

4

Colonial Geology and African Gold Discoveries

In 1935, Alexis Chermette, a French geologist working in French West Africa (Afrique-Occidentale Française [AOF]), descended into the “old native workings” of a lode-ore gold deposit in Hiré, a village in south-central Côte d’Ivoire. Chermette worked with two African research assistants from nearby villages: Niango, a veteran of World War I from Oumé, and Beriabou, the chief of Dibikro. These men, Chermette wrote, knew the location of all the “native [gold] pits.”¹ In this forested region, the earth’s substratum was revealed only along river gullies or by historical mine shafts, carved open by long-deceased *orpailleurs*. As Chermette descended into these abandoned mine shafts, he interpreted two histories inscribed in the rock: one geological, one social. Gold deposition at Hiré was lenticular, shot through with veins that ran parallel to one another like the sinuous fibers of celery.

Samples chipped from the rock revealed that gold likely entered the surrounding granite as an injection of a greenstone amalgamate during a major geological event. Hiré’s rocks also told a story of human labor. The mines were the work of ethnic Baoulé, Akan-speaking people who mined gold across southern Côte d’Ivoire and Ghana. The Baoulé shafts (*puits Baoulé*), as the AOF’s geologists called them, were twenty meters deep and irregularly distributed. Most *orpaillage* workings in the basin of Siguiri in Guinea were of secondary or placer deposits. At Hiré, however, *orpailleurs* had splintered gold-bearing quartz from the surrounding granite with fire and pulverized the quartz with rock stones before washing the powder.² Chermette remarked on the “very important native works,” in his final report, “which denote such skill on the part of Baoulé miners.”³

Chermette was one of dozens of European geologists, prospectors, and mining engineers—employed by the AOF and private firms—who mapped

and sampled African gold workings over the course of French colonial rule. In 1935, with gold prices still high from the global Depression, orpillage flourished in Guinea, Soudan, and Senegal. In Côte d'Ivoire, by contrast, orpillage was largely abandoned in favor of wage labor on French-owned coffee plantations or migration to African-owned cocoa farms in southern Gold Coast (Ghana). The AOF's Service of Mines and Geology sent geologists to track new gold discoveries made by orpailleurs and to study abandoned orpillage sites to evaluate whether a European firm could profitably exploit the "former workings of the natives."⁴

Between the 1910s and the 1950s, the AOF's Service of Mines developed insights into the federation's structural geology and mineralization through the techniques, political and ritual institutions, and skilled labor of West African orpailleurs. Because funding for scientific research in colonial Africa was sparse, collaboration with African experts was common in field-based sciences, including geology, agronomy, botany, cartography, and anthropology. As the historian Helen Tilley argues, by the end of World War I, British technicians in Africa had critiqued earlier pejorative views of African environmental practices as backward and primitive and begun to seriously study "Africans' subaltern, or orally transmitted, knowledge" of the natural world. African assistants, Tilley shows, shaped the epistemology of the field sciences in colonial Africa to a degree unparalleled elsewhere in the imperial world.⁵ If this argument holds for the sciences in British Africa, an even more forceful case could be made for geology in French Africa.

By the turn of the twentieth century, the British financed extensive geological research in South Africa, Ghana, and Rhodesia, colonies with capital-intensive gold and copper mines.⁶ By contrast, the AOF marginalized the Service of Mines and dismissed plans for industrialization out of fear they would "proletarianize" African peasants.⁷ In this policy framework, the AOF's geologists focused on the future, generating geological surveys and mineral inventories to locate deposits for exploitation by future European enterprises. Working across a vast federation with few preexisting geological maps, geologists asked African elders and guides to lead them to abandoned orpillage workings and iron kilns: sites with known metal deposition. Though geologists forged relationships with individual orpailleurs and blacksmiths, they were interested in the aggregated gold discoveries of men and women over the course of decades. Just as customary law recognized Africans as members of groups, the AOF's geologists and mining engineers saw orpailleurs as a "mass" of specialists, not as individuals. In this respect, studies of orpillage articulated with the broader impulse of colonial states in

Africa, which were less focused on producing knowledge about individuals, than knowing their populations on a collective scale.⁸

Colonial-era geologists mapped dozens of hard metal deposits in the AOF. Due to the federation's anti-industrial policies, however, most of these discoveries were shelved for future development. But studies and maps of African mines did accelerate scientific understanding of the West African Craton, the Precambrian basement rock that contains gold-bearing Birimian rocks in its southeastern portion. Studies of Birimian rocks made the careers of dozens of French and British scientists in the early twentieth century. British geologists working in Ghana coined the term *Birimian* after the Birim River in the gold-producing zone of Akyem.⁹ French geologists deepened knowledge of regional Birimian formations through scientific publications and, by the 1930s, *Birimian* (*Birrimien* in French) became the accepted scientific term for Precambrian basement rocks found in West Africa and South America—two continents once conjoined as part of the supercontinent of Pangea.¹⁰ Because most of West Africa's gold is found in Birimian rocks, mapping orpaillage sites was crucial to the aggregation of regional scientific knowledge about the geology of the AOF's basement rocks, which were significantly older than those of Western Europe.

In the AOF, regional geological knowledge was forged through the encounters of geologists with regional ecology—savanna scrubland, deserts, and rain forests—in addition to a millennium of human mining history.¹¹ As geologists began to aggregate data from orpaillage sites into a regional view of geological formations, they also glimpsed the edges of West Africa's ritual geology that spread piecemeal across gold-bearing Birimian rocks. In their field reports and publications, geologists commented on the cosmology of orpaillage and ironworking kilns that harnessed the occult forces of volcanic rock. Hand-drawn maps of abandoned orpaillage workings created a visual archive of human-spirit relationships, some turned malevolent from inadequate sacrifices. To conduct geological surveys on the AOF's Birimian rocks was to document a regional ritual formation in rapid transformation with the expansion of orpaillage. This chapter's account of geology in French West Africa invites historians of science to consider how the making of regional environmental knowledge may, in fact, be built on older concepts and practices of regional interconnection.

The dense entanglement of field geology with orpaillage in the colonial AOF is not a simple story of the colonial appropriation of indigenous mining knowledge, although this is an important thread. Just as French prospectors benefited from the labor and mineral expertise of generations of African

miners, *orpailleurs* acquired new techniques from expatriate geologists. The dynamic exchange and pirating of mineral discoveries created an “open access” economy of subterranean knowledge that blurred any facile distinction between African and European mining practice.¹² At the same time, racist colonial mining laws ensured that the benefits of this fluid exchange of knowledge accrued largely to the colonial state and French mining firms. The documentation of African mining discoveries and the regulation of *orpillage* were carried out by different colonial officials with divergent interests. When merged, however, colonial laws restricted the rights of *orpailleurs* while geologists accumulated subterranean knowledge they produced.

Geology in French West Africa

By the late nineteenth century, when European powers had colonized much of the African continent, the earth sciences in France, Britain, and Germany were tightly bound to industrial developments and mining of coal, iron, and copper ore.¹³ The professionalization of field sciences, including geology, produced studies of the earth that made nature amenable to calculation and conscription into property regimes.¹⁴ Dreams of turning easy profits from mineralized land motivated European colonization. As a result, geology was part and parcel of imperial expansion in India, Canada, Australia, and across the African continent.¹⁵ European states conducted surveys of their national and imperial mineral resources as a means of measuring state power and making estimates of global mineral resources.

In the early decades of the twentieth century, geological exploration in the AOF was carried out primarily by one man: Henry Hubert, a colonial administrator with training in the natural sciences. Hubert traversed much of the federation by horseback, collecting rock and mineral samples that he sent for analysis to the *Muséum National d'Histoire Naturelle* in Paris.¹⁶ In 1911, Hubert drew the AOF's first geological map, which remained the only one of its scope for decades. In the late 1920s, Fernand Blondel, director of the Service of Geology in French Indochina, campaigned to reverse the AOF's poor reputation in international mining circles. Blondel asked why “mineral riches appear, by virtue of an inexplicable phenomenon, to stop at the political frontiers” of French West Africa.¹⁷ Citing major mining projects in the British colonies of Nigeria, Ghana, and Sierra Leone—which shared geological formations with French colonies—Blondel concluded there were undiscovered hard metal deposits in the AOF. For Blondel, *orpillage* also evidenced the AOF's mineral potential. A federation, he wrote, where “the

natives were able to extract with their own labor 2,900 kilos of gold in one year, should allow the possibility of profitable operations for others.”¹⁸ “Others” implied Europeans. In 1927, the Colonial Ministry financed a new Service of Mines in the AOF and hired a French mining engineer, Jean Malavoy, as its first director. Malavoy and Blondel expanded geological exploration in the AOF, recruiting young, athletic geologists who showed signs of “loving a life in the bush.”¹⁹

Malavoy coordinated geological research from Dakar, where the Service of Mines occupied a single floor in a downtown office building that housed a chemistry and gold-smelting laboratory, a map-drafting room, and rock and map collections.²⁰ During the rainy season, Dakar was the stage for scientific exchange, when geologists wrote reports and collaborated with cartographers to visualize their observations in the field. During the dry season, geologists fanned across the federation on missions of eight to nine months to conduct geological reconnaissance over large expanses or more focused prospecting of specific minerals.²¹ Most French technicians were unfamiliar with West Africa’s rock structures and sedimentary deposits. Similar to nineteenth-century European explorers, geologists stayed in villages as guests of local chiefs, in huts constructed and set aside for the occasional visits of French commanders during the annual tax collection and census. But geologists became far more adept in local languages than most circle commanders. The AOF implemented a “turntable” principle, transferring commanders from post to post and colony to colony every few years. This policy was intended to prevent French officials from developing strong ties to any particular area.²² Geologists, by contrast, returned to the same region year after year, sometimes over the course of decades. Geologists often provided local administrators with data about the terrain; the presence of natural curiosities, such as waterfalls; and the location of remote farming hamlets.²³

Dozens of African porters carried equipment, tents, and provisions for geologists. Geological teams numbered anywhere from twenty to one hundred men. They began their journey by train, truck, or boat. In zones free of the tsetse fly, French technicians and African assistants traveled the final distance on horseback, camel, or donkey. In forested areas, porters traveled on foot and carried geologists in rope hammocks.²⁴ Geologists recruited blacksmiths and Maninka and Baoulé orpailleurs to accompany them on prospecting missions to regions with little history of orpillage.²⁵ African men carried out the brutalizing labor of digging exploration trenches. This was similar to work Africans performed, often by force, to build colonial roads and railways. Figure 4.1, a photograph of a gold-prospecting mission

Figure 4.1 “Digging a trench in a gold-bearing placer.” Côte d’Ivoire, 1950. From Michel Bolgarsky, *Étude géologique et description pétrographique du Sud-Ouest de la Côte d’Ivoire*, planche photographique 10.



to Côte d’Ivoire in the 1940s, displays the racialized exploitation of African labor in geological research that was characteristic of the colonial period.

While geologists wrote dozens of reports from the field and back in Dakar, little is revealed about the identity of the diverse West Africans who participated in their missions. Geologists credited African workers for identifying outcrops, locating abandoned placer mines, and for their knowledge of botany and its relationship to underground resources, including aquifers and the presence of tin, gold, iron, and zircon.²⁶ Given their intimacy with rural populations and African orpailleurs, it is no surprise that geologists took an interest in the social and political institutions of the African people they encountered in the field in addition to the geophysical landscapes they were commissioned to document.

Encountering a Ritual Geology

The AOF’s early geologists read the earth’s sedimentary strata as a palimpsest, correlating the fragments and arranging them in a sequence to develop theories of temporal causation.²⁷ In the absence of aerial mapping, and with geochemical techniques in their infancy, rock outcrops were the primary

road signs for the earth's history. Outcrops are fragments of basement rocks that push through superficial deposits to appear on the surface of the earth, exposed through erosion or tectonic uplift. Outcrops may be single boulders, a cliff, or an entire exposed mountain range. By measuring the bedding planes and foliation of outcrops, geologists constructed a picture of how and when the underlying bedrock was formed. Outcrops are rare on the West African savanna and Sahel, where meters of laterite, sand, and volcanic basalt cover much of the earth. Farther to the south, dense tropical forests cover rock formations, providing few insights into the earth's terrane. Geologists complained about walking "tens of kilometers without finding a clean rock."²⁸ They walked along colonial railways, where dynamite blasting revealed the substratum, and along gallery forests lining rivers, where water eroded the laterite to expose portions of bedrock underneath. Geological work was cumulative. Geological surveys generated baseline studies designed to develop insights into basic structural geological formations. Later generations produced more granular maps of regions that the Service of Mines deemed of interest to understanding the AOF's mineral potential.

Many West African communities living on the savanna in the early twentieth century also valued rock outcrops as portals to the domain of otherworldly forces and ancestors. In Côte d'Ivoire and Haute-Volta, outcrops were a common base for shrines, glossed in French as "fetishes" (*fétiches*).²⁹ Geologists recognized shrines and the entries to sacred groves "used for the initiation of children" by the smearing of chicken blood, strips of cloth, or the juice of mashed kola nuts on rocks or trees. In some sectors, geologists reported that nearly every visible outcrop adjacent to village settlements was a shrine. Geologists sought permission from local chiefs to sample rocks from these sacred platforms. In a memoir of his geological work in interwar Côte d'Ivoire, Alphonse Obermuller recalled the use of outcrops as shrines: "If, after 5 to 10 kilometers of the road, the only rare outcrops that were particularly interesting were fetishes, I would summon the village chief and explain to him that my job was to break rocks without any intention of trying to oppose their customs. The sample was taken in his presence." Many African field assistants and porters refused to eat food prepared in a village from which such samples were taken out of fear of retributive poisoning for disturbing the patron spirits of the shrine. For this reason, triple rations of rice were distributed to African staff before traveling to "fetishist sectors."³⁰

Rock outcrops that doubled as shrines were one site through which French technicians engaged with the ritual geology of West Africa's Birimian rock formations. Ritual practices observed on goldfields, where generations

of colonial geologists sojourned, provided another angle. J. Siossat, a private gold prospector working in western Soudan in the 1930s, reported that the blood of slaughtered animals was poured into mine shafts to “force the hand of the devil, to make him abandon his gold.”³¹ Geologists assigned to Guinea and Côte d’Ivoire learned that spirit animals haunted the underground. Geologists reported that Maninka-speakers in Bambuk referred to gold veins as “spirit snakes” (*jinn saa*), a reference to the mystical snake of Nininkala, who consumed iron and excreted gold in her wake.³² In Siguiri, this spirit appeared as a white ram who circulated beneath the surface of the earth, birthing gold or shedding his golden fleece, which created gold deposits.³³ On the ethnically heterogeneous goldfields of Côte d’Ivoire, by contrast, an earth deity known as “Koyo” excreted gold veins.³⁴ These stories resonate with oral traditions of Bida, whose trisected body, slain by the lover of Sia in medieval Wagadu, nourished the goldfields of Akan, Buré, and Bambuk. Geologists and colonial administrators working among the Lobi reported that gold was “a dangerous living thing” that had to be “killed” before it could be processed or sold.³⁵ On the goldfields of Poura, shrine priests converted gold to a “dead” substance by making sacrifices of domestic animals on lineage shrines to the guardian spirits of gold.³⁶ In Siguiri, large gold nuggets were “killed” through prayers and incantations by ritual practitioners the French called wizards (*sourciers*), fetishists (*féticheurs*), and Muslim religious leaders (*marabouts*). Tomboluma, the indigenous police force of mining sites, fired at gold nuggets with rifles to “chase away the genies.”³⁷

Similar to other colonial personnel who frequented the AOF’s goldfields, geologists took an interest in the cosmology of orpillage as an object of intellectual curiosity and exoticism.³⁸ They also sought empirical correlations between African “beliefs” about gold and geological phenomena. In the 1910s, for example, the AOF commissioned Jean Méniaud, a natural scientist, to study the economic potential of Haut-Sénégal-Niger (divided after World War I into the colonies of Soudan, Guinea, and Haute-Volta). Writing about the goldfields of Bambuk and Buré, Méniaud drew correlations between the “superstitions” of orpailleurs and the mineralization of gold. He interpreted the widespread belief that “gold moved from place to place” as a practical explanation for the fact that many alluvial deposits were found in depressions along ancient waterways. Over time, as violent storms disaggregated laterite rock, gold flakes were newly distributed across the regional water-drainage system, creating new alluvial deposits and revealing others formerly buried under laterite and sedimentation. This, Méniaud concluded, explains the

“belief of the blacks that gold ‘walks’ and that it can be found anew in exhausted mines, after two, three, or four years of neglect.” In contrast to European travelogues of the eighteenth and nineteenth centuries, which denigrated the beliefs of African miners as “irrational,” Méniaud argued that these “superstitions” were based on “considerable experience in the matters of the subsoil.”³⁹ In a 1935 report, Rostislav Goloubinow, a geologist then working for the AOF in Siguiri, remarked that apart from “their particular superstitions” and “their sacrifices,” Maninka prospectors have “good knowledge” of the subsoil. Orpailleurs, he described, prospected for gold by proceeding from a hillside along the downward sloping edge of a valley, where gravity caused the heavy metal to accumulate in the local water table.⁴⁰

Just as colonial technicians studied the earth’s topography for signs of the architecture of the terrain, African prospectors scanned the surface of the savanna for signs of underlying gold deposits. While anyone except leatherworkers could putatively prospect for gold, ethnic Maninka were specialists in the domain in Guinea, Soudan, and Senegal. Some deposits were discovered by accident as men dug water wells or women glimpsed gold in the roots of cassava plants. In some villages, orpailleurs organized prospecting campaigns toward the end of the dry season. West Africans drew on botanical knowledge, embedded in a ritual cosmology of its own, to guide gold prospecting. Geologists wrote about the importance of several tree species to prospecting. Trees known in Maninka as *congouroun* and *bourne* (*Kigelia Africana*) were counter-indications for gold.⁴¹ *Sounsoun* (*Diospyros mespiliformis*) and *so* or *soso* (*Berlinia heudelotiana*) grew in land depressed by the weight of underwater aquifers, often lined with alluvial gold deposits.⁴² A French prospector working in Maramandougou, Soudan, remarked that orpailleurs there dug prospecting mine shafts perpendicular to the branches of *sounsoun* to test for the presence of gold. *Nyama* or *niomo* (*Bauhinia reticulata*) trees also grew along alluvial gold deposits. A shrubby tree with gray bark, *nyama* was considered favorable to spirits, which accounts for its name, *nyama*, the life force of Maninka cosmology.⁴³

Orpailleurs bathed in the leaves, bark, and sap of certain trees to earn the favor of the spirits haunting ore bodies. Maninka-speakers considered plants—like all animate and inanimate objects from the natural world—charged with *nyama*. Certain plants were burned or steeped for fertility, to protect newborn babies from spirits, and for burials. When burned, the *nyama* of plants could be transferred onto people and animals. Maninka authorities, who presided over the ritual life of placer mines in Soudan, Guinea, and Senegal, erected shrines at the base of African mahogany trees

(*Khaya senegalensis*), known as *jala* (*diala*, *jalo*) in Maninka. The Maninka term for shrine—*jalan* (*jalang*, *jalano*)—is derived from the *jala* tree.⁴⁴ The *jala* is the most important tree of the Maninka spiritual world. After giving birth, women and their newborns were bathed in a poultice of *jala* leaves. Some mothers named their newborns after the *jala* to recognize the tree's power to intervene in fertility.⁴⁵ *Jala* bark was burned as incense when praying for the deceased. Gold prospectors conducted sacrifices at the base of the *jala* to guide their work and orpailleurs also washed in its bark as protection against malevolent spirits.

Dreams and guardian spirits also guided gold prospecting. It was reported in a 1946 article on the placer mines of Siguiri that a man named Siaba Kone had discovered a gold deposit by consulting with the Koma, likely a reference to *komo*, the historic Maninka power association and masking society. For several nights, Koma led Saba through the bush to a rich gold placer, later named “Siabala” after its founder.⁴⁶ In Guinea, a dream led a man named Bamba to the discovery of the placer of “Bambala,” which he envisioned by a stream, afternoon sunlight streaming through the trees.⁴⁷ The names of seasonal placer deposits carried echoes of the circumstances of their discovery: the personal names of prospectors (Moussala, Niagalla), features of the physical landscape (Sondondiala, Tambaoura, Linguekoto), or the name of guardian spirits (Maimouna, Ningri).⁴⁸

Orpailleurs, geologists learned, avoided mining some tracts of land altogether due to the presence of malevolent forces. Colonial reports from Soudan and Guinea are riddled with stories of people rendered blind, insane, or deaf by handling gold nuggets. In 1913, Méniaud reported an account of this genre circulating several years prior in Guinea.

I heard it affirmed by the natives that Mount Didi contained considerable wealth in gold, but that the devil did not wish to relinquish it. They added, in their ardent faith, that there are mortars and pestles for millet made entirely of gold, which were hidden by the first inhabitants of the region. Those who have seen them or attempted to move them were stricken with madness. A woman who still lives in the village of Fatoya discovered them, on a day when she was looking for firewood in the bush. At the moment when she leaned down to gather the pestles, she was violently knocked down on the ground by invisible hands and showered with blows. She could not rise until she let go of the previous instrument and returned to the village after having lost the ability to hear.⁴⁹

There are two plausible reasons for the retribution of spirits in cases such as these. First, gold nuggets presumably contain powerful concentrations of nyama that were harmful to those who did not take ritual protections against this occult force. Second, there is no mention that the woman offered a sacrifice to spirits in exchange for the large quantity of gold contained in the golden mortar and pestle. In other stories of this genre, territorial spirits asked for the sacrifice of people for gold (see chapter 7). If West Africans refused to meet this sacrificial demand, they avoided mining the mineralized tract of land altogether or did so at the risk of bodily and psychological harm at the hands of angered spirits.

West Africa's ritual geology was in rapid evolution under colonial rule, as orpaillage spread in some zones and dried up in others, and as head taxes encouraged the commodification of labor and ritual payments on large multiethnic placer mines. The AOF's geologists translated elements of this ritual geology into scientific correspondence by marking the locations of abandoned orpaillage sites and reporting rumors about guardian land spirits in their field reports. As they archived the sacred engagement of orpailleurs with the earth, they also gained insights into the structural geology of Birimian rocks and the distribution of gold across the West African Craton.

Gold Prospecting in Ancient Quarters

In June 1939, several months prior to the outbreak of World War II, Marcel Bardin, a contractual geologist employed by the AOF, was sent to carry out "a methodical and rational study of the work undertaken by the natives on the gold deposits of Upper Guinea." Bardin was instructed to establish "their [gold deposits'] intrinsic value, their yield, and the average profits made by the orpailleurs."⁵⁰ The reliance of geologists on orpaillage—as a source of geological data, labor, and techniques—reached its apogee between the wars. Geologists profited from the expansion of orpaillage during the global financial depression by prospecting for gold in the wake of gold deposits newly discovered by orpailleurs. During this time period, geologists and orpailleurs, working in each other's shadow, discovered several major gold deposits that, decades later, would become the region's most lucrative corporate open-pit gold mines. Geologists also documented iron, copper, phosphate, and bauxite deposits in the federation. But gold was favored in the short-term due to the lower upfront expense to mine it compared

with these industrial metals, which required railroads, major roadways, and electricity production.

For geologists, the value of mapping orpillage sites was indirect and deferred. Most Africans mined alluvial deposits, whereas the AOF's geologists were primarily interested in lode ore that, they hoped, could one day be exploited by capital-intensive mines controlled by Europeans. But since alluvial deposits were generally formed in proximity to lode ore, mapping the former could lead geologists to the latter. Goloubinow refined methods of using orpillage workings to guide prospecting for lode ore. He spent years living and working in Upper Guinea, gaining fluency in Maninka. He published a doctoral thesis on Guinea's gold resources and methodological articles on how to conduct "rapid gold prospecting" on West Africa's old rock platforms.⁵¹ He elaborated his method in a 1940 article:

The only guide for prospectors is generally a large-scale geological map, demarcating [...] gold-bearing regions to eventually prospect and indicating a certain number of rudimentary native mining sites, when they exist. Traditional prospecting work which consists of pits and surveys reaching down to the bedrock is slow and costly; it is very difficult to extend this to the entirety of a zone demarcated by the geological map; one is obliged to make a choice before beginning actual prospecting. To give oneself the best chances, the prospector usually chooses the site of old native mines.⁵²

Goloubinow went on to explain that "native miners tend to group around the mountains, where water runs down." By studying the secondary deposits exploited by orpailleurs, prospectors could determine whether the gold originated from the decomposition of quartz located farther uphill.⁵³

Goloubinow's hand-drawn maps of his gold-prospecting activities in northern Guinea visualize his method of triangulating orpillage workings with features of the landscape—ridges, depressions, and riverways—to identify the likely location of lode ore. Figure 4.2, "Bassin inférieur du Lélé," is one of a series of maps attached to a 1935 prospecting report on the Lélé River basin. The map shows how "the author's itinerary" (*itinéraires de l'auteur*) intersects with "native works, current or former exploitations" (*travaux indigènes, exploitation actuels ou anciens*). The names of villages are indicated on the map, along with a "former women's mine" (*anciennes mines de femmes*). Some mine workings are simply labeled "old" (*ancien*); while others are dated.⁵⁴ Clusters of dots indicate "prospecting shaft lines" (*lignes*

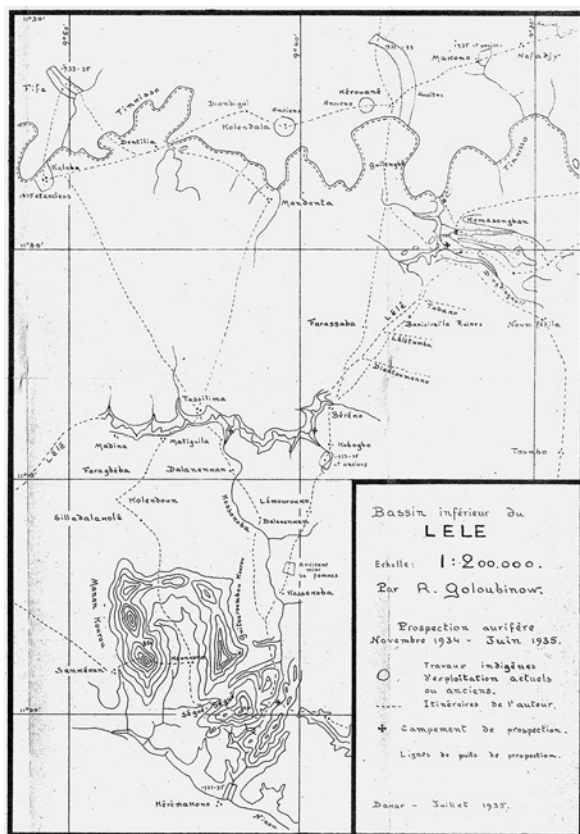


Figure 4.2 Map of the geological itinerary of Ros-tislav Goloubinow in the Lower Lélé Basin, Guinea, 1935. Courtesy of the Direction des Mines du Sénégal.

de puits de prospection) dug by Goloubinow's team to test gold concentrations. Many clusters align with "native works," revealing the extent to which Goloubinow's shadowed the prospecting activities of unnamed orpailleurs. Goloubinow also adopted orpailleurs' techniques—notably the use of the cylindrical "Maninka shafts" (*puits Malinké*), measuring three-quarters of a meter in diameter—as prospecting shafts.⁵⁵ Private gold prospectors in the interwar AOF also used the location of "indigenous gold exploitations" to determine if there were deposits "in their [orpailleurs'] former workings or in their proximity" of interest to European investors.⁵⁶

Some technicians working in the AOF learned more indirectly from orpailleurs. This was the case for Eduard Julian, a French mining engineer who worked in interwar Guinea. In 1933, Julian piloted a model mine (*exploitation modèle*) in Kentinian, a village located in the heart of the circle of Siguiri. The goal of the project was to model "technically improved procedures" to

orpailleurs to increase the quantity of gold they extracted from gold-bearing rock.⁵⁷ The governor-general financed the model mine on the grounds that, as long as “orpaillage substitutes for modern industry, we are morally obligated to improve the process of exploitation.”⁵⁸ As Blondel put it in 1934, “To increase indigenous production . . . reconciles both our moral duty and our material interest: to improve the well-being of orpailleurs and increase their buying power, which would benefit the colonial economy.”⁵⁹ Julian demonstrated the use of wooden pillars to support subterranean mine caverns, designed to replace the rock pillars constructed by orpailleurs.⁶⁰ But Julian struggled to recruit workers, who preferred orpaillage to laboring for a colonial officer, and a flood rotted his wood supports.⁶¹ In 1936, the Service of Mines closed the project, and Julian returned to France embroiled in a forced labor scandal.

Though Julian’s model mine was a failure, he recorded numerous African gold discoveries while in Siguiri. While awaiting equipment shipments for the model mine, Julian passed the time by traveling to gold deposits recently discovered by orpailleurs. In 1933, for example, he visited a newly discovered mine near Kouroussa, where he tested orpaillage shafts. He recruited an elder to guide him to the “ancient quarter” of gold workings “abandoned more than 100 years ago,” where he took more samples.⁶² The overlap between Julian’s efforts to improve orpaillage and his documentation of African gold discoveries was not lost on orpailleurs. Decades after Julian’s departure, orpailleurs viewed any effort by French geologists to “improve” their techniques as a cover for French mining interests. This was the concern of Framoi Bérété, the postwar Guinean politician who accused French geologists of marketing gold deposits discovered by Africans to French financiers (see chapter 3).

With the onset of World War II, the AOF’s Service of Mines retrenched its reliance on African mining economies as a source of subterranean knowledge and revenue. By August 1939, nonessential European personnel in the AOF, including most geologists, were enlisted in the French army. Within the year, the collaborationist Vichy regime had gained control over the south of France and most of the French empire, including the AOF. Marshal Philippe Pétain, leader of Vichy France, requisitioned peanuts, cotton, palm oil, and gold dust from the AOF to finance the war effort. The skeleton wartime staff of the Service of Mines scrambled to increase gold production to meet the demands of the governor-general of the AOF, who remained loyal to Vichy. Their strategy was twofold: to encourage orpaillage where it would not interfere with cash-crop production and to re-exploit orpaillage tailings.⁶³

On the Poura goldfields of Haute-Volta, an important Atlantic-era center of gold mining and trade, the administration injected funds into a middling public-private partnership that dated to the mid-1930s to exploit a “large mass of rejected native exploitation of lode ore.”⁶⁴ By processing the tailings of African mine workings at Poura, more than four kilograms of gold were recuperated in 1939, its first year of production. Encouraged by this success, the Service of Mines opened another state-run enterprise to exploit an African alluvial gold discovery: a deposit in Dahomey (now Benin).⁶⁵ Through the rest of the war, the AOF’s sole mining industry was based on exploiting the tailings of earlier generations of *orpailleurs*. Ironically, just as the AOF’s Service of Mines reached an apogee in its reliance on African mining economies, African *orpaillage* was criminalized outright. In 1942, the governor-general closed placer mines across the federation to funnel African labor toward agricultural production, deemed more important for the war effort.

L'Ingénieur and l'Indigène in the Postwar AOF

Subterranean knowledge did not flow in one direction in French West Africa. *Orpailleurs* also profited from the gold discoveries of European prospectors. As early as the 1890s, French prospectors working in Soudan complained to French commanders that Africans dug out their prospecting pits to create *orpaillage* sites.⁶⁶ This was the source of a controversy in the 1930s in the circle of Dabola, situated on Guinea’s border with Sierra Leone, where *orpailleurs* “followed in the wake” of exploration trenches dug by a French firm. Local employees of the firm reported that, when the firm’s “prospectors found interesting concentrations, the natives started working after the team had progressed 40 or 50 meters.”⁶⁷ In 1949, a French company operating a dredge boat on the Falémé River began to prospect for gold in Soudan but was forced to abandon its permit when *orpailleurs*, having been informed “from the indiscretion of our own workers that there were rich deposits, used their usual methods to skim the richest parts of the deposit.”⁶⁸

Orpailleurs also learned new techniques from Europeans. In Siguiri of the 1910s, *orpailleurs* began damming rivers, based on observing French prospectors using this method, to reveal previously submerged alluvial deposits.⁶⁹ *Orpailleurs* readily adopted wooden sluices that were introduced by the AOF’s Service of Mines in the 1930s. *Orpailleurs*’ selective embrace of European mining methods built on centuries of technical exchange on the region’s goldfields, including the adoption of Islamic weights; numismatic

systems; and the spread of more angular, Akan-style mining shafts, well suited to wet climates, into other forested regions of West Africa. Africans also exchanged techniques with one another during the colonial period. Diamond digging, which became a boom industry in interwar Sierra Leone and in Guinea's forested region, drew heavily on gold-panning methods refined in Buré. And in the 1940s, *orpailleurs* in Kédougou recruited expert gold miners from Siguiri to teach them eluvial mining methods.⁷⁰ Far from two hermetically sealed mining "systems," European and African miners evolved their techniques, and made gold discoveries, in dialogue with one another.

The end of World War II in 1945 brought about a long-anticipated influx of funding for geological surveys and mining development in French West Africa. It also shifted the value geologists placed on *orpailleurs* from one focused on mapping their gold discoveries to an explicit attempt to integrate Africans into colonial knowledge production. At the Brazzaville Conference of 1944, a wartime meeting of European leaders, France and Britain embraced "development" as a renewed justification for imperial occupation. France ended a long-standing policy of self-financing in the colonies, which they renamed overseas territories, and invested in scientific research and industrial development. After the explosion of nuclear bombs in Hiroshima and Nagasaki, and with the metal demands of postwar reconstruction, France turned to its overseas territories as a source of "strategic" and "industrial" minerals. In 1945, France created an agency dedicated to prospecting for petroleum (Bureau de Recherche de Pétrole [BRP]) and one for uranium (Commissariat d'Énergie Atomique [CEA]). In 1948, a final public organism, the Bureau Minier de la France d'Outre-mer (Bureau of Mines of Overseas France [BUMIFOM]), was created to develop mining projects for all other minerals in overseas France. Meanwhile, the AOF's Service of Mines became a major recipient of social and economic development funds financed in part by the US Marshall Plan. Under this new bureaucratic configuration, the AOF's Service of Mines would no longer operate mines. In theory, it would conduct geological surveys to orient mining projects that BUMIFOM organized as state or public-private mixed ventures.

After the war, the AOF's mining industry expanded from one based on African *orpaillage* and the exploitation of African gold mine tailings to include industrial phosphate and bauxite mines and the documentation of major deposits of uranium, petroleum, cassiterite, and iron. In 1944, after years of subordination to the Department of Public Works, the service became an independent federal department known as the Direction Fédérale des Mines de la Géologie (DFMG). Two years later, a three-story building was completed

in Dakar for the department. The building housed up to forty-five geologists and was equipped with modern laboratories, a mineral museum, dozens of offices, a mapmaking studio, and a library. With new scientific equipment and funding, the AOF's geologists undertook detailed studies of basement rock platforms and mineralization in Dahomey, Haute-Volta, Côte d'Ivoire, and Guinea. These studies generated data for dozens of doctoral theses completed when geologists returned to France. In these and other publications, the regional scope of West Africa's Birimian-age rocks came into view, previously seen on a more localized scale.⁷¹ Exploration of younger sedimentary deposits near the Atlantic coast of West Africa led to discoveries of bauxite in Guinea and phosphate in Senegal. In the early 1950s, mixed state-private firms were created to exploit these metals, which replaced gold as the AOF's most important mineral exports until decolonization in the late 1950s.

Even as the mandate of the AOF's Service of Mines expanded to include other metals, gold prospecting remained a priority for the federation.⁷² Due to the ubiquity of *orpaillage* workings, geologists argued, gold prospecting generated rapid insights into the region's Birimian rock formations, which could lead to the discovery of other hard metal or gemstone deposits of potential interest to the state or private firms. In 1946, the governor-general reopened the federation's placer mines, but *orpaillage* never reached its pre-war levels due to suppressed gold prices (see chapter 3). Rising prices for agricultural products also made *orpaillage* less attractive. The Service of Mines saw the contraction of *orpaillage* as an opportunity for staff geologists to prospect for gold without attracting *orpailleurs* to their exploration trenches.⁷³ For them, the development of capital-intensive gold mines was finally within view, an industry that would supplant *orpaillage* and create jobs for Africans in industrial manufacture.

Geologists envisioned a role for *orpailleurs* in the transition to this industrial future, particularly in geological exploration. In the words of Gilbert Arnaud, the director of mines before and after the war, "Experienced miners, true specialists who have a deep experience with certain types of deposits and who conduct real prospecting. . . , probably more than 100,000 in number, already familiar with subterranean work and with recuperating gold, [are] immeasurable capital for the AOF that we must prudently manage."⁷⁴ Arnaud imagined that Africans would carry out the bulk of gold reconnaissance in the AOF, "at their risk but also to their entire benefit," with some technical assistance from geologists. The shortcoming of *orpailleurs*, he argued, was that they lacked "a general view of the geographic distribution of mineralized zones. They can therefore only extrapolate timidly beyond the quarters of

former mines.”⁷⁵ French geologists could eliminate this problem by offering an “aerial view” of gold distribution through maps. With the use of maps, geologists could collaborate with African prospectors to guide “African mining chiefs . . . to deposits they can extract with their empirical knowledge.”⁷⁶

André Marelle, who briefly directed the Service of Mines in 1948, also saw a dynamic role for “skilled Guinean shaft-diggers” in mineral research conducted in the federation.⁷⁷ Marelle recognized that “a problem very particular to the AOF is that of the insertion of customary *orpaillage* into the framework of mining development.” He envisioned incorporating “this local craft into the gold industry” by encouraging *orpailleurs* to prospect for gold while restricting them from mining lode ore, which would be reserved for European enterprises. To implement this vision, Marelle drafted a plan to open a “school for prospectors and mining foremen” at the *École Technique Supérieure de Bamako*. The aim was to educate young men from gold-producing regions in French prospecting techniques.⁷⁸ The school in Bamako never came to fruition, but in the late 1940s geologists opened a school based on this model in Bas-Cavally, Côte d’Ivoire, where *orpaillage* was expanding.⁷⁹ In 1951, an *École des Moniteurs des Mines* was attached to Côte d’Ivoire’s section of mines, at which engineers taught African *orpailleurs* how to read topographic maps, use a compass to mark their routes, and create a mineral profile based on soil sampling. African students with basic French fluency were taught to write reports and prepare documents for permit requests.

The *École des Moniteurs des Mines*, later renamed the *École de Prospecteurs-Topographes*, was an attempt to formalize the long-standing practice of European geologists and prospectors who sojourned in the AOF: to map, sample, and track *orpailleurs* to advance administrative knowledge of the distribution and concentration of gold. But Marelle’s view departed from that of prewar colonial officials in that he envisioned *orpailleurs* as aides in a modern economy, not as people engaged in a traditional activity. Recognizing Africans as specialists enrolled in a “rational” organization of extraction articulated with a broader shift in the postwar AOF to seeing Africans as active participants in development.⁸⁰ Postwar colonial institutions and private firms trained Africans in scientific disciplines, including cartography, agronomy, medicine, and psychiatry. The AOF’s Service of Mines took part in these efforts by training African assistants in the field and, after 1954, in the federal laboratories in Dakar.⁸¹ Despite these changes, AOF’s geologists did not see African miners as their equals. Postwar directors of the Service of Mines maintained a technical division between Africans—glossed in their

reports as “natives” (*indigènes*)—and European “engineers” (*ingénieurs*). Africans would be trained as prospecting and geological aides, not as engineers and geologists.⁸² Independence movements, which gained speed in the mid-1950s, troubled this vision, insisting that Africans be trained as scientists and managers of African-led mining enterprises.

Erasing Orpillage

When the annual rains beckoned, the AOF’s geologists returned to Dakar with dozens of hand-drawn maps and field reports and rock and soil samples. They had learned broken Wolof and Maninka while traveling with dozens of African porters on foot, on horseback, and in hammocks. They carried simple pencil drawings, sketched in journals and on parchment paper—a few embellished with watercolors. These sketches gave shape to the geological anomalies they encountered across the federation: granite rocks protruding like rotted teeth from the plains and waterfalls cascading along the cataracts of the Falémé. Other maps traced itineraries traveled by geologists on foot through abandoned orpillage workings. Shaded pen marks on map legends corresponded to “old native mines” and farming hamlets. Geologists embedded these landscapes of human labor and settlement within more stable geophysical features of the land: depressions, streams, plateaus. In Dakar, field geologists collaborated with cartographers to draw formal maps to scale. They used blue and red pens to indicate the suspected location of lode-ore deposits in relationship to these data points. Some of the abandoned villages on these maps were once seasonal orpillage sites, cosmopolitan hamlets of migrants congregated to mine for gold.

Across the roughly six decades of French colonial rule in West Africa, geologists shadowed orpailleurs, both living and dead, through the traces they left on the landscape: shafts, tunnels, caverns, and piles of discarded mine tailings. While many Atlantic-era European travelers to West Africa denigrated African mining traditions, by the turn of the twentieth century the AOF’s geologists praised the skill and dexterity of male and female miners and marveled at “ancient [African] mines.” In part, the reliance of geologists on the labor and knowledge of orpailleurs was an innovation born of necessity. Chronically underfunded until the postwar period, geologists tracked and mapped the gold discoveries of orpailleurs. Geologists also used technologies unavailable to orpailleurs: soil composition analysis and structural mapping. The search for subterranean knowledge in the AOF produced other kinds of knowledge: ethnographic, political, and ritual. Orpillage was

deeply embedded in the cultural and political history of West Africa. It was also enmeshed in the evolving ritual geology of the savanna, a centuries-old dialogue between diverse West African communities and the Birimian rock formations that geologists mapped for a global scientific community. For colonial technicians, engaging with this ritual geology was an obligatory passage point for acquiring insights into regional geology.

The exchange of techniques and gold discoveries between the AOF's geologists and orpailleurs shaped the methodology of geological research in overseas France. It also enabled colonial technicians to model the region's primary gold-bearing rock formations: Birimian rocks. An influx of funding after World War II enabled the AOF's Service of Mines to expand geological reconnaissance across the federation, gaining a more regional view of West Africa's structural geology and the place of Birimian formations within it. At the same time, two intertwined processes—one cartographic, the other temporal—erased the contributions of African orpailleurs to geological knowledge. Between the wars, maps drawn by geologists depicted the distribution of African placer mines in intimate relationship to the landscape, tracing the precise itineraries they walked and the location of every passing village. These maps were drawn on a large scale, where one centimeter equaled two hundred meters. Some maps encompassed no more than a single village and its farming hamlets; a cluster of settlements on a hillside; a row of mining shafts winding along a riverbed. As geological research accumulated over the decades, however, geologists drew maps at smaller scales, to depict geological formations across multiple colonies. While these smaller-scale maps were drawn from aggregating data from maps of African mines and settlements, the final product no longer signaled the presence of orpillage on the landscape. Mineral discoveries made by orpailleurs were subsumed under colors that corresponded to auriferous zones on map legends. Geologists still included maps at larger scale in their field reports and doctoral theses based on research in West Africa. Figure 4.3 exemplifies the attention given to the location of African gold placer deposits in a geology thesis focused on southwestern Côte d'Ivoire. But concise publications on this research that appeared in international scientific journals offer only an "aerial view" of colony or federal-level mineral inventories that no longer included the mineral discoveries of orpailleurs—and the names of their villages and gold placers—on the ground.

Temporal delays between the mapping of gold mines and the opening of industrial-scale mines facilitated amnesia and the erasure of contributions by orpailleurs to colonial-era gold discoveries. The AOF's geologists documented

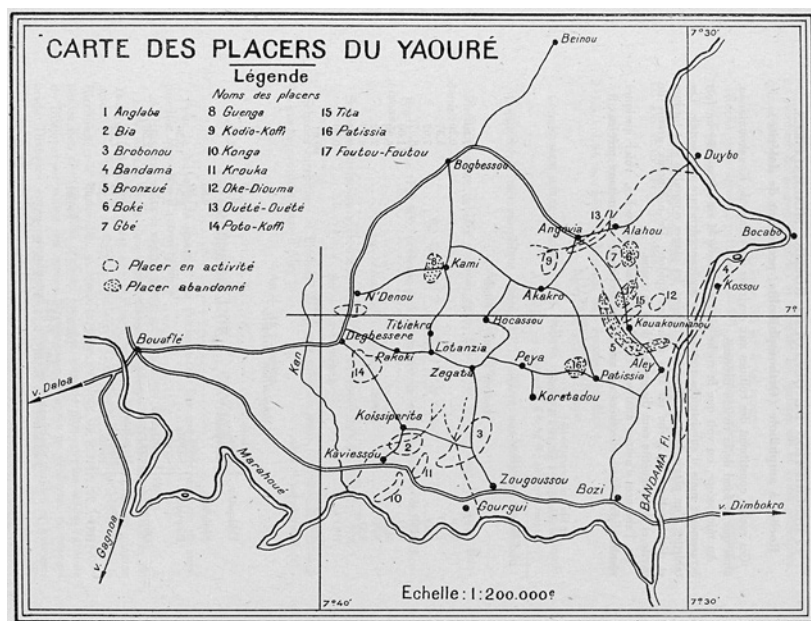


Figure 4.3 “Map of Yaouré Placers.” Côte d’Ivoire, 1950. From Michel Bolgarsky, *Étude géologique et description pétrographique du Sud-Ouest de la Côte d’Ivoire*, 135.

dozens of gold deposits, many of them discovered by orpailleurs, over the course of six decades of colonial rule. But apart from short-lived private mining operations, and the Poura mining project in Haute-Volta, only orpailleurs exploited these deposits under French rule. Capital-intensive gold mines would not be opened in the former federation of the AOF until the late 1990s. In an ethnography of petroleum exploration in São Tomé and Príncipe, Gisa Weszkalnys describes the temporal “pauses” in mineral exploration as central to the contradictory processes entailed in the capitalist accumulation of nature. Pauses, Weszkalnys argues, are acute in “frontier regions” where “scientific knowledge is incomplete, and geological conditions challenging.”⁸³ In the case of gold mining in the AOF, the delay between the colonial mapping of key goldfields and the industrial mining of these deposits spanned decades. The interim period was filled by the heady optimism and bitter disappointments of independence, the global oil crisis, structural adjustment, and the expansion of corporate mining across the formerly colonized world. In the next chapter, I turn to the social and scientific life of this pause on the goldfields of one independent nation-state: Senegal.