scrape the floors, they wrap rooms in plastic, they tear the plastic down. The marks of asbestos upon these images are the very layers of plastic that hide the surface of the walls and the bodies of the workers.

Asbestos itself is not made visible in the optically captured images that make up the film. What the images reveal instead are the practices and infrastructures asbestos necessitates and leaves in its wake, the chain reaction that is triggered beginning with its extraction from the ground. In an attempt to tackle an imperceptible material through a visual medium, what came into sharp relief instead is the contact zone between the material and its use. And this realisation is key, as it is precisely that contact zone that needs examining and renegotiating. As Kathryn Yusoff argues, drawing on Deleuze and Guattari's work on stratification, because geological strata subtend all life, it is necessary to remain embedded in and dependent upon them, while simultaneously

examining and undoing the most destructive relations between capitalism and the geological, including the institutions and practices that shape the modes of capitalising on the geological. Or as Nigel Clark elaborates, the continuation of life among geophysical processes is dependent on “how we, collectively and heterogeneously, might negotiate more carefully, more judiciously, more generatively with strata” (228). *Asbestos*, the mineral, and *Asbestos*, the film, demonstrate that the human does not just touch the non-human, culture does not just touch nature, but the boundaries between them become porous, interpenetrating and dissolving in an act of what Stacy Alaimo in *Bodily Natures* calls trans-corporeality: a theoretical site that is constituted by a dual recognition that “‘the environment’ is not located somewhere out there, but it always the very substance of ourselves” (4) and that “humans are the very stuff of the material, emergent world” (20). *Asbestos*, the mineral, and *Asbestos*, the film, traverse the boundaries of inside and outside, which shift in scale from individual cells to the skin that forms the outer boundary of our bodies – from skin to the outer skin of the protective hazmat suits, from bodies to walls, from interiors to exteriors of domestic spaces, from the local to the global, from the screen to the optical nerve.



Fig. 1 Still from *Asbestos* (2016).
Sasha Litvintseva and Graeme
Arnfield



Fig. 2 Still from *Asbestos* (2016).
Sasha Litvintseva and Graeme
Arnfield



Fig. 3 Still from *Asbestos* (2016).
Sasha Litvintseva and Graeme
Arnfield



Fig. 4 Still from *Asbestos* (2016).
Sasha Litvintseva and Graeme
Arnfield

The sinkholes decimating the Dead Sea shore are equally testament to the impossibility of drawing solid boundaries between the environment and its occupants. Close to seven thousand sinkholes have appeared in the last four decades, making the majority of the shoreline inaccessible. This rapid transformation of the landscape is a direct outcome of anthropogenic intervention into hydro-geological cycles of the area. Specifically, the dropping of the level of the Dead Sea and subsequent melting of ancient salt deposits underneath the newly exposed shoreline have led to the creation of cavities in the sub-terrain. As the topsoil collapses, a sinkhole appears. The dropping of the sea level is primarily affected by two factors, each related to a mode of instrumentalisation of nature as a colonial tool. On the one hand, the surface of the land upon which the sinkholes are appearing is highly politically contested and subject to meticulous cartographic quantification, as the border between Israel and the West Bank is articulated. Though control of the surface territory of the West Bank was given to the Palestinian Authority in 1995, Israel “retained control over [...] the sub-terrain beneath” (Weizman 1), thus allowing private companies in Israel to develop industry by the Dead Sea,

leading to the depletion of minerals and dropping of sea level. On the other hand, the question of the articulation of the boundary of Life and Nonlife, as explored by Elizabeth Povinelli in her work on *geontopower*, in the Judean Desert has been highly charged historically, as the supposed absence of life in the area was used as a pretext by settler colonialism for the confiscation of Palestinian lands. Foreign life forms were forced into the environment as part of the Zionist agricultural strategy of claiming territory. The irrigation of the desert requires rerouting water from the river Jordan. This is the other key reason for the dropping of the level of the Dead Sea and consequent creation of sinkholes, which in turn leads to the abandonment of date groves and Kibbutzim (communal agricultural settlements). More than just a surface interference, a sinkhole is also testament to unstable ground such that the assumption of the existence of nature as a stable baseline to human activity, which has fuelled the environmental destabilisation in the area, can no longer be supported. The sinkhole's appearance, while being directly caused by anthropogenic changes to the geology of the area, itself directly interferes in the possibility of its ongoing habitation or capitalisation. As Moore writes, "geology is at once subject and object;" it both acts and is acted upon in the emergence of historically specific relations of "states, classes, commodity production and exchange" (179). The sinkhole is not merely static consequence of human activity upon otherwise stable reserves; rather it is both producer and product, both symptom and cause, of the ongoing transformation of the naturecultural environment.

The figure of the sinkhole thus becomes a compelling prism for a filmic investigation of the contact zone between the human and the geological, as it embodies the intersection of the dynamics of capitalism and natural resources, colonialism and territorial volume, infrastructural violence and environmental violence, historical time and deep time, horizontal and vertical planes, looking across a terrain and cutting through it. In making *Salarium* (2017), in collaboration with Daniel Mann, we attempted to visually oscillate between these poles. We shot the infrastructural elements of the landscape (fig. 5), such as roads, orchards and electric pylons that permeate the otherwise empty Judean desert, from a tripod with a wide lens, aiming to visually echo the instrumentalising and quantifying approach to space of the cartographic and surveying practices historically fuelling colonial expansion (Cosgrove; Mitchell; Siegert). Through these static, stable and wide shots, we aimed to gradually weave together a map of the space, and provide for the viewer a sense of coherent horizontal spatiality. In the environment itself, sinkholes appear as interventions in this horizontal spatiality and surface stability. Throughout the film, we aimed to make perceptual and visceral interventions into the stability of the landscape shots to open them up to questions of verticality and destabilised depths while destabilising the objectifying visuality of horizontality they contribute to. Though images of sinkholes do appear towards the end of the film (fig. 6), we primarily worked on creating destabilising stylistic interruptions through camera work. All the images on the shores perforated by sinkholes were shot handheld, so that even when we did not see the sinkholes directly, a precarious feeling arose through the (in)stability of the shots mediated through the (in)stability of my arms and my steps as I guided the camera through the landscape through the motion of my body. When the

ground itself stops being dependable, the visuality of the film aims to become demonstrably probing of the environment.

Fig. 5 Still from *Salarium* (2017).
Sasha Litvintseva and Daniel
Mann



Fig. 6 Still from *Salarium* (2017).
Sasha Litvintseva and Daniel
Mann



Fig. 7 Still from *Salarium* (2017).
Sasha Litvintseva and Daniel
Mann



As well as the feeling of groundlessness and of vertigo created by the increasingly abstracted and visceral hand-held shots of the ground, we aimed to create a feeling of entering the vertical dimension of the landscape by penetrating its surface into its depth. In a scene on the beach, the camera continuously breaks the surface of the water: with its every emergence and submergence, we aimed to open up the vertical dimension of the landscape, the above and the below and the permeable nature of the surface that separates them (fig. 7). In cutting the landscape vertically, this camera movement aims to render the surface of the water as perpendicular to the surface of the screen. The cinematic image here becomes a material surface of the three-dimensional environment, rather than merely an immaterial window onto it in the way of traditional perspectival images, which has historically powered the conception of space as abstractly geometrical and quantifiable (Panofsky). Through this formal intervention, we aimed to echo the way sinkholes breach the surface of the physical landscape and actualise its depth, while searching for ways of recording environments that depart from the quantifying and instrumentalising representational traditions bound up with histories of colonisation and extractivism. In thinking of the cinematic image through the question of surface and depth, I would finally like to bring formal concerns together with cinematic materiality and suggest further that the depth of the image can also be understood as precisely the geological materiality of the media involved in every stage of the production and exhibition of the image: from the circuit board of the camera and the lithium in its batteries, to the rare earths in the computer used to edit it and the electricity powering the bulb in the projector.

Geological Time Through the Geology of Film Temporality

In this last part of the article, I will examine film temporality in its interaction with geological materiality, formation and temporality. I will look at the complexities, contradictions and multiplicities inherent to the temporality of geological phenomena, through sinkholes and asbestos. And I will consider the way these are able to manifest through the multifaceted temporalities of film, from the duration of the screening experience to the production and decomposition of the celluloid strip, magnetic tape or digital file. The temporality of film embodied a contradiction from its very emergence. As Mary Ann Doane writes, the emergence of cinematic time happened amid a “cultural imperative” for “the structuring of time and contingency” prevalent at the end of the nineteenth century (3). It was not only the earth that the colonial and industrialising drives reimagined as a resource, but also time itself, as the latter became increasingly uniform, homogenised, standardised and rationalised. Alongside the discoveries around the irreversibility of time through the Second Law of Thermodynamics, and the establishment of universalised world clock time, much of time’s standardisation was linked to its becoming, after Marx, a measure of value. For the capitalist to buy a quantity of the labourer’s time, it had to be “measurable and therefore divisible” (8), which clashed with the longstanding philosophical understanding of time, as conceptualised by Bergson during the same historical period, that posited time as “uninterrupted transition, multiplicity without divisibility and succession without separation” (Bergson 205). This dilemma around the (dis)continuous

nature of time became the locus of the theoretical discussion surrounding the possibility of its representability. It was then that film emerged and appeared to embody this dilemma: on the one hand made up of individual frames, the dreaded instants of time and, on the other, able to emulate the perception of continuous time. Deleuze later used the geological metaphor of a crystal to further theorise the ability of the cinematic image to make visible the dual nature of time in Bergsonian philosophy itself. He examined the split of “the present into two heterogeneous directions,” namely, of the present that passes on and the past that is preserved (Deleuze, *Cinema 2* 79). With televisual transmission and recording on magnetic tape or via CCD sensor, the ability of the moving image to create the illusion of continuous motion was no longer tied to straightforwardly separable frames. Yet, as we will see, there is a host of ways in which cinematic temporality harbours a rich multiplicity.

For the sake of specificity, let me begin once again from the ground up – from the attempt to mediate the temporality of a sinkhole. Sinkholes collapse two temporal scales, that of deep time and historical time. They are the result of both the millions-of-years-long history of the underground salt deposits as much as of the decades-long history of colonial settlement, mineral extraction and desert irrigation. Sinkholes do not merely combine these two temporal scales: they intervene. In appearing, they disrupt the possibility of a linear progression of either topsoil sedimenting on salt deposits, or continued capitalisation of the land through extraction and cultivation. In this sense, more than operating on multiple scales, sinkholes embody multiple modes of relating to the past and to the future. On the one hand, time as it is experienced when traversing the perforated landscape is of an intense anticipation of the sudden forming of a new sinkhole and a collapse. Time becomes an extreme expanded present moment in a perpetual anticipation of a catastrophic future. When a sinkhole does appear, the pressure valve of the present is released and a breadth of time flows in: the entirety of the past that has made the sinkhole possible is made present in it. In all senses, the temporality of the sinkhole is not the chronological or teleological time of one-thing-after-another, but of an expansive present opening up towards the future and of the expanse of the deep past made manifest at once.

In *Salarium*, we also aimed for a temporality oscillating between anticipation and collapse, for example, by interrupting stable and durational shots with erratic editing and visceral shots replicating the sensation of falling. But, in considering the geology of film temporality, one ought to think beyond the confines of the duration, rhythm and movement of each individual shot, of the way the shots flow into each other, or of the film as a whole. The temporality of a film in the first instance can be thought through the prism of the deep past of the formation of the geological materials that make up cinematic technologies: seen this way the duration of any film is billions of years old. The materiality of cinematic technologies is also subtended by the geological time of media history sedimentation. As Parikka writes in *What is Media Archaeology?*, “the media-technological artifact as a monument is a reminder from a past media culture, and as such carries with itself pastness,” each machine “itself a concrete form of the principles, diagrams, examples of past media in action” (132). The example of the sinkhole makes it possible to theorise the temporality of media history itself not as a linear historical time of

one-thing-after-another, but as a geological time where each formation carries the trace of its formation: every media technology is inscribed with every phase that led to its current state and the entirety of media history is made manifest in every contemporary technology. While a sinkhole is a geological event that makes manifest the breadth of geological past that had led to it, so every cinematic image, film, and contemporary cinematic practice rely on and make manifest the entire history of technology and cinematic formal conventions.

The geological temporality of the materiality of cinematic technology and media-technological history open up not only to the past, but to the future. Parikka (*Geology*) writes about the deep future of media technological fossils and the potential of the plastics and metals they are made of to far outlive what we understand as human civilisation. On the opposite end of the longevity of the geological materiality of media technological apparatuses, there is the impermanence of media artefacts through the degradation of their material supports. In the case of cinematic artefacts, these range from celluloid strips, to magnetic tape to digital files, the latter no less material than the former two. Early cinematic nitrate stock was made using camphor and nitrocellulose, which are extremely flammable: “even without fire, the stock gradually outgasses, leaving a sticky and unworkable gel,” which mutates beyond the ability to retain the images it carries given enough time (Cubitt, *Finite Media 2*). Cubitt writes of the decomposition of the celluloid strip carrying a fragment of the 1906 film *The Story of the Kelly Gang*: “the filmstrip is a slowly percolating soup, a patch of molecular combination and mutation” (2). For Cubitt, however, this process is not to be understood merely as destruction, but as an “evolution of a new artefact from the old” (2). In their materiality, all moving images are subject to entropy, but the resultant change is not simply an erasure of a past communication, which would be privileging the content over the materiality or a complex understanding of cinematic temporality, but rather carries the potential to communicate across time beyond original intent and across the boundaries of human and non-human.



Fig. 8 Still from *Asbestos* (2016).
Sasha Litvintseva and Graeme
Arnfield

One of the archival segments in *Asbestos* is an excerpt from a 1980s documentary on the molecular structure, potential health hazards, detection and removal of asbestos. Shot on magnetic tape, and perhaps stored incorrectly, the tape has disintegrated in the intervening decades and the images it carries have become corrupted (fig. 8). These aged and decayed images of once cutting-edge laboratory optical technology stand in contrast to the crisp HD images we shot of the aging and decaying industrial machinery at the mine. The optical technology from the 1980s depicted in the corrupted images is now out of date, reminding us that the contemporary HD images may themselves become entirely unreadable due to a future switch in file formats. Through their distorted colouration, the corrupted images perform as what Susan Schuppli calls a material witness: an image that not “merely records history” but “one that is itself an object of historical forces, capable of testifying on behalf of its own history” (28). The compromised images are still able to communicate their content, but their damaged material support communicates the complexities of asbestos temporality with added nuance and accuracy. The temporality of asbestos embodies a contradiction surrounding (un)certainly, combining unintended consequences with what I term, after Haraway (in Haraway and Goodeve), an already-written-future. On the one hand, asbestos’s fall from grace followed millennia of being considered a magic mineral. This is one example of the unplanned toxic consequences of extractive capitalism, alongside rising CO₂ in the atmosphere as a result of the burning of fossil fuels. On the other hand, when considered from the point of view of the encounter of asbestos with biological matter, the temporality of this toxic event is like the temporality of debt, where in the piercing of a cell a process is triggered that makes some aspects of the future guaranteed. What the damaged images from the documentary reveal is that these two modes of relating to the future are not contradictory, but rather that human agency or intention, as invested into the content of the images or the extraction of asbestos, is but one factor among a host of material agencies, such as manifest in the entropy that ravishes cinematic images over time and in the specificities of the molecular structure of asbestos.

Conclusion: Geological Filmmaking

In considering the temporality of film through geology and the temporality of geology through film, a reciprocity of insights is established: the nature of sinkhole time triggers a conceptualisation of a multifaceted material reading of film temporality from the formation of geological materials to the sedimenting of media history, and, in return, a consideration of the material future of film artefacts provides insights into the geological temporality of asbestos. It is important to stress, however, that I do not mean to draw any false equivalences or causalities across the domains of geology and film and across the material and metaphorical uses of “geology,” but merely to think across multiple disciplines and objects of enquiry simultaneously in order to generate new readings and insights. In the course of these projects, a similarly reciprocal relationship emerged between the insights from the parallel and ongoing investigations in the medium of film and the medium of words, where the filmic insights were often triggered by questions that arose through theoretical inquiry, and in return grounded and advanced the theory. It is in this sense that

geological filmmaking is both a practice and a concept. It is an ongoing practice of identifying, implementing and conceptualising the inextricable connection of the material and the perceptual in film in order to develop an aesthetic strategy of grappling with the geological. It is also a concept to be mobilised towards inspiring other artistic experiments and towards further theorising of the rich variety of ongoing film practice with similar concerns.

Geological filmmaking emerges from the understanding that the form and content of any film, and thus the perceptual and durational experience it engenders, are rooted in geological materiality. In focusing on the relationship of reciprocity between the ways in which film formulates the environment aesthetically by drawing from it materially, geological filmmaking brings into sharp relief the entangled and reciprocal co-emergence of the geological and human factors that shape the environments it depicts. This realisation moulds the formal decisions that go into the film, which in turn shape the experience of space and time that can be generated in viewing the film, aiming to put the viewer in an embodied and embedded position as both producer and product of environmental phenomena, and to foster modes of non-linear and non-teleological cinematic temporality, across its material and perceptual dimensions. Ultimately, it is both the material and perceptual dimensions of film that are tied to the question of the future: the material future of the film artefact and the future that it helps to shape.

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