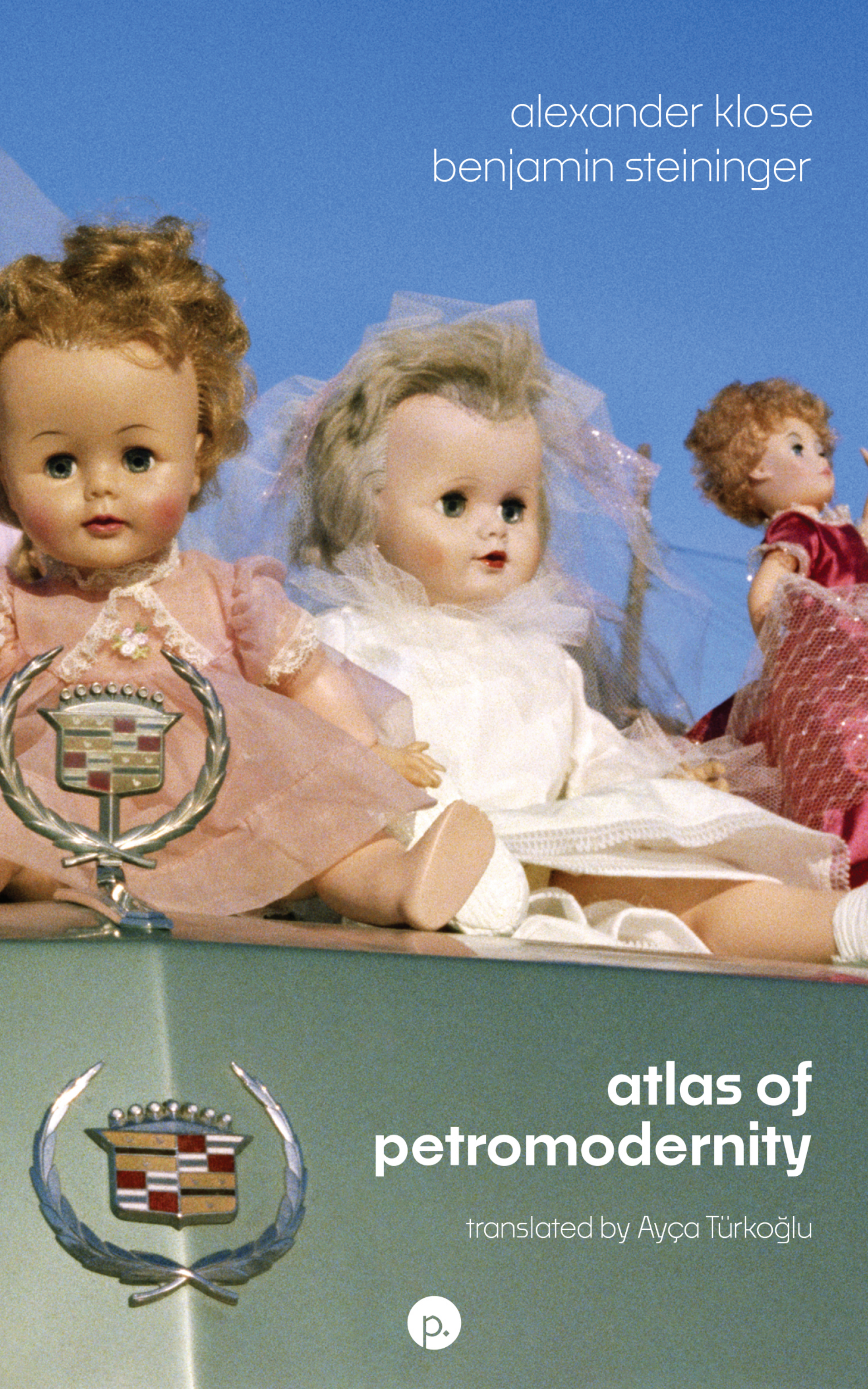

alexander klose
benjamin steininger

atlas of petromodernity

translated by Ayça Türkoğlu

ATLAS OF PETROMODERNITY

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Fig. 1. Detail from Hieronymus Bosch, *Ship of Fools* (1490–1500)

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alexander klose
benjamin steininger

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Foreword

Stephanie LeMenager

Long ago, the novelist Amitav Ghosh warned us that the Oil Encounter between localized landscapes and global markets defies storytelling.[1] The genre of the atlas is an antinarrative one, perhaps better suited to the Oil Encounter than storytelling forms. The *Atlas of Petromodernity* stands as a testament to the force of spatial knowledge and to the spatiality of poetic thought. It maps the world that oil makes and has made through the seemingly incommensurable spatial logics of drill records and Sunday strolls, plankton and suburban sprawl. With a distinctly poetic sensibility, it generates metaphors and rhythms, and it encourages associative, poetic linkages among distant geographies and objects. Authors Alexander Klose and Benjamin Steininger describe their project as "a spatial and visual manifestation of knowledge […] a book you open at a certain page and then leaf through, a landscape to wander, but also a mine from which to salvage treasures which could well be explosive." → Atlas$_{19}$ Note the analogy of the book to the mine — and then remember the significant expenditure of fossil energy needed to create this book, any book. The zombified Fossil Era defies our aspirations to sustainable knowledge. This *Atlas* records our complicities and disorientation. It asks us to craft a retrospective

1 Amitav Ghosh, "Petrofiction," *The New Republic,* March 2, 1992, 29–34.

journey across the long petromodern century from our twenty-first-century perspective of fossil hangover and climate collapse.

When I coined the term "petromodernity" in my book *Living Oil,* I intended it to mean "life based in the cheap energy systems made possible by oil."[2] I sought psychologically deep "bad love" looking for modern media forms that are indebted to fossil fuels and sustain modern cultural expression. I wrote that "oil itself is a medium that fundamentally supports all modern media forms concerned with what counts as culture — from film to recorded music, novels, magazines, photographs, sports, and the wikis, blogs, and videography of the Internet."[3] I was, and remain, worried about Western petromelancholia (i.e., the violent grieving of fossil energy),[4] so I didn't spend much time pursuing the doubts that always have haunted petromodernity, about which the authors of this *Atlas* have much of interest to say. They pursue throughlines of critique originating in the nineteenth century and extending into the present, noting that "the age of fossil fuels seems to be nearing its end — and with it, the era of petromodernity." → Atlas19 They anticipate "humanity's farewell to fire," and they question whether explanations of the internal combustion engine and the attachments it sustained are worthy of explanation anymore. Perhaps this *Atlas of Petromodernity* serves as a grave and — like all graves — a portal toward a new time. The new era that we may imagine with this Atlas is one of renewable energy, molecular mobilization toward just transition. With the chemist Robert Schlögl and others, we glimpse the possibilities of the solar refinery and the sustainable production of hydrogen energy by splitting water.

The *Atlas of Petromodernity* reaches toward futures beyond petromodernity, and, like most of us, it stumbles a little as it dreams. It perceives the "oleoducts," the pipeline and platform infrastructures of the Fossil Era, as "the hidden monuments of

2 Stephanie LeMenager, *Living Oil: Petroleum Culture in the American Century* (New York: Oxford University Press, 2014), 67.

3 Ibid., 6.

4 Ibid., 102.

our time." → World Cultural Heritage 201 Yet these infrastructures might be redeemable resources that are converted to renewables production, as has been imagined by transition-minded oil democracies of their platforms in the North Sea. The *Atlas* reminds us that "petromodernity can be understood as *a historically unique era of wastefulness,*" with the implication that such an era will surely end. → Tehran Museum of Contemporary Art 181 Klose and Steininger critique the Western mythologies of US petro-democracy versus Soviet petro-authoritarianism, and of Christian restraint versus Muslim petroviolence, as they remind us that "no such foreign region is as close to […] petromodern western culture as the Arabian desert." → Priceless 149 Oil cultures from Baku, Azerbaijan, to Houston, Texas tend to be cosmopolitan and sophisticated, and yet they end up flirting with or falling to the kleptocratic aspects of the Oil Curse, wherein state power becomes absorbed in corporate fossil fuel interests. Exceptions, such as the case of Norway, where a strong democratic state can profit from the resource, → World Cultural Heritage 201; Plankton 213 remain exceptional. Even in best-case scenarios, has any nation's attempt to establish a secure supply of fossil energy resulted in an expansion of democracy or peace?

The *Atlas of Petromodernity* unearths a rich history of European and Central Asian oil encounters that feature jarring cameo appearances by twentieth-century monsters, notably Joseph Stalin and Adolf Eichmann. As it turns out, both of these men cut their teeth through early careers in oil — in Baku and Austria, respectively. What twentieth-century power player did not traipse through an oil field? We can't forget the salient examples of the Bush family in the United States and their Saudi friends. With a sensitivity to historical detail that strikes me as European — in opposition to my own country's talent for myth-making — this *Atlas* foregrounds the relationships among fossil fuel development, global economics, and war, over time. Some of its visual examples of these interrelationships render what already is well known, such as the "futurist swagger" of the Soviet space race or the role of petrochemistry in the Allied victories of World War II. The *Atlas* also explores recent, uncooked examples, including those petro-memes proliferating on the Internet where Ukrainian farmers haul away abandoned Russian tanks: "Some of the war vehicles captured by the farmers become part of the Ukrainian army's inventory […] others are towed home to the barn and disassembled into parts." → Zombie 309 Hearing an exuberant farmer shout "blacksmiths at work!"[5] — in anticipation of repurposing a Russian tank as scrap metal — we imagine an era of repair or bricolage, life lived beyond petromodernity.

Yet the global socioeconomic systems of Fossil Empire, the "Oleoviathan" in our authors' heavy phrase, staggers on. European dependence on Russian natural gas illustrates the zombiism: "What reared up like an undead monster in 2022 is petromodernism as a whole: old geostrategic mischief and false history policies instead of new eco-geohistorical and cooperative consciousness. → Zombie 309 Note, too, the persistence of that "technological-social lifestyle based on expending as much energy as possible: the 'American Way of Life.'" → Oleoviathan 113 This remains a global fantasy, even as activists, scholars, and ordinary people worldwide (including in the United States) organize and strive for change. The "crisis-ridden, reactionary hypermasculinity" of Anthropocene autocrats (Bolsonaro, Putin, Trump) and the female faces of neofascism (Marine Le Pen in France, Giorgia Meloni in Italy, that loudmouth Marjorie Taylor Greene in the United States) show petromelancholia to have inflected gender expression. Especially toxic petromasculinities, in Cara Daggett's phrase, dominate our screens and lives.[6] Silicon Valley bros ride on private rocket ships and dream of Mars, neo-Nazis assume increasing popularity across the United States and Europe. Their extravagances and hatreds have been stoked by the migrations and economic shocks tied to climate collapse. Meanwhile, data centers, which Klose and Steininger call "the new refineries," commodify our desires and

5 Radio Free Europe/Radio Liberty, "Ukrainian Tractors versus Russian Armor," *YouTube,* March 16, 2022, https://www.youtube.com/watch?v=yMtP7OipYJg.

6 Cara Daggett, "Petro-masculinity: Fossil Fuels and Authoritarian Desire," *Millennium: Journal of International Studies* 47, no. 1 (2018): 25–44.

stimulate addictions (including our addiction to fear). The digital infrastructures that extract human data incur deep material costs in both fossil fuels and water, whose global scarcity is certain. The world is a blazing mess.

So, what, then, of the *Atlas of Petromodernity?* Why enter here? Don't come if you crave the spectacular certainties of apocalypse or measured, sociopolitical solutions. Like the Norsk Oljemuseum in Stavanger, Norway's large and surprisingly self-critical museum of petromodernity featured in the *Atlas,* here lies a site of public memory that doesn't construct memory so much as provoke you to remember. Like Alain Resnais's gorgeous, slightly terrifying film *The Song of Styrene,* also featured in the *Atlas,* this book invites you to work out for yourself the contradictions of petromodernity — its amoral, even sociopathic, beauty and the complexity of exiting its grasp. This is a memory project without the therapeutic promise of story, a critical project without the bracing framework of argument. The *Atlas of Petromodernity* offers us the chance to be a flaneur within its distinctively curated and therefore somewhat realistic world. Enter at your own risk, with the affinity for risk that may well define you, even still.

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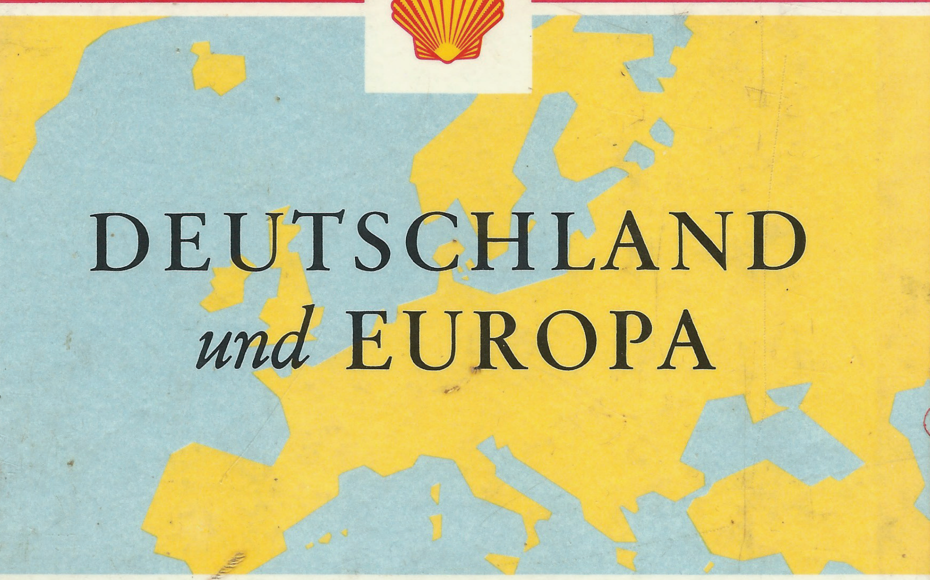

DEUTSCHLAND *und* EUROPA

← *Fig. 1*

Atlas

In classical mythology, Atlas carries the weight of the world and the star-studded sky on his shoulders. Much like his brother Prometheus, Atlas, a Titan, is punished by the victorious Olympian gods, led by Zeus, for siding with Kronos and the humans created by the Titans in the war against them. Prometheus is also notorious for having given humanity fire. Consequently, he is viewed in the Western tradition as a benefactor of culture.[1] Similarly, the culture of the modern age can, and indeed should, be viewed as Promethean.[2] Never have more fires burned so hot. The industrial age began with the utilization of fossil coal as an energy source on a massive scale. With the advent of oil and natural gas, collectively referred to by engineers as "petroleum," the turn of the twentieth century saw the emergence of new sources of energy, resources, uses, and effects, unprecedented

1 Many non-European cultures and traditions of thought have also captured the significance of fire in fermenting culture in tales of myth. See Jens Soentgen, *Pakt mit dem Feuer: Philosophie eines weltverändernden Bundes* (Berlin: Matthes & Seitz, 2021).

2 On the preoccupation with the industrial age as a Promethean culture, see Claus Leggewie, Ursula Renner, and Peter Risthaus, eds., *Prometheische Kultur: Wo kommen unsere Energien her?* (Munich: Brill/Fink, 2013), and Peter Sloterdijk, *Die Reue des Prometheus: Von der Gabe des Feuers zur globalen Brandstiftung* (Berlin: Suhrkamp, 2023).

in both quality and quantity. The atlas you hold in your hands hopes to examine this era of *petromodernity,* powered as it is by oil and gas: the intensification of a modern age already defined by fossil fuels.[3]

For his betrayal of the gods' secret, Prometheus was chained to a rock in the Caucasus Mountains and sentenced to have an eagle peck out his liver, only for his body to heal itself each night, ready for the ordeal to be repeated the next day. Atlas was banished to the western edge of the world, to the Strait of Gibraltar, and condemned to carry the weight of the Earth and the sky on his shoulders for all eternity.

Ovid's *Metamorphoses* tells of how Atlas was punished a second time, for refusing to allow Perseus, hero and son of Zeus, to seek shelter in his kingdom and threatening to attack him. In return, Perseus showed him "the visage of the dreadful Medusa," the severed head of the Gorgon whose gaze would turn the beholder to stone, and which he carried with him in a sack: "Atlas, as great as he was, became a mountain; already his beard and hair are transformed into woods: his shoulders and hands become mountain ridges; and what was previously his head is now a peak on the summit of the mountain. His bones become stones; then, being enlarged on every side, he grows to an immense height (so ye gods determined) and the whole heaven, with its stars so numerous, rests upon him."[4]

Atlas — who, according to various sources was born either directly of Gaia, the Earth mother, or of one of her children — is the bearer of an embodied knowledge of the laws of nature and the stars, because he does not carry it within himself as abstract, linear knowledge subject to the law of a single god, but as the plurality of its manifestations:

3 Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (London: Verso, 2016).

4 Ovid, *Metamorphoses: Books I to III (IV, V),* trans. Roscoe Mongan (London: James Cornish & Sons, 1881), 21.

> Atlas, the vanquished warrior, forced to immobilize his strength, unfortunate hero oppressed by the weight of his punishment, eventually becomes an immense and moving thing, rich with wealth of teachings. He has given his name to a mountain (Atlas), an ocean (the Atlantic), to an underwater world (Atlantis), to all kinds of monumental, architectural statues designed to support palaces (atlases), and soon a new kind of knowledge intended to gather, through images, the dispersion — but also the secret coherence — of our entire world.[5]

An atlas in this latter sense constitutes a spatial and visual manifestation of knowledge, a book you might sooner flick through than read from cover to cover, a book you open at a certain page and then leaf through, a landscape to wander, but also a mine from which to salvage treasures that could well be explosive.[6] An atlas gathers together in images or maps a series of "presents," layers, or sections, condensed or splayed out horizontally. These can relate to completely different norms or fields of knowledge; even historical or chemical processes can be translated into the geographical or artistic style of a map or an image. And they create connections, linking to a network of knowledge or uncovering patterns or hidden causal links without this interaction being bound to a single set structure or regularity.

What else can an atlas do? The concept of the atlas as a book-bound series of maps goes back to the latter third of the seventeenth century. The idea for an *atlas portabilis* — an easy-to-transport travel atlas — emerged not long afterward, and with it travelers found they had the whole world in their pockets. There was no longer a single place into which they weren't prepared to venture, at least cartographically speaking. An atlas provides

5 Georges Didi-Huberman, "Atlas or the Anxious Gay Science," in *Atlas: How to Carry the World on One's Back?,* ed. Georges Didi-Huberman, exh. cat. (Madrid, Karlsruhe, Harburg: Museo Nacional Centro de Arte Reina Sofia, ZKM Center for Art and Media Karlsruhe, Phoenix Art Stiftung Falckenberg, 2011), 65.

6 Ibid., 15.

an overview of an area and, in doing so, gives its user power over that space. It can contain almost anything: *Theatrum Orbis Terrarum* was the title of the first work of this kind by Abraham Ortelius, published in 1570, and Gerhard Mercator's book of maps contributed by coining the term "atlas" just a few years later. Or, at least, it contains everything that is of relevance to its respective user, be it situated in Germany, Europe, the Christian world, the New World, or in a specific field, such as skiing, minerals, insects, or religion.

The production of atlases saw its first major boom in Germany in the latter third of the nineteenth century. The "belated nation" secured its existence through elaborate series of maps, such as Ludwig Ravenstein's *Atlas des Deutschen Reiches* [An atlas of the German Empire], published by the Bibliographisches Institut in Leipzig in 1883. Alongside ten pages detailing every region of the empire on a scale of 1:850,000, the atlas also included statistical maps on "population density, denomination and occupational activity," and also "small production charts on soil culture, livestock breeding, agricultural crops and useful minerals."[7]

Yet the greatest age of the national atlas, at least as far as general distribution is concerned, came after 1900, in the form of the road atlas. The spread of vehicles with petrol-powered engines saw a boom in personal transportation. The first edition of *Continental Landstrassen Atlas für Automobilisten und Motorradfahrer* [Continental road atlas for motorists and motorcyclists] was published in 1907. Between the wars, various oil companies, tire manufacturers, and newspapers published competing, comprehensive map series and atlases. The spread of petromodern culture correlates to an increase in atlas production. The first edition of the *Shell-Autoatlas* was published in the spring of 1950, merging the principles of tour maps and road maps for the first time. According to its introduction, it is "no

7 Ludwig Ravenstein, *Atlas des deutschen Reichs* (Leipzig: Bibliographische Anstalt Adolph Schumann, 1883), http://www.landkartenarchiv.de/landkarten.php?q=Ravenstein_Atlas_des_Deutschen_Reichs_850T_1883.

mere promotional item, but a publication which aims to serve the fields of mototourism, business travel and freight transport."[8] Routes with especially beautiful scenery were highlighted in green, and campsites and tourist attractions were also listed. It was a success. Numerous up-to-date editions were published within a couple of years. The first publication of *Der Große Shell Atlas — Deutschland und Europa* [The big Shell atlas: Germany and Europe] came in 1960, the cover of which is depicted at the beginning of this chapter (see fig. 1).

In 1966, during the postwar economy's oil-powered boom, Westermann Press, based in Braunschweig, Germany, published an extensive *Erdöl-Weltatlas* [World atlas of petroleum] in the style of a school atlas. It showed the essential elements of the petro-industrial complex, from the oil-producing countries to pipeline networks and oil tanker routes, to the refineries across the globe, providing its readers with information about economic figures and regional distribution in the process.[9] Readers could, or indeed had to, use their own imagination to conjure up any associated social and cultural developments, topographical transformations, displacement, or upheaval.

So what is our *Atlas of Petromodernity* capable of and what purpose does it serve? The figure of Atlas the Titan is perhaps more closely bound up with this piece of work than we would like. Our actions, too, stand with their heavy feet deep in the fossilized layers of the Earth, reaching up into the sky. It seems apt, too, that the ironic nickname for the cartel of seven multinational oil corporations that dominated the global oil market from the 1940s to the 1970s was the "Seven Sisters": a reference to the seven daughters of Atlas, the Pleiades. These seven oil companies were Exxon, Mobil, Chevron, Gulf Oil, Texaco, BP,

8 *Shell-Autoatlas* (Stuttgart: Mair 1950), https://www.landkartenarchiv.de/autoatlanten.php?q=shellatlas1_1950.

9 Ferdinand Mayer, *Erdöl-Weltatlas,* ed. Esso AG Hamburg (Braunschweig: Westermann, 1966), and Ferdinand Mayer, *Weltatlas: Erdöl und Erdgas,* 2nd rev. ed. (Braunschweig: Westermann, 1976).

and Shell.[10] It also calls to mind the title of Ayn Rand's literary magnum opus, *Atlas Shrugged,* which poses the question of what happens when the main pillars of society, the "creators" who build society (e.g., capitalist corporate groups) are demoralized by "destroyers" and "plunderers" (e.g., socialist activists) and driven to (self-)sacrifice.[11] Published in 1957, the book, addressing the holy pillars of US neoliberalism and neoconservatism, is one of the most politically successful books of the twentieth century and has also enjoyed lively interest and rising sales figures in the age of neo-petromodern "turns" reaching from Ronald Reagan all the way to Donald Trump.[12]

Pursuing a cartography of the present day means tying together political, economic, social, technological, and cultural-historical developments with the biochemical, geohistorical, and evolutionary processes in which they are embedded and in which they themselves intervene. If petromodern process-landscapes and materialities that are molecularly mobilized are sustained by chemical technology and fossil fuel energy, chemical geographies and cultural theory are required to describe human activity on all relevant scales.[13]

Aby Warburg's *Mnemosyne Atlas*[14] and Walter Benjamin's *The Arcades Project*[15] may still be regarded as the most signifi-

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10 See Anthony Sampson, *The Seven Sisters: The Great Oil Companies and the World They Shaped* (New York: Viking, 1975).

11 Ayn Rand, *Atlas Shrugged* (New York: Penguin, 1957).

12 See Jonathan Freedland, "The New Age of Ayn Rand: How She Won Over Trump and Silicon Valley," *The Guardian,* April 10, 2017, https://www.theguardian.com/books/2017/apr/10/new-age-ayn-rand-conquered-trump-white-house-silicon-valley.

13 Andrew Barry, "Manifesto for a Chemical Geography," inaugural lecture, Gustave Tuck Lecture Theatre, University College London, January 24, 2017, https://www.ucl.ac.uk/anthropocene/sites/anthropocene/files/andrew_barry_manifesto_for_a_chemical_geography.pdf.

14 See also Georges Didi-Huberman, *The Surviving Image: Phantoms of Time and Time of Phantoms: Aby Warburg's History of Art,* trans. Harvey Mendelsohn (Philadelphia: Pennsylvania State University Press, 2016).

15 Walter Benjamin, *The Arcades Project,* trans. Howard Eiland and Kevin McLaughlin (Cambridge: The Belknap Press of Harvard University Press, 2002).

cant reference points in terms of modern ventures into atlas-making for the purpose of *Zeitdiagnostik,* that is, analyzing the present era; both emerged around the same time, in the 1920s and '30s, in the first phase that saw an acceleration in petromodern technology, economics, and culture. Among other things, both works are driven by an attempt to identify—in times of upheaval—the present and what is to come in what is declining and what has already perished. Today, we once again find ourselves in a period of upheaval. The age of fossil fuels seems to be nearing its end, and with it, the era of petromodernity. The condition in which the world will emerge from this era remains highly uncertain. If atlases have always been able to position nature and culture, climates and transport routes, cities and continents, language regions and political alliances side by side, then today they must portray not just humanity's short-lived history and geography on a seemingly immovable planet, but the planet itself, an accumulation of environments and natures that shift with, and in part are the result of, human activity.

This poses a new challenge to all mapmaking, all atlases, all systems of coordinates, and all academic patterns. The proclamation of the Anthropocene as a new geohistorical era throws up historico-philosophical questions not just as to the end of the modern age, but as to the end of the Western project of history.[16] This explains a certain boom in approaches to a horizontal, archaeological—that is, layer-by-layer—nonlinear or polylinear and noncentric or polycentric historiography of the

16 A few of these significant approaches reach far back to before the proclamation of the Anthropocene, such as Michel Foucault's *The Archaeology of Knowledge,* trans. A.M. Sheridan-Smith (New York: Pantheon Books, 1972), and Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia,* trans. Brian Massumi (Minneapolis: University of Minnesota Press, 1987). For the call for an "end to grand narratives" associated with the postmodern age, see Jean-François Lyotard, *La condition postmoderne* (Paris: Les Éditions de Minuit, 1979), or Hans Ulrich Gumbrecht, *In 1926: Living at the Edge of Time* (Cambridge: Harvard University Press, 1997).

present, which we would absolutely attribute to ourselves.[17] Such attempts at historiography, traversing as they do geographical and systemic contexts without imposing a unified, organizational principle, inevitably remain fragmented.

Especially since such undertakings today are concerned not least with breaking out beyond the Atlantic, that is, the Western world's narrative between Atlas and Caucasus, between Atlas and Prometheus. Instead of reproducing further versions of a universalist European (and US) "History 1" — something this book will henceforth take to mean the rule of a US-dominated petromodernity and its values — we must listen to the multiple histories of (formerly) colonized and Indigenous peoples, and to local traditions and individual impulses in the petromodern motherlands themselves, which have always countered and corrected the claims of History 1, and out of which "History 2" is compiled, as Dipesh Chakrabarty writes on the Marxist reading of history as the colonial spread of capitalism.[18] The local world histories of oil can be written from Baku, or from Texas, or, as in the case of this book, from Vienna and Berlin.

Yet it is nevertheless more important than ever to uphold the Atlantean attitude, to ascend to different verticals in order to see different horizontals, to look over and under the Earth, to make incisions, to record places and technologies in more than one single grid, just as places always have multiple connotations according to climate, diocese, language region, and political boundaries, as is the assertion that we ought to go to the very limits in both the smallest and the greatest detail, at least illus-

17 Such as "100 Jahre Gegenwart" from the Berliner Haus der Kulturen der Welt, https://www.hkw.de/de/programm/projekte/2015/100_jahre_gegenwart/100_jahre_gegenwart_start.php, and Karen Pinkus, *Fuel: A Speculative Dictionary* (Minneapolis: University of Minnesota Press, 2016). For a definition of an archaeology of the present, see Knut Ebeling, *"Die Mumie kehrt zurück II:* Zur Aktualität des Archäologischen in Wissenschaft, Kunst und Medien," in *Die Aktualität des Archäologischen in Wissenschaft, Medien und Künsten*, eds. Stefan Altekamp and Knut Ebeling (Frankfurt am Main: S. Fischer Verlag, 2004), 9–30.

18 Dipesh Chakrabarty, *Provincializing Europe: Postcolonial Thought and Historical Difference* (Princeton: Princeton University Press, 2000), 71, 254.

tratively, in order to use these margins to stake out the territory for a new geophilosophy in which history and culture play out.

Less a series of maps than a deck of cards, it will lay out images from different contexts we consider to be characteristic of petromodern developments and conditions. Our atlas brings together finds and marginal pieces in which the big is reflected in the small, and the small in the big. We read these pieces as flickering indices, cutting through geographies, technologies, processes, and histories. “The sun is mirrored even in a coffee spoon,” wrote Sigfried Giedion.[19] We would like to add to this well-known dictum: focus closely enough on a single drop of black crude oil, and it will glitter all the colors of the rainbow.
→ Black Mirror 247

19 Sigfried Giedion, *Mechanization Takes Command: A Contribution to Anonymous History* (New York: W.W. Norton, 1969), 3.

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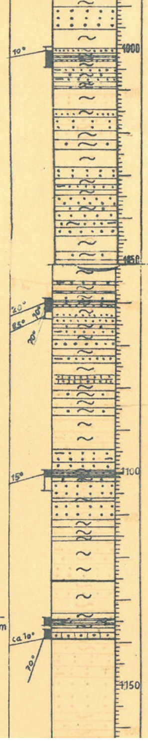

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- 1001.75 grün. bis graugrün., fest. z.T. glimmr. Tonmgl. m. zahlr.
- 1002.00 gelb. Oelfeinsand [braun. Oelfeinsandlagen
- 1002.35 dkl.-graugrün., fest., braungefleckt. Tonmgl. m. einzln. Fossilspl.
- 1002.90 graugrün. Tonmgl., zahlr. dkl.-braun. Oelfeinsandlag., Oeltropf.
- 1004.50 dkl.-grau. bis grünl.-grau., fest., etw. schiefr. Tonmgl.
- 1006.00 etw. tong. Sand, wahrscheinl. oelimprägn.
- 1007.00 Sandg. Tonmgl.
- 1008.00 etw. tong. Sand, wahrsch. impr.
- 1009.20 " sandg. Tonmgl.
- 1009.60 sandg. Tonmgl.
- 1014.80 Tonmgl.
- 1016.60 " m. Sandlagen
- 1019.50 Oelsand
- 1021.60 fest. Tonmgl.
- 1024.00 ", sandg. Tonmgl.
- 1028.00 Tonmgl.
- 1030.80 Oelsand
- 1032.00 Tonmgl.
- 1033.20 etw. tong. Sand, vermutl. etw. imprägn.
- 1034.80 Tonmgl.
- 1037.20 Sand, vermutl. impr.
- 1038.20 sandg. Tonmgl.
- 1040.40 Sand, vermutl. impr.
- 1042.00 sandg. Tonmgl. u. tong. Sand
- 1044.00 Oelsand
- 1048.00 Tonmgl.
- 1050.00 sandg. Tonmgl.
- 1054.00 Tonmgl.
- 1056.00 etw. tong. Sand, wahrsch. imprägn.
- 1057.20 Tonmgl.
- 1057.60 tong. Sand, " "
- 1059.30 grau., z.T. stark sandg. Tonmgl. [durchsetzt
- 1059.45 Schwarz, " " " ganz v. kohlig. Substanz
- 1060.30 grau., sandg. Tonmgl. v. zahlr., braun. Oelfeinsandlag. [durchzogen
- 1061.00 gelb., s. fein. Oelsand m. grau., dünnen Tonmgl.-lag.
- 1063.20 grau. Tonmgl., m. braun. Oelfeinsandlagen
- 1065.00 Sand, vermutl. imprägn.
- 1066.00 sandg. Tonmgl.
- 1067.60 tong. Sand
- 1068.40 Tonmgl.
- 1070.80 Oelsand
- 1072.40 Tonmgl.
- 1074.00 tong. Sand, wahrsch. gering imprägn.
- 1080.40 Tonmgl. m. hart. Kalkmgl.-lag. v. 1077-1079
- 1082.40 sandg. Tonmgl., wahrsch. Oelspuren
- 1084.80 Tonmgl.
- 1086.40 sandg. Tonmgl.
- 1094.40 Tonmgl.
- 1097.20 etw. tong. Sand, wahrsch. impr.
- 1099.50 Oelsand
- 1099.65 dkl. grau Tonmgl. v. Störungsfläch. durchzogen
- 1100.00 braun. Oelsand [Teil impr.; Kohlehäcksel
- 1100.50 grau. Tonmgl., hellgrau gebänd. m. zahlr. Sandlag., z. groß.
- 1101.00 braun. Oelsand
- 1102.00 st. sandg. Tonmgl.
- 1106.00 Oelsand
- 1106.80 Tonmgl.
- 1111.00 Oelsand
- 1113.00 sehr hart. Tonmgl.
- 1115.00 fester "
- 1116.00 sehr harter "
- 1125.50 fester Tonmgl.

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- 1133.00 sehr hart. Tonmgl.
- 1134.70 grau. bis grünl.-grau., z.T. verruschelt. Tonmgl. m. Kalzitadern u. Harnischfläch. Einlagerung v. hart., grau. Mergel
- 1134.75 dkl.-grau., sandg-glimmrig., mürb. Mgl. Oeltropf. auf den Kluftflächen
- 1135.10 grau. bis dkl.-grau., verruschelt. Mgl.
- 1135.95 " " grünl.-grau. Mgl. m. Lagen v. dkl.-grau., verruschelt. Mgl.-schiefer
- 1136.50 weicher, grünl.-grau. Tonmgl.
- 1137.50 grau., st. verruschelt. Tonschief. m. Kalzitadern
- 1139.00 grau., s. feinkörng., glimmrig. Kalksandst. m. tonig. Belägen

Flysch

1139.00

← *Fig. 2*

Drill Record

"Blue-grey to grey-blue," "micaceous," "grey-green to green, flecked with yellow"—these are descriptions of colors from an industrial drill record, recorded at the Gaiselberg 1 borehole near Vienna, Austria, on July 1, 1938 (see fig. 2). On the hunt for oil, you've got to rely on nuances and subtle, tangible gradations; you have to look closely at the mined material and rub it between your finger and thumb—*Is it clayey or sandy?*—sometimes, according to some geologists, you have to go so far as to chew on it. → Drilling Fluid 43 At 925.2 meters, you finally reach "oil sands" then clay marl again, at 1,002 meters there is another layer of "yellow fine oil sand," at 1,134.75 meters "dark grey, sandy-micaceous, crumbly. Poss. oil drops on cleft areas." The record identifies the location of a total of seventeen, to a lesser or greater extent, oil-bearing layers lying one atop the other, until the fourteenth of these "horizons," sitting at a depth of between 1,095 and 1,112 meters, where the oil-bearing layer is drilled and tapped, making the whole investment worthwhile.

A convergence of different kinds of processes and different forms of history is required for an incision to be made through the bedrock in selected sites in order to realize a profit for the present. → Temporal Abyss 241 The same applies to efforts to create an archaeological historiography of the presence of oil, as this atlas undertakes to do. The horizontal and, to some extent, geographical movement of assembling different contexts is complemented by a vertical movement that interrogates their historicities and how they relate to other historical layers: the histories of technology, economy, mentality, nature, the Earth, and so on. This activity is a matter of "geological historiography" insofar as it respects the specific processualities of the located layers of time — their norms, their closures and openings, the way they are organized — and concentrates on the dynamics operating within them as principles of their expansion and interaction.[1] The aim is to uncover the hidden — buried or decayed during the continuous processes of sedimentation — layers and facets of petromodernity.

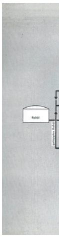
It is important to remember that we are not dealing with a strictly defined epoch, the principles of which can be applied to all findings. On the contrary, deep explorations test out new conjunctions under the twofold question of "oil" (as a material, technology, and extractivist approach) and "modernity" (as a set of modes of perception, explanations of the world, moral premises, and manners of conduct); ideally, with each new borehole they bring to light, a somewhat differently situated concept of petromodernity emerges, analogous to "oil sand," "fine oil sand," and "oil droplets."

The drill record from Gaiselberg 1 and its historical environment provide clues as to what to look out for. Drilled by Rohöl-Gewinnungs AG, this is one of the world's oldest oil wells still in commercial use. The company was founded in 1935 by the Socony-Vacuum Oil Company, Inc. (Mobil Oil) and Bataafsche Petroleum Maatschappij, an entity of Shell PLC. Renamed Rohöl-Aufsuchungs GesmbH and now owned by Austrian shareholders as RAG Austria AG, today RAG is the only company remaining from a once-glittering age of rapid industrial expansion, and is predominantly active in the gas storage business in upper Austria. On July 25, 1938, the cry went up, "Well now producing!" Extraction in the 1,139-meter-deep drill hole started

1 For more on seeking a geological historiography, see Manuel Delanda, *A Thousand Years of Non-Linear History* (New York: Zone Books, 2009), 20.

in the fourteenth Sarmatian horizon, named after its geological setting, and the third layer of the twelfth Sarmatian horizon was tapped from the 1970s onward, from a depth of between 1,010.5 and 1,016 meters. By 2013, which saw the well's seventy-fifth anniversary celebrated in the presence of Abdallah Salem el-Badri, OPEC general secretary, more than 126,000 metric tons of oil and 6,500,000 cubic meters of gas were extracted from Gaiselberg 1. In 2013, 97 percent of the extracted liquid was salt water, but this still resulted in around three metric tons of crude oil being produced daily.[2] And the well is still in production, even following the sale of the Zistersdorf and Gaiselberg RAG oil fields, steeped as they are in tradition, to the Australian company ADX in January 2019.

Taking a closer look at this borehole today means both deciphering contemporary history and revisiting how the Earth's history has historically been deciphered. When the borehole was drilled, geology was in the service of the incoming National Socialist wartime economy. → Molecular Mobilization 63 The Vienna Basin would prove to be the largest oil district in Greater Germany — a fact that, to this day, is rarely mentioned in the historiography of the *Anschluss,* the annexation of Austria. The Gaiselberg oil field was also massively expanded. After the war, the Republic of Austria paid reparations to the Soviet Union in the form of oil. The signing of the Austrian State Treaty, which paved the way for Austria to become an independent republic, was in no small part dependent upon negotiations over extraction rights to oil in the Vienna Basin.[3] A substance that had tightly bound the region to Nazi terror now became a means by which to establish a democratic welfare state.



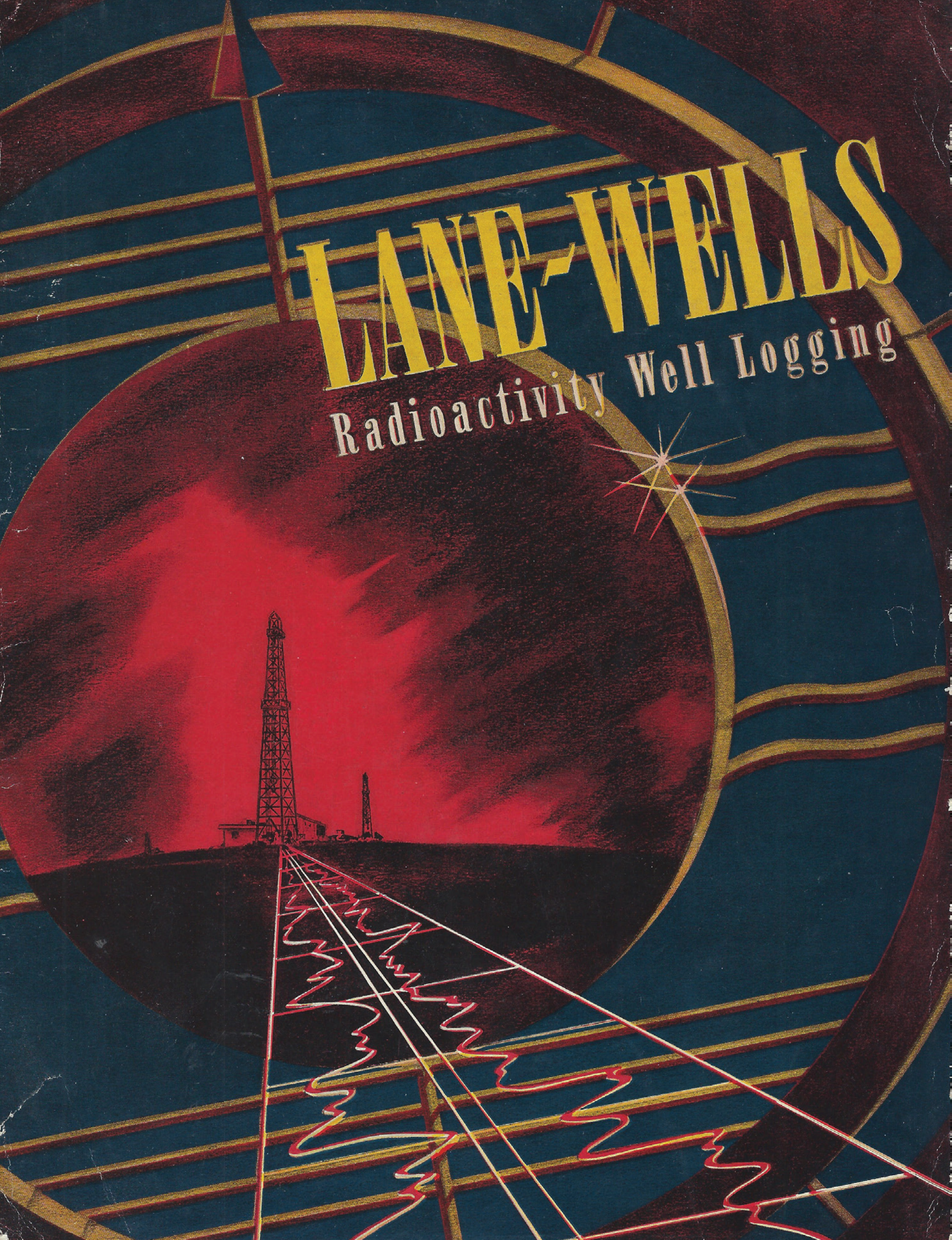
2 Ruth Schneggenburger, *75 Years of Successful Energy Production: Zistersdorf* (Vienna: RAG Rohöl-Aufsuchungs Aktiengesellschaft, 2013), https://www.rag-exploration-production.at/fileadmin/bilder/6_presse/Broschueren/rag_zistersdorf_75years_brochure_web.pdf.

3 Walter Iber and Peter Ruggenthaler, "Sowjetische Wirtschaftspolitik im besetzten Österreich: Ein Überblick," in *Stalins Wirtschaftspolitik an der sowjetischen Peripherie,* eds. Walter Iber and Peter Ruggenthaler (Innsbruck: StudienVerlag, 2011), 197–99.

Even the petroleum geologists at the well focus on very different natural-historical quantities. Quantitative data on the exact time and drilling depth are compared with qualitative observations of “microfauna” and “macrofauna and flora” and entered under the aesthetic category *Gesteinsbeschreibung* (rock description). Oil finds appear twice in the log, as a round point on the field “Oil, Gas, Water” and as entries underlined in red, “oil sand,” “fine oil sand,” “fine oil sand sites,” “oil traces,” again in the field labeled “petrography.” “Coal chips” and “coaly substance” are also recorded, along with generic paleontological terms, such as the “foraminifera,” which serve as important indicators of hydrocarbons, and individual species are indicated with abbreviations. → Plankton 213 Together, the entries provide a model of the geological substratum. An overview of the details offers a notion of geohistorical eras: “Oberpannon,” “Flysch,” “Sarmat.”

In this collection of text and images, the spectrum — between the macro and micro worlds, between distance and proximity, between enormous machinery, sensorily tangible materials, and the smallest catalytically manipulable molecules — is drilled, bored out, and tested. As can be seen from the drill record, seemingly incompatible elements are set out side by side. But only by passing through all the layers, the combination of geographical surface layers and geological depths, do we gain a sufficiently complex picture of the current era, characterized by oil use — one worthy of being termed an “atlas of petromodernity.”

Upstream/Downstream


LANE-WELLS
Radioactivity Well Logging

← *Fig. 3*

Exploration

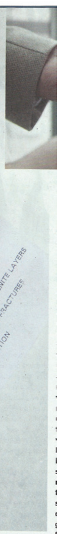
"Tomorrow's Tools — Today!" Lane-Wells promises in an information leaflet for "Radioactivity Well Logging" from 1952 (see fig. 3). Since humans cannot put the Earth through an X-ray machine to see where its various resources are to be found, they must pass gamma rays over it and introduce neutron beams into it.

The process of screening the substratum with all conceivable signals has made significant strides in the burgeoning nuclear and information eras. Nuclear physics not only emerges as a utopian vision for a future energy economy, but it also becomes an integral component of petrogeology. Radioactive borehole surveys form the microphysical pole for a geophysics that is operating on all bandwidths of signaling technology.

The most significant physical processes associated with this geophysics are geoseismic. These processes employ vibration trucks, heavy vehicles which use special plates that cause the ground to shake, or use controlled, usually small, blasts. In both cases, seismic waves are sent into the substratum with the aim of making underground structures visible up to depths of thousands of meters through specific reflections of signals. The geoseismic approach resembles the nautical practice of echo sounding, which employs acoustic signals to scan the ocean floor.

Hydrophones in large towing units send pulses into the sea floor in order to examine the composition of what lies beneath.

The 3D models created from the captured data are then examined by teams in special screening rooms. It takes experienced specialists to identify precisely those structures where drilling could be worthwhile amidst the virtual color display of geological faults and shifts. This preliminary exploration may be laborious and expensive, but drilling in the wrong place would be even more so. → Core Sample 207



In these configurations, geology serves as media technology. Only an Earth's crust that is wired up to an excessive degree, shot through with all sorts of signals, will disclose a portion of its secrets with the aid of computers. Since the 1960s, hydrocarbon exploration has been one of the most complex issues in data processing: "Some of the most advanced scientific computing was needed to perform shock wave analysis and to avoid the expense of a dry hole."[1] Alongside nuclear physics, geoseismology is one of the most significant historical trendsetters in the development of increasingly powerful data-processing centers. → Data Is the New Oil 277 The substratum will only give up a portion of its secrets if it is clamped in a media-technological machine, perforated, and picked out by signals.

There is an unintended side effect, however; machinery overhears more in the lithosphere than it needs to for commercial purposes. Notably, offshore discoveries provide geohistorical insights that go beyond deposit geology. Former river valleys on the bottom of the Mediterranean Sea floor — which largely dried up 5 to 6 million years ago during the Messinian salinity crisis — are picked up by seismic explorations performed by the oil industry, or, more precisely, by devices from this industry, as are the structures of settlements in Doggerland, which was submerged by the North Sea more than 8,000 years ago. During a survey in the Barents Sea, Norwegian oil geologists

1 James W. Cortada, *The Digital Hand: How Computers Changed the Work of American Manufacturing, Transportation, and Retail Industries* (New York: Oxford University Press, 2004), 166.

uncovered the largest river delta ever discovered, a structure that once drained the supercontinent of Pangaea to the north.[2] Even the discovery of the famous Chicxulub crater off the coast of Mexico — where, 66 million years ago, a meteor strike led to the mass extinction of countless species and brought about the end of the dinosaurs — is closely bound up with the oil industry. The formation first emerged during explorations carried out by the Mexican oil company PEMEX in the 1940s, and further investigation into the formation was facilitated by oil-related exploration.[3]

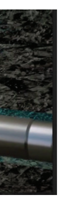
Following the devastating events in Southeast Asia on December 27, 2004, tsunami research benefited from readings acquired from oil field prospection: when the scope of academic seismology reached its limits, specialists in oil field exploration were able to jump in with their equipment, capable of reaching much deeper underground, in order to drive progress in the understanding of tectonics and the ocean floor.[4] The fact that finds of this sort, with high geohistorical epistemic and entertainment value, are increasingly becoming part of science reporting could indicate that industrial geophysics is being understood more and more as part of open-ended research than as part of a purely purpose-driven industry, or that it wishes to be understood in this way, in whoever's interest it may be. → Schlumberger 125 The scale of geophysical exploration is variable. And the technological resources invested correspond to the zones of the unknown

2 Andrew S. Madof, Claudia Bertoni, and Johanna Lofi, "Discovery of Vast Fluvial Deposits Provides Evidence for Drawdown during the Late Miocene Messinian Salinity Crisis," *Geology* 47 (2019): 171–74; Esther Widmann, "Unter der Nordsee liegt Doggerland, das Atlantis von Jägern und Sammlern," *Neue Zürcher Zeitung,* July 27, 2018, https://www.nzz.ch/wissenschaft/doggerland-ld.1403047; and Tore Grane Klausen, Björn Nyberg, and William Helland-Hanse, "The Largest Delta Plain in Earth's History," *Geology* 47 (2019): 470–74.

3 Jaime Urrutia-Fucugauchi et al., "The Chicxulub Multi-ring Impact Crater, Yucatan Carbonate Platform, Gulf of Mexico," *Geofísica internacional* 50, no. 1 (2011): 99–127.

4 T. Bunting et al., "The Science of Tsunamis," *Oilfield Review* 19, no. 3 (2007): 4–19.

rendered accessible by them. Hydrophones or air-based signals sit at the minimally invasive end of the scale. At the other end is the Soviet program of Deep Seismic Sounding, in operation since the 1960s. Unlike Radioactivity Well Logging, mentioned at the beginning of this chapter, this process does not employ radioactivity for its specific radiation quality, but for its ability to produce extraordinarily powerful blasts. As part of the program, from 1971 to the late 1980s a geoprofile more than 100 kilometers deep was created of large parts of the Soviet Union using underground nuclear explosions.[5] Planetary technology — in this case, nuclear technology created by a planetary geostrategic constellation → Zombie 309 — enables us to plumb the geology of the planet to previously unexplorable depths.



It is impossible to solve the contradiction between economic and strategic calculations and the broad horizons open to research. Instead, it must be emphasized that this is characteristic of this field of technoscience. → Frontier of the Technosphere 223 In the words of Martin Heidegger, in the beacon of seismology, the Earth's crust becomes "a gigantic gasoline station, an energy source for modern technology and industry."[6] Then again, it is precisely this purpose-driven access to the substratum that unearths the phenomena of the lithosphere, which have little to do with the calculations and objectives of humankind.

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5 J.F. Scheimer and I.Y. Borg, "Deep Seismic Sounding with Nuclear Explosives in the Soviet Union," *Science* 226, no. 4676 (1984): 787–92, and H.M. Benz et al., "Deep Seismic Sounding in Northern Eurasia," *Eos* 73, no. 28 (1992): 297–304. See also the work of the Lamont-Doherty Earth Observatory at Columbia University (LDEO), e.g., I.B. Morozov, E.A. Morozova, and S.B. Smithson, "Digital Database of Deep Seismic Sounding Profiles in Northern Eurasia," *29th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies* (2007): 164–74, https://www.ldeo.columbia.edu/res/pi/Monitoring/Doc/Srr_2007/PAPERS/01-17.PDF.

6 Martin Heidegger, *Discourse on Thinking: A Translation of Gelassenheit,* trans. John M. Anderson and E. Hans Freund (New York: Harper & Row, 1966), 50.

← *Fig. 4*

Drilling Fluid

A light grey, clayey fluid covers the ground and flecks the boots of a worker on the rotary table. It's a snapshot of what you might encounter at any drilling site. Nothing could be more mundane than this amorphous, colorless, viscous mass (see fig. 4).

Yet the opposite is true. Drilling fluid is one of the most important technical components involved in drilling any borehole. It serves simultaneously as a means of transport, coolant, and transmitter of information. It combines within it something that, elsewhere, would require a whole host of mining equipment and teams. This liquid tool, diagnostic instrument, and means of acquiring information is just as much an element of highly technologically advanced fleets of equipment as kilometer-long drill pipes, drill heads tipped with artificial diamonds, nonmagnetic drill string components equipped with heat-resistant electronics, and drive units and compressors. It is in this seemingly unremarkable mud that all of the activities involved in drilling converge.

The role of liquids — especially water — in the transportation of goods and other substances has often been captured in writing. Hegel described the body of water that made up the Mediterranean Sea as one of the central "means of communication" in antiquity[1] and therefore a medium, in contemporary usage.

In the 1920s, Fritz Heider interpreted the physical structures of substances as carriers of sensory impressions in their media characteristics.[2] A closer look at the functions of drilling fluid as the medium of drilling provides an overview of what this technology is.

The simplest and first task of the liquid in the drilling fluid cycle is transporting the rock cut by the drill bit out of the well. Inside the tube-shaped drill pipe, the fluid is pushed down under high pressure. Outside, it flows back up together with what are known as the "cuttings," between the drill pipe and rock. In this way, it serves as a kind of fluid conveyor cage. It also fulfills another purpose by cooling the drill bit, helping to preserve a component that is highly expensive and undergoes considerable mechanical and thermal strain.

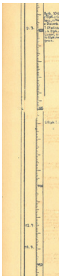
This task — mediating, interposing to an extent, between technicians above ground and the operation site below ground — could also be performed with pure water. However, the additives in the fluid bring with them additional effects. Clay dissolved in water is capable of sticking to the well wall and sealing it against falling rock. Aggregates such as baryte also increase the weight of the fluid in the borehole, using their sheer weight to suppress uncontrolled outbursts. Losses that occur despite the clay seal, such as a drop in pressure in the drilling fluid being pushed back up, indicate fissured rock. Here, the fluid serves not only as a means of transport and as a sealant, but also as a measuring device. It is also possible to use aggregates to achieve effects wherein the fluid sets like a gel during breaks in drilling, and pieces of rocks that have already been carried upward are prevented from sinking again via a process known as *thixotropy*.

1 Georg Friedrich Wilhelm Hegel, *Vorlesungen über die Philosophie der Geschichte* (*von WS 1822/1823 bis 1830/1831 fünfmal gelesen*) (Stuttgart: Reclam, 1961), 147. See also Friedrich Kittler et al., eds., *Götter und Schriften rund ums Mittelmeer* (Paderborn: Brill/Fink, 2017), 114.

2 Fritz Heider, *Ding und Medium* (Berlin: Kadmos, 2005).

The role of drilling fluid in directional drilling is, again, different. In contrast to the classic rotary process, where the drill pipe and, therefore, the drill bit are set in rotation via a rotary table on the surface of the ground, this process sees the drill driven by a turbine deep inside the borehole. → Frontier of the Technosphere 223 This makes it possible to create sidetracked — or even horizontal — boreholes, to reach and unlock deposits in a precise manner. In this case, it is the pressurized drilling fluid that drives the turbine inside the borehole; the aggregate is even described as a "mud motor." Thus, the drilling fluid facilitates the transport of both energy and cuttings.

In addition to material and energy, however, the fluid also carries information. "Mud logging" — the immediate, material inspection of pieces of rock washed up to the surface of the earth — is another comparatively simple way to gain geological and geochemical insights from the borehole. → Drill Record 29 Measurement while drilling, or MWD, is its own branch of advanced technology, a process of geophysically surveying the borehole during drilling. It assesses the electrical conductivity of the rock, its porosity, the reflection of sonic and ultrasonic waves and specially generated X-rays in the rock, and also the exact position of the drill bit. Artificial chemical elements from the fields of nuclear physics and nuclear technology, such as Americium (used as Americium-Beryllium) and Californium — which, with a reported price per gram of up to a phenomenal USD $60 million[3] is by far the most expensive chemical element on the planet → Priceless 149 — are used, serving as neutron sources delivering data in a measuring device. All of these data are transmitted via drilling fluid: valves specially positioned inside the drill bit serve as pulse generators with which the information gathered by the measuring devices can be coded and transmitted as pressure waves. By the same



3 R.C. Martin, J.B. Knauer, and P.A. Balo, "Production, Distribution, and Applications of Californium-252 Neutron Sources," *Applied Radiation and Isotopes* 53, nos. 4–5 (1999): 789.

token, this technology also facilitates remote control of the drill bit from top to bottom.

Thus, the fluid acts as a transfer medium, assuming several different functions at once. It transfers cuttings and engine energy in a pivotal position and ensures the borehole is sealed and stable, thereby guaranteeing the media function of this channel. It also serves as a carrier for geological information that is identified atomically and then coded hydraulically in one, technologically advanced system of media.

In addition to the transfer from A to B, however, drilling fluid also exhibits another media function, one less common in physics than in chemistry and biology.[4] Within the context of these fields of knowledge, surroundings and milieu are also considered media, the latter deriving etymologically from the term *medius locus,* to which Walter Seitter alluded in his work on water as a medium for organisms.[5] In fact, the entire metal apparatus seems to swim in the mud as if it were immersed in some kind of nutrient solution; every action must be performed through it. It forms the very liquid environment, the circulatory system of blood, hormones, and plasma, in which this technology is able to operate and thrive.

All this is performed by one of the most unremarkable substances imaginable, a light grey, amorphous liquid. And once this largely unknown medium — which is nevertheless essential for drilling and, therefore, petromodernity itself — has served its role in the high-tech machinery, it may well land on a worker's shoe, a splash of ordinary clayey soup from a muddy puddle.

4 See Peter Berz, "Die Lebewesen und ihre Medien," in *Ambiente: Das Leben und seine Räume*, eds. Thomas Brandstetter, Karin Harrasser, and Günther Friesinger (Vienna: Turia + Kant, 2010), 23–50.

5 Walter Seitter, *Physik der Medien: Materialien, Apparate, Präsentierungen* (Weimar: VDG, 2002), 231–42, esp. chap. 16 "Das Wasser."

← *Fig. 5*

Pumpjack

Their heads rise and fall, measured and thoughtful. All that can be heard is the gentle thrum of electric motors and the rhythmic squeaking of the machinery, the frame, piston, valves, and rods. They are known as "pumpjacks," "horsehead pumps," or "nodding donkeys," and can be found in the oil regions of the Midwest and Ontario, in the Caspian Sea and in Romania, in Lower Saxony in Germany, and in Austria's *Weinviertel* (see fig. 5). They are now more firmly a part of the landscape than the animals from which they take their name.

Sites, manufacturers, and construction types boast striking variety. These machines are in operation on steppes and in deserts, in oil-soaked grazing pastures home to herds of sheep, → Animals in Oil Fields 219 in fields of corn, vineyards, and scraps of woodland, in orchards and front gardens, in backyards, and even in a museum forecourt in Baku, documenting several decades of technological and industrial evolution. They stand solitary, sometimes loosely grouped together, sometimes in rank and file. The oldest specimens still run on a single central engine driving several pumps via a greased-wire rope hoist. The newest among them use fiber optics and Wi-Fi, enabling them to exist in the field and in cyberspace simultaneously.

The fundamental principle remains the same, however. If the pressure inside a reservoir is not sufficient for the oil to flow out naturally, it must be pumped up to the surface mechanically. There is the gas-lift process, in which gas is forced into the well, pushing the oil up to the surface; there are progressive cavity pumps, which use a kind of Archimedes's screw to push the oil upward. The most widespread, however, is the pumpjack system, which performs up to a depth of 2,700 meters and comprises pipes, pistons, and valves, and involves the oil column in the well being lifted upward, piece by piece, by a pump rod. This process invests a small amount of energy in order to suck a far greater quantity of energy out of the ground.

Across the world, these machines are a symbol of our civilization's hunger for energy, tapping the deepest layers of the Earth without putting down roots. → Pierced Earth 121 Take the pumps standing in rank and file in the 1956 film *Giant,* which sees James Dean in the role of the upstart Jett Rink, or the sculptures of pumps set against the granite of Wall Street in *Manhattan Oil Project,* the 2012 art piece by Josephine Meckseper.

There is a long tradition of finessing natural forces using comparably small, mechanical forces multiplied by levers and wheels. Hydraulic bucket wheels and Archimedean pipes are milestones in the history of technology, be they in Babylon, Egypt, China, or Europe. The technical construction of pumpjacks, however, calls to mind a more recent revolution: in around 1800, steam-powered pumps sparked an energetic chain reaction in coal mining. They made it possible to pump away mine water, facilitating, on the one hand, access to much deeper and much larger quantities of coal and, on the other, the arrival of the steam engine, which saw the birth of a new power plant, one that consumed ever-increasing quantities of coal. → Terminator 257 The rotation that came to symbolize the machine would not arrive until later, but Newcomen's steam engine, invented in 1712, with its rising and sinking "Balancier" crossbeams, had already set in motion an accelerating spiral of ever-more fuel and faster and faster machines. → Molecular Mobilization 63

Set against the landscape, these whirring horsehead pumps seem like a distant, and perhaps last, strikingly agrarian echo of the Big Bang that sparked the modern age of fossil fuels. We cannot know if the pumps are dreaming of the past, or, as in the quote preceding the passage "Fourier, or The Arcades" in Walter Benjamin's *Arcades Project*, "Chaque époque rêve la suivante"[1] (Every epoch dreams of the next), of the future, with wind turbines or geothermal power. At first glance, however, it is difficult to expect innovation from any new type of valve, any fiber-optic measurement unit or console unit, in addition to a pumpjack. It is the indispensable service of "beasts of burden," on which the overall system here is built.

And the sheer character of the pumps, the height of them, the weight of the flywheels and counterbalances to the sucker rod, shows that only a small section of the beast itself is visible. On each pump, pipes lie horizontally as far as the next buffer oil tank, forming a network of capillaries to the arteries of the intercontinental pipelines. Vertically, the device extends hundreds or even thousands of meters deep. Each stroke moves an appropriately long sucker rod and its load, weighing several dozen metric tons. The whole chain of the so-called sucker rod strings, worn out from weight and friction, must be dismantled and replaced from time to time in what is known as "well workover."

The worn-out rods, ultimately sold for scrap, can still be seen, serving as fence posts, archways, playground fencing, and other bits and pieces in the oil belts. In Lower Austria's very own oil district, they can be found in vineyards, supporting the vines growing around and among the pumpjacks.

1 Walter Benjamin, *The Arcades Project,* trans. Howard Eiland and Kevin McLaughlin (Cambridge: The Belknap Press of Harvard University Press, 2002), 893.

← *Fig. 6*

Pipeline

The 1960s saw one of Central Europe's most spectacular structures laid through the Alps: the Central European Line (CEL), an oil pipeline that connected the Port of Genoa with the oil refinery in Ingolstadt, Germany, via Lake Constance and Ulm until 1997. The individual pieces of pipe were hauled up and over mountain ranges via cableway. The construction of the "Oleodotto" — a neat linguistic reference to the aqueducts of ancient Rome — was followed by Bernardo Bertolucci, who would go on to become a world-famous director, in the third part of his early neorealist work of 1967, *La via del petrolio,* which was financed by the Italian state oil company, ENI.[1] → The Song of Styrene 235

The global pipeline network is one of the largest and most important transport systems on the planet — yet under normal circumstances most of the infrastructure remains invisible. Long-distance pipelines serve as "steel veins for energy" and capillaries to every well and every pump, constituting the pulse of the world economy, but also determining whether its complexion will be pale or flushed with "health." → True Oil 251 Even

1 See Georgiana Banita, "From Isfahan to Ingolstadt: Bertolucci's *La via del petrolio* and the Global Culture of Neorealism," in *Oil Culture,* eds. Ross Barret and Daniel Worden (Minneapolis: University of Minnesota Press, 2014), 145–68.

without the local pipelines in oil or gas fields, about which no data can be gleaned, there is currently a worldwide network in use covering 3.5 million kilometers, 2 million of which can be found in the United States alone.[2] By way of comparison, the total length of all the railways on Earth comes to 1.3 million kilometers.[3] With their liquid and gaseous transport goods and the closed character of their system, pipelines practically embody the ideal of logistically optimized infrastructure. Once they have been laid, you can only really spot them if you know where they are — thanks to inconspicuous clues in the landscape, such as little yellow cones or poker-straight swathes of denuded ground in the forest, which are often untouched by frost in winter.

As political projects, however — be it the Baku–Tbilisi–Ceyhan pipeline (BTC), Keystone XL, or Nord Stream 1 & 2 — they are prime examples of political and ecological friction. Unlike almost no other element in the petro-technological distribution trail, it is the hidden pipeline that makes the links between economics, technology, ecology, and politics most obvious.[4]

The most drastic showcase on many levels has played out before our very eyes since Putin's Russia invaded Ukraine in 2022. → Zombie 309 Europe's mightiest pipeline system, with its connections to Russia and other former Soviet countries, has become embroiled in hybrid warfare. In recent decades, it has significantly helped to fill Russian war chests, and Europe's dependence on the liquid goods transported via this framework could now be used to extort its economies. In September 2022, three of four Nord Stream pipelines exploded in the Baltic Sea, emitting 300,000 tons of methane, → Burning Soil 229 but other pipelines are still in operation, and countries such as Austria

2 Imre Szeman, "Pipeline Politics," *South Atlantic Quarterly* 116, no. 2 (2017): 402–7.

3 *The World Factbook — Central Intelligence Agency*, https://www.cia.gov/the-world-factbook/field/railways/country_comparison/.

4 See Ursula Biemann's impressive artistic research project "Black Sea Files," in *Mission Reports — Künstlerische Praxis im Feld: Videoarbeiten 1999–2011* (Zurich: Helmhaus, 2009), 84–101.

intend to fulfill their contracts to import Russian natural gas until 2040.

The lengthy prelude to this dire turn of events can tell us a lot about the pipeline as both a technological and a political object. In western Siberia, at Tyumen, lie the oil fields that have served both the COMECON states and the former petrochemical combine in Schwedt, East Germany (GDR), with crude oil since the 1960s. The *Druzhba* (Russian for "friendship") pipeline extends more than 5,300 kilometers through the Eurasian landmass beyond the Urals. In the early 1970s, the decision was taken to build another pipeline, this time for natural gas, with the allied socialist states all participating in the construction. It bore the name *Soyuz* ("union") and connected gas fields in western Siberia with Central Europe. Less well known is the fact that this project can be traced back to an agreement signed between the Soviet Union's minister for foreign trade and West Germany's minister for economic affairs in February 1970: pipeline pipes made in the German Federal Republic in exchange for Russian natural gas.[5] The aim was to contribute both economically and politically to German chancellor Willy Brandt's "Ostpolitik" of détente.

As early as 1980, the two countries made a similar follow-up agreement, undertaking to build another 4,500 kilometers of gas pipelines, stretching as far as eastern Siberia and Kazakhstan. The fact that sections of both natural gas projects carried out by the GDR were done so under the name *Druzhba* continues to cause confusion to this day. The construction sites, arranged as an "FDJ central youth project" on the Druzhba natural gas pipeline route (FDJ, *Freie Deutsche Jugend,* was the state youth organization in the GDR), were a means of communication and propaganda and became the stuff of legend in "actually existing socialism." → The Great Leap Forward 143 It is probable that no pipeline anywhere has been photographed, filmed, painted, and

5 Hajo Obuchoff, Lutz Wabnitz, and Frank Michael Wagner, *Die Trasse: Ein Jahrhundertbau in Bildern und Geschichten* (Berlin: Das Neue Berlin, 2012), 7–8.

extolled with greater frequency. To this day, greying former GDR welders enthuse about their adventures on the pipeline's construction sites.

Engineers and construction workers were sent to the Ukrainian steppe, along with musicians, performers, DJs (in "disco-mobiles"), and artists. Among them was the painter Wolfgang Liebert, who can be seen with his easel in front of the massive pipes at a gas compression plant in figure 6. The photographs of this extreme form of painting *en plein air* were taken by his artist friend Armin Herrman. Both men, the painter and the photographer, spent several weeks of each year from 1981 to 1987 on construction sites for the great gas pipeline from Siberia into Central Europe. Liebert's paintings — mostly in oil pastels; because of a lack of turpentine, he used petroleum as a paint thinner — reveal a petromodern update on cultural landscape painting. Herrmann's photographs capture the bold faces and poses of a brigade of welders. When we spoke to them, the two men described these stays as times of great freedom and artistic and personal self-discovery, even though the FDJ granted them the opportunity for ideologically motivated reasons. To them, this remote region amid the vastness of the USSR was a kind of "Wild East." The workers tasked with this enormous project, employing the latest machinery and materials from the socialist states, as well as from the Federal Republic of Germany, Finland, Italy, France, the United States, and Japan — the steel pipes were made by the German brand Mannesmann — had access to freedoms and rights to self-determination that would have been unthinkable amid the confines of the "small republic" of the GDR.[6] The aggressive geopolitical aspirations and military actions of Russia today, as Putin moves to restore the imperialistic grandeur of the former Soviet Union, have tainted this latently nostalgic view of the past.

The history of pipelines is almost as old as the oil age itself. Some of the first pipes were put in place in the legendary vil-

6 See ibid., 9–12.

lage of Titusville, Pennsylvania, as early as the 1860s.[7] In 1907, the construction of a pipeline linked the oil city of Baku to the Black Sea and global shipping routes. The intercontinental pipeline "Big Inch" was laid between Texas and the greater New York area in the 1940s, in order to bypass reliance on tankers that were under threat from German submarines. In 1940, there was a total of 187,000 kilometers of pipelines laid in US soil. → Louisiana165 And the advance of Allied troops in Normandy was supported by temporary systems in the English Channel, such as PLUTO (Pipeline Under the Ocean).[8] War infrastructure was also crucial for the first pipelines to transport natural gas in Eastern Europe. A pipeline built by Nazi occupying engineers in 1943, between the gas field of Dashava in the Ukrainian region of Boryslav and the Polish steelwork in Stalova Wola, became a model example of a postwar international natural gas pipeline in the Soviet sphere[9] — and it also became part of a system that heated Kyiv, Moscow, St. Petersburg, and Minsk with Ukrainian natural gas in the 1950s, long before the Siberian gas fields were tapped.

In contrast to oil, which can easily be shipped in tankers and transported on trains, natural gas was impossible to transport without a closed pipeline system (at least until the invention of mass scale LNG-transport). To this day, missing pipelines are a major reason for the mass-scale "flaring" or "venting" of natural gas (as opposed to selling), a common practice even in the United States.

In Western Europe, the postwar period saw oil and gas companies building pipelines in order to ensure frictionless transportation of enormous tonnages out of increasingly large crude oil tankers from ever-deeper port basins located in Rotterdam, → Greenhouse105 in the new oil terminal of Wilhelms-

7 Wilhelm Krass, Alfred Kittel, and Alfred Uhde, *Pipelinetechnik: Mineralölfernleitungen* (Cologne: TÜV Rheinland, 1979), 1.

8 Michael Poppe, *Integration von Infrastrukturen in Europa im historischen Vergleich,* Bd. 5: *Öl- und Treibstoffpipelines* (Baden-Baden: Nomos, 2015).

9 Per Högselius, *Red Gas: Russia and the Origins of European Energy Dependence* (New York: Palgrave Macmillan, 2013), 13–14.

haven, in Marseille and Trieste — primarily avoiding problems with inland waterway transport posed by ice drifts or low water levels — into the continent's interior. The natural system of flowing transportation — rivers — declined in importance, since the artificial streams in the pipelines began supplying the industrial chemical centers in Wesseling, Karlsruhe, Ingolstadt, and Vienna, which were originally built on large rivers to facilitate shipping.

Pipelines belong to the isolated world of the oil and gas industry; their steel pipes, hundreds of kilometers long, serve as a technological medium of transport, because they function as part of the landscape, on both large and small scales. Tunnel building, material engineering, soil mechanics, and groundwater management have to be conceived of as a system, and executed both scientifically and technically in a way that ensures the steel pipes, with their specific temperature and material capabilities, act as part of their nontechnological environment, adapting to soils, rocks, weather zones and groundwater streams, and ensuring perpetual flow. Similarly, transported materials such as oil, which is naturally fluid to begin with, must be treated as a difficult, complex natural entity unto itself. Different oil regions supply different mixtures of hydrocarbons with different levels of viscosity and flow properties. If refined products and crude oil are intended to be transported via a pipeline — one after the other and separated by spacers — then construction should allow for further molecular differences. → Science-Fashioned Molecules 71 Monitoring the technical and landscape system is as much a part of the operation as the technically and economically optimized batch management of a pipeline with different products. Even fluctuating electricity prices along the course of the pipeline should be factored into the calculations: which pump transports which substance when and at what speed.[10]

Clearly, there are tremendous differences in ecological standards — not only between industrial and developing countries, but also between countries such as Norway or the United

10 Krass, Kittel, and Uhde, *Pipelinetechnik,* 189.

States. Leakages and considerable damage arise more often as the result of political problems than technological ones. The equivalent of the amount of methane released by the sabotage of the Nord Stream pipelines is emitted globally because of planned sloppiness — every day.[11] As the case of the now-ruined German–Russian pipeline friendship of 2022 shows, pipelines do not merely run through soil and mountains — where technology could serve at least to monitor and manage the overall situation — they also travel through politically sensitive spaces and across borders. They open one region up and bypass others; they benefit one consumer and disadvantage another. They often operate according to the rules of a corporation, which exists outside of local political and environmental scrutiny. Conversely, entire states can be disconnected from the pipeline, or extorted via energy flow. It is not just enormous quantities of energy — transported around the clock in pipes measuring up to 120 centimeters in diameter — that are present at the receiving end, after having crossed all borders by pipeline. The societal problems and contradictions that the oil passes through along the way — be they in Siberia, the Midwest, Georgia, or Nigeria → Petroporn 173 — are always dangerously close at hand.[12]

The Russian invasion into Ukraine in 2022 has made clear that geostrategic areas of conflict are built into pipelines, and the explosion of the Nord Stream pipelines in the Baltic Sea in September 2022 — still under investigation at the time of this writing — was only the most spectacular scene in what could be interpreted as a generally dramatic historical screenplay, if it were not brutal reality. For decades, and particularly in Germany, there was hope that the close, almost organic pairing of producing and consuming nations via the pipeline's shared network of veins would make hostility impossible, because no one can pose an existential threat to their best customer,

11 See "Global Methane Tracker 2023," *International Energy Agency,* https://www.iea.org/reports/global-methane-tracker-2023/overview.

12 Andrew Barry, *Material Politics: Disputes along the Pipeline* (Oxford: Wiley-Blackwell, 2013).

but this has proven to be misjudged. The close links between industry, electricity and heat production, and Russian natural gas have proven fatal ever since February 2022, because both operation and withdrawal of the pipeline could be used as a means of destabilizing foreign nations. The ongoing operation of the pipeline is considered to be politically crippling, while a stop in supply would be economically so. The pipeline's comparatively simple, technological infrastructure poses a complex political dilemma. Major efforts may be required, entailing further risks — such as trading relationships with other politically problematic despots or regions with ecologically questionable extraction practices — in order to break free from the pipeline's chokehold.

The Druzhba pipeline has often been described as a means for economic extortion by the Soviet Union and its successor, the Russian Federation, but without historic experiences in Central and Eastern Europe finding their way into the Western European approach. In this way, countries that were connected to the system during the Soviet era, such as the Baltic states, Ukraine, and Poland, have been repeatedly exposed to attempts at extortion by Russia, the oil-producing nation.

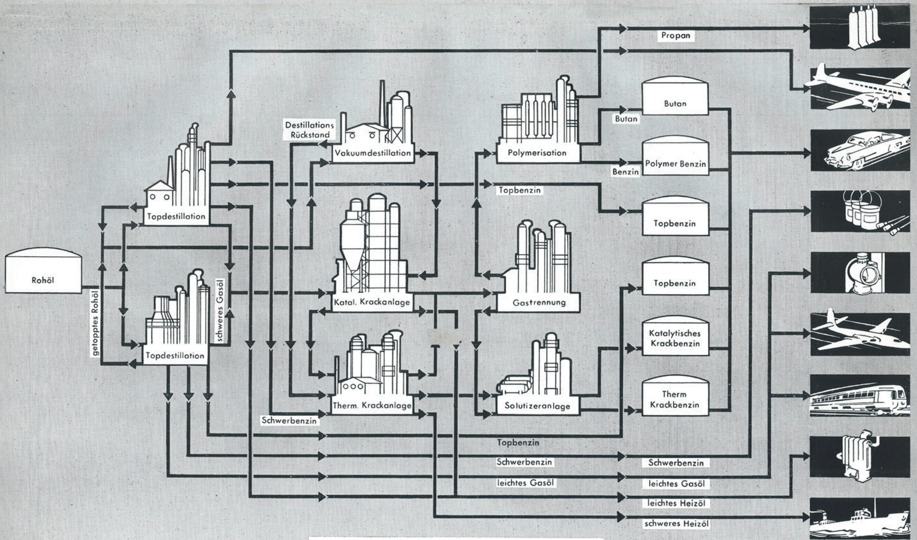
Sometimes it was back and forth, carrot and stick. In Belarus, the economy of which has long depended significantly upon refining Russian oil, which continued to be supplied at domestic market prices following the collapse of the Soviet Union, the end of a bilateral agreement to this end in 2020 and the threat of a breakdown in negotiations over its extension presented an existential threat. In early 2020, the Druzhba, which had been pumping from east to west for decades, had to pump in the opposite direction for the first time, in order to supply oil from other parts of the world to the state refinery in Novopolotsk via Poland. Because of the Belarussian regime's political approach to the war in Ukraine, this rationale has reverted back again.

If pipelines are, in this regard, considered to be sensitive media for the state of the global petro-organism, and if a critical public learns to use this to take the planet's pulse, this problem could well become an advantage. "This is where my story ends," declares the voice of the poet Mario Trejo, born in the Argentinian oil town of Comodoro Rivadavia, at the end of Bertolucci's *La via del petrolio*, "where Bavarian rococo meets the oil extracted in Persia, the Sahara or Sinai." Trejo offers a historical reading of this road:

> The oil transplanted from deserts to snow-filled areas has huge effects on a country's economy, technology, and sociology. It alters humanity's existence just as the wheel did, much like the first metals, gunpowder, steam engines, and electricity. At least one thing has become clear to us mere mortals after travelling thousands of kilometers along the pipeline through Europe: oil means past, present, future.[13]

This final point would have to be treated differently today, and the future of the pipelines that define our existence would have to be considered in a manner that expressly involves their ultimate dismantling. We would have to come off the track in order to learn not just how these "oleoducts" emerged as the hidden monuments of our time, but also what we ought to do away with or what might be converted, and how that might be achieved.
→ World Cultural Heritage 201

13 Bernardo Bertolucci, dir., *La via del petrolio* (RAI, 1967).



Vereinfachtes Fließschema der „SHELL Oil Comp. Montreal East Refinery"

← *Fig. 7*

Molecular Mobilization

Crude Oil Distillation, volume 5 of *ABC des Erdöls* (*The ABC of Oil)*, from the 1955 Shell Library, boasts impressive flowcharts (see fig. 7). One such chart sketches out the general principle of refining. At the beginning, there is a tank full of (presumably) raw, fossilized nature. This then leads into a system of pipes and chemical reactors. Various functional units appear in the form of pictograms, and, at the end, there is the stuff of modern life: aircraft, watercraft, and land-based vehicles, combustion-type heaters, welding gas, paint, and varnish.

And so crude oil marks the interface between two technological endeavors — what the industry refers to as *upstream* and *downstream*. Following on from seismology, geology, and drilling technology, the process universe of industrial chemistry begins, and it is only from this point onward that we reach *automobilized* history. → Sprawl 89; Cannonball 301

Both historically and systematically, refining begins with distillation. Depending on its deposits, crude oil, a natural substance, is composed of a very varied mixture of thousands upon thousands of different molecules, open- and closed-chain hydrocarbons, compounds of these hydrocarbons with oxygen and nitrogen, and also mixtures including other elements, such as sulfur. During distillation, these are sorted according to their

boiling points; longer molecules are separated from shorter molecules, lighter from heavier.

Since the 1920s, however, the refinery process has seen hydrocarbon molecules treated not just as natural substances requiring separation into substances of varying quality, but ones to be deliberately converted into synthetic materials by means of chemical industrial processes. A 1948 advert from Standard Oil of Indiana aptly summarizes this technology in its tagline "Science-fashioned Molecules for Top Performance."[1] Long molecular chains are "cracked"; they are rearranged or "reformed"; sealed into ring structures, or "cyclized" or "aromatized"; combined together or "polymerized"; and enriched with hydrogen or "hydrogenated." Hydrogen plays a particularly interesting role. Hydrogenation can be used to create a liquid, synthetic oil even from solid coal, and a high-quality fuel from inferior fractions of oil, which sees not only carbon but also hydrogen providing chemical energy. Chemical catalysis is the most important tool in this chemical toolkit, appearing in the graphic labeled prominently in its shortened form "Katal. Krackanlage," "catalytic cracking unit." Catalysts are substances that accelerate chemical reactions without ultimately appearing in the product of this reaction. The phenomenon was first described in the early nineteenth century as a kind of "contact action": an explosive gas mixture composed of hydrogen and oxygen can apparently be forced into a reaction by the mere presence of platinum — as demonstrated in spectacular experiments in 1820s Weimar by Johann Wolfgang Döbereiner, a friend of the German polymath Johann Wolfgang von Goethe, and put to commercial use in the form of a table-top lighter. Goethe himself thanks the inventor, "for I find the lighter you so happily invented is ready to hand every day and the uncovered important test of so energetic a

1 *The Inside Story of Modern Gasoline: Science-Fashioned Molecules for Top Performance* (Jerry Fairbanks Productions Inc., 1946), presented by the Standard Oil Company of Indiana, https://archive.org/details/0320_Inside_Story_of_Modern_Gasoline_The_21_01_00_00.

combination of two elements, the heaviest and the lightest, is continually of the most wonderful use."[2]

In 1835, the Swedish chemist Jöns Jakob Berzelius termed this type of reaction "catalysis," a coinage akin to "analysis." Yet the principle did not become a driving force of chemical industry until the end of the nineteenth century, when chemistry began to profit from the thermodynamic understanding of reactions. → Terminator 257 The Leipzig-based chemist Wilhelm Ostwald redefined the catalyst as an accelerator of a chemical reaction that is capable of occurring of its own accord, but at a much slower rate. This earned him the Nobel Prize for Chemistry in 1909.

Ostwald's new definition saw an inscrutable, uncanny force rendered into a measurable phenomenon and a universal tool of chemical, industrial, and ultimately macrosocial acceleration. The explosive nature of this innovation was recognized at once: "If one considers that the acceleration of reactions via a catalytic agent occurs without energy being expended, i.e., in such a sense, essentially *for free,*" writes Ostwald in a lecture of 1901, "and that, in all matters technological, and therefore also chemical, time is money, we see that the systematic use of catalytic aids leads one to anticipate the most profound transformations."[3] In fact, the substances that can be rendered producible within a few decades by the use of catalysts — fertilizers and munitions in nitrogen chemistry; fuels, pharmaceuticals, and solvents in the chemistry of hydrocarbons — entail further processes of acceleration, the "Great Acceleration," in a dromological[4] cascade: in mobility, in warfare, in population growth, in the economy,

2 Letter from Johann Wolfgang von Goethe to Johann Wolfgang von Döbereiner, October 7, 1826, in Alwin Mittasch, *Döbereiner, Goethe und die Katalyse* (Stuttgart: Hippokrates Verlag, 1951), 29.

3 Wilhelm Ostwald, "Über Katalyse: Vortrag, gehalten 1901 in der Versammlung der Gesellschaft Deutscher Naturforscher und Ärzte zu Hamburg," in *Abhandlungen und Vorträge allgemeinen Inhaltes (1887–1903)* (Leipzig: Von Veit & Co., 1904), 96.

4 See Paul Virilio, *Geschwindigkeit und Politik: Ein Essay zur Dromologie* (Berlin: Merve, 1980).

and in tourism. Or, to phrase it the other way around: at the foundation of the visible mobilization of vehicles, goods, people, whole economies,[5] and indeed — whether academic geology calls it "Anthropocene" or not — of processes in the Earth's systems[6] — which is characteristic of modern societies in the twentieth century, and has been described by authors such as Ernst Jünger as "total" — lies a molecular mobilization at work in chemical factories. → Temporal Abyss 241

The focus on catalysis as the core of this chemical mobilization shows that raw materials such as coal or oil only make history when combined with a whole system of other materials and infrastructures. In this way, sources of energy become — in the words of Jane Bennett — "vibrant matter."[7] Catalysts set other substances in motion in precisely this way, by forming volatile and therefore productive intermediate bonds: "In alternating processes of being wrapped and unwrapped, being switched on and switched off,"[8] noted Alwin Mittasch, a student of Ostwald, BASF laboratory director, and philosopher of catalysis. Crucial innovations in early catalytic industry stem from the chemistry of sulfuric acid and nitrates. Yet it is the chemistry of hydrocarbons in which synthetic catalysts serve as tools that not only accelerate but also direct chemical reactions, and in which the aforementioned principle of chemical building blocks emerges.[9] Depending on whether the starting materials CO and H are directed via iron, zinc oxide/chromium oxide, or zinc oxide/chromium oxide/alkali, the result will be methane, methanol, or isobutyl alcohol, and a whole different array of molecules composed of the basic building blocks of carbon and hydrogen,

5 Ernst Jünger, "Die totale Mobilmachung," in *Krieg und Krieger* (Berlin: Junker und Dünnhaupt, 1930), 9–30.

6 Will Steffen et al., "The Trajectory of the Anthropocene: The Great Acceleration," *The Anthropocene Review* 2, no. 1 (2015): 81–98.

7 Jane Bennett, *Vibrant Matter* (Durham: Duke University Press, 2010).

8 Alwin Mittasch, *Kurze Geschichte der Katalyse in Praxis und Theorie* (Berlin: J. Springer, 1939), 25..

9 Alwin Mittasch, "Einiges über Mehrstoffkatalysatoren," in *Von der Chemie zur Philosophie* (Ulm: J. Ebner, 1948), 67–91.

or already synthetic building blocks, such as ethylene (C_2H_4). Catalysts serve as a means of molecular design. And as propellants of a high order, catalysts are, for their part, the result of molecular design, since in many industrial applications they are not natural substances but a mixture of synthetic and systematically combined substances.

The development of dialectically synthetic catalysts from the 1920s onward in projects aiming to generate gasoline is spectacular. In order to tame the element sulfur, which was feared to cause catalyst poisoning and which was a challenge to remove from coal and oil, BASF developed sulfide catalysts that already contain the poison.[10] Like a double agent, sulfur switches sides and now works for rather than against the catalyst. Similarly, cooperation also exists between former adversaries on a business level: between coal chemistry and the petroleum industry, between IG Farben and the Standard Oil Company. In 1929, US money was required to rescue the German project. Patents and stocks were shared, and such joint laboratories and structures as the Catalytic Research Associates (CRA) emerged in Baton Rouge, Louisiana.

A new phase of petromodernity began, as an intercontinental, interfossil alliance — just a few years before these one-time partners found themselves on different sides of a world war. In Baton Rouge in 1942, this cooperation nevertheless gave rise to the first catalytic fluid bed reactor in history, → Louisiana 165 where, in the practical process that differs from the theory, the expended catalyst mass regenerated in a continuous eddy current in a second reactor and was fed back into the process. To put it pointedly, the war saw oil cracked in this way on a mass scale triumph over coal gasoline, produced in eternally insufficient quantities in German hydrogenation plants in Leuna, Pölitz, Wesseling, Blechhammer, Scholven, and other places.

10 Anthony Stranges, "Germany's Synthetic Fuel Industry," in *The German Chemical Industry in the Twentieth Century,* ed. John E. Lesch (Dordrecht: Springer Netherlands, 2000), 147–216.

Yet, at the same time, out of this constellation rich in contradictions emerged the age of "science-fashioned molecules" that were so typical of the postwar era. Raw fossil resources from the Earth's history no longer defined the scope of technology, politics, consumption, and prosperity, but indicated the degree of their internal molecular mobilization.

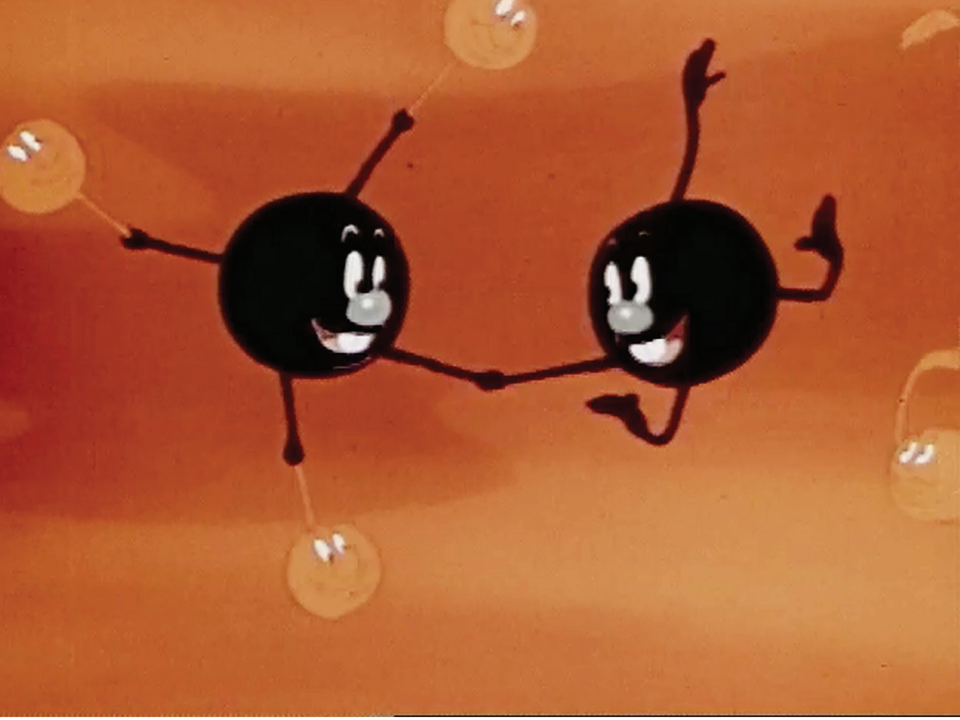
This access to the molecule has depended on, and continues to depend on, planetary calculations. Around 1900, the synthesis of ammonia in Germany followed global, geostrategic plans to replace Chilean saltpeter for munitions and fertilizer, which was easy for the British navy to block. → Ammunition 97 And the intercontinental development of coal gasoline since the 1920s has at its foundation a fear that spread among all industrialized societies at this time, namely, that the end of oil was predicted to come in 1940, a fear that would arise again periodically. → Burning Man 285; Cannonball 301 These global and planetary perspectives, world markets and world wars, mobilize the means required for this level of molecular mobilization, which then changes planetary calculations in turn.

Catalytic chemistry first developed as a tool to molecularly and internally mobilize the riches of fossil raw materials. Around 20 to 30 percent of global GDP currently depends on its products. But despite all the efficiency of catalytic processes, 80 percent of the chemical industry's energy demand and 75 percent of its greenhouse gas emissions can be traced back to catalytic processes. What is required is not just new catalysts, but also new process architectures, in order to permit several reactions to occur at low temperatures simultaneously, perhaps following the example of biochemical processes. But again, it is crucial to remember that only planetary necessity, only the political will to systematically replace fossil energy with other forms of energy can initiate a new mobilization of the microlevel toward sustainable cycles of materials and energy.

According to Robert Schlögl, German catalysis chemist and former director of the Max Planck Institute for Chemical Energy Conversion, the complex to strive for is a "solar refinery."[11] Renewably generated electricity would be used for water-splitting and, in doing so, contribute to the sustainable production of hydrogen — sometimes with even higher yields than with natural photosynthesis. This could then aid the manufacture of synthetic hydrocarbon molecules, which could be treated as chemical energy stores in existing infrastructures and burned in a climate-neutral way in existing engines. Chemical technology has the potential to be the climate's savior and "gravy train."[12] However, one cannot predict for certain whether a problem caused by technology can be solved through technological means. What's clear, however, is that if it succeeds, the problem's molecular and planetary levels, and the solution, would have to be considered together. This is the only way to use the means and infrastructures of fossil chemistry to think beyond fossil chemistry altogether.

11 Robert Schlögl, "Solar Refinery," in *Chemical Energy Storage* (Berlin: De Gruyter, 2013), 235–55.

12 Barbara Gillmann and Klaus Stratmann, "Hinter dem Wasserstoff-Thema verbirgt sich die größte Gelddruckmaschinerie: Interview mit Anja Karliczek und Robert Schlögl," *Handelsblatt,* February 6, 2020, https://www.handelsblatt.com/politik/deutschland/anja-karliczek-und-robert-schloegl-hinter-dem-wasserstoff-thema-verbirgt-sich-die-groesste-gelddruck-maschinerie/25507504.html.



← *Fig. 8*

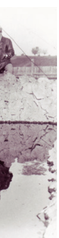
Science-Fashioned Molecules

Advertisements from the 1930s to the 1960s — an era that saw the first great expansion in motoring — see fuels often appear in human form: "My name's Shell Benzin. I'm in the gasoline family. Most people only know me by sight — when I flow out of the nozzle and into their tank, for instance," explains one fuel in the German *Shell Atlas* from 1962.[1] It continues: "My real job starts in the carburetor. This is where I'm mixed with air and turned into a fine mist, because that's the only way a gasoline engine can stomach me. Once I'm in the closed cylinder, the piston compresses me until my body temperature reaches 600 degrees. Then there's a sudden spark, and the ignition plug helps my spirit reveal its full power. I burn."

And *The Inside Story of Modern Gasoline,* a promotional film from Standard Oil of Indiana, released in 1946, features cheerful carbon atoms with four arms, and their one-armed friends, the hydrogen atoms, who make up the whole world of hydrocarbons (see fig. 8). Inside the engine, teamwork is especially important. Untamed, stubborn natural substances often work against each other instead of working together, leading to misfires. This is why it is crucial that "science-fashioned molecules" collaborate in a disciplined manner.

1 Ferdinand Mayer, ed., *Der Große Shell-Atlas* (Stuttgart: Mair, 1962), 79.

Despite all the anthropomorphizing and playing down of chemical processes, this rightly conveys the fact that the fuels burned in the engine are in no respect products of nature; they are complex and highly technical cultural products — even if their foundation may be what we think of as a natural resource. The film also visualizes first contact among life forms over millions of years of the Earth's history. This little enactment does more to express the truth about the relationship between petromodern humans and fuels than the promotional strategy team's chosen aesthetics might lead one to suspect. After all, we learn what and who we are in our partner's reflection. From a sociopsychological perspective, therefore, it comes as no surprise that when humanity looks into the mirror of technology, it sees humanoid beings looking back. → Black Mirror 247 Yet what reflects and what is reflected develop reciprocally, even if only one side of this process actively operates. For this reason, it would be just as important to pay attention to the technoformities, in this case "fuel-formities," which arise out of these reflective processes.



In "A Cyborg Manifesto," the American philosopher Donna Haraway speculates about the coevolution of different lifeforms.[2] Certain capabilities in species only develop in association with other lifeforms. And it's not just dogs that are artificial beings brought about by breeding; human beings would similarly not be human beings if they had not spent thousands of years learning alongside dogs about what community is. This concept of coevolution doesn't stop at the loyal gaze of human's best friend. The most elementary vital processes, such as metabolism, are only possible in unconscious partnership with lifeforms so numerous that bacteriologists and biologists by no means know precisely how many billions of them can be found within the human organism.[3]

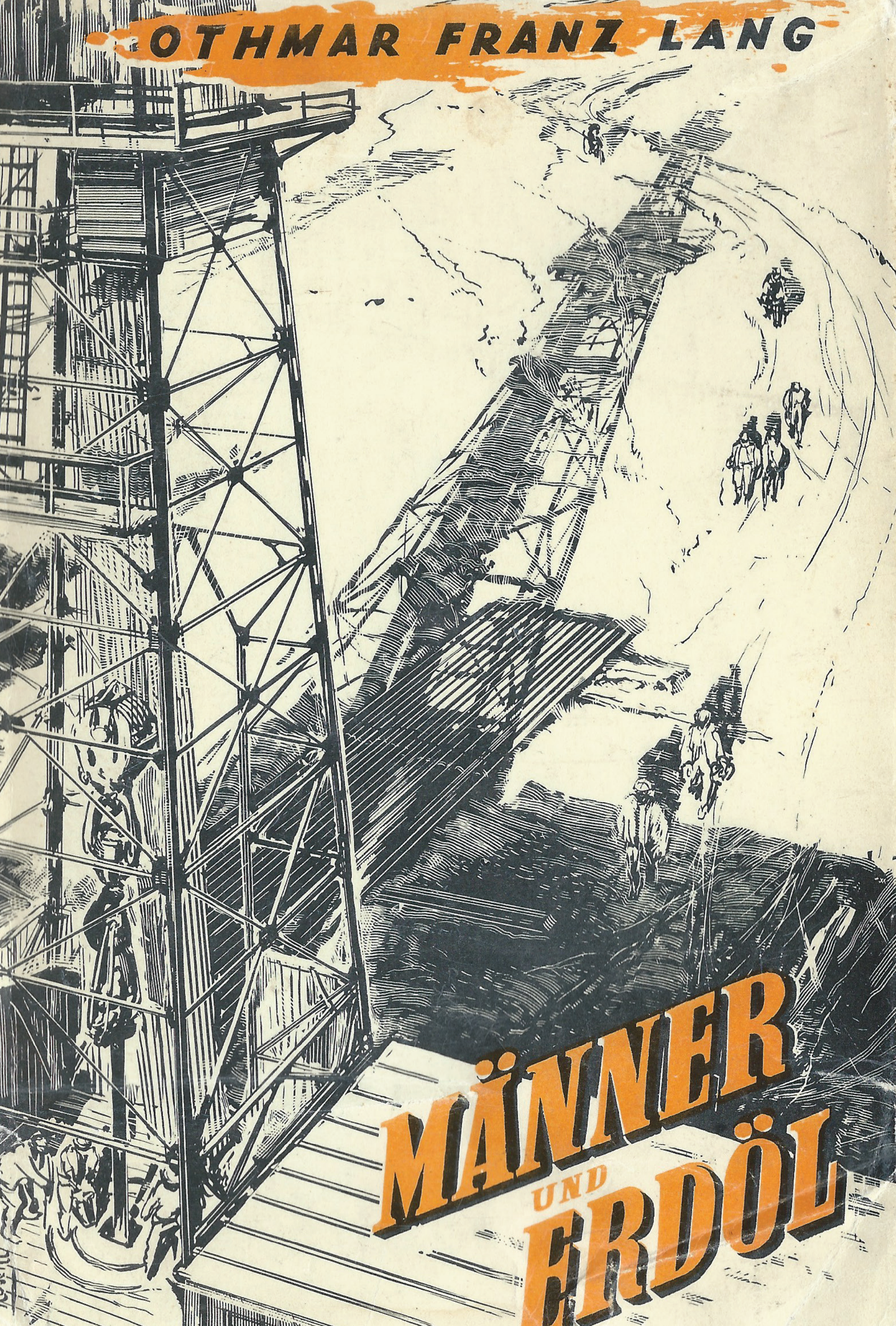
2 Donna J. Haraway, *The Companion Species Manifesto: Dogs, People, and Significant Otherness* (Chicago: Prickly Paradigm Press, 2003).

3 See Lynn Margulis, *The Symbiotic Planet: A New Look at Evolution* (London: Phoenix/Orion, 2001).

We likely know much more about the existence and impact of hydrocarbons on our side. The short but radical evolution away from a *Homo sapiens* living in closed, solar economic cycles to the Anthropos of the Anthropocene, capable of changing the history of the Earth → Pierced Earth 121 was only possible because of the parallel development of new hydrocarbons for fuels or plastics, an extension of what Olivia Judson describes as the evolution of the Earth's energy regime.[4] This development accounts for a self-intensifying dynamic between the cultures of "Hydrocarbon Man," on the one side, demanding ever-greater quantities of energy and using them to develop further at a rapid rate, and the continuously rising outputs, optimization levels, and chemical transformations of fossil fuels, on the other. The artificial molecules in the Shell refinery mentioned above, and in all other refineries, have emerged, much like petromodern technologies, economies, and lifestyles, literally through the interplay of human culture and hydrocarbon materiality.

In the imaginary world of advertisements, the strangely informative conviviality with our molecular friends has faded away again since the 1960s. In real life, however, the confirmation that hydrocarbons are the true and most significant companion substance has continued to build. Every plastic bag photographed in the Mariana Trench by a diesel-powered submersible demonstrates the collaborative reach of hydrocarbon humans and human hydrocarbons. → The Song of Styrene 235

4 Olivia P. Judson, "The Energy Expansions of Evolution," *Nature Ecology & Evolution* 1, no. 0138 (2017).


OTHMAR FRANZ LANG
MÄNNER
UND
ERDÖL

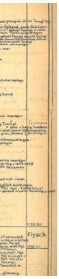
← *Fig. 9*

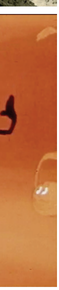
Men and Petroleum

"He drilled his holes. One by one, each as neat as the last, and he did it with zeal." Rivalry over a woman forms the background to this tribute by an oil worker to his chief engineer in Lukas Bärfuss's play *Oil*. It explains the caricaturish exaggeration of the image at the high point of the speech: "Day after day, he drove his long pipe into Mother Earth's womb with love, and smiled in ecstasy as he did it."[1] → Pierced Earth 121

One of petromodernity's most popular promises is that the progress it provides will benefit every individual and, in doing so, lead to greater equality among people, regardless of sex or background.[2] Yet this is contradicted by the persistence with which heteronormative and even racist clichés are maintained, and a toxic kind of masculinity propagated, in the representation of core petromodern technologies — from drilling platforms to SUVs — clichés long deemed dubious in other fields. Indeed, the days when US oil workers rode around the oil fields and drilling platforms like macho cowboys are long gone. → Terminator 257 Working in an oil field nevertheless remains a male domain. For a long time, women were permitted access to the field at

1 Lukas Bärfuss, *Öl: Schauspiel* (Göttingen: Wallstein, 2016), 60.
2 Stephanie LeMenager, *Living Oil: Petroleum Culture in the American Century* (New York: Oxford University Press, 2014), 7.





most as paleontologists. And, to this day, heavy machinery and heavy physical work feature as the most prominent element of photographic and film-based representations of this work, even though oil production and extraction depend just as heavily on delicate measuring equipment, laborious data processing, and scientific expertise. → Drill Record 29

One particularly expressive genre in this respect is the German-language *Rohstoffroman* (raw material novel), which enjoyed significant public attention and achieved a circulation of millions of copies from the 1930s to the 1950s. It can also, in a broader sense, be credited for the novel from which this chapter takes its name, *Männer und Erdöl* (Men and petroleum) by Othmar Franz Lang, published in Austria in 1956, which tells the story of the Austrian petroleum industry (see fig. 9). → Adventurers 129 The subject at the heart of the raw material novel was a geopolitics of materials. These novels provide both an understanding of the strategic role of raw materials and an overarching ideological structure. The protagonists, ingenious chemists, and daring engineers are consistently male. Matter is fundamentally malleable and imposes no insurmountable boundaries on the ingenious spirit, entirely in accordance with a patriarchal hierarchy that goes back to the ancient philosophy of nature conceiving of matter as feminine and passive, and form or spirit as masculine and active. → Science-Fashioned Molecules 71 "And the idea became matter by fancy, faith, and work," summarizes Karl Aloys Schenzinger, one of the most well-known and successful proponents of the genre, in one of his later novels.[3]

"Make yourself happy — fuck the world," reads a graphic created by the Dutch comic artist Theo van den Boogaard in the early 1970s, and then reproduced by Klaus Theweleit in *Male Fantasies,* his classic exploration of "armored masculinity."[4] It shows a befuddled young man literally embracing the globe and

3 Karl Aloys Schenzinger, *Bei I.G. Farben* (Munich: Wilhelm Andermann Verlag, 1953), 325.

4 Klaus Theweleit, *Male Fantasies,* Vol. 2: *Male Bodies: Psychoanalyzing the White Terror* (Minneapolis: University of Minnesota Press, 1989), 247.

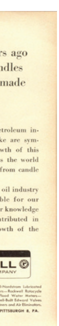
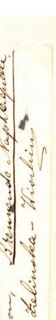
penetrating it with his erect penis. It is left startlingly unclear as to whether this is done with violence or tenderness; in petromodernity, however, everyone has the opportunity to "fuck the world" with a big gas-guzzler, the crude flipside of the promise of prosperity for all. The matter of men and petroleum takes in the performance of gender — acting out socially defined gender roles[5] — by both "men" and "women" (and by all other gender identities that might one day be possible). So "men and petroleum" takes aim not just at the world of oil-related male work but also particularly at the realms of all experiences opened up by oil-related technologies.

Stereotypically butch and "harsh" masculinity, as it is embodied in the raw material novel, also arises in classic petro-films. Consider films such as *The Wages of Fear*[6] (1953), *Giant*[7] (1956), or *Hellfighters* (1968), in which John Wayne, in a characteristically masculine performance, portrays the legendary firefighter Red Adair (Chance Buckman in the film), who specialized in putting out burning oil wells.[8] → Burning Soil 229 An almost caricaturish exaggeration of petromasculinity can also be found in the sci-fi film *Armageddon* (1998), in which Bruce Willis plays an oil driller who is sent to an asteroid making its way towards Earth, in the hope that he might split the asteroid in half and in doing so save the world. The high point comes when the asteroid that threatens the Earth is successfully drilled and blown up.[9]

It seems particularly important today to exhibit the petromasculinity of the oil pioneers in all its unscrupulousness and brutality, in order to hold up a mirror to the present era with its different manifestations of crisis-ridden, reactionary hypermasculinity.[10] The return or persistence of political macho men such Vladimir Putin and Donald Trump confirms this fear. The

5 Judith Butler, *Bodies That Matter* (New York: Routledge, 1993).
6 Henri-Georges Clouzot, dir., *Le Salaire de la peur* (Vera Films, 1953).
7 George Stevens, dir., *Giant* (*Warner* Bros., 1956).
8 Andrew V. McLaglen, dir., *Hellfighters* (Universal Pictures, 1968).
9 Michael Bay, dir., *Armageddon* (Jerry Bruckheimer Films, 1998).
10 Cara Daggett, "Petro-masculinity: Fossil Fuels and Authoritarian Desire," *Millennium: Journal of International Studies* 47, no. 1 (2018): 25–44.



link between Trump's obscene playboy persona and the petro-regime is obvious. And Putin — sitting at the controls of real-life fighter jets — similarly embodies petromodern masculinity to an almost phenotypic degree. Politically speaking, these two men stand for holding onto fossil power in all its facets, through state-run corporations, such as Gazprom, and natural gas supplies as tools of geopolitical extortion; → Pipeline 53; Zombie 309 or consider that Rex Tillerson, a former Exxon chairman, was installed as the Trump administration's first secretary of state. → Oleoviathan 113 It remains to be seen, though, whether these exaggerations strike at the core of the complex, techno-social-mental constellation of petromodernity, or simply affect that portion of personnel companies set aside for the "dirty work." The question remains as to how patriarchal and chauvinistic petromodernity was as a whole, and how highly the emancipation dynamics developed within it are to be valued. → Baku 135

The significance of the role of the automobile in the emancipation of women has been noted time and again. Indeed, some of the most important pioneers in motoring and aviation were women, such as Bertha Benz, wife of Carl Benz, inventor of the automobile, who embarked upon the first long-distance automobile ride in history with her sons in the backseat in 1888, or Clärenore Stinnes, the daughter of an industrialist who, together with the photographer Carl-Axel Söderström, was the first person to drive around the world in an automobile from May 1927 to June 1929,[11] or the pioneering pilot Elly Beinhorn, who, from December 1931 to July 1932, flew once around the world in a small aircraft.[12] But where are the women at the top of energy and automobile companies? And what happened to all the women who weren't among this vanishingly small group of daring adventurers?

In liberal, democratic nations where "the customer is king," oil-consumption technology paves the way for the logic of con-

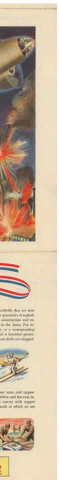
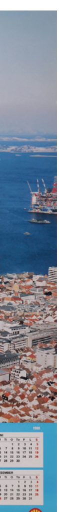
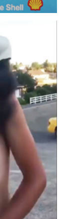
11 Clärenore Stinnes, *Im Auto durch zwei Welten (mit Photos von Axel Söderström)* (Vienna: Promedia Verlag, 1996).

12 Elly Beinhorn, *Alleinflug: Mein Leben* (Munich: Herbig, 2007).

sumer society. The promotion of petromodern consumer culture to reigning social model has occurred in parallel to the blossoming of the advertising industry. Together, they sell a notion of gender that poses as modern, progressive, and emancipatory, but which is reactionary at its core, in which housewives must be as beautiful and attractive as Hollywood goddesses and who, at best, use the family's second car to pick up the kids and do the shopping, while men get the fancy car and of course pay for both.

One of petromodernity's legacies that has thus far had little light cast upon it is cosmetics and the associated shift and simultaneous cementation of gender roles. Vaseline, also known as *petrolatum* and *petroleum jelly,* a salve-like blend of hydrocarbons produced from distilled petroleum waste and patented in the United States as early as 1872, remains to this day the most important base for cosmetic products. Thus, cars and makeup both share a dependency on oil. In 1900, only relatively few women wore makeup, for professional purposes: aristocratic women stepping out as groomed *grandes dames,* actresses, and women marketing their bodies as sex workers — or as all three — but as early as the late 1920s, the notion of "natural" female beauty in the United States required that a woman wear makeup even at home. "They're doing their bit by keeping their femininity; that's one of the reasons we are fighting," claims an advertisement from World War II, the words sitting above the image of a housewife with perfectly mascaraed lashes, penning a letter to her husband at the front.[13] The advert was put out by Maybelline, inventors of the makeup essential, mascara: an oil-based base material enriched with carbon black, a soot pigment made from natural gas. When the wartime economy led to a restriction on supplies of petroleum products to nonmili-

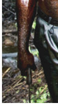
13 "They are doing their bit by keeping their femininity. That's one of the reasons we are fighting," in Cecily Devereux, "'Made for Mankind': Cars, Cosmetics, and the Petrocultural Feminine," in *Petrocultures: Oil, Politics, Culture,* eds. Sheena Wilson, Adam Carlson, and Imre Szeman (Montreal: McGill-Queen's University Press, 2017), 162–86, esp. 175.

tary fields, the Pentagon sent a warning to the White House: "The war should not create a glamor shortage," because "such a loss of beauty […] might lower national morale."[14] The intervention was a success, and the cosmetics industry was able to continue production, its products having been declared a war-critical resource. → Ammunition 97 In its mask-like quality, petromodern makeup culture — which demands that women manufacture femininity by putting in the hours in front of the mirror — shares a little with the "blackface" of oil workers in heroism-loving oil films. Their faces are drenched or smeared with oil in an expression of joy or triumph, such as James Dean's in *Giant,* or a Soviet film from 1953 celebrating the construction of the Neft Daşları platforms in the Caspian Sea off Baku.[15] → World Cultural Heritage 201 With joy and absolute tenderness, two oil workers smear each other's faces with the oil bubbling out of a freshly tapped well, as if they were applying war paint. The images say less about men and technology than they do about magic rituals, possessed bodies, and spiritual relationships. → Burning Man 285 They spark associations that break through the confines of a simple history of technology, queering the field of familiar classifications of identity,[16] inviting readings that go beyond the heteronormative.

In the face of the persistence of sexualized and gender-role-cementing images of petrotechnology, it seems all the more important to question these images and replace them with others. → Petroporn 173 Neither a vehicle such as the Tesla Cybertruck, with its design inspired by stealth bombers, nor the efforts of big energy companies to pinkwash their image[17] are likely to contribute anything substantial to the change in mindset required; even if the former, the electric vehicle, is promising a post-petromodern future and the latter choose to present themselves

14 Ibid., 177.
15 Marc Wolfensberger, dir., *La cite du pétrole* (Intermezzo Films, 2009).
16 On the term "queer," see Butler, *Bodies That Matter,* 223.
17 No Pride in BP, Platform, and People & Planet, "Fight BP's pink-washing. A briefing for LGBTQ rights campaigners," *Platform,* https://platformlondon.org/app/uploads/2017/02/Fight-BPs-pink-washing-1.pdf.



as the engines of a fair and tolerant society. A queer perspective of societal images for energy and technology,[18] however, would open up the possibility of creating a different relationship between industry, bodies, and nature, one of the manifold entanglements with undetermined options for power or control, a multidirectional and polycentric happening, in which "men" are just one vector among many.

18 Kathryn Yusoff, "Queer Coal: Genealogies in/of the Blood," *philoSOPHIA* 5, no. 2 (2015): 203–29, and Jenny Ingemarsdotter, "Normal Cars and Queer Driving: Or, Why Charlie Loved to Speed," *Lambda Nordica* 22, no. 1 (2018): 38–70, https://www.lambdanordica.org/index.php/lambdanordica/article/view/496.


SHELL führt durch den Motor
Nr 2
1/150 Sekunde entscheidet über Qualität
Wir stehen unter der Zündkerze — ein greller Funke zwischen ihren Elektroden entzündet das Gasgemisch und löst eine gewaltige Arbeitsleistung aus. Nur 1/150stel Sekunde dauert der ganze Vorgang. Voraussetzung für augenblickliche Entzündung und gute Verbrennung sind unbedingt zuverlässige Betriebsstoffe. Weltweite Erkenntnisse und Erfahrungen schufen Qualitäten wie
SHELL Kraftstoffe
Sie vergasen leicht, verbrennen vollkommen und gewährleisten die mathematisch genaue Wiederholung jeder Verbrennung. Die volle Kraftausnutzung wird gesichert durch den reibungsmindernden reißfesten Schmierfilm der hochwertigen SHELL AUTOOELE. Sie sind abgestimmt auf alle Motortypen und werden nach modernsten Verfahren in deutschen Fabriken hergestellt. Immer und überall
SHELL AUTOOELE
SHELL hat für jeden Motor den richtigen Kraft- und Schmierstoff

← *Fig. 10*

Engine

"Before us sits the engine. Dead, seemingly numb, but when it awakes, it is a giant in its work."[1] A six-part advertising campaign, "Shell führt durch den Motor" (A Shell Guide to the Engine), in a 1938 edition of motoring magazine *DDAC-Motorwelt,* pitches the engine compartment as an obstacle course for an interested group of visitors (see fig. 10): "We're in the engine's combustion chamber. This is where quality is constantly and unrelentingly tested. This is where concentrated energy is released. The effect is gigantic: about 6,000 piston strokes per minute — every ignition sees around 2,000 kg or more pressed onto piston head at temperatures of over 2,000 degrees Celsius."[2]

Indeed, what is being evoked here — the time and place at which the fuel's energy transfers, via the act of explosion, into the motion of the pistons and the transmission and, in doing so, becomes available for human use — is a key scene in petro-modernity. It is repeated countless times each day, in billions of combustion engines across the world. Unlike steam engines, the first prime movers of the modern industrial age, a combustion engine does not involve chemical energy being converted into kinetic energy via a detour involving heat and water vapor;

1 "Shell führt durch den Motor Nr. 6," in *DDAC-Motorwelt* (1938), 515
2 "Shell führt durch den Motor Nr. 1," in *DDAC-Motorwelt* (1938), 285.

instead, the conversion is a direct one. This affects which fuels may be used in the process. Whereas a boiler could and would be heated with practically any fuel — coal, peat, wood, old tires, or even organic waste — combustion engines only work with fairly narrowly defined substances, manufactured in chemical processes. Unlike coal and oil, "gasoline" and "diesel" are not notions of sensory experience but products of chemistry, extracts artificially manufactured through distillation, fractions of the sum of crude oil molecules. → Molecular Mobilization 63

And the "octane rating" at every filling station provides a subtle hint that engines are refueled with even more select substances, with outright "chemical individuals";[3] 2,2,4-Trimethylpentan, or iso-octane, from which the octane rating takes its name, is a hydrocarbon molecule with the formula C_8H_{18}. In an even narrower sense, it is precisely one of the numerous structures possible under this formula. In 1926, this individual substance was declared the standard thanks to its optimal combustion properties in gasoline engines.[4] At the other end of the scale is another chemical individual, a fuel with the greatest tendency toward misfiring ("knocking"), n-Heptane (C_7H_{16}). The quality of all other fuels is determined according to this gauge; 98-octane gasoline has the effect of a substance that is 98 percent iso-octane and 2 percent n-Heptane.

Nothing, down to the exact structure of the molecule, can be left to chance when it comes to steering a technical course for fire — be it autoignition, as in the case of the diesel engine, or using spark plugs, as with the gasoline engine. You can take the Shell advert at its word: "We're under the spark plug — a bright spark between its electrodes ignites the gas mixture and triggers a powerful output. The whole process takes just 1/150 of a second. A reliable fuel is an absolute necessity for instant ignition and good combustion."[5] In accordance with this, a technological-sci-

3 Edmund Waldmann, *Erdölbestandteile: Bisher aus Erdölen isolierte chemische Individuen* (Vienna: Verlag für Fachliteratur Ges.m.b.H, 1937).

4 Wolfgang Ellissen, *Antiklopfmittel und Ottokraftstoff-Qualitäten in Deutschland, 1923–1973* (Bad Lauterberg im Harz: Kohlmann, 2002), 16.

5 "Shell führt durch den Motor Nr. 2," in *DDAC-Motorwelt* (1938), 299.

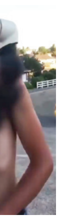
entific feedback system of gauge gasolines and test engines has been in use since the first decades of the twentieth century. The aim of this is to create optimal blends, such as the German ARAL gasoline, developed in the 1920s by Walter Ostwald, son of the catalysis chemist Wilhelm Ostwald, from aromatic compounds and aliphates (ar + al = ARAL). Other optimized fuels consist of synthetic molecules, or use additives such as tetraethyl lead ($C_8H_{20}Pb$), which enhance the performance of basic fuels.

The freedom gained from compact, light combustion engines, controlled paradigmatically by individuals rather than lumbering collectives — be it in an automobile, a Jet Ski, a helicopter, a diesel generator, or a garden appliance — is all thanks to a maximum degree of molecular control. "A Shell Guide to the Engine" is especially clear-sighted in this regard, despite or perhaps because of its historically oppressive context in a publication medium that was compiled during the era of National Socialism: subjects are only motorized because chemical individuals → Science-Fashioned Molecules 71 in the engine compartment are activated in unison and transfer chemical energy to a piston at a precise moment and without misfiring.

But the controlled nature of a process that is hidden behind steel walls is precisely what makes it so difficult to appreciate — no matter how significant, how ubiquitous, or how typical it is for the history and societies of the twentieth century. And the advertising campaign "A Shell Guide to the Engine" demonstrates the effort necessary in terms of design and perspective, in order to draw this process into the public consciousness, not just opening up the engine but by appearing to present the explosive goings-on from the molecules' perspective.

But a transparent engine wouldn't just be an ambition for tech heads. Since Bertha Benz set off on the first long-distance car ride in history in 1888, the engine has developed into a keystone of petromodern subjectivity and power. → Men and Petroleum 75 Yet the foundation of this power is growing ever-more elusive, be it behind steel cylinders or onboard electronics. Is this a first step toward an anthropological shift? Do humans, born culturally and evolutionarily of fire, need to have the fire of

the engine explained to them again in a new way, because they suppose it to be self-explanatory and no longer understand it? Or ought it to be actively forgotten, in anticipation of humanity's farewell to fire? A majority of the technological fires currently driving technology and industry will have to be quelled in the coming decades out of consideration for the climate. The transition will be almost impossible to accomplish without an insight into the role of fire in both the evolution of man and the evolution of modern, interventional science,[6] which can hardly be overstated.



Gaston Bachelard's *The Psychoanalysis of Fire* acknowledges the central significance of the cultural technology of fire, and its afterlife, to the modern age, → Burning Man 285 but it overlooks the unseen, treasured fire of the combustion engine.[7] There are undoubtedly psychological aspects to the fossil-industrial engine power that has been unleashed en masse in modern societies, supposedly eternally available and, in this way, integrated into our image of ourselves. We must confront them. If engine fuels, Peter Sloterdijk hypothesizes, "do not just drive our engines but also burn within our very existential motives, in our vital concepts," if we are actually "no longer capable of imagining freedom which does not entail the freedom to pursue perilous accelerations, the freedom of locomotion to the most distant destinations, the freedom of hyperbole and waste, even ultimately the freedom of explosions and self-destruction,"[8] then the relationship between humanity and the engine seems to have been skewed.

We might wish to determine whether freedom that permits us to think only in terms of motorization is in fact freedom at all — or rather a façade obscuring dependency. → True Oil 251 When

6 Jens Soentgen, *Pakt mit dem Feuer: Philosophie eines weltverändernden Bundes* (Berlin: Matthes & Seitz, 2021).

7 Gaston Bachelard, *A Psychoanalysis of Fire,* trans. Alan C.M. Ross (Boston: Beacon Press, 1964).

8 Peter Sloterdijk, "Wie groß ist 'groß'?" in Paul J. Crutzen et al., *Das Raumschiff Erde hat keinen Notausgang: Energie und Politik im Anthropozän* (Berlin: Suhrkamp, 2011), 97.

it comes to recognizing and evaluating fossil-fueled freedom as such, both now and in the future, in order to transfer the fossil-powered freedoms we deem valuable to a post-fossil era, it is not just engines we will have to open up, but motorized subjects themselves. → Cannonball 301

← *Fig. 11*

Sprawl

Writing about the autobahn from the perspective of Lower Bavaria in 1981, Herbert Achternbusch, a Bavarian artist, filmmaker, and author — whom the East German dramatist Heiner Müller once dubbed "a classic artist of the anticolonial liberation struggle within the territory of the FRG" — said: "Even the place where I live is part of The World now. It used to be Bavaria. Now it's The World. Like the Congo or Canada, Bavaria has been conquered and is governed by The World."[1]

The clash between local cultures and the possibilities, demands, and practices of (Western) petromodernity is what is known in petrocritical theory as the "oil encounter." The term can be traced back to the Indian writer Amitav Ghosh, *Petrofiction: The Oil Encounter and the Novel.*[2] Ghosh discusses the novel series *Cities of Salt* by Jordanian author Abdelrahman Munif, which sets its sights on the transformation of Saudi society brought about by the exploitation of its gigantic oil reserves, to reflect on what is, in Ghosh's view, a dearth of twentieth-century Western literature examining the significance of oil.

1 Herbert Achternbusch, "Die Autobahn," in *Du hast keine Chance aber nutze sie,* Bd. 4., *Das Haus am Nil, Schriften 1980–1981* (Frankfurt am Main: Suhrkamp, 1987), 193–99.

2 Amitav Ghosh, "Petrofiction: The Oil Encounter and the Novel," *The New Republic,* March 2, 1992, 29–34.

It remains to be seen whether Ghosh's analysis gets to the heart of the matter. Or whether the absence of great "petrofiction" that he criticizes can be justified by, if nothing else, the fact that, in the twentieth century, other genres, such as science fiction, and other art forms, such as film and photography, were the media of choice for society to interrogate the effects of technological modernity.[3]

However, it is by no means the case that the oil encounter can only be found on the peripheries of Western society. The people in the countries where petromodern developments had their beginnings were the first to feel its effects; those who found themselves in landscapes and interiors that have been literally reshaped by oil, in forms of settlements, and working and domestic environments that can be read as products of oil itself.

Notably, it is the perspectives on being en route in a car → Cannonball 301 or an airplane that depict the intrusion of "The World," and therefore oil, into our physical and mental landscapes. William Eggleston's photograph *En route to New Orleans* can be interpreted as an iconic example of this pictorial tradition. The image shows an enticing orange/amber-colored drink in a transparent plastic cup, filled with ice cubes, on the foldaway table of a passenger plane. An arm looms into the image from the right. There is no person to be seen, only a hand gracefully stirring the drink with a straw. The plane's interior might look a little shabby, but this gesture lends the scene a celebratory, elegant feel. Sunlight slants through the airplane window, it makes the liquid in the plastic cup gleam and throw colorful, crystalline shadows, almost like a depiction of the Annunciation from the late Middle Ages. In the window, gradations of blue and white: a film of fluffy white clouds dotted here and there, above sky, horizon, and sea.

3 For a discussion of Gosh's dictum see also the section "Writing Oil" in the introduction chapter to Stephanie LeMenager's *Living Oil: Petroleum Culture in the American Century* (Oxford: Oxford University Press, 2014), 11.

The image originates from Eggleston's "Los Alamos"[4] group of works, which emerged between 1966 and 1974, and constitutes a journey on the trail of the expanding petromodern sphere in the southern United States. This image is the only one in the series that captures that space from the elevated position of an airplane. All the others demonstrate what might have been found on the way to the airport: shopping carts, filling stations, patches of ground sealed with concrete or asphalt reaching to the very edge of the image, luminously colorful drinks, car dealerships, a collection of plastic dolls on the hood of a car. Even the colors contrast petromodernity with the much older and paler palette of the traditional houses and vegetation of the South.[5]

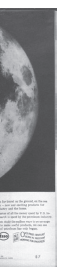
Barely half a century of petromodernity later, in 2008, the Los Angeles photographer Alex Prager orchestrates an explicit remake of Eggleston's image of freedom with *Nancy,* the photograph that introduces this segment of our atlas (see fig. 11). Prager described her first encounter with Eggleston's photography as a pivotal event, and her image also reveals a drink gleaming in a plastic cup atop a foldaway table. However, in this image, the person to whom the drink belongs — a women with long red hair — has moved fully into the photo yet remains half in darkness, with her arm leaning on the armrest. The drink, which seemed to promise a little piece of heaven in Eggleston's work, remains untouched. The two windows cut into the image reveal no gleaming, transcendental blue, but rather an earthy-colored sprawl, a rampant grid of houses and streets that make up a suburb. "The Big Valley," the name of the series to which this image belongs, is not a natural formation but a proliferation of human settlement activity, specifically the area of Greater Los Angeles — the petromodern metropolis par excellence — extending almost unendingly, a maze of asphalt, front yards, and concrete.

4 William Eggleston, *Los Alamos,* ed. Thomas Weski (Zürich: Scalo Verlag, 2003).

5 On the impact of color, cropped image details, and (petromodern) motifs in Eggleston's photography, see Thomas Weski, "Entwurf einer Vorstellung," in Eggleston, *Los Alamos,* 172–75.

There seems to be a yawning gulf in terms of the shifting of mentality between the images captured by Eggleston and Prager. No more ocean of sky. No transcendental promise. → Rocket 159 Instead, there is a sea of suburbs. A shuttered world. A puppet town, made of oil. Why bother flying when you don't even see the clouds? What has happened in the forty years between these two images? This downward view of a landscape reshaped by oil, as seen in Prager's photograph, really gets to the heart of the power of the petromodern era.

In an atlas of petromodernity such as this, flying takes on a role of manifold significance. For one thing, it represents the height of what is possible with the socio-technological means of this era. It stands for freedom, the oil-powered fulfillment of the dreams of Icarus and Phaëthon, of illuminated Siberian shamans and rides out to the witches' sabbath. → Space Travel 271



Additionally, aviation and space travel are the maximum means available to one of the scientific technologies central to all exploration of the Earth and the creation of atlases: cartography. Maps merely imagine the ideal godlike gaze and the gaze of power that seeks to draw closer to the gods,[6] and geodesists are only able to artificially create this gaze over the Earth from below, using all kinds of cumbersome apparatus, linear measurements, theodolites, and pen and paper, but flying makes it possible to truly assume this position. This changes the relationship between maps and the Earth. Soon after their introduction during World War I, aerial photography and photogrammetry presented a cartographically indispensable tool, and not just for military reconnaissance. The orthophoto, a straightened-out, precisely orthographic aerial photo, becomes the standard for every map.[7] With the advent of mass air traffic in the postwar decades — which, contrary to all ecological logic, expanded in the 1990s into subsidized cheap air travel for weekends away,

6 Thomas Macho, "Übersehen," in *AutoBahn und Medien*, eds. Walter Pamminger et al. (Vienna: PVS Verleger, 1995), 0–8.

7 See an introduction to the atlas, "Kartenlesen: Vom Bild zur Karte," in *Diercke Weltatlas*, ed. Thomas Michael (Braunschweig: Westermann, 2015), 12.

commuting, and shopping day trips — the view from above becomes an experience available to the masses.

And here emerges a third way in which flying has a role to play in the atlas. It is only the view from above that permits us to recognize the landscape as a product of petromodernity.

Prager's view of the sprawl — in which it is unclear whether the plane is poised to leave this area, or whether it is returning to it, or whether it might perhaps never be in a position to detach itself from the Earth — is a perfect example of this. "Air traffic takes place on the ground,"[8] both logistically and technologically, Lars Denicke claims in his dissertation titled "Global/Airport." Runways made of petromodern materials, bituminous asphalt, or concrete — that ubiquitous element of housing developments — are what are literally required for a plane to be able to lift off from the ground. The latter is responsible for around 8 percent of global CO_2 production, due in part to the chemical reaction for creating cement itself, but also because immense quantities of coal, old tires, and petroleum coke — a coal-like residue left over from refining — are burned in the process.

Once they have lifted off from the leveled Earth, airplanes are also connected and related to everything that a passenger might see below. First of all, airports: intercontinental hubs that have long embodied the complexity of whole cities, and that are positioned on the global map as paradigmatic sites of petromodernity between Denver, Istanbul, Dubai, and Beijing. Then highways lie over the landscape like extended runways reaching toward the horizon. Cars themselves seem like airplanes stuck at a point in their development. You see lightweight-design industrial estates built in the style first developed in the aircraft industry, where another half of the building always seems to be under construction, a myriad of lights that do not, however, illuminate hangars or obstacles, but instead merely light up the emptiness of the sprawl at night. You see villages where a nonmotorized

8 Lars Denicke, "Global/Airport: Zur Geopolitik des Luftverkehrs" (PhD diss., Humboldt University of Berlin, 2012), 18, https://edoc.hu-berlin.de/bitstream/handle/18452/17972/denicke.pdf.

life is an impossibility, because the nearest workplaces, schools, and shops are dozens of kilometers away. You see regions that might not exist at all in their current socioeconomic states if it were not for aviation, touristic reserves from Mallorca to the Maldives, but also seemingly dignified capital cities, which define themselves according to a kind of lifestyle competition held between several continents, linked by airplanes.

Even when you seem to have escaped civilization altogether, you can catch glimpses from above of commodity districts, linked by air travel, usually kept out of sight on the ground with a host of fences and guards. Glimpses of pipelines in the tundra, vast areas of tar sands in Canada, the Neft Daşları production platform, hidden from Google Maps, in the Caspian Sea. → World Cultural Heritage 201 And over Greenland, you can see the glaciers melting.

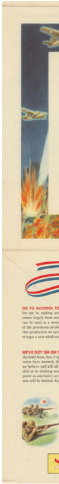
From the ethereal tip of the pyramid of technology, from aviation, its earthly foundation comes into view. Space travel constitutes the most extreme form of this new positioning. And the view it permits, back over the Earth, is defining a new standard for cartography, be it for war rooms or smartphones. The first space missions — and with them the first images of the Earth from space — were successfully carried out just as Eggleston was working on "Los Alamos." For the first time, the globe no longer manifests as a mere model plastered all over with colored paper, but as photographic proof of a real sight. The image of the "blue planet" becomes an icon of a new, holistic — that is, ecological — view of the Earth.[9] This maximal overview reveals its object in a manner that is not simplified, but complete in its interconnectedness and its fragility: an Anthropocene planet, reshaped by humanity.[10]

Walter Benjamin characterized humanity's position following the harrowing experience of World War I — the first indus-

9 Kevin W. Kelley, ed., *Der Heimatplanet* (Frankfurt am Main: Zweitausendeins, 1989).

10 Diedrich Diederichsen and Anselm Franke, eds., *The Whole Earth: California and the Disappearance of the Outside* (Berlin: Sternberg Press, 2013).

trial and petromodern war — in the following terms: "A generation that had gone to school on a horse-drawn streetcar now stood under the open sky in a countryside in which nothing remained unchanged but the clouds, and beneath these clouds, in a forcefield of destructive torrents and explosions, was the tiny, fragile human body."[11] → Ammunition97 On the basis of current knowledge, you can be sure that even clouds no longer signal any guarantee of continuity, but that humans and their fuels have been woven into them — whether you see them from an airplane en route to New Orleans, from an Apollo mission, or from Achternbusch's Bavarian forest.



11 Walter Benjamin, "The Storyteller: Reflections on the Work of Nikolai Leskov," in *Illuminations: Essays and Reflections,* trans. Harry Zohn (Boston: Mariner Books, 2019), 27.

BOMBS FOR BERLIN... TERROR IN TOKYO!

3 Out of Every 5 Bombs Dropped on Axis Targets Are Made Possible by Esso Research

Did we say Oil is Ammunition?

Here's a proof. The basic ingredient of T.N.T., the explosive used in bombs, shells, and torpedoes, is toluol. In the last war toluol came from coal. In this war the United Nations need far more toluol than the coal industry can produce.

Fortunately, in 1935 Esso research workers, in cooperation with the U. S. Army, found a way to make toluol synthetically from petroleum. In October, 1941, a toluol plant, built in accordance with our specifications and under our supervision, was completed for the Army Ordnance Department which *more than doubled* America's T.N.T. output.

We shared this process with other refiners so that three out of five bombs dropped on Axis targets will be filled with T.N.T. derived from Esso-developed toluol.

HUNDREDS OF ESSO PRODUCTS DRAFTED FOR THE DURATION

In war-time Esso products turn up with the most unexpected assignments. Here are just a few more examples of how civilian oil is helping to win Victory for the United Nations.

ESSO MARKETERS

OIL TO ALCOHOL TO PLASTICS AND POWDER. Alcohol for use in making artificial fabrics, plastics, and explosives comes largely from molasses, sugar, or grain. Now petroleum can be used as a source and Esso Marketers will make 30% of the petroleum alcohol produced in this country. Thanks to that production we save for America's sweet tooth 300,000 tons of sugar a year which would otherwise be needed for munitions.

ASPHALT IN THE ARMY. New Army airfields that are now being rushed to completion take immense quantities of asphalt—the asphalt that used to go into road construction and repairs. And asphalt has many other uses in the Army. For instance, it has proven highly satisfactory as a waterproofing agent applied to paper sleeping bags. And it furnishes protection to the spiral containers in which certain shells are shipped.

WE'VE GOT 'EM ON THE RUN. That enemy of all armies, the body louse, has, it appears, met his Waterloo. Esso Laboratories have recently developed a petroleum product which we believe will kill all lice, fleas, ticks, and chiggers, on the skin or in clothing seams. If present Army and British tests prove as conclusive as ours, the only safe place for such vermin will be behind Axis lines.

THREE SPEEDS FORWARD. Petroleum Wax, one of our refinery products, goes into all three grades of wax which are supplied to the ski troops of the United States Army. One is especially made for climbing up slopes, another for running, and one for high-speed, down-grade travel.

NO MILDEW. Under certain conditions tents and tarpaulins contract mildew which injures the fabric and lets rain in. This can be avoided by treating the canvas with copper naphthenate, made from naphthenic acids of which we are producing large quantities.

SABOTEUR No. 1. Rust has been routed. Today your Army and Navy are using an Esso product called Rust-Ban to prevent corrosion of metal parts in use, in transit, and even in manufacture. One grade protects and lubricates the clips of the fast-firing Garand rifle. Another Rust-Ban is applied to tank engines that may be idle for seventy-two hours or more. Rust-Ban qualities have also been incorporated in oils that lubricate as well as protect. This has made possible the smallest anti-friction bearing ever used—an aviation instrument bearing of less than 1/10 of an inch in diameter.

MISSIONS OF MERCY, TOO. Not all Esso products are used in engines of destruction. Some of our petroleum jellies, white oils, and alcohols find their way into healing lotions and disinfectants which are used by the Medical Corps of the United States Army and Navy.

OIL IS AMMUNITION — USE IT WISELY!

← *Fig. 12*

Ammunition

"Oil is ammunition. Use it wisely!" In 1942, on the occasion of the United States' entry into World War II, the *Esso War Map* shows petroleum and petrochemistry as actual weapons of war: as fuels and lubricants, as ski wax for mountain troops, as a raw material for synthetic rubber and medicine for military doctors, as rust protection, and even as a remedy for lice. The illustration in figure 12 is a veritable celebration of bombing raids: "Bombs for Berlin, Terror in Tokyo!" Toluol, the basic ingredient in TNT bombs, the *War Map* explains, has recently been manufactured from petroleum.

In the twentieth century, petroleum is both a weapon of war and a military objective; it is both fuel and explosive. Together, these aspects create an expansive system: oil supplies the energy required to capture more energy. It drives the engines of tanks and fighter planes, rockets, and helicopters, and in doing so it serves as the foundation of the century's most important armaments. As early as 1843, a much-quoted remark from Heinrich Heine makes it clear that even a transport system can be a kind of weapon: "Space is killed by railways, and we are left with time alone."[1] Transport systems that operate outside of fixed

1 Heinrich Heine, *Vermischte Schriften* (Hamburg: Hoffmann & Campe, 1854), 78, quoted in Wolfgang Schivelbusch, *The Railway Journey: The*

infrastructures such as rails or roads, that is, across country or through the air, eliminate the space factor in terms of resistance even more radically. No swamp, no range of hills, no wall or desert can offer any kind of protection. A front can open up anywhere a paratrooper might swoop in, anywhere a helicopter or cruise missile might land, anywhere a crawler might be able to plough through the terrain. The engine is the platform for this use of force, possible anywhere, and yet it's also much more than that; the fuel chemist Walter Ostwald goes so far as to compare it to "a utopian machine gun, but one which wants to mix the gunpowder for each shot itself."[2]

Some of the most well-known and most powerful weapons unleash the force concentrated in petroleum in a targeted manner. From the seventh century CE onward, the Byzantines began using "Greek fire" to set fires and throw flames — these hydrocarbons could not be quenched, and they even burned in water, thanks to various ingredients that remain unknown to this day. The substance constituted a kind of miracle, secret weapon for the Christian Byzantines, until — writer Arno Schmidt describes in a 1956 think piece that takes a view both historical and related to the nuclear arms races of the 1950s — Muslim, Arab chemists drew level with them when it came to causing terror.[3] Modern flamethrowers were used regularly until well into the twentieth century. They have now been outlawed under the rules of war, but the principle of using hydrocarbons as a weapon is still in use in many fields. Factory-produced Molotov cocktails were used on the Finnish front in World War II, and since then homemade variations have been used on the streets. Explosive devices filled with heating oil and used as barrel bombs attained tragic notoriety in Syria. And napalm, which was banned after the Vietnam War, is also a hydrocarbon weapon.

Industrialization of Time and Space in the Nineteenth Century, trans. Anselm Hollo (Berkeley: University of California Press, 2014), 37.

2 Walter Ostwald, "Kraftstoff im Kriege," *Kraftstoff* 16 (1940): 167–69.

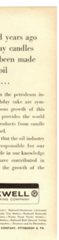
3 Arno Schmidt, "Griechisches Feuer: 400 Jahre Geheimwaffe," in *Griechisches Feuer* (Bargfeld: Haffmanns Verlag, 1989), 7–11.

The age of modern ammunition began in the late nineteenth century with smokeless powder. In place of mixtures of chemically unconnected substances that were relatively ineffective, there were now explosive molecules. From amidst the chemistry of nitrates and hydrocarbons emerged substances such as nitroglycerine ($C_3H_5N_3O_9$), which explodes without producing smoke — entirely, and with a maximum of explosive force per unit of space — because, the chemist and philosopher Jens Soentgen writes, "every atom is enlisted."[4] But other hydrocarbons, such as methanol, → World Cultural Heritage 201 also serve as the basic material for ammunition, or are themselves explosive, such as in aerosol or thermobaric bombs. These involve small proportions of gasoline or methane being finely dispersed and then ignited. The deflagration has a devastating effect. The largest conventional bomb ever detonated was a Russian aerosol bomb tested in 2007, which exceeded the explosive power of smaller atomic bombs. In 2017, the US Army used aerosol bombs on a system of tunnels in Afghanistan. The Russian rocket launchers TOS-1 and 2, equipped with thermobaric warheads, were similarly used in Afghanistan, in Grozny in Chechnya, in Aleppo, and most recently in Ukraine in 2022. → Zombie 309 They are the vanguard of contemporary, petromodern horror.

The British navy's switch from coal to oil combustion in 1911 under Winston Churchill, first lord of the admiralty, is considered a historic first for its epoch-defining use of petroleum as a military fuel. The principal advantage of this liquid fuel is a reduction in the time it takes to heat up the machine, which can be of crucial strategic importance. Similarly, oil-powered ships can, unlike coal-powered ships, be refueled on the high seas — as will later prove possible for airplanes in mid-flight.

Yet there is in fact a precursor to this well-known Atlantic innovation. The tsarist Caspian Flotilla was oil-powered from the late 1870s onward. → Baku 135 The development of special injection nozzles made it possible to use the comparatively heavy petroleum from Baku in steam engines. In 1893, both the

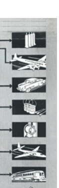
4 Jens Soentgen, *Konfliktstoffe* (Munich: oekom verlag, 2019), 73.



Russian fleet and the Russian railways switched to oil. → Black Square 263 For the first time — and thanks to the cooperation of Azeri and international entrepreneurs — a comparatively harmless lamp oil became engine fuel, and therefore a strategic factor.[5] → Oleoviathan 113 Since then, geostrategy has become almost synonymous with observing the geographical distribution of hydrocarbons.

In retrospect, even World War I was won with oil. "The Allied cause floated to victory upon a wave of oil," according to one well-known remark by Lord Curzon to the Inter Allied Petroleum Conference in 1918.[6] It took great efforts to supply German submarines with Galician and Romanian diesel oil — for the price of darkened petroleum lamps in Vienna — while the Entente kept global supply routes open.

With the outbreak of World War II, motorized units took center stage. The successes of Germany's blitzkrieg in Central and Western Europe were achieved with Soviet oil; only following the termination of the Hitler–Stalin pact and the German attack on the Soviet Union launched in June 1941 did the Caspian oil fields become a target that could not be regained — contrary to a well-known (and fabricated, presumably by the Soviet secret service) film scene in which Adolf Hitler is served the Caspian Sea as a sea of chocolate and Baku in the form of a piece of cake for his birthday. Romanian, Austrian, and Hungarian petroleum, and, above all, coal gasoline produced synthetically in hydrogenation plants kept the war machine running. But even with the greatest chemical-industrial efforts, it was impossible to permanently make up the deficit when compared with the petromilitary mega-nations of the United States and the Soviet Union. → Posidonia Shale 189; Molecular Mobilization 63 Because of a lack of fuel, even the German Messerschmitt Me 262 — a prototype of postwar fighter jets — stayed grounded. Thus, the "total



5 Eve Blau and Ivan Rupnik, *Baku: Oil and Urbanism* (Zürich: Park Books, 2018), 56–59.

6 Daniel Yergin, *The Prize: The Epic Quest for Oil, Money, and Power* (New York: Simon & Schuster, 1991), 183.

war" unleashed by Germany left behind a country destroyed by Allied aircraft bombs.

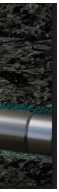
Since 1945 and since Hiroshima and Nagasaki, nuclear armament has denoted the limits of what is militarily feasible. But beneath the cosmic threat potential of uranium or hydrogen bombs with the equivalent explosive power of up to 50 million metric tons of TNT, molecular energy storage remains central, not least as fuel for nuclear bomb carriers in the form of aerially refuelable B-52 bombers, or cruise missiles, or also in reconnaissance planes that circle the Earth twenty-four hours a day.

The Cold War and Pax Americana cemented a state in which oil was elevated to the staple foodstuff on which the world's economy now runs. In the shadow of bloc confrontation, the Middle East became a guarantor and a factor of uncertainty for a superpower built on oil imports.[7] → Priceless 149 Declared and undeclared armed conflicts at all levels of intensity, sometimes labeled as the US "War on Terror," can be traced back to the geopolitics of oil created in the postwar period. Local dictatorships are supported or overthrown, equipped, or ostracized, depending on what better serves the calculations of supply security.

The fuel systems developed for supersonic aircrafts, such as the Lockheed SR-71 in the 1960s, mark a key position in the forefront of military hydrocarbon technology.[8] For speeds of Mach 3 — that is, approximately three times the speed of sound — and the thermal deformations that occur to the machinery as a result, these supersonic aircrafts were refueled on the ground with the specialized jet fuel JP-7, which contained additives making it extra resistant to combustion, until the intentionally leaky tanks closed as a result of frictional heat and the fuel took on its desired molecular form as a result of the chemical absorption of frictional warmth, in order to then be forced into a chemical reaction in the engines with the aid of catalysts. In order to conceal the ionization of the atmosphere occurring at these heat

7 Rüdiger Graf, *Öl und Souveränität* (Berlin: De Gruyter, 2014), 66–70.
8 Niels Klußmann and Armin Malik, *Lexikon der Luftfahrt* (Berlin: Springer, 2018), 358.

zones, and consequently their visibility on radar, however, it was necessary to turn to nuclear physics and to add cesium — which can only be produced in nuclear reactors — to the exhaust gases.
→ Frontier of the Technosphere 223



The program was discontinued following the end of the Cold War because of the enormous costs involved, particularly for storing JP-7. And asymmetrical wars are lost rather than won with napalm or supersonic technology. Nevertheless, air strikes reliant on fossil fuels and carried out in a more or less "smart" manner were the method of choice in the wars in Yugoslavia, Iraq, and Afghanistan.

And bizarrely, military aviation fuel from the Cold War has also left its mark on popular culture. On August 28, 1988, at an air show at the Ramstein US airbase in Rhineland-Palatinate, Germany, three aircraft in the Italian air force display team collided in midair before catching fire and hurtling into the 300,000 spectators watching from the ground: 70 people were killed in the resulting fireball, and around 1,000 were injured. The band Rammstein, founded by avowed socialists in former East Berlin in 1994, explicitly named themselves after West Germany's worst aviation disaster (the slightly different spelling is intentional). Rammstein is one of Germany's most successful cultural exports, notably in the United States, despite — or perhaps because of — their hyperaffirmative militaristic shows. The band is known for their legendary flamethrowing costumes — these are not fueled with petroleum, but with Chinese lycopodium powder, a natural product — but, above all, for the amount of energy one of their concerts requires. Smaller venues might otherwise be prone to power outages, so each evening sees generators, which take up two of the band's twenty-four tour trucks, translating approximately the equivalent quantity of fuel that exploded in Ramstein in 1988 into warm stage lighting and rich sound from the band's 380,000-watt system; that's almost 1,000 liters of fuel.[9]

9 Alexander Gorkow, "USA, 20.56 Uhr," *SZ-Magazin,* August 14, 2012, https://sz-magazin.sueddeutsche.de/musik/rammstein-band-usa-tour-79122.

Yet hydrocarbons — the most compact chemical energy stores — will survive in any technology of war that is not reduced to infowar or cyberwar, even if at some point no more oil can be produced, despite fracking. As trials by the US Navy have already demonstrated, aircraft carriers fitted with nuclear reactors make it possible to manufacture JP-5 fuel for their aircraft in onboard chemical factories with the aid of sea water. Using CO_2 dissolved in the water and also hydrogen attained via electrolysis, it is possible — provided there is sufficient energy, be it nuclear, hydraulic, or solar — to compose almost any hydrocarbon chemically catalytically.[10] → Molecular Mobilization 63

The most radically possible innovation in wartime dealings with fuel, however, is described neither by a soldier nor by a chemist, but the often belittled Munich cabaretist and avant-garde artist Karl Valentin. “These days I keep reading everywhere in the papers that there’s a big gasoline shortage,” he announced, having been bombed-out himself, to his audience in 1944, continuing:

> And no wonder! The Germans fill up their planes, load them with bombs, fly to England, throw the bombs out and fly back. How much gas does that use? And what do the English do? They fill up their planes, load them with bombs, fly to Germany, chuck the bombs out, fly back, and they need a lot of gas too. Wouldn’t it be easier if the German planes just flew over Germany and dropped their bombs here and the English planes flew over England and dropped their bombs there? The result would be the same. But think how much gas we’d save![11]

10 Daniel Parry, “NRL Seawater Carbon Capture Process Receives U.S. Patent,” *U.S. Naval Research Laboratory,* June 8, 2016, https://www.navy.mil/Press-Office/News-Stories/Article/2259523/nrl-seawater-carbon-capture-process-receives-us-patent/.

11 Karl Valentin, quoted in Helmut Bachmaier, *Warum lachen die Menschen?* (Grünwald: Komplett-Media, 2011), 22.

← *Fig. 13*

Greenhouse

The satellite image shows the Port of Rotterdam (see fig. 13). Every year, about 100 million metric tons of petroleum reach Europe's largest port and one of the world's biggest trading centers for crude oil. Half of this is processed on site, in refineries in the port area; the other half is sent via pipeline to Belgian and German refineries. The port's hinterland is all of Europe. But it is the little known, petrochemical-agrarian aspect of this geography — and not the famous, transport engineering-related aspect — that ought to be of most interest here. In fact, the satellite image also shows a European center of fossil-organic metabolism.

Metabolic processes are an essential criterion for all life. Lifeforms translate fleeting radiation energy into chemical energy stores; other lifeforms metabolize these chemical energy stores in order to release the energy and generate movement and warmth. → Frontier of the Technosphere 223 There has been a quantitative concept of human metabolism since around 1790, when chemists sealed human test subjects in oilcloth suits for a number of days and weighed and measured all of their chemical "products" in minute detail.[1] Animals, plants, fungi, protozoa,

1 Barbara Orland, "Die Erfindung des Stoffwechsels," in *Stoffe in Bewegung*, eds. Kijan Espahangizi and Barbara Orland (Zürich: diaphanes, 2014),

and bacteria all occupy different roles in the classification of living things because they carry out different forms of metabolism: photosynthesis or fermentation, taking in and giving out air, food, and excrement. Cycles of metabolism are formed in relation to each other, in the depletion of plant-produced oxygen by animals, and, vice versa, in the provision of CO_2 for the growth of plants. The waste product of one process is the starting product of the other.[2]

Humankind's metabolic system corresponds, on the one hand, to that of other animals. We breathe and require oxygen; we're carnivores or herbivores. On the other hand, the art of making and tending fire has allowed for a crucial expansion of the human metabolic system, leaving evolutionary traces even in the biochemistry and bacteriology of our digestive systems.[3] Since the earliest ceramics, metallurgy, and pharmacy, the chemical household of humanity — a technological species — has gone far beyond food and breathable air. Since then, the firewood converted into thermal energy and the material conversion of the clay bowls and other tools used in even the simplest cooked meal would have to be factored into its metabolic economy if you wanted to describe it properly and in detail.[4]

The tapping of fossil resources sees this perspective expand once again. Fossil energy and molecules are now built into both the technological and biological cycles of humans: "Good calorific provision and a high component of meat in the diet today may be attributed in the first place to the fact that more

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71–93.

2 An early representation of these cycles can be found in Robert Mayer, *Die organische Bewegung in ihrem Zusammenhange mit dem Stoffwechsel* (Heilbronn: C. Drechsler, 1845). See also Emanuele Coccia, "Pflanzenphilosophie: Die Wurzeln der Welt," in *Von Pflanzen und Menschen: Leben auf dem grünen Planeten,* eds. Kathrin Meyer and Judith Elisabeth, exh. cat. (Göttingen: Wallstein, 2019), 32–36, esp. 35–36.

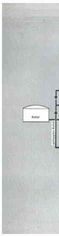
3 Stephen Pyne, *Fire: Nature and Culture* (London: Reaktion Books, 2012).

4 See Marina Fischer-Kowalski, *Gesellschaftlicher Stoffwechsel und Kolonisierung von Natur: Ein Versuch in sozialer Ökologie* (Amsterdam: G+B Verlag Fakultas, 1997).

energy is invested in agriculture in the form of fossil fuels than its biomass returns."[5] And the German original of Sieferle's text goes one step further: "We are, in effect, consuming coal and petroleum." Even the production of fertilizers by means of the Haber–Bosch process is a branch of petrochemistry. → Molecular Mobilization 63 In the beginning, around 1910, the hydrogen in ammonia was industrially produced with water and coal, but it has also been gleaned from natural gas for a number of decades. The massive boom in this industry in the 1960s, for instance in Louisiana, → Louisiana 165 was reliant not least on the development of new natural gas deposits.[6]

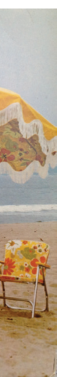
The satellite image of the Port of Rotterdam shows the consumption of fossil-based resources intensifying. The port is not just a trading center, it is also a process landscape. → Louisiana 165 South of the estuary arm of the Rhine River — known here as "Nieuwe Maas" or the "Nieuwe Waterweg," covering 40 kilometers between the edge of the city and the petroleum terminal on the artificially raised island, Maasvlakte 2 — are row upon row of tank farms and refineries. To the north of the river is a more compact, but similarly large area (identifiable in the satellite image by its silvery structures), boasting one of the largest landscapes of greenhouses in Europe. Together, they constitute a fossil-ecological system.

After all, it is not just products that accrue in the refineries, but massive quantities of CO_2, and, as in every metabolic system, the waste product from one process can serve as a raw material to be used in the other. Hundreds of thousands of metric tons of CO_2 are pumped under the river and into the greenhouses on its northern bank through a pipeline system spanning several hundreds of kilometers, in order to be metabolized by tomatoes, cucumbers, and lettuce. In this way, we eat oil liter-



5 Rolf Peter Sieferle, *The Subterranean Forest: Energy Systems and the Industrial Revolution,* trans. Michael Osmann (Cambridge: White Horse Press, 2001), 135.

6 Benjamin Steininger, "Ammonia Synthesis on the Banks of the Mississippi: A Molecular-Planetary Technology," *The Anthropocene Review* 8, no. 3 (2021): 262–79.



ally, not merely indirectly via the energy footprint of industrial agriculture, which has, for some time now, lived less on sunlight and more on fossil energy thanks to transportation, artificial fertilizers, heating, and the machines required, → Zombie 309 as expressed in the Rolf Peter Sieferle quote above.[7] By consuming the products of these kinds of greenhouses, we are literally taking up fossil carbon from oil into our bodies. → True Oil 251

The Linde Group estimates the contribution of the Shell refineries to Dutch vegetable production to be around 400,000 metric tons of industrial CO_2 a year. This is an unusual case, because petrochemical companies do not typically celebrate their intervention in the ecosystems in the surrounding environment. A harmful greenhouse gas now becomes something useful: “Plants need carbon dioxide to grow. The more they get, the better,” the company proudly declares.[8] This cancels out the consumption of a city with 150,000 inhabitants, according to claims in the Linde Group journal,[9] because the refineries no longer release their CO_2 into the atmosphere and the greenhouses are no longer burning natural gas themselves in order to promote growth and produce CO_2 — which implies that we had previously been eating fossil carbon from natural gas, entirely without realizing.

On the one hand, the ecological value of the Rotterdam intervention makes sense. In this case, laying a pipeline allows for a wasteful and environmentally damaging system to be closed, reducing its emissions. On the other hand, we must ask ourselves where this actually leads, and how sustainable it is to systematically and consciously expand the human metabolic niche using fossil foodstuffs. The fact that foodstuffs are obliged to loudly declare whether or not they contain traces of shell-

7 See also Richard Manning, “The Oil We Eat: Following the Food Chain Back to Iraq,” *Harper’s Magazine,* February 2004, 37–45.

8 “Vom Treibhausgas zum Gewächshausgas: CO_2-Recycling bei Linde,” *UmweltDialog,* July 4, 2008, https://www.umweltdialog.de/de/wirtschaft/oekologie/archiv/2008-07-04_Linde_OCAP_Projekt.php.

9 “Neue Pipelines für den Klimaschutz: CO2 für Gewächshäuser und Gasfelder," *Linde Technology,* no. 1 (2010): 37.

fish, but that the products of a Shell refinery can go undisclosed ought to alarm consumer champions who care about the evolutionary footprint.

Oil Encounters

One hundred years ago these birthday candles would have been made from whale oil and beeswax . . .

Even the candles on the petroleum industry's 100th birthday cake are symbolic of the enormous growth of this basic industry that provides the world with a myriad of products from candle paraffin to rocket fuel.

Just as we're sure that the oil industry has been largely responsible for our growth, there is pride in our knowledge that we, in turn, have contributed in some small way to the growth of the oil industry.

it's ROCKWELL MANUFACTURING COMPANY

Rockwell products for the oil industry: Rockwell-Nordstrom Lubricated Plug Valves—Rockwell Large Capacity Gas Meters—Rockwell Rotocycle Liquid Meters and "ER" Liquid Meters—Water Flood Water Meters—Tank Truck Meters—Republic Flow Meters—Rockwell-Built Edward Valves—Chart Drives—Chart Integrator Computers—Strainers and Air Eliminators.

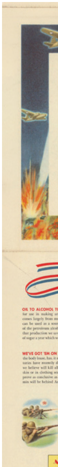
ROCKWELL MANUFACTURING COMPANY, PITTSBURGH 8, PA.

← *Fig. 14*

Oleoviathan

Do substances have birthdays? In 1959, an advertisement was released in the style of a birthday postcard to celebrate the anniversary of the legendary Drake Well in Titusville, Pennsylvania (see fig. 14). The birthday boy had to blow out 100 candles, which, as the advert explains, come 1959, were no longer made of beeswax or whale oil → Plankton 213 but modern, petroleum-based stearin.

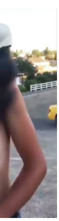
In the face of oil's primeval origins and its long-running cultural history, the notion of pinpointing its birthday might seem absurd. Its story reaches from the first Babylonian bitumen sculptures to the Greek fire of antiquity, → Ammunition 97 the Burmese oil dynasties of the Middle Ages, and the industrial histories that occurred in parallel and sometimes even earlier than in Titusville — in Lower Saxony, Galicia (now Ukraine), → Zombie 309 and Azerbaijan. In fact, a special edition of *Petroleum Engineer* from 1959, from which this ad originates, mentions one of the most significant forerunners to Drake's foundational act, if only indirectly.[1] A now almost forgotten but historically indispensable pacesetter from the first phase of petromodernity can be seen time and again in the graphics assembled in this special



1 "The Petroleum Engineer for Management," *The Petroleum Engineer: Drilling & Production* 31 (1959): E31.

edition: the petroleum lamp, developed by Ignacy Łukasiewicz, a Lviv-based apothecary, inventor, and political activist, in 1853. The lamp appears amid the pages of *Petroleum Engineer* almost as a symbol of enlightenment, an oil lamp that, paradoxically, was already burning on its "birthday" in 1859.

Nevertheless, the cake can be interpreted as a valuable testament to the time. Dimly recalled stories that are repeated and passed on create facts, and this is very much a recognized feature of family celebrations and special birthdays. You need only remember the Pennsylvanian birth of the age of petroleum long and often enough for it to at some point become fact — as the accepted canon of oil historiography, which endures to this day, demonstrates.[2] Then again, in Pennsylvania from 1859 onward and later on the beaches of California and the plains of Oklahoma and Texas, something was growing, something fundamentally new; a technological-social lifestyle based on expending as much energy as possible: the *American Way of Life*.



Unlike other familiar forms of chronology, however, be it the Roman *ab urbe condita* or *Anno Domini,* the cake does not define a "zero hour," or Day One. The exclusivity of new ages in the religious sense → Burning Man 285 would not be appropriate here. Nevertheless, this scion of history is closely related to parallel guises that emerged shortly before or after, such as "modernity," the "industrial age," and "the age of coal." And all the attendees at the family celebration know about the relatives of this particularly vital offshoot.

The circumstances of its birth and upbringing are part of modern mythology and therefore widely known. It emerged out of the interaction between petroleum, a raw material, and a US society expanding on all fronts — technological, economic, scientific, military — and preparing itself to rise to become the most powerful country on Earth and witness the twentieth century immortalized in history books as "the American century." Personifying the age of petroleum — itself the subject of the cake

2 *Daniel Yergin, The Prize: The Epic Quest for Oil, Money, and Power* (New York: Simon & Schuster, 1991).

in the cheery advertising graphic — without showing the people themselves in the picture can correspondingly be interpreted as a symptomatic, but therefore all the more sound, indication of the primitivity, vitality, and agency of this being. This is a celebration of a technological-organic, fossil-modern, sociopolitical superorganism; in the style of the Old Testament cipher for uncanny omnipotence, it is an Oleoviathan.[3]

By human standards, a hundredth birthday may well be a solid marker of old age; in the case of the age of petroleum, however, it signified the beginning of a phase of utmost vitality. The 1950s saw petroleum grow in all areas of life, not just war and mobility, but also pharmaceuticals, cosmetics, and design. Ian Morris, a British historian who teaches in the United States, is convinced that there is a necessary connection between the spread of the utilization of fossil resources and the implementation of the values of freedom and egalitarianism. He suggests referring to these as "fossil-fuel values" instead of describing them, as is more usual, as "Western values": "Liberalism and democracy have spread around the world because the industrial revolution has spread around the world; and because liberal, individualist values are the ones that work best in Industria, people all over the world have, to greater or lesser degrees, embraced them."[4] This would consequently make the Oleoviathan a perfect democrat. Timothy Mitchell, a political scientist and Arabist from Columbia University, paints a distinctly differ-

3 Thomas Hobbes, *Leviathan or The Matter, Forme and Power of a Commonwealth Ecclesiasticall and Civil* (New York: Simon & Schuster, 1997). On the iconography of the Leviathan, see also Horst Bredekamp, *Der Leviathan: Das Urbild des modernen Staates und seine Gegenbilder, 1651–2001* (Berlin: Akademie Verlag, 2012). While working on this book, we learned of the existence of a children's book about monsters that destroy the environment, featuring an "oil leviathan": Marie G. Rohde, *Planet SOS: Modern Monsters Threatening Our Environment* (Tonbridge: What on Earth Publishing, 2020). The monsters most suited to our book include "the Plaken," "the Road Snake," "the Urban Sprawlosaurus," "the Noisybird," and "Smogosaurus."

4 Ian Morris, *Foragers, Farmers, and Fossil Fuels: How Human Values Evolve* (Princeton: Princeton University Press, 2015), 163.

ent picture. According to his analysis, the specific possibilities for extracting, distributing, and exploiting petroleum with their decentralizing tendencies led to the gradual withdrawal of the democratic accomplishments that were fought for in the age of coal, which was characterized by centralized large-scale technologies and corresponding vulnerability because of strikes and sabotage.[5]

Yet the graphic in the advertisement imagines our birthday colossus as a spirit of service to mankind, one you might be happy to invite to the table. In its younger years, however, it must have been quite a rough fellow. To this day, the name John D. Rockefeller, which is linked to industrial America's first boom period and establishes the petroleum industry's substantial influence in US domestic and foreign policy, is shorthand for monopolistic capitalism and unscrupulous business practices. The Standard Oil Company, founded by Rockefeller in 1870, is akin to the specter of looming global capitalism that Pablo Neruda evoked in the following terms in his poetry collection of 1940, *Canto General*:

> A President assassinated
> for a drop of petroleum,
> a millionacre
> mortgage, a swift
> execution on a morning
> mortal with light, petrified,
> a new prison camp for
> subversives, in Patagonia,
> a betrayal, scattered shots
> beneath a petroliferous moon,
> a subtle change of ministers
> in the capital, a whisper
> like an oil tide,
> and zap, you'll see

5 Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (New York: Verso, 2011).

> how Standard Oil's letters
> shine above the clouds,
> above the seas, in your home,
> illuminating their dominions.[6]

Another significant literary text that describes the petrocapitalist, neocolonial mechanisms at work in the early years of petromodernity is the 1929 novel *Die weiße Rose* [The white rose] by B. Traven. It tells the story of the unscrupulous takeover of a Mexican hacienda by an American oil company, and its transformation into an area for oil production. Right at the beginning of the novel, the (fictional) firm is described thus:

> Since the Condor Oil Company, given its small capitalization and the number and richness of its producing wells, could not rival the great oil companies, it had to take the second course — namely, to secure more land suspected of having oil than any other company[....] So it can quite readily be said that there wasn't any misdeed or crime that the company's land agents would not have committed to get the desired land if it seemed necessary.[7]

As an integrated, multinational oil corporation and as a superorganism equipped with multiple organs that interfere in politics, the military, and the secret services, Standard Oil is perhaps the most concise embodiment of the evil side of the Oleoviathan. Even after it was broken up by the US Supreme Court in 1911, it remained active through its successors. Standard Oil of New Jersey (Esso), Standard Oil of New York (Socony), Standard Oil of Indiana (Amoco), Standard Oil of Ohio (Sohio) and Standard Oil of California (Chevron) continued to rank among the largest oil companies in the world. → Atlas$_{19}$

6 Pablo Neruda, "Standard Oil Co.," in *Canto General,* trans. Jack Schmitt (Berkeley: University of California Press, 2011), 7:176–77.

7 B. Traven, *The White Rose,* trans. Donald Davidson (London: Allison & Busby, 1980), 4.

Come the end of the 1940s, newly tapped, giant oil wells on the Arabian Peninsula were flooding the market. → Priceless 149 The Oleoviathan was rearing its head once again in a decisive way. For the first time in human history, there was significantly more energy than had been possible to consume with hitherto normal behavior patterns. Oil was embedded in all areas of life by means of extra-large engines and mass-produced petrochemical products; it was hoped that increased sales would keep prices stable.[8] In 1949, Georges Bataille described the US industry, with its almost irreducible surpluses, as "the greatest explosive mass the world has ever known."[9]

Soon, the problem would not be scarcity, but excess, and this could only be tempered by a cult of wastefulness adopted as principle. → True Oil 251 This cult continues to this day. The United States accounts for 20 percent of the Earth's energy use, despite boasting just 5 percent of the world's population. No US president has yet been able to tame the Oleoviathan; the last one to try — in response to the oil crisis of the 1970s — and certainly not the last to stumble at this hurdle, was Jimmy Carter. Consumption and production have continued unabated since the inauguration of Carter's successor, Ronald Reagan. The current fracking-related oil boom — introduced as policy under Barack Obama, pushed to its former, uninhibited heights by Trump, the Petroleum President, → Men and Petroleum 75 and further stabilized by European countries' increased demand for fracking gas in response to the partial breakdown in gas supplies from Russia because of the war in Ukraine → Zombie 309 — has once again sent the United States to the top of the leaderboard of oil-producing countries.[10]

8 Mitchell, *Carbon Democracy,* 409.

9 Georges Bataille, *The Accursed Share: An Essay on General Economy,* trans. Robert Hurley (New York: Zone Books, 1988), 171.

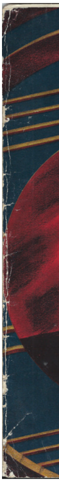
10 Meg Jacobs, "America's Never-Ending Oil Consumption: Why Presidents Have Found It so Difficult to Ask People to Just Use Less," *The Atlantic,* May 15, 2016, https://www.theatlantic.com/politics/archive/2016/05/american-oil-consumption/482532/.

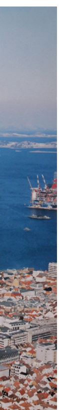
Now, after a sixty-year interval, it is decidedly unclear whether it was a cheerful birthday boy who was invited to the party or a difficult-to-appease Hydrocarbon Hydra, who must be presented with the sacrifice of an enormous cake to stave off catastrophe.

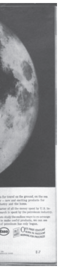
← *Fig. 15*

Pierced Earth

Could it be revenge for the constant mix-ups between Austria and Australia? In the 1960s, Vienna-based company Schoeller-Bleckmann Tiefbohrtechnik — which remains, to this day, the world leader in nonmagnetic drill-collars under the name Schoeller-Bleckmann Oilfield Equipment AG (SBO) — promoted its “plants and tools for modern drilling and extraction operations” with the image of an extreme borehole drilled right through the Earth (see fig. 15). The image in the poster hits on a central point of planetary technology. The drilling of deep holes sits among the various phenomena proposed as distinct markers of the planet’s entry into the new geological era of the Anthropocene, alongside the distribution of radioactive isotopes from nuclear explosions, → Exploration 37 or the sedimentation of plastic worldwide. → The Song of Styrene 235 It is a lesser-known activity that, nevertheless, can hardly be disregarded over long geological periods. In this case, it is not a matter of contamination from a manmade substance; on the contrary, it is about the carving out of materials. Whereas badgers and rabbits burrow just a few meters underground, and crocodiles dig holes 12-meters deep at most, human beings have been deep-mining since the early Stone Age. Whole mountain ranges have been riddled with holes over thousands of years in the search for salts and ores.







Yet the modern age sees the establishment of a new, distinctly intensive form of hole-making and, with it, a new kind of underground landscape-making, mining for energy resources. → St. Barbara 293 In surface mining and in tunnel mining, digging for coal excavates whole stretches of land underground, remaining nevertheless limited to specific territories, while oil and gas extraction is spread across diverse landscapes in countless regions around the globe and leaves characteristic, practically indelible marks in the soil, on the landscape, and on the sea floor: circular boreholes, often up to several kilometers deep. And though erosion might wash away traces of humans relatively swiftly on the surface, these deep, manmade, underground structures remain distinguishable across geological time periods. → World Cultural Heritage 201 In addition to humanity's layer-building activities, therefore, there are also those activities that bind these layers together.

The scope of this human activity is almost unimaginable and consequently requires somewhat cosmic comparisons to help illuminate it. Since the beginning of the modern petroleum age, approximately 50 million kilometers of boreholes have been produced in the drilling of hydrocarbons alone — and these make up far and away the largest proportion of all drilling.[1] In fact, an estimate of this kind is only possible because it is not just companies who happily celebrate the 200,000th meter drilled at a rig; state mining authorities also gather this information, which is then published in annual reports. The entire length of all road networks on Earth, or the distance between the Earth and Mars, → Space Travel 271 has been traversed by drills on the search for oil and gas. In 2014, this equated to 7 meters per human being.

In terms of visualizing these distances, Schoeller-Bleckmann's graphic from the 1960s seems something of an underestimate. Members of the species *Homo sapiens perforans* have

1 Jan Zalasiewicz, Colin N. Waters, and Mark Williams, "Human Bioturbation and the Subterranean Landscape of the Anthropocene," *Anthropocene* 6 (2014): 3–9.

drilled through the whole globe not just once but about 4,000 times, all the way from Austria to Australia.


Schlumberger
7044
Schlumberger
2777

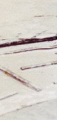
← *Fig. 16*

Schlumberger

There is a measuring truck on the premises of Schlumberger Limited in Punta Arena, Chile: one of the vehicles with which this market leader has been carrying out borehole measurements since the pioneering work of the company's Alsatian founder, Conrad Schlumberger, in the 1920s (see fig. 16). Parked as meticulously as it is improvised, the vehicle stands on a plastic sheet to keep it away from the fine gravel lining the parking space.

The paradox is clear: a massive technological machine that serves to measure distances kilometers-deep underground, → Exploration37 deciphering the innermost regions of rock layers by means of sophisticated, globally networked computer technology, is shielded from its direct surroundings as if it lies on an operating table. → The Song of Styrene235 This technological giant is transformed into a shy little dwarf.

The calculation goes as follows: this controlled, scientifically precise and legally secured intervention underground ought not to be jeopardized by the unrestricted spread of traces of harmful or even toxic substances with which the wheels of the truck might have come into contact in the vicinity of the boreholes. → Drilling Fluid43 The oilfield service company's concerns regarding the proliferation of material-chemical traces in a small parking lot contradicts the lack of concern with which the petroleum



industry as a whole accepts contamination the world over. In fact, it is precisely this shielding, discretion, and meticulous adherence to certain rules that lie at the heart of how this kind of company functions.

What began in the 1920s with comparatively simple measuring probes on long steel cables, which were able to gauge the electrical resistance in the rock within the borehole, and in doing so determine the type of stone, not only founded a science in itself but also serves as a main pillar of the oil industry. The corporations we know from filling stations and stock markets are not able to operate without specialist companies such as Schlumberger and the skills accumulated therein. Leading brands in terms of market capitalization and public perception have long since surrendered technological dominance and have to purchase the relevant services from hidden champions.

Meanwhile, the commercial success of this special knowledge, as chronicled by the measuring truck in its sterile plastic gown, no longer depends solely on the most unbroken, most complete development of oil and gas deposits. The only good invasion of the terrestrial body is one that is minimally invasive. Companies operating on a global scale, which are therefore subject to global observation, would often no longer be able to mine oil and gas without consideration for ecological environments. Even billion-dollar companies feel the pinch when the compensation claims run into the billions of dollars. It is in the interests of even the most lucrative and innovative companies to leave as little trace as possible, aside from the planned operations. After all, this is a matter of activities so massive that targeted improvements can make significant changes. This can lead to the somewhat absurd situation where it is none other than the oil companies that emerge as pioneers of environmental regulation, when operating in areas of the world with only patchy state monitoring, because they are obliged to adhere to much stricter rules on their sites than outside of them.[1] → Adventurers 129

1 The authors are grateful to Dieter Hiller, longtime environmental advisor to Schlumberger Limited, for this information and for providing access to

Thus, the protective cover with which the industry hopes to shield itself from precisely those local environments it is permanently destroying can itself be read as a means of proliferation, a membrane of sorts. It transports wholly practical environmental knowledge into surroundings often little bothered by such concerns. Conversely, it shows that core areas of what was once an industry entirely without concerns are now infected with the idea that the oil industry must change if it is to have a future at all.

his professional photo album, from which figure 16 is taken.

Ein Wasserfall von Öl das dem
Brunnen № 128 den ich

POST CARD

◆ VELOX ◆ PLACE STAMP HERE ◆ VELOX ◆

mitbohrte entstammt.

CORRESPONDENCE ADDRESS

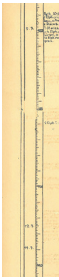
Ein Selbstspringer
war der Brunnen.

Wurde nach seiner Produktion
der reichste Südamerikas.
Ganz Argentinien schreit über
den Reichtum, den so oft
prahlerisch erwähnten, dieses Landes.

← *Fig. 17*

Adventurers

Comodoro Rivadavia, Patagonia, 1921. “A waterfall of oil, flowing from well No. 128, which I helped to drill. The well was a gusher. The richest in South America in terms of output.” These few lines, penned on a postcard (see fig. 17), were written by Otto Ritter von Oppolzer, born in Prague in 1898, the son of an astronomer who died of blood poisoning at just thirty-eight. In 1920, Otto fled his Vienna family, which was left with many children and little money after the war, and the now disintegrating Habsburg Empire after three semesters at the University of Technology, in order to seek his fortune in the emerging empire of oil at the other end of the world. On his arrival in Argentina, he leafed through the address books for names beginning with letters uncommonly used in Spanish, and under “K” he landed on a German-Austrian company and soon found himself amid the oil fields discovered around Comodoro Rivadavia in 1907. He was hired to work as a laborer and cultivated a practical knowledge that was not taught at any university. On his return to Austria in 1934, following the global financial crisis and various adventures in business, he boasted the titles of engineer and master driller. He soon became indispensable in the oil fields in the Vienna Basin. → Drill Record29 He traveled in wartime Austria, Italy, and Albania without an *Ariernachweis,* a certificate proving he was a member of the “Aryan race,” but with spe-

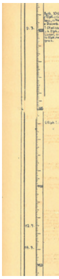


cial Nazi documents belonging to the "Representative for the Extraction of Oil," Professor Alfred Bentz. In the Apennines, he escaped the Partisans by posing as an Argentinian. When the Soviets invaded Lower Austria, he evacuated drilling equipment of strategic importance and nursing mothers. This macho man, brawler, and highly respected expert was involved in all significant Vienna-based companies until his death in 1969. A "brickyard owner, master driller, and circus artist," he was eulogized as one of Austria's most dazzling oil pioneers. And in 1956, he even became the protagonist in a novel, as Engineer Pacher in Othmar Lang's *Männer und Erdöl* (Men and petroleum).[1] → Men and Petroleum 75

Oppolzer is in good company. There are several illustrious Austrian life stories linked to oil. Take, for instance, that of the Canadian-Austrian oilman Richard Keith van Sickle. In this case, Central Europe is not so much the starting point as the destination of various adventures. Van Sickle was born in the Romanian oil city of Câmpina in 1899, the child of an originally Scottish-Huguenot family. His father and uncle celebrated their first drilling successes in the town of Petrolia, Ontario, but then moved to Romania via oil districts in Galicia (now Ukraine) and Australia. In the mid-1930s, Van Sickle acquired mining claims in Austria, but in as early as 1937 he was forced to cede part to Deutsche Petroleum AG. It was here where, after the *Anschluss* — the annexation of Austria by Nazi Germany in 1938 — and on behalf of Deutsche Petroleum AG, Van Sickle drilled the most productive oil source in the territory of Greater Germany. A dual power of attorney, granted to his lover Elfriede Krasa and trustee Hermann Fritsche, took care of business during wartime, but Van Sickle himself was to be found on the other side of the front, fighting against precisely this oil. He trained as a pilot in World War I, and from 1939 onward he served as a major in the British army in the Royal Engineers Corps in North Africa, and later as lieutenant colonel

1 Othmar Franz Lang, *Männer und Erdöl* (Vienna: Österreichischer Bundesverlag, 1956).

and oil attaché in Baghdad and Tehran. Meanwhile, in London, the Luftwaffe was laying waste to his wife's mansion in genteel Sumner Place, once used as a mortgage for the Austrian mining claims. In 1945, Van Sickle returned to Vienna via Indonesia. His oil fields sat in the Soviet zone, but Van Sickle was used to dealing with Soviets from his time in Tehran, and decided to stand up to them. Based on a Russian tip, he acquired a magnificent mansion in Baden, Vienna, and was named in the *Staatsvertrag*, the treaty that guaranteed Austria's independence in 1955. → Drill Record 29 He died in 1961, and the company continued into the next generation.[2]



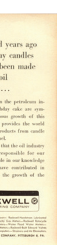
Oil powers engines, but it also powers life stories, both today and yesterday. As a resource, it is fluid and, unlike coal mining, requires only a few workers to extract it. But even oil will not flow out of the deep sea, the desert, or tundra and into urban centers, filling stations, and chemical factories of its own volition. Local laborers are employed to extract this raw material, but international specialists go from one production rig to the next, from head offices to chemical laboratories. → Schlumberger 125

The use of mobile technicians in the raw materials business is not a phenomenon limited to the present day, or to the era of the Wild West. Mining towns were drawing daring characters from all over to remote regions as far back as the Middle Ages. Struggling along the geographical and social margins of civilization and the risk of being stranded far from home are as much a part of the mythology of history's real-life gold diggers as suddenly striking it rich.

2 Archive material on Otto von Oppolzer, Richard Keith van Sickle, and other Austrian oil pioneers, such as János Siklósi, taken from the Geological Survey of Austria and via Benjamin Steininger, *Die Sammlung Rohstoff Geschichte — Ein Findbuch* (Vienna: Geologischer Bundesanstalt, 2016), https://opac.geologie.ac.at/ais312/dokumente/BR0116_000.pdf.pdf; further information at http://www.rohstoff-geschichte.at.

The Wages of Fear is testament to the stranded.[3] Georges Arnaud, author of the novel published in 1950, fled to South America himself after a questionable acquittal in a murder case, and took on work in the Venezuelan oil industry. He returned as a writer and landed a bestseller, which was made into a film starring Yves Montand and directed by Henri-Georges Clouzot in 1953. The film features four desperados who have turned their backs on Europe — for good reason. In Latin America, they have risked everything, and lost it too, and have agreed to a suicide mission in the hope of winning a plane ticket back to Europe. They are tasked with driving two trucks, loaded with highly explosive nitroglycerine, through jungle and desert to an oil well that has caught fire, in the hope of using the explosives to put out the flames. → Men and Petroleum 75 One manages to make it and the explosion is a success, but he will not survive. "Your effort's no use anymore, it's only served the petroleum," the author's voice calls to the man who has driven his truck over a cliff and fallen into the abyss on the last page of the novel. It's a radical conclusion: technology and energy do not serve human beings. This radicality led to the film not being available in the US-film distribution other than in an edited version, in which every perceived anti-Americanism (and hints to homosexuality) were eliminated, until 1992.[4] The conclusion is shared by B. Traven's novel *The White Rose*: "What do we care about people? All that matters is oil."[5] → Oleoviathan 113

Conversely, it is this practice of burning through life stories that drives an industry on. Arnaud's fable follows the dramaturgical founding principles of petrochemistry: catalysis. → Molecular Mobilization 63 In theory, catalysts emerge from a process



3 Georges Arnaud, *Le salaire de la peur* [The wages of fear] (Paris: Juillard, 1950).

4 Brian Eggert, review of *The Wages of Fear, Deep Focus Review,* September 10, 2008, https://www.deepfocusreview.com/definitives/the-wages-of-fear/. A remake of the film produced by Netflix was released online in March 2024.

5 B. Traven, *The White Rose,* trans. Donald Davidson (London: Allison & Busby, 1980).

unused. In practice, they are used up after a few cycles, and great pains must be taken to revive them.

Missions such as those in *The Wages of Fear* are hardly conscionable in today's highly regulated oil industry. Any nervousness on the part of the driver would immediately be registered by onboard electronics and classed as a safety risk. But the army of people stranded in the service of oil has likely never been greater, if you take into account the workers who have migrated to the extraction regimes of the Gulf region from South Asia and Southeast Asia and entered into service under terrible conditions, like ghosts of the postwar Europeans in South America. → Priceless 149

The Oppolzers and Van Sickles of today travel somewhat differently. They commute across the globe not just once in their lives, but once a month: fly in, fly out, a weekly migration with no romance to it. After a fortnight in a sterile offshore container, it's time for days of flights back to the family home before a new cycle begins. Employees in oil and gas are offered a global network of lounges in the form of the Flying Blue Petroleum Card from KLM and Air France, at 108 locations between Edmonton, Tashkent, and Buenos Aires, and especially in those places far better known for their technological facilities rather than their touristic ones, and where the Western lifestyle of an engineer would be difficult to account for outside of protected zones: Antananarivo, Abuja, Bata, Cotonou, Douala, Entebbe, Lomé, Niamey, Nouakchott, among others. The Flying Blue Petroleum Club displays one of the few global business maps in which Africa is overrepresented rather than underrepresented, logging twenty-seven destinations in total. This is exclusivity as an expression of extractive brutality. → Petroporn 173 These days, it's not saloons or dive bars but the Flying Blue Petroleum Lounge that denotes the frontier for corporate gold diggers. But it's doubtful that these lounges still boast stories of circus artists, brickyard owners, and fortune-seeking chevaliers such as Oppolzer.

Baku, 1/XI. 14/XI. 1902.

Brennende Naphtaquelle

Grüße von, Marianne Zelinska-Wionkin

Für Ihre liebe Karte besten Dank.
Die liebe Mama ist Gott sei Dank
schon wieder ganz gesund. Haben
die Unterhaltungen in Leoben
schon ihren Anfang genommen.
Wünsche Ihnen recht viel Vergnü-
gen zu denselben. freundliche

← *Fig. 18*

Baku

Parasols, fur hats, and sailor suits: in figure 18, a multicultural bourgeois society can be seen posing in front of veritable hellfire, as if they're on a phony film set.

In 1902, Marianne Zielinska-Wischin wrote a postcard from Baku, addressed to Leoben in Austria, to what was and remains an academic center for petroleum and mining geology. Marianne herself had arrived — presumably with her engineer or geologist husband — in Baku, the former global center of this science. The caption “Brennende Naphtaquelle” (Burning naphtha well) is visible in the top right of the postcard. → Burning Soil 229

No one in Baku at this time would have needed any explanation of what a burning oil well looked like. International trade statistics from the year this postcard was sent indicate petroleum production amounting to 11 million metric tons for Baku, 500,000 metric tons for the rest of Russia, 10 million metric tons for the United States, 573,400 metric tons for the Austrian province of Galicia, 380,000 metric tons for the Sunda Islands (Indonesia), 320,000 metric tons for Romania, 180,000 metric tons for India, 120,000 metric tons for Japan, with Germany and South America far behind, logging 50,000 and 15,000 metric tons, respectively. Consequently, just under half of the annual production for 1902 (23,141,200 metric tons) originated in Baku, the city on the Caspian Sea.[1] A concentration of this kind has never again been witnessed in the history of oil.

In more distant centuries, reports would likely have told of an even-more prominent ranking, had international trade statistics been available at that time. As far back as the tenth and thirteenth centuries, there are reports of black, yellow, but primarily white oil — "like jasmine oil" — in numerous wells within the vicinity of the city, and even Marco Polo is reputed to have seen Baku: "To the north of Armenia lies Zorzania, near the confines of which there is a fountain of oil, which discharges so great a quantity as to furnish loading for many camels. It is good for burning, in the neighbourhood no other is used in their amps, and people come from distant parts to procure it."[2]

In the fifteenth century, Abd al-Rashid al-Bakuwi wrote of daily caravans of two hundred camels loaded with oil, at a time when crude oil was certifiably in use in many other parts of the world, albeit in much more modest quantities.[3] There are reports of 40 liters per day being produced for healing purposes at St. Quirin's well by the Benedictine monks of the Bavarian Tegernsee Abbey.[4]

Openly burning gas fields in the environs of Baku have been the object of religious veneration since the dawn of time. The region has also been one of the centers of Zoroastrians and Parsees for centuries, as "the land of burning fire" — itself a translation of "Azerbaijan." Atəşgah, the Zoroastrian fire temple, boasted an eternal flame lit by naturally emitted gas until into the nineteenth century. Oil wells close to the temple, owned by none other than Ludvig and Robert Nobel — brothers of the

1 "Erdöl," in *Meyers Großes Konversationslexikon*, 6th ed., Vol. 6: *Erdeessen bis Franzen* (Leipzig: Bibliographisches Institut, 1909), 27.

2 R.J. Forbes, *Bitumen and Petroleum in Antiquity* (Leiden: E.J. Brill, 1936), 28.

3 Leila Alieva, ed., *The Baku Oil and Local Communities: A History* (Baku: Center for National and International Studies, 2009), 40.

4 Günter Schönwälder, *Erdöl in der Geschichte* (Mainz: Hüthig und Dreyer, 1958), 112. See also Roland Götz, "Quirinus — Wasser — Öl: Von der Heiligenverehrung zum Heilbad am Tegernsee," *Beiträge zur altbayerischen Kirchengeschichte* 58 (2018): 111–48.

now much better-known dynamite magnate and prize donor Alfred Nobel — turned off the gas that fed the holy flame. This didn't prevent the Nobel brothers from using the image of the temple as the logo for their company. Today, the flame is once again burning in the temple. It has been elevated to the status of a national cultural heritage site (and reclassified as a museum), and now runs on gas from the city's gas pipeline.

In the nineteenth century, the oil wells of Baku went from being on the peripheries of three empires — the Ottoman Empire, the Persian Empire, and the Russian Empire — to being at the center of petromodernity, as the rest of the world also began to discover the wondrous properties of petroleum. The Nobels, for instance, arrived in Baku searching for Caucasian walnut wood for one of their weapons factories and found themselves hung up on petroleum. It remains to be seen whether Baku, not Titusville, Pennsylvania — which crops up in every founding story about petroleum — is the true place "where the modern oil era began," writes Vaclav Smil, geographer and energy historian.[5] → Oleoviathan 113 What is certain, however, is that the region became the petroleum capital of the Old World in the second half of the nineteenth century, a *fin de siècle* Petropolis. International specialists arrived in Baku in droves, as did an increasingly confident workforce from neighboring states, a real melting pot of cultures at the intersection of Orient and Occident, North and South, and proletarian and bourgeois modernity. The local and national entrepreneurship of Azerbaijanis, Armenians, and Russians benefited from the legal reforms brought in by Tsar Alexander II, which made a bourgeois oil industry possible, as did the international entrepreneurship of the Rothschilds and the Nobels. This was followed by technological innovations, such as the "Zoroaster" developed by the Nobels — the first oil tanker in history, introduced around 1878; subsequent tankers were named Buddha, Muhammed, and

5 Vaclav Smil, *Energy Transitions: History, Requirements, Prospects* (Santa Barbara: Praeger, 2010), 3–4.




Socrates — or the first long-distance pipeline to Batumi on the Black Sea. → Pipeline 53

The tsarist-imperial administration proved itself to be beneficial to the city.[6] Within a few decades, this dusty little town in the desert was transformed into a bright metropolis, inhabited by people from all over the world and built by international architects.[7] → Tehran Museum of Contemporary Art 181; Priceless 149 Pipelines carried drinking water out of the Caucasus, oil tankers brought fertile Volga soil for parks on their return journeys from Astrakhan. The fabulous wealth of both local and international oil magnates was obvious not only here — in mansions kept cool with natural ice, casinos, theaters, and gilded palaces — it was also sustainably invested and flowed into the construction of a modern, diversified industry and modern institutions for science, education, and culture. Muslim magnates from Baku invested in girls' schools and a free press between Syria and Pakistan. → Men and Petroleum 75

Then, during the revolution of 1905, the oil fields burned on a large scale, but this time there were no middle-class onlookers posing with parasols in front of the flames; this time, it was a real catastrophe. Massacres between the Armenians and Azerbaijanis saw thousands of people killed. Hundreds of drilling rigs were destroyed, and an era of prosperity for both the Russian and international oil industries in Baku came to an end for a time. It is quite fitting that, from 1907 to 1909, a certain Iosif Vissarionovich Dzhugashvili spent time with the oil workers in Baku under his then fighting name, "Koba," that the man who would go on to become Joseph Stalin wanted to have his "second revolutionary baptism of fire" precisely here, and that he is said to have agitated via magazines such as *Bakinski Proletari* (The Baku proletariat) and *Bakinskie Rabotschi* (The Baku worker).[8]

6 See also Felix Rehschuh, *Aufstieg zur Energiemacht: Der sowjetische Weg ins Erdölzeitalter* (Vienna: Vandenhoeck & Ruprecht, 2018), 34–35.

7 Eve Blau and Ivan Rupnik, *Baku: Oil and Urbanism* (Zürich: Park Books, 2018).

8 J.V. Stalin, *A Short Biography* (Moscow: Foreign Languages Publishing House, 1942), 26.

And then, the old world, in all its colorful and brutal contradictions, was lost forever — as described by the Azerbaijani writer Essad Bey during the time of the Weimar Republic in his then hotly disputed bestseller *Blood and Oil in the Orient,*[9] which is now once again in print. The Democratic Republic of Azerbaijan declared independence in 1917 after renewed ethnic massacres, described in a dramatic account by Bey. Muslim but pluralist Azerbaijan was one of the first nations worldwide to bring in women's suffrage. The girls' school founded by oil magnate Zeynalabdin Taghiyev became the official seat of parliament. Just two years later, the country's independence came to an end. Baku and Azerbaijan were part of the Soviet Union until 1991. → Black Square 263

The other layers of petromodernity that stacked up in the same place will only receive a cursory mention here. The Wehrmacht's failure on the road to Baku marked a turning point in World War II. During the postwar period, the region's oil and gas industry underwent both decline and expansion, primarily offshore, in the form of the gigantic Neft Daşları oil platform. → World Cultural Heritage 201 Named the "Second" and "Third Baku" (much like the concept of Moscow as the "Third Rome"), there were yet larger, newly discovered oil districts that outstripped the First Baku to the east of the Volga and in West Siberia.

And what about Baku today? The Eurovision Song Contest and Formula One auto racing championship took place along the walls of the old city, declared a UNESCO World Heritage Site in 2000, and between the postmodern signature buildings that have sprung up out of the ground, like those in other oil cities on the Persian Gulf; → Tehran Museum of Contemporary Art 181 filling stations belonging to the state oil corporation SOCAR can be found across half of Europe, and drone warfare and mass expulsion of the Armenian population have been witnessed in Nagorno-Karabakh. → Zombie 309 The year 1900 saw an entire

9 Essad Bey, *Blood and Oil in the Orient,* trans. Elsa Talmey (Frankfurt: Bridges Publishing, 2018); for the massacre, see 63–64.

society modernized and democratized during the oil boom, despite all its problems, but after 1991, the oil and gas revenues cemented the authoritarian course of the despotic Aliyev family, which emerged from the Soviet nomenklatura.[10] The free press, art, and science have been suppressed, dissidents have been driven from the country, and diversification of the economy has ceased. The *oil curse* has the oldest and most scintillating oil district in the world in its grip.

10 See Leila Alieva, “Old Baku: Money, Freedom, and Satire in the Oil Capital,” in *Oil: Beauty and Horror in the Petrol Age,* eds. Andreas Beitin, Alexander Klose, and Benjamin Steininger (Cologne: Verlag der Buchhandlung Walther und Franz König, 2021), 140–49.

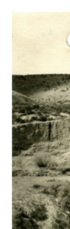
为创建十来个“大庆”油田而斗争

← *Fig. 19*

The Great Leap Forward

It is midwinter, fat snowflakes fall in drifts, and Chinese oil workers clad in helmets, hoods, and padded coats are pulling on thick ropes with their bare hands. There are six men and, according to Chinese color associations, a woman, dressed in red. Just what they are pulling—and what they are pulling it toward—remains unseen. In the background, there is a steel drilling rig, a whole row of harnessed Stalinets tractors, and the distant outline of more drilling rigs. If you take the caption seriously, then all this is just a taste of things to come: "The struggle for the creation of more than ten Daqing oil fields," it reads, somewhat immodestly. The image in figure 19 is a Chinese propaganda poster from 1978, celebrating the petroleum heroes in Manchuria. Joris Ivens also detailed the working lives of these pioneers in the 1970s in his mammoth documentary series *How Yukong Moved the Mountains.*[1] → Adventurers 129; Pipeline 53

The seven biggest oil producers in the world currently are the United States, Saudi Arabia, → Priceless 149 Russia, → Black Square 263 Canada, Iran, → Tehran Museum of Contemporary Art 181 Iraq, and China. The People's Republic sits ahead of countries better known for being exporters of petroleum, such as the



1 Marceline Loridan-Ivens and Joris Ivens, dirs., "Chapter 4: Petroleum," in *Comment Yukong déplaça les montagnes* (CAPI, 1976).

United Arab Emirates, Venezuela, Nigeria, → Petroporn 173 and Kuwait.

China's rise into the circle of oil-producing countries began all the way back in the era of Mao Tse-tung, with the discovery of the Daqing oil fields in the late 1950s. The approximately 10 billion barrels of crude produced to date from the inhospitable steppe landscape of Manchuria — which was barely accessible during its ice-cold winters — is in no small part responsible for elevating the country to the top of the most productive economies of the present era.

In fact, there is hardly a single ore or mineral, hardly any rare or common chemical element that has not been mined in the greatest possible quantities in this geographical area, which covers a region as large as the whole of Europe all the way to the Urals. This differentiates China from countries that are perceived as oil economies in the classical sense, and raises this huge country to the level of resource mega-powers, such as the United States and Russia. Global mining statistics reveal China to be in top position for coal, iron, manganese, molybdenum, aluminum, gallium, germanium, and indium. This is the basis of what is being produced in gigantic industrial regions, such as the Pearl River Delta. Chinese mining corporations are also highly active globally, including on the African continent.

The range of goods, the range of materials, and the complete exploitation of energy resources required to operate industrial machinery are all linked. Today, almost the entire palette of Mendeleev's periodic table is used in technology: more than seventy chemical elements (from a total of 118, eighty of which are stable) are used in the mostly Chinese communication and information electronics found in our trouser pockets and on our desks.[2] → Data Is the New Oil 277 At the same time, it is practically impossible to alter whole parts of the Earth's crust through mining, traffic, and chemical-molecular reconfiguration without fossil energy. So even if we encounter little Chinese oil at

2 Mai Thi Nguyen-Kim, *Chemistry for Breakfast: The Amazing Science of Everyday Life,* trans. Sarah Pybus (Vancouver: Greystone Books, 2021), 93.

the local filling station, we absorb it into our everyday lives with every Chinese industrial product we use.

The mobilization at unprecedented speed of the Chinese portion of the Earth's crust in recent decades shows how unbroken petromodern momentum is. Soviet technology — in the form of the ancient Stalinets tractors depicted in the poster — could still be seen in Joris Ivens's film from the 1970s, but today the country has left its erstwhile teacher far behind. And since, despite all climate-political sense and innovation, global rates of oil use and especially coal use continue to shoot up, and as much CO_2 has been emitted in the last three decades as in the entirety of fossil modernity since 1800, a very significant portion of this lays at the feet of Chinese mines and chimneys.[3]

But the question as to which political-economic system is powering these chimneys with coal and oil, be it Chinese communism or global capitalism, remains surprisingly unclear. It appears to be both. Only in a country with legions of cheap workers and resources is such production according to the old rules of Manchester capitalism possible, whether it be by Apple, Foxconn, or medium-size businesses from Swabia. Only through the exploitation of all global market mechanisms is it possible for China to develop according to the directives of an all-powerful Communist Party — to the point of total electronic-social control. Freedom, growth, and consumption clearly mean different things, depending on whether it's a Chinese family or a German one thundering along the autobahn in a BMW.

From today's perspective, one might ask which rope it was that the historic heroes of Daqing were pulling on. Were they promoting, against their will, the capitalist calculus of a (to some extent) autocatalytic momentum? — according to which each product of a process accelerates the process exponentially, because it is only this self-intensifying momentum of profit-oriented capital reinvested into the means of production that drives the spiral of the production of desire and consumption? → Oleo-

3 Andreas Malm, "China as Chimney of the World: The Fossil Capital Hypothesis," *Organization & Environment* 25, no. 2 (2012): 146–77.

viathan113 Or does the Chinese experience — in which resources were developed via collective, communist endeavor — suggest that the reference to ubiquitous, capitalist structures still does not describe the deepest and hardest layer of petromodernity? → Atlas19 After all, it is not necessary to unequivocally decide who exactly is roping in whom on the admittedly eye-catching surface, be it communist apparatchiks pulling the capitalists' strings, or vice versa, if it is clear that, under current conditions, any such tug-of-war serves only to open the faucets and floodgates all the more.

← *Fig. 20*

Priceless

Two men lounge in a suite, clad in white, floor-length thawbs. The upholstery is gilded, a cheetah sits on the sofa, and a hawk is perched on one of the men's arms. In *The Challenge,* the film by the Italian artist Yuri Ancarani from which figure 20 originates, we watch an hour of Qatari men at leisure — women do not appear for a second.[1] → Men and Petroleum 75 We watch them looking after doves raised for falconry in a large hall, dashing across the dunes in their Jeeps. There are a few moments of tension — when tens of thousands of dollars are offered for a bird at auction, when the commentator almost loses his composure at one falconry event. Otherwise, a sense of majestic calm reigns. Bikers park up their gold-plated Harley Davidsons for evening prayers in the desert. A group of men use their fingers to partake of the traditional meal from a bowl the size of a table in the middle of them, in a camp of tents. A man lets his cheetah ride in the front passenger seat of his Lamborghini. Scattered among these are moments in which Jeeps, camps, and people are viewed from the lofty perspective of a hawk itself.

Ancarani does not portray *dolce far niente* as a pleasant walk or gazing into the starry sky; the act of doing nothing must be

1 Yuri Ancarani, dir., *The Challenge* (Atopic Films, La Bête, Ring Film, 2016).

manufactured with the aid of private jets, hundreds of off-road vehicles, floodlights, and exotic animals. At the center of these activities, however, is the most prestigious discipline, the ancient tradition of falconry, and the vast camps in the desert where the hunting parties gather. → Animals in Oil Fields 219

An Icelandic documentary film from 2010 provides the context behind Ancarani's disconcerting images, under the somewhat sensational but enlightening title *Feathered Cocaine.*[2] It tells the story of Alan Howell Parrot, a falconry specialist who procured and trained hawks for the Persian shah in the 1970s and later for various Arab leaders, and who, in the 1990s, became a pioneer in efforts to combat illegal international trading of falcons. He crossed paths not just with numerous powerful emirs and sheikhs, but also with high-ranking smugglers — and Al Qaida terrorists.

Falconry is an integral part of the culture of nobility, and of world literature,[3] but above all it is an ancient method of hunting, practiced most significantly by the nomadic peoples of Central Asia. In open country composed of steppe, desert, and semidesert, it is possible to hunt birds and small animals, and even wolves and gazelles, using hawks, and also eagles. The Arab world also boasts a long history of falconry. Thanks to the help of Arab specialists, Frederick II, king of Sicily and Holy Roman emperor in the thirteenth century, became an adherent of falconry and declared it a model of good rulership. To this day in the Middle East, hawks are viewed as the ultimate status symbol and the most precious of all gifts. In Arabic, they are known as "the priceless ones," because the beauty of these creatures is considered to be beyond that of any commodity.

And yet there are those who will pay for them, as *Feathered Cocaine* makes clear. Upward of a million dollars has been known to change hands over especially valuable specimens.

2 Örn Marino Arnarson and Thorkell S. Hardarson, dirs., *Feathered Cocaine* (Markell Productions, 2010).

3 See the short story "Federigo's Falcon" in Giovanni Boccaccio, *The Decameron,* trans. G.H. McWilliam (London: Penguin, 2003).

By weight, a bird of this kind is more expensive than any narcotic. The gyrfalcon of Northern Europe and Asia is particularly prized among falconry enthusiasts for its white plumage. Since the collapse of the Soviet Union, these birds have been flown from Central Asia to Arab nations on private jets and in diplomatic bags. In the desert, however, gyrfalcons have an average lifespan of just a month, because they are accustomed to a more northerly climate. "Priceless" creatures are rendered commodities, used and discarded in shockingly little time. Over the course of just a few years, this predatory exploitation of wild animals saw numbers of these birds drop by as much as 90 percent in their countries of origin. The nature-culture system of falconry has been thrown off balance and its continuing existence is threatened by smuggling, hybrid breeding, and by its role in a luxury economy. Those of a more impish inclination might perhaps be reminded of the general principles of petromodernity when it comes to dealing with natural, fossil, or biospheric resources. → Frontier of the Technosphere 223; Greenhouse 105

So, what happened? "Today we're all paying for the consequences of the oil fever that gripped Saudi Arabia in the 20th century," writes Alexander Ilichevsky in his novel *The Persian,* set on the coast of the Caspian Sea, in which the Arabian obsession with falconry plays a supporting role. People "who just yesterday were ranging through the land like shepherds have, in the course of a single generation, been washed up on the tip of the pyramid of power and wealth; from Mecca and Medina to Las Vegas and Hollywood."[4]

Through the eyes of orientalizing Western observers, the desert and the remote Bedouin lifestyle of the still-recent past, the excess and luxury of the present, and the lightning-quick development from one extreme cultural state to the other might seem to enunciate a maximum of ethnological alienation. At the same time, no foreign region is as close to our petromodern Western culture as the Arabian desert. The two poles of

4 Alexander Ilichevsky, *Der Perser*, trans. Andreas Tretner (Berlin: Suhrkamp, 2016), 523.

otherness are mutually dependent on one another. → Black Mirror 247 It is only because we — and the entire permanently accelerated world — have been dependent on the oil in this region for the past seventy years that the majestic timelessness of an order both feudal and hypermodern reigns there; one in which the latest communication technologies sit side by side with the beheadings of wrongdoers by the stroke of a sword, in which Formula One racing and spending millions on radical Qur'anic schools and bands of Islamist fighters are present at the same time, where — as is the case in Saudi Arabia — one-seventh of the population were still living as slaves in the mid-1950s, because slavery, along with its offshoots, such as the trafficking of children and concubines, was not outlawed and phased out until 1963.[5] The fact that these countries and societies, with populations highly international and diverse thanks to economic migration, make up a central component of petromodernity despite — or perhaps because of — their extreme contradictions, is generally ignored by Western perspectives, because Islamic nations must serve as the "absolute Other" to Western civilization.[6]

The fundamental contradiction between "civilization" and "barbarism" is as constitutive for many aspects of petromodernity as the contradiction between ancient, fossil resources and the hypermodern lives we have built with them. → Temporal Abyss 241 The confrontation between the petromodern West and Arab culture has been described as an *oil encounter.*[7] → Sprawl 89 This presents a very special variation on the colonial encounter. Even the most brazen imported elites from the United States or

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5 "Arabien/Sklavenhandel: Ein ehrsames Gewerbe," *Der Spiegel,* August 22, 1956, 30–31, https://magazin.spiegel.de/EpubDelivery/spiegel/pdf/43063789, and "Sklaverei formal abgeschafft" [Slavery formally abolished], *Die Zeit,* July 26, 1963, https://www.zeit.de/1963/30/zeitspiegel/seite-3.

6 John Paul Jones, *If Olaya Street Could Talk: Saudi Arabia — The Heartland of Oil and Islam* (Albuquerque: Taza Press, 2007), 163–64.

7 Amitav Ghosh, "Petrofiction: The Oil Encounter and the Novel," *The New Republic,* March 2, 1992, 29–34.

Europe have to comply with laws formulated by flush, conservative royal dynasties. Western governments regularly enter into political spats with Iran, Iraq, or Russia about human rights, → Tehran Museum of Contemporary Art 181; Zombie 309 but crucifixions and stonings do not appear to tarnish business with the Arabian Peninsula.

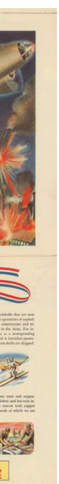
Oil was first discovered in Saudi Arabia in 1938. Before this, the country's main income came via pilgrimages to Mecca. With the 1948 discovery of al-Ghawār, the largest oil field tapped so far on Earth, Saudi Arabia — a country primarily inhabited by the Bedouin peoples until well into the twentieth century — became a global actor. Riyadh, which around 1900 was an oasis with 16,000 inhabitants, a world away from the urban and intellectual centers of the Arab world, such as Damascus, Baghdad, Beirut, or Cairo, became a metropolis, the population of which has increased tenfold in the last forty years alone, totaling 7,700,000 in 2019. Wahhabism, an absolutely conservative interpretation of Islam — one that does not permit women any degree of participation in public life — is the state religion in an economy that, thanks to oil revenue, requires no taxable productivity of its national population. Both the royal family, which amounts to several thousand members, and the nation as a whole appear to be a rentier state supported by oil. And the wealth trickles out of the big cities across the entire country. Even in small villages in remote desert regions, where people were still living primarily in tents just a few decades before, half a century of gushing petroleum wealth has brought well-lit, tarmac-covered roads, spacious homes and millions of foreign workers who have taken on service-industry jobs, becoming everything from street cleaners to small business owners to "that ubiquitous crutch of Saudi domestic life, the Indonesian maid."[8]

If we follow the falcon's flight, we can see both the top of the pyramid and its foundation; from a distance, we can clearly see the relationship between oil, money, geostrategy, and desert. The feudal-nomadic pleasure of the highest circles appears to be an


8 Jones, *If Olaya Street Could Talk*, 182.

indicator for the excesses of oil markets and oil politics, extrapolating them and rendering them visible in a more pointed way. Falconry camps play host to meetings between falconry enthusiasts from all social strata, and also (especially) the political elites of the Arab world, and selected guests. Up to George W. Bush, renowned for his statements on the "axis of evil" and his claims that countries must decide whether they were "with us or against us," the highest-level US dignitaries would honor Arab falconry camps with visits, where strategies would be discussed and deals struck—and huge donations would change hands, with radical religious and terrorists groups among their recipients.

Track the falcon flying in the desert, and it is possible to home in on even the most historically consequential and permanently unsettling loss of control within the petro- and geopolitical alliance between the Gulf states and the United States: the attacks on September 11, 2001, which saw nineteen assailants, fifteen of them Saudi subjects, turning four fully refueled airplanes into weapons, → Ammunition 97 ploughing two of them into the towers of the World Trade Center in New York City, causing them to collapse, with another airplane crashing into a portion of the Pentagon, and a fourth missing its target, going down near Pittsburgh.



Osama bin Laden was widely known to be a keen fan of falconry. The son of a Saudi building contractor and millionaire, bin Laden himself arranged hunts during his time in Afghanistan, and was a regular attendee at royal falconry camps in the desert, be they in the United Arab Emirates or Saudi Arabia, even doing so during his time as a wanted man and internationally sought terrorist.[9] It was at one of these camps, organized in the Kandahar region in 1999 by esteemed guests from the United Arab Emirates, that the CIA almost tracked down and eliminated bin Laden with a cruise missile. But the preemp-

9 Christopher Peak, "Feathered Cocaine: The Story of Money, Terrorism, and Falconry," *HuffPost,* April 2, 2014, https://www.huffpost.com/entry/feathered-cocaine_b_4392859.

tive strike on the desert camp failed to materialize, whereas the attack on the world order of Manhattan and Washington, DC, did not. What shook the foundations of this world order to Ground Zero in 2001 came — contrary to all presidential rhetoric of absolute hostility — from precisely those precarious foundations, from the vital link between the West and the oil wells in the Arabian desert. If every form of terrorism touches on the specific foundations of states and exposes them to recognition, then Al Qaeda's Islamic terrorism is a form of reverse petro-terrorism. It is in keeping with the logic of extractivism itself, which Friedrich Kittler outlines in "On States and Their Terrorists": "The superpower is encroaching on its opposite. The opposite of the sea is the desert, the opposite of the city, the steppe. Step-by-step the civilizing process — or, more precisely, the US military infrastructure — is advancing into regions hitherto closed off to Western Civilization [...] as the city runs up against the steppe and houses encounter tents, the nomads become irritated."[10]

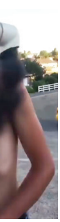
And that's why bin Laden — the rich, internationally socialized son of a millionaire — presented himself as a nomad on horseback, out hawking with his brothers. The ancient confrontation between settled peoples and nomads is symbolically galvanized here, and out of it emerged — according to Kittler in the same article, in reference to Nietzsche's research on Zoroastrianism → Baku135; World Cultural Heritage201 and to Foucault and Deleuze/Guattari — the matrix of good and evil, which both sides draw on in the conflict between Islamist terrorists and US civilization.

In *Cyclonopedia*, Reza Negarestani pursues the interconnections between oil, war machines, and monotheisms with similarly exhaustive interest. The oil of the Arabian desert, the Iranian philosopher claims, sees the convergence of jihad and techno-capitalism as in a shimmering mirage: "While for western technocapitalism, the desert gives rise to the oiliness of war

10 Friedrich Kittler, "Of States and Their Terrorists," trans. Geoffrey Winthrop-Young, *Cultural Politics* 8, no. 3 (2012): 385–97.

machines and the hyper-consumption of capitalism en route to singularity, for Jihad oil is a catalyst to speed the rise of the Kingdom, the desert. Thus for Jihad, the desert lies at the end of an oil pipeline."[11]

When city and desert, petrodollars and feudal traditions come together, what results is an explosive geopolitical situation that must be managed with utmost caution. Luxury and terrorism are equal reflections of this situation. It is a thin line that determines the direction in which the petrodollars flow and which symptom of the Western–Arab contact allergy develops: hawks and cheetahs in the passenger seat, or jihadists in Afghanistan, Syria, and Manhattan, or — as in Osama bin Laden's case — both.



Looking through the hawk's eyes, we can clearly make out a haziness beneath the shimmering sky of the deserts between Saudi Arabia, Qatar, and Kandahar. It's not just luxurious royal hunting camps that can switch functions and turn into terror camps — and vice versa. Victims and aggressors can blur, like in a fata morgana. When we gaze down on the desert as a place of contemplation and self-knowledge, the bizarre exoticism of the foreign and the patriarchal living out of all the desert sons' dreams can tell us a lot more about us and our spiritual voids than theirs. A Rolex? $100,000. Your very own gyrfalcon? $1 million. Cutting loose with your buddies? Priceless. → Burning Man 285

11 Reza Negarestani, *Cyclonopedia: Complicity with Anonymous Materials* (Melbourne: re.press, 2008), 19.

← *Fig. 21*

Rocket

In a backyard in Saint Petersburg, Russia, sits a children's slide shaped like a rocket. This object has not been manufactured on an industrial scale; the painted steel bars have been welded together by hand. Not white and cosmic, but colorful and chubby, it was photographed less than a meter off the ground (see fig. 21) in the spring of 1999.

The Soviet craze for space travel and rockets is the stuff of legend. → Black Square 263 It manifested in mosaics and military monuments, such as the statue of Yuri Gagarin in Moscow, on tea glasses in cozy Russian trains, and on cigarette packets such as *Kosmos* and *Laika,* on the latter, next to the famous portrait of the first dog in Outer Space. Whereas in the West fast cars and the overflowing wealth of a tapped oil well, a gusher, served as central icons of the cult and culture of petromodernity, in the East, the collectively built rocket can be considered the most significant image that foments a sense and a dream of this kind.[1]

What is less well known is the fact that key Soviet successes in space travel, such as the start of Sputnik in 1957 and Gaga-

1 The authors are grateful to Konstantin Kaminskij, literary theorist and energy historian, for this insight, shared during the conference Energy Humanities East: Energie- und Ressourcendiskurse in der (post-)sowjetischen Kultur, Humboldt University of Berlin, June 24–26, 2018.

rin's Vostok 1 in 1961, were achieved with petroleum-based fuel blends composed of kerosene and liquid oxygen. Special-engine fossil fuels, such as Syntin ($C_{10}H_{16}$), which boasts a special molecular structure of three strained cyclopropane rings, came into use later. → Science-Fashioned Molecules 71

The driving principle behind the backyard rocket only becomes apparent with closer consideration. After all, little cosmonauts don't slide out of the sides of the rocket, they slide out the back; they represent the rocket's fuel, or—better yet—its thrust. There is something melancholy about this seemingly cheery image of a backyard, in part because of the futility of this playful self-sacrifice. How is such a thing ever supposed to take off? Here, fuels do not represent a replacement for human labor; human pleasure serves as the fuel for an impossible machine. Children's play reverses the rationale that characterizes technology in the twentieth century, the notion that industrialized human beings do not muster the energy for their deeds themselves when they accelerate horizontally or rise vertically through the air or in orbit, but are powered by coal, oil, and gas.

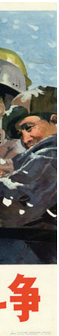
On the other hand, this children's climbing frame is in good company among the impossible machines found in science fiction. Since their emergence in the latter third of the nineteenth century, imaginary and speculative constructions have exerted significant influence on forthcoming visions of technology, and technology itself.[2] In literature, people first flew to Outer Space in a rocket in 1865, the year of Jules Verne's novel *From the Earth to the Moon,* adapted by film pioneer Georges Melliès in 1902 as *A Trip to the Moon.* In this context, we mustn't neglect to mention the 1928/1929 film *Frau im Mond* (The woman in the moon) by Fritz Lang: two real-life pioneers of rocket technology, Hermann Oberth and Rudolf Nebel, were involved in the construction of the film's rocket in the UFA Studio Neubabelsberg in Potsdam, Germany. Oberth later went on to be a mem-

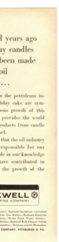
2 With respect to driving forces and energy-generating machines, see Graeme Macdonald, "Improbability Drives: The Energy of SF," *Paradoxa,* no. 26 (2014): 111–44.

ber of Wernher von Braun's construction team at the Heeresversuchsanstalt (Peenemünde Army Research Center). In the era of adventurousness preceding the October Revolution and the founding of the Soviet Union, Alexander Bogdanov (the philosopher, Bolshevik, and rival to Lenin) wrote the utopian fable *The Red Star* (also published under the name *The Red Planet*), which begins with a journey to Mars. Published in 1908, the book is considered a foundational text of later Soviet science fiction.[3]

Children as fuel? It may seem macabre, but it is not just a matter for fiction. Human beings have indeed served as cannon fodder in the drive to realize humanity's high-flying technological dreams. The first rockets to achieve orbit were German Aggregate 3 and 4, known as V1 and V2 (from *Vergeltungswaffe,* literally "retaliatory weapon"), and were fired off by the Wehrmacht in their thousands in the direction of London and Antwerp starting in September 1944, using ethanol from scarce potatoes and liquid oxygen as fuel. The construction designed by SS officer Wernher von Braun and his team was built by prisoners in the underground Mittelbau–Dora concentration camp complex; tens of thousands died. → World Cultural Heritage201 After the war, von Braun and leading members of his team were key figures in developing US rocket technology. And the industrialization and mechanization programs of the first real space nation, the Soviet Union, were driven forward under Stalin with murderous consequences, with the exploitation of hundreds of thousands of forced laborers, whose deaths were simply accepted. The greater good of developing a socialist society provided seeming justification for any victims — in war anyway, but also in space programs and the exploitation of mineral resources as driving forces of all efforts towards a higher purpose, be they in space stations and in orbit, or in the struggle against the elements at frosty drilling sites in Siberia, at the wells on the Caspian Sea, → Baku135 or on the earthquake-threatened oil island of Sakhalin.

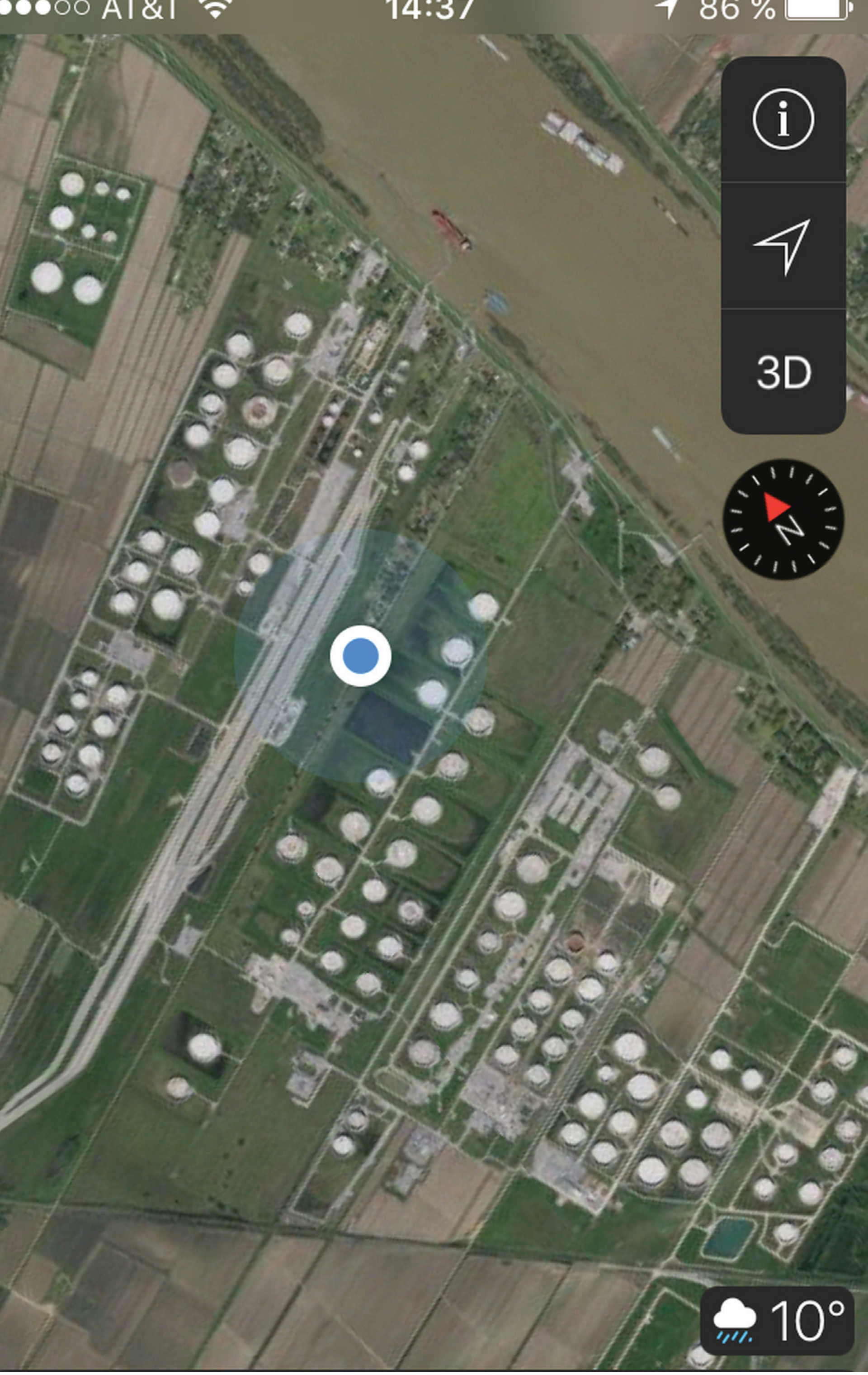
3 See McKenzie Wark, *Molecular Red: Theory for the Anthropocene* (London: Verso, 2015).





Raising a system's flag in orbit requires collective endeavor, it needs collective victims no matter the political system, → The Great Leap Forward143; Oleoviathan113 and regardless of whether one wishes to know about them or not. It is testament to the peculiar, if perhaps involuntary, achievements of Soviet Russia, that even a children's toy brings to mind these tragic and system-crossing elements of petromodern progress.[4]

4 For a comprehensive analysis of various aspects of the culture of remembrance of the Soviet Union, see Karl Schlögel, *The Soviet Century: Archaeology of a Lost World,* trans. Rodney Livingstone (Princeton: Princeton University Press, 2023).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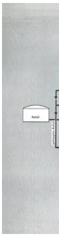
← *Fig. 22*

Louisiana

One of the world's largest landscapes dedicated to chemicals and refineries extends between Baton Rouge and New Orleans, covering a good hundred miles along the Mississippi River before it reaches the Delta and the Gulf of Mexico. Companies, some well known, some not, sit along the course of the Mississippi like a string of pearls: Exxon, Methanex, BASF, Nachurs Alpine Solutions, Shell, Rubicon, Praxair, Air Liquide, Formosa, Shintech, Mexichem, Poly One, Mosaic, CF Industries, DuPont de Nemours, Chevron, Sid Richardson, Epsilon, Marathon, Nalco, Colonial Sugar, Witco, Dyno Nobel, Genesis Energy, Honeywell, and countless others. The companies congregate at sites such as Norco, Plaquemine, and Geismar, and you need a business directory to get your bearings.[1] In among these are a few coal-fired power stations and a nuclear reactor, to supply the area with energy.

Chemical history was written in Louisiana. The fluidized-bed reactor for the catalytic cracking of oil → Molecular Mobilization[63] — developed in Baton Rouge in 1942 out of a collaboration



1 See Randy W. Peterson, *Giants on the River: A Story of Chemistry and the Industrial Development on the Lower Mississippi River Corridor* (Baton Rouge: Homesite Co., 2000); or see the online industry directory compiled by Peterson, http://www.chemplants.com.

between US chemistry and the German conglomerate IG Farben — is now a National Historic Chemical Landmark. → World Cultural Heritage 201

The Mississippi River — one of the most powerful water courses in the world, with a rate of 15,000 cubic meters per second in this segment — supplies the chemical commodity H_2O for cooling and steam. It also serves as an official, or unofficial, transport route for the facilities' wastewater. Yet the river is also one of the most significant inland waterways on the planet and is kept clear by the US Army Corps of Engineers for ocean-going freighters up to a depth of 13 meters and as far as the Exxon refinery at Baton Rouge. This facilitates a direct connection to all the world's oceans, and to numerous domestic agrarian and industrial regions via the world's largest network of inland shipping routes. Gigantic towboat convoys with up to seventy barges connected to one another ship artificial fertilizers and pesticides from the lower course of the Mississippi to the maize and soya steppes for the production of food and animal feed, and for so-called biofuels at the upper course. Erosion carries the leached nitrates back past the factories where they were made and into the Gulf of Mexico, where they cause algal blooms and zero-oxygen zones — which, ironically, is one of the conditions required for the formation of crude oil. → Temporal Abyss 241

Streams of oil and gas lie across this doubly significant water course, both resource and means of transport. Louisiana itself has considerable oil deposits in the immediate vicinity of the Delta and offshore. A bafflingly dense network of pipelines crosses and traces the course of the river to this end. Plantation, Dixie, Coastal, and Colonial are just a few of the names of the best-known pipelines that connect the region to the oil belts between the Gulf of Mexico, Texas, Oklahoma, the Dakotas, and Alberta. In many cases, their position is unclear, even to landowners; special authorities must be contacted to supply information before earthworks can begin. → Pipeline 53 And then there is LOOP, the Louisiana Offshore Oil Port, also connected by a pipeline, in the water and just 30 kilometers off the coast, at a depth otherwise impossible to reach on Louisiana's alluvial plain coasts, but at which the largest existing oil tankers can dock. Thirteen percent of US oil imports flows ashore here.

All kinds of chemicals are produced along the chemical corridor between Baton Rouge and New Orleans: primary materials, such as fertilizers; sulfuric acid, methanol, aluminum, and chlorine; refinery products, such as fuels, solvents, and lubricants; fuel additives, such as tetraethyl lead (the lead in formerly leaded gas); synthetic fibers and plastics, such as nylon, neoprene, and synthetic rubber, plus pesticides, coolants, et cetera.

Everything that every sphere of the globe has to offer streams together in the reactors in the chemical factories: salts from the region's gigantic salt domes, hydrocarbons and sulfur from oil reservoirs, hydrogen and ethane from natural gas, nitrogen from the atmosphere, and coal, ores, and metals from all over. And what is synthesized from the lithosphere and atmosphere streams back into the technosphere and biosphere, changed and capable of changing what is around it, as fuel, or synthetic materials, fertilizers, pesticides, or plastic. → Greenhouse 105; The Song of Styrene 235

Yet, one factor hardly seems to show up at all in these kinds of material streams: humans. The navigational display at the beginning of this entry expresses their marginalization and imperilment (see fig. 22). Observed for long enough, the image shows a residential district of the town of St. James Parish in Louisiana: a single line of houses wedged between fuel depots and loading stations. You need to visit the place to see the houses. You need the satellite view to capture the dimensions of the surrounding petro-environment.

The San Francisco-based photographer Richard Misrach visited this area with his camera on two occasions, in 1998 and 2009. Misrach released the book *Petrochemical America* in collaboration with Kate Orff, a New York-based landscape architect and urban designer. Orff and her collaborators employed thorough background research and visualization strategies to provide an impressively dense and historically deep close reading of Misrach's multilayered images of the region, which is also known as "Cancer Alley" for its notoriously toxic living condi-

tions.[2] Indeed, people in the petrochemical corridor have historically been intimately tied to and burdened by global commodity flows. The ancestors of most of those people who inhabit the region today were themselves degraded and exploited as global commodities and human fuel for generations — enslaved on sugar plantations. French, German, and British-American enslavers operated in this region. → Petroporn173 Slavery was officially outlawed on December 18, 1865, in the United States; today, sugarcane is harvested and loaded with the aid of machines. But since they have not been addressed, the energy regime and the economic system of slavery are still at the foundation of the region's present-day commercial geography. Sugar factories were the first chemical factories in the region, long before the oil boom. Petrochemical complexes sit on the cadasters of former plantations; old cemeteries can be found behind the barbed wire surrounding the refineries. Black families were living in wood cabins built for enslaved people until well into the 1990s, while plantation mansions edged with boulevards are rented out for white people's weddings. Companies in the petrochemical corridor benefit from weak social structures and a civil society versed in injustice brought about by slavery and racism and weakened by a lack of prospects and work. Conditions aiming to protect workers and the environment are systematically ignored, taxes are cleverly evaded, and land development plans are tampered with. Only in select cases are unflinching peoples' representatives and civil rights campaigners able to negotiate on conditions. In this way, the historic renovation of the Whitney Plantation and its transformation into the only memorial to slavery in Louisiana are due in no small part to plans by the Taiwanese Formosa conglomerate to establish a synthetic silk factory on the Whitney site. The industrial plan failed, but one

2 Richard Misrach and Kate Orff, *Petrochemical America* (New York: Aperture, 2012).

of its preconditions — an investigation into the history of the estate — was ultimately pursued.[3]

The promises of freedom that petromodernity makes fall flat here — in its heartland, of all places, the country that recently gave its hydrocarbons the ideological name "molecules of freedom."[4] → Engine 83 Indeed, as early as 1920, the average American had access to energy equating to sixteen human helpers in the form of coal energy;[5] in 1937, this rose to twenty-one, including crude oil. This is a relationship that has shifted dramatically multiple times since, with every pickup truck, every air conditioning system, and every plastic plate. Yet along the petrochemical corridor, fossil energy does not equal empowerment; it means domestic colonial paternalism. This links — in parallel to a whole bundle of actual pipelines — the circumstances in Louisiana with those in the Athabasca Oil Sands in Alberta, Canada. Members of the First Nations in Alberta are granted rights to the land only on the very surface, but the substratum is being ploughed on an industrial scale. In Louisiana, it is primarily First Nations Peoples and people of color who suffer the effects of the raw materials industry. Within the most modern economies, the pursuit of fossil profit is ruining whole ecosystems, placing individuals and communities in chains, corrupting universities, and weakening the state.

Thus, the ecological burden on the region is founded on a repeated, historical burden, and it continues this tradition. Cheap labor and lax regulations are crucial for ensuring that an unscrupulous, national but also international industry can continue to invest billions in precarious and harmful infrastruc-

3 Ibrahima Seck, *Bouki fait Gombo: A History of the Slave Community of Habitation Haydel (Whitney Plantation), Louisiana, 1750–1860* (New Orleans: University of New Orleans Press, 2014).

4 Luke O'Neil, "US Energy Department Rebrands Fossil Fuels as 'Molecules of Freedom,'" *The Guardian*, May 30, 2019, https://www.theguardian.com/business/2019/may/29/energy-department-molecules-freedom-fossil-fuel-rebranding.

5 Hermann Staudinger, *Vom Aufstand der technischen Sklaven* (Essen: Dr. Hans von Chamier Verlag, 1947), 60–66.

tures, which ceased to be innovative long ago and are now, if anything, backward-looking. The fact that the term "Cancer Alley" was coined in the 1980s as the result of a bitter labor dispute at the BASF plant in Geismar (Ascension Parish), and that the historic political burden of the alliance between Standard Oil and IG Farben — into which the BASF was merged during the Nazi era — is returning in an ecologically problematic way are direct symptoms of this.[6] Withdrawal would have been required years ago. Catastrophes such as Hurricane Katrina in 2005, when New Orleans was under water and a number of chemical plants burned down, have demonstrated the region's climatic vulnerabilities and, without massive technological interventions in the medium term, the area is doomed in the truest sense of the word. At the same time, nobody knows how long the Mississippi's lower course will continue along its present route. In 1973, a major deviation fom the main stream to the arm of the Atchafalaya River, which flows 130 kilometers farther west, and the draining of petrochemical plants worth billions between Baton Rouge and New Orleans were prevented thanks only to considerable engineering and a lot of luck. Would it succeed a second time? The answer is written in the stars.[7]

6 For more on this connection, see also Benjamin Steininger, "Ammonia Synthesis on the Banks of the Mississippi: A Molecular-Planetary Technology," *The Anthropocene Review* 8, no. 3 (2021): 262–79.

7 James F. Barnett, *Beyond Control: The Mississippi River's New Channel to the Gulf of Mexico* (Jackson: University Press of Mississippi, 2017). Local artist and activist Imani Jacqueline Brown depicts the network of oil infrastructures in the petrochemical corridor of Louisiana as a constellation of stars in her art installation *What Remains at the Ends of the Earth?,* exhibited at the Berlin Biennial in 2022 and at Petromelancholia in Rotterdam in 2023, https://art.brutus.nl/Mzg1LzA=.

← *Fig. 23*

Petroporn

"Oil-soaked workers take a break from cleaning up a spill in the swamps near Oloibiri."[1] These are the words that caption the image featured in this chapter. The photograph by Ed Kashi also graced the cover of his highly lauded book of documentary photographs, *Curse of the Black Gold: 50 Years of Oil in the Niger Delta* (see fig. 23).

Nigeria is the largest oil-producing nation in Africa. It is rich in resources and blessed with a lush natural environment. More than 500 years of colonial and neocolonial trade relations have rendered the violent influence of foreign states and international businesses almost normal for the people and cultures in the Niger Delta — beginning with slavery in the early modern era, continuing with the palm oil boom in the nineteenth century, to the oil and gas of at least the last fifty years. Yet the authors of *Curse of the Black Gold* come to a horrifying conclusion: no era has been as devastating for the region as the present age of fossil materials. According to an estimate from the World Bank from 2008, oil and gas to the value of around USD $600 billion had been mined and, for the most part, sold abroad between

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1 Ed Kashi, *Curse of the Black Gold: 50 Years of Oil in the Niger Delta,* ed. Michael Watts (New York: PowerHouse Books, 2008); caption is on the inside of the cover.

the time extraction began in 1958 and the time of the survey. Yet the average standard of living in the region has dropped and rates of illiteracy have risen since oil and oil money have been flowing through the country. Corrupt elites have become rich in the Niger Delta, and ordinary people have seen none of the profits, while their livelihoods have been destroyed.[2] The natural environment of the Niger Delta has been polluted and poisoned to an unfathomable degree. The poverty rate is more than 90 percent, notably higher than the already very high rates across the country. "Nigeria has become a model failure."[3]

The situation in the country is akin to an African variant of the oil curse, the phenomenon that sees numerous countries acquiring no wealth from oil, only suffering. → Black Square 263 This is what *Curse of the Black Gold* is about. The book was edited by Michael Watts, a professor of African Studies at Berkeley. Among the series of images in this large-format book of photographs, alongside the two text contributions from Kashi and Watts, there are texts exclusively by Nigerian writers. They provide a comprehensive and critical image of the history and present of Nigeria as a multinational setting for the exploitation of people and raw materials, shaped by internal struggles and rivalries.

The Niger Delta was a significant hub for the trade in enslaved people with colonial European trading organizations, which began in the late fifteenth century and soon became a transatlantic enterprise. Crude oil export terminals, such as Bonny, Brass, Escravos, and Forcados, were built on the ruins of former central port transshipment points during the era of enslavement. The Escravos terminal even takes its name from this period; the river that bears the same name, and on the banks of which the terminal is located, was named in the fifteenth century for the

2 On the sinister combination of economics and social history in the Niger Delta, see also Aktindunde Akinleye, "Oil and Ethnicity in Nigeria: A Case of Malfunctional Dialectics," in *Oil: Beauty and Horror in the Petrol Age,* ed. Andreas Beitin, Alexander Klose, and Benjamin Steininger (Cologne: Verlag der Buchhandlung Walther und Franz König, 2022), 250–58.

3 Michael Watts, "Sweet and Sour," in Kashi, *Curse of the Black Gold,* 44.

Portuguese word for “slave.”[4] The transatlantic trade in enslaved people seems to have anticipated the trade in energy resources in its treatment of people as mere commodities and disposable bodies devoid of rights. Kathryn Yusoff, a British geographer, takes sugar as an example to explain the systematic connection: “Sugar was the conversion of inhumane slave energy into fuel, then back into human energy, plus inhuman energy, to produce industrialization. Coal was the unhuman corollary of those dehumanized black bodies.”[5] What Yusoff summarizes so pithily is a variant of the well-known trade triangle:[6] enslaved people from present-day Senegal, Nigeria, Cameroon, and Congo were shipped to the Caribbean islands, Brazil, and later to Central and North America, and were forced to work in the sugar plantations in these regions. The sugar they worked to produce was supplied to the colonial nations of Europe and provided coal and industrial workers in this part of the world with the energy required to further the advance of industrialization. → Louisiana 165

Then again, one of the driving phantasms of petromodernity was and remains the notion that the energy supplied to the industrial metabolism by enslaved people and other workers would be replaced by fossil fuels. → Engine 83; Data Is the New Oil 277 Time and time again, however, history has proven that this is merely a fairy tale of Western modernity, as fantastical as the story of “Africa” and the presumed inhumanity of “the Negro,” which was once used to justify the inhumane undertakings of enslavement itself. “If there is one space,” writes Achille Mbembe (Cameroonian historian and cultural theorist), “in which the imaginary relationship and the fictional economy undergirding it existed in their most brutal, distinct, and obvious form, it is

4 G. Ugo Nwokeji, “Slave Ships to Oil Tankers,” in Kashi, *Curse of the Black Gold,* 62–65.

5 Kathryn Yusoff, *A Billion Black Anthropocenes or None* (Minneapolis: University of Minnesota Press, 2018), 15.

6 David Eltis, *Atlas of the Transatlantic Slave Trade* (New Haven: Yale University Press, 2010).

in the sign that we call Blackness, and, as if by ricochet, in the seeming outer zone that we call 'Africa.'"[7]

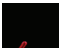
The fabulous but nevertheless constitutive tales of racism and the promises of fossil energy clash in Nigeria. It seems all the more important, then, to recall those workers' bodies, still exploited, as shown on the cover of *Curse of the Black Gold:* in Kashi's photograph, we observe the naked, muscular, and oiled upper bodies and torsos of two workers, almost like statues from antiquity. Their heads and legs are cut off, outside of the frame. Unlike a classical sculpture, each torso has arms and hands, which hold sticks and machetes, tools and weapons. Kashi's photograph nevertheless displays the two Black workers in a deeply alienating way — without names, without the possibility of self-determination. Their bodies stand *pars pro toto* for the powerlessness, disenfranchisement, and exploitation of all people in the Niger Delta.

Yet another layer of meaning unfolds beneath or perhaps next to this reading of the image, in which stories begin to detach themselves from bodies spread out like landscapes: small black crumbs are scattered across the muscular chest, stomach, and arms of the headless body on the left; they seem to float on the oily surface like waterweed or duckweed. Held up by a black leather belt with a brass buckle, the figure's silver-grey suit trousers stand in almost technoid-like contrast to this natural surface. Above these is a large navel, gleaming and framed by a wreath of black crumbs, delicate and vulnerable-looking like the slimy inside of a mussel. The worker on the right, his body leaning out of the image slightly, wears anthracite-colored joggers with a yellow cord, which has mischievously crept a little out of the waistband, gaping forward ever so slightly. This directs the gaze to the oily pubic hair, glistening in the lateral light, which spreads up from the waistband to the navel. One of the ends of the cord points down at an angle like a crooked finger, where the man's glans bulges gently against the soft material of the joggers.

7 Achille Mbembe, *Critique of Black Reason,* trans. Laurent DuBois (Durham: Duke University Press, 2017), 12.

The “official,” accusatory message the photo conveys comes from what cannot be seen: the men’s faces and heads, and thus the negation of the personalities and individual will of those presented by structural violence. The “unofficial” message comes from what can be seen: the oily, muscular bodies. It is precisely because the figures are headless that nothing stands in the way of the images they conjure of virility and sexual potency, of natural, instinctive reproductive vigor, which is able to feed off centuries of “frivolity and exoticism” in dealing with Black bodies, or images of them.[8] This sexualizing gaze also appears to be effective when it remains in the background as a perception distinctly taboo. Once we become conscious of its presence, it becomes hard to ignore; it is what gives the image its energy. It begs the question, which of the two is the fundamental message? The question is all the more pressing against the backdrop of the ubiquitous dynamics of the mutual aesthetic supercharging of forms of economic desire and those of sexual desire in petro-modern consumer capitalism. → Men and Petroleum 75 What difference is there between the image of oil-smeared workers and the images of scantily clad women in an automotive calendar?

Kashi’s photographs draw on an emotive, radical visual language that places contrasts front and center. In this way, they conform not only with the mainstream of documentation of the living and working conditions on the “dark continent” of Africa, but also with icons of petrocritical image production, like the seemingly hellish images of burning oil wells, → Burning Soil 229 the dead cormorant, the plastic contents of its stomach filthy and there for all to see amid the rotting, organic remains of the rest of its body, → The Song of Styrene 235 or the photographs of oil-soaked seabirds, distressed and peering out at the camera from black caverns at the people of the world, who, with their consumption habits, are the ones who made the accident-prone movement of oil profitable in the first place. High gloss and the aesthetics of the spectacle seem to be a prerequisite for images of this kind circulating.



8 Ibid., 131–32 and 142.

In a statement in response to the accusation of spectacularizing Black bodies, Michael Watts points out how multifaceted Kashi's photographic examination of the situation in the Niger Delta is, and that *Curse of the Black Gold,* unlike many other comparable projects, is a book in which images and text are of equal importance, and which, in this way, offers a differentiated and multilayered portrait of the situation in the Niger Delta.[9] Both are true. Yet the question instigated by Watts remains as to why the image of the two headless men, of all possible options, was chosen for the cover of the publication. Wouldn't another form of photographic examination of the complex situation in the Niger Delta be more fitting than one that retains the suffering and uses it as a vehicle for an emotive response?

When observing images in the "petroporn genre,"[10] like the aforementioned pictures of hellish flames, suffering workers, and dead seabirds, an ambivalence sets in, which appears similar to that inherent in pornographic images. Whereas, in the case of the latter, it remains unclear whether they are serving the liberation of sexual desire or whether desire is in fact subordinated to a kind of market logic, in the case of the former, the question arises as to whether the charge that ought to emanate from these images is addressing political subjects capable of critique or whether the affects they produce are consumed by the observer as part of a culture of spectacle, and the outrage dissolves into a cathartic sense of well-being. After all, representations of suffering function as commodities in the attention economy, and, in this way, an extra level of exploitation is added to the physical happening.

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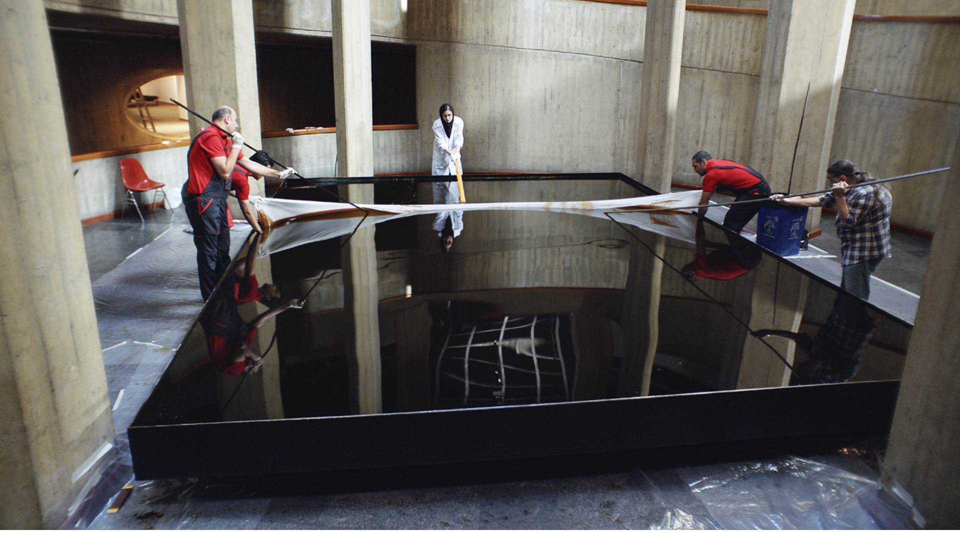
9 Michael Watts, "Specters of Oil: An Introduction to the Photography of Ed Kashi," in *Subterranean Estates: Life Worlds of Oil and Gas,* eds. Hannah Appel, Arthur Mason, and Michael Watts (Ithaca: Cornell University Press, 2015), 165–77.

10 For a discussion of images in the "petroporn" genre, see also Alexander Klose, "Extraction — Destruction — Production: On the Contradictory Productivity of Oily Images," *Resolution Magazine 1: Hot Pictures,* eds. Kyveli Mavrokordopoulou, Giacomo Mercuriali, and Laurens Otto (London: Antenne Book, 2021), 17–28.

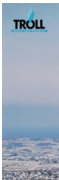


← *Fig. 24*

Tehran Museum of Contemporary Art

After forty years, *Matter and Mind* needs cleaning up. The piece's creator, Noriyuki Haraguchi, now seventy-two, has traveled from Japan on the invitation of the Iranian artist Shirin Sabahi to oversee works on his sculpture, permanently installed at the foot of the rotunda staircase at the Tehran Museum of Contemporary Art, which opened in 1977.

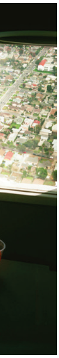
Workers draw long rakes and cloths through the flat, rectangular pool, filled to just below the brim of its steel container with used, black engine oil. Using sieves and nets, they fish out objects that visitors to the museum have thrown into the oil over the past four decades. Coins, pencils, shards of crockery, paper planes, sweets, pills, and sugar cubes emerge like fossils from a lake of asphalt, like an ancient bronze fibula recovered from moorland. → Posidonia Shale 189; World Cultural Heritage 201 Four barrels of oil dating from the time when the sculpture was installed, organized from stock, will compensate for what has evaporated over the years. The procedure, both painstaking and meditative, is captured in Shirin Sabahi's video piece *Mouthful*

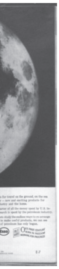


(see fig. 24 for a video still) and the installation *Pocket Folklore,* which exhibits the objects recovered from the oil.[1]

If oil can serve as the foundation of art in three entirely different ways — as the medium employed in the work itself, as a prerequisite for the living and working environments presented in the artwork, and as the means with which the artwork can be purchased — then Sabahi's work addresses these three coordinates in an exemplary manner. The third way is the least visible and yet the most important here: the oil money invested in art. Haraguchi's liquid sculpture quite literally reflects one of the most astonishing artistic ventures in the world: the largest collection of modern Western art outside of Europe and the United States, and a museum established specifically for this purpose in a country that has considered Western modernity its enemy since 1979.

The collection was acquired in the 1970s on the personal initiative of the empress, Shahbanu Farah Pahlavi, with funds from the National Iranian Oil Company (NIOC). The Iranian imperial couple's glitzy lifestyle was the stuff of legend. The Shahbanu was said to bathe in milk, and the shah was fabled to have had his lunch delivered by Concorde from Paris.[2] → Sprawl 89; Space Travel 271 An imperial art collection funded with oil money seems like a fitting addition to this picture. "It was the early 1970s," Pahlavi explains in a 2016 interview with *The Guardian.* "Our oil revenue had significantly increased and I spoke to His Majesty [the shah] and [the then prime minister] Mr Amir-Abbas Hoveyda, and told them that it was the best time to buy some of our ancient [and contemporary] works both internally and





1 Shirin Sabahi, "Mouthful Excerpt," *Vimeo,* February 2, 2020, https://vimeo.com/388802800.

2 See also the opening sequence in *Argo,* dir. Ben Affleck (GK Films, 2012), cited in Jan von Brevern, "Luxury, Speed, and Nostalgia: The Concorde," in *Oil: Beauty and Horror in the Petrol Age,* ed. Andreas Beitin, Alexander Klose, and Benjamin Steininger (Cologne: Verlag der Buchhandlung Walther und Franz König, 2021), 311.

from outside."[3] And so it was. An American curator was hired as a consultant. Pieces by Bacon, Pollock, Rothko, Stella, Motherwell, Moore, Kandinsky, Degas, Renoir, Gauguin, Ernst, Giacometti, and Magritte made their way via Christie's, Sotheby's, and Beyeler to a new building established for this specific purpose by Kamran Diba, the shahbanu's cousin, in the center of Tehran.

Like an inverted version of the Guggenheim Museum, the building coils its way from a ground-level portal via a spiral corridor, out of which doorways lead into the galleries, curving several floors underground. Protected by prudent directors and a courageous head of collections, the building and its collection survived the Islamic Revolution of 1979 — and the years of shifting radical Islamist rule that followed — unscathed. The collection, composed of 1,500 Western artworks, remained in a strong room in the basement for two decades, behind two steel doors, only be opened to carefully selected visitors.

The year 1999 saw the first exhibition of Western art, with works by Warhol, Lichtenstein, Rauschenberg, and Hockney on display. In 2018, attempts to exhibit parts of the collection abroad in the West for the first time — in Berlin — failed, after years of dogged preparation, because, ultimately, in Tehran's view, it seemed too dangerous to hand the artworks over. One Pollock was estimated to be worth $250 million, and experts consider it to be one of his best; two Rothkos have been valued at between $100 million and $200 million each, then there are the thirty Picassos, a dozen Rauschenbergs, and fifteen Warhols.[4] Yet it is precisely the value of these works that make any loan difficult, because a country subject to an embargo runs the risk of losing the pieces it loans out. And because it could prove difficult to receive the transfer of any purchase fees in the first

3 Saeed Kamali Dehghan, "Former Queen of Iran on Assembling Tehran's Art Collection," *The Guardian,* August 1, 2012, https://www.theguardian.com/world/2012/aug/01/queen-iran-art-collection.

4 Peter Waldman and Golnar Motevalli, "Iran Has Been Hiding One of the World's Great Collections of Modern Art," *Bloomberg Businessweek,* November 17, 2015, https://www.bloomberg.com/features/2015-tehran-museum-of-contemporary-art/.

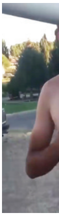
place, even Bacon's undisguised depiction of homosexual love, *Two Figures Lying on a Bed with Attendants,* despite multiple attempts to purchase it, remains in Iran, a country where homosexuals are at risk of torture and the death penalty.

The Tehran collection is undoubtedly one of the most spectacular instances of oil money being invested in art, but it is by no means an isolated case. It is a field that promises not only high profits but social capital too. Like other magnates of the bourgeois era, oil tycoons (and oil states) continue an old aristocratic and dynastic tradition. Here, we cannot fail to mention the engineer and crude oil speculator Calouste Sarkis Gulbenkian, who put the legendary wealth he made from oil shares in the Middle East into an enormous art collection of more than 6,000 pieces — artworks from ancient Egypt to the modern day. Using funds from the foundation created after Gulbenkian's death in 1955, the Museu Calouste Gulbenkian was established in Lisbon, where he spent the latter years of his life. Today, his collection forms the core of the museum, which was opened in 1969 and is one of the largest art museums in the world. Gulbenkian's US counterpart is J. Paul Getty, the oil magnate whose fortune was founded on his family's oil wealth in Oklahoma, and who invested huge sums in acquiring a private art collection. In the 1950s, he became one of the richest men in the United States thanks to the revenue from shares in Kuwaiti and Saudi Arabian oil-producing regions, which he had acquired in 1949, shortly before the first oil discoveries were made. He was responsible for the J. Paul Getty Trust, to which the J. Paul Getty Museum in Los Angeles, founded by him and provided with the record sum of USD $ 1.2 billion in 1982, belongs. To this day, the J. Paul Getty Trust and the Calouste Gulbenkian Foundation are among the largest foundations in the world dedicated to the advancement of arts, culture, and social causes.

One of the most prominent, recent initiatives to institutionally link the worlds of oil and art is the Louvre Abu Dhabi, the 2017 inauguration of which was attended by Emmanuel Macron, the president of France. This is an instance of oil money providing for post-oil times. Abu Dhabi's museum island, which is still under construction, features, alongside other signature buildings, the Guggenheim Abu Dhabi, designed by Frank Gehry. In this way, both Paris and New York — the art capitals of the world in the nineteenth and twentieth centuries — are present in the oil-financed future metropolis on the Arabian Gulf. Finally, the Museum of Modern Art (MoMA) in New York, which regularly ranks as the most significant art institution in the world, must also be mentioned within this context. It was cofounded in 1929 by Abby Aldrich Rockefeller, an art collector and daughter-in-law of John D. Rockefeller. The family donated their New York estate — the house where Rockefeller Sr. had lived in his time as an oil tycoon — to the new museum.[5]

Altogether, petromodernity can be understood as a historically unique era of wastefulness; an epoch of ecstatically burning old treasures. → Temporal Abyss 241; Burning Man 285 Georges Bataille emphasized the fact that this state of overspending is, in a sense, less exceptional than it may appear in his major theoretical work on the economy of wastefulness: “The history of life on earth is mainly the effect of a wild exuberance; the dominant event is the development of luxury, the production of increasingly burdensome forms of life.”[6] With these words, Bataille turns on its head an understanding driven to prominence by the political economy since the eighteenth century, according to which scarcity, deprivation, and the exploitation and efficiency they give rise to are crucial factors of development in nature as much as in culture.

In the years before and after World War II, when Bataille was sitting down to write this theoretical work, it became clear that overspending had become a publicly proclaimed economic imperative in the industrial accumulation of petromodernity, be it in the excesses of the wartime economies on all sides or in the

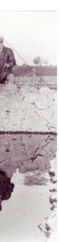


5 For a comprehensive take on the petromodern link between oil money and art, see Elena Engelbrechter, “Oil That Glitters Is Not Gold. Patronage and Interest Politics: On the Ambivalent Relationship between the Oil Industry and Art,” in Beitin, Klose, and Steininger, eds., *Oil*, 218–37.

6 Georges Bataille, *The Accursed Share: An Essay on General Economy*, trans. Robert Hurley (New York: Zone Books, 1988), 33.

economic struggle of political systems on both sides of the Iron Curtain. Fossil resources in the form of coal and, above all, oil were an energy-based requirement of these excesses and were also, therefore, tied up with inordinate financial means.

The link between oil (money) and art seems more than logical when considered from this perspective; indeed, one of the core functions of art in the modern age is to formulate an antithesis to calculations concerned only with utility, and to celebrate the luxuries of shape, material, function, and thought. It is only when resources, be these labor or materials, are withdrawn from the "regular" economic metabolism and transformed into high-value treasures that — under the conditions of the early modern era, mercantilism, or capitalism — baroque churches and concert houses, literature, paintings, and music emerge. The art of the petromodern era has the specific task and opportunity of making the constitutive profligacy of the era come into its own, making it visible and reflecting it in a concentrated way. Considered in this way, it is perhaps no coincidence that there are places as contradictory and extreme as Abu Dhabi, Los Angeles, or Tehran, where this succeeds symptomatically.



As a looking glass into an imperial treasury, Haraguchi's pool reflects the economic and geostrategic situation of petromodernity as a whole. → Black Mirror 247 Hoarding, wastefulness, and luxury only seemingly form an opposing pole to the logic of reinvestment in ever-productive industries and the continual multiplication of profits. → Priceless 149 It is precisely the uneconomic overspending of siphoned-off profits in cultural sectors that calls to mind the economic power of the cycle. Yet Shirin Sabahi's work renders the everyday dealings with the black mirror, the items left behind by classes of school children, the workers' conversations, as the object of art too. And here, at the very latest, it becomes clear: we, all of us, who partake in the riches and whims of this epoch in one way or another, are stuck in this pool until, perhaps in forty years' time, we are pulled out and become the butt of the cleaners' friendly jokes.

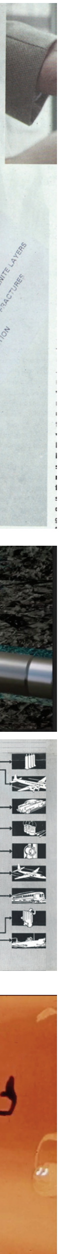
← *Fig. 25*

Posidonia Shale

The Natural History Museum in Braunschweig, Germany, boasts spectacular research facilities. The museum's paleontologists conduct their own digs, prepping an entire spectrum of fossilized life and fossil ecosystems from the region's sedimentary layers in their laboratory: whole ichthyosaurs, several meters in length, like the one on the preparation table in figure 25; bony fishes emerging out of the rock with their gleaming scales and sharp teeth, as if they found themselves trapped and preserved in the sediment only yesterday; also grasshoppers, dragonflies, and butterflies, whose patterned wings still seem to shimmer, vivid and lifelike, as imprints in the rock; snails, mussels, and sea urchins. And under the scanning electron microscope, microfossils come into view: prasinophytes, coccoliths, spores, and pollens from land-based organisms. → Plankton 213

The fossilized Jurassic Sea, from which these discoveries emerged, lies just a few meters beneath the Earth's surface between Braunschweig and Wolfsburg, near a village called Schandelah. The sediments are known as "Posidonia shale," after their index fossils, the Posidonia mussel.[1]

1 Rolf Bernhard Hauff et al., eds., *Jurameer: Niedersachsens versunkene Urwelt* (Munich: Pfeil, 2017).



It wasn't always professional paleontologists and committed laypeople digging up natural history in the Braunschweig region. The rock contains not only pretty fossils of natural historical interest but also strategic ones. → Core Sample 207 Posidonia shale contains high proportions of kerogen, a geohistorical and geochemical precursor to bitumen and, therefore, petroleum. The natural philosopher and science historian Peter Berz has described it as the transition from the biochemistry of lifeforms to the chemistry of rock: "Kerogens are the interface between the *soil* as part of the biosphere and *minerals* as part of the lithosphere."[2] → Frontier of the Technosphere 223 A process of heating and distilling makes it possible to accelerate the process of geohistorical oil formation by a few million years. In this way, it is possible to create artificial crude oil from what would have otherwise been an oil source rock only in the distant future. → Molecular Mobilization 63; Science-Fashioned Molecules 71

Depending on your perspective, the potential of the deposit in the Braunschweig region — 4 kilometers wide, 15 kilometers long, and 40 meters thick — is either enormous or ridiculous. In 1980, because of the price of oil reaching an all-time high, the state government and mineral oil companies considered the possibility of extraction. The potential yield was estimated at up to 100 million metric tons of artificial crude oil or — less impressively — eight months' worth of West Germany's oil consumption at the time.[3] Citizens' initiatives — and, more specifically, a fall in the price of oil — brought the brutal plans for oil surface mining to a standstill.

By way of comparison, a daily average of around 180,000 metric tons of oil are manufactured from viscous bitumen from the oil sands of Alberta Province, Canada — one of the largest and most controversial oil mining projects in the world since production began in the 1960s — and transported via pipelines

2 Peter Berz, "Die Philosophie des Kohlenstoffkreislaufs," unpublished manuscript of the lecture "Ökologie" at the Institute for Scientific Research, University of Lucerne, Winter Semester 2017/18, 34.

3 Oliver Mattenhof, "30 Jahre Naturzerstörung für acht Monate Öl," *Natur: Horst Sterns Umweltmagazin*, no. 1 (1980): 55–65.

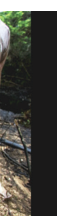
to the refinery regions of North America. → Louisiana 165 Experts estimate the total quantity of minable bitumen to be somewhere between 23 billion and 57 billion metric tons. In a booklet compiled in 2016, the state-owned Oil Sands Discovery Centre touts these reserves as being capable of covering all of Canada's oil requirements for the next 500 years.[4] The price of this, however, is preposterously high energy consumption in the manufacture of synthetic crude oil (Syncrude), landscapes completely destroyed, and purification ponds poisoned for decades to come by the waste water from bitumen processing.[5]

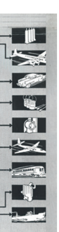
Plans to exploit the kerogen-rich formation in Braunschweig were being implemented on an experimental basis as early as the 1940s. The Nazi administration anticipated that domestic oil resources would provide some relief for the wartime economy, which was under strain from a lack of fuel. Test drillings had indicated the thickness of the formation in 1916 and during the 1930s. And so, a pilot plant was set up with Steinöl GmbH, founded for this specific purpose. As many as 800 detainees from the Soviet Union, Poland, Belgium, France, and numerous other European countries were tasked with mining the oil shale → Eichmann 195 for Steinöl GmbH's pyrolysis experiments in a subcamp of Neuengamme concentration camp built in the village of Schandelah as late as 1944. Several hundreds of prisoners died while carrying out this work.[6] The open oil shale surface mines are still visible today, serving as a memorial to the events

4 Oil Sands Discovery Centre, *Facts about Alberta's Oil Sands and Its Industries,* https://open.alberta.ca/dataset/d5a7fec7-6e37-431c-9f33-eb98510c65e4/resource/eb20740d-d1bc-4e60-b441-99f6c84998d8/download/2016-oil-sands-discovery-centre-osdc-facts-about-albertas-oil-sands-and-its-industry.pdf.

5 Ke Wang et al., "Energy Return on Investment of Canadian Oil Sands," *Energies* 10, no. 5 (2017): 614. An overwhelming impression of the vastness and radicality of the terraforming open pit mining is given by Peter Mettler's documentary film *Petropolis: Aerial Perspectives on the Alberta Tar Sands* (Greenpeace Canada, 2009).

6 Diethelm Krause-Hotopp, ed., *Das Konzentrationslager Schandelah-Wohld, 1944–1945: Ein Außenlager des KZ Neuengamme* (Schellerten: Einert & Krink, 2020).





of recent history; → World Cultural Heritage 201 the pits are very similar to those just a few hundred meters away, at the so-called Geopunkt Schandelah, where many of the paleontological gems from the museum were unearthed.

This geohistorically and contemporary historically explosive formation in the Braunschweig countryside is not a one-off. The industrial and deposit structures in the Posidonia shale regions in the mountain range of Swabian Jura in southern Germany between Tübingen and Rottweil on the Neckar were similar and even more expansive. From late 1943, prisoners were exploited here for oil shale mining in a number of subcamps of the Natzweiler–Struthof concentration camp as part of the fuel project known as Unternehmen Wüste (Operation Desert). At least 3,500 of the 10,000 prisoners met with violent deaths in the camp's surrounding villages such as Dormettingen.[7] And here, too, there are sites of natural historical education, such as the Dormettingen Fossil Museum, run by the cement corporation Holcim, and those that provide information about events of recent history, such as the Bisingen Museum and Concentration Camp Memorial; the two sites lie close to each other. The fateful connection between supposedly sublime natural history research and criminal, colonial mining — an "afterlife" for slavery in the sciences of paleontology and geology, recently debated by geographers[8] → Petroporn 173 — exists here in domestic circumstances in the middle of Germany.

In his 1959 essay "An der Zeitmauer" (At the wall of time), Ernst Jünger → Molecular Mobilization 63 describes humankind as the "index fossil" of a newly dawning geohistorical era.[9] If not only the quantities — like the masses of *Posidoniidae* found in a specific geological structure — but also the qualitative range

7 Michael Grandt, *Unternehmen Wüste. Hitlers letzte Hoffnung: Das NS-Ölschieferprogramm auf der Schwäbischen Alb* (Tübingen: Silberburg, 2002).

8 Kathryn Yusoff, *A Billion Black Anthropocenes or None* (Minneapolis: University of Minnesota Press, 2018), 3.

9 Ernst Jünger, "An der Zeitmauer," in *Sämtliche Werke,* Vol. 6: *Essays* (Stuttgart: Klett, 1981), 573.

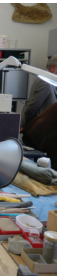
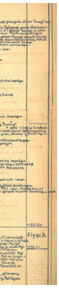
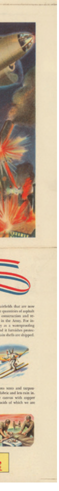
of activities of the human index fossil are to be observed in its, in Jünger's words, "layer-forming" capacity, then it is precisely those profoundly ambivalent, even tainted places such as Schandelah, Bisingen, and Dormettingen — places where natural history cannot be conveyed without an insight into bitter contemporary history — that offer privileged windows for observation.

Waller-See
Salzburg
S A L Z B U R G
1 Blatter A. u. Bader J.
2 Deutsche Petroleum A.G.
3 Eichmann Adolf
4 Gewerkschaft Elwerath
5 Habelsberger Herm.
6 Hofer Georg
7 Kamig, A.G.
8 Land Oberösterreich
9 Alpine Montan A.G. „Hermann Göring"
10 Rohölgewinnungs A.G.
11 Renzo Piga
12 Stadtgemeinde Gmunden
13 Stern K. Jng., Naumann H., Dr. Hafferl, F. Hafferl
14 Welser Papierfabrik G.m.b.H.
15 Wintershall A.G.
16 Wolfsegg Traunthaler A.G. Freischürfe u. Grubenmaße
17 Zeitlinger M. u. Eichmann A.
Schutzgebiete
Böhm. Massiv
Flysch
Kalkalpen

← *Fig. 26*

Eichmann

There are some names the eye cannot slip over the way it might past a neutral piece of information; it catches, pauses. Adolf Eichmann is one such name. Eichmann, the unremarkable organizer of the Holocaust, the pen-pusher from the Reichssicherheitshauptamt (Reich Security Main Office), has an unshakeable place in the history of the twentieth century. Thanks in particular to Hannah Arendt's observations about the Eichmann trial in Jerusalem, phrases such as "the banality of evil" are familiar to many. But what business does this name, this cypher for crimes against humanity, have appearing on geological maps for Upper Austria and the federal state of Salzburg? The exploration license for "Eichmann Adolf" can be seen listed in the regions of Linz, Salzburg, and Attersee (see fig. 26). On maps in the archive of the Geological Survey of Austria in Vienna, rights to hydrocarbons are marked in purple and orange watercolors. Is it a simple mix-up? Or is this the *real* Adolf Eichmann (1906–1962), whom we are obliged to picture as a youthful oil baron in the alpine uplands of Upper Austria? Well, it's both. From 1927 onward, the future mass murderer did in fact deal in oil in Upper Austria. Eichmann worked for the Vienna branch of the Vacuum Oil Company. However, it's not *that* Adolf Eichmann to whom the exploration licenses on the map belong; they belong to his father, Karl Adolf Eichmann

(1878–1960). After being employed at Linz Tramway and Electricity Company, Eichmann Sr. became self-employed, owning an oil shale company and a mill. Eichmann Jr., who was born in Solingen in 1906 and moved to Linz with his family in 1914, left school with no qualifications and was somewhat idle, so he was placed in his father's industrial network, first in oil shale mining → Posidonia Shale 189 at the Untersberg, and then — thanks to the intercession of a Jewish family friend in Vienna — at the Vacuum Oil Company, the company that, just a few years later in 1935, would go on to found Rohöl-Gewinnungs AG together with Shell. → Drill Record 29

The young Eichmann would travel around the Austrian Mühlviertel on his motorcycle, working as a representative for fuel and gasoline, but also planning new filling stations.[1]

Petroleum, a raw material that would later prove to be of central strategic significance to the National Socialists, is woven through the biography of this organizer of the death camps in a coincidental yet apposite manner. It is petroleum that would drive the world war, as a means of perpetrating the Blitzkrieg, for air forces and armored forces, and also as an objective of the war itself. → Ammunition 97 Yet hydrocarbons are also — as Peter Weiss demonstrated with material from the Auschwitz trial in "Song of Phenol" in his play *The Investigation* — direct methods of killing: as in the case of phenol (C_6H_6O), which was administered to the heart by injection.[2] Gasoline was also employed quite literally as an instrument of murder, in the gas chambers at Sobibór, Bełżec, and Treblinka, and in mobile gas vans, for instance at Kulmhof concentration camp or during the T4 campaign to murder people with disabilities. The SS functionary Erich Fuchs described the process as it was in 1942 at the Sobibór trial of 1965–1966: carbon monoxide from specially configured heavy gasoline engines purchased for this specific

1 David Cesarani, *Eichmann: His Life and Crimes* (London: Vintage, 2005), 23.

2 Peter Weiss, "The Song of Phenol," in *The Investigation: Oratorio in 11 Cantos,* trans. Alexander Gross (London: Calder & Boyars, 1966).

purpose was channeled into the gas chambers.[3] Almost 2 million people were killed in this manner. Like the much better-known industrial chemical Zyklon B, carbon monoxide occupies the positions designated for the transport of oxygen in the hemoglobin. Though the blood continues to circulate, oxygen can no longer be supplied to the cells. Death occurs via a kind of internal suffocation.

Any horror felt at the appearance of the name "Eichmann" on a geological map lays bare the burden of petroleum in a radical way. The relief one feels that it is "just" the father of the Nazi bureaucrat who wanted to become an Upper Austrian oil baron doesn't last for long.

Family ties to the name and, ultimately, the geology and land survey ought to have set investigators on Eichmann's trail. In 1959, Simon Wiesenthal was surprised by a Linz obituary: Why did Vera Liebl (who allegedly had divorced Eichmann) still appear under his surname in the obituary for Eichmann's mother?[4]

It wasn't until 2021 that the story of the special personnel network that carried out Eichmann's arrest was published. Gerhard Klammer, a geologist who had emigrated to Argentina, played a pivotal role. He recognized Eichmann, despite his use of a pseudonym and the job he was using as cover (working as a land surveyor for Klammer himself) and got in touch with the Bonn-based military bishop, Hermann Kunst. Kunst informed the Jewish-atheist Social Democrat and prosecutor-general Fritz Bauer in Frankfurt, who was ultimately able to convince the Israeli secret service to seize Eichmann.[5]

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3 See Achim Trunk, "Die todbringenden Gase," in *Neue Studien zu nationalsozialistischen Massentötungen durch Giftgas. Historische Bedeutung, technische Entwicklung, revisionistische Leugnung,* eds. Günter Morsch and Bertrand Perz (Berlin: Metropol, 2011), 23–49. See also Sarah Jansen, *Schädlinge: Geschichte eines wissenschaftlichen und politischen Konstrukts* (Frankfurt: Campus Verlag, 2003), 338–44.

4 Cesarani, *Eichmann,* 317.

5 Bettina Stangneth and Willi Winkler, "The Man Who Exposed Adolf Eichmann," *Süddeutsche Zeitung,* August 20, 2021, https://www.sueddeutsche.

The same evil side harbored by history at large can also be applied to the history of oil: the horror can only be explored in the interplay of astonishment and recognition, of opening up and pinning down historic charges. It is only in this way that the horror felt by future generations at the sight of a name on a map can become a valuable resource for reprocessing and remembering.

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1988 | 1988

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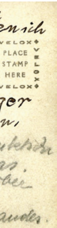
A/S Norske Shell

← *Fig. 27*

World Cultural Heritage

A gas platform stands in the heart of a seaport, towering above the city like a cathedral. And yet, this structure, which features on a 1988 Shell company calendar in downtown Stavanger, Norway, goes beyond the limits of a classic cathedral (see fig. 27). Concrete cylinders arranged in a ring formation reach into the sky like gigantic silos, topped again by four pillars bearing a platform, on which sit a number of different buildings: a kind of hotel, a drilling rig, and a large crane. This is the Troll A gas platform. The transcendental relationship that this "cathedral" demonstrates is no longer the relationship between human community and what was thought to be a higher, godly order. Rather, the relationship between the community and its energetic foundations is granted the appearance of transcendence.

The calendar was published a good four years before works to build the natural gas platform actually began. The development of the Troll gas field, off the Norwegian coast approximately 100 kilometers to the west of Bergen, was carried out from 1992 to 1995. Construction on the Condeep structure took a similar length of time. Condeep stands for "concrete deep water structure," where the supporting structure for an offshore platform is not, as was previously the norm, constructed from steel skeleton parts, but cast in reinforced concrete. The plinths also serve as tanks for oil or gas and need not be anchored to the sea floor



because of their substantial individual weight. The technology was designed by Norwegian engineers and was conceptualized for the rough conditions in the North Sea. → Adventurers 129 It was used a total of fifteen times between 1973 and 1995. The Troll A platform is the last of its kind and, to date, is the largest structure ever moved by mankind. It measures 472 meters from its base 300 meters below sea level to the tip of its crane. Its reinforced concrete structure was first cast in the dry dock, then in the fjords, perfectly suited to this kind of underwater structure, in Stavanger, and then hauled to its current location in the open sea and sunk to the sea floor.

The Troll A platform is expected to continue operating until at least 2050; other Norwegian oil and gas fields in the North Sea, such as Statfjord, Ekofisk, Gullfaks, and Draugen, are predicted to operate for shorter periods. The state of Norway, home to a little more than 5 million people, which rose to become one of the world's great oil-exporting nations thanks to the exploitation of its deposits, and grew rich, has made provisions for a state fund when these end. → Plankton 213 This also affects how their economic, societal, and cultural significance will be remembered in the future. The Norsk Oljemuseum in Stavanger, planned in the 1970s and opened by King Harald in 1999, is Europe's leading museum of petroleum. Its mission, formulated by the Norwegian state authority for cultural heritage, is "to draw up a systematic overview of large physical oil installations that may be preserved — on the spot, at museums or elsewhere."[1]

Every era has its cathedrals, buildings that impress with their size and splendor, all while giving expression to the spirit of the age. In the nineteenth century, the era of industrial modernity, these were the great new railway stations built of steel and glass, factory halls, and other manufacturing plants, regularly described as cathedrals of labor or industry. A large portion of these architectural testaments to industrial culture have lost

1 Cited in Finn Harald Sandberg, "Condeeps: The Dinosaurs of the North Sea," *Journal of Energy History/Revue d'Histoire de l'Énergie* 2 (June 2019), https://energyhistory.eu/en/node/136.

their original function over the course of recent decades. They are now subject to monument conservation orders and serve mostly cultural purposes, from the turbine hall at London's Tate Modern to the Hamburger Bahnhof in Berlin (a former railway terminus), to the Gasometer Oberhausen. Significant industrial monuments to carbon modernity, such as the Zollverein Coal Mine Industrial Complex in Essen, Germany; the Völklingen Ironworks; or Ironbridge in England's West Midlands, are UNESCO World Heritage Sites.

Retired engineer Finn Harald Sandberg spent thirty years working for the Norwegian offshore oil industry and now serves as a consultant to the Norwegian Petroleum Museum. He has set himself the goal of ensuring that one of the Norwegian Condeep oil platforms due to be decommissioned in the foreseeable future — the Draugen platform in the oil field of the same name — is declared a UNESCO world heritage site. For the time being, the structures of the decommissioned Condeep platforms located above the water have been dismantled and the concrete base was left standing. Sandberg's plan — which, according to experts' estimations, would cost from USD $1 billion to $3 billion — proposes that the platform be preserved as a historical industrial landmark and made accessible for visitors.[2]

The initiative is in a class of its own. The legacies of petromodernity — the legacies of tanker spills, burst pipelines, destroyed drilling platforms, and, above all, of CO_2 and microplastics — will remain in the oceans, in the atmosphere, and in the soil for thousands of years to come; they will have altered the planet's biosphere, whether they are declared sites of world cultural heritage or not. → Pierced Earth 121; The Song of Styrene 235 If drilling platforms in Norway become part of the global memory and technological-historical preservation, then it stands to reason that other, previously hidden structures of petromodernity could be thought of in a new light. Industrial archaeologists have long reported on the ambivalent legacy of refineries. They are monstrous monuments to technology and environmental-technological renova-

2 Ibid.

tion projects in one; they are torn down and rebuilt faster than historians and heritage conservationists might like.

There is a long list of locations and sites where petromodernity could now be remembered in all its ambivalence. Refineries around Houston, the North Sea, the Caribbean island of Curaçao, and Louisiana would be possible candidates. The first fluidized bed reactor used for the catalytic cracking of petroleum on the premises of the Exxon refinery in Baton Rouge → Louisiana 165 has already become a National Historic Chemical Landmark, even if it does not enjoy the same accessibility as other landmarks. Before other sites can be memorialized, they have to be made visible, such as Neft Daşları, the enormous agglomeration of artificial islands and offshore platforms in the Caspian Sea off the coast of Baku, which is invisible on Google Maps. The drilling platform opened in 1948 during the Stalin era is a petro-Venice on stilts, containing hundreds of kilometers of heavy-goods vehicle bridges spanning between 2,000 derricks, apartments, sports grounds, and clubs for 5,000 inhabitants. Even the mother of all tanker ships, the Zoroaster, developed by the Nobel brothers in 1878, is built into its foundations.[3] → Baku 135

An actively commemorated oil industry and its genealogy sheds new light on sites of cultural history that have hitherto carried very different connotations. Even the ancient Processional Way of Babylon was grouted with bitumen, and some of the oldest artworks from Mesopotamia are 6,000-year-old figurines with bitumen hair and animal heads molded from bitumen. Sites from the Old Testament, such as the pillars of fire and cloud that guided the Israelites through the desert (Exodus 13:21–22) can also be traced to gas fields on Sinai.[4]

The fact that existing or recommended UNESCO sites have or could have old oil connections is demonstrated most keenly in Baku by the natural-gas-fed fire temple of Atəşgah and by the

3 Eve Blau and Ivan Rupnik, *Baku: Oil and Urbanism* (Zürich: Park Books, 2018), 162–168.

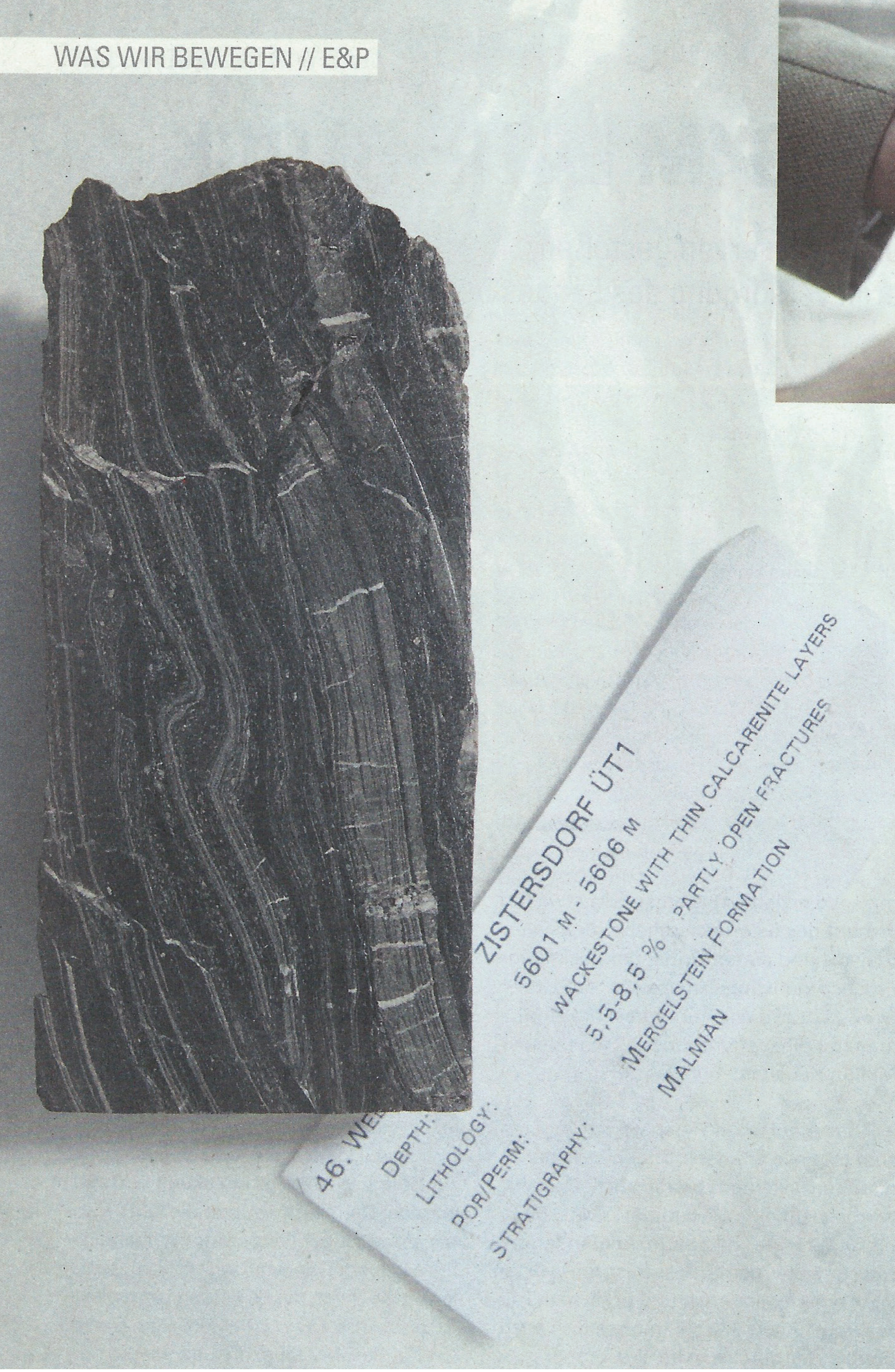
4 Günter Schönwälder, *Erdöl in der Geschichte* (Mainz: Hüthig und Dreyer, 1958), 73.

Qız Qalası (Maiden Tower), with its ceramic pipes and mezzanine floors built over petroleum wells, where medieval chemists may have worked with oil and gas.[5] Asphalt lakes such as La Brea Tar Pits in Los Angeles have already become National Natural Heritage sites, or such as the no less spectacular asphalt lake in the Baku district of Binəqədi, which has been suggested as a future UNESCO site and conservation site for fossil ecosystems and their scientific reconstruction.

Out of museums of natural history, museums of the working world of oil and gas, ethnographic and cultural-historical collections, industrial-archaeological locations and memorial sites → Rocket159 would emerge a new simultaneously geological, industrial, and generally historical memory landscape, one suited to the legacy of the era. Last, designating petromodern production sites as world heritage also means commemorating the catastrophic dimension of this era. This arc reaches from a memorial site barely known by the public at large, such as Ferryhill parish church in Aberdeen, → St. Barbara293 the stained-glass windows of which commemorate one of the greatest catastrophes the petroleum industry has ever seen — the Piper Alpha platform fire of 1988 — to one of the most monstrous and most well-known UNESCO world heritage sites, the former concentration camps at Auschwitz. At the Auschwitz subcamp Monowitz, the petrochemical production and destruction site, prisoners were put to work building and operating the methanol and Buna rubber factory established by IG Farben. The chemist and writer Primo Levi, who was imprisoned there and forced to work at the research laboratory, published higly impressive and disturbing writings on the experience.[6] → Molecular Mobilization63

5 Marina Döring-Williams and Luise Albrecht, "Baukeramik und technische Einbauten im Maiden Tower (Qiz Qalasi) in Baku, Aserbaidschan," in *Gebrauchskeramik. Ritualkeramik, Beiträge zum 51. Internationalen Keramiksymposium des Arbeitskreises für Keramikforschung,* ed. Karla Roşca (Sibiu: Museul ASTRA, 2022), 141–49.

6 Primo Levi, *If This Is a Man/The Truce,* trans. Stuart Woolf (London: Penguin, 1979), and Primo Levi, *The Periodic Table,* trans. Raymond Rosenthal (New York: Schocken Books, 1984), esp. 139–46.


46.
ZISTERSDORF ÜT1
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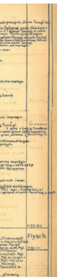
POR/PERM: 5,5-8,5 % PARTLY OPEN FRACTURES
STRATIGRAPHY: MERGELSTEIN FORMATION
MALMIAN

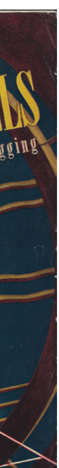
← *Fig. 28*

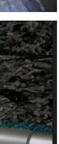
Core Sample

A stone is a stone is a stone. But unlike Gertrude Stein's roses, stones don't wilt, nor do they lose their fragrance. In stone, time stands still. What volcanic activity or life in the form of seashells or radiolaria have built is stilled in stone, be it granite or sediment. The changes in the rock are the result of geophysical and biogeochemical processes that have taken place over long periods of time. Additionally, however, a stone can switch roles in the short term, from a static, silent object to a dynamic, revelatory, and politically volatile one. → Posidonia Shale 189

The image that accompanies this entry shows a sedimentary rock that has changed many times in this way (see fig. 28). The sample originates from the substrate of the Vienna Basin in Lower Austria. It was part of a drill sample excised in 1980 at the Zistersdorf Übertief 1 borehole ("Übertief" = "more than deep") by the Austrian state-owned oil and gas company ÖMV (Österreichische Mineralölverwaltung) (Austrian Mineral Oil Administration), or OMV since 1995. The attached paperwork from the OMV core sample repository → Plankton 213 lists the classification of rock (Wackestone), the stratigraphy (Mergelstein Formation, Malmian), its porosity (5.5 to 8.5 percent), and the depth at which the sample originated: 5,601 to 5,606 meters. The sample was gathered from a record borehole, which only stopped once it was 7,544 meters down. In 1980, a tremendous







effort was to be taken to tap oil and gas in what was referred to as the "third floor" far beneath hitherto known oil deposits, in a geological fault area in the Vienna Basin unique across the entire Alpine–Carpathian arc, deeper even than the Neogene, Flysch, and Waschberg layers, in sediment estimated to be around 150 million years old. → Drill Record 29 When oil prices were at an all-time high, even the biggest investments in the deepest boreholes seemed justified. And as it happened, on January 16, 1980, Zistersdorf Übertief 1 did indeed strike gas. It was necessary to burn off 1.2 million cubic meters of natural gas per day in a controlled manner. Yet the well never reached a stage where it was productive. The borehole caved in just three days later. And the replacement borehole sunk in 1983, the Zistersdorf ÜT 2A, was unable to reach hydrocarbons, even at a depth of 8,553 meters. Instead of a gold mine, the boreholes offered nothing but empty rock. Nevertheless, science itself benefited from several hundreds of millions of misinvested euros with basic research carried out into the composition of the Alpine–Carpathian arc.[1] → Exploration 37

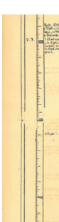
But a piece of rock is more than just rock. If the conditions change around an object that, according to human estimations, is stationary, then the object can be set in motion. This is what this chapter's image is in fact about. It illustrated an astonishing reevaluation of the historic boreholes in a 2010 edition of the OMV employee magazine. If the record borehole itself depended on the peak in oil prices generated by the Iranian revolution, → Tehran Museum of Contemporary Art 181 then the 2010 reevaluation was based on a technological revolution originating in the United States. → Frontier of the Technosphere 223

It is the global and new paradigm of fracking that makes core samples — which were locally shunted off as museum pieces to dwell in the dusty corners of the sample repository — attractive

1 Godfrid Wessely, "Geological Results of Deep Exploration in the Vienna Basin," *Geologische Rundschau — Mineral Deposits* 79 (1990): 513–20.

as new objects of research, as "epistemic things."[2] The hydraulic breakup of formations known as "source rocks" but, previously, never treated as "oil reservoir rocks," from which oil is gleaned, saw a change in the calculations of the global economy and, ultimately, global politics from the 1990s onward. Such vast resources were tapped in shale formations in Pennsylvania, Texas, North Dakota, and elsewhere, which changed the United States from an oil-importing nation to an oil-exporting one. Natural gas had to be destroyed for a fee in some locations around 2020, and, in early 2020, before the beginning of COVID-19, even fears over a possible world war in the Persian Gulf left oil prices practically untouched. → Temporal Abyss 241; Cannonball 301

Resources promising sovereignty were also on the agenda in the Vienna Basin in 2010. Experts were (over)enthusiastic in their assessment of the formation's potential, predicting a reservoir amounting to a full thirty years of national gas consumption. And yet, the treasure hunt in the Vienna Basin suddenly disappeared again from the employee magazines and daily papers. The rock — first drilled at great expense, then worthless, then destined for a museum, then epistemic, because of its offer of economic and geostrategic hope — had demonstrated its capacity for ecopolitical disruption. In a communications disaster of unparalleled proportions, the country's largest corporation had underestimated the fracking debate in the age of YouTube and Facebook. Test boreholes were scheduled not in experienced and welcoming oil communities, → Drill Record 29; Pumpjack 49 but close by. Legitimate environmental concerns were dismissed, and the company was not prepared for viral video clips from the United States showing burning faucets that seemed to prove that fracking was causing methane to leach into groundwater and drinking water. The fact that the film *Gasland* showed not the burning of fossil methane but that of biogenic



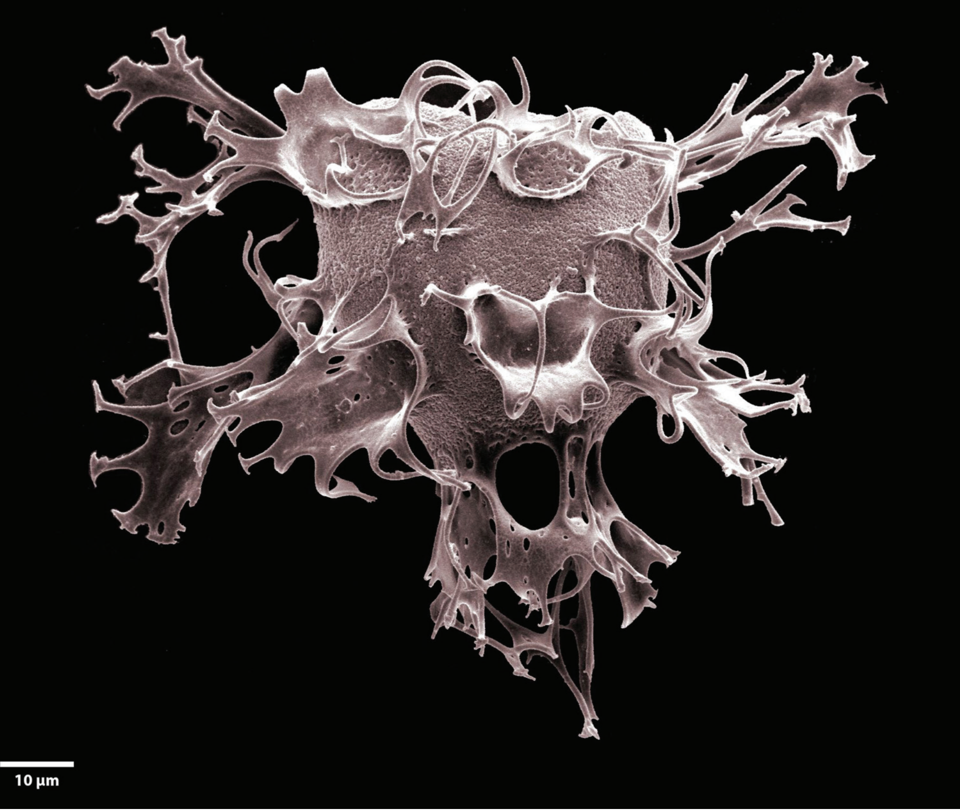
2 Hans-Jörg Rheinberger, *Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube* (Stanford: Stanford University Press, 1997).

methane — which occurs naturally in ground water — was lost in the ensuing hullabaloo.[3]

Instead of voting for domestic natural gas reliably present for decades from a company that still remains under 31 percent Austrian state ownership, is held in high esteem by classic petroleum communities, → St. Barbara[293] and adheres to high environmental standards, the community held a series of tumultuous open councils in which they voted for another principle altogether: *leave it in the ground.*

Even so, it is hard to say whether this brought discussions around the Weinviertel's gas deposits to a close, or whether perspectives on subsurface rock might change again. For as long as the behavioral habits of consumer countries fail to detach themselves from fossil resources, it's also a matter of distributing the risks fairly. Importing gas and exporting environmental hazards → Petroporn[173] fail to achieve this goal. And the crisis of European gas supplies prompted by the advent of the war in Ukraine in 2022, → Zombie[309] in addition to the European Union declaring gas to be a climate-friendly transition technology, has seen the situation change yet again. Thus, the development of mining technology as transparent, citizen-accompanied, and as environmentally monitored and state-monitored as possible could give rise to better role models than simply saying "not in my backyard." It could very well be that, under these conditions, the core samples mothballed for the time being have switched roles, not for the last time.

3 Josh Fox, dir., *Gasland* (International WOW Company, 2010).


10 µm

← *Fig. 29*

Plankton

Fossil plankton is one of the most captivating objects in the science of petroleum. An ethereal beauty is revealed to petroleum geologists who examine this object under an electron microscope. The beginning of fossil accumulation becomes visible from the geohistorical end of the industrialized food chain: tiny life forms that have stored energy from the sun in great masses in shallow coastal waters, and that we now use to power our technologies and our economies. As objects, they chronicle the most distant realms of natural history, but they also testify to the conditions in which they are tapped today. → Frontier of the Technosphere 223 Figure 29 shows the scanning electron microscope image of a sample taken from the core sample repository of the Norwegian Petroleum Directorate (NPD) in Stavanger.

It's no coincidence that the core sample repositories of today recall the mineral depots of the institutions of natural history established during the ages of colonialism and imperialism, such as the national geological institutes and natural history museums in London, Paris, Moscow, Washington, Berlin, and Vienna. Whereas imperial collection efforts once were backed by the political and military might of nation-states, it is now private commercial multinational companies in whose depots the planet is being gathered up and stored. → Core Sample 207 Geographies and geologies of not only individual state mining jurisdictions but whole continents lie in narrow wood or plastic boxes belonging to these companies, identifiable by paper or QR codes. Here's Romania, Libya, and Angola; New Zealand is over there at the back. And there's a forklift with a couple of bags' worth of Iraq.

It is well known that the colonial perspective has been capable of generating new overarching scientific narratives. Charles Darwin's theory of evolution, for instance, was only made possible by the imperial flow of traffic and robbery. It took a global empire to gather together the dynamics of evolution in the kingdom of nature and to be able to survey the long chain of life.[1] The effects of the petro-imperial accumulation of knowledge are less well known, but they occur on the same global scale. The fact that access to animal and plant specimens was only possible for institutions of a royal or imperial standing corresponds to the fact that access to these fossil rock samples is only possible for institutions involved in petro-imperialism.

A prerequisite for the value of these activities to nonindustrial research is data acquired by imperial means not remaining the "knowledge of rule" and the possibility of epistemological interests of the basic research also being pursued. Strong state institutions capable of staking out claims against large corporations are required in order to ensure that this does not merely rely on the somewhat unreliable goodwill of the companies. The Norwegian Petroleum Directorate is one such example of a highly powerful institution located somewhere between industry, state, and science. It is under the control of the Ministry of Petroleum and Energy and collates all the petrogeological information from what has, as of 2016, been defined as the Norwegian Continental Shelf. Its objectives are efficiency, transparency, high environmental standards, and mobilizing all acquired knowledge for the transition to a postfossil era. So if microfossils are dissected here with the finest possible brushes, → Posidonia Shale 189 then this is done under the banner of a

1 See Janet Browne, "A Science of Empire: British Biogeography before Darwin," *Revue d'histoire des sciences* 45, no. 4 (1992): 453–75.

strong state aiming for the good of its people. The most visible sign of this is a state pension fund fed by oil revenues, which is calculated to hold about USD $240,000 per citizen in Norway (as of 2022). → World Cultural Heritage 201 The Norwegian artist Ellen Karin Mæhlum's ultimately unimplemented 2014 design for a new 500-krone note represents one of the most consistent attempts to conceptually combine technology, nature, and Norway's wealth. The front and back of the banknote — Norway's second largest — would have sported the aesthetically linked shapes of the rolling cutter bits used in drilling for crude oil and the phytoplankton Emiliania *huxleyi*.[2] It would have been an extension of Ernst Haeckel's "art forms of nature"[3] to include "nature forms of technology" and "the naturality of money" and, as such, unique in the enlightened degree of its self-referentiality.

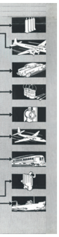
However, there are still points to consider about the fact that Norway's economy has relied on petroleum since the early 1970s, and has fossil plankton to thank for its fabulous wealth. Until the late 1960s, Norway was dependent on whaling and exporting whale oil, pushing these plankton and krill-eating sea mammals to the brink of extinction with such technological innovations as the explosive harpoon. The swing from whale oil to petro oil — which the United States, once the most successful whaling nation on Earth, had already undertaken in the latter half of the nineteenth century[4] — saw the country switch its place at the end of the hunting food chain for one at the end of the geotechnical food chain. As one of the youngest petroleum nations, it was also an understandable and smart objective to learn from the mistakes of the pioneers and to try to take the top

2 Norges Bank, *Forslag til motiver på ny seddelserie. Norges ny seddelserie: Havet* (Norges Bank, 2014), https://www.norges-bank.no/globalassets/upload/images/pressebilder/sedler_mynter/nyseddelserie/konkurranse/norges-nye-seddelserie-havet.pdf.

3 Ernst Haeckel, *Art Forms in Nature* (New York: Dover, 2012).

4 See Heidi Scott, "Whale Oil Culture, Consumerism, and Modern Conservation," in *Oil Culture,* eds. Ross Barrett and Daniel Worden (Minneapolis: University of Minnesota Press, 2014), 3–18.

spot in the shark tank with new technologies and sustainable forms of organization. In the interim, all further steps will aim to keep the top spot at the end of all food chains. Yet this comes at the price of contradictions — as a country, for instance, that has committed itself to a complete transition to renewable energy by the end of the current decade and where the sale of combustion engines is to be banned from 2025, but whose wealth and progress could be fed by exporting only recently tapped oil and gas stocks until at least 2070.[5] It remains to be seen whether the next real swing toward becoming the sustainable "battery of Europe" — which uses hydropower to drive the construction of synthetic molecules → Molecular Mobilization 63 — takes place again under the heraldic banner of plankton, and which species will be saved and which will be threatened in the trade.



5 Kai Strittmatter, "Norwegens Regierung eröffnet ein gewaltiges Ölfeld," *Süddeutsche Zeitung,* January 7, 2020, https://www.sueddeutsche.de/wirtschaft/norwegen-erdoel-johan-sverdrup-1.4747060.

← *Fig. 30*

Animals in Oil Fields

Wild boar snuffling in a clearing in a forest of oak trees: What could be a more natural sight? Even the tractor in the photograph (see fig. 30), taken in the 1970s, indicates a pastoral scene. Yet the leveled ground, the men in helmets, the portacabins, tanks, and a conspicuous steel construction speak to a more technological background. As it happens, the wild boar have mistakenly wandered onto the drilling site of the Tiefbohrunternehmen Richard Keith van Sickle (a deep drilling company) in Lower Austria. → Adventurers 129 Wild boar were not infrequent visitors to the Plattwald Forest near Neusiedl an der Zaya in the 1970s. James van Sickle, the director at the time, said the men treated the creatures with care and affection.

Local hunters also reported the astonishing effects of interactions between animals and technology. Ironically, at the time, the practice of collecting deep ground water → Drilling Fluid 43 in open pits—which would now be handled differently because of their mineral, and sometimes radioactive, components—was not frowned upon, because the hair of the animals that so loved wallowing in the mineral deep ground waters developed a unique sheen, which also made their skins attractive trophies.

Tales of the boars' special affinity for black gold were also passed down in the Alsatian oil districts at Pechelbronn and

Lampertsloch.[1] → Schlumberger 125 The legendary monk Lampert, who gave his name to the village and oil well, on record since 1501, was said to have asserted the oil's beneficial properties for wild animals in the seventh century. Wild boar that wallowed in the oil flowing from a hot spring on the earth's surface were protected from swine fever. And wild boar tracks can still be found around the open tar pools in the alluvial forests at Pechelbronn.

Prompted by these findings in 1734, Johannes Theophil Hoeffel submitted a dissertation at the University of Strasbourg, one of the first scientific studies on oil, which had been widely documented as a spiritual cure and listed in books of miracles since the early modern period.[2] Hoeffel recalls the countless benefits of oil to human beings:

> It is helpful for asthma, chronic coughing, and other breathing difficulties. A poor man, who had been living close to the well with his family at the time, used the water both as a drink and for preparing food, and an old woman, copying the poor man, found she was swiftly and unexpectedly cured of her ailment.[3]

Chewing globs of tar was said to help toothache, prevent tooth decay, and stimulate the drainage of pus. Tar was also said to ease nerve pain and headaches. For cramps and colic, it was recommended that tar be applied externally as a warm compress; in the case of scabies and even syphilis, Hoeffel advised rubbing the area with oil or tar water and ingesting the latter.

Yet oil cast a fatal spell over other species, particularly in the warmer months, Hoeffel claimed: "Both the smell, which spreads over large distances, and the specific behavior of insects, flies, wasps, and hornets, which rise and fall in a column over

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1 Alfred Scheld, *Erdöl im Elsass: Die Anfänge der Ölquellen von Pechelbronn* (Ubstadt-Weiher: verlag regionalkultur, 2012).

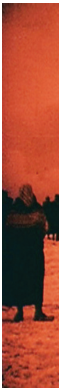
2 See Anonymus, *Tegernsee, Mirakelbuch: Gebetserhörungen des hl. Quirinus, 1732–1784*, https://digitales-archiv.erzbistum-muenchen.de/archiv-medien/Sonstiges/KB185_MirakelbuchTegernsee_Transkription.pdf.

3 Scheld, *Erdöl im Elsass,* 68.

the well, indicate that evaporation is significant at this time of year. Once the creatures have been lured in, they drop from the sulfurous vapor, dumbstruck, into the well. In the summer, the oil is polluted by such a quantity of insects that it is unsuited to any use."[4]

In extreme cases of evolution, however, it is possible for the biochemistry of lifeforms to adapt to petrochemistry — and insects prove this. *Diasemocera petrolei* (Coquillett, 1899), or *Psilopa,* or *Helaeomyia petrolei*[5] according to the old nomenclature, is a fly that thrives in Californian, Cuban, and Caribbean petroleum seeps. The biologist Theodosius Dobzhansky references it as a prime example of a lifeform limited to a minuscule ecological niche, quite in contrast to human beings.[6] The fly's larvae develop in — and only in — oil, and the mature flies are able to move along the sticky surface. Here, it is not just the fly that is making a significant contribution to evolutionary adaptation, but also its micro-bacterial symbionts, such as its digestive bacteria.[7] → Greenhouse 105

These bacteria may well offer a technological use in breaking down oil in polluted soils and waters, → Burning Soil 229 a far more attainable goal than Alsatian wasps and Austrian wild boar evolving an adaptation to oil. But the title of Dobzhansky's article would still hold true even if the human species pulled off this technological-biological trick: "Nothing in Biology Makes Sense except in the Light of Evolution."

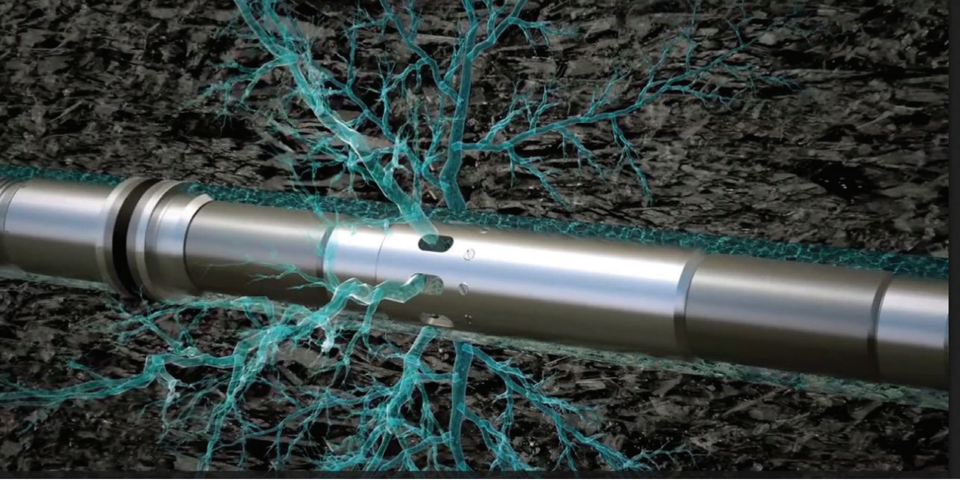


4 Ibid., 45.

5 On the current taxonomic debate, see Tadeusz Zatwarnicki, "Solving the Puzzle of Taxonomic Position of the Petroleum Fly by Resurrection of Diasemocera Bezzi from *Psilopa* Fallén (Diptera: Ephydridae) with Proposed Specific and Generic Synonymies," *Annales Zoologici* 68, no. 3 (2018): 527–52.

6 Theodosius Dobzhansky, "Nothing in Biology Makes Sense except in the Light of Evolution," *American Biology Teacher* 3 (1973): 125–29.

7 See R. Kadavy et al., "Microbiology of the Oil Fly, Helaeomyia petrolei," *Applied and Environmental Microbiology* 65, no. 4 (1999): 1477–82.



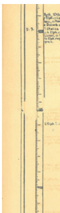
← *Fig. 31*

Frontier of the Technosphere

A layer unique to the Earth joins, blends, and blurs lithosphere, atmosphere, and hydrosphere — earth, air, and water. The Austrian geologist Eduard Suess first described this as the "biosphere" in 1875: "The plant that sinks its roots into the soil in search of food and, at the same time, rises breathing into the air, is a good image of the position of organic life in the region of the interaction between the upper spheres and the lithosphere, and it is possible to distinguish an independent biosphere on the surface of the solid."[1]

A narrow interface proves to be a powerful, even planetary operator. After all, life is not an unfamiliar guest between rock and atmosphere. The oxygen in the atmosphere, limestone mountains, banded iron formations, hydrocarbons, minerals, such as slate and granite — central parts of all the other layers — are made of life. → Posidonia Shale 189; Drill Record 29

Some decades after Suess, the Russian biogeochemist Vladimir Vernadsky identified an especially active region closely tied to the biosphere: the "noosphere," the sphere of the human mind and science. This sphere of the technological goes beyond the realm of animal and plant life — both literally and conceptually. Yet the mixing of the other layers is driven



1 Eduard Suess, *Die Entstehung der Alpen* (Vienna: Braumüller, 1875), 159.

by rather more ethereal factors: knowledge and reason: “The occurrence of reason and its practical emergence — the organization of science — is a principal fact in the history of the planet which, perhaps in the depths of change, surpasses everything which was previously manifested in the biosphere, and which is familiar to us. This fact was primed by the evolutionary process enduring over billions of years, and we can now see its effects, in geological minutes in the most extreme case.”[2]

An adaptation on this concept — the “technosphere” — is also present in contemporary debates on the Anthropocene, including in the work of Peter Haff.[3] A sphere of human technology and reason anchored in evolution, and simultaneously founded on an understanding of it, is reflected most notedly in the mining of the substratum. “Underground forests” in the form of coal or oil have been exploited since the advent of the fossil industry.[4] The technosphere is being expanded, downward by means of underground tunnels → Pierced Earth 121 and upward, in the fossil carbon emissions in the atmosphere. At the same time, a new rational order is emerging from the knowledge accumulated here: a geology and paleontology informed by evolution, and, therefore, the narrative essential to the worldview of modernity, that of a several-billion-year-old Earth in a state of biogeochemical development. → Temporal Abyss 241

A complete order of epistemic and practical rationality emerges out of access to fossil resources, an order — if you will — of “fossil reason.”[5] To date, it is the advancing access to increasingly remote, complicated hydrocarbon deposits that is

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2 Vladimir Vernadsky, *Scientific Thought as a Planetary Phenomenon,* trans. B.A. Starostin (Moscow: Nongovernmental Ecological V.I. Vernadsky Foundation, 1997), 72.

3 Peter Haff, “Humans and Technology in the Anthropocene: Six Rules,” *The Anthropocene Review* 1, no. 2 (2014): 126–36.

4 Rolf Peter Sieferle, *The Subterranean Forest: Energy Systems and the Industrial Revolution,* trans. Michael Osmann (Cambridge: White Horse Press, 2001).

5 Alexander Klose and Benjamin Steininger, “Im Bann der fossilen Vernunft,” *Merkur* 72, no. 835 (2018): 5–16, https://www.merkur-zeitschrift.de/artikel/im-bann-der-fossilen-vernunft-a-mr-72-12-5/.

mobilizing and further developing the latest standard of fossil reason. → Exploration 37

One such example is the drilling carried out in the estuary at the mouth of the Amazon River by the Brazilian oil corporation Petrobras. The continental shelf falls away steeply, and it requires enormous resources to drill down to such depths. However, if drilling is carried out in this environment, it is possible to use pollens and microfossils to glean a close reading of South America's natural history over the last 12 million years, since the rise of the Andes and the Middle Miocene.[6]

This sees the peak evolution of technology, science, and financial capital deployed for the exploitation and interpretation of natural history. Players such as Petrobras invest sums of up to USD $300 million — more than the $200 million annual budget of the International Ocean Discovery Program (IODP), a consortium for climate and sub-seafloor research funded by international participation — in drilling a single offshore deep borehole into deposits intricately concealed beneath thick salt layers.

Yet the technosphere has most recently expanded considerably into the substratum of classic, almost depleted — and therefore more likely to be written off — oil regions. Since the 1990s, high hydraulic pressure has been used to break up the microstructures of petroleum source rocks, which had previously not been considered exploitable reservoirs. The image accompanying this chapter (see fig. 31) is a schematic representation of how this technology, known as "fracking," works. Fracking has granted global economies — beginning with the United States — a new oil boom; *peak oil* has retreated into the distance. → Core Sample 207

This technology is on everyone's lips, both as a political issue and an environmental hazard. But even when conducted with all due diligence and responsibility at great depths that are not

6 J. Figueiredo et al., "Late Miocene Onset of the Amazon River and the Amazon Deep-Sea Fan: Evidence from the Foz do Amazonas Basin," *Geology* 37, no. 7 (2009): 619–22.

subject to the risk of earthquakes, with intact pipework and proper disposal of all wastewater, → Drilling Fluid 43 there remains the cultural-philosophical question as to the crossing of which boundaries define the realm of the technological and, therefore, the cultural. In these kinds of unconventional deposits, the transition from lithosphere to technosphere is laid directly into broken-up rock pores, in precisely the place where the biosphere once generated the rock and its energetic cargo.

The frontiers and the standards of the technological are set out in both tiny mineral details and in huge techno-economical settings. It is a shift that, in all probability, cannot be restored if the capitalist praxis of thinning "former biospheres"[7] ends. The "fossil reason" mobilized in the confrontation with these boundaries — the conjunction of unscrupulous market mechanisms, and geohistorical and evolutionary knowledge — will also play a role in all future technospheres and rationales. And just as the idea of life searching for sustenance did for Eduard Suess, this sphere of technological activity very much gives the impression of having been involved in all other spheres, too.

7 Vladimir Vernadsky, "Some Words about the Noösphere [1943]," trans. Rachel Douglas, *21st Century Science and Technology* 18, no. 1 (2005): 18, https://21sci-tech.com/translations/The_Noosphere.pdf.

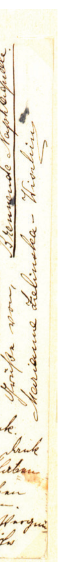
← *Fig. 32*

Burning Soil

People wander across a field, distraught in the face of a burning petroleum well (see fig. 32). Even building a chapel directly on the site of an earlier conflagration has not been enough to quell the dark might of oil, which has broken free once again. *The Burning Soil* (1922) by Friedrich Wilhelm Murnau is one of the first films in cinematic history to capture the destructive power of oil.[1] A large, extended family finds itself in dire straits when one of its sons — unkeen to work the land, and incapable of love — learns of the existence of a petroleum well under Devil's Field. Several women meet their deaths, by suicide and by misadventure, and the well burns away.

What Murnau is tackling here, through the prism of a somber family saga, is not an exceptional case — he himself would go on to die in a car accident in Santa Barbara in 1931. There has never been a petroleum industry without attendant petroleum catastrophes, be they social or ecological. The historically special case of a modern age nurtured by huge quantities of fossil energy is only conceivable against the backdrop of ever-possible and constant catastrophes of greater or lesser intensity. And cinema, in particular, has paid special attention to distortions of this kind; indeed, the ages of oil and of cinema play out almost congru-

1 F.W. Murnau, dir., *The Burning Soil* (Deulig Film, 1922).



ently. Fire is a permanent feature of petroleum cinema, rearing up, colossal, demonic. A burning, bellowing monster barrels along the corridors of an exploded drilling platform in Peter Berg's 2016 film, *Deepwater Horizon*.[2] In Werner Herzog's *Lessons of Darkness* (1992), a black, apocalyptic sky filled with fire, smoke, and soot settles over the Kuwaiti desert; Wagner plays in the background.[3] → Zombie 309 And as early as 1896, only a year after the invention of cinema, a film strip from Studio Lumière shows the infernal images of a burning oil well in Azerbaijan.[4] → Baku 135

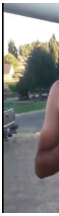
Yet the focus of pop culture and art on such catastrophes seems only fitting. How else would society draw attention to its greatest ills? → Petroporn 173 And this is certainly what we are talking about, for example, in the case of the BP drilling rig that exploded on April 20, 2010, polluting the deep sea and the coasts of Louisiana and Florida with a million metric tons of oil; satellite images showed plumes of smoke half a county wide, and new details about the spill are still coming to light more than ten years later.

And yet, understanding the catastrophes in the Gulf of Mexico or in Kuwait sheds almost as much light on how the oil industry functions as how it fails. And so, the wrecked borehole at the Deepwater Horizon rig, gushing before a global and cinematic audience, allows us to guess at the unthinkable streams of oil that gush out of thousands of "holes in the world"[5] day after day, quite inconspicuously and without any fanfare. → Pierced Earth 121 The oil that washed up on the coast and blackened the atmosphere as worthless poison in 2010 was only one-four-thousandth of the oil produced worldwide. The other 3,999 four-thousandths were — assuming theoretically that other

2 Peter Berg, dir., *Deepwater Horizon* (Summit Entertainment, 2016).
3 Werner Herzog, dir., *Lessons of Darkness* (Canal+, 1992).
4 See Robin L. Murray and Joseph K. Heumann, "The First Eco-Disaster Film?," *Film Quarterly* 59, no. 3 (2006): 44–51.
5 Naomi Klein, "Gulf Oil Spill: A Hole in the World," *The Guardian,* June 19, 2010, https://www.theguardian.com/theguardian/2010/jun/19/naomi-klein-gulf-oil-spill.

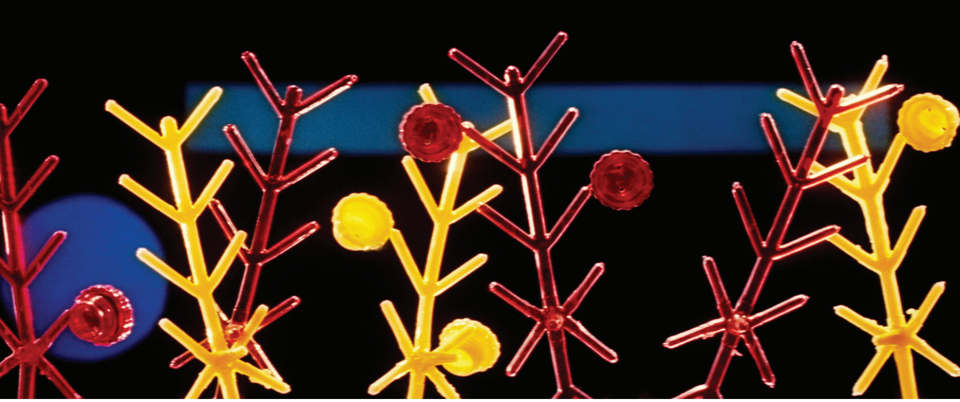
spills were avoided — drilled, transported, and large portions burned and deposited in the atmosphere and the world's oceans.

As loud and dramatic as exploding oil wells might be, and as seamless as the fade from action film to "awareness cinema" is here, it is probably not the disaster but the inconspicuous day-to-day that presents the greater ecological catastrophe, the oiled and damaged machinery that flies under the radar.[6] The house is not on fire because of out-of-control, burning soil, it's on fire because of fuels generated and burned in controlled circumstances, in the engines of certified road-worthy cars. → Engine 83; Burning Man 285



6 See the recent "The Curse of Smooth Operations," *IMPAKT Festival*, https://impakt.nl/festival/2022/concept/.

Regard Eloigné



← *Fig. 33*

The Song of Styrene

Alain Resnais's thirteen-minute documentary film *Le chant du styrène* (The song of styrene) from 1958 deals with modern, plasticated environments. Styrene is one of the oldest and most historically significant basic materials in the plastics industry. Yet, the film's French title also hints at the beautiful but beguiling song of the sirens in classical mythology. Resnais, who made his name in the 1960s as a radical exponent of the avant-garde films of *la nouvelle vague,* was commissioned to make the film for a French industrial group. His is not a unique case, either: other famous filmmakers, such as Bernardo Bertolucci, began their careers with commissions for the oil industry. → Pipeline 53 The film tells the story of how plastic came to be, backward, beginning with the end product.

It begins, figure 33 shows, with a dreamlike sequence in a mythical landscape: a forest of multicolored plastic figures, their shapes reminiscent of the prehistoric plant species growing on the Earth when the organic foundations of the *prima materia* of petrochemistry, of petroleum itself, were deposited, collected, and condensed over the course of millions of years. Dramatic music accompanies transparent forks that stand erect like flowers, and strange red and yellow rods sway to and fro like branches, as if rocked by the wind.

"Oh, plastic substance," a voice declares off-screen, reciting a text by Raymond Queneau, "Where do you come from? Who are you? And how to explain your quality?"[1] Then follows another sequence of unusual, otherworldly settings, presenting the things of everyday life: storage containers, refrigerator doors, sippy cups, tennis racquets, an electrical kitchen or office device that is difficult to identify, a compendium of the stuff of life since the beginning of the second half of the twentieth century, when a large number of objects and fittings in modern environments were remade in plastic.

And finally, almost like a summation of all objects, a red bowl. The cultural history of humanity began with simple containers. The same applies, or so it seems, to the second culture-nature of the modern world of plastic, in which everything can be made new and from the new. In Adorno and Horkheimer's famous interpretation of the sirens episode in Homer's epic, Odysseus embodies the modern bourgeois subject, whose aesthetic pleasure (the song) is bought for the price of self-denial (he is tied to the mast and can only surrender himself to the beauty from a distance) and, at the same time, requires the muscle activity of a working class kept in ignorance (the crew at their oars).[2] The song of styrene, on the other hand, the promise of industrial mass culture, is available to all, regardless of class or sex. → Men and Petroleum 75 Plastic is "the first magical substance which consents to be prosaic,"[3] wrote Roland Barthes around the time Resnais's film was released and when large exhibitions organized by the industry were advertising the new plastics in both Western and Eastern industrial nations.[4]

1 "Oh matière plastique, d'où viens-tu? Qui es-tu? Et qu'est-ce qui explique ta qualité?"; Alain Resnais, dir., *Le chant du styrène* (Les Films de la Pléiade, 1958).

2 Theodor W. Adorno and Max Horkheimer, *Dialectic of Enlightenment,* trans. Edmund Jephcott (Stanford: Stanford University Press, 2002), 26–27.

3 Roland Barthes, "Plastic," in *Mythologies,* trans. Annette Lavers (New York: The Noonday Press, 1991), 98.

4 On the history of plastic in East Germany, which is equally ideologically saturated, see Katja Böhme and Andreas Ludwig, eds., *Alles aus Plaste: Versprechen und Gebrauch in der DDR* (Cologne: Böhlau, 2012).

Plastic is the fulfilment of the ancient alchemical promise to turn dirt into gold, gold for the masses: “A luxurious object is still of the earth, it still recalls, albeit in a precious mode, its mineral or animal origins […]. Plastic is wholly swallowed up in the fact of being used: ultimately, objects will be invented for the sole pleasure of using them. The hierarchy of substances is abolished: a single one replaces them all: the whole world *can* be plasticized.”[5]

However, the fact that plastic can be manufactured cheaply and replicates practically everything once a luxury — leather, porcelain, jewelry — is also a curse, because the value of plastic cannot hinge on the origins or rarity of the materials involved, instead it depletes itself through use. It is for this reason that plastic is generally not intended to be kept, but thrown away.

The screen fades to black and then the setting changes; shapes and presses that serve to mechanically complete the petrochemical process of creation enter the frame. First, we see the “frontend,” where the new plastic objects come into being, then the “backend,” where the raw materials are added. In the workshop of creation, clay would have been used. In modern creation, it is granules: small, hard, colorful pellets, like gravel or pearl barley. Plastic is transformed back into something approaching this form by the forces of erosion and water after it has been used. Despite the fact that this petrochemical material has organic origins, it behaves like a mineral. → Sprawl89

The camera continues along the production process. We see a thin, white powder that must be mixed with dyes. In the film, it comes out of a large tube. These days, plastic powders like these wash up on shores across the world, and even in the nightmares of apocalyptically minded people with an understanding of the Anthropocene. They are the accumulated sediment of petromodernity.

Hydrocarbon compounds from petroleum (or, as in Resnais’s chemical plant, from coal, which makes no difference to our argument) form the base materials of most synthetic plastics.

5 Barthes, “Plastic,” 98.

From a temporal perspective, they are full of contradictions and extremes: plastic is both a material intended for quick use and one that does not decay, as if the ancient age of its original material persists within it. → Temporal Abyss 241 It is not soluble in water and, despite its organic origins, it does not involve itself in the metabolic processes of decomposition and degradation prevalent in organic surroundings. Equipped with these properties, this new manmade material has spread alarmingly to all water cycles on Earth. From the plastic gyres in the oceans to the pollution of inland waters and drinking water with bisphenol A and plasticizers, which can have hormone-mimicking effects on animal and therefore human organisms, to the accumulation of microplastics in the food chain and in the human metabolism.[6] → Greenhouse 105 It is a form of "slow violence,"[7] → Louisiana 165 the long-term effects of which are as yet impossible to assess.

There are increasing indications that plastic, which is valued in packaging and medical technology precisely for its aseptic properties, is becoming part of ecological systems, but in previously unknown evolutionary ways. Yet, unlike the technical horror of nuclear technology, which is often associated with giant mutated creatures, in this case it is tiny life forms that are the source of uncertainty. → Plankton 213 Microplastics particles floating around in the oceans serve as a kind of raft for biodiverse ecosystems comprising thousands of different bacteria and viruses. → Cannonball 301 It is as yet unknown whether metabolic processes are taking place in these "plastispheres" with the plastic and the fossil energy stored here, but it seems very probable that it will happen sooner or later. → Animals in Oil Fields 219 It would be at this point, at the latest, that we would have to deal with an unintended evolutionary process prompted by petromodern activity.[8]

6 See the impressive documentary film *Plastic Planet,* dir. Werner Boote (Daniel Zuta Filmproduktion, 2009).

7 Rob Nixon, *Slow Violence and the Environmentalism of the Poor* (Cambridge: Harvard University Press, 2013).

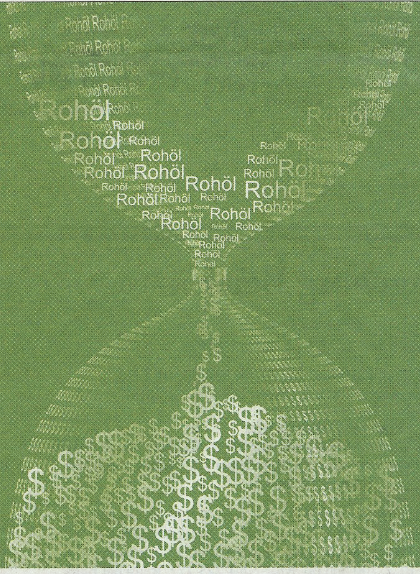
8 Heather Davis, "Toxic Progeny: The Plastisphere and Other Queer Futures," *philoSOPHIA* 5, no. 2 (2015): 231–50, and Heather Davis, *Plastic*

Yet it remains unclear how long this process will take, whether it will provide a solution to the plastics crisis, or will be primarily detrimental in its effects, and whether all this will play out on a timescale relevant to humans in the first place. *Le chant du styrène*—even though its title hints at the song of the sirens and therefore at dangers of a mythical nature—tells a creation story in the style of human creation myths, such as Genesis, in just a few days. Contrary to what its narrative structure implies, however, this creation story is far from over. → Science-Fashioned Molecules 71 The second chapter, its evolutionary consequences in the organic world, has yet to be told. We are all protagonists in this long-term, experimental film, as are our human descendants, and all other organisms in the *plastic age*.[9]

Matter (Durham: Duke University Press, 2022).

9 Richard C. Thompson et al., “Our Plastic Age,” *Transactions of the Royal Society* 364, no. 1526 (2009): 1973–76.

Produktinformation



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← *Fig. 34*

Temporal Abyss

Crude oil pours through an hourglass and transforms into dollars. Here, an object that has symbolized death in European art history since the early modern era — continuing in this vein as the logo of the environmental protest movement Extinction Rebellion, founded in 2018 — serves to make an investment product appealing. Time is oil is money. The message in this newspaper advertisement for the Royal Bank of Scotland from 2010 (see fig. 34) is clear: invest in an increasingly scarce resource now, and turn the passing time into profit. But what does time mean in the context of oil? Every drop of this natural resource contains geohistorical chasms.

Petroleum comes from fossilized plants and animals, and, in principle, it contains nothing but energy from the sun, stored by prehistoric organisms in the form of molecules. This is what any children's science book will tell you. Through oil, the early days of life on Earth — with dinosaurs being a component of practically every modern child's bedroom — reach into every layer of our living environment. → Greenhouse105

On the one hand, the sheer age of this energy can be strangely affecting. The fact that the stuff of everyday life is, in all seriousness, driven by energy that accumulated more than 150 million years ago can, perhaps even should, be disturbing. Yet what is almost more unsettling is the staggering asymmetry between the slow process by which this substance is formed, and the lightning-quick speed at which it is consumed.

Geohistorical periods of millions of years appear to be central to the formation of crude oil and gas in two ways. For one, the geophysical and geochemical processes needed to transform the remains of algae and plankton into highly compressed hydrocarbons require vast lengths of time. Even the shifting of sediments away from the surface and toward the deeper levels, where the necessary pressure and temperature ratios are present, takes millions of years.

What's more, the oil and gas available for mining today represent a grotesquely condensed and selective portion of total prehistoric algae and plankton masses. Only a tiny proportion of the biomass formed from sunlight escapes the closed loop of formation and decay and does not become CO_2 but is instead stored, in a sense, in anaerobic zones, where it is transformed into kerogen. → Posidonia Shale 189 Of this one-thousandth of annually produced biomass, only 2 percent becomes bitumen, of which just 0.5 percent finds its way into oil and gas deposits.[1]

According to this model, statistically only one of the 50 million carbon atoms in the cycle finds its way into oil and gas deposits; that is 0.00000002 percent. Based on the initial quantity of 100 billion metric tons of biomass per year calculated by petroleum geologists, only 10,000 metric tons of oil and gas form each year.

This is offset by the current annual usage of around 4.5 billion metric tons of crude oil worldwide. And the quantity is not decreasing. In 1990, it was 3 billion tons. It is these astronomical numbers that wrench open the geohistorical abyss, because estimates suggest that it would require the vital activity and accumulation of 450,000 years of algae to supply just one year's worth of current global petroleum consumption. Even if this

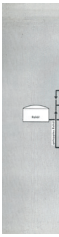
1 Werner Ladwein and Franz Schmidt, "Bildung und Geochemie von Kohlenwasserstoffen sowie deren Anreicherung zu nutzbaren Lagerstätten," in *Erdöl und Erdgas in Österreich*, ed. Friedrich Brix (Vienna: Naturhistorisches Museum, 1993), 14.

ratio has "improved" thanks to fracking, providing access to additional, unconventional deposits that are not summarized in this model, these gigantic dimensions remain beyond anything experienced.

At these orders of magnitude, familiar, spatially conceived calculation models of the unsustainable use of resources → The Great Leap Forward[143]; Data Is the New Oil[277] — according to which two or three Earths are being consumed — and illustrations of the ecological footprint simply fade away. If people, in the words of an old saying, see themselves as dwarves who are only able to see farther because they are standing on the shoulders of giants, then this applies to the current situation in a different, yet exaggerated way. Like footnotes to plankton we are standing on the shoulders of a gigantic number of microorganisms. → Molecular Mobilization[63]

The giantism of the petromodern present age reveals itself at both ends of the timescale. It is the access to a fossilized past that places a heavy burden on the future. And it is precisely the technologies, sciences, and cultural techniques related to superhumanly fast processes and enormous numbers on a small scale that play a central role in the study of superhumanly slow geohistory.

No contemplative science sinks into natural history here for its own sake, like in Goethe's or Buffon's era in the late eighteenth and early nineteenth centuries. The understanding of geologically slow contexts is driven both by short-lived market mechanisms and fast-paced machines. Economics and epistemology, economy and science cannot be separated here, because only what promises the greatest profits is approved for research grants. To put it bluntly, the internal combustion engine and the petroleum exchange were the first to give rise to petrogeology and petrochemistry, equipped with technologically advanced resources, as we know them today. → Exploration[37] It was only the price of the resource that prompted fossil oil to constitute a technological and scientific object. → Frontier of the Technosphere[223]; Cannonball[301]



The short-term nature of machine-driven stock share transaction operations is a critical commonplace and serves as a bizarre counterpoint to the fossil foundations of capitalism. Today, a share is owned for just twenty-two seconds, on average.[2] However, even further below, in the realm of truly minuscule numbers, sits the technical level of high-frequency trading, where economic decisions are taken automatically by algorithms in a matter of microseconds (10^{-6} seconds). Clocking in at even briefer intervals are the chemical technological instruments that can detect short chemical events down to the femtosecond (10^{-15} seconds). These abysses of temporal tininess form the maximum antithesis to the enormous numbers factored into fossil modernity. But it is only through these time spans, through the knowledge that is generated at these two opposing temporal poles, that the technological and cultural epoch of petromodernity becomes possible. The process area of an entire epoch that treats and must treat geohistorical, economic, demographic, and socio-technological processes as part of the common phenomenon of the "Great Acceleration" extends from fifteen digits after the decimal point of a second to millions of years before it.[3]

In the petrochemical age of man, time as experienced by an individual human being, be it measured by the seconds of a heartbeat or the hourglass of a human lifespan, is the dwarflike mediocrity between two distant, gigantic abysses.

2 Andreas Malm, *Fossil Capital: The Rise of Steam Power and the Roots of Global Warming* (London: Verso, 2016), 380.

3 Will Steffen et al., "The Trajectory of the Anthropocene: The Great Acceleration," *The Anthropocene Review* 2, no. 1 (2015): 81–98.

← *Fig. 35*

Black Mirror

Oil makes for an impressive mirror. Thanks to its high viscosity, its surface reflects light with greater precision than water. But what does this mirror show when a person looks into it? And what does it tell us about the medium of reflection itself? (see fig. 35).

When it comes to the sciences of petroleum, an exact reflection — which can be observed in a black oil mirror, even with the naked eye — is less relevant than the specific refraction of light, visible only with specialist instruments. Central research questions can be linked to the rotation in polarization. A substance's optical activity, that is, the fact that certain substances lend the light and its waves a certain twist to the right or left, allows for conclusions to be drawn on the molecular composition of the substance itself.

The optical activity of petroleum and its products was noted sporadically by chemists as early as the nineteenth century. In the early twentieth century, this phenomenon went on to attain relevance in a larger context. In light of the new structural chemistry developed since the time of August Kekulé, optical activity and the asymmetry of the molecule that stands behind the shifted reflection serve as a strong indication that only biochemical processes, and therefore organisms, could have formed petroleum molecules. Kekulé had discovered the benzene ring, and with it came the realization, soon to be employed industrially, that both the chemical formula of a molecule *and* its exact spatial form and structure were responsible for a substance's properties. This realization was reflected in biochemistry, which emerged in parallel to this and was equipped with the same, optical tools.

"Almost all petroleums display a rightward rotation of the polarization plane," writes Hans Höfer, geologist and chemist, one of the central proponents of the organic theory of oil genesis, in his book *Das Erdöl und seine Verwandten* [Petroleum and its relatives]. But,

> plant oils, except for sesame, castor, croton oil, and certain turpentine oils, exhibit a leftward rotation. Optical activity makes it possible to infer the organic origin of the petroleum which displays this characteristic. Due to the optical activity, the presence of asymmetrical carbon compounds in the petroleum must be assumed.[1]

Over a few pages, he unpacks the matter of polarization and the arguments of numerous authors, and focuses on an unequivocally organic substance found in numerous petroleums: cholesterol. The fact that, even millions of years later, clearly biogenic substances, such as the hormone cholesterol, and derivatives of chlorophyll and hemin, can be detected in petroleum,[2] → The Song of Styrene 235 and that, therefore, both plant and animal chemistry have entered into the mix of petroleum, makes a strong case for a renunciation of the theory of the inorganic formation of hydrocarbons from the carbide in the depths of the

1 Hans Höfer, *Das Erdöl und seine Verwandten: Physikalische und chemische Beschaffenheit, Vorkommen, Ursprung, Auffindung und Gewinnung des Erdöles* (Braunschweig: Vieweg+Teubner Verlag, 1922), 62.

2 Alfred Treibs, "Chlorophyll- und Häminderivate in bituminösen Gesteinen, Erdölen, Erdwachsen und Asphalten: Ein Beitrag zur Entstehung des Erdöls," *Justus Liebigs Annalen der Chemie* 510, no. 1 (1934): 42–62.

Earth's mantle, as propagated by great chemists such as Dmitri Mendeleev.[3]

Unequivocally organically formed petroleum and its deposits are easier to find in the Earth's crust using unequivocally geohistorical, paleontological, and biochemical methods and observations. At each drill site, efforts are made not to simply inspect dead stone in the search for deposits, but to follow a paleontological path by way of microfauna and microflora, from macrofossils to chemofossils. → Plankton 213

However, the demarcation of the organic and inorganic world is never just limited to practical and target-oriented matters. Alongside these more pragmatic aspects, another, rather hidden and almost ideological motive appears to play a role in the arguments in, and the style of, the debate: the idea of the chain of being introduced by Darwin's evolutionary teachings. → Frontier of the Technosphere 223 It links every lifeform on the planet; contemporary human existence and fossil life encounter one another as distant but manifest relatives. Interpreted in this way, *Petroleum and Its Relatives* deals not just in bitumen, natural gas, coal, and other fossil hydrocarbons, but it appears to include us, humans, in this relationship, too. → Science-Fashioned Molecules 71



3 Dmitri Mendeleev, "On the Origins of Oil," trans. Veselin Kostov, in *The Oil Industry in Pennsylvania and in the Caucasus (1877)* (2008), https://phe.rockefeller.edu/docs/Energy/Mendeleev/Origins_of_Oil_JHA_1.pdf.


ON THE BEACH

← *Fig. 36*

True Oil

In 1974, the Canadian singer-songwriter Neil Young released *On the Beach,* his fifth studio album. The album cover (see fig. 36) shows a photo of a beach on the Pacific Ocean. There is a yellow sun lounger on the sand, and a lonely figure of a man in a yellow jacket — Young himself — stands with his back to us. In the foreground of the image, next to an abandoned table/umbrella/deckchair ensemble, the isolated tail fin of a yellow 1959 Cadillac protrudes from the sand — like a rocket engine burrowed into the beach.

Young's record instantly captures the sense of "the end times" that followed the first severe oil crisis in 1973. In a review of the album in *Rolling Stone,* Stephen Holden writes, "Young has dared what no other major white rock artist (except John Lennon) has — to embrace, expose […] the collective paranoia and guilt of an insane society, acting it out without apology or explanation."[1] One of the tracks on the album is titled "Vampire Blues." On it, Young sings, "I'm a vampire, babe, sucking blood from the earth / I'm a vampire, babe, sucking blood from the earth / Well, I'm a vampire, babe, sell you twenty barrels' worth."

With these lines, Young exposes a vampiric attitude toward earthly resources, one entirely suited to the petromodern way

1 Stephen Holden, "The Sands of Time," *Rolling Stone,* September 26, 1974.

of life. If we understand the Earth to be a lifeform, as *gaia*[2] or *pachamama*,[3] as is increasingly the case in Western societies in the course of the ecological and Anthropocene turn, then we might consider petroleum to be its blood. This was and is a common view in many Indigenous cultures across the globe. The aforementioned change in mentality in industrial societies, however, has thus far not prevented them from threatening the survival of the last remaining Indigenous communities through the further advancement of oil extractivism. "The land has blood, and it is bleeding; the multinationals have cut the veins of our mother Earth," wrote Pope Francis in an apostolic exhortation in February 2020, quoting the inhabitants of the Colombian region of the Amazon.[4] Our hunger for the blood of the Earth appears to be insatiable. It is for this reason that others have described oil as the lifeblood of capitalism,[5] → Pipeline 53 or as its "material unconscious," which comes uncannily into view in natural or extraction-related pools of oil, which seep like the black blood of the Earth.[6] Petromodern vampires require such

2 The "Gaia Hypothesis" proposes that the Earth is a living organism. It was developed in the 1970s by the chemist and engineer James Lovelock and the biologist Lynn Margulis. Initially ridiculed and disputed, it is now considered a significant trailblazer for Anthropocene thinking. The story of its origins stands in direct contrast to the revolutionary emphasis with which the term is employed in the field today: Lovelock carried out his research funded and commissioned by Shell. See Leah Aronowsky, "Gas Guzzling Gaia, or: A Prehistory of Climate Change Denialism," *Critical Inquiry* 47, no. 2 (2021): 306–27.

3 "Pachamama" is the name given to the Earth by the Indigenous peoples of the Andes and literally means "Mother Nature." In Bolivia, the rights of nature or *pachamama* were enshrined in law in 2015.

4 Pope Francis, "Querida Amazonia: Post-Synodal Apostolic Exhortation," *The Holy See,* February 2020, https://www.vatican.va/content/francesco/en/apost_exhortations/documents/papa-francesco_esortazione-ap_20200202_querida-amazonia.html.

5 Matthew T. Huber, *Lifeblood: Oil, Freedom, and the Forces of Capital* (Minneapolis: University of Minnesota Press, 2013).

6 Oxana Timofeeva, "A Theatre of the Wounded Earth" (unpublished lecture script, True Oil conference, Kunstmuseum Wolfsburg, October 25–27, 2018). See her theory of oil as material unconscious in Oxana Timofeeva, "Ultra-Black: Towards a Materialist Theory of Oil," *eflux* 84 (2017), https://

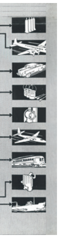
quantities of this substance to indulge their lust and their craving that the Earth is at risk of falling into a severe state of maltreatment, half living and half dead — undead.

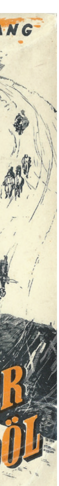
In the US television series *True Blood,* which follows the parallel lives of vampires (and other undead creatures from the myths and fairy tales of world literature) and human beings, the substance after which the series is named — "True Blood" — is an artificial substitute for human blood available in pharmacies. It enables vampires to live among humans without being dependent on their blood for food. The actual substance of the series, the real "true blood" is, however, the blood of vampires. It carries within it the history of humanity. It is dealt under the name "V" as an illegal psychoactive drug, giving normal, mortal consumers strange insights and unprecedented powers. Suddenly, the story turns on its head, and the hunters, the vampires, who represent an older and higher nature, become the hunted.[7]

The status of the "real true blood" and its relationship to an artificially manufactured substitute as an energetic and imaginary resource calls to mind the disputes about the move away from fossil energy via the provision of energy alternatives, and it asks questions about inebriation and withdrawal. → Data Is the New Oil277 The questions and duties that arise in the context of a future "without oil" happen to structurally resemble a whole bunch of material withdrawal or substitution projects that appear to be typical of a time grown skeptical of itself: enjoyment without additives, meals without meat, milk without lactose, bread without gluten, smoking without nicotine, drugs without the high, and so on. The question stemming from these crisis phenomena of consumer culture in each case is: should we continue familiar practices with the content changed — attempting a smooth transition — or make a break and rely on something

www.e-flux.com/journal/84/149335/ultra-black-towards-a-materialist-theory-of-oil/.

7 *True Blood,* created by Alan Ball, aired 2008–2014 on HBO. The title of this series not only inspired the title of this chapter, but it was also the inspiration for a symposium of the same name, conceptualized by the authors and hosted at Kunstmuseum Wolfsburg in December 2018.





else altogether? Meatless sausages or vegetables? Methadone or cold turkey? And, in the case of petroculture without petrol: synthetic fuel or cargo bike? → Molecular Mobilization 63

Could we even conceive of continuing the value frameworks and cultural practices of modern societies without oil? Much like psychoactive drugs, petromodern technologies "undermine one of the fundamental powers of existence," time.[8] → Temporal Abyss 241 On the one hand, petrochemical pharmaceuticals and even cosmetics are tools of an effort to decelerate aging and suspend death: with precise life-lengthening services and superficial interventions in cellular processes. → Men and Petroleum 75 On the other hand, combustion engines and catalytic petrochemical processes mobilize and accelerate individuals, economies, and societies, such that, today, the average individual has at their disposal intoxicatingly physical speeds, of which the godlike despots of antiquity could hardly have dreamt.

The ethnobotanist Dale Pendell points to the fact that the drug-like character of petroleum substances must be taken literally. In his three-volume compendium on drug plants — *Pharmako/Poeia, Pharmako/Dynamis,* and *Pharmako/Gnosis* — beneath the lemma "Fossil Fuels," he describes the inhalation of propellants and solvents, such as hexane, ethyl acetate, toluene, acetone, trichloroethylene, butane, and methanol, which are all of petrochemical (or, in a few cases, coal chemical) origin. Substances sniffed include hairspray, glue, stain remover, nail polish remover, correction fluid thinner, PC cleaner, and, of course, gasoline. Pendell also takes aim at the tricky matter of temporal entanglement when he writes that drugs have their "home in the Paleozoic": "Nerve cells doze, sleepwalk with the ally back to a gooey subterranean syncline."[9] Sniffing gasoline can thus be understood almost as a kind of subversive reaction to a general acceleration brought about by its combustion. The

8 Ernst Jünger, *Approaches: Drugs and Altered States,* trans. Thomas Friese (Candor: Telos Press, 2022), 26.
9 Dale Pendell, *Pharmako/Poeia: Plant Powers, Poisons, and Herbcraft* (Berkeley: Mercury House, 2010), 90.

mechanized, oil-powered world sees modern humanity enter into a mode of existence that Paul Virilio, the French media theorist and exponent of the discipline of "dromology" ("velocity research"), which he himself invented, describes as being "IN SPEED,"[10] → Cannonball 301 an ecstasy of artificially generated tempos, permanent renewal and manipulated time from real time to stasis. In the face of the enormous production dynamics of modern industrial companies, there is no doubt that this intoxication by speeds revolves around a principle of productiveness. → Sprawl 89 Nevertheless, both societies as a whole and numerous among their individuals who have devoted themselves to oil as a pharmakon exhibit the characteristics of addiction. Young's "Vampire Blues" is shrewd in this respect: "I'm a black bat, babe, banging on your window pane / I'm a black bat, babe, banging on your window pane / Well, I'm a black bat, babe, I need my high octane." → Engine 83

The "five stages of grief," the common name given to a five-phase model for the acceptance of illness stemming from the work of the psychiatrist Elisabeth Kübler-Ross with terminally ill people, has been used in many holistic, diagnostic, and therapeutic fields. Phase One: denial; Phase Two: anger; Phase Three: bargaining; Phase Four: depression; Phase Five: acceptance.[11] The phase various representatives of an oil-addicted modern civilization find themselves in, indulging in grief and "petromelancholia" in the face of having to let go of it[12] and the point at which they achieve a state of acceptance, will be crucial in ultimately deciding which consequences can be drawn from this realization.

10 Paul Virilio, "Vehiculaire," in *Nomades et vagabonds,* ed. Jacques Bergue (Paris: Union Générale d'Éditions, 1975), 43.

11 Elisabeth Kübler-Ross, *On Death and Dying* (New York: Scribner, 2014), 37.

12 See Stephanie LeMenager's introduction of the concept in her book *Living Oil: Petroleum Culture in the American Century* (New York: Oxford University Press 2014), 102–41, and the 2023 exhibition *Petromelancholia* at Brutus, Rotterdam, http://beauty-of-oil.org/2023/10/04/petromelancholia-essay-version/.


TERMINATOR

← *Fig. 37*

Terminator

"I wish that I could be the Terminator in real life to be able to travel back in time and to stop all fossil fuels when they were discovered."[1] These are the words of Arnold Schwarzenegger, former bodybuilder, Hollywood actor, and former governor of California, addressed to a UN climate conference in the Polish coal city of Katowice in December 2018.

Schwarzenegger's breakthrough role came as the Terminator in 1984. In his political life, Schwarzenegger was known for his yellow Hummer — a Humvee military SUV equipped for civilian use with a V8 engine and 20-liter per 100 km (11.8 MPG) fuel consumption. → Oleoviathan 113

Schwarzenegger was said to have purchased the first two Hummers when General Motors brought the vehicle onto the market in 1992. Schwarzenegger even made campaign appearances in them. Since then, as he announced in 2018, he has had the vehicles retrofitted to run on hybrid and electric power. What's more, he has reportedly adopted a mostly vegan diet out of concern for the climate. → Greenhouse 105

1 Nick Visser, "Arnold Schwarzenegger Goes after Trump on Climate: America Is More Than One 'Meshugge,'" *HuffPost,* December 3, 2018, https://www.huffpost.com/entry/arnold-schwarzenegger-trump-poland-climate-summit_n_5c05c885e4b0cd916faf034b.


Schwarzenegger's desire to go back in time as the Terminator and destroy the roots of the petroleum age → Pumpjack 49 entails, like all time travel in science fiction, irresolvable yet illuminating contradictions. → Rocket 159 A quick recap on the Terminator's story: in the year 2029, a combat robot — from the Terminator T 800 series — is sent back from a highly technologically advanced future ruled by machines, where all humans have been destroyed or enslaved, to the year 1984 — the film's present day — to prevent the birth of a future rebel leader who threatens the coming posthuman order. The mission fails, hence the sequel: *Terminator 2: Judgment Day.* This time, however, the mission jumps a level in terms of complexity: the rebels of the future want to prevent the manufacture and sale of a computer chip that made the later artificial intelligence possible, and they send one of their own fighters on a mission back in time — just like the real Schwarzenegger, wishing in 2018 he could return to the past and stop the invention of the internal combustion engine, or even the steam engine. The machines want to prevent this act of destruction because it would destroy the very circumstances that made their superior existence possible.

One fears the same could apply to Schwarzenegger, since he is a (petro)modern subject par excellence. Neither emigration from humble beginnings in Austria to California, nor the extreme cultivation of one's own body using hormones and nutritional supplements, → Men and Petroleum 75 nor the success of cinema as a global mechanism of entertainment, nor the development of big, bulky automobiles seem probable without the tapping of fossil energy. It is unclear how history as a whole might have developed if "fossil fuels had been stopped," or if they had at least not become established. Yet there is much to be said for the notion that, without them, we would not have the modern age, accelerated on every level, be it molecular or planetary, that we know today. → Molecular Mobilization 63

The rise of the Terminator — much like the actor playing him — seems almost impossible in a low-energy world without fossil fuels. In the sci-fi vision of 1984, even the anticipated battle

of 2029 between machines and rebels is a petromodern conflict fought with mobile war machines and canons.

The fact that Hollywood can be understood in terms of its proximity to the oil business (or *should* be understood in such terms, given that Los Angeles owes its economic power not least to the oil discovered in the region), was outlined by Ronald Reagan, political and cinematic predecessor to Schwarzenegger, in his function as the tax-critical head of the Screen Actors Guild in the 1950s. Long periods of drought were said to be necessary here and there, until wealth would eventually bubble up again. Then, however, the market value would drop rapidly. "We feel we are about as short-lived as an oil well and twice as pretty," claimed Reagan, but without tax compensation, as in the case of the exhausted oil wells.[2]

In another, fundamental sense, it can also be said that, in the history of science, a mathematically precise understanding of time and its direction and terms for entropy and dissipation first entered the sphere along with steam and combustion engines and the thermodynamics formulated alongside them, that is, with a chemical-physical interest in the processes of transience.[3] A scientific concept of time — something of a challenge for Terminators — was not formulated with mathematical precision before the age of fossil resources, and it is highly doubtful whether it would have been formulated at all without the related, systematic optimization of combustion processes.[4] It is only because Schwarzenegger is a child of an epoch shaped by

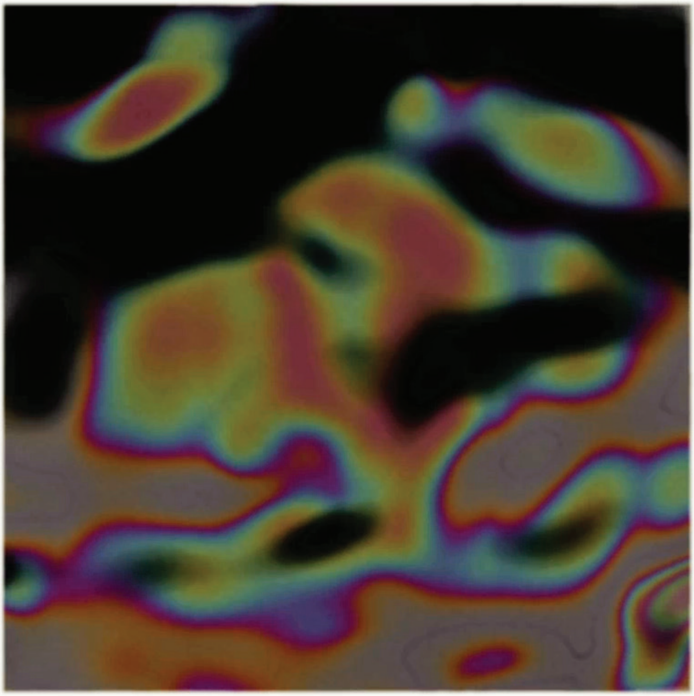
2 Cited from Peter A. Shulman, "The Making of a Tax Break: The Oil Depletion Allowance, Scientific Taxation, and Natural Resources Policy in the Early Twentieth Century," *Journal of Policy History* 23, no. 3 (2011): 306.

3 Wilhelm Ostwald, "Das Problem der Zeit," in *Abhandlungen und Vorträge allgemeinen Inhaltes (1887–1903)* (Leipzig: Von Veit & Comp, 1904), 241–57.

4 On the fundamental, culturally revolutionary significance of the development and intensification of fire technologies, see Stephen J. Pyne, *Fire: Nature and Culture* (London: Reaktion Books, 2012), esp. 157–58, and Jens Soentgen, *Pakt mit dem Feuer: Philosophie eines weltverändernden Bundes* (Berlin: Matthes & Seitz, 2021).

thermal engines, a veritable "Therminator," that he can dream of using time travel to ease the woes of this era.

However, one might wonder whether the former body-builder did in fact happen upon the idea of intervening in the sequence of time in such a skewed, historically contradictory way. It seems much more plausible that this was, in fact, a coded message from a Terminator speaking from the future, one with no sense of obligation for the course of the past. And clearly, he has not been tasked with making a last-ditch attempt at the *beginning* of the fossil fuel era, but *now*. We should take him at his word. *He won't be back.*



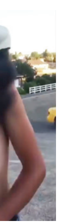
← *Fig. 38*

Black Square

In 1913, eight years after the suppressed revolution of 1905 and a year before the beginning of World War I, the *Black Square* emerged in pre-Soviet Russia (see fig. 38). Kazimir Malevich painted the *Black Square* as the central part of a stage design for the opera *Victory over the Sun,* which premiered at the Luna Park in Saint Petersburg. The futurist opera at the Luna Park served as a starting signal for the artistic vanguards in the making. With its radical abstraction and spiritual concentration, the *Black Square,* of which Malevich painted several versions, became one of the most significant art works of the twentieth century.

The plot from which the opera takes its name — insofar as there is a plot to speak of; all four of the artists involved set out to smash traditional aesthetic conventions — centers on the titanic struggle between a future house of heroes and the sun. Futurist "Strong Men" use modern technology to fight against the dependence on natural life cycles based on the sun's energy, against the resulting cyclical orders of night and day, sowing and reaping, summer and winter — and, in doing so, they fight against the old societal order determined by the laws of nature, for the ultimate victory of the culture of industry. They succeed in trapping the sun inside a concrete cube. From this point onward, the "light is inside [them]."[1]

From today's perspective, this resembles a modern parable: fossil energy sources, chemical industry, and electrification have made a radical reorganization of life and production possible over the course of the twentieth century and have allowed for a "second nature" to emerge. As early as 1909, Marinetti's *Manifesto of Futurism* opened with a celebration of the combustion engine and derived a new aesthetic from a new technology. In this sense, it can be read as the first work to document an explicitly petromodern artistic program:[2] "We affirm that the world's magnificence has been enriched by a new beauty: the beauty of speed. A racing car whose hood is adorned with great pipes, like serpents of explosive breath — a roaring car that seems to ride on grapeshot is more beautiful than the Victory of Samothrace."[3] The Russian and the Italian versions of futurism mirror each other in their appropriation and abolition of traditions. Malevich's *Black Square,* made from fossil resources, industrial technology, spiritual tradition, and a belief in progress, takes the place of an order based on the laws of nature and interpreted as God-given, one expressed in Heidegger's famous *das Geviert* (the fourfold).



All modern industrial societies of the twentieth century share in this project. → Burning Man 285 But nowhere else is it elevated in such a pure form to an ideology as in the early Soviet Union, which set its sights on bringing forth a new nature and a "New Humanity" from social and ecological conditions changed by revolution. The futurist utopia of Russian cosmism played a

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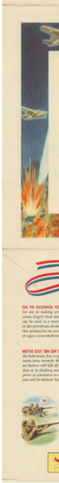
1 Rosamund Bartlett, "Annotated Translation of the Libretto of Victory over the Sun," in *Victory over the Sun: The World's First Futurist Opera,* eds. Rosamund Bartlett and Sarah Dadswell (Exeter: University of Exeter Press, 2011), 37.

2 See Alexander Klose and Benjamin Steininger, "The Art of the Petrol Age: An Exploration," in *Oil: Beauty and Horror in the Petrol Age,* eds. Andreas Beitin, Alexander Klose, and Benjamin Steininger (Cologne: Verlag der Buchhandlung Walther und Franz König, 2021), 28–65.

3 Filippo Tomaso Marinetti, *Manifesto del Futurismo* (1909), English translation available at http://manifestos.mombartz.com/manifesto-of-futurism.

substantial role in the phase during which the communist ideology of Soviet Russia was forming. It emerged as early as the late nineteenth century under the Russian Empire, and sought to engender an immortal humanity through technology. *Victory over the Sun* can also be attributed to it. → Rocket 159

However, specific dealings with oil as a resource — the most concentrated and energy-rich of all fossil fuels, and one already starting to make its mark on the new century — were characterized by surprising contradictions in the land of futurist swagger. Tsarist Russia, for example, was considerably more "advanced" in the second half of the nineteenth century than its revolutionary successor state in terms of the use of petroleum as an energy source. Since crude oil was cheaper to extract and transport than coal thanks to the abundance of oil wells in Azerbaijan, annexed in 1806, the first wave of industrialization, and also railways, factories, and many power plants, ran on oil fuel.[4] As early as the 1870s, the tsarist navy was experimenting with oil-powered warships on the Volga and in the Caspian Sea — forty years before the British navy made the switch from coal to oil, which was decisive in World War I.[5] → Ammunition 97 In the longer term, however, people in Russia did not trust this form of modernity and planned instead for comprehensive electrification run on regional, less energy-intense fuels.[6]



Because of war and revolution, however, this no longer fell under the dominion of the tsar. Yet the Bolsheviks continued to pursue this course of action. In addition, Lenin personally rejected the crude oil industry as a hotbed of monopolistic capitalism. The electrification project, which he founded on the famous formula *Communism = Soviet power + the electrification of the whole country,* and which remained at the heart of the Soviet modernizing ideology into the postwar years, employed hydropower, on the one hand, and the fossil fuels coal

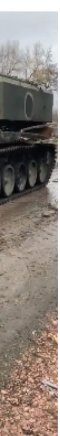
4 Felix Rehschuh, *Aufstieg zur Energiemacht: Der sowjetische Weg ins Erdölzeitalter* (Cologne: Böhlau, 2018), 33.

5 Daniel Yergin, *The Prize: The Epic Quest for Oil, Money, and Power* (New York: Simon & Schuster, 1991), 155–56.

6 Rehschuh, *Aufstieg zur Energiemacht,* 40.

and peat, on the other.[7] Crude oil was predominantly produced for exports. And despite it gaining increasing significance as a source of foreign currency and an opportunity to purchase urgently required technologies abroad, the infrastructure was neglected, workers were poorly paid, and the pioneer generation of qualified oil engineers and geologists carried over from the Russian Empire was decimated in the course of the "purges." This course of events only changed in the immediate run-up to the Soviet Union's entry into World War II, when it was barred from access to the global market and the existential necessity of oil for its own war machinery became unmistakable.[8] Thanks to intensified extraction and exploration, and the development of new oil and gas finds in the Volga/Ural region and then in western Siberia, the Soviet Union was able to establish itself as one of the world's three largest producers of oil and gas, first alongside the United States and Venezuela, and then alongside the United States and Saudi Arabia. From 1975 to 1991, the Soviet Union ranked first overall. Soviet oil was of great importance to the economies of COMECON countries, such as the GDR, with its large petrochemical industry. → Pipeline 53

For Russia today, the oil and gas industry is one of the very few economic areas with ties to dreams of Soviet global power. → Zombie 309 Nevertheless, the upheaval within post-Soviet Russian society — the emergence of a nouveau riche, the struggle against the oligarchs, and the development of a Russian variant of the *oil curse*[9] — pinpoint the originality of the Soviet Russian road into petromodernity. In contrast to the proverbial "American Way of Life," it was characterized not by abundance, but by shortages and an economy of scarcity. The proverbial link between oil and wealth did not exist in the consciousness of



7 Robert Bird, "The Poetics of Peat in Soviet Literary and Visual Culture 1918–1959," *Slavic Review* 70, no. 3 (2011): 594–95.
8 Rehschuh, *Aufstieg zur Energiemacht,* 40.
9 Aleksander Etkind, "Bevölkerung: überflüssig — Russland leidet an der von seinen abgehobenen Eliten verhängten 'Öl-Krankheit'," *Neue Zürcher Zeitung,* December 24, 2019, https://www.nzz.ch/meinung/bevoelkerung-ueberfluessig-russland-leidet-an-der-oel-krankheit-ld.1529872.

the peoples of Soviet Russia, nor in the expanding oil regions.[10] The Russian literary scholar Ilya Kalinin demonstrates how this influence also affected interactions with culture as a resource in authoritarian post-Soviet Russia:

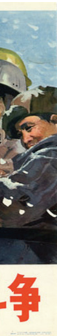
> The discourse affirms the abundance of natural and cultural riches inherited from our ancestors, yet at the same time asserts the need to protect them from internal and external enemies, since global competition for resources […] is described as an external threat that must be resisted.[11]

The social program that developed out of the revolutionary situation at the beginning of the twentieth century not only claimed a zero point in the art of painting, but also a zero point in history. The basis of a new energy regime and, therefore, a new type of culture looks back from this zero point. Malevich's *Black Square* submerges the gaze, as if in a pool of oil. This material interpretation of a simultaneously spiritually charged form seems to find resonance in more recent artistic works, such as in the strict geometric forms of Japanese artist Noriyuki Haraguchi's oil pools, developed in the 1960s out of his engagement with the tradition of Zen gardens in monasteries. → Tehran Museum of Contemporary Art 181

In 1913, however, the paths that history might take on the black map were not yet certain. Nor was the fact that a victory over the sun might be a Pyrrhic victory of sorts, that the proposition to decouple culture from solar rhythms by means of fossil energy would lead to an act of climatic vengeance by the main celestial body, which now positions all ideological camps and

10 Douglas Rogers, "Deep Oil and Deep Culture in the Russian Urals," in *Subterranean Estates: Life Worlds of Oil and Gas,* eds. Hannah Appel, Arthur Mason, and Michael Watts (Ithaca: Cornell University Press, 2015), 65.

11 Ilya Kallinin, "Carbon and Cultural Heritage: The Politics of History and the Economics of Rent," *Baltic Worlds* 7, nos. 2–3 (2014): 73, https://balticworlds.com/carbon-and-cultural-heritage/.

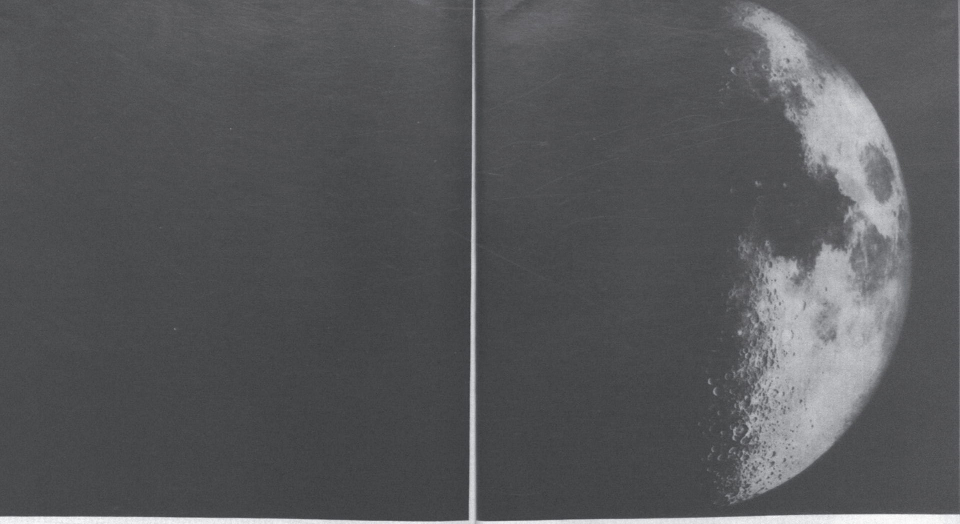


narratives of progress before a new, unclear window into the future.[12] → The Great Leap Forward 143

Nevertheless, the banished sun is still extolled in Russian oil circles today. A Gazprom company anthem from the 2000s sings: "Davay za nas, / davay za vas, / davay za ves' rossiyskiy gaz" (Let's drink, to us, to you, to all the Russian gas) and further on, at the absolute zero point of corporate poetry: "Za vseh, kto iz zemli dobyl / Iskusstvennoe solntse" (To all those who brought it up out of the ground, the artificial sun).[13]

12 Contemporary, somehow complementary yet completely different approaches to the futurist's "Victory over the Sun" that don't "take the sun for granted" can be found in Cymene Howe, Jeff Diamanti, and Amelia Moore, eds., *Solarities: Elemental Encounters and Refractions* (Earth: punctum books, 2023).

13 "Давай за нас, давай за вас, / давай за весь российский газ, / За всех, кто из земли добыл / Искусственное солнце." Truestefku, "The Gazprom Song," *YouTube*, January 26, 2009, https://www.youtube.com/watch?v=xGbI87tyr_4. We would like to thank Johannes Grenzfurthner and Oxana Timofeeva for pointing us to the culture of Russian oil company anthems. For an impressive retrospective on growing up in a Siberian oil town, see "Surgut" in Oxana Timofeeva, *How to Love a Homeland* (Beirut: Kayfa ta, 2021).



THE 69½ FEET THAT REACH THE MOON

From a hole no deeper than that, drilled in Pennsylvania 100 years ago, have come endless miracles of oil.

Today, petroleum gives us fuels that are capable of moving man from earth to the moon and beyond. Such explorations can bring new knowledge of incalculable value.

But no less certain than that we will one day fly through space is that we will have ever better fuels and lubricants for travel on the ground, on the sea and in the air — new and exciting products for the farm, industry and the home.

Today one quarter of all the money spent by U.S. industry on research is spent by the petroleum industry.

And as chemists study the endless ways to re-arrange oil molecules to make useful products, we can see that the age of petroleum has only begun.

Standard Oil Company (New Jersey) Esso

OIL'S FIRST CENTURY
BORN IN FREEDOM
WORKING FOR PROGRESS

← *Fig. 39*

Space Travel

The atomic age, the information age, the space age — the high modernity of the twentieth century has acquired a range of epithets that take the narrative of progress to an extreme. Into the world of the smallest, high-energy components, away from all substances and into a reality borne by nonmaterial signals, up and away from the pull of earthly gravity and into the endless expanse of outer space.

Each of these guiding principles has, in a sense, been fulfilled: nuclear energy is utilized technologically, information technology is everywhere, and humanity has made it to the moon. Yet each of these guiding principles has also made clear that the binding forces of obstacles to be overcome are too strong to dismantle permanently. Earthly limits pop up everywhere. Nuclear power plants produce risks and residue of such enormous quantities that they can hardly be socially justified. Supposedly feather-light digital technologies have a weighty material and energy-intensive flip side. → Data Is the New Oil 277 And leaving the Earth is only possible with fuels intimately bound up with the planet's biogeochemistry.

This connection is expressed in an Esso advertisement taken from a 1959 edition of the magazine *The Petroleum Engineer for Management,* with the slogan "The 69½ Feet That Reach the Moon" (see fig. 39). It was a time when, shortly after the Sputnik

crisis, space travel became a cipher for the future and a main driving force for research in the West, too: "Today, petroleum gives us fuels that are capable of moving man from earth to the moon and beyond." This logic can be confirmed, on the one hand, and reversed, on the other.

Even reaching the first of the multitiered cosmic velocities in order to leave the Earth — entering into orbit around the Earth at 7.9 kilometers per second, before being able to leave the Earth's gravitational field at 11.2 kilometers per second, then leaving the solar system at 42 kilometers per second and the galaxy at 320 kilometers per second — requires such concentrated quantities of energy that, in practice, they can only be supplied by chemical energy stores. And all of these come from specific fossil substrata.

Rockets powered by chemical fuels were being sent into the sky very close to Earth as early as the Middle Ages. → Ammunition 97 Mongol warriors used a kind of military rocket in Europe presumably for the first time at the Battle of Liegnitz in 1241, and in thirteenth-century attacks in Japan and Baghdad.[1] Saltpeter was the crucial ingredient for both gunpowder and rockets powered by gunpowder. This nitrate compound remains an important strategic chemical to this day, serving as an explosive rather than a fuel.

However, it was only from the beginning of the twentieth century, following the production of ammonia and saltpeter in the chemical reactors of the Haber–Bosch process → Molecular Mobilization 63 that air itself became a resource for cannon or rocket fuel in the form of atmospheric nitrogen. Until this point, saltpeter came from the earth. For centuries, "saltpeterers" would traverse the land on the order of the king, scraping away at chemical compounds formed in damp cellars or garbage dumps, or even simply tearing down cellar walls to acquire the

1 Werner Buedeler, *Geschichte der Raumfahrt* (Künzelsau: Sigloch, 1999), 159.

saltpeter.[2] When, at the end of the nineteenth century, the chemistry of explosives moved from simple blends of substances to the construction of volatile molecules, it was fed from another substrate, namely, the chemistry of coal. Nitrocellulose, nitroglycerine, and trinitrotoluene are fully synthetic explosives, and all originate from coal chemistry. The science of trial and error that started in shallow saltpeter pits has given rise to an entirely fossil-based industry, grounded in the depths of the geochemical sciences.

A more narrowly defined history of the rocket, conceptualized with the long-term aim of traveling to outer space, begins in the early twentieth century. Even Konstantin Eduardovitch Tsiolkovsky, who became founder of the discourse with "The Exploration of Cosmic Space by Means of Reaction Devices" (1903), suggests using liquid fuels, instead of powder, as rocket fuel because of their much greater density of energy: hydrogen and hydrocarbons, but also liquid oxygen, to make it possible to achieve oxidation outside of the Earth's atmosphere.[3]

The rockets subsequently built in Europe, the United States, and the Soviet Union by pioneers such as Hermann Oberth, Robert H. Goddard, Wernher von Braun, Helmut Gröttrup, and Sergei Korolev used very different main and secondary fuels, such as hydrogen peroxide to power pumps, and ethanol and liquid oxygen for thrust.

Milestones in space travel were achieved with the propellant combination of liquid oxygen and kerosene: take, for instance, the Sputnik launch on October 4, 1957, the Vostok I launch with Yuri Gagarin as the first person in space on April 12, 1961, but also various early US rockets and rocket stages, from Vanguard

2 Jens Soentgen, "Die Bluttaufe des Salpeters: Über die vorindustrielle Herstellung einer Machtsubstanz," in *N. Stickstoff — ein Element schreibt Weltgeschichte*, eds. Gerhard Ertl and Jens Soentgen (Munich: Oekom, 2015), 79–100.

3 Buedeler, *Geschichte der Raumfahrt,* 127–35, and Konstantin E. Tsiolkovsky, "The Exploration of Cosmic Space by Means of Reaction Devices (Исследование мировых пространств реактивными приборами)," *The Science Review* 5 (1903).

1958 to Saturn I in 1961, and the Soyuz rockets still used internationally today.

On the one hand, this confirms the Esso slogan, "The 69½ Feet That Reach the Moon," but it also corrects it on a significant point. History shows that it is far from the initial, random shallow drilling that sends humanity swinging into space. On the contrary, in fact, the entire path of chemical and energy-technological science is mobilized on Earth, so as to reach targets comparatively close to the Earth. Or, to consider it on a different scale: it requires a project as politically motivated and symbolically charged as a competition between systems to mobilize a workforce of 400,000 people, as in the case of NASA, → Rocket 159 so that, from 1969 onward, a handful of inhabitants of the Earth can be sent to the moon for a few hours.

No space travel would be possible from the moon itself. The chemistry of the moon has not given rise to higher hydrocarbons, not at 69½ feet and not at great depths, either. "Could there be oil on the moon?" wondered one question posed in 1970, but geochemists were obliged to answer no.[4] If you wanted to start a hydrocarbon-powered flight from the moon, you would first have to put them together from components available in the lunar landscape.

4 Kurt Turnovsky, "Kann es Erdöl auf dem Monde geben?," in *Österreichischer Berg- und Hüttenkalender* (Vienna: Montan Verlag, 1970), 83–85.


2
3
OMV
600
IBM
IBM 729

← *Fig. 40*

Data Is the New Oil

This chapter takes its title from a much-quoted text by mathematician and businessman Clive Humby, published in 2006, which has become a kind of platitude for the digital age: "It's valuable, but if unrefined it cannot really be used. It has to be changed into gas, plastic, chemicals, etc., to create a valuable entity that drives profitable activity; so must data be broken down, analyzed for it to have value."[1]

The internet companies' great assets, and the advance of so-called artificial intelligence, that is, algorithmic systems that evaluate huge quantities of data using neuronal networks and machine-learning processes to recognize patterns and draw conclusions, appear to confirm the core substance of this comparison. Humby acquired a fortune via his company, when, in the mid-1990s, the company developed the world's first loyalty cards for the Tesco supermarket chain, the principle of which is based on providing the customer with a bonus scheme in return for collecting and analyzing all their consumer data. Data has become a new kind of valuable raw material because the rise of

1 Lecture by Clive Humby, ANA Senior Marketer's Summit, Kellogg School, cited from Michael Palmer, "Data Is the New Oil," *ANA Marketing Maestros*, November 3, 2006, https://ana.blogs.com/maestros/2006/11/data_is_the_new.html.

so-called big data. Many believe that data will be to the twenty-first century what oil was to the twentieth century. The Israeli historian Yuval Noah Harari has gone so far as to diagnose the emergence of a new "data religion," "dataism."[2]

What is the implication of this? There is a widespread hope that smart and ecologically informed digital technology will supersede the wasteful and unrestrained production and consumption practices of the nineteenth and twentieth centuries, which were founded first on coal and steel and then on numerous other metals and fossil fuels. This hope is based not least on its appearance as a virtually material-free technology, devoted only to the enhancement of the mind. Digital devices have been growing ever smaller since the PC arrived on the market as the first tabletop computer in the 1980s. Their triumphant march through offices, homes, and ultimately our bags and coat pockets unleashed those "specters of virtuality and dematerialization"[3] in the collective imagination of technological progress, and we are still dealing with them today. So far, however, there is no hint of a light, energy-saving, and environmentally friendly technology, as suggested by the omnipresent metaphor of "the cloud."

On the contrary, it requires enormous material and energetic output to generate the "appearance of immateriality," as Jennifer Gabrys maps out in an impressive study on "digital rubbish."[4] Hardly any technology requires so many different materials; on average, a thousand different substances—including the notorious coltan from the Congo or rare-earth elements from China—are involved in the manufacture of a single electronic device. → The Great Leap Forward 143 Core production processes in the electronics industry, such as the manufacture of microchips, also create environmental pollution, the toxicity of which surpasses that of classic industry. Today, Silicon Valley is one of the most heavily polluted regions of the United States. And

2 Yuval Noah Harari, *Homo Deus: A Brief History of Tomorrow* (London: Penguin Random House, 2015), 367.

3 Jennifer Gabrys, *Digital Rubbish: A Natural History of Electronics* (Ann Arbor: University of Michigan Press, 2011), 4.

4 Ibid.

the short consumption cycles associated with electronic devices generate a gigantic mountain of electronic junk, composed to a large degree — alongside numerous chemically transformed and shaped metals — of petroleum-based plastics. → The Song of Styrene 235 Similarly, from an energy-efficiency perspective, computers and their networks are anything but immaterial: "If the internet were a country, it would have the third highest electricity consumption in the world, behind China and the US."[5]

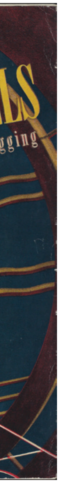
Digital modernity is no less fossil-based than fossil modernity itself: "Like oil has had its dirty sides, from environmental pollution to dirty wars, so does the manufacturing industry of computation get its hands dirty. […] But this dirt also includes chemicals as the geological legacy of digital culture."[6] Therefore, in order to get to the bottom of the phrase "data is the new oil," it would be more logical to hypothesize an overlap of the fossil and digital ages and take the parallel developments of both formations into consideration than to replace one age with the other.

From oil exploration and drilling, transport, processing in refineries, to distribution, since the 1950s, petroleum and computer technologies have undergone a kind of coevolutionary development. The image that accompanies this chapter is testament to this: Figure 40 shows an IBM 1410 with 80 KB of memory and tape drives, installed as mass storage at Austria's state-owned oil and gas company ÖMV (now OMV) in the mid-1960s. → Core Sample 207 It ran simulation programs supporting machine scheduling within a refinery. With their large and complex process architectures, refineries are perfect locations for using computer control systems, says computer historian James W. Cortada,[7] and, for decades now, the most advanced scientific

5 Research Group on Digitization and Socio-ecological Transformation, *Eine andere Digitalisierung ist möglich*, Berlin, 2019, https://www.nachhaltige-digitalisierung.de/postkarten/.

6 Jussi Parikka, *A Geology of Media* (Minneapolis: University of Minnesota Press, 2015), 111.

7 James W. Cortada, *The Digital Hand: How Computers Changed the Work of American Manufacturing, Transport, and Retail Industries* (Oxford: Oxford



computer methods have been used to analyze geological data and prepare for exploratory drilling.[8] → Exploration 37 Similarly, it is sometimes the misuse of petrochemical computer technology that produces advanced digital culture. In was in this way that, according to local claims, Belarus's first ever electronic music was programmed, on a refinery computer in Navapolazk. The extent to which technologies for energy generation are interconnected with those related to information processing makes it seem plausible to regard today's technosphere as one enormous "carbosilicon machine."[9]

Another core area of overlap is the social pervasion that has evolved over time, the habits and standards that grew out of the socio-technological formation of the petroleum age. "Where are the personal helicopters we were promised?" wondered the media theorists and activists of the Dutch writers' collective Adilkno/Bilwet in the early 1990s, making wry reference to one of petromodernity's popular promises that can be traced back to a futuristic advertisement in the US magazine *Popular Mechanics* in the early 1950s.[10] We had almost got used to giving up on these classically modern promises, from the dream of unlimited freedom of movement, to luxury for all, to the notion of colonizing Mars. The first massive slumps in the optimistic belief in progress came with the Club of Rome's recognition that resources are finite, and with the oil crises of the 1970s. → Cannonball 301 With the advent of individual automobile travel, the promise of technological freedom seemed to have reached its

University Press, 2004), 166–67.

8 For a first systematic historical take on the use of tech in oil exploration, see Christoph Engemann, "Data Is Oil Is Data: On John Gerrard's *Western Flag (Spindletop, Texas)*," in *Oil: Beauty and Horror in the Petrol Age,* eds. Andreas Beitin, Alexander Klose, and Benjamin Steininger (Cologne: Verlag der Buchhandlung Walther und Franz König, 2021), 154–62.

9 Matteo Pasquinelli, "The Automaton of the Anthropocene: On Carbosilicon Machines and Cyberfossil Capital," *South Atlantic Quarterly* 116, no. 2 (2017): 311–26.

10 Adilkno/Bilwet, *Medienarchiv*, trans. Gerrit Boer (Bensheim: Bollmann, 1993), 8–9.

absolute peak and limit — with unending traffic jams and ecological catastrophes.

Today, however, explicitly petromodern promises of individual empowerment are honored at an unprecedented rate — virtually, that is. The almost unlimited internet-based availability of all possible kinds of indulgence comes to mind. Or the all-encompassing presence of individualized communication and analysis technologies, which treat each user as a preferred subject. Or smartphone applications, which also operate with localization technology that places a psycho-geographical layer over real, traversed spaces.

Here's the crucial line that vindicates the claim that "data is the new oil." Even more significant than a review of the individual elements of the metaphorical transition from the dirty and eminently material plane of petrochemical processes to the supposedly immaterial plane of data-processing, the interdependence of oil and digital technologies and the afterlife of petromodern values is the conclusion that the principles of extractivism — that is, an economy based on the exploitation of raw materials → True Oil 251 — have been transferred to another sphere. The new front of extraction runs between the industry and the users of its technological devices and applications. Neo-extractivism occurs not just as an intensified resumption of prospecting and drilling situations in countries in the former "Third World," where the focus is typically on mining petroleum and precious metals, but it is also wrought upon the bodies and movements of the inhabitants of industrial nations. It is possible to observe a new form of "digital excavation and extraction."[11]

In consumer capitalism, the desires and behaviors of consumers have long constituted a resource of sorts. This is borne out by the rise in market research and the advertising industry following World War II and the establishment of the Consumer Confidence Index as a core economic indicator. However, the

11 Sandro Mezzadra and Brett Neilson, "On the Multiple Frontiers of Extraction: Excavating Contemporary Capitalism," *Cultural Studies* 31, nos. 2–3 (2017): 194.

complete interlinking and humongous intensification of data collection sees all personal biographical marginalia, such as movement habits or consumer preferences, become data and, therefore, a resource. This is extracted from electronic sensors, surveillance tools, and billions of laptops and smartphones. Data centers are the new refineries. Not only are all objects, backdrops, and surroundings commodities, but the communications and interactions that occur in and between them are too.

The liberating elements of digital culture — the increases in the efficiency of organizing interest-based or libidinous relationships, the easy, universal availability of goods and information, the new means of transport, such as digitally connected car-share schemes, e-scooters, and e-bikes, the profitability of which turns out to be a bet on incidentally collected movement profiles — come at the price of the people involved turning themselves into "oil," an exploitable resource. Or to stick with a more geohistorical picture: if crude oil itself emerges out of the reduction of fossilized lifeforms → Plankton 213 to their energy content, then the new oil stems from the accumulation of the behavioral legacies of all people, lifeforms, and things, which are involved in information cycles, in digital memory formations.

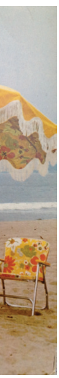
← *Fig. 41*

Burning Man

A young man, naked from the waist up, takes a shower under the tailpipe of a pick-up truck (see fig. 41). No water can be seen pouring from the pipe, positioned curiously high up and to the side; instead, out streams thick, black diesel smoke. This practice, known as "rolling coal," emerged in the rural regions of the United Stated and involves manipulating a truck's diesel engine such that, when the driver depresses the gas pedal with force, the tailpipe produces vast clouds of soot from fuel which has not burned completely. → Engine 83 "Coal rollers" view this as funny and masculine, but they also consider it a form of protest: "Want cleaner air and a tiny carbon footprint? Well, fuck you!"[1]

Coal rollers upload videos to YouTube showing hefty trucks engulfing Japanese cars with hybrid engines and electric cars — their adversaries of choice — but also police cars, women, cyclists, protestors, and "non-White" people in clouds of soot. Another subgenre reveals trucks competing to create the largest cloud of soot or even — as figure 41 shows — people taking soot showers under tailpipes at trucker gatherings. In 2014, this bizarre petrocultural practice gained attention across the United

1 Ryan Grenoble, "Political Protest or Just Blowing Smoke? Anti-Environmentalists Are Now 'Rolling Coal,'" *HuffPost,* July 6, 2014, https://www.huffpost.com/entry/rolling-coal-photos-video_n_5561477.



States. Newspapers, magazines, and TV programs all over the country were talking about it, laws were passed, and existing regulations were tightened in order to come to grips with a phenomenon that was, if nothing else, a culture war waged by right-wing, rural America on liberal cities and the environmental policies of the Obama administration.

Oregon-based petroculture researcher Stephanie LeMenager, whom we have to thank for pointing us toward the coal rolling phenomenon, interprets the practice as an expression of "petromelancholia," in which US culture has increasingly indulged since the end of "Easy Oil," that is, the reserves of easily accessible petroleum deposits.[2] → True Oil 251 The notion that all the wonderful luxury and excess could soon be over, LeMenager argues, has brought forth wave upon wave of cultural practices that fetishize oil technologies and automobility, burn gasoline, and shoot exhaust fumes into the air like there's no tomorrow.

Yet a fundamental critique of the principles of fossil modernity is nothing new; it has been there since the beginning. This critique took aim at the overspending of resources, the associated environmental pollution, and the economic, growth-oriented, and instrumentally rational spirit that drove the industrial projects forward. Rationalism and antirationalism emerge as two sides of the same historical coin. Antirationalism is found in the Romanticism of the early nineteenth century, in life-reform and dropout-movements from 1900 to the hippies, in various waves of esotericism, and in the ecological turn since the 1960s. It is often hard to determine whether this antirationalism has, at its core, a progressive or a reactionary justification — ideologically colored classifications between "progressive," on the one side, and "precursor of fascist ideology," on the other, continue to resonate to this day — and must be carefully considered on a case-by-case basis.

The antagonism that has formulated itself since the early days of fossil modernity seems to be repeating itself in the dispute over

2 Stephanie LeMenager, *Living Oil: Petroleum Culture in the American Century* (New York: Oxford University Press, 2014), 105.

the meaning, justification, reach, and implications of describing the present era as the "Anthropocene," in which many suspect (or hope or fear) we might see the end of the fossil-modern project. A broad international front of scientists from a variety of disciplines criticizes the extension of responsibility for environmental issues to include the entirety of humanity as potentially presenting a continuation of colonialism by different means, if the groups of people who have thus far occupied a subordinate position in modernity are not given a voice, and are not enabled to share in decisions made about the future. However, making the voices of non-Europeans heard would also mean breaking the monopoly of a Western rationalist understanding of nature and admitting to the reality of the spirits and gods of other conceptions of the world.[3]

The British sociologist Bronislaw Szerszynski goes one step further and seeks out the "gods of the Anthropocene" in the Western rationalist project itself, in its interactions with cultures and societies around the globe.[4] He states that these never stopped being part of the multiple Anthropocene dynamics and, alongside "high gods," such as the Anthropos, capital, the sun, and the Earth, → Black Square 263 also deal with "low spirits of planetary flow." In this, he includes specific laws of fluid dynamics, but also principles analyzed by Marx, such as the primitive accumulation or the act of "enchantment" necessary to imagine transforming raw materials into commodities. All these dynamics contribute to the "spiritual entropy" which drives current world events: "The gods and spirits enumerated here are not mere epiphenomena of more fundamental social, economic, technical and natural processes, but an integral part of what make things flow, tune, and distribute entropy and order in the changing body of the Earth."[5]

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3 Dipesh Chakrabarty, *Provincializing Europe: Postcolonial Thought and Historical Difference* (Princeton: Princeton University Press, 2000), 18.

4 Bronislaw Szerszynski, "Gods of the Anthropocene: Geo-Spiritual Formations in the Earth's New Epoch," *Theory, Culture & Society* 34, nos. 2–3 (2017): 253–75.

5 Ibid., 269.

The Burning Man festival, which lends its name to this chapter, can be understood as emanating from this kind of spiritual confusion. The festival — founded in San Francisco for the 1986 summer solstice as a hangover from the hippy era and a link to the age of electronic music and digital media → Data Is the New Oil 277 — has touched down at a place called Black Rock in the Nevada desert each year since the early 1990s. Tens of thousands of people make the pilgrimage to the site. It is considered the most progressive and liberal festival in the United States, an experiment in communal living and new ideas. In 2004, Larry Harvey, one of the festival's founders and its artistic director until his death in 2018, formulated the "Ten Principles of Burning Man." These include, among others, "decommodification," that is, an attempt to suspend the commodification of social relations in consumer society; "leaving no trace," that is, taking all garbage with you and leaving the sites "in a better state than when we found them"; → Schlumberger 125 and "immediacy": "We seek to overcome barriers that stand between us and a recognition of our inner selves, the reality of those around us, participation in society, and contact with a natural world exceeding human powers."[6] Thus, they aim to strike a spiritual and ecological path. However, ticket prices as much as USD $400 and additional expenses that, depending on requirements and wallets, range from $1,300 to $20,000,[7] coupled with the fact that, for several years, Silicon Valley's superrich (such as Mark Zuckerberg and Elon Musk) have counted themselves among the "burners" (as the international community of Burning Man

6 "The Ten Principles of Burning Man," *Burning Man Project,* https://burningman.org/culture/philosophical-center/10-principles/.

7 Hillary Hoffower, "Burning Man Was Just Canceled for the First Time Ever. Here's How Much People Are Willing to Spend on the 'Commerce-Free' Festival, from $425 Tickets to $14,000 Private Planes," *Business Insider,* April 15, 2020, https://www.businessinsider.com/how-much-does-burning-man-cost-tickets-transportation-2019-8.

attendees refer to themselves) have long had critics doubting the reality of the festival's claims to subculture and anticapitalism.[8]

At the festival site, far from civilization, and which can only be reached by car (or private jet), cars themselves are banned, unless they are what are known as "mutant vehicles," vehicles converted to display fantastical, elaborate bodywork. The festival's aesthetic has much in common with the *Mad Max* film series,[9] which features endless desert but very little water or fuel, and in which cars with combustion engines are, nevertheless, a crucial status symbol and means of transportation. The question arises as to why both sentimental enthusiasts and (supposedly) resolute opponents of petromodernity envision themselves in a both post- and hypertechnologically developed desert, where they carry out archaic rituals. → Priceless 149 This also brings us full circle, back to the petromelancholic, diesel-burning coal rollers.

Perhaps the eponymous figure of the Burning Man provides a clue — beyond all the campfire incidents that Larry Harvey reports — as to how this huge festival grew out of the spontaneous burning of a driftwood figure soaked in gasoline.[10] Which spirits, capitalist or anticapitalist, rational or nonrational, are involved here? In his classic study *The Psychoanalysis of Fire,* Gaston Bachelard examined the persistence of the "idolatry of fire" in modern society. → Engine 83 At one point, Bachelard sums up the poetic productivity of fire imagery: "Not only does the interiorization of fire exalt its virtues, it also leads to the most categorical contradictions. In our opinion, this is the proof that

8 Felix Gilette, "The Billionaires at Burning Man," *Bloomberg Businessweek,* February 5, 2015, https://www.bloomberg.com/news/articles/2015-02-05/occupy-burning-man-class-warfare-comes-to-desert-festival.

9 *Mad Max,* dir. George Miller (Kennedy Miller Productions, 1979), and *Mad Max 2: The Road Warrior,* dir. George Miller (Kennedy Miller Entertainment, 1981). The most recent instalment is *Mad Max: Fury Road,* dir. George Miller (Village Roadshow Pictures, 2015).

10 Davia Nelson and Nicky Silva, "Burning Man — Archiving the Ephemeral," in *The Kitchen Sisters Present* podcast, September 2019, https://beta.prx.org/stories/288417.

we are here dealing not with objective properties but rather with psychological values. Man is perhaps the first natural object in which nature has tried to contradict itself."[11]

Like Easter fires or bonfires on the summer solstice, → St. Barbara 293 the Burning Man is an end and a beginning all at once, an archetypal figure of renewal, like the Roman god Janus, the last and the first step not, however, in the wheel of the year, but in a turning point in history. Out of the deepest depths of the petromodern night and into a new era, the last gasoline fire of the old age and the first of the new one.

11 Gaston Bachelard, *Psychoanalysis of Fire,* trans. Alan C.M. Ross (Boston: Beacon Press, 1964), 75.


PRESTIGE

← *Fig. 42*

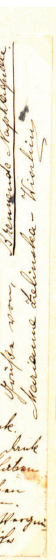
St. Barbara

"700 Intellectuals Worship an Oil Tank" is the title of a poem by Bertolt Brecht from his *Reader for City Dwellers,* published in 1929: "You are not invisible / Nor without end / But seven metres high. / There is no mystery in you / There is Oil," it reads, before ending, "Hear us therefore / And deliver us from the evil of the spirit / In the name of electrification and statistics / Forwards with Ford!"[1]

According to sociologist Max Weber's influential secularization thesis, the processes of secularization in the modernizing societies of the nineteenth century did not effect any kind of radical break with religion, but instead engendered a translation of religious substance and conventions into new social areas.[2] Religious rites of passage help with the societal mediation of new, large-scale technologies; the sacred staging of the World Expositions of the nineteenth and early twentieth centuries comes to mind. The traditionally religious prowess in matters of transcendence as a way of dealing with the intangible is

1 Bertolt Brecht, "700 Intellectuals Worship an Oil Tank," in *The Collected Poems of Bertolt Brecht,* ed. Tom Kuhn and David Constantine (New York: Liveright Publishing, 2019), 330–31.

2 Max Weber, *The Protestant Ethic and the Spirit of Capitalism,* trans. Talcott Parsons (Abingdon: Routledge, 2001).



conveyed in part onto a way of dealing with technology.[3] Thus, the technological utopias associated with the modern project are often described as essentially religious or "religioid."[4] Petromodernity is also awash with holy and unholy promises aplenty, such as that featured in the aforementioned poem by Brecht — with regard to new technologies, consider the promises of air and space travel, striving for the heavens in the truest sense of the word. → Space Travel 271 "After His death, God turned into oil," write Finnish philosophers Antti Salminen and Tere Vadén, "and oil became a surrogate God with very straightforward utility: everything that smacks of being sacred is burned in the black motor of economic growth."[5]

Alongside these modern metamorphoses of matters of faith, however, there are also many more direct links between the petromodern or fossil-technological world and Christian — or other religious — practices. → Baku 135 The practice envisioned here grows out of the tradition of Christian miners, whose patron saint is St. Barbara, because, according to legend, she hid in a crevice in the rocks while fleeing her persecutors. Few probably know that oil workers also celebrate St. Barbara's Day — oil extraction is considered part of mining both in a social and labor-historical sense — but it makes immediate sense; after all, oil, like coal or iron ore, is mined from the depths of the Earth. It is also clear from the symbol of mining, the crossed hammer and chisel, complemented by the silhouette of a drill bit, used in connection with oil extraction (in figure 42, it appears in the background on the right, next to the crucifix). Yet it is also clear from the way it is integrated into the institutions: mining

3 Christian Schwarke, *Technik und Religion: Religiöse Deutungen und theologische Rezeption der Zweiten Industrialisierung in den USA und in Deutschland* (Stuttgart: Kohlhammer, 2014), 10–11.

4 Hartmann Tyrell, "Das Religioide und der Glaube: Drei Überlegungen zu einer Religionssoziologie um 1900," in *Georg Simmel und das Leben in der Gegenwart*, ed. Rüdiger Lautmann and Hanns Wienold (Wiesbaden: Springer VS, 2018), 347–362.

5 Antti Salminen and Tere Vadén, *Energy and Experience: An Essay in Naphtology* (Chicago: MCM Publishing, 2015), 2.

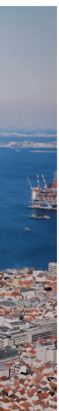
authorities are responsible for oil extraction; they train engineers and publish annual statistics on outputs.

What can we see in this picture? Archbishop Dr. Josef Schoiswohl is speaking in front of the altar. To his right, next to the altar and in front of a large emblem of an oil well on the wall, there is a Volkswagen Transporter. In front of the van, there is a statue of St. Christopher, a gift that will be blessed later in the service; down at the front, an electric guitar stands ready. It is the Feast of St. Barbara, 1970 — observed here on the Sunday following St. Barbara's Day — on December 6 in St. Leonhard's church, Matzen, Lower Austria. No oil tank is being worshipped here; this is a spiritual accompaniment and recognition of human labor. The theme of this celebration is the transportation department of Austria's state-owned oil and gas company ÖMV (now OMV). Photo albums belonging to the ÖMV's fleets of vehicles are full of images of this kind. Like in a family photo album, → Oleoviathan 113 they mark the annual celebrations the year round.

In 1957, Fr. Günther Gradisch had the idea of linking labor and faith, rural spirituality and mining culture, commemorating those who died carrying out dangerous work, and holding worker's services under the banner of St. Barbara of Nicomedia, and, to this day, he is still revered in Matzen as a church reformer.

In the pews, truck drivers, drilling workers, mechanics, geologists, and administrative staff sit alongside the company's top management, centered around the company's deeply Catholic executive director, Margarethe Ottillinger. In 1948, Ottillinger, then a top official close to Peter Krauland, the Austrian minister for asset protection and economic planning, was kidnapped from the minister's car and sent to a Soviet Gulag after being suspected of espionage.[6] She was allowed back to Austria only seven years later. In 1957, she became the managing director of ÖMV, one of the most significant managers in the Second

6 Stefan Karner, *Im Kalten Krieg der Spionage: Margarethe Ottillinger in sowjetischer Haft 1948–1955* (Innsbruck: Studien Verlag, 2016).


Austrian Republic. In the late 1960s, she was also involved in negotiating the first supply contracts for Soviet gas to the West → Pipeline 53.

Ottillinger appears in the Matzen parish chronicle in 1962 as a "great benefactor to the church." She became an advisor to the Austrian cardinal Franz König on matters of policy toward the Soviet Union and Eastern Europe, and in the 1970s, following a vow made at Potma, the Soviet penal camp, she spurred on the construction of the Wotruba church in the Viennese district of Mauer, which was built with concrete blocks. This indirectly secured her a permanent place in the history of the sacral architecture of the twentieth century. → World Cultural Heritage 201

The time when the church and the oil industry determined how the region lived is now over. Automation has expelled labor from the oil fields, and the fact that society has been completely pervaded by the mobility demands of the automobile → Sprawl 89 has turned villages into commuter towns. Only the region's elders are still attached to the memory of that heroic time, when ÖMV apprentices welded the new Matzen altar crucifix on St. Barbara's Day, right there in the church, and celebrated afterward with wine and dancing, because the company — with both its good and bad sides — was still a family.

The chancel still retains a magnificent testament to this spiritual side of oil. It is one of the most significant Christian symbols there is: the symbol of resurrection, the Easter candle. In Matzen, it sits atop a candlestick, also designed by apprentices, made of a granite drill core taken from the depths of the Vienna Basin, and mounted on a tool with which fossil oil was made to rise again to the land of the living: a tricone drill bit → Drilling Fluid 43.

Epilogues


De Anza Boulevard ¾
Wolfe Road 1¾
Stevens Creek Blvd 2¾

← *Fig. 43*

Cannonball

They were simple figures on a dashboard clock: 31:04 on October 9, 2006; 28:50 on October 21, 2013; 27:25 on November 12, 2019; 26:38 on April 5, 2020, and 25:39 on an undisclosed day in May 2020. Yet they tell a mind-boggling story. The Cannonball Run has been taking place since the 1970s. It is an illegal record attempt and a celebration of American liberty in one. It sees competitors drive incognito from coast to coast, from New York to Los Angeles, employing everything a team of three people, a machine, and ample fuel have to offer.

The total time, which registers on the dashboard clock in hours and minutes, represents a dynamic inequality. On the opposing side are geography, the complex relief and weather of an entire continent, along with road conditions, other road users, traffic management systems, and legions of traffic wardens. On the drivers' side are planning and technology: a specially adapted motor vehicle, an extra tank, onboard electronics, satellite navigation devices, radar detectors, traffic light jammers, night-vision devices, and a few dozen helpers along the route who warn drivers of checks and keep the corridors clear.

In early 2020, far beyond the confines of this one continent and its technological infrastructure, the planet itself lent the Cannonball community a hand. That April, the previous record time of 27:25, achieved in November 2019 in a Mercedes-Benz

AMG E 63, was smashed by a comparatively ordinary Audi A8 L, at 26:38. Later, in May 2020, the record was broken again. The team around Doug Tabbut and Arne Toman, the 2019 record-setters, managed to retake the title, cutting it down to 25:39.

A total of seven teams are reported to have hit record times in the five weeks of the COVID-19 pandemic after April 5, 2020. This was reported by Ed Bolian, the legendary 2013 record holder who beat Alexander Roy's 2006 record, achieved in a BMW M5, by a whopping 2 hours and 14 minutes in his Mercedes Benz CL55 AMG, clocking in at 28:50. Among them, at the time of this writing in June 2020, a record of mythic proportions ("unbeatable") was first rumored and then confirmed, achieved by Tabbut and Toman, with an average speed of 120 mph (193 km/h) at some stages. They competed in an Audi A6, which was disguised in a matter of days and by comparatively simple means as a Ford Taurus, such that it would appear to observers as a typical white police car at high speed. And thanks to modifications, it was also able to be refueled with 91-octane fuels at filling stations in the Rocky Mountains. A competitor also claimed a solo run in 25:55 in June 2020, but those on the scene have since cast doubt upon this figure.[1]

These records were smashed because the COVID-19 pandemic saw a unique system of microcosm and macrocosm, of phenomena ranging from the minuteness of a virus and the enormity of global health and monitoring systems stopping almost all traffic, because the police had other things to do than monitor the deserted highways.

Consequently, a 2020 Cannonball Run is more than just a record. There are several ways in which the run can be read as testament to an era, as an experimental, performative setting for recording a highly specific situation in history.

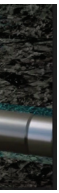
The fact that it is possible to consider the Earth as a whole from one part of the planet, or more precisely from a specifically defined distance, has been part of geography since its very begin-

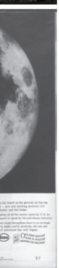
1 Ed Bolian, *YouTube,* s.v. "cannonball," https://www.youtube.com/@EdBolian/search?query=cannonball.

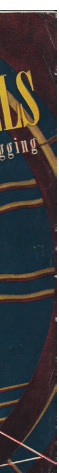
nings. The figure of Atlas himself marks a mythical beginning, and it is him we have to thank for the name of this book. → Atlas 19 The calculation of the Earth's circumference by Eratosthenes of Cyrene in the third century BCE denotes, with mathematical precision, the hour of this science's birth. Eratosthenes observed that when the sun beams down at midday on the summer solstice, it casts no shadow in a deep well in Syene, present-day Aswan, close to the Tropic of Cancer. A parallel beam of sunlight at Alexandria — further north, on the same meridian — casts a shadow on an upright rod; the sunlight falling at an angle of around a fiftieth of a circle. By Eratosthenes's astonishing calculations, the circumference of the Earth must therefore be fifty times the exact distance measured between these two locations.[2] Countless schoolbooks on mathematics and geography contain this precise calculation of the Earth's circumference, which is as legendary as it is staggering. What is often overlooked is that there is an entire state system and calendar built into this natural science, complete with communication technology and royal step-counters, or "bematists." The grade measurement from Dunkirk to Barcelona — used to measure the circumference of the Earth in the revolutionary 1790s in order to define the meter as 1/40,000,000th thereof — was also achieved in this way, in the hope of banishing all royal cubits and feet from the metric.[3] → Sprawl 89 The Cannonball Run follows a basic route, from the Red Ball Garage of East 31st Street in Manhattan to the Hotel Portofino Inn in Redondo Beach, Los Angeles, on the Pacific. Yet this "measuring" of the world is not undertaken to acquire a statistical state and standard, but as a dynamic test of equally

2 "Gradmessungen," in *Meyers Großes Konversationslexikon*, 6th ed., Vol. 8: *Glashütte bis Hautflügler* (Leipzig: Bibliographisches Institut, 1902–1908), 206–8, and Lorenz Hurni, "Digitalisierung und Virtualisierung der Landschaft," in *Vermessene Landschaft,* ed. David Gugerli (Zürich: Chronos, 1999), 65–78.

3 "Meter [1,]" in *Meyers Großes Konversationslexikon,* 6th ed., Vol. 13: *Lyrik bis Mitterwurzer*, 707–8, and Pierre F.A. Méchain and Jean B.J. Delambre, *Grundlagen des dezimalen metrischen Systems oder Messung des Meridianbogens zwischen den Breiten von Dünkirchen und Barcelona, ausgeführt im Jahr 1792 und in den folgenden* (Frankfurt am Main: Thun, 2000).







dynamic and therefore typically petromodern limits. How far does the power of technology stretch? And which engines and navigational devices are the best for outsmarting geography and the arms of the state?

It seems fitting for that especially unusual COVID-19 spring of 2020 that these limits were shifting faster than one could write. → Frontier of the Technosphere 223 In the age of satellite navigation, the basis of surveying is no longer massive steel rules placed on the ground or paces counted, but spacecrafts orbiting the Earth at a precisely defined immense speed. → Space Travel 271 In the spring of 2020, the Cannonball cars were like little brothers to the Earth-measuring satellites, scurrying about on the Earth's surface, and what they detected on their run was a kind of coma in the petromodern planetary organism, just as they themselves were exhausting all the organism's remaining possibilities. An immobilized epoch can be dissected like a cadaver on an operating table. Our era of permanent motion and permanent growth is like an airplane that must be kept in the air continuously. During the COVID-19 spring, it was as if that plane was bewitched, suspended mid-flight, while the Cannonball drivers raced past. Everything other sciences have discovered has been indirectly documented via the medium of these record runs: the silence of the Earth's crust without commuter traffic, registered on seismographs, → Exploration 37 the atmospheric chemical decline in greenhouse gases, and the price of oil, which, for the first time in history, fell below negative, leaving economists astounded.

In its characteristic dialectic, technological modernity, which has poured an unprecedented level of static elements — buildings, infrastructure, soil sealing — onto the Earth, only functions in constant motion. Sales must be made, loans repaid, fragile global production and supply chains managed, to prevent severe stagnation or crashes. Gushing oil wells cannot simply be shut down from one day to the next and reopened when demand rallies. Pipelines, oil tankers, and oil tanks are — just like today's warehouses — no longer permanent vessels, where one might provide for an eventual emergency, like the Egyptian granaries of the Old Testament, they are dynamic containers. They are filled in order to be emptied and refilled once more.[4]

At that time, fuel depots were almost overflowing because of lack of traffic. The southern route of the Cannonball Run passes one of the most prominent of these at a distance of 20 miles — the fuel depot in Cushing, Oklahoma, which is defined as a reference point by the New York Mercantile Exchange (NYMEX). Like the price of oil — into the numerical value of which feed countless technological, scientific, and financial parameters, countless hard facts and soft predictions → Temporal Abyss 241 — a whole host of multifaceted factors also feed into the measurement of the journey time. Just as the needle on a record player can convey an entire orchestra, so too can the needle on a speedometer convey a comprehensive, historic special status.

Conversely — and this is another thing revealed by these journeys, the escapism of which can be understood as a space onto which to project all unrealized desires — it wasn't until the withdrawal of mobility, freedom of movement, travel, and excess that accompanied the COVID-19 pandemic that it was laid bare to us just how much fossil freedoms have subtly been internalized and not just by ideologically driven motorists. → Burning Man 285 *On the Road,* Jack Kerouac's novel of 1957,[5] was not only responsible for influencing generations of beatniks and hippies with the emotional draw of a permanent escape toward the future, it can also be understood as indicative of a whole era during which the industrial mainstream and the counterculture, individuals and entire economies served as projectiles forever shooting themselves into the future. On balance, numerous projects seeking a dissolution of boundaries, from the protest movement of '68 to the fall of the Berlin Wall to cheap flights, only traveled in one direction. → True Oil 251; The Great Leap Forward 143

4 Hannes Böhringer, "Der Container," in *Orgel und Container* (Berlin: Merve-Verlag, 1993), 11.

5 Jack Kerouac, *On the Road* (New York: Viking Press, 1957).

In the COVID-19 spring of 2020, "being-toward-movement" was suspended, and only officially granted to "system-relevant" individuals. The Cannonball racers were outlaws, serving all the more as blank canvases onto which anything might be projected — like a message from another time or another sphere, like Sputnik over the United States. From this point of view, the situation brought about by a reaction to the dangers of a virus seemed like a potential glimpse into a time after the end of petromodernity, when societal will or economic and political constraints will have forced a new notion of travel.

At the time of editing and translating this text in the spring of 2023, it remains unclear as to whether the singular crisis posed by COVID-19, unique in the history of industrial modernity, and the intervention of a minuscule virus in the process of history present a tipping point, a catalyst for a post-fossil turn, which will make even historic turning points, such as the fall of the Berlin Wall in 1989 or 9/11, seem comparatively superficial, because here, beyond the political level, a viral immobilization strikes as a new kind of molecular mobilization. It remains unclear as to whether the fatal amalgamation of global capitalism, extractivism, and traffic — and a biosphere deeply damaged as a result of these, manifesting in zoonotic diseases such as COVID — will ultimately be tackled,[6] or whether the pendulum will swing back for the time being, as replete as after the legendary oil crises of the 1970s, which were surprisingly lacking in consequences. The front lines are merely more sharply drawn than they once were.

This presumably once-in-a-lifetime window of time manifested like a rare astronomic event, the transit of a virus, not that of Venus. During that time, it was possible to vivisect blast-frozen petromodernity with fantastical records such as "sub-26 hours" and fantastical prices such as "minus $40.32 a barrel." The window closed again in June 2020 and with it came the end of a very special glimpse into an uncertain future, be it one with petromodernity or without. You can now watch documentaries

6 Andreas Malm, *Corona, Climate, Chronic Emergency: War Communism in the Twenty-First Century* (London: Verso, 2020).

on the record ride narrated by Ed Bolian in June 2020. And who knows what the more distant future will bring: it seems quite unlikely that a Cannonball record even more spectacular than those made in the COVID-19 spring of 2020 will be remotely achievable in this petromodernity, on this planet, and by this fuel-using human species.

СтратКом ЗСУ / AFU StratCom

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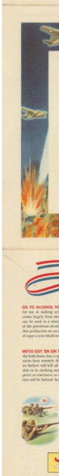
← *Fig. 44*

Zombie

A Russian tank gets stuck. Abandoned by its crew, the tank is recovered by a Ukrainian farmer with a tractor. Countless versions of this scene did the rounds of social media in the spring of 2022. A whole host of different combat vehicles with wheels or chains fell prey to the tractors, from outdated T-62 tanks introduced the year the Berlin Wall was erected, to the armored TOS rocket launcher, which, in the illustration accompanying this chapter (see fig. 44), is being towed away by a German Fendt tractor, produced at Marktoberdorf in the Allgäu. Weapons first introduced in Afghanistan in 1980 — used to reduce Grozny and Aleppo to ashes and rubble in 1999 and 2014, respectively → Ammunition 97 — lie scattered in the mud like stunned beetles.

Initially planned as a three-day "special operation" with the aim of decapitating the head of state of a country deemed Russia's inferior, the operation in Ukraine reached a deadlock soon after the invasion on February 24, 2022. The Kremlin regime, fattened with billions of petrodollars, had overestimated its powers. It had also underestimated the spirit of resistance shared by the people of Ukraine, its government, and its army, which had been able to train several tens of thousands of soldiers on rotation at the front in the Donbas since 2014, the real beginning of the war. The date was, after a brief shock about the annexation of Crimea, forgotten in the Western world. But after 2022, Ukraine



has been able to curb the invasion and to fight back with massive military aid from the West through weapons systems, such as the Javelin antitank missile, the HIMARS rocket launcher, and IRIS and Patriot missiles.

Some of the military vehicles captured by farmers have been added to the Ukrainian army's arsenal. Others are dragged home and into barns and dismantled into usable individual parts for civilian use. Images of the astonishing triumph of tractors over tank weaponry have spread across social media in no time at all. The joy at the news that it was Ukrainian farmers, of all people, towing away Russian war machines is not without bitter historical significance. It is ninety years since the Holodomor, the period of starvation suffered by the Ukrainians from 1931 to 1933, when grain from Ukraine's forcibly collectivized agricultural system was exported in order to support industrialization, as more than 3 million Ukrainians, including many farmers, were deliberately left to starve to death. Similarly, in 2022, Russia used blockades on grain as a weapon both internally and externally.

The typically complex and, to some extent, contradictory circumstances of petromodern history, technology, politics, people, and landscape manifest in the scene with the tractor and the tank. Like the COVID-19 crisis before it, the war in Ukraine seems to be a key turning point, particularly in terms of examining the present era as the age of petromodernity. In 2022, what with the unique arsenal of weapons, a petrostate as aggressor, and the energy transition under threat, it soon became clear to us that the English edition of this book would need a new final chapter addressing the war in Ukraine. In fact, the war has even affected this book and our research collaboration on "Petromodernity East," which we had been pursuing since 2018 together with scholars from Russia and Belarus, and with the help of the Goethe Institutes in Minsk, Moscow, Baku, and Novosibirsk. Just weeks before the invasion, *Neft: Atlas Petromoderna,* the Russian translation of this book and one of the products of our collaboration, was published in Moscow.[1] Presentations and discussions scheduled to be held in Russia could not take place.

Yet, in the course of working on this text, it became equally clear that it is hardly possible to provide a finished narrative when history is unfolding as war as we write, and distance from the subject matter is almost impossible to attain. The present situation sees a clear interaction between innumerable layers of the petromodern energy and material complex, and yet these cannot be captured with sufficient clarity, because there are too many observation points and ethical standards blending together and coming into immediate conflict with one another. This chapter ought to be read as an attempt to nevertheless tie them together in an epilogue to our assessment of the petromodern present.

We interpret both the COVID-19 pandemic and the war in Ukraine as events taking place on and in a threshold or *Sattelzeit* ("saddle period"), in the words of the German historian and philosopher of history Reinhart Koselleck,[2] which is characterized by a much more fundamental state of upheaval. Climate heating, the mass extinction of species, and massive global injustices in the distribution of both wealth and ecological damage caused by industrial civilization are creating a permanent "global state of emergency"[3] and demand changes to the technological, ecological and economic system that has catapulted the planet into a new era. With the emergence of COVID-19, the complexity of the Anthropocene seemed to have arrived in global politics. As radical as the interventions were during the pandemic — in personal freedoms, in economic cycles — they

1 Alexander Klose and Benjamin Steininger, *Нефть: Атлас петромодерна*, trans. Sergej Pavlovitskij (Moscow: Logos, 2021).
2 Reinhard Koselleck, *"Einleitung,"* in *Geschichtliche Grundbegriffe,* Bd. 1, eds. Otto Brunner, Werner Conze, and Reinhart Koselleck (Stuttgart: Klett-Cotta, 1979), xv. For an English-language discussion of the concept of Sattelzeit, see Keith Tribe, "Translator's Introduction," in Koselleck, *Futures Past: On the Semantics of Historical Time,* trans. Keith Tribe (New York: Columbia University Press 2004), xv–xvi.
3 Slavoj Žižek, "Heißer Frieden," *Der Spiegel,* March 25, 2022, 46–49.

hinted at the capacity of states to take action, not least against the production processes of the fossil economy, which would be urgently required in the face of ecological catastrophe.[4] As far as the war in Ukraine is concerned, however, the path into the future runs deep through the past. Instead of discussing the 2015 Paris Agreement on tackling climate change, the controversy turns to compliance with the 1951 Geneva Convention or the 1907 Hague Convention on land warfare, which remain the most significant international agreements with the enduring aim of legally containing armed conflicts.

Three days after the incursion began, German chancellor Olaf Scholz described the situation as a "Zeitenwende"[5] (a historical turning point) in a speech given in front of the German Bundestag to announce that he would be granting the Federal Armed Forces a special fund of 100 billion euros. Nothing, he said, was "like it was before." Yet the contrary is also true. Much too much has returned to how it was "before." Like it was before 1989, when arms races were run-of-the-mill, like it was before the understanding, which accompanied the proclamation of the Anthropocene, that climate collapse and global mass extinction of species might put human wars, hot or cold, in the shade.

The Russian writer Vladimir Sorokin describes the reanimated "corpse of the Soviet world" as a "zombie."[6] In response to the annexation of Crimea in 2014, the Belarussian author and Nobel Prize winner Svetlana Alexievich quoted an old Russian

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4 See Andreas Malm, *Corona, Climate, Chronic Emergency: War Communism in the Twenty-First Century* (London: Verso, 2020), 29: "the shutdown of fossil capital would have to be permanent."

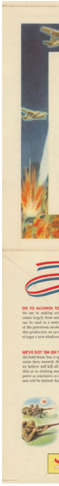
5 Olaf Scholz, "The Global Zeitenwende: How to Avoid a New Cold War in a Multipolar Era," *Foreign Affairs,* December 5, 2022, https://www.foreignaffairs.com/germany/olaf-scholz-global-zeitenwende-how-avoid-new-cold-war.

6 Andrei Arkhangelsky, "Interview: Writer Vladimir Sorokin Says Russia's Unresolved Historical Traumas Have Now 'Taken the Form of War,'" *Radio Free Europe/Radio Liberty,* February 1, 2023, https://www.rferl.org/a/russia-ukraine-war-interview-vladimir-sorokin/32249339.html.

saying: “The past is still ahead of us.”[7] We believe that this notion of an ominous return serves to capture and explain more than just the Soviet case. What reared its head in 2022, like an undead monster, is petromodernity in its entirety: the old demon of geostrategy and a false politics of history instead of new eco-geohistorical and cooperative consciousness. More specifically, armaments produced decades ago, and that might have been forgotten as fossils of the Cold War consigned to the past, revive a panorama of old modern wars—distributed in real time via countless images and videos in the digital media. → Data Is the New Oil 277

The ploughed-up landscapes of World War I, the first industrialized and petromodern war, have returned in the ravaged forests and fields of Bakhmut in eastern Ukraine, riven by trenches. German tanks are now being called in to help as Russian tanks belonging to an invading army roll through places and across landscapes to which the Wehrmacht laid waste from 1941 to 1943, → Ammunition 97 and which were later liberated by Soviet tanks. Molotov cocktails, invented and employed with great success against the Red Army in the Finnish Winter War of 1939, are being produced in the spring of 2022 in private workshops of the Ukrainian civil defense. Today, just like Prague in 1968, clueless, baby-faced soldiers, sent to the slaughter, can be seen sitting in Russian tanks, most of them from distant, Asiatic regions and recruited from among Russia’s numerous minoritized ethnic groups.

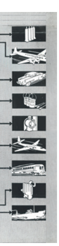
The attacks against civilian energy infrastructure such as the destruction of the Kakhovka dam and the respective reservoir, causing extensive floodings in June 2023, and various attacks on the power plant and DniproHES dam at Zaporizhzhia also have historical precedents. To halt the advance of the Wehrmacht in 1941, the Soviet secret service blew up the DniproHES dam



7 Andreas Breitenstein, “Rückfall in unselige Zeiten. Wohin treibt Russland. Und welcher Teufel reitet Putin, gegenüber dem Nachbarland Ukraine einen Krieg vom Zaun zu brechen? Ein Gespräch mit der Schriftstellerin Swetlana Alexijewitsch,” *Neue Zürcher Zeitung,* March 14, 2014, https://www.nzz.ch/feuilleton/rueckfall-in-unselige-zeiten-ld.766409.

— the largest hydropower plant in Europe at its construction in 1932 and, today, close to the largest nuclear power plant in Europe, which was captured by Russian troops. Tens of thousands of people were killed by the ensuing flood. → Rocket 159 Yet the Germans occupied the country, repaired the plant, and blew it up again on their retreat in 1943. Under their rule, more than 8 million people were murdered in the country by starvation, shooting, and gassing.[8] It is only now that large sections of the public are beginning to pay attention to the fact that Ukraine and the country's central sites of Nazi terror have played a somewhat marginal role in the German national discourse on memory, the war, and the Shoah.

"The harvest in the fields, the seeds in the soil / We burned the very earth itself. / From the White Sea to the Black Sea. Soviet power / shuts its eyes tight and sends tractors."[9] These are the words of the GDR playwright Heiner Müller from a play of 1958 about the forced collectivization of farmland in East Germany following German warfare in Eastern Europe and the beginnings of industrialized agriculture.



In Ukraine in 2022, tanks and tractors stand for conflicts that continue to simmer, unsolved by Soviet "brotherhood." In terms of how they relate technologically to the landscape, these two vehicles are more similar than they might appear at first glance. Both have contributed in historically decisive ways to the mobilization of all areas of life, which characterized the petromodern twentieth century. → Molecular Mobilization 63 On the prairies of the Midwest and the steppes of Ukraine and Russia, the tractor has proven itself to be a key instrument in a new, industrial agriculture — the American Fordson of 1917 was soon copied in the Soviet Union as the Fordson–Putilovets. Around the same time, in September 1916 at the Somme and at the Battle of Cambrai during the revolutionary November 1917,

8 Timothy Snyder, *Bloodlands: Europe between Hitler and Stalin* (New York: Random House, 2010).

9 Heiner Müller, "Die Umsiedlerin oder Das Leben auf dem Lande," in *Werke* 3, *Die Stücke* 1 (Frankfurt am Main: Suhrkamp, 2000), 211

the tank established itself as an icon of petromodern warfare in its first applications in military settings. The idea crucial to the tank's success — putting down a chain track as a kind of steel road for the vehicle's wheels to run along, making almost any ground traversable — comes from agriculture, from the legendary US inventor Benjamin Holt, who first tested the chain track in 1904.[10] In the Soviet Union in particular, tanks, tractors, and hybrids, such as the Stalinets tractor used in the Red Army, but also in the petroleum industry, → The Great Leap Forward 143 were built in the very same factories in Chelyabinsk, in Stalingrad, and in Kharkiv, Ukraine. This, the former "capital of red modernity,"[11] was the domain of Michail Koshkin, the developer of the most-produced tank in the world, with 80,000 units built: the T-34, which proved decisive in World War II.

Whether it uses wheels or a chain track, the tractor is one of the most powerful symbols of an agricultural technology made mobile by petromodernity, one that views the soil not as part of nature that grows of its own volition but as a technological resource, → Greenhouse 105 a concept of agriculture, in which farmers no longer work with nature, but employ machines to work against it.[12] Reflecting the radical transformation of agriculture in the United States during the 1930s, John Steinbeck writes in his most famous novel, *The Grapes of Wrath,* on the impact of the tractor:

> The tractors came over the roads and into the fields[....] Snub-nosed monsters, raising the dust and sticking their snouts into it, straight down the country, across the country,

10 See Peter Berz, "Die Schlacht im glatten und gekerbten Feld," in *Schlachtfelder: Codierung von Gewalt im medialen Wandel*, eds. Steffen Martus, Marina Münkler, and Werner Röcke (Berlin: Akademie, 2003), 265–83.

11 Karl Schlögel, "Look upon This City: Kharkov, a Capital of the Twentieth Century," in *Ukraine: A Country on the Borderlands,* trans. Gerrit Jackson (London: Reaktion Books, 2022).

12 Frank Uekötter, *Die Wahrheit ist auf dem Feld: Eine Wissensgeschichte der deutschen Landwirtschaft* (Göttingen: Vandenhoeck & Ruprecht, 2010), 320.

> through fences, through dooryards, in and out of gullies in straight lines. They did not run on the ground, but on their own roadbeds. They ignored hills and gulches, water courses, fences, houses [.…]
>
> The man sitting in the iron seat […] could not see the land as it was, he could not smell the land as it smelled; his feet did not stamp the clods or feel the warmth and power of the earth. He sat on an iron seat […] and he was proud of the straight lines.[13]

The subjugation of enemy armies or rebellious populations goes hand in hand with the taming of natural processes in a spirit of total technological control. "The human domination of nature has a lot to tell us about the nature of human domination," writes historian David Blackbourn.[14] He summarizes the clearance of natural wilderness by means of draining, straightening of water courses, and diking, often protected with military surveillance, and the resulting possibility of cultivating the soil and creating new human settlements as "internal colonization." Thus, from the very beginning and in a deep-seated sense, though peaceful agricultural landscapes such as those depicted in paintings from the eighteenth or nineteenth century were not the reality but an idealization even before petromodernity, mechanical engineering and artificial fertilizers have meant access has attained a new quality.

The labeling of tractors dragging away tanks on social media as the "Ukrainian Agricultural Brigade" might appear to be relatively harmless wordplay. Beyond this, however, it reflects the dissolution of the boundaries of the battlefield in a war characterized by massive Russian attacks on civil infrastructure, the civilian population, and their entire future. In recent years, Ukrainian society may well have had its first chance to step out of the long historical shadow of war, deportation, genocide, and to

13 John Steinbeck, *The Grapes of Wrath* (New York: Random House, 1939), 47–48.

14 David Blackbourn, *The Conquest of Nature* (London: Pimlico, 2007), 6.

make tentative attempts to process this, but it is now being torn apart once again. Some fight, be it on the front or in the interior of the country, while others are obliged to flee their country and leave their homeland behind. In 2022, it's impossible to ignore the fact that the war is happening just a few hours' drive from Central Europe, and that the exodus from Ukraine is also part of the panorama of petromodernity. The mud of Ukrainian fields and farm tracks has not just stopped tanks, it was soon to be seen on cars in parking lots across Central Europe. Much like during the pandemic, fossil technology and a jerrican of diesel in the trunk have seemed not just like promises of freedom but like a kind of life insurance. The thought of being stranded a few miles from a safe neighboring country having run out of charge with your electric car is too much to bear.

In casting light on their dependency on Russian gas, the war has hit Europeans where it hurts. → Pipeline[53] It wasn't even the withdrawal, it was the supply of the resource that proved fateful, as the substance that had just been posited as a bridge toward a post-fossil age suddenly served as a perfidious bargaining chip. The fact that natural gas is also part of the petroleum industry, the fact that the energy transition must also consider how to generate heat and not just electricity, the fact that ammonia and therefore fertilizers are also manufactured using natural gas and that, therefore, everything we eat depends directly on it, → Greenhouse[105] the fact that the diesel additive AdBlue, also produced from ammonia and used to neutralize exhaust emissions, is running low and, paradoxically, the lack of natural gas may cause harmful nitrogen oxide emissions from truck traffic to rise, → Engine[83] the fact that large parts of German (and other) industry (be it chemical industry, the glass industry, or even bakeries) are in desperate need of gas, the fact that, even in tattoo studios, the pigment "carbon black," which is made from gas soot, could run out → Men and Petroleum[75] — all of these things indicate that we are only just half way toward understanding the widely ramified, material relationships at hand. In the light of current events, the history of energy and resources is also gaining new significance and provoking reinterpretation. The Soviet

Union's gas exports since the 1970s temporarily compensated for their losses in agriculture; gas and the fertilizer produced from it were exported through the Iron Curtain in order to import grain from the opposing side and therefore feed the Soviet population.[15] The network of international petromodern entanglements becomes ever-more muddled the closer you look.

In boilers and gas hobs, natural gas fuels some of the most private parts of our lives. Can you still enjoy a hot shower, or is every bubble bath lining the coffers of a war criminal? And weren't euros from natural gas funding the destabilization of Western democracies even before 2022, but still after the annexation of Crimea in 2014, via armies of trolls online and pacts between Putin's party and far-right forces across the world, from Central Europe to Trump? Gas, because of its high hydrogen content, is the cleanest fossil fuel we consume — unlike coal or oil, gas can be burned on a kitchen hob — which shackles us more tightly to fossil politics than we could ever have imagined. In fact, the life cycle assessment for natural gas, whether it comes from Russia via pipeline or from Qatar or the United States via LNG terminal, is only acceptable if the calculations are restricted to the kitchen. Assessed throughout the entire line, it is disastrous: the main component of natural gas, methane, is much more damaging to the climate than CO_2 if it escapes during extraction or during transport and leaks, unburned, into the atmosphere, as is frequently, massively, and often deliberately the case.[16] → Pipeline53

Enormous resources, which would be urgently required to build new, sustainable technologies and economies — and this includes a new system of food production and agriculture — are

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15 Christian Gerlach, "Das US-amerikanisch-sowjetische Getreidegeschäft 1972," in *Ökonomie im Kalten Krieg. Studien zum Kalten Krieg,* Bd. 4, eds. Bernd Greiner, Christian Th. Müller, and Claudia Weber (Hamburg: Hamburger Edition, 2010), 480–500.

16 IPCC, *Climate Change 2021: The Physical Science Basis. Working Group I Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change,* eds. Valérie Masson-Delmotte et al. (Cambridge: Cambridge University Press, 2023), esp. 700–703.

being invested and burned in anachronistic, petromodern military technology under the banner of "realpolitik." Even those with the noblest of motives cannot ignore that new machines of destruction are being launched or newly built — requiring huge energy input — and then transported in global logistics chains, that fuel depots and trains are being blown up, explosives detonated, and habitats devastated in order to halt Russia's imperial aspirations. Even if certain major interventions in ecological cycles — think of the use of Agent Orange in the Vietnam War or the torching of oil fields in Kuwait in 1991 — have been sanctioned by the international law of war since the 1970s and the war in Ukraine has, since its beginnings, also been observed in terms of anticipated ecological damage and the consequential costs of this to the global climate,[17] it seems difficult to imagine a war fought using sustainable fuels and complying with environmental standards, even in the distant future. → Terminator 257
Despite all the cybertroops deployed, warfare as it exists today is deeply anchored in the petromodern *dispositif*. And those who most benefit from war — inherently, one might say — form precisely that part of the industry that has always dealt most recklessly with the fate of humanity and nature, that is, those who produce ammunition and killing machines, highly potent fuels, vehicles, and aircraft, the emissions and consumption of which will never have been part of the calculation. A full 5 percent of the world's total CO_2 emissions can be traced to the US Army alone — in peacetime. Significantly, these figures have yet to be included in the reports compiled by the IPPC, the intergovernmental organization for scientific research on climate change.[18]

17 The total CO_2 emissions produced by the war and its consequent costs — particularly when rebuilding destroyed buildings and infrastructure — was estimated at 100 million metric tons for the first seven months of the war, which is equivalent to the total emissions of the Netherlands for the same period. See Lennard de Klerk et al., "Climate Damage Caused by Russia's War in Ukraine," by Initiative of GHG Accounting of War, November 1, 2022, https://climatefocus.com/wp-content/uploads/2022/11/ClimateDamageinUkraine.pdf.

18 Mohammad Ali Rajaeifar et al., "Decarbonize the Military — Mandate Emissions Reporting: Armed Forces Have a Massive Carbon Footprint

Wouldn't it be possible to deliberately let petro and other aggressors run aground, rather than making pacts with them time and time again? Could these few be stopped in a way that doesn't endanger the livelihoods of the many? Is an end to fossil geopolitics even conceivable? It seems that, as far as the doctrine of realpolitik is concerned, global environmental policy can only be realized in peace time. However, a vicious circle of rising floods, the spread of drought, and the huge water demands of extraction and industrial activities of all kinds, as well as the resulting lack of food and water, increase the probability of armed conflicts. This connection has already been discussed as a causal factor in the war in Syria[19] — which was also waged by Russia, among others, with well-known hybrid aims — and also in the civil war in South Sudan. At the beginning of the war in Ukraine, hopes surfaced in ecologically minded circles that the Green German minister for economic affairs, Robert Habeck, would utilize the momentum of a wartime state of emergency to force through urgently needed ecological reforms. Successful planned and wartime economies were even discussed as models for a route out of the imperatives of economic growth.[20] Yet, there was little sense of this as matters developed. The key maxim of social-democratic/liberal/green realpolitik was and is, at the time of writing, to protect the German population and the German economy against any extreme impacts. On the other hand, there is recognition from a real-ecological perspective that a transition to ecologically sustainable forms of economy and society is only realistically possible by accepting significant losses (to the total quantity of materials metabolized by society, from raw materials to food to energy) and through an accompanying radical redistribution of wealth.[21]

That Is Absent from Global Accounting," *Nature* 611, no. 2 (2022): 29–32.

19 Jan Selby et al., "Climate Change and the Syrian Civil War Revisited," *Political Geography* 60 (September 2017): 232–44.

20 Ulrike Herrmann, *Das Ende des Kapitalismus* (Berlin: Kiepenheuer & Witsch, 2022).

21 This scenario has been laid out most notably by Kim Stanley Robinson, *The Ministry for the Future* (London: Orbit, 2020).

"Let us learn to wage war with the elements, not with our own kind," wrote the Scottish moral philosopher James Dunbar in the late eighteenth century. Dunbar was a professor at King's College, Aberdeen, and author of *Essays on the History of Mankind in Rude and Cultivated Ages.*[22] From today's perspective, since the scientific and industrial revolutions that have occurred since Dunbar's time have brought about a truly changed and destabilized "nature" on a planetary scale, it seems more than evident that war among humans and the "war on nature" are in fact closely linked. What is clear is that oil and natural gas would be of little value as political bargaining chips in a world that had seriously cut ties with fossil fuels. A genuinely sweeping response to the political and economic pressure would generate ecological momentum, on the sides of both consumer nations and extraction nations. It would be in the interest of oppressed societies to free themselves from the fossil snare, especially in those extraction states and petrostates, → Priceless 149 which are often ruled by despots because of their ties to these corrupting raw materials. → Petroporn 173

However, we are far from finding a way out of the snare ourselves. In 1914, at the beginning of the petromodern era, World War I "woke with a bang"[23] a European bourgeoisie, which, in Walter Benjamin's words, was only dreaming of itself as modern. The destructive potential of industrial progress in the planetary dimension suddenly burst its way into the public consciousness. Today, a good century of petromodern contradictions and disasters later, at the ostensible end of the era that began back then, we find ourselves in a comparable situation. We are dreaming of its end, but on waking we don't know how to release ourselves from its spell. If, as Vladimir Sorokin's interpretation states, "Z" — the cryptic symbol of war found on Russian vehicles and in Russian propaganda on the war in Ukraine — does indeed stand for "zombie," then it is not just the undead "corpse of the

22 Cited in Blackbourn, *The Conquest of Nature,* 12.

23 Walter Benjamin, *The Arcades Project,* trans. Howard Eiland and Kevin McLaughlin (Cambridge: The Belknap Press, 2002), 551.

Soviet world" to which it should be applied. As the final letter in our *Atlas of Petromodernity,* "Z" like zombie stands for a festering historical situation that has long since become untenable.

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