Today's Issues May 17 2020

The Today's Issues group is resuming its regular meetings, Sunday at 9:30, in Zoom until such time as in-person meetings are advisable. The Zoom Room opens at 9 a.m. at the following URL: https://us02web.zoom.us/j/88222987556 Discussion goes from 9:30 to 11, at which time you can switch to the UU church service in Zoom.

You can also dial in by telephone:
+1 312 626 6799 US (Chicago)
or +1 929 205 6099 US (New York)
Meeting ID: 882 2298 7556

The group will be discussing two essays from the May 14 issue of the New York Review of Books:

Page 30, Howard French, "Treasures of the Sahel" a review of an exhibition of African art at the Metropolitan Museum of Art. We will be able to see slides of many of the art works through Zoom.

Page 49 Jonathan Mingle, "A World Without Ice" about the melting of the world's glaciers and polar ice sheets

Both essays are attached to this mailing. Please check out the reading and join our lively discussion on Zoom.

Treasures of the Sahel
Howard W. FrenchMAY 14, 2020 ISSUE
Sahel: Art and Empires on the Shores of the Sahara
an exhibition at the Metropolitan Museum of Art, New York City, January 30–August 23, 2020
(The museum is temporarily closed. Works from the exhibition can be seen at metmuseum.org.)
Catalog of the exhibition by Alisa LaGamma
Metropolitan Museum of Art, 303 pp., $65.00
An equestrian pendant from the Dogon or Bozo peoples
Metropolitan Museum of Art
An equestrian pendant from the Dogon or Bozo peoples (Mali), copper alloy, 3 1/2 × 3 1/4 × 1/2 inches, nineteenth century
As a senior in college in 1979, I set off with a brother seven years my junior, first by rickety train and then by bush taxi, heading north from the coast and deep into the West African interior. Our point of departure was Abidjan, the gleaming modern financial capital of Ivory Coast. We had no fixed destination but a clear goal: to voyage as far north along the Niger River as our funds and my school holiday would permit. Distant Timbuktu, the most fabled town on the river and one of the sturdiest metaphors for remoteness, was a long shot, but even if we couldn't make it there, we had other objectives that seemed attainable.

I had been reading about Africa intensively since my parents moved to Abidjan with my younger siblings a few years earlier, and I was all but obsessed with a couple of questions. The impressive new wealth of Ivory Coast, built on cocoa and coffee farming, was exciting enough to behold, but what really interested me was seeing evidence of the great empires that had made the Sahel, the broad interior region just south of the Sahara Desert, a critical but overlooked engine of early Western modernization through its control of what was then the world's most plentiful source of gold. And beyond that, I wanted to understand what had made the civilizations of this region all come to ruin: How had those empires that spanned the third to the sixteenth centuries—Ghana, Mali, Songhay—all lost their splendor and fallen apart, leaving hardly a trace?1

The town of Bandiagara, which sits in the center of butterfly-shaped Mali, some forty-five miles from the great river on a parched plain dominated by purplish cliffs that are one of the region's most spectacular sights, was as far as we got before I succumbed to a severe gastrointestinal illness.2 We had been drawn there by the Dogon, a small and isolated people known for their distinctive traditions of statuary: elongated sculptures of the human form that recall Giacometti, who was strongly influenced by African art; sharp-faced figures that stand erect or ride on horseback; and, most famously, wooden doors ornately carved with anthropomorphic spirits and lizards and snakes, which are immediately recognizable to anyone knowledgable about the region's art.

But the Dogon were known for other reasons as well. Their story, first recounted to me by a crowd of teenage boys in Bandiagara, was one of refuge taken in these badlands from expanding empires to the north and south, both of which sought to forcibly convert them to Islam. Their ancestors, who were once patronizingly spoken of as animists, took up residence in hollows in the cliffs to preserve their way of life, replete with traditions of ancestor worship and a complex cosmology.

It would be another decade and a half before I again ventured northward along the Niger River. In 1995, as a correspondent for The New York Times, I strode the enormous tell, or unexcavated archaeological mound, of the lost city of Djenné-jeno with Roderick McIntosh, an American archaeologist who had been leading excavation efforts there, along with his then wife, Susan Keech McIntosh, and a team of Malian researchers. Their work helped prove that the city, located in an inland delta at the confluence of the Niger and the Bani Rivers, was the oldest site of urbanism in Africa outside of Egypt (it has since ceded that distinction to Timbuktu). There, beginning around 250 BC, an iron-making civilization built a major city by the standards of the world in that era.

This was long before the trans-Saharan caravan trade with North Africa, which has often been invoked as the spur for most medieval advances in the Sahel—things such as urbanization, social segmentation, structured religion, and long-distance trade. McIntosh at the time told me something very close to what he wrote with Mamadou Cissé, a leading Malian cultural official, in

the catalog of “Sahel: Art and Empires on the Shores of the Sahara,” an exhibition at the Metropolitan Museum of Art:

So seductive to the colonial mind-set was this grand thesis of stimulation that the first archaeologists to investigate the Sahel did not even look for evidence of local origins of towns, states, or organization of production.

As we toured the tell together, the ground crackled with the sound of innumerable pottery sherds underfoot as McIntosh explained the race that he and his colleagues had joined to study the secrets of this site before an army of looters could pry out the most valuable objects for sale to European and American “primitive” art dealers.

Among the most intriguing finds was a single transparent, dark-blue bead whose chemical recipe was only known in East and South Asia. It had most likely reached Djenné-jeno from China roughly within a hundred years of the start of China’s second imperial dynasty, the Han, in 206 BC. McIntosh told me recently that it had probably arrived via a route that connected the region to the Horn of Africa, far to the east. This meant that the western Sahel, once imagined as a civilizational backwater before the emergence of Mali’s subsequent great empires, was far more connected to the wide world, far earlier, than anyone had thought possible.

The last time I traveled up the Niger, in 2011, the farthest I could penetrate into Mali’s vast interior (it is three times the size of California) was Segu, a mere 140 miles along the river-hugging national highway from the Malian capital, Bamako. Segu, which was founded in the mid-seventeenth century, was once the capital of an important kingdom of the same name that sprang up after the fall of Songhay (circa 1464–1591), the most recent of the great empires of the western Sahel. Segu briefly stood out as a prodigious source of slaves sold into the transatlantic trade and the producer of a great deal of the art on display in the Met exhibition, before it fell in 1861 to a Muslim conqueror, El Hajj ‘Umar Tall. What brought me back there in 2011 was my interest in a nearby Chinese textile factory that I visited for research on a book about Chinese migration to Africa.3 Already it wasn’t safe to travel much further north in the country, which had been wracked by Islamic terrorism.

In the years between these last two overland trips, I had finally made it to Timbuktu but could only safely reach it by prop plane, and Islamists fired rockets into the city the day after I left. The word “Sahel” comes from the Arabic word for “shore,” and as attested by its streets buried in sand and the high dunes that loom just at its edge, Timbuktu is situated on the shore, so to speak, of the Sahara. The other term traditionally used for this part of the world, long before the era of African independence began in the 1950s, was Sudan; as France’s colony, Mali was once called French Sudan. Like “Sahel,” “Sudan” also derives from Arabic, with the phrase bilād as-sūdān meaning “lands of the blacks.”

In the colonial period the French considered vast stretches of these countries to be wasteland, designating their southern, well-irrigated bands le pays utile—the useful country. Now it was

terrorism more than the desert that was rendering more and more of Mali, and much of the rest of the Sahel, virtually useless economically. Just a few months after my 2011 trip to Segu, the violent, Western-sanctioned overthrow of Libya's Muammar Qaddafi left Mali and much of the Sahel awash in weapons, many of which fell into the hands of radical Islamists. The work of McIntosh and of Malian teams of archaeologists, too, has been completely halted while the country's slide into violence continues. Chronic conflict, poverty, and a long record of scholarly neglect of the history and cultural contributions of this part of the world have left the Sahel seriously understudied. What George P. Murdock, the author of an influential textbook on Africa, wrote in 1959 remains no less true today: "The spade of archaeology…has thus far lifted perhaps an ounce of earth on the Niger for every ton carefully sifted on the Nile."

This is the political and historical backdrop of the Met's exhibition, which draws heavily on items in African museums, some of which have seldom been displayed, and provides a rare chance to appreciate the long history and remarkable artistic output of the civilizations that succeeded one another in the long Niger River valley. "The objective of this publication and the exhibition it accompanies is to situate these temporally distant, quasi-mythical realms within the complex cultural landscape where they emerged, flourished, and eventually faded," writes Alisa LaGamma, the exhibition's curator.

Even for me, much was new and surprising. Upon entering, for example, I was immediately confronted with an object that visually bore no obvious connection to the West African artistic traditions I was familiar with: a large, brown megalith, shaped like an enormous lyre or the letter V. If I had encountered this almost architectural work, with its crusty surface and brace-like bar near its top, somewhere else in the museum, I would not have guessed it was from the region at all. Little is known about the megalith, except that such objects are common to the part of Senegal just north of the Gambia River, where it was erected sometime in the eighth or ninth century.

Beyond its dramatic, even otherworldly aesthetic, the megalith is important because it informs the changing sense of how social organization evolved in this part of West Africa. It was long assumed that megaliths like this and thousands of tumuli—burial mounds—found in the region were the product of typical early kingdoms, i.e., highly hierarchical societies in which a ruler extracted taxes from a subject population in the form of payment or, in this case, the forced labor believed necessary to build large works of religious or ceremonial importance. A more recent view, based on careful archaeological work in the Senegambia region, now holds that the megalith and tumuli were created by much more egalitarian and possibly mobile societies that migrated between different locations after working the soil in one spot for several years. Specialists say the apparent modest scale and lack of stark hierarchy of the society that built these monuments recall pre-Aztec Chavin-era monument-building in the Andes, as well as societies in the pre–Genghis Khan grasslands of Mongolia.

The longtime assumption that classic early state-building involved powerful chiefs or kings had the perverse effect of inciting much digging in the region by amateurs seeking artistic works and

treasure that could be sold to collectors. Their premise was that kings accumulate prestige objects. This activity, ironically, is the source of another of the most extraordinary pieces in this exhibition: a large golden breastplate believed to have been worn ceremonially by a young twelfth- or thirteenth-century prince in an area unrelated to the megalith in what is now modern Senegal. One of the most striking paradoxes of the history of the western Sahel—an area larger than France, the UK, and Germany combined—is that despite the enormous quantities of gold that it injected into the economies of the Middle East and Europe from the twelfth to the sixteenth centuries, little archaeological trace of this production has turned up in the form of artwork or jewelry. The studded breastplate's size makes it perhaps the most stunning exception, and it stands out as well for its extraordinarily detailed filigreed finish.

During my visit to the exhibition, LaGamma said that the director of another major American museum reflexively expressed his doubt to her that the breastplate could have been produced in sub-Saharan Africa, proffering an off-the-cuff theory that it came from somewhere in the Arabo-Islamic world. LaGamma said the item was unearthed in an intact burial site replete with other grave goods and close to the goldfields in forested regions just to the south of the Sahel, making the thesis of Arab origins highly unlikely.

The areas where both the breastplate and the megalith come from lie beyond the western limits of the three great empires whose stories are in many ways central to this exhibition, and the task of bringing together two of those empires—Ghana, which initiated imperial commerce in gold across the Sahara through a caravan trade sometime before the tenth century, and Mali, which significantly expanded it—is complicated by important gaps in the archaeological record. The capital of Ghana, although amply described by eleventh-century Arab visitors like the renowned Andalusian Muslim historian and geographer al-Bakri, for example, has never been definitively located, and even though there is a possible site for it at Kumbi Saleh, in modern Mauritania, the material record there is inconclusive. The empire's rise seems to have been strongly linked to its success in dominating a preexisting regional commerce in salt and copper late in the first millennium, followed by its cornering of the northward gold trade.

The story of Mali (circa 1230–1600) is in some ways even more frustrating. It was literally put on the map by the visit to Cairo and pilgrimage to Mecca of Mansa Musa, its tenth ruler, in 1324–1325, during which he dispensed so much gold that according to contemporaneous Egyptian accounts, prices for it were depressed for years afterward as a result of its sudden abundance.4 Already by 1339, word of Mansa Musa's extraordinary fortune had circulated so widely in Europe that a figure representing the Malian sovereign sitting on a golden throne in the middle of the Sahel began appearing on European maps of the world.

Mansa Musa took pains to impress his hosts not just with his unheard-of wealth but also with his culture and erudition. Judging by Mali's robust oral traditions, however, he seems to have been less appreciated back home. Other Malian emperors of that era were richly celebrated by griots, or bards, in epic, musically performed poems, a tradition that continues to this day. Strangely, not only are there no known gold regalia or other relics associated with Musa, he barely earned

a mention in the empire's oral traditions. Could it be that his people resented his profligacy or his overweening attention to foreign relations? So far, unfortunately, neither history nor archaeology has provided much clue.

One enduring legacy of Mansa Musa, however, would be wrong to overlook: the extraordinary mosques he built after his return from Mecca. Musa's commitment to Islam was a leitmotif of his rule, and affirming that Mali was an integral part of the Muslim world seems to have been an obsession of his. This, in turn, left a deep if depersonalized mark on the culture, as the practice of Islam spread more widely throughout the realm. Musa's grand mosques must have struck wonder among the population. The most famous of these, the Djinguereber mosque, built in Timbuktu sometime between 1325 and 1330, helped to anchor the reputation the city would enjoy for centuries as a center of Islamic scholarship.

The Met exhibition and its catalog encompass a complex set of messages about Islam, one far preferable to the racism-tinged and oversimplified ways in which the history of this region was written about for so long. For the period covering Djenné-jeno, a preimperial-era polity, as well as for the rise of Ghana and Mali, readers are asked to understand that the cultural achievements of this part of the world from the third century BC to roughly the year 1000 had little or nothing to do with diffusion or direct borrowing from North Africa, whether before or soon after the Arab conquests that swept that part of the world late in the seventh century. This is meant to correct the long-promoted notion, sometimes called the "Hamitic hypothesis," that black Africans had little capacity for civilization or state-building.

By Mansa Musa's time, however, there were altogether new trends. He used Mali's extravagant wealth to recruit scholars from the Muslim world to teach in his realm. He also hired a leading Andalusian Muslim architect, Abu Ishaq al-Sahili, to assist with his mosque-building project. The result was far from slavish adoption but something new and distinctive, the product of what the art historian Labelle Prussin calls an "intertextuality of cultures."

A boli from the Bamana people
Metropolitan Museum of Art/Francesco Pellizzi
A boli from the Bamana people (Mali), wood and other materials, 12 1/2 × 7 1/2 × 17 3/4 inches, nineteenth–twentieth century

For my brother Jamie and me, among the deepest experiences of wonder that we felt on our 1979 trip came while visiting the great mosque at Djenné, a modern city near Djenné-jeno, which was founded sometime after the older city was abandoned around 1400. The first version of the Friday Mosque of Jenné, as this structure is known, was erected in the thirteenth century, even before Mansa Musa's Timbuktu mosque. It has since been rebuilt twice. Outside of the Egyptian pyramids, the Friday Mosque is perhaps Africa's most celebrated and recognizable building. It is also the world's largest structure built in banco, a mud-based material so vulnerable to erosion that mosques constructed in this characteristic Sudanic style are studded to striking aesthetic effect with their own wooden scaffolding. This allows for their regular repair and continual modification. When Jamie and I arrived in Djenné there were no air-conditioned

tour buses crowding an asphalt parking lot, as one might have expected. In fact, there were no paved roads at all, and no other tourists, just us, pacing the dusty, barren perimeter under a scorching sun. The spread of fundamentalist terrorism in Mali sadly ensures that this will remain the case for the foreseeable future.

Through its catalog, the Met exhibition articulates an important criticism of a Western habit of mind just as tenacious as the Hamitic thesis that often still attempts to sustain a dichotomy between what is Islamic and what is supposedly genuinely African. Islam is overwhelmingly the most common religion throughout the Sahel, where it has been practiced for over one thousand years. “According to some, only that which is typically ‘animist’ can be African and Black,” the Guinean historian Djibril Tamsir Niane wrote.

But we believe this is not the correct way to look at things, for ten centuries of presence in the Sudan should grant Islam citizenship in the region. Just as, in certain parts of Europe [the Nordic countries], ten centuries of Christianity’s presence have granted local citizenship to this religion from the East.

Mansa Musa’s great ambition was to have Mali considered part of the Islamic heartland. It is time to acknowledge how fully this wish has been realized.

The other major current in this exhibition, and the final narrative twist involving Islam, highlights the explosion of aesthetically impressive art from societies of the Middle Niger River valley just before many of their traditions were eclipsed by the broad spread of Islam. In some cases, as with the jihadi conquest of Segu in the mid-nineteenth century, this transition was forcible and violent; in other, much earlier instances, such as sculpture associated with Djenné-jeno, it remains a mystery but seems plausibly much gentler. One of the most visually striking pieces in the show is also one that best reflects the enigmatic nature of this transition: a confidence-exuding male terracotta figure with ample breasts and a large, herniated navel, semi-reclining with its weight resting on its left arm.

Roderick McIntosh excavated the terracotta masterpiece at Djenné-jeno during a dig in 1981. It has been dated to sometime between the twelfth and fourteenth centuries, a time of strong new focus on the human form. This period coincides with devastating but unexplained demographic decline in the region, culminating in the abandonment of Djenné-jeno and other nearby towns. In addition to the magnificent workmanship, two things make this object especially interesting. The rendering of this androgynous figure suggests a member of a social elite, both by its corpulence and by its necklace, other high-value adornments, and the dagger it wears sheathed on its upper arm. Roderick sees it as perhaps a priest figure.

It is also headless. The sculpture was obviously not made this way but was decapitated; its head has not been recovered. This apparent act of iconoclasm, a theme that runs throughout the exhibition, seems to speak volumes about the religious politics of the moment. One imagines that during a violent Islamic conquest, “idols” like it would have been smashed

outright. This piece, however, seems to have been carefully disposed of, possibly in an attempt to respect both the tenets of the incoming religion and the feelings of family members or neighbors who still clung to their ancestral faith.

Other work from the Middle Niger region from roughly the same time seems hauntingly plaintive, with figures appearing to beseech the heavens for relief from environmental or other forms of calamity. A series of these terracottas shows human figures kneeling, singly or in pairs, their heads elevated skyward, as if in prayer. This gesture is amplified yet further by the way some of them place their crossed arms upon their chests.

The region presently inhabited by the Dogon people was previously settled by a little-understood people known as the Tellem, a name that means “we found them here” in the Dogon language. Some specialists think that the Tellem migrated to the cliffs where the Dogon now live from an area to the southwest that had been controlled by the Ghana Empire until the late eleventh century. The Tellem sculptures on display in the exhibition, mostly dating from the tenth to the fifteenth centuries, exhibit another distinctive form of what one might imagine as plaintiveness. These wooden sculptures, gnarled and crusty from deliberate slathering with organic materials like chicken blood and gruel, stand erect with their arms high above their heads, perhaps to petition, but as if in some kind of cosmic stop-and-frisk.

When the Dogon moved into the cliffs near Bandiagara, they adopted many of the artistic and religious traditions of the Tellem, even incorporating votive offerings from Tellem collective burial sites in their own altars. They did this even as the Tellem mysteriously disappeared. Today, certain sculptural traditions of the Dogon are indistinguishable from those of the earlier Tellem styles. This is particularly true of Dogon figures included in the exhibition that hold their hands aloft. Other Dogon sculpture, though, is utterly distinctive, with profound meditations on the relationship between mother and infant or on mourning. The most powerful example of the former is a late-eighteenth-century wooden figure of a stoic mother who fixes the gaze of the viewer head on, her long nose stylized in the form of an arrow, a characteristic common to much Dogon sculpture, while a child sits sideways on her left thigh as he feeds from her hand. The most moving example of a mourning figure is more abstractly stylized and feels distinctly modern. It is a thin human form with a large, smooth, round head and slot-like mouth. It sits as one would sit on the ground, clasping its raised knees.

Many people will leave “Sahel: Art and Empires on the Shores of the Sahara” so dazzled by examples of the region’s clothing and textiles that hang in the final room that they will miss one of its most powerful, albeit quiet pieces. It is also one of the most recent sculptural creations on view, and a final example of the transition to Islam from some of the traditions that it gradually supplanted. This dark, brooding, encrusted object, all rounded shapes whose style falls just shy of abstract, is suggestive of a hornless black bull with enormous shoulders or a hippopotamus-like beast (see illustration on page 31). The Bamana people of Segu revered sculptures like these as repositories of enormous protective spiritual power; so much so that they were kept in the houses of priests, out of the view of the uninitiated. Such objects were built

up slowly through an accretion of material that the catalog says could include “animal bones, vegetal matter, honey, metal, and human remains” coated with “chicken and goat blood, expectorated kola nuts, alcoholic beverages, and millet.”

‘Umar Tall, the jihadist who led his forces eastward into the Sahelian interior after the French colonial incursions in Senegal, sacked Segu in 1861 and executed its leader, Bina Ali, after he refused conversion to Islam. The repression of local religious traditions and the destruction of objects like these, which was an obsession of the jihadists, fostered intense resentment, and the catalog notes that “for the next thirty years, the Bamana maintained an active opposition to the Umarian regime”—a testament to the strength of local “idols.” Considered against the broader sweep of time, however, the capture of Segu by jihadists was a mere blip. With its fall to the French in 1890, the entire millennial history of empire in the Sahel was brought to a close.

1
Imperial Ghana (circa 300–1200) was largely situated in modern Mali and Mauritania. The former British colony known as the Gold Coast adopted its present name, Ghana, from the early, inland empire of that name, but bears no geographic or direct historical relation to it. ↩

2
This voyage to Mali was the subject of my first book, A Continent for the Taking: The Tragedy and Hope of Africa (Knopf, 2004). ↩

3
China’s Second Continent: How a Million Migrants Are Building a New Empire in Africa (Knopf, 2014). ↩

4
See François-Xavier Fauvelle, The Golden Rhinoceros: Histories of the African Middle Ages, translated by Troy Tice (Princeton University Press, 2018), which I reviewed in these pages, June 27, 2019. It quotes al-Umari, the secretary of the chancery of Mamluk Egypt, to this effect (p. 196). ↩

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A World Without Ice
Jonathan MingleMAY 14, 2020 ISSUE
The Ice at the End of the World: An Epic Journey into Greenland’s Buried Past and Our Perilous Future
by Jon Gertner
Random House, 418 pp., $28.00
IPCC Special Report on the Ocean and Cryosphere in a Changing Climate
by the Intergovernmental Panel on Climate Change
755 pp., September 2019, available at ipcc.ch

Vanishing Ice: Glaciers, Ice Sheets, and Rising Seas
by Vivien Gornitz
Columbia University Press, 381 pp., $35.00
The Hindu Kush Himalaya Assessment: Mountains, Climate Change, Sustainability and People
by the International Centre for Integrated Mountain Development
627 pp., January 2019, available at link.springer.com
The End of Ice: Bearing Witness and Finding Meaning in the Path of Climate Disruption
by Dahr Jamail
New Press, 273 pp., $25.99; $17.99 (paper)
Iceberg in Mist; painting by Gerhard Richter
Gerhard Richter: Iceberg in Mist, 1982; from ‘Gerhard Richter: Painting After All,’ an exhibition at the Met Breuer. For more on the exhibition, see Susan Tallman’s essay in this issue.
There is a house-sized boulder in the woods near where I live. I can see it through my window, perched at the top of a steep slope. It seems as though it were set there by a giant’s hand; in a sense, it was. The great rock was deposited by the Laurentide Ice Sheet, which blanketed the northern half of North America roughly 20,000 years ago. By 12,000 years ago, the Laurentide had retreated from my corner of northern New England, leaving Lake Champlain and a scoured, striated landscape in its wake. Around that time, the earth’s temperature spiked rapidly.

We know this thanks to samples, known as ice cores, extracted from Greenland’s two-mile-thick ice sheet, parts of which are almost a million years old. There is a huge variety of information locked in its layers—isotopes of oxygen, trapped bubbles of methane, traces of pollutants—from which entire ancient worlds can be inferred and their climates reconstructed.

In his new book, The Ice at the End of the World, the journalist Jon Gertner chronicles the labors of the scientists who drilled and studied those cores in frigid trenches dug out of the ice sheet itself, occasionally pausing to marvel at layers formed from snow that had fallen when Marcus Aurelius invaded Germany, or that contained traces of volcanic dust from an eruption during Caesar’s reign.

Gertner visited the storage facility in Colorado that now houses the cores. Joan Fitzpatrick, the US Geological Survey scientist who runs the facility, showed him one that dates to 11,700 years ago. “Boom. All of a sudden they get tighter here,” she said, pointing to a sharp transition in the layers of ice that marks a warming spike of about 10 degrees Celsius—the same increase that caused the Laurentide to melt. “Ice age here. Not ice age there. We think this was in the space of a few years. And the whole point is, we all once thought it would take thousands of years.”

There are mounting signs that we are living through a similarly wrenching transition in the global climate—one of our own making. But there may be no clearer signal of the scope and speed of this transformation than the accelerating melting of the cryosphere, the frozen realms of our planet. The cryosphere encompasses glaciers, permafrost, sea ice, snow fields, ice shelves floating on the sea, and ice sheets made from snow piled up over thousands and millions of years. Around 10 percent of Earth’s land is covered by glaciers or ice sheets, which hold 69

percent of the world's fresh water. Arctic ice helps drive the temperature difference between the poles and lower latitudes that is responsible for the jet stream, the stability of which underpins our global food production system. The permafrost that blankets a quarter of the land in the Northern Hemisphere stores—for now—twice as much carbon as the atmosphere.

For most of human history, the perpetually ice-bound parts of the planet have been an enigma. Concerted efforts to get to know them have been relatively recent. Gertner recounts the obsessive efforts of explorers such as Fridtjof Nansen, Robert Peary, Knud Rasmussen, Peter Freuchen, and Alfred Wegener to cross or map Greenland's unknown interior in the late nineteenth and early twentieth centuries. These are gripping tales, but Gertner's main project is describing how Greenland would later become a laboratory for exploring time rather than space. He notes that the French ethnologist Paul-Émile Victor—one of the figures who bridged the adventurers' era with that of the researchers who came after them, riding enormous diesel tractors called "weasels" instead of dogsleds—organized the first large, post–World War II research expeditions into the island's interior, motivated by his insight that "Greenland was…a tremendous recording machine of times and climates past." Over the course of his own research into the history of the world's largest island, Gertner also comes to regard Greenland's ice "as an analog for time"—one that "seems capable, too, of telling us how much time we might have left."

"The Greenland and Antarctic ice sheets are continuing to lose mass at an accelerating rate and glaciers are continuing to lose mass worldwide," according to the authors of the IPCC Special Report on the Ocean and Cryosphere in a Changing Climate, released by the Intergovernmental Panel on Climate Change in September. The key word is "accelerating." The rate at which Himalayan glaciers are melting has more than doubled since 2000, while the rate of ice loss from the West Antarctic Ice Sheet (WAIS) has tripled. The rate at which Greenland's ice is losing mass has increased sevenfold since the 1990s. The volume of meltwater pouring off Greenland's ice sheet is the highest it has been in the past seven or eight millennia; the rate of surface meltwater runoff over the past twenty years is 33 percent higher than the average for the twentieth century. Greenland alone has boosted global sea level by more than half an inch just since 1972; half of that contribution came in the past eight years.

The reason for this quickening meltdown is simple. Our greenhouse gas emissions have warmed the globe by about one degree Celsius since the preindustrial era. Polar and high mountain regions are warming much faster than the global average: temperatures in the Arctic, for example, have risen by one degree Celsius just in the past decade. By mid-century, even if global temperature rise is limited to 2 degrees Celsius, the Arctic will have warmed by 4 degrees Celsius.

Models suggest that both the WAIS and the Greenland ice sheet will be locked into a path of irreversible melt at somewhere between 1.5 and 2 degrees Celsius of global warming. Some researchers believe that the collapse of both these ice sheets is already underway, and unstoppable. Most of the world's mountain glaciers, and much of its polar ice sheets, are going

to melt. The only question is how fast. “The fuse is lit,” says Donald Blankenship, an expert on the WAIS. “We’re just running around mapping where all the bombs are.”

Humans have never inhabited a world without ice. In addition to being archives of ancient climate and thermometers with long memories, glaciers and ice sheets are water tanks and weather engines. They are implacable sculptors of the land we tread. They are the mothers of great rivers. They are objects of obsession and of terror. They are inhospitable and indispensable. The Himalayas, the Andes, the Alps, and the frozen North have long shined in our collective compass as fixed, immutable, monolithic. They have also proven surprisingly vulnerable to the ratcheting rise of atmospheric carbon dioxide—now at levels that are unprecedented in the past three million years—and other warming pollutants produced by human activities.

Glaciologists like to joke that their field isn’t rocket science: as it gets hotter, ice melts. But the actual processes are extraordinarily complicated. Vanishing Ice by Vivien Gornitz, a retired research scientist at Columbia University and the NASA Goddard Institute for Space Studies, is a comprehensive survey of the varied ways ice is turning back to liquid, pretty much everywhere. Laden with diagrams and definitions, Vanishing Ice reads like an intro-level college course on the still young science of why glaciers and ice sheets wax and wane over millennia—and how they can disintegrate quickly in a self-reinforcing process.

Gornitz also makes an extended argument for why everyone should care about all this melting, even those who live far from any ice. As such, she helps us prioritize our cryospheric concerns. Care about sea level rise? Focus on Greenland and Antarctica: combined, they contain about 216 feet of it. Among the third of humanity that depends to some degree on water flowing down from mountain ice? Then pay attention to how very sensitive mountain glaciers are to rising temperatures around the world, and how “their relatively small total ice volume belies their importance to global welfare” as irrigation, hydropower, and cultural resources.

In January 2019 an international consortium of researchers published a comprehensive assessment of environmental change in the Himalaya Hindu Kush region: The Hindu Kush Himalaya Assessment. They concluded that a third of all Himalayan ice will vanish by 2100. That is the best-case scenario, the increasingly far-fetched one in which humankind reins in its greenhouse gas emissions quickly enough to stay under 1.5 degrees Celsius of warming. If emissions continue at their current rate, two thirds of Himalayan ice will be gone by the end of this century. The glaciers on and around Mount Everest are likely to disappear no matter what.

“As the dew is dried up by the morning sun, so are the sins of men dried up by the sight of the Himalaya,” according to the Skanda Purana, an ancient Hindu text. “It would be such a catastrophic, shameful thing to do to melt away Mount Everest,” a prominent atmospheric scientist once told me, describing what motivated his work to reduce the air pollution that darkens Himalayan ice with soot, which is, along with greenhouse gases, a major accelerant of glacier loss.1

Whether or not the sight of the naked Himalaya—whose name means “abode of snows”—one day induces shame, or outrage, catastrophes are certain to follow after the disappearance of ice. As glaciers retreat, they reveal long-frozen soil. That, too, will thaw. As it does, mountain slopes will come unglued. This phenomenon is already fissuring rock faces and toppling mountainsides, causing landslides and rock-ice avalanches in the Swiss Alps and beyond.

Some retreating glaciers also feed growing lakes that are dammed by unstable moraines. When these burst, the resulting floods can be immense. From Nepal to Peru, glacial lake outburst floods threaten downstream villages and infrastructure such as hydropower plants. In 1981 this kind of flood destroyed the China–Nepal Friendship Bridge and killed two hundred people. Since then, glacial lakes have grown in size and number; a study in 2010 found at least four thousand across the Himalayan region, with hundreds considered dangerous.

Water availability will change in huge river basins and irrigation networks. In the Himalaya, glaciers regulate the flow of the Indus, Brahmaputra, Mekong, Ganges, Yangtze, and other rivers that nearly two billion people depend on. These glaciers’ seasonal runoff is an essential complement to monsoon rains. About 40 percent of the dry-season water in the Indus River basin, shared by India and Pakistan, comes from glaciers. In the near term, warming temperatures will cause glacial runoff to spike, and water flowing through the Indus’s tributary rivers will increase. And then, at some point later this century, the flow of meltwater will decline, irrevocably, and slow to a trickle.2

For the 670 million people around the world who live in high mountain regions, from the Andes to the Caucasus, this reduction of glacial meltwater will profoundly disrupt their agriculture, livelihoods, and ways of life. For the 680 million people who live in the world’s low-lying coastal regions, the meltdown threatens to wash away the land under their feet.

The vast majority of the earth’s ice lies at the poles. While mountain glaciers hold less than one percent of the world’s ice, equivalent to a potential 1.4 feet of sea level rise, the Antarctic continent is home to 87 percent of the world’s ice by volume, or almost two hundred feet of potential sea level rise. Greenland has 10 percent of the world’s ice—and over twenty feet of sea level rise.

When it comes to these great ice sheets, what should worry us isn’t so much the prospect of ice slowly melting into the indefinite future, but the mechanics and probability of abrupt collapse. As the geophysicist David Archer warned in his slim, superb book The Long Thaw (2009), “there are reasons to worry that real ice sheets can melt in ways that would evade the current state-of-the-art model forecasts…. Ice knows a few tricks for melting quickly that glaciologists are not predicting in advance, but only discovering as they happen.” A decade later, the authors of the IPCC special report have vindicated him. They admit that previous IPCC projections “have tended to err on the side of caution” when it comes to sea level rise: “Significant sea level

rise contributions from Antarctic ice sheet mass loss…, which earlier reports did not expect to manifest this century, are already being observed."

Both Gertner and Gornitz highlight the research of Eric Rignot, a scientist at UC Irvine and NASA, who has closely studied glaciers in both Greenland and West Antarctica. He doesn't think current models capture the "threshold behavior" exhibited by large, fast-changing glaciers that terminate in the ocean, such as Greenland's Jakobshavn and the West Antarctic's Thwaites Glacier. Recent expeditions have shown that warmer ocean water is lapping at the ice shelves that buttress these enormous seaward-flowing glaciers, chewing at them from below, and lubricating them at the point where ice meets bedrock.

Rignot believes that he and his fellow scientists are witnessing the early stages of their collapse. The rate of ice discharge from the Florida-sized Thwaites, which keeps an enormous amount of upstream ice in the WAIS locked in place, was four times higher between 2003 and 2010 than it had been in 1970. A new study by Rignot and his colleagues at UC Irvine suggests that the floating shelf attached to Thwaites—which holds back the rest of the glacier—could disappear within a few years or decades. After that, the entire glacier (containing enough water to raise seas by two feet) would melt completely within sixty years (worst-case scenario) to a couple centuries (best-case). The glacier will be doomed if its "grounding line"—the boundary between the glacier on land and the attached ice shelf floating on water—retreats past a certain subglacial ridge, beyond which lies a deep, downward-sloping basin that could funnel warmer seawater even farther under the glacier. If Thwaites and its neighbors like Pine Island Glacier go, most of the remaining WAIS would vanish in a self-sustaining process. Seas would rise by ten feet globally.

Rignot's research also challenges the conventional wisdom that Greenland's melt will be gradual—as reflected in the IPCC's latest projection that it will take millennia for large portions of the ice sheet to go. "It's not like we're looking at the big taps opening up in the next century," Rignot says. "They're going to be opening up in the next decade or so." The models used by the IPCC suggest we're in for about three feet of global sea level rise by 2100, with 1.5 degrees Celsius of warming. But Rignot deems those projections too conservative. Thanks to the accelerating melt in Greenland and Antarctica, he thinks it's more likely that seas will rise five feet by 2100. The total potential sea level rise could be much higher. "There's not so much we're going to be able to do to change that," Rignot says.

Just as glaciologists import terms from medicine and biology—glaciers are "thinning" or "wasting"; when they lose big chunks they are "calving"—climate science more broadly seems to borrow metaphors from the way that ice and water flow. These reports are rife with mention of "cascading effects" and "tipping points," invisible thresholds past which natural systems topple, often irreversibly, into new states.

Many such tipping points may have already been crossed. Greenland's accelerating melt is sending fresh water into the North Atlantic. Because it's less dense than saltwater, that infusion

could be contributing to the observed diminishment of the Atlantic Meridional Overturning Circulation, the system of ocean currents that transport heat northward from the tropics, sequesters huge amounts of carbon, and keeps Britain temperate. If this system of currents, already at its weakest point in the past millennium, slows significantly or shuts down, it could lead to more heat being kept in the southern oceans, which would further destabilize the great ice sheets of Antarctica. A weaker system of currents in the Atlantic also leads to less rainfall over the Amazon, and hence more fires—potentially shifting the world's largest rainforest from carbon storehouse to carbon emitter.

Feedback mechanisms—effects of warming that drive more warming—threaten to send parts of the cryosphere into a death spiral. For example, as glaciers recede, they expose dark rocks near their edges, which soak up the sun's heat, which spurs more melting to reveal more and more dark land. The shrinking of sea ice creates the same result: more dark ocean water soaks up more heat, melting more ice. Reduced sea ice will warm the Arctic further, possibly fueling the "dieback" of boreal forests—as rates of regeneration are outpaced by tree loss from spreading fires and pests—and accelerating permafrost thaw.

Photograph of birds on an iceberg in Greenland
Ulrike Crespo
Photograph by Ulrike Crespo from her book Grönland (Greenland), just published by Kehrer
Even if these thresholds aren't crossed anytime soon, the forecast for the frozen Arctic tundra is about as grim as the prognosis for mountain glaciers. About a quarter of permafrost will thaw by 2100 even if warming is limited to well below 2 degrees; if emissions continue at their current rate, close to 70 percent of permafrost will melt. The most visible consequences are heaving house foundations and "drunken forests"—trees tilting at wild angles as the ice wedges under their shallow roots melt and soil subsides—which can already be found in Alaska and Siberia, along with the rapid spread of "thermokarst" lakes forming in some spots where permafrost melts.

The hidden consequences are much more alarming. As permafrost thaws, carbon in frozen soils will be digested by microbes and released as carbon dioxide or methane.3 If a significant fraction of that carbon is exhaled as methane—a super-potent warming agent—then temperatures could spike sharply over a short time period. There is little evidence that this has begun. But it's the kind of "carbon climate feedback" that keeps climate modelers awake at night, partly because most climate models don't tend to include this mechanism. (As one climate modeler once told me, "If we can't quantify something very well, we tend to ignore it.") Even if this enormous methane "pulse" doesn't happen, permafrost is scheduled to continue adding carbon to the atmosphere for centuries to come. One permafrost expert, Kevin Schaefer, estimates permafrost carbon feedback alone will increase temperatures by 0.2 degrees Celsius by 2100, and—inevitably—more beyond that point.4

In The End of Ice, Dahr Jamail recounts a series of pilgrimages to the doomed glaciers of the Alaskan Range, the Cascades of Washington state, and Glacier National Park in Montana. He

visits the Pribilof Islands in Alaska's Bering Sea, and listens to locals describe how rising ocean temperatures and dwindling sea ice are killing off the seabirds, seals, and other wildlife that make subsistence there possible. (Ice, it's worth noting, is not the only thing that ends in The End of Ice; Jamail also travels to warmer climes to document and foretell the end of coral, the end of forests in the American West, the end of the Amazon, the end of Miami Beach.)

Jamail's spare prose at times veers into cliché ("But now, these frozen rivers of time are themselves running out of time") and maudlin personal reflections. But he ably renders moments of grief and outrage, through moving testimony from indigenous inhabitants of the far north and brutally candid assessments from the dozens of scientists he interviews. Toward the end of The End of Ice, Jamail travels to Utqiagvik, a 1,500-year-old Inupiat village (for a while known as Barrow) in Alaska's North Slope. The northernmost settlement in the US, it's a stop-off point for flights carrying workers heading to the oil fields of Prudhoe Bay. Elders there have watched in recent years as storm surge has chewed away at the berms protecting the village from the encroaching Chukchi Sea.

Jamail visits Vladimir Romanovsky, a permafrost specialist doing research in the area. Over his thirty-five years of temperature monitoring, Romanovsky has seen a staggering rise of 3 degrees Celsius in permafrost twenty meters below the surface. At this rate of warming, the permafrost will rise above 0 degrees Celsius by mid-century at the latest. "Nobody was expecting this, and most people would be surprised to see this happen so soon," he tells Jamail. Since that conversation, Romanovsky has published a study documenting thawing at permafrost sites in the Canadian Arctic to depths that weren't expected, according to most models, until 2090.

In the most affecting passage of The End of Ice, Jamail visits Wesley Aiken, the ninety-two-year-old town elder. Aiken describes the changes he has seen in Utqiagvik. The main one is that it used to be "far, far colder." The walruses don't show up as often because the sea ice is less reliable and doesn't last as long. Snows start not in August, as they used to, but in October:

"All the ice is melting," he says and just looks at me to let the weight of his statement sink in. He speaks slowly. He is from a world where there was never a need to rush anything. "The ice used to hang around here all summer when I was young. The ocean is now eroding the coast. The waves are getting bigger and rolling into the coast. I think we'll have no more Point Barrow before much longer." …He tells me the permafrost is thawing, that while it used to be only a foot below the surface, it is now four and even six feet down. "I can see more green grass out there in the tundra," he says, pointing out the window.

The passage brought to mind an eerily similar conversation I had several years ago with a man named Ishay Paldan, the eldest resident of the one-thousand-year-old Himalayan village of Kumik, in north India. As we sat in his kitchen, he pointed out his window and described how a now-distant glacier—the sole source of water for Kumik—once covered the rock and grass on

the slopes above. “When I was a child, there were no problems with water,” he told me. “The snow line then almost came down to the top of the village. Now look.”

“It’s all changing,” Aiken concludes, echoing the message of so many scientists who study the world’s ice. “We know this is happening…and I don’t think it’s going to stop.”

Climate models and emissions projections tend to treat the year 2100 as some kind of deadline or denouement. But time, of course, doesn’t stop at 2100. Most of the carbon dioxide that we emit today will still be in the atmosphere, trapping heat, in the century to come. The oceans will absorb some of that heat, and will nibble at the ice sheets that abut them. The warming will continue long after. The seas will keep rising. Permafrost will go on thawing and releasing its long-stored carbon. The Himalaya will lose most of its ice. The ice sheets will continue to lose mass. It’s not alarmism to acknowledge all this. It is simply what will happen.

The authors of the IPCC special report dryly note that all of these changes “occur on spatial and temporal scales that may not align with existing governance structures and practices.” Some will play out over millennia; some may come much sooner. Regardless, we aren’t remotely prepared—logistically or psychically—for any of them.

“Sometimes, the ice sheet has also struck me as the photographic negative of an ocean,” writes Gertner, reflecting on his many visits to Greenland. “Rather than darkness streaked with white foam, it is lightness streaked with silt and dust. Even over the course of a few years, I could see it thin and recede.” He writes of watching the appearance of “new land”—a technical term, apparently, describing the barren till that is so loose it blows into the eyes, mouths, and instruments of researchers—revealed as glaciers recede. And as that new land emerges, thousands of miles away some old, beloved land succumbs to newly formed seawater.

The irreversibility of these changes might provoke despair, a sense of futility. It would be wrong, and dangerous, to let our response stop there. All of these studies arrive at the same, now familiar conclusion: reducing emissions of greenhouse gases is the only way to slow down and perhaps shrink the magnitude of this loss. For the next few years, maybe a decade or two, we can still influence the rate of melting through swift action.5

In industrialized societies, we don’t tend to think of ourselves as ancestors—in the deep, many-generations sense—but that’s what the moment demands. The project before us is paradoxical: thinking on long time scales while acting with furious urgency.

In the closing pages of his book, Gertner notes that Greenland’s ice cores contain traces of lead dating to ancient Roman smelters and to the dawn of the Industrial Revolution in the early eighteenth century. And then, in ice cores from the 1980s, one can read the signs of another abrupt transition: the moment when the US decided to phase out lead in gasoline. The ice got clean. The mirror of ice offers this other kind of reflection, too. It reminds us that we are capable of our own “threshold behavior.”

1
Black carbon from incomplete combustion of fossil fuels and biomass reduces the amount of light reflected from snow and ice and increases absorption of solar energy into the icepack. Soot borne aloft from recent fires in the Amazon is reaching Andean glaciers, where the dark particles are boosting melt rates. Australia's recent wildfires turned New Zealand's glaciers red and brown from dust, ash, and soot. ↩

2
The Indus River Basin is home to the world's largest irrigation system; Pakistan's agricultural sector almost entirely depends on it. The river basin is shared by Pakistan and India, two nuclear-armed, hostile neighbors who are in a seventy-year-standoff over Kashmir, bound by the Indus Waters Treaty—which will have to be renegotiated as the glacial runoff inevitably declines and the flow rates on which the 1960 river-sharing agreement was predicated no longer apply. ↩

3
In addition to carbon, Arctic permafrost holds enormous quantities of naturally occurring mercury. As it thaws, that neurotoxin will be released to the environment, available for dispersal through ocean food chains. There are still other nasty surprises lurking in the cryosphere. The US Army lugged an experimental nuclear reactor to power its research and development operations at Camp Century, in the northwest part of the Greenland ice sheet, in 1960. The reactor was removed, but radioactive coolant left behind when the camp was abandoned in 1966 will one day flow in subterranean channels to the sea. The meltdown will give rise to some fearful symmetries, too: that ice will become seawater that, as sea levels rise, eventually submerges and disseminates toxic chemicals from chemical plants, oil refineries, and industrial sites along the US coastline, from Florida to Texas. ↩

4
The latest "Arctic Report Card," released at the American Geophysical Union meeting in December, concludes that global permafrost has already crossed a sobering threshold: it has become a net carbon emitter, on the order of one to two billion tons of carbon dioxide per year. The cumulative evidence amounts to a "smoking gun" indicating that the carbon feedback loop has already begun, said Ted Schuur, the researcher who wrote the chapter on permafrost. ↩

5
In a recent study of 19,000 glaciers in forty-six UNESCO World Heritage sites around the world—corresponding to about 9 percent of all glaciers on the planet—researchers projected a total loss of 33 percent to 60 percent of their cumulative ice volume by 2100 and complete glacier extinction in eight to twenty-one of those sites. But if our greenhouse gas emissions peak in the next few years and steadily decline thereafter, we could still preserve most of them. On top of all their critical ecosystem services—as regulators of water availability and weather

systems—these frozen expanses are part of humanity's shared cultural inheritance, the study's authors argue, and should be stewarded as such. ↩