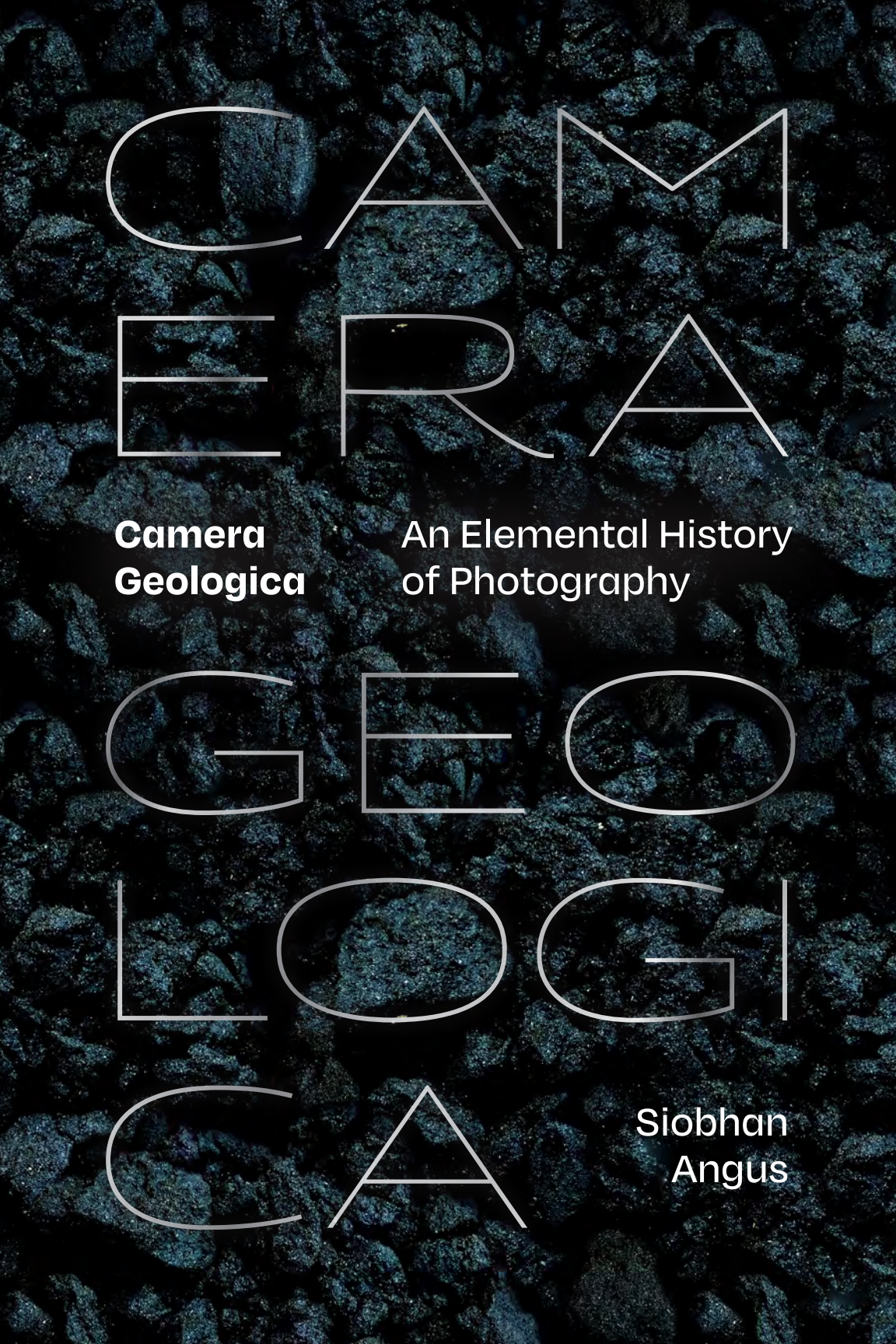


**Camera Geologica**

An Elemental History of Photography

Siobhan Angus

CAMERA
GEOLOGICA

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## An Elemental History of Photography

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# Introduction

IN 1871, the North Bloomfield Gravel Mining Company hired Carleton Watkins to document a hydraulic mining operation at Malakoff Diggins in the Sierra Nevada mountains of California. A photograph of the scene holds industry and nature in a delicate balance (plate 1). The arc of water from the four hydraulic hoses resembles a set of rainbows, gently cascading in front of the rock cliffs. The curvilinear ridge frames the scene, while the hazy vapor softens the hardness of the exposed rock. In the foreground, smooth water streams through rugged stone. A bridge intrudes into the landscape, while the rock face dwarfs five men who pose casually, looking toward the camera as pressurized water reshapes the ecosystem. The miners are diminutive compared to the water and the rock, but by harnessing water as a productive force, they dominate the landscape. The water cannons blasted sixteen thousand gallons of water per minute, removing four

thousand cubic yards of earth every day. The dramatic, large-format "mammoth" print has a remarkable precision that brings the scene into sharp focus and creates a sense of tactility, emphasizing the spray of water and the striation in the rock cliff. The detail enhances the tenuous equilibrium of the photograph, but a closer look reveals a set of forces in conflict within the image.

The striking formal beauty of the image stands in contrast to contemporary descriptions of Malakoff Diggins, which was described as desolate and forbidding, a "battlefield" where "nature here reminds one of a princess fallen into the hands of robbers who cut off her fingers for the jewels she wears."[1] The image sustains a fantasy of nature and industry held in balance because the more damaging impacts of blasting are illegible within the photographic frame.[2] Hydraulicking was pioneered in the 1850s during the California Gold Rush to facilitate the search for new ore bodies by blasting "overburden"—everything above the ore (the silver or gold)—with pressurized water. As a concept, overburden reveals a particular way of seeing nature that prioritizes extraction. At Malakoff Diggins, it is estimated that twelve billion tons of debris were washed downstream, damaging forty thousand acres of land in the vicinity of the mining operation.[3] The demands of capitalist extraction recast trees, rocks, flowers, plants, insects, and animals as obstacles, a burden to be blasted away to facilitate the removal and processing of parts of an ecosystem for profit. The image renders the violence of blasting quietly aesthetic.

The mining company commissioned Watkins to document the site in order to raise capital investment for the company; encouraging further extraction is the intended function of the image.[4] Within the scene, the nonmining histories of this landscape are unevenly represented, if at all. The foundational act of violence that made hydraulic blasting possible was the expropriation of Indigenous land, as the Sierra Nevada region is the traditional territory of the Nisenan people. The Gold Rush brought a flood of migration and changes in land use that resulted in dispossession. This history of the violent seizure of Indigenous land is not visible in the image, though the fruits of the labor of Chinese migrant workers is. Malakoff Diggins's infrastructure was partly built by three hundred Chinese laborers who dug reservoirs out of the mountains to provide the water for the blasting, and built 5,276 miles of flumes, canals, and ditches to supply water to the mines. This infrastructure harnessed water as a productive

force, putting it to work. The spectacular, immediate destructiveness of the hydraulic blast, killing plants, insects, animals, and people, led to flooding and mercury contamination as mud, gravel, and debris clogged waterways. There are no visible traces of animal, insect, or plant life in the frame. Nor can the photograph show us what was to come, a landscape shattered by the pressure of blasting. The effects of hydraulic mining still mark the eroded landscape of Malakoff Diggins known as an "industrial Grand Canyon."[5] The decimated landscape led to the first environmental legal decision issued in the United States, as California banned hydraulic blasting in 1884.[6]

Watkins's photograph stages a confrontation between deep time and industry that makes visible what Karl Marx called a "metabolic rift": a fracture between the natural world and the human society that grew out of it, an internal rift driven by the perpetually accelerating growth imperatives of capitalism. For Marx, humans were part of nature: "Man lives on nature. . . . That man's physical and spiritual life is linked to nature means simply that nature is linked to itself, for man is a part of nature."[7] The extraction of more and more energy (both as natural resources and labor) to create endless accumulations of capital disrupts, for Marx, the temporal complementarity—or metabolism—of human activity in its relation to the other ecological processes making up life and landscape on Earth. Marx links ecological thought with economic theory, highlighting the incompatibility of capitalism's imperative for growth and speed with natural processes requiring limits to use and periods of recovery in order to successfully renew. The rapid speed of industrial growth jolted human society out of sync, out of time. Three temporalities thus coexist within Watkins's image: the gradual layering of geological time visible in the stratified rock, the hyperacceleration of industrial mining, and the flash of light that set the photo in silver.

Watkins's visually striking photograph also gestures to the materiality of the print itself. Metals used in photography—silver, gold, and mercury—were mined in Malakoff Diggins. Silver forms light-sensitive silver halides, gold is a toner, and mercury is a developing agent. Ecosystems like Malakoff Diggins provided the raw materials for photography, establishing an essential link between the arts of photography and the multisited work of mining. The material and social connection between mining and photography lies at the heart of this book. I analyze the extraction of materials by focusing on images whose subject matter and

photographic materiality tell us something about these processes and their extension into social and ecological worlds of work and despoliation that make them possible.

Different materials have been extracted from the earth at various points in photography's history to facilitate image-making. In this book, I focus on six: bitumen, silver, platinum, iron, uranium, and rare earth elements. Exploring the role played by materials in photographic processes allows us, in turn, to consider how these images help make sense of the social relations that sustain our world as it is. The history of photography cannot be reduced to the history of the mine, but new histories emerge when we reorient our vantage point: How does photography look from the perspective of the mine?

A focus on mining enacts a reorientation of vision that directs our attention underground. Light is often emphasized in photographic discourse, reflected in its name, "written with light." But light is only part of the story. It is the interaction of light with metals that makes photography possible. *Camera Geologica* shifts the focus from light to metals to consider the histories of labor and environment that underpin the photographic object. An emphasis on mined materials draws into view the connective tissue between geology, raw materials, labor, empire, colonization, and art. Thinking materially alongside representation—considering photographs as both objects and images—yields new insights into the history of photography and environmental change. Rather than take the ubiquity of mined materials for granted, this book focuses on their materiality, the work of their extraction, and the social, cultural, and political imaginaries that accompany them. Narratively, each material is laden with histories, both symbolic and concrete. Materials bring these histories into the everyday. Once set in the photograph, they communicate meaning. As such, photographs are a powerful means to illuminate ecological catastrophe in the present and to conceptualize how to redress such harm for the future.[8]

At the root of this book is a simple premise: that the mine is a necessary precondition for photography as a medium. Since its inception, photography, both analog and digital, has relied on both small- and large-scale extraction. In 1863, Oliver Wendell Holmes—a poet and physician who

wrote extensively on photography—vividly described the Messrs. E. & H. T. Anthony factory in New York, one of the largest photographic supply companies in the nineteenth century. Of the chemical substances used in photography, he summarized that "to give an idea of the scale on which these are required, we may state that the estimate of the annual consumption of the precious metals for photographic purposes, in this country, is set down at ten tons for silver and half a ton for gold."[9] Holmes noted photography's industrial nature and the expansive work processes that enabled production: the factory was powered by steam and the "labor [was] greatly subdivided, [the workers became] wonderfully adroit in doing a fraction of something." That "fraction of something" was embodied, for instance, by the rows of young women processing eggs, which acted as a chemical binding agent in albumen prints.[10] Here, we see how gender and class divides structured the labor within the factory. As photography became a mass medium by the end of the nineteenth century, this demand for materials escalated.



What materials, besides metals and eggs, were required for photography? As Kodak summarized, film is "animal, vegetable, and mineral," borrowing the slogan of alchemy.[11] Paper was made from plant fibers like cotton and linen, while cotton was essential to celluloid for film stock.[12] By 1929 Kodak used more than five million pounds of cotton annually.[13] The gelatin in film stock was made from the hide, bones, cartilage, ligaments, and connective tissue of calves (considered the very best), sheep (less desirable), and other animals who passed through the slaughterhouse.[14] Six kilograms of bone went into a single kilogram of gelatin. Eventually, the demands of photographic industries generated so much need for animal byproducts that slaughterhouses became integrated into the photographic production chain.[15] Controlling the supply chain became key to Kodak's success. In 1882, as Kodak began to grow as a company, widespread complaints of fogged and darkened plates stopped production. The crisis almost ruined Kodak financially and resulted in the company tightly monitoring the animal by-products used in gelatin. Decades later, a Kodak emulsion scientist discovered that cattle who consumed mustard seed metabolized a sulfuric substance, enhancing the light sensitivity of silver halides and enabling better film speeds. The poor-quality gelatin in 1882 was due to the *lack* of mustard seeds in the cows' diet. The head of research at Kodak, Dr. C. E. Kenneth Mees, concluded, "If cows didn't like mustard there

wouldn't be any movies at all."[16] By controlling the diet of cows who were used to make gelatin, Kodak ensured the quality of its film stock. As literary scholar Nicole Shukin reflects, there is a "transfer of life from animal body to technological media."[17] The image comes alive through animal death, carried along by the work of ranchers, meatpackers, and Kodak production workers.

In addition to the extensive use of organic materials, photography is also synthetic, tracking the rise of the chemical industry in the late nineteenth century.[18] By the mid-twentieth century, the Kodak Park plant produced hundreds of different chemicals for use in photography and thousands of research chemicals.[19] Photographic film was one of the earliest applications of plastics, as cellulose nitrate, the first semisynthetic polymer, coated glass plates and transparent roll film.[20] Cellulose nitrate is perhaps best known as gun cotton—a mild explosive that was also quickly applied in mining.



The material realities of photographic production undermine many of the stories photography likes to tell about itself—whether about its ease of use, its lack of mediation, or its nonorganic technological sophistication. Photography has long been invested in appearing immaterial. For instance, Oliver Wendell Holmes, who invented a streamlined stereoscope that illusionistically rendered three-dimensional views of photographs, wrote, "Form is henceforth divorced from matter. In fact, matter as a visible object is of no great use any longer, except as the mold on which form is shaped. Give us a few negatives of a thing worth seeing, taken from different points of view, and that is all we want of it."[21] As we saw from his description of the factory, Holmes was very aware of the material foundations of photography when he laid forth this immaterial fantasy; it was not ignorance of material realities that drove his narrative but a desire to transcend them.

This pursuit runs throughout photographic discourse, as if the medium itself aspires to transparency.[22] Photographers are not unique in the desire to transcend banal materiality: artists often try to overcome paint and canvas to produce something more meaningful, creating a rift between the object and the masterpiece, which is located somewhere in the immaterial idea.[23] Photography, however, so often promises the possibility of an unmediated lens onto the world. A lightness, pure vision, unchained from the earthly work of production and reproduction. Of all mediums, it is the most effective at concealing its materiality.

Photography's mechanical reproduction promises to divorce the possibilities of representation from the expense and limitations of matter and space. This is significant, for as Holmes went on to clarify, "Matter in large masses must always be fixed and dear; form is cheap and transportable."[24] In this framing, photography allows the reproducibility of form across distances and thus annihilated the friction and costs of matter. This conceptual separation of form from matter—which works to make certain industrial processes less visible—has tangible impacts.[25] Holmes concludes that photography is a new system of value, which could create a "universal currency of these bank-notes . . . which the sun has engraved for the great Bank of Nature" and invites readers to "fill out a blank check on the future as they like."[26] Throughout the nineteenth and twentieth centuries, this extractive way of understanding nature—a blank check on the future—subtly implied that the mining that made the technology possible was both necessary and natural. Holmes invokes the sun but also currency, which historically was made of metals, but had begun to shift to paper. Reproducibility—of the image and of currency—thus seems to promise the possibility of moving past the messy material processes of mining.

Photography's desire to transcend its material origins parallels oft-hidden extraction processes. Despite the centrality of mining to economies, extractive capitalism functions by making industrial production largely invisible: it shifts attention to the commodity, not the labor or materials that make it. Consumer capitalism encourages us to forget how commodities are made. Photography's narratives of effortless ease invite comparisons to oil, which likewise promised the ability to overcome the limits to growth bounded by the productivity of land and human labor, transformatively reducing the cost of bringing any particular thing to where it needed to be.

The networked or so-called dematerialized world of the present is profoundly reliant on resource extraction. In the context of climate crisis, extraction is a pressing material problem. According to a recent United Nations report, resource extraction is a primary driver of global climate change, responsible for half of the world's carbon emissions and more than 80 percent of its biodiversity loss. Despite the increasing awareness of the impact of extractive activities in contributing to climate change, the annual global extraction of materials by ton is increasing by 3.2 percent per

year.[27] While the world's population has doubled since the 1970s, resource extraction has tripled. Once extracted from the earth, raw natural resources are eventually transformed into consumer goods, which bear little evidence of the complex networks of human and nonhuman labor that brought them into being. In the process, extraction's histories of labor, displacement, and ecosystem destruction are cast out of view. Scientist Stefanie Hellweg describes how consumer products hide the cost of extraction, observing that "resources are hiding behind products."[28] Mined materials are omnipresent in our daily lives to the degree that we rarely notice them, or at least stop asking where they came from and what the consequences of this extraction are to humans and ecosystems.



The seductive fantasy that the world has become altogether dematerialized is only possible because corporations deliberately aim to obscure the labor of extraction and its environmental costs. These consequences are felt most acutely in what cultural theorist Macarena Gómez-Barris calls "extractive zones": resource-rich regions that are often far from cities and centers of power.[29] Corporations and governments turn these landscapes into sacrifice zones where their original inhabitants are displaced, exposed to toxicity, or both. Working-class people mine and refine raw materials, often experiencing industrial disease and the precarious livelihoods that mark mining's boom-and-bust economies. Industrial production's toxic refuse is typically processed or dumped in racialized, low-income neighborhoods. Environmental racism has global dimensions: corporations have largely outsourced extraction and waste dumping to the Global South. This neocolonial process alleviates the immediate violence of extraction in the countries that bear the most responsibility for climate breakdown. Environmental injustice tracks the fault lines of race, class, and geography.

Taking the integral relationship between form and matter as my starting point, I propose a reorientation of perspective that restores the photograph to histories of materials, land, property, and labor.[30] A structural analysis that considers the people, places, and beings that bear the costs of hyperextraction is necessary to address the urgent challenges of the present. The cumulative and successive crises of climate change have such vast temporal and spatial dimensions that they transcend comprehension and pose challenges for understanding how we got here and where we go from here. Shifting our relationship to resource extraction,

by staring back at it through the representation it makes possible, is one place to start.

Vast amounts of earthly materials have to be dredged up to make photography seem weightless. While metals and fossil fuels are used in many, if not all, artistic mediums, *Camera Geologica* makes a case for medium specificity. In doing so, I follow historians Kevin Coleman and Daniel James, who argue that photography and capitalism are premised on the "fiction of endless accumulation in a finite world" while being characterized by a "nervous vibration between the concrete and the abstract."[31] Photography's material and symbolic links to extraction—and its emergence as a technological form coincident with the rise of large-scale industry and the spread of global capitalism—make it a particularly productive angle from which to consider the complex imbrication of extraction in daily life.

Photography emerged within a rapidly industrializing world. In 1784, the Scottish inventor James Watt patented the steam engine, which connected coal fire to the continuous motion of the wheel, transforming heat into energy. The eighteenth and nineteenth centuries became known as the Era of Steam, though it is more accurately the beginning of the era of "Fossil Capital."[32] Quickly, the United Kingdom transitioned to a mineral-based economy, in which burning coal produced a power source so potent that it allowed burgeoning sites of capitalist production to break free, relatively, of the limits to growth imposed by the productivity of land and human labor in particular places.[33] The breakneck increase in industrial development coupled its rapidly accelerating production of wealth with devastating accumulations of environmental and social damage. And the system fed on itself: more factories in more places demanded other mined materials in addition to coal, as the needs of industry expanded the traditional use of metals in agriculture, the military, and currency.[34] These transformations required, technically and culturally, new forms of representation and meaning-making, and photography emerged, in part, in response to these socioeconomic shifts.

The coal-fueled socioecological transformations of the nineteenth century are part of a longer continuum of extraction. Still, the rise of fossil fuels as primary energy sources marked a rapid escalation in the

human impact on the environment. In 1848, Marx and Friedrich Engels described how "modern bourgeois society, with its relations of production, of exchange and of property, a society that has conjured up such gigantic means of production and of exchange, is like the sorcerer who is no longer able to control the powers of the nether world whom he has called up by his spells."[35] The reference to the netherworld is not only metaphorical, importantly: coal is quite literally extracted from deposits deep in the earth.[36] Marx and Engels's framing gestures to an implicit perversion, for coal is carbon based, which is the basic element of life—fossil fuels are the remains of ancient life—so to "conjure" coal is to disturb the dead. We witness here a very particular twist on the revivification of dead labor in production.

The rise of an intensively mineral-based economy also complicated emergent photographic processes in material ways, as atmospheric pollution caused the degradation of photographic prints. Silver is the most common material used in analog photography. The high light-sensitivity of silver halides allows for short exposure times, which in turn provides for instantaneous image capture. The relative chemical stability of silver was another asset, as the metal doesn't react to air or water. However, silver does tarnish when exposed to sulfur compounds. In the coal-fueled Victorian period, this was a significant problem. Reactions with atmospheric sulfur pollution damaged silver prints, and many nineteenth-century photographs printed in silver degraded into a faded, brownish tinge.[37] In 1880, the *Photographic News* described the polluted, sulfur-filled atmosphere of industrial cities as one of the primary challenges facing photographers, reminding readers that "the photograph is, after all, but a thin film of metallic silver, and silver is of all metals one of those most prone to suffer from the action of sulphurous acid."[38] This highlights that the photograph's materiality—and its meaning—changes as it moves through the industrial world. Photographers sought alternatives to silver-based processes because of the challenges of fixing a silver print in the polluted atmosphere.

### Photography as and against Extraction

This book turns to the questions of expropriation at the heart of photography. Extraction is both a material process and a worldview.[39] Materially, extraction provides the raw materials that give our world

form. Fundamentally, mining is a problem of *material* production: the raw materials, machinery, facilities, and labor used to produce goods. Extraction describes the physical processes of taking raw natural materials from the earth, which, under extractive capitalism, often results in the violent dispossession of Indigenous peoples and the destruction of lands, waters, and nonhuman species. Extraction is the first step in an accumulative process through which materials are transformed into wealth.

Some of these raw materials become the material foundations for art-making. This link is made explicit in the Prussian metallurgist Georgius Agricola's groundbreaking sixteenth-century pedagogical guide to mining and metallurgy, *De Re Metallica* (*On the Nature of Metals*), which argues that the mine is a precondition for art. Agricola observed mining techniques during the Central European mining boom (1451–1540), and his text marked a transition within mining from artisanal practice to codified engineering knowledge. *De Re Metallica* was lavishly illustrated with woodcuts and created deliberate visual motifs intended to shape ways of relating to land and labor under industrial mining. In one woodcut, the engraver presents nature as a resource: water is diverted, trees are cut down, and ore is removed. This image shows an apparatus that captures wind to provide air to miners underground. The wind is anthropomorphized with a face, borrowing from cartographers' conventions. Even wind, the woodcut suggests, participates in mining. In the background, the city signifies the necessity of metals for economies and, of course, art. Photo theorist and photographer Allan Sekula observes that mining was one of the first industries to be pictured visually, while the geologist Martin J. S. Rudwick argued that developing a visual language was central to producing geological knowledge.[40] Specific modes of visual representation perform crucial work in the context of developing the means and social relations required to enable mining on an expanded scale.

The first section of *De Re Metallica* restates and responds to the criticisms of mining by ancient and early modern writers who censured the practice for promoting avarice, war, and the destruction of the earth. In the *Metamorphoses*, for instance, the first-century Roman poet Ovid linked mining to conflict: "Men descended into the entrails of the earth, and they dug up the riches, those incentives to vice, which the earth had hidden and had removed to the Stygian shades. Then destructive iron came forth, and gold, more destructive than iron; then war came forth."[41]


Ecofeminist scholar Carolyn Merchant documents how sixteenth-century descriptions of nature as a nurturing mother in literature and philosophy operated as an ethical constraint on mining.[42] In this context, Merchant suggests that Agricola's treatise functions as an attempt to free mining from the moral restrictions imposed by such an understanding of the natural world, presenting a more instrumental conception of nature that would allow for forms of development required by mercantilist policy. In his defense of mining, Agricola pointed to the role that mining played in art production, noting that extraction enabled the production of metal-based pigments and tools while artists used mined materials decoratively to make "elegant, embellished, elaborate, useful" works of art.[43] He concludes with the reflection: "How few artists could make anything that is

I.1 Georgius Agricola, illustration from *De Re Metallica*, book 6.

beautiful and perfect without using metals?"[44] In an early example of art-washing, Agricola invokes art to make climate-damaging practices seem more culturally acceptable. It subtly implies that art justifies mining and that aesthetics justify the environmental and human costs.

Agricola's text responds to shifting cultural values around mining and nature, highlighting how materials are enmeshed with cultural and economic systems that change over time.[45] Nature is not a static condition that lies outside of culture: the imaginaries of materials take on different cultural valences in different contexts and times. In the Romantic period, the fascination with the natural world and the proliferation of developments in geology lent a profound cultural significance to mining, particularly in Germany and England. However, variable forms of mining resulted in very different cultural connotations. Germany was the primary source of precious metals in Europe. Still, it was a century behind England in industrializing mining, as Germany did not develop the coal fields of the Ruhr Valley until the mid-nineteenth century. The smaller scale of production gave greater autonomy to the individual worker and was less destructive to the environment. As a result, within German Romantic literature and art, the mine was imagined as a place of "mysterious caves, wise miners, hidden secrets and ancient knowledge," linking the mine to the hero's journey.[46] This conceptual link between underground descent and the journey of the soul dates back to ancient literature: Odysseus, Aeneas, and Dante all travel to the underworld on heroic quests. The symbolic power of the mine did not displace its material realities: many German romantic artists trained as mining engineers.[47] In contrast, the rapid development of the coal and iron mines in England was tied to the emergence of steam power and was marred by pollution and social dislocations.[48] The tensions that accompanied industrial growth enabled by mining were perhaps most famously evoked by William Blake in 1804, who decried the "dark, Satanic Mills" of industrial England and the resultant destruction of nature and human relationships.[49] The mine as an imaginary emerges from the material realities of labor and environment. As such, this book does not posit one singular relationship to extraction: the forms of labor and technology required to extract, process, and transform these materials are different, resulting in disparate cultural imaginaries and political possibilities.

Agricola's text links extraction to culture, highlighting that extraction is not simply a material reality but a cultural problem: it is a way of

seeing and understanding the world. As a worldview, extraction views nature—and the people understood as part of nature—as a resource to be expropriated. This way of seeing promotes economic growth as an all-consuming priority. Nature becomes a backdrop to human activity and a storehouse of resources. Turning land into property that can be expropriated is a prerequisite to extraction, and this way of seeing nature is thus foundational to empire, settler colonialism, and neocolonialism. European settler colonialism in the Americas, for instance, evidences the world-building power of the extractive gaze. European colonial powers established colonial-capitalist systems by transforming natural resources into commodities traded on global markets.[50] Throughout the Americas, settler states invoked the terra nullius (nobody's land) doctrine to argue that the land being conquered was legally empty because its inhabitants were not using it according to a particular standard of productivity and, therefore, could be expropriated regardless of the existing settlement. In this context, productive land use meant logging, agriculture, and mining. As Glen Coulthard (Yellowknives Dene) has shown, in the settler-colonial states of the Americas, the state's attempt to secure access to land cannot be reduced to a historical event but instead forms an ongoing and constantly renewed structural relationship.[51]

Notions of the "right to property" that underpinned European settlement in the Americas are entangled with the histories of extraction in the other geographies that this book traces. Still, the transnational and ever-changing geographies of extraction make determining a singular explanation of the motive forces that underpin extractive capitalist colonialism difficult. While property is a core thread, the specific histories of the extraction of labor and land look different in each context.[52] Still, we can broadly conclude that to frame land as "empty" and to turn life into "commodities" is a deliberate refusal to see a world teeming with life (and value that exists outside of economic calculation) that lies at the heart of extraction.[53]

What are the visual imperatives of extraction, and how do these imperatives shape how we see and know? Media studies scholar Nicholas Mirzoeff describes this way of seeing nature as "Anthropocene visuality," a way of seeing that obscures rather than reveals environmental and social injustices, rooted in an understanding of the human relationship with nature as a conquest. Mirzoeff suggests that "Anthropocene visuality allows

us to move on, to see nothing and keep circulating commodities, despite the destruction of the biosphere."[54] One example of Anthropocene visuality, or the extractive gaze, is a 1918 advertisement for a mining explosives company, the Hercules Powder Co., that ran in the *Saturday Evening Post*. Coal is emblazoned over a cartoonish drawing of a stegosaurus in front of rock cliffs (see figure I.2). The ad exults:

> Millions of years before the advent of man, Nature was preparing for his comfort. In the gray dawn of the world—when gigantic saurians dragged their ungainly bodies through thickets of giant ferns, when mighty tempests beat to earth trees as tall as cathedral spires, when flying reptiles bigger than aeroplanes rushed screaming through the air—She was laying the foundations of our coal beds.

The ad goes on to describe the importance of dynamite to coal miners, who are, in turn, central to the United States war effort in World War I. The anthropocentrism of the ad is hyperbolic: the ad looks back hundreds of millions of years and concludes that the sole destiny of the dinosaur was to transform itself into fossil fuel for the future comfort of human beings. The metaphors deployed reframe natural phenomena in human terms: trees become cathedral spires; animals become airplanes. The ad narrates a guiding hand prefiguring the eventual dominion of humans over nature. In this framework, coal mining is not just necessary—or even a necessary evil—but right, preordained. The stark phrasing of "*to get it out*" crystalizes the crude realities of extraction. Although the cartoonish stegosaurus is charming—charismatic megafauna if there ever was any—most fossil fuels are formed by plants, trees, and tiny marine organisms. The ad taps into "dino-fascination" by dressing coal in the charisma and grandeur of the prehistoric great beasts.[55] In the process, it diverts attention away from the messier realities of coal mining to frame the use of fossil fuels as benign, even preordained. This way of seeing the world recasts environmental degradation as progress under the guise of technological innovation, economic development, and increasing quality of life. At the same time, it appeals to ideas of nature and the natural to legitimize the exploitation of humans and the natural world. A key area of focus in this book is how abstract conceptions of nature come to justify extraction. As the ad shows us, extractive capitalism did not just change materials into commodities


but also assembled a constellation of images that made large-scale extraction seem not only necessary but natural. Embedded within the image are more ambivalent messages, however. In popular culture, the story we tell about the mass extinction of dinosaurs centers on the dependence of life on its planetary environs, and thus on the fragility of that reliance. The ad therefore links fossil fuels to a precursory moment of mass extinction. Within the valorization of the extraction and burning of fossil fuels, then,

1.2 Hercules Powder Company, "Coal," *Saturday Evening Post*, October 12, 1918.

are the seeds of its undoing, a—perhaps unconscious—recognition of its overreach. We can also locate a link to photography: Hercules Powder Co. supplied papers to photographic industries, highlighting the complex imbrication of the chemical, extractive, and photographic industries.

Extraction is thus not only an economic process but a way of engaging with the world around us. Fundamentally, *Camera Geologica* is concerned with how extraction shapes how we see and know. While considering the cultural forms of extraction, land and labor remain central to my focus. Photography scholars have observed the violent language of photography: shoot, take, aim, capture, trigger.[56] This language of the hunt is often confirmed in extractive image-making processes. The culturally extractive nature of photography as a medium is well established: for instance, a photographer with institutional power extracts meaning, beauty, or pain from the subject, transforming these intangible things into the art world's marketable commodities. However, Imre Szeman and Jennifer Wenzel call attention to the loss of meaning when extraction is deployed as a metaphor (a cultural and ideological problem) rather than a material process: it is attention to material processes that makes extractivism a useful analytic.[57] As such, I examine how cultural forms of extraction shape ways of seeing nature, but I keep the material realities of mining in view to consider how cultural forms function to naturalize and thus facilitate extraction—resituating photography within histories of mining and industry means not thinking about visual regimes alone but situates them within the violent human-nature interactions, with the viciously and unevenly distributed burdens and benefits, that they make possible.

While the extractive gaze teaches us to see nature as a resource, there are alternative viewpoints within this system of visuality that enable us to see nature and human relations in different ways. Extraction is never an all-encompassing process that displaces all other forms of living and relating.[58] In part, seeing extractively is rooted in deliberate forgetting, in a refusal to reckon seriously with the inheritances of the past. By naming the processes and structures that have produced the interlocking crises of the current historical moment, artists can and have intervened in an extractive visuality, redirecting the same materials toward the undoing of the ecocidal and genocidal projects they have underpinned.

There is no guarantee, however, that environmentally activist photographs result in empathy or action. Indeed, in many cases, they

may aestheticize or anesthetize. In the context of climate change, images play a complex role. Paradoxically, the same chemicals that cause harm can document extractive practices and processes, making visible what extractive capitalism renders invisible. Despite its historic and material complicities, photography can challenge extraction as a worldview.[59] As with any liberatory action taken within a broader set of exploitative relations, materials and practices from those relations must unavoidably be repurposed toward other ends—as there is no world-changing action from nowhere within that same world.[60] It is photography's implication in damaging systems that makes it a productive site to initiate critique.

### The Ecology of Photography

Ecology is another thread that runs throughout the book. The use of photography to explore environmental issues has a long history. Perhaps the most famous points of intersection between photography and the environment center on wilderness landscape photography. Carleton Watkins, whose work opened this book, rendered the vastness and grandeur of the glacial valleys, cascading waterfalls, and ancient rock faces of the western United States in exquisite detail. Watkins arrived in California in 1851 and documented the birth of industrial mining alongside his famed wilderness landscape photos of nearby Yosemite, which were instrumental in establishing the American visual vocabulary of wilderness.[61] His photographs of Yosemite would establish him as the preeminent landscape photographer in the United States and bring him national fame. It was partly due to the rugged sublimity of these photographs that President Lincoln set aside Yosemite for conservation and public use in 1864, creating the blueprint for the National Park System.

In the early twentieth century, Ansel Adams's explicitly environmentalist work for the Sierra Club, a nonprofit organization dedicated to environmental conservation, used vast vistas in sharp focus to promote a particular vision of the wilderness there was to conserve. Similarly, Eliot Porter's closely framed photographs of flora and fauna—also taken for the Sierra Club—celebrated the Northeastern United States on an intimate scale. As art historian Robin Kelsey has written, the widespread use of photographs to promote conservation confirms the assumption "that the value of those places was primarily visual."[62] It would seem that the

motivation behind many strands of environmentalism was at least partially aesthetic—the desire to maintain a more attractive place to live and play.

The ties between conservationist landscape aesthetics and extraction are stronger than they initially might appear. Wilderness landscape photography played a dual role that points to the tensions and interconnections between preservationist and instrumental approaches to nature. These contradictory myths—the spiritual call of virgin wilderness that needed to be protected and the promise of an extractive frontier that would fuel development—both find their natural expression in landscape photography. As Watkins's work and biography reveal, wilderness played a more complicated role than simply celebrating ancient and unchanging nature. These pristine sites often had direct links to extraction. The Gold Rush brought settlers like Watkins to California. Watkins began his commercial career by photographing California's rapidly developing mining industry, taking photographs to promote extraction as well as to serve an evidentiary function in mining land-claim disputes. Watkins first visited Yosemite in 1861 with his patron, the mine owner Trenor Park. Later, Watkins became a photographer for the California Geological Survey and Clarence King's US Geological Exploration of the Fortieth Parallel. The photographs produced for the geological survey played a pivotal role in transforming land into settler property, in both private and public forms. While Yosemite became a protected wilderness site, whose status as a "conserved" landscape was predicated on the displacement of Indigenous peoples and nations, Malakoff Diggins became an environmental sacrifice zone, an ecosystem destroyed for profit. These two ways of seeing are integrally connected.[63] In Watkins's oeuvre, we witness the visual emergence of a binary yet mutually constitutive understanding of ecosystems marked for protection or exploitation.

With the rise of environmental art history as a field of study, there has been considerable analysis of how the visual shapes our understanding of the natural world. I turn to photographs of extraction, which make visible the violent interactions of humans with nature, to consider how the products of extraction ultimately come to form the image itself. Here, my approach is informed by art historian T. J. Demos, who proposes we read spectacular, aestheticizing images of climate breakdown against the grain by resituating these images in the relational realm of ecology.[64] Rather than thinking of such images as "pictures of ecology,"

we might place them within an "ecology of pictures." A more capacious understanding of the image brings into view the structural causes and gross inequalities at the heart of ecological crisis, which converge in images—if not representationally, then relationally. Such convergences may not always be visible *in* the image as representation but reading the photograph as an object *and* an image reveals these histories are *in* the physical materiality of the image.

In ecology, *ecotone* describes a junction between two distinct ecosystems. In a process called the *edge effect*, the two ecosystems meet and integrate. These are locations of high biodiversity but they contain characteristics of two different zones, likewise considered zones of tension.[65] As a medium, photography is analogous to an ecotone. It is at once an art, science, and technology; evidentiary and aesthetic; a material object and representation; fixed and contingent. In keeping with this, I approach photography as a zone of tension rather than trying to locate photography in any one category. Photography's overlapping spheres of influence and unstable boundaries make it a fruitful site for ecological thought.

### Materials and Materialism

Mined materials are the organizing structure of the book: each chapter centers on the extractive, material, and visual history of one metal or fossil fuel used in photographic processes, ranging from their discovery to the present. As we follow materials and the social relations required for their production and use, unexpected connections between images emerge across genres, geographies, and temporalities. As such, the structure of this book employs an iterative approach to consider how nineteenth-century image-objects reveal something about our present condition. In turn, I explore how artists in the present are critically reactivating these analog methods. These images emphasize their corporeality, drawing explicit links between materiality and meaning. With the exception of the final chapter, I focus on materials that were used as light-sensitive materials or, in the case of uranium, light sources. Here, we are reminded that even a seemingly immaterial element of photography—light—is intrinsically bound up with its material characteristics.

To think materially about photography, I use Marx's historical-materialist framework, which draws attention to the impossibility of transcending the material world of nature, infrastructure, and the power relations that structure the social reproduction of human life. Ideology and culture are the products of material realities, and politics and culture emerge from and in material circumstances, even as they take on relatively autonomous lives of "their own." Marx employs the analogy of the camera obscura to show that idealist philosophy approaches the world backward, writing, "If in all ideology men and their circumstances appear upside-down as in a *camera obscura*, this phenomenon arises just as much from their historical life-process as the inversion of objects on the retina does from their physical life-process."[66] In a materialist framework, the world of concepts and images emerges from the tangible world of changing forms of human interaction with nature and, in turn, responds to and shapes material conditions. Following Marx, then, in this book, "we ascend from earth to heaven": we move from materials to representation, from the mine to meaning.[67] The interplay between material and representation is a complex dialectic, however. In "Theses on the Philosophy of History," Walter Benjamin, building from Marx and referencing class struggle, reflects on "the fight for the crude and material things, without which no fine and spiritual things could exist."[68] Throughout this book, I think about the "crude and material" alongside the "fine and spiritual." Such an approach centers labor, process, and the contingency of making, as well as the aesthetic power of the image.

The image-objects explored in this book have very different material foundations, technological histories, and visual forms, drawing attention to the base fact that, *pace* Holmes, form can never be divorced from matter. Thinking these objects alongside each other destabilizes a clear notion of what constitutes photography. What these different visual forms I study share is an interest, whether intentional or unintentional, in exploring the consequences of extraction. My focus on extraction does not suggest that photography can be reduced to its materials, its production, or its commodity status. It is precisely by bringing together these inextricable but often ignored aspects of photography's material and social origins that we can take seriously the affective and artistic value that transcends their production as commodities. The photographer Simon Starling (whose work is discussed in chapter 3) reflects:

> A photograph is invariably a symptom of the forces that brought it into being—the institutions that surround it, the economics that fuelled its making, etc.—but also that photography's particularities—its conflation of chemistry and optics, its phantasmagorical relationship to history—can in some way transcend those institutional boundaries, to be "itself" in one way or another.[69]

The particularities and paradoxes that make photography so compelling come into the foreground when we put materiality into dialogue with representation, and each chapter makes both a material and visual argument—both of which, as we shall see, are profoundly social. As Starling's practice shows us, tracing the chains of photographic production reveals unexpected interconnections between the natural and cultural world and between the miner and the artist.

My emphasis on materials may sound aligned to the goals of new materialism, but the history of materials themselves is not the project's aim. The chemical properties of materials are only part of the story. In studying materials in their chemical and physical specificity, I am interested in how they mediate relations between people through sociospatial relations of production and cultural forms, as well as how they enable certain processes of production that result in variable, geographically uneven forms of labor exploitation and environmental pollutions. As such, I do not make arguments about the agency of materials but rather employ a historical-materialist approach that explores how processes and relations of labor transform and refine the innate chemical possibilities of materials, adapting them to forms of utility dictated by and powerful within the social structures of power and relation that make these processes possible. Materials can be an entry point to explore capitalism, labor, and land as they relate to photography: extraction emphasizes structural questions that exist in the political sphere of human organization, in all of its conflictual differentiation, across the planet's surface.

An emphasis on materials also enables a different engagement with the past. The interplay of image and material forges a tangible connection between the past and the present. Walter Benjamin used photography's relationship to time as an analogy for a historical project that sought to challenge the understanding of time as linear and progressive. Benjamin argued that moments from the past could "blast forward" into the present,

introducing the possibility of future action.[70] Making the past active in the present is a method to open up the rewriting of history from below. This conception of photography and history suggests that the past, particularly the often overlooked history of labor, forms an integral part of the present in material and symbolic ways. Benjamin argues that history, like the photograph, is contingent. He reflected:

> No matter how artful the photograph, no matter how carefully posed his subject, the beholder feels an irresistible urge to search such a picture for the tiny spark of contingency, of the here and now, with which reality has (so to speak) seared the subject, to find the inconspicuous spot where in the immediacy of that long-forgotten moment the future nests so eloquently that we, looking back, may rediscover it.[71]

Drawing from the contingency that lies at the root of Benjamin's conception of history and the photograph, I approach the photograph as something that contains multiple and unruly meanings. Even the most staged photograph contains information that evades the control of the photographer, and this "tiny spark of contingency" makes the photograph a powerful resource for critical inquiry. Within each photograph is a confusion of intersecting histories concretized through the image's materiality. The photograph's meaning is never fixed; meaning is always negotiated and changing. In light of this, I argue that something is recoverable from the past, even from its more complicated legacies. Often these important movements are found in the "overburden"—to borrow a mining term—that has been stripped away and obscured by discourses of transparency, immediacy, and immateriality.

For photography to play an activist role in the context of environmental justice, however, its intimate links to extraction must be understood. Photographs often fail in the context of environmental justice: images of nature tend to make the scene seem timeless and outside of human history. Scenes of climate catastrophe become abstracted into spectacular, tragic forms that blame everyone and no one, shifting attention away from the specific set of choices that were and are being made to prioritize wealth-production over sustainable worlds. In both cases, a politically informed, historically rooted indictment of the consequences of a particular set of economic relations becomes transformed into evidence

of suffering that speaks to human nature and the human condition, a belief reflecting in the very naming of the Anthropocene.[72] This critique of photography's transhistoricizing tendency has long roots. Bertolt Brecht, for instance, argued that photography is often superficial, functioning to aestheticize and abstract social relations.[73] For Brecht, the social and economic relationships structured by capitalism are not easily made visible within photography: a photograph of a factory struggles to show how the factory functions within capitalist social relations. As he summarizes, photography's abstract, aesthetic universalism results in significant problems for political action: "It seems impossible to alter what has long not been altered. We are always coming on things that are too obvious for us to bother to understand them."[74] The factory is one such site; so is the mine. In the process, historically contingent social relations transfigure into something eternal: it becomes easier to imagine the end of the world than the end of capitalism.[75]

Brecht, however, also provides a model for mobilizing art and spectatorship for political change. His most famous work outlined a model of historical materialist theater that could provoke politically engaged consciousness among spectators. By emphasizing, through a variety of techniques, how the social world depicted in the play is continuous with the world that made the play possible—the theater, the actors, the wood used for the stage—*and* how the dilemmas within the social world depicted on the stage are the product of changeable human social relations, this type of art functions through alienation: it allows us to recognize its subject but makes it at once unfamiliar and broader than what we see before us. By alienating the familiar, it is possible to develop a critical eye that sees how society could change, and indeed already is changing through human activity. By showing the construction of the scene, its historical and material specificity comes into view: the social relations depicted transform into something socially constructed and historically contingent. Following Brecht, a dialectical materialist art must "put some artistry into the act of showing"; the processes, inconsistencies, and seams, all of which are seeds for change that is yet to unfold, should be visible.[76] A form of Brecht's method here is applied by many of the critical contemporary artists I examine in this book, but it also guides my own method as a spectator and critic. Examining any piece of art for the historical-social relations that made it possible—both in its aesthetic form and in its ma-

terial constitution—is precisely the kind of critical dialectical work that art historical criticism can enable, situating our practice within a broader struggle over the shaping of these same earth-choking social relations of industrialized human sacrifice.[77]

The majority of photographs in this book do not register as photographic in the sense of a neutral window onto the world. Rather, they make their objectness—and by extension their historical and material specificity—clear. The materials themselves are not the agent of meaning, but artists, by making the materials visible, render the obvious scene strange. Situating images of extraction within the historical and material contexts of production reveals dissimilarity and contradiction. *Camera Geologica* assembles an archive of images that denaturalize photography, making the production and illusions of the image visible. For instance, LaToya Ruby Frazier's cyanotypes of the steel industry are obviously artificial, rendered unnaturally in shades of blue, denying the absorption of the image into a canon of liberal humanist images of labor. In doing so, Frazier's cyanotypes shift attention from a human tragedy to a structural critique of organized abandonment, as is shown in chapter 4. More broadly, *Camera Geologica* works toward a methodology to name and analyze the complex networks of materials and labor that make images possible. In doing so, it proposes a mode of critical spectatorship that generates questions about how extraction makes our world and how these processes are historically contingent choices based in what society has chosen to value. Recognizing contingency means that these things can change: we can shift our relationship to capitalist extraction. By generating a critical attitude toward the scene, art can encourage the spectator toward transformation by developing a consciousness of the contradictions of life under capitalism. Art of this kind can be one entry point into the multisited and durational process of large-scale social change.

Chapter 1 begins with bitumen, the light-sensitive material in the first photograph taken by Nicéphore Niépce in 1826. Taking as a case study Warren Cariou's petrographs of the Athabasca tar sands in Western Canada, the chapter proposes a shift in focus from light to minerals, considering the complex interplay between time, fossils, solarity, and labor that

bitumen introduces. I situate Cariou's very material photographs within the hidden-in-plain-sight visual culture of oil, reading Cariou alongside work by Tsēmā, Edward Burtynsky, and Allan Sekula. Crucially, Cariou's petrographs move toward a land-based photography, bringing into view the complex networks of settler colonialism, petrocapitalism, and consumption that make the image possible while proposing other ways of seeing human relations with territory. In doing so, Cariou makes a case for photography as a critical site of anti-extractive world-making.

Chapter 2 turns to silver, the most important material used in analog photography. Silver's remarkable light sensitivity, relatively low cost, and ubiquity enabled the rise of photography as an industry. Focusing on scale, this chapter traces a long historical arc, moving from the fifteenth-century discovery of silver in Potosí (now Bolivia) to Timothy O'Sullivan's photographs of silver at Comstock Lode, Nevada, in the 1860s, concluding with Eastman Kodak Company and the rise of photography as a mass medium. In the process, we see how socially contested changes in currency standards, industrial uses, and recycling impacted the supply of silver that could then be conscripted into the scaled-up production required for Kodak to become a household name.

Chapter 3 turns to platinum and the theme of atmosphere. The pictorialists championed the atmospheric aesthetics of platinum prints, but platinum and atmosphere also have a material dimension: platinum prints were a chemically stable alternative to silver prints, which were vulnerable to growing industrial air pollution. Tracing platinum's supply chains to South Africa, I do an atmospheric reading of platinum prints by David Goldblatt and Simon Starling to show how the metal's promise of stable boundaries is undermined by the dust and particles that atmosphere carries between bodies and landscapes. I conclude with Larry McNeil's exploration of coal mining and atmosphere in the western United States to contrast the futurity promised by the stability of the platinum print with the reality that polluted atmosphere is foreclosing collective futures on this planet.

The theme of unstable boundaries is developed in chapter 4, which centers on iron and cyanotypes, or blueprint photography, which I argue materially register industrial growth. Reading Anna Atkins's cyanotypes of algae and ferns through Walter Benjamin's writing on the links between iron, metabolism, and industry reveals the connections between the

print, the plant, plantation slavery, and industrial growth. I then turn to railroad photography in Pennsylvania's Steel Belt during the Second Industrial Revolution to consider the rise of blueprint photography, contrasting blueprints with William Rau's albumen prints. The chapter concludes with LaToya Ruby Frazier's cyanotypes, which explore embodied histories of deindustrialization in the Rust Belt. Throughout, I show how iron as a material moves between registers—the plant, the body, and infrastructure—enabling both biological and industrial growth alongside differentially distributed costs to sacrificed life.

Chapter 5 explores how uranium pushes photography beyond that which is visible to the human eye. Centering on the problem of slow violence, the argument in this chapter is twofold.[78] First, experiments by Niépce de Saint-Victor, Wilhelm Röntgen, and Henri Becquerel show that photography is central to the development of atomic culture—just as many of the qualities of radiation were first perceived on photographic paper. Photography was deliberately used to direct attention from the violence caused by the atomic bomb to the spectacular imaginary of the bomb itself. At the same time, photographs made with uranium can make visible forms of attritional violence that otherwise can't be seen. Materially, uranium highlights the limits and possibilities of seeing and visibility in the context of violence, both slow and spectacular.

Chapter 6 turns to the digital world to consider the extractive and visual image economies of the present. I focus on rare earth elements, seventeen chemically similar minerals that make technologies brighter, faster, and lighter. Rare earths serve as our guide to digital images because they are used in lenses and screens and to build color. Following rare earths from their extraction in Baotou, Mongolia, through the very material infrastructure of the Cloud, which runs through cables deep under the ocean, to Agbogbloshie, an e-waste dump in Accra, Ghana, highlights the environmental and labor costs of seemingly immaterial images and points to the open global contests over what new forms of image-making will do, and who, where, will pay the price.

Throughout, materials and photographs form an entry point into the broader system of extractive capitalism. The structure of this book is kaleidoscopic: each chapter makes a stand-alone argument, but when the fragments are placed alongside the others and filtered through a lens (photography and extraction), a more complex picture of photography's

implication within, and potential to resist, extraction emerges. Works of art are both enmeshed within and enable geopolitical and economic systems, a position of complicity that is relational *and* material. More productively, the ability of art to produce and form worlds reveals that art's role is not passive—pointing to possible, if so often unrealized, political potential.[79]

Extraction reveals complicated networks of implication: the universities that fund research to develop extractive industries, the nation-states that subsidize mining, and the museums that greenwash corporations through exhibition funding and boards of trustees, to name a few sites of intersection. Those who are insulated from the *immediate* violences of extraction often prefer not to think about their implication in this component of capitalist industry more generally.[80] For some of us, it is a choice not to look, not to do the reconnecting work. I am a white settler in the settler-colonial state of Canada, which is one of the primary drivers of extraction worldwide. Over 75 percent of mining corporations worldwide are headquartered in Canada, and the Athabasca tar sands are one of the largest single contributors to global climate change.

On a more personal level, mining shaped my family's history. My great-grandfather Joseph MacNeil worked in the coal fields of the British Empire Steel Company's Dominion #6 Colliery in Glace Bay, Nova Scotia, and, later, deep underground in the McIntyre Mines in Schumacher, Ontario, one of the richest gold finds in history. He broke his back during a cave-in underground and occupational disease slowly poisoned him. My other great-grandfather, Charlie Angus, a miner and socialist organizer, died in an accident underground at the Hollinger Mine in Timmins. At the same time, mining labor was a critical organizing site for working-class people, which, coupled with the investment in the welfare state in the postwar period, enabled my grandparents to move into the middle class.[81] The benefits that have shaped my life, like public education and national health care, are in part funded by Canada's extractive history and present—which is predicated on the theft and ongoing occupation of Indigenous land. The legacies of these violences are responsibilities I have inherited as a settler.[82] Generational distance from mining labor likewise did not prevent exposure to toxins like lead and arsenic, industrial histories indexed in my body. The ubiquity of toxicity shows that no one is insulated from the slow violence that accompanies the extraction and

refining of materials, processes that release toxins that mutate bodies and transform ecosystems globally. I have benefited from extraction and have been damaged by it. I write this book from a position of entanglement and implication underpinned by a commitment to ecosocialism and environmental justice. Consciousness of complicated histories and the complex path forward to a more ethical relationship with the natural world are the first steps to transformation.

While my focus on materials might suggest a suspicion of the visual, I am deeply invested in representation. Activists and artists—most often people working at the intersection of both—have shaped my thinking on extraction. In the context of catastrophe, slowing down and looking closely is important to diagnose the historical roots of our current crisis so that, collectively, we can chart more just paths forward. Given that the science on climate change is clear and yet political change has been lethally slow, it is evident that we need new narratives, new stories, and new ways of seeing. This is what artists do: they can transform how we see our world, helping all of us take the many actions we need to remake it into a world worth living in.

# NOTES

## Introduction

Parts of the introduction have been revised from "Mining the History of Photography," in *Capitalism and the Camera*, ed. Kevin Coleman and Daniel James (New York: Verso, 2021), 55–73.

1 Hoskins, "People Like Us," 17.

2 Marien, "Imaging the Corporate Sublime," 1.

3 Sawyer, "Woodruff v. North Bloomfield Gravel Mining Co."

4 Hult-Lewis, "The Mining Photographs of Carleton Watkins," 172–74.

5 Hoskins, "People Like Us," 14.

6 Scott, *Photography and Environmental Activism*, 40.

7 Marx, *Economic and Philosophic Manuscripts of 1844*, 37.

8 Azoulay, *The Civil Contract of Photography*, 129; Benjamin, "A Little History of Photography."

9 Holmes, "Doings of the Sunbeam."

10 Holmes, "Doings of the Sunbeam."

11 Gordon, *Book of Film Care*.

12 Dootson, *The Rainbow's Gravity*, 128.

13 Eastman Kodak Company, *The Home of Kodak*, 23. Writing on the importance of photographic paper includes Mintie, "Material Matters"; and Messier, "Image Isn't Everything."

14 Sheppard, *Gelatin in Photography*, 25.

15 Rogers, *Chemistry of Photography*, 17.

16 Mees, "The History of Sensitisers," 104.

17 Shukin, *Animal Capital*, 104.

18 Lovejoy, "Celluloid Geopolitics."

19 Eastman Kodak Company, *The Kodak Park Works*.

20 "Gun Cotton and Collodion," *Scientific American*, 109.

21 Holmes, "The Stereoscope and the Stereograph."

22 Schaefer, "Photographic Ecologies," 45.

23 Belting, *The Invisible Masterpiece*.

24 Holmes, "The Stereoscope and the Stereograph."

25 Mumford, *Technics and Civilization, 25*.

26 Holmes, "The Stereoscope and the Stereograph."

27 International Resource Panel, *Global Resources Outlook 2019*, 7

28 Hellweg is the coauthor of a comprehensive study produced by the United Nations on climate change. Watts, "Resource Extraction Responsible for Half World's Carbon Emissions."

29 Gómez-Barris, *The Extractive Zone*.

30 As curator Royce K. Young Wolf (Hiraacá, Nu'eta, and Sosore) explains, materiality and representation disconnected from land are incomplete histories. Young Wolf's careful reconnecting of objects in museum collections with the material, embodied histories of land is an important addition to art historical methodologies, and conversations with Young Wolf have influenced my thinking on photographs as emplaced objects. Throughout, I attempt to resituate objects within the landscapes of their making, though some attempts are more successful than others.

31 Coleman and James, *Capitalism and the Camera*, 11.

32 Malm, *Fossil Capital*.

33 Wrigley, "The Supply of Raw Materials in the Industrial Revolution"; Mumford, *Technics and Civilization*, 156–57.

34 Ziolkowski, *German Romanticism and Its Institutions*, 23.

35 Marx and Engels, *The Communist Manifesto*, 225.

36 Taylor, "Auras and Ice Cores," 77.

37 Ware, *Mechanisms of Image Deterioration in Early Photographs*.

38 "Fixing and Washing Silver Prints," *Photographic News*, 150.

39 For an analysis of extraction, ways of seeing, and world-making, see Gómez-Barris, *The Extractive Zone*; de la Cadena, "Uncommoning Nature"; Goffe, "Human Resources."

40 Rudwick, "The Emergence of a Visual Language for Geological Science"; Sekula, "Photography between Labor and Capital," 203.

41 Agricola, *De Re Metallica*, 7.

42 Merchant, *The Death of Nature*, 29.

43 Agricola, *De Re Metallica*, 19.

44 Agricola, *De Re Metallica*, 19–20. Agricola's treatise influenced the experiments of Georg Fabricius, who first identified silver chloride, though Fabricius did not observe the impact of light on silver chloride. Eder, *History of Photography*, 25.

45 Mumford, *Technics and Civilization*, 74–77.

46 Lorke, *Liminal Semiotics*.

47 For instance, Johann Wolfgang von Goethe's experience in silver and copper mines inspired the poem *Ilmenau*. Ziolkowski, *German Romanticism and Its Institutions*, 33.

48 E. Miller, *Extraction Ecologies*, 4.

49 Blake, *Milton*.

50 Gómez-Barris, *The Extractive Zone*, xvi.

51 Coulthard, *Red Skin, White Masks*, 14.

52 Lisa Lowe traces the connections between European liberalism, settler colonialism in the Americas, the transatlantic African slave trade, and the imperial trade with the East Indies and China in the late eighteenth and early nineteenth centuries, showing how "differentially situated histories of indigeneity, slavery, industry, trade, and immigration give rise to linked, but not identical, genealogies of liberalism." Lowe directs attention to "relation across differences" and "the convergence of asymmetries." Following Lowe, I want to think about these histories as entangled but not equivalent. Lowe, *The Intimacy of Four Continents*, 11.

53 Some might conceptualize this using Heidegger's ideas around "the conquest of the world as picture" as well as the understanding of nature as a standing reserve of resources. See Heidegger, "The Age of the World Picture," 67.

54 Mirzoeff, "Visualizing the Anthropocene," 217.

55 W. Mitchell, *The Last Dinosaur Book*.

56 Sontag, *On Photography*, 14; Solomon-Godeau, "Who Is Speaking Thus?," 181. Scholars have extended this analysis to consider the links between

photography and hunting. See, for instance, Braddock, "Poaching Pictures"; Brower, "Trophy Shots"; Ronan, "Capturing Cruelty."

57 Szeman and Wenzel, "What Do We Talk about When We Talk about Extractivism?" See also Raab, "Landscape and the Risk of Metaphor."

58 Gómez-Barris, *The Extractive Zone*, 1; Riofrancos, *Resource Radicals*.

59 Azoulay, *The Civil Contract of Photography*, 129; Benjamin, "A Little History of Photography," 512.

60 Gilmore, *Abolition Geography*, 79.

61 The often-contradictory aims of national parks and their shifting relationships to the natural world have been explored by Berger, "Overexposed"; M. Barringer, *Selling Yellowstone*; Campbell, *A Century of Parks Canada*; Cronin, *Manufacturing National Park Nature*; McLaren, *Culturing Wilderness in Jasper National Park*; Gaudet, "Patterns of Possession."

62 Kelsey, "Sierra Club Photography and the Exclusive Property of Vision," 12.

63 Hodgins and Thompson, "Taking the Romance out of Extraction," 395.

64 Demos, "The Agency of Fire."

65 Tiffany Lethabo King uses the concept of ecotone to think through shoals, formations that are "liminal, indeterminate, and hard to map," locating potential in the friction produced by these indeterminate spaces and the new topographies they shape. King, *The Black Shoals*, 3–4.

66 Marx, *The German Ideology*, 36.

67 Marx, *The German Ideology,* 26.

68 Benjamin, "Theses on the Philosophy of History," 254.

69 Ray 2015, "Interview with Simon Starling."

70 Benjamin, "Theses on the Philosophy of History."

71 Benjamin, "A Little History of Photography," 511.

72 Berger, *About Looking*, 40.

73 Brecht, "The Threepenny Lawsuit," 469.

74 Brecht, "A Short Organum for the Theatre," 192.

75 Fisher, *Capitalist Realism*, 2.

76 Brecht, "A Short Organum for the Theatre," 194.

77 Gilmore, *Abolition Geography*, 475.

78 Nixon, *Slow Violence*.

79 Lee, *Forgetting the Art World*, 19, 25.

80 Sekula, "Between the Net and the Deep Blue Sea," 33.

81 Stephanie LeMenager shows how the cheap energy facilitated by oil made the expansion of the US and Canadian middle classes possible, and many

things considered central to liberal values like public education and activist movements like feminism, antiwar activism, and environmentalism are underpinned by access to cheap energy. LeMenager, *Living Oil*, 3.

82 I use *responsibility* in the sense of what Donna Haraway calls being "response-able": having "the capacity to respond." Haraway, *Staying with the Trouble*, 78.

### Chapter 1. Bitumen and a Reorientation of Vision

1 Treaty 8 (between the Crown and First Nations of the Lesser Slave Lake area) was initiated following the discovery of gold in the nearby Yukon and the subsequent Klondike Gold Rush, and the boundaries of the treaty reflect mining regions. It has a different history than the other numbered treaties in the Canadian West, which emerged following the collapse of the bison population as Indigenous communities in the West faced starvation, compounded by successive waves of disease. Beginning in 1878, the dominion under Prime Minister John A. Macdonald pursued a policy of state-supported starvation to force Indigenous communities to sign what came to be known as the numbered treaties. On what eventually became Treaty 8 lands, Indigenous communities in the region requested a treaty but the region was considered too northern to be suitable for settlement or development (see Daschuk, *Clearing the Plains*). After the discovery of oil in 1891, the Crown began to prepare a treaty, but it was not implemented. It was with the gold rush and the influx of white prospectors into the region that the government initiated the treaty process. As a retired Indian agent explained to Clifford Sifton, superintendent general of Indian Affairs, "They will be more easily dealt with now than they would be when their country is overrun with prospectors and valuable mines be discovered. They would then place a higher value on their rights" (Hall, *Clifford Sifton*, 272).

2 Leahy, "This Is the World's Most Destructive Oil Operation—and It's Growing."

3 Sierra Club Canada Foundation, "Tar Sands."

4 Niépce, "Heliography."

5 Cariou, "Petrography."

6 This photograph is the oldest camera-made photograph, but a photomechanical reproduction of a seventeenth-century Flemish print was made in 1825.

7 Benjamin, "The Work of Art in the Age of Mechanical Reproduction."

8 Mathiot, "The Capability of Photography," 46.