Fossil fuels and Western imperialism are widely recognized as key elements that shaped the modern world. Today, they are also acknowledged as major forces that threaten future human existence. However, our historical understanding of these powers, and especially of their complex relationship to one another, is still vastly misinformed. For example, the Middle East, which is now mostly associated with oil extraction and American power, was in its history turned into a coherent region by British coal and imperial interventionism. This legacy provides an opportunity for a reappraisal of the entanglements of energy and empire, of classical- and neoimperialism, and of coal and oil. Unsettling the familiar geographies of extraction and combustion, coal’s peculiar Middle Eastern career exposes both these processes and the connections between them to inquiry. In short, it could help us understand the complex process by which the hydrocarbon economy was created and globalized.

In relative terms, only a small portion of the coal mined in the British Isles was exported outside of Europe, and only a small amount of that was shipped to the Middle East. Yet the relative perspective of statistics is misleading, as it obscures the fact that this was enough to fuel a revolution of steamboat imperialism and eventually bring coal mining to life in the Ottoman Empire, as well as in India, China, and elsewhere. Depositing “black diamonds” in Ottoman territories en route to the British Indian Crown Jewel allowed the global fossil fuels economy to pick up steam and take shape during the long nineteenth century. The
discovery of liquid “black gold” in this territory at the beginning of the twentieth century is one of the legacies of this passage. Indeed, under the mark of British fossil-fueled imperialism in these settings, coal (both imported and local) was transformed from a useless “black stone” into a valuable “treasure,” rendering it into a resource that could be managed by Islamic and capitalist ethics, which sometimes competed and sometimes complemented one another. Thus, beside its familiar role in fueling industrialization in western Europe, the coal transported from Europe to today’s oil-producing regions set in motion crucial yet overlooked circulations and calculations, which connected the world with durable carbon fibers. Essentially, these are the historical global underpinnings of our current global warming.

Alfred Thayer Mahan who coined, or at least widely popularized, the term Middle East in 1902, exemplifies Britain’s historic carbon footprint. As an American naval strategist, he gained much of his fame and what he thought about the world from the maritime history of the British Empire. Mahan’s understanding of the sea as “a system of highways,” and his consideration of one of these maritime corridors—a string of British coaling depots used as “bases of refit, of supply, and in case of disaster, of security”—as “Middle East” drew on a British nineteenth-century perspective. From the 1830s, Britons tended to refer to the ocean, once seen as a barrier, as “the highway of the nations,” and to the steamship as “the railway train minus the longitudinal pair of metal rails.” Coal thus served as the main building block for the Middle East, both physically and conceptually. Through this vital carbonized hyphen between Europe and Asia, fossil fuels could be unleashed at large.

The British engineers who pioneered thermodynamics and the new science of energy around the 1840s were among the first to make pronouncements like those later adopted by Mahan. The solidification of once-liquid barriers into transmaritime connectors complemented the world these experts promoted conceptually, in which previously distinct physical realities could be made commensurable by means of the abstraction of energy. Histories of empire had neglected thermodynamics and its own epistemic imperialism—the fact that “energy” rapidly became a crucial organizing principle for scientific, and gradually also social and political action—just as current histories of thermodynamics have neglected the imperial aspects of this story.

However, beyond and behind abstraction and the British Isles, a great deal of concrete work and terraforming accompanied the solidification and globalization of the coal economy through avenues like the
one between the port cities of Aden and Port Said—the corridor that runs through the heart of this book. The very geography of this region, the basic modes of provisioning water and food, and key forms of conviviality, sociality, and politics owe their existence—and often even their current shape—to mineral coal shipped from the British Isles. In key ways, we are still trapped in coal’s amber.

Insisting on regarding coal exclusively as an energy source renders some of these important aspects—the very dimensions that make coal so detrimental—transparent. After all, it is not its use as an energy source, but rather factors like the emissions from combustion and land degradation resulting from mining and transporting coal, or the carcinogenicity of many coal-based dyestuffs used in synthetic chemistry that should concern us most. Why, then, do we keep using the master’s tools, fuels, and energies to try to dismantle the master’s house? To decarbonize our world, we need to decolonize our terminology and our history and loosen energy’s grip.

That the world we associate with oil in fact rests on the foundations of coal is indeed a symptom of a larger problem in our thinking about—and with—energy. After all, our own “age of oil,” and by some accounts even “post-oil,” is currently witnessing unprecedented coal burning. Rather than a story of “transitions” between different “energy regimes,” this book reveals a great intensification of the existing forces that coal itself supposedly replaced. These included the power of water, human and animal muscles, as well as less tangible forces such as Islamic piety, competing against and converging with notions of risk management tied to finance capitalism, which were also on the rise. Tracing such historically specific entanglements, this book anchors the annals of the Middle East in the broader history of fossil fuels and what we call the Anthropocene, while at the same time asking what the history of this region, with its particular ethical dispositions, ideas about the body, about solidarity and community, and about nature, might offer in the face of our shared planetary conundrum. Any comprehensive scheme of decarbonization must begin by addressing the double historical nexus of how different energy sources are connected to one another and of the role of non-Western settings and actors in the global march of hydrocarbons.

COALONIALISM

Britain’s industrialization and imperialism were not separate processes: both—not only the former—were predicated on coal. In the second
quarter of the nineteenth century, a gradual reorientation of the British coal industry began, moving away from London household consumption and toward overseas export. Between 1816 and 1840, exports rose as a proportion of the output of England’s northeast—itself continuously on the rise until the early twentieth century—from approximately 4 percent to nearly 13 percent. By 1900, British coal constituted about 85 percent of the entire international trade. England used coal exports to project its power, offshoring and outsourcing the Industrial Revolution by building an infrastructure that could support it overseas and connect it to other facets of the imperial project. This resulted in the development of “landscapes of intensification,” which simultaneously stimulated an increase in production as well as new uses and demands for British coal, and eventually for coal mined overseas as well.

From the 1830s onwards, a system of regularly spaced coaling depots sprang up in places like Gibraltar, Malta, Port Said, Mocha, Aden, and Bombay in a reverse domino effect. This development concurred with another one: the fact that Britain is an island, which was previously understood as a disadvantage, came to be seen during the Victorian era as a “wise dispensation of Providence,” a means to access the wider world. The new artificial archipelago soon began providing coal to various interiors, animating riverboats, irrigation pumps, railways, telegraphs, streetlights, and tramways in what would soon become the Middle East. This process offers a grounded substitute for the vague designation “modernity,” which we implicitly ascribe to the political, social, spatial, and temporal effects of the aforementioned technologies. Time/space compression, integration into the global economy, the rise of the interventionist state, urbanization, and the emergence of cash-cropping were all energized by these carbon fibers. In the Ottoman Empire, the lion’s share of the coal flowing through these ports was British. Coal depots provided perfect pretexts for military presence and securitization; they were thus also footholds for British and other European colonial officials, as well as for Ottoman, Egyptian, and other local powers.

Historicizing energy at these meeting points repoliticizes coal and casts new light on energy politics. If in the British Isles coal appeared to be “political” mainly in the sense of labor- and class politics, lending itself neatly to a framework of capitalism and accordingly pushing us to diagnose our present fossil-fueled planetary crisis as “Capitalocene,” here a more complex carbon politics animated by interimperial rivalry was hard to miss. This book probes how these ostensibly separate political registers were in fact mutually constitutive.
Coal bunkers were indeed established throughout the British Empire for reasons other and often more pressing than fueling alone. The most obvious of these motivations was territorial expansion. Regarding coal today exclusively as an energy source misses this crucial part of the story, and makes us complicit with nineteenth-century imperialist excuses. It was not only European powers but also Cairo and Istanbul that played this game. However, the British usually came out on top. Ruling the waves in the Mediterranean and Indian Ocean and being the world’s largest coal exporter during the nineteenth century, Britain regularly established coal depots in order to extend the British Isles. The neologism “coalonialism” thus seeks to capture the confluence of energy and empire and bind them analytically together. Simultaneously, it also seeks to estrange and puncture holes in the gravity of both concepts. As historians of empire have already done this repeatedly, let us begin with energy.

Against energy

This is a book about coal, the emblematic energy source. It is also a book against energy, the supposed transparent and ambient essence of all motive powers, which vaporizes materiality and specificity. In order to discuss coal as more than just a fuel—indeed, even to understand more fully how its use as fuel affects other domains—it is essential to set energy aside. What better way is there to recognize and resist energy’s abstractions than by historicizing them?

Energy is a child of its time, the nineteenth century, despite feigning perpetuity. (According to the first law of thermodynamics, the total amount of energy in the universe remains constant, and energy cannot be created or destroyed.) The term took on its current meaning at the beginning of the century, indexing new assumptions about the convertibility of heat, motion, and work. Energy picked up steam from the 1840s on with the emerging science of thermodynamics. Over the next decades it inflated and absorbed more and more domains, from the life sciences to the social sciences. A child, but not a brainchild or otherwise immaculately conceived: like several other major physics abstractions, the science of energy did not spring out of pure theoretical contemplation. It was, rather, the messy challenges of handling steam engines, as well as less obvious activities like brewing beer or sailing in foreign waters, that gave rise to the general laws of thermodynamics. We know relatively little about these latter contexts of emergence and, erroneously, we tend to situate the former squarely within the British Isles.
Only by shedding specificities and disguising its birthmarks and foreign accent could energy become a universal force present in all matter, capable of converting itself into innumerable forms, yet inalterable and constant, a power perceived only in terms of its effects.9

However, it is worth insisting on the messy and worldly nature of epistemology. Like other nineteenth-century universals, energy depended on various imperial hierarchies and forms of praxis. This book rewrites them into the story, investigating the historical connection of energy and empire. It is a link that has ongoing implications: from our continuing fossil-fueled acceleration into geopolitical and environmental crises and their codependencies to the ongoing division into winners and losers from their mutual fueling.

Historians have catalogued the religious Presbyterian assumptions informing the science of energy and its debt to Romanticism. In this Presbyterian version, energy was fashioned against metropolitan, anti-Christian materialists and naturalists, attributing to God alone the power to regenerate a fallen man and a fallen nature.10 They have revealed energy’s class politics and its role in struggles between cotton capitalists and organized labor and between elite northern British men of science and “practical men.” Most recently, the rise of work as the essence of energy, at the expense of heat and motion, has been anchored in the context of racial and antiproletarian maneuvers and in the beliefs of energy’s Scottish Presbyterian promoters.11 Perhaps most crucially, such studies demonstrate that energy and the laws of thermodynamics were not simply out there waiting to be discovered, as an older cohort of historians and philosophers believed. Rather, they were scientific constructs predicated on existing traditions of thought and action. The importance of prevailing forces in shaping the efficacy of coal is a key insight this book builds on and develops. However, historians have yet to attend to the importance of empire-making in the annals of thermodynamics, and vice versa—to that of coal in the annals of empire.12

Thermodynamics needed an imperial context for its emergence and growth. Consider the scientists crowned by Thomas Kuhn as having led the race to “discover” the first law of thermodynamics during the early years of the 1840s.13 The first, Julius Robert Mayer, developed his insights about the relationship between heat and work in East Java as a ship’s doctor aboard a Dutch vessel trading with the East Indies during the peak years of the coffee trade. Mayer noticed that venous blood he let from a European seaman was lighter in the tropics than in Europe, and this pushed him to connect heat, motion, and work (revealed in
blood oxygenation) via a unifying “living force.” A Christian theist abroad, Mayer also pushed this ontology of force as a counterweight to philosophical materialism.\textsuperscript{14}

The second contender, James Joule, arrived at his own insights in his father’s Manchester beer brewery. Joule was a member of a new generation of “scientific brewers” who aimed at achieving a quantitatively controlled standardized brewing process, and whose most valued skill was the accurate measurement of liquid temperature.\textsuperscript{15} The industrialization of the brewing sector during the following decades had a less familiar imperial dimension: the rapidly mechanizing English beer industry relied on barley grown overseas, by Bedouins in the Negev desert, for example. This particular short-stapled barley, high in sugar and low in protein because of its arid habitat, was a winter crop taken by camel to Gaza in time to arrive by steamer at English breweries early in the summer. It helped promote a shift from heavy Porters to lighter pale ales brewed to be transported to the colonies, as well as the shift to year-round beer drinking.\textsuperscript{16} Joule was by no means indifferent to oceanic steam navigation or to the ecological effects of replacing British coal with imported corn, wheat, and meat. And he was clearly interested in imperial politics in the remote settings from which barley arrived at England or beer left it.\textsuperscript{17} Like Mayer, Thompson, and other pioneers of thermodynamics, Joule realized that temperature variations mattered on a scale ranging from a jug of ale to the vastness of the empire itself.

The coal business was also stimulated by the coffee trade in places like the port of Mocha, the first coal depot in the Red Sea. The global rise of coal and the attendant science of energy were also linked to the “tea races” to deliver to Europe Asian leaves whose price stood in direct proportion to their freshness, galvanizing the shift from sailing ships to steamers. Water desalination in Suez and Aden, Chinese tea, Mocha or Java coffee, and Gaza barley turned to India Pale Ale, not to mention European and even non-European blood and sweat—from the 1840s and on these and other loci and flows examined in the following pages were all frontiers where heat, cold, steam, and coal were tested, developed, and theorized.

These aspects and peripheries are largely absent from the familiar stories and histories of thermodynamics. They matter not only as lacunae, but mostly because in these peripheries thermodynamics stalled and often required other—sometimes conflicting—epistemologies in order to work and pick up steam. In this sense, the empire created the “constitutive outside” of thermodynamics, a world where not only the
scientific but also the economic and political presuppositions that informed European history during the long nineteenth century relied on a set of mirror images and inflections. Rather than the familiar stories of gradual or stalled westernization (taking place in many domains during this time), a transregional and transmaritime history of energy reveals that the Europeanization of Europe depended on consolidating existing forces and often stirring up unforeseen ones in the colonies. Such a history reveals how democracy, individualism, liberalism, and secularism in Europe depended on making places like the Middle East more racialist and racialized, sectarian, authoritarian, and quite differently Islamic.

A TENTACULAR HISTORY OF GLOBAL CARBONIZATION
A more global history of energy reveals what is lost and added in its articulation in other tongues, times, and settings. It divulges energy’s outlandish support systems, recounting but also calling out its artifices. This book takes up coal—which in a thermodynamic perspective is little more than energy’s external shell—and examines its career over the long nineteenth century outside of the usual context of the industrializing British Isles. Yet coal could accomplish very little by itself. Rather than a history of coal’s innate energy or intrinsic agency, this is a history of the multiple, nonlinear juxtapositions and chains of agency that spawned new objects, addictions, and consumption practices. In all these respects of history, materiality, and peripherality, I seek to provincialize energy.

Provincializing is not simply a geographic move away from the metropole, though such decentering helps defamiliarize energy in other ways. Figure 1, Charles Joseph Minard’s 1864 depiction of British coal exports, described by contemporaries as “a giant octopus,” suggests how. This French pioneer of “thematic cartography” (today we call it infographics) sought to capture the trajectory of the British coal economy, represented by the lines’ direction, and its volume, represented by their width. Trying to depict the maritime nature of this flow, Minard was compelled to expand the Straits of Gibraltar almost beyond recognition. His fossil octopus thus exposes some of the choices, tensions, and contradictions between competing regimes of empiricism; here a statistical logic trumped that of cartography. This triumph is symptomatic of the rise of relative ratios and of actuarial models of the future, which also underpins our fixation with notions like “energy transitions.” Minard’s map illustrates both how abstractions divert attention away
from the material world and how they function as harbingers of very concrete terraforming that would follow suit in the coaling system. It thus simultaneously cautions us to resist the pull of these tentacles as analytical categories, while documenting their effect as categories of praxis and instruments of world-making.

The octopus is also a good metaphor for thinking about empire, another creature whose tentacles are often smarter than its actual brain. With wits distributed in ways that favor “boots on the ground” and proximity to junctions of tension, and with the ample acumen generated in these interfaces, both empires and octopuses have more neurons closer to the action. This fact alone justifies attending to the sign language of the tentacles at least as much as to the declarations of the mouth.

Especially when dealing with corridors such as the one between Aden and Port Said or between other coaling stations or port cities, tentacles, those elongated muscles studded with suckers, joining line and node, help illustrate the active and agentive nature of connectors. Such a tentacular focus helps extend insights like those in Kenneth Pomeranz’s seminal study, which also addresses energy and empire yet connects them in their separateness. Comparing the importance of coal mining for the “great divergence” of England vis-à-vis China, Pomeranz discusses the spaces he compares as linked by British imperialism, while ignoring the actual bridges—territories like the Middle East—that
physically bind them to one another. Such tentacles, through which much of the British Asia traffic flowed from the nineteenth century, were narrow channels composed of coal depots, artificial canals, and deep-water ports, as well as elaborate new political, legal, religious, and economic arrangements. Rather than functioning as passive thoroughfares, they actively promoted steam navigation and both the fuel and the politics necessary for its progress.

Finally, the octopus offers a useful metaphor for portraying this book’s structure. Each of the chapters independently addresses one or more key aspects of coal that the framework of an “energy source” would occlude or impoverish. If from the 1840s energy became coal’s essence, its pulsing heart, taking note of coal’s materiality, weight, and nonthermodynamic exchangeability with other motive forces and examining the geopolitics and ethics that were informed by and in turn animated it outside Europe are other ways of provincializing energy. Each chapter charts a transformation that begins with the adoption of coal and ends with the arrival of oil in the early twentieth century. Powering Empire may then be divided into two clusters. The book’s first three chapters disrupt the prevalent notion of “energy regimes,” which organizes our thinking about the times before and after the industrial adoption of coal. Why is it that even though we have yet to see an “energy transition”—in the sense of actually leaving an old power source behind—we are convinced that steam power competed with, and then replaced reliance on, biomass or waterpower, when in fact we only see more of the latter? Where others see “replacement,” I see intensification and an enrichment of fuel baskets; where others talk of “transition,” I discuss a reordering or repurposing. If we care more about coal’s environmental impacts than about its energy potency, as we should, we have to acknowledge that alongside the undeniable ruptures and transformations it wrought, coal is also responsible for significant prolongations with detrimental effects. The book’s following three chapters are each devoted to an environment shaped by coal, be it material, financial or spiritual, maritime or subterranean.

In a cephalopodic manner, the introductory chapter holds the tentacles and clusters together, thus showing how cohesive this creature is and marking its trajectory as well as what drives it. This exposition also seeks to flesh out the benefits of the proposed thought experiment of sidelining energy, thereby clearing the ground—as well as the waterways and underground—for a closer consideration of coal. Rather than seeking alternatives to energy or making a case for removing it altogether, I ask what other frames of reference reveal about things that
usually fall within energy’s domain and identify foreclosed conversations that may be reopened if energy is muzzled.

What follows is a survey of the book’s main themes according to an organizing principle of growing complexification, one akin to an evolutionary tale: from water and marine biota, to fish and water birds. Next, it moves to larger mammals, and then to humans, first attending to their bodies and physicality, thereafter to their manual labor arrangements, forms of togetherness, and finally to abstractions, including cerebral and emotional forms of calculation and devotion and other kinds of intellectual, affective, and spiritual labor. While the composition of a drop of water might be infinitely more complex than an ideology, there are several advantages to pursuing this scheme. Energy was an imperialist project epistemologically as well as literally: as part of the ascent of physics in the nineteenth century, energy impinged on biology, physiology, labor science, and neoclassical economics. Through Darwinism, Spencerism, and Marxism, it traveled to the social sciences. Retracing and reverse-engineering carbon’s footprints inevitably goes through this intellectual trajectory. Pursuing an evolutionary course into a book about coal also helps to historicize and connect the “species thinking” at the base of modern anthropocentrism with fossil fuels, to link biopolitics and thermopolitics, as well as nonenergy aspects of coal.

**WATER: THE SUBSTANCE OF HEAT AND COLD**

British imperial extension often happened in the most literal sense of the word when raw chunks of material from beneath the British Isles were shipped and distributed around the world. To appraise this terraforming in nonthermodynamic ways, chapter 1 pays attention to water, which furnished the conveyer belt along which much of this substance moved. Such an aqueous account goes back to the roots of the development of the steam engine and coal-fueled industrialization in the British Isles rather than other global coal regions. It was the proximity of English coal mines to waterways that could carry this material with relative ease, and the related problem of mine flooding, that resulted in the development of fire engines that were connected to mine pumps. Coal moved across the empire in very much the same fashion, via artificial and natural canals, rivers, and other waterways. In addition, it was similarly used to pump water, rather than simply evaporate it into steam to produce mechanical energy. As Minard’s straits-expanding map also demonstrates, there was nothing metaphoric about the fact that coal flowed.
Alongside this horizontal flow, the nexus of coal and water also reveals the importance of verticality. Initially, coal was transported to the Middle East in sailing ships. From around the middle of the century, as more and more ships began to burn carbonized fuel during steam navigation, a ballasting problem arose. Steamers were rising in the water—often more than an inch a day—as they consumed their coal supplies. Coal-as-fuel detracted from coal-as-makeweight, and this required various kinds of solutions, such as water-ballasting systems: coal-fired steam pumps that drew seawater to compensate for the loss in coal—a loss to which they contributed by their own operation.

Early thermodynamics focused on a single dynamic inside steam engines, the heating of liquid water into steam, pressure from which turned wheels and produced movement. Yet coal’s transformation into a global energy source was also tied to how it was carried via waterways and replaced with liquid seawater. Therefore, I insist on retaining water in the analytical picture of the age of coal, as historians of oil have done.22 Another transparent yet highly significant dimension of water in the age of steam was salt—particularly so with seawater, of which salt is the main mineral constituent. From a limited steam-engineering perspective, salty and thus dense seawater was detrimental to engines and boilers. It required more fuel to heat and resulted in steam that was less elastic and therefore inferior to freshwater steam. In the early 1850s, this challenge animated the development of desalination technology on board steamers. Solutions to these problems of steam navigation, such as coal-fired desalting condensers, eventually led to an increase in the populations of coaling stations in arid environments. Thus, growing numbers of European merchants and troops were able to survive in places like Aden and Port Said, where fresh water was very limited. To this day, this is one of the main sources of political power in the Arabian Peninsula and the Gulf: Saudi and Emirati oil-based desalination as well as politics rest not only on the abundance of oil, but also on the shoulders of British coal and imperialism.

The salt ejected in the desalination process, and more so through the system of land reclamation, usually by solar evaporation of seawater—the vast process of dehydration whereby many depots were established—enabled the emergence of economic sectors predicated on conserving fish and meat. These, in turn, supported the growth of human populations in these ports. Like other parts of the Middle East associated with oil, several of the chief coal depots were, in the words Abdel Rahman Munif used to describe Arabia’s oil boomtowns, “cities of salt.”
MULTISP E C I E S  B O O M T O W N S

Stressing coal’s synergies with water over the entire spectrum of its functions, states of matter, and chemical composition also yields insight because water is the medium for multiple life forms and processes that steam evaporates from sight. Both fresh- and seawater were brimming with life that engineers often chose to ignore until they could no longer do so. Consider water ballast and the related need to replace liquid make-weights, solid cargos, and fossil fuels in different ports of call. Transporting earth-matter and then water across the world as makeweight involved other circulations, intended and not. Exotic flora sprouting on ballast hills in the British Isles clearly revealed this about terrestrial domains. The dramas underwater were in the beginning less visible, but in retrospect no less significant. Fossil fuels are associated nowadays with reducing biodiversity and with “the sixth mass extinction”—the vast annihilation of wildlife in recent decades. But during their initial spread they actually put in motion new circulations of species and spurred ecosystems in productive, rather than only destructive, ways.

Water ballasting triggered what biologists call “propagule pressure” and a mass movement of marine biota inside steamers’ water tanks. Ballast water is nowadays the largest vector for the invasions of nonnative aquatic species. Since the late 1860s, these flows blended with what marine biologists term “Lessepsian migration” (after Ferdinand de Lesseps, founder of the Suez Canal Company), another unintended mass movement of species along the canal between the Indian Ocean and the Mediterranean. It was triggered not only by the artificial connection of these bodies of water, but also by the standardization of their salinity as they came into contact with one another.

For better or worse, predation does not exclude collaboration. In the context of coal-fired transformations underwater—but also on land and even in the air—the axis of both intra- and interspecies collaboration and predation characterized the flows of creatures along steamer, rail, and telegraph lines. Coal depots were often multispecies boomtowns. Coaling stations were shaped by the multiplicity and heterogeneity and no less by the unprecedented rapidity and regularity of the arrival of numerous species. Although in the past many of these places had been visited on occasion or seasonally by foreign ships, most migratory life forms find it difficult to reproduce in low-density populations. Colonization could begin in earnest only with regular and rapid all-season communication.
Colonizing species were often not the benign ones but rather the most resilient, adaptable, and guileful. Anna Tsing researched species attracted to industrial environments and especially to those that thrive in postapocalyptic habitats. European railroads similarly attracted multiple life forms; so did the Hijaz Railway, a gigantic pollinator that standardized the flora of this Ottoman overland counterpoint to the maritime British network described here.

As chapters 2 and 3 show, respectively, if coal did not simply replace water and hydropower, the same is true of animal and human muscle power. At the peripheries of empire, the entanglements of fossil fuel and other driving forces are thrown into sharp relief. Because colonial coal depots often created new environments, it is easier to recognize in them the invigorated inflow of such forces that coal supposedly obviated.

Both Aden and Port Said offer examples of the complex synergy between the aforementioned variables: steam navigation, submarine and surface migrations, the coexistence of hydraulic, muscular and fossil powers, and salting, culminating in the creation of new multispecies imperial geographies. Unpacking this synergy here is also an opportunity to get familiar with the geography covered in this book. Only 150 people lived in Port Said in 1859. In 1869, when the canal was opened for navigation, the town’s population numbered 10,000, and by the 1882 British occupation, it had reached 17,580. Port Said’s physical development involved massive land reclamation, mostly in the form of the extension of wharves into the sea and solar evaporation of seawater. Lessepsian migration, the arrival of steamships and their water-ballast tanks at its docks, and the pulsating life onshore increased the number of fish and produced a vibrant fishery. Simultaneously, salt, made available by the above-mentioned processes of seawater evaporation and land reclamation, allowed a fish-salting sector to emerge. Together with the installation of coal-burning water-desalination condensers and other engines that solidified this desalted liquid into artificial ice, salted and frozen Port Said fish were increasingly traded all around Egypt and its coastal neighbors. The town’s expanding fisheries and fish-salting industry attracted, in turn, a growing number of water birds that could also be hunted, salted or frozen, and similarly shipped across the region.

As chapter 2 documents, this was not necessarily a rosy picture of convivencia (like figure 2); such processes soon created a host of problems resulting, for example, from differential fishing and bird hunting permits (foreigners were allowed to shoot from boats whereas local Egyptians could only use nets). Property rights on land reclaimed from
the sea became another bone of contention and were articulated as tensions between “natives” and “foreigners.” This canal town, which was initially a tabula rasa with no one then “native” to it, grew into a dual city split into Arab and European quarters marked by intercommunal tensions.

Similar multispecies tensions (and their communal modes of reduction) animated life in Aden, where human and other populations were also exploding. Aden’s population soared from 600 in the year 1839 to 20,738 in 1856. By 1891, it numbered 40,926 inhabitants. Other life forms followed suit, and proximity between species quickly became an object of fascination and experimentation in this coal depot. For example, European steamer travelers developed a habit of standing on deck and throwing coins for the Arab and Somali boys to retrieve from the shark-infested bay (see figure 3). The racialized economy of lives that this practice revealed prompted disapproving comments by Islamic pilgrims in their travelogues.

Moving British troops from India to Aden entailed making environmental changes that were simultaneously planned yet had unintended consequences. For instance, during the 1840s, the British started importing cacti from the Deccan Plateau to plant living barriers (or precursors to barbed wire) that were supposed to ward off attacks by nearby tribes. When these did not work, they coopted tribal leaders by buying their animals for consumption. To provide increasing quantities of meat to the growing troop and steam-passenger traffic in Aden, the British eventually took over Somalia, which became known as “Aden’s butcher shop.” Indeed, meat consumption was another outcome and engine of colonialism, a result of the transformation of livestock from workforce into fuel, and from a relationship of collaboration with humans to one of predation. Animal biomass and related greenhouse gas emissions, soil erosion, and water depletion have mounted during and since the
nineteenth century to the extent that today ecologists claim giving up beef would help curtail global warming more than giving up cars.

**CARBON AUTOCRACY**

To simultaneously tease out this process and flex our “provincializing thermodynamics” muscle once more, let us examine ice machines (which used coal power to produce cold by solidifying water rather than heating and vaporizing it, as with steam engines). These condensers made places like Aden cooler and homelier for Europeans. Standardizing the temperatures of empire was one of the most exciting potentials of artificial cold production. As explained in the 1860s by an anonymous European, “If beverages can be cooled by means of ice; if meat and other articles of food can be preserved in good condition for some time by its agency . . . if these things be so, then some, at least, of the miseries that press upon the white man in a hot climate might be alleviated, and we might then really see what northern muscles can effect in southern regions.” Yet again, coal power emerges as an enabler rather than a replacement for muscle power.

As chapter 3 reveals, ice eventually cooled human bodies, and not only those endowed with northern muscles. Moreover, it was not only a product but also an enabler of steam power. Below the decks of steamers commanded by Europeans, the engine rooms were manned by dark-skinned stokers or firemen—among the hardest, most dangerous, and