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ABSTRACT This paper explores two places usually left off nuclear maps: Madagascar and Gabon, where the French mined and processed uranium ore, starting in the 1950s. It analyses how the 'rupture-talks' of nuclearity and decolonization became intertwined, first by examining the production of these rupture-talks by French expatriates, then by exploring how sociotechnical practices at each site both belied and performed claims to rupture for Malagasy and Gabonese mineworkers. Rupture-talk had material effects: it was inscribed in sociotechnical practice, it involved staking claims to power, and it created expectations among both élites and non-élites. Sociotechnical practices 'conjugated' colonial power relations, creating real and imagined technological futures in which nuclearity and decolonization confronted and shaped one another. Drawing on the insights and methods of postcolonial studies, this paper argues that focusing on uranium mining in Africa reveals the power effects of creating and maintaining the ontological categories of the nuclear age.

Keywords colonialism, decolonization, Gabon, Madagascar, mining, safety, sociotechnical practices, uranium

Rupture-Talk in the Nuclear Age: Conjugating Colonial Power in Africa

Gabrielle Hecht

Ever since Hiroshima, political, popular and technoscientific discourse about the 'nuclear age' has invoked rupture with the past. For some, the bomb would guarantee planetary peace – for others, the extinction of the human race. In their dreams of electricity 'too cheap to meter', optimists saw a future of limitless modernity. In their nightmares of invisible, deadly radiation, pessimists saw only sickness and decay.[1] During those first decades of Cold War, the only consensus in public debates was that, for better or worse, nuclear technology had changed the world forever.

For the weakening colonial powers, meanwhile, another rupture loomed: the loss of empire. Events such as Indian independence, the war in Indochina, or the Algerian crisis foretold the end of European imperialism. With an ambivalent eye on the USA, British and French leaders in particular began to argue that the basis of international power was no longer empire, but nuclear bombs – and their nations had better make the switch before it was too late.[2] Indeed, only atom bombs could prevent imperial states from themselves becoming colonized subjects. Witness Churchill's chief scientific advisor in 1951:

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> If we have to rely entirely on the United States ... for this vital weapon, we shall sink to the rank of a second-class nation, ... like the native levies who were allowed small arms but no artillery. [Lord Cherwell, quoted in Cawte (1992): 41]

Or French parliamentary deputy Félix Gaillard:

> ... those nations which [do] not follow a clear path of atomic development [will] be, 25 years hence, as backward relative to the nuclear nations of that time as the primitive peoples of Africa [are] to the industrialized nations of today. [quoted in Hecht (1998): 62]

Even as it fuelled the world's most modern industry, Africa remained the eternal metonym for backwardness. Such discourse mapped two claims of geopolitical rupture on to each other: nuclear = (former) colonizer; non-nuclear = colonized (or formerly so).[3]

But this rupture-talk obscured a more complex reality, for colonialism proved central to the technopolitical success of the nuclear age. Hiroshima uranium came from the Belgian Congo [Helmreich (1986)]. After the war, Britain's colonial ties to uranium-producing regions in Africa and Australia proved crucial to its nuclear development [Borstelmann (1993)]. France could pursue nuclear independence because it had access to uranium not just on metropolitan soil, but also in its African colonies. Internal colonialism figured as well: the USA found uranium on Native American lands, while Australia found it on Aboriginal lands [Cawte (1992); Kuletz (1998)]. The Soviet Union mined uranium in East Germany and Czechoslovakia; South Africa in (present-day) Namibia; Canada on native lands, India on tribal lands. And on and on.

This paper explores two areas usually left off the nuclear map: Madagascar and Gabon, where the French mined and processed uranium ore, starting in the 1950s. I analyse how the twin rupture-talks of nuclearity and decolonization became intertwined, first by examining the production of these rupture-talks by French expatriates, then by exploring how sociotechnical practices at each site both belied and performed claims to rupture for African mineworkers. I thus aim to go beyond the ritual debunking of rupture-talk, in which scholars demonstrate that the sharp breaks proclaimed by élites masked profound continuities. Tracing continuity *is* important: uranium mining in Africa *was* strongly shaped by colonialism, and any changes it wrought were neither big nor sudden. At the same time, nuclear and postcolonial rupture-talk were far more than mere rhetoric. Rupture-talk had material effects. It was inscribed in sociotechnical practice, it staked claims to power, and it created expectations among both élites and non-élites. The tensions between rupture-talk and colonial continuities created spaces within which nuclearity and decolonization confronted and shaped one another. *Via* the sociotechnical practices produced by these tensions, Malagasy and Gabonese negotiated the realities of decolonization, and the local meanings of the nuclear age.

One source of tension between rupture-talk and colonial continuity, I argue, was the mapping of sociotechnical practices on to racial and ethnic

hierarchies, and on to ideas about citizenship and the state. French engineers and geologists helped to mutate the 'civilizing mission' into developmentalist discourse by proclaiming the end of racial divisions and the triumph of technological skill as the foundation of social relations.[4] I show that technological knowledge did offer some Malagasy and Gabonese a mechanism for economic and social mobility, but race never dropped out of the equation. A second source of tension concerned mobility itself, both physical and social. Geological necessity demanded ongoing prospecting, both locally and globally.[5] Uranium mining was thus an inherently mobile practice, and geographical motion provided opportunities for social mobility. Malagasy and Gabonese who acquired the sociotechnical skills needed for prospecting (and a few other domains) had good career prospects. For French experts, meanwhile, a stint overseas offered a fast track up. As we will see, mobility as a sociotechnical practice could involve moving up, moving away, or even staying put.

Throughout my analysis, I argue that sociotechnical practices 'conjugated' colonial power relations. This metaphor requires explanation.[6] Conjugating a verb preserves its root while changing either its tense, its subject (person), or both. Conjugation transforms the meaning of a sentence by shifting its time frame or by changing who performs the action. Sometimes these are radical transformations, sometimes not. Conjugation thus enacts continuity and change simultaneously. When I say that sociotechnical practices conjugated colonial power relations, therefore, I am both highlighting the dynamics between rupture-talk and continuity and emphasizing their inseparability. I aim to call attention not simply to a *disjunction* between real and imagined technological futures (the time-shift produced by conjugation), but also to the *relationship* between these futures. I hope to show not just *that* Africans shaped both nuclearity and decolonization (the subject-shift produced by conjugation), but also *how* their involvement mattered.

This paper thus departs from most work on the nuclear age. While few nuclear or Cold War scholars would argue that the atomic bomb produced a fundamental geopolitical rupture, their choice of, and approach to, topics has perpetuated the divisions produced by the twin rupture-talks of nuclearity and decolonization. Irrespective of political proclivity, most nuclear scholarship implicitly accepts polarities such as pro-nuclear/anti-nuclear, nuclear/conventional technology, or perpetrator/victim, simply by focusing on a single pole.[7] Such polarities have, in effect, become the ontological categories of the nuclear age. In S&TS, most nuclear-related work pertains to the creation of technoscience – a focus that stems from the field's love affair with studying micro processes and the theoretical premium placed on unpacking knowledge production. Such tendencies produce vacuums between the poles, particularly where uranium mining and Africa are conjoined. Uranium fuels nuclear systems, but the technology of extraction and milling is mostly 'conventional'. Who wants to study the 'conventional' end of an otherwise exciting industry? And even the few existing studies of uranium perpetuate polarities by looking solely at the global diplomacy of

uranium acquisition by Europe and North America (thereby ignoring local conditions of production), by concentrating only on North America or Australia (thereby mapping the geopolitical marginality of African mining sites on to their technological conventionality), or by focusing on the radiation-related health and environmental risks posed by uranium mining and milling (reinforcing both the nuclear/conventional and the victim/perpetrator divides).[8] The problem lies not within the studies themselves – after all, scholars must make practical decisions about inclusion and exclusion. The problem is that taken together, this scholarship skews the aggregate picture of the nuclear age in ways that reinforce the divisions proclaimed by its élite actors. Drawing on the insights of postcolonial studies, I argue that focusing on uranium mining in Africa reveals the power effects of creating and maintaining the ontological categories of the nuclear age.

Breaking from the Colonial Past? Expatriates and Ethnology

From the earliest days of the French nuclear programme, the colonies played an important rôle in its strategic calculations. In 1944, Madagascar's reputation as a mineralogical treasure-trove led nuclear scientists to urge Charles de Gaulle to hang on to the colony regardless of the political cost [Goldschmidt (1967); Paucard (1992)]. The famous Shinkolobwe mine in the Belgian Congo, provenance of Manhattan Project uranium, gave geologists hope that a similarly rich deposit might be found in French Equatorial Africa (AEF). By the late 1940s, France's Commissariat à l'Energie Atomique (CEA) had prospecting teams working in Madagascar and Francophone Africa, as well as in France. By the late 1950s, the CEA had mines operating in all three regions.

The two colonial sites – in Madagascar and Gabon – differed greatly from one another, but many of the metropolitan technicians who travelled to one or the other shared a sense of destiny. This sense was born in part from expectations about life overseas, in part from post-war zeal for the transformative powers of technological change, and in part from an emerging metropolitan discourse that associated French national identity with nuclear power. From the earliest days of the CEA, nuclear development was discursively and materially constructed as the new carrier of French global 'radiance', the industry that would restore to France the glory lost through both the war and the weakening of its empire [Hecht (1998)].

The French who went to Africa on behalf of the CEA thus carried the future of nation and empire with them. But the empire was crumbling, so this future had to be conjugated into a postcolonial tense. From the mid-1950s through the 1970s, going to Africa or Madagascar involved not only finding uranium, but also defining France's rôle in a postcolonial world. Even before the official end of colonial rule, this process involved asserting a rupture from the earlier excesses of imperial imaginaries and practices, and defining a 'development' mission that would succeed – but also transform – the 'civilizing mission' of the colonial era.[9] The metropolitan

who went south had to be a different man from his colonial predecessors: more enlightened, more rational, and more technologically sophisticated. On these differences rested his legitimacy, and his destiny.

Whatever sense of destiny expatriate experts may have had came not merely from amorphous discourse about nuclear might, Africa, colonialism and development: it was also explicitly prescribed for them in a 39-page booklet issued by the CEA. The 'Information Notice for Europeans Likely to Leave for Africa or Madagascar' outlined the expectations that metropolitans should have about themselves, their work, their wives, and Africans – all the while emphasizing the differences between the postcolonial present and the colonial past. The 1963 edition of this booklet gives a sense of how this rupture-talk operated, and the rôle that technological skill was expected to play in shaping Decolonization.[10]

Some colonial tropes obtained. CEA employees should view themselves as brave and solitary male adventurers in order to thrive in their new jobs.[11] Travel involved rupture: a man had to have 'sufficient strength to liberate himself from his social framework ... Once liberated, a man can count on only himself. His personal mental, intellectual, and temperamental resources constitute his only wealth' [2]. The harsh conditions of the tropics brought a man face-to-face with his inner self:

> Do not harbour any illusions by thinking that 'once there, you'll figure it out'. Bluffing might work in Paris; it will not stand up to the climate of the tropics. [3]

But Africa had changed: 'adventure' was still possible, but 'not adventure with a capital A. Gone is the time when one could succeed after having left on impulse, as an escape, with a desire to restart from scratch a life ...' [4]. Travel overseas involved rupture, but not rebirth.

The technological success of the mission – and the very future of Franco-African relations – rested in the metropolitan's ability to break from both his social setting and the clichés of colonial expectations. Gabon and Madagascar were no longer part of France, but independent nation-states with their own laws, the *Notice* booklet admonished. The new French emissaries needed to understand the differences between the 'traditional' view of Africans and their 'real potential' [16–19]. The typical colonial perspective portrayed 'Blacks [as] impulsive, ungrateful, liars, dirty, somewhat thieving, above all lazy, and in the end incapable of perseverance and personal progress'. Readers would also doubtless hear that Africans mistreated mechanical objects and were 'incapable of analysis, unable to conceive of both the whole and its parts, and scornful of the laws of causality'. None of this was true, and readers should 'dare ... to be sufficiently non-conformist' to learn about 'the true face of the African'. That French universities trained Africans as doctors, professors, lawyers, administrators and bishops showed that Africans were fully capable of 'elevating themselves intellectually'. A similar argument obtained for manual and technical training. Africans were not inferior to Europeans – just less developed. The break from the colonial past, therefore, had to take

place deep within the European himself. Much rode on his success: 'remember that the CEA and France are often judged through you' [22].

The *Notice* booklet encouraged its readers to develop an ethnographic interest in Africans. For example, certain forms of behaviour that might at first appear irresponsible in fact had deep cultural meaning. The 'character traits' of Africans 'have often been misunderstood, because they have been interpreted hastily and according to our European habits'. Examples of this misinterpretation were legion [18–19]:

> Dependence behaviour has been described as a mark of ingratitude ('you were good to me, so you are my father and my mother, so you owe me everything'.) Fear, not natural dissimulation, is often the cause of lying, and is explicable both by an ancestral habit of fear and by the frequent brusqueness of Europeans today . . .
>
> The so-called instability that tears the worker from his urban job and sends him toward his village, represents instead a higher form of loyalty (annoying for the employer, of course): loyalty to his native country, to his family, to his tradition. The call of the father or the brother living in the brush who needs the urban worker to resolve an issue for the family or the village is far more powerful than the lure of financial gain or the desire of security which might keep a man on the job.
>
> For him, this is neither a lark, nor a temptation, nor an impulsive act. He's going back to his true place in the society to which he feels he belongs no matter where he is. He's going to accomplish his social duty; he stops being an individual, and once again becomes member of a group.

The scientific distance entailed in this ethnographic approach would help Europeans to manage their own emotions and deal with their subordinates in a more reasonable and patient fashion, without resorting to the violent practices that had characterized so many colonial encounters. Cultivating scientific distance was especially important for the women who would accompany their husbands overseas. Six pages told wives how best to support their husbands and manage their own time overseas.

> You will discover new landscapes, unknown cities, and unusual flowers; above all, you will encounter new aspects of humanity. Quite aside from any taste that you might develop for ethnology or psychology, you will experience completely new types of human relations. [23]

The rationality born of scientific (that is, ethnographic or psychological) distance would help women overturn colonial clichés and fulfil their own domestic destiny:

> Another duty falls specially to you, a national duty and also just a human duty. If some European women have offended Africans by their attitude towards Blacks and by their general behaviour, to the point of having created a barrier between their husbands and the Africans, other [European women] have known how to approach Africa with the fraternal interest and discreet devotion which alone can maintain a respect for France in African territories . . . [27]

The reputation of the French nation, therefore, also rested in the hands of its expatriated women.

Of course, travel overseas involved transformation as well as observation. At the most basic level, European men and women should never forget that their own behaviour would set an example.

> Evolved Africans, torn between their education which brings them closer to us and the traditions which still govern the actions and attitudes of their families, strongly desire to model their lifestyle on ours. [27]

Africans – at least, 'les évolués' – *wanted* to be modernized. Europeans merely had to set a good example. Thus, even as the *Notice* pamphlet condemned old colonial practices and attitudes, the model it offered for postcolonial relationships continued to cast Europeans in an active rôle and Africans in a passive one, and continued to perpetuate the idea of two kinds of Africans: 'evolved' Africans (who bore the seeds of modernity) and others.

Ultimately, technological skill would fuel the transformations and ruptures mapped out by the *Notice* booklet. Technical expertise opened up Africa as a place of opportunity for the Frenchman: a man with 'identical skills [would receive] greater responsibilities'. The technical challenges would be greater too: the expert would have fewer and more rudimentary machines at his disposal, not to mention a largely untrained workforce. His own skill and ingenuity thus constituted the crucial means through which he would make the mission work. Similarly, technical interactions – first training, then work – constituted the main vehicle for social interactions and for the uplift of Africans. In all such encounters, Europeans had to be careful not to let expertise translate into arrogance or violence:

> Africans depend on you on the technological front, but this should not lead to a dependence of one individual on another. Your skills, which constitute your instrument of work, should contribute to the enrichment of Africa; this is your contribution to the work of civilization, not a source of superiority that entitles you to be haughty and brutal. [14]

Technology could thus transcend racial distinctions: what differentiated individuals was not the colour of their skin but their technological knowledge. European authority was justified technologically, not racially, and was therefore 'provisional' [22].[12] Even the authors of the *Notice* booklet, however, seemed to feel ambivalent about this state of affairs. On the surface, the categories used to describe subjects seemed geographical rather than racial; the term 'Blacks' appeared only in discussions of colonial errors. Yet one of the first things that readers learned about Madagascar and Gabon was their racial and ethnic composition. 'European' and 'African' were thin substitutions for racial categories.[13] The substitution of technology for race, therefore, was by no means comfortable. For Europeans, this substitution was palliated by the fact that only technological knowledge related to industrial machinery or scientific instrumentation would qualify someone as 'evolved'. The large difference in industrial experience, therefore, meant that European authority would

likely continue for some time: metropolitans had to exercise caution and consideration, but they need not fear too much for their position. In the meantime, technology could provide a rational basis for social differentiation, a means for proclaiming a rupture from colonialism and legitimating continued French presence in Africa.

At least through the late 1960s, the CEA thus encouraged a sense of destiny in its envoys to Madagascar and Gabon, one born from the marriage of nuclearity with decolonization. Both processes were conceived as ruptures; expatriates had a mission to perform these ruptures by mining uranium for the independence and glory of France, setting a new standard for French behaviour overseas, and using technology to uplift Africans. Europeans themselves would be transformed in the process, becoming more moral and more enlightened. A new, more rational world would emerge, one organized according to technology rather than race.

So much for the guiding principles established for European behaviour. What were the consequences of coupling these two modes of rupture-talk, and how did this rupture-talk confront daily practices? And what of the Malagasy and Gabonese who laboured in the mines?

Madagascar: Ethnotechnical Hierarchies

Travellers to Madagascar learn early on that the island houses 18 different ethnicities. Typically, these ethnicities are described as falling within two racial groupings. The first originated in Malaysia and Indonesia, and has been variously known as the Merina, the Ambaniandro, the Hova, or the people from the high plains.[14] The Merina had dominated the island before the arrival of European colonists, having subjugated and in some cases enslaved other inhabitants. When French colonists took over from the British, they enlisted élite Merina to help run the colonial state, even adopting some Merina administrative institutions. The Merina continued to dominate the Malagasy intellectual élite, shored up by colonial education: the French considered educated Merina the 'évolués' of Madagascar. Other Malagasy peoples originated from the east coast of Africa. They formed a single grouping only from the perspective of the Merina and of French colonists; no one designation covers all of its members. In this story, we shall encounter only one of these ethnicities: the Tandroy. As the migrant workers of the island, they lay at the bottom of Malagasy and colonial social hierarchies, and had a reputation among French and Malagasy alike for being strong, fierce, and primitive.

In 1953, the CEA found a uranium deposit in the Androy desert (as the Tandroy homeland was called), and began to move mining equipment there. The centre of operations was dubbed Ambatomika.[15] The CEA built housing as well as a mill, a laboratory, a few offices, a small clinic, a store, and a clubhouse for expatriates. Small, open-pit mines pitted the desert in a 10–20 kilometre radius around this centre.

Colonial patterns offered the CEA a handy template. It began by hiring a number of *colons*: sons of French planters and industrialists born

and raised on the island. Several of the young Frenchmen who worked for the CEA also married the daughters of *colons*. These men and women taught their metropolitan colleagues how to be French in Madagascar, reproducing their colonial world in mining sites and on prospecting missions. Among other things, this resulted in what we might call an *ethnotechnical hierarchy*:[16] French engineers and geologists ran prospecting and mining operations; Merina worked as lab technicians, mechanics, chauffeurs and budget officers; and the Tandroy worked as guards, porters and rock-breakers. At Ambatomika, racial and ethnic divisions also structured housing development and leisure activities.

Perhaps influenced by the CEA's behavioural injunctions, French personnel tried hard to incorporate ethnological and psychological perspectives in their work. Thus, typical reports of four-month prospecting missions detailed not only geological findings and prospecting methods, but also the ethnic composition of territories covered and relationships between personnel of different ethnic backgrounds. Ethnological conventions about race relations on the island dominated explanations of why missions encountered success or failure. One geologist, reporting on a mission in which progress had been slow, noted that European planters in the region had had to 'import manual labour from the South', because they could not persuade local Merina to fill that rôle. He concluded that for the CEA, the 'exclusive use [of Tandroy as porters] seems necessary in the regions that remain to be prospected and that are far from any [population] centre'.[17]

Some Tandroy went north, and served as manual labourers. Others stayed in the south, travelling less than 30 kilometres from their villages to work at Ambatomika. Meanwhile, some Merina worked for the CEA near their homes in the central plains, where the CEA maintained a laboratory. Others went south to serve as specialists. Eventually, a small number left the island altogether, hired by the CEA to work in other prospecting missions and mining sites, first in Africa, then elsewhere.

The differences among these mobilities are reflected in the traces they left behind. The Tandroy who went north probably did not do so expressly to work for the CEA: more likely, they simply migrated north in search of work. In any case, their mobility did not leave traces findable by a western researcher three decades later. The several hundred Tandroy who worked close to home received scarcely more attention in CEA documentation, but enough had remained in the region that I found and interviewed 19 of them. Barely a dozen Merina ended up with international careers in the uranium industry, but they were fairly easy to track down. Many now live in France, well known by the French veterans of the CEA's time in Madagascar (who, in turn, are the easiest of all to locate). The Merina also figured more prominently in CEA documentation: as subjects of ethnographic interest, as actors in the uranium adventure, and (very occasionally) as writers of reports. The long-term consequences of these different mobilities thus shape whose story I can tell, and how.

For the Merina who worked at Ambatomika, the Androy was an uncomfortable foreign territory. It had escaped Merina control in the previous century, and few had ever been there. Its spiny desert had a harsh, forbidding reputation. In order to lure Merina specialists south, the CEA had to promise them high ranks and wages, and separate housing – better than the Tandroy, if not quite as good as the French.[18] The Merina made no secret of their discomfort in the Androy – either at the time, or in interviews over three decades later.[19]

The French cultivated the sense of separateness maintained by the Merina. In 1958, a CEA report on a nine-day mission to Ambatomika noted that the site personnel comprised 44 Europeans and 550 'autochthons'. But, it added, the autochthons should not all be lumped together, since they included 'a certain number of qualified agents from the high plains who have demonstrated abilities often analogous to those of European agents'. Alas, continued the author, these Merina preferred administrative jobs to technical ones. Under colonialism, administrative jobs had carried more prestige than technical ones, offering the 'évolués' better upward mobility. This, in turn, made recruiting 'intelligent agents' for technical posts difficult. In order to encourage enthusiasm for a technical 'vocation', the author recommended sending 'a training specialist who could use psychotechnical methods in organizing complementary classes at appropriate times'.[20]

The CEA responded to this call by sending Marc-Edmond Morgaut, the vice-president of the Association pour le Développement de l'Enseignement Technique Outre-Mer, to evaluate the personnel at Ambatomika. His mission was to evaluate how the Malagasy personnel had adapted to work at Ambatomika, and to determine whether the CEA should invest in a formal training programme. Morgaut coupled 'informal observation' with formal methods, the latter comprised of psychological and intelligence tests 'that have been applied ... to Africans from very diverse territories and to Europeans. [These] have served, depending on the case, either to select industrial or mining workers from a large applicant pool, or to look for elements – at the level of manual or low-skilled worker – from within the existing personnel who might be considered for promotion'.[21] His report did not describe the tests *per se*, but concentrated instead on his conclusions.

Morgaut began by commenting briefly on the French personnel, whom he did not test but who impressed him as having 'true faith in their task'. Far from opposing the training and promotion of Malagasy employees, 'each one is interested in such or such a case that seems particularly full of promise and worth of encouragement'. They manifested a 'desire to learn more by reading; in the end, they asked me to give a talk which they all attended, along with their families'. He then offered some general comments about the Merina personnel:

> The Ambaniandro [Merina] or people from the high plains, the first to be recruited by the CEA and brought here because of their training, demonstrate an awareness of having been expatriated because of their merits and

> a certain disdain toward local autochthons. ... In fact, I got the impression that, beneath an extremely strict sense of self-control and a traditionally elaborate politeness, most – though not all – nurture a fairly similar feeling of distant condescension toward the Whites. They form a very tightly knit community, very deliberately segregated and organized, with a very strong sense of solidarity ... .
>
> At the end of the second day of testing, ... the Ambaniandro – and only them – had clearly advised each other on the most efficient method of succeeding [in these tests]. This means that, at the end of the first day, they must have met to discuss the experiences of the first ones tested, the solutions that seemed best to them, and the advice they thought they could give those who had been summoned for the following day ...[22]

Whereas Morgaut viewed French interest in his mission as helpful, he regarded Merina behaviour – both in general and with respect to his tests – with some suspicion. The test was meant to measure individual performance. The Merina, however, had treated it as a social experience, one that required discussion and strategizing. This 'inappropriately' social response caused Morgaut to mistrust the rest of their behaviour. That the French lived and socialized separately did not provide cause for comment, but similar behaviour among the Merina became 'distant condescension' and appeared particularly disturbing because it seemed directed not just against locals, but also against 'Whites' (this was only passage in the report where he used this designation – elsewhere, he used 'European').

Morgaut's interpretation may have been influenced by unease on the part of some French personnel. While they viewed the Merina as the most 'evolved' among Malagasies, not all manifestations of 'evolution' were reassuring. Some Merina had begun to demonstrate an increasing interest in unionization, and a clear awareness that they got paid less than their French counterparts: 'the good elements (some are employed in payroll) compared their salaries to those of Europeans, and the representatives of the local CFTC union are beginning to get interested in the French Miner Statute'.[23] While unions never featured prominently at the site, the Merina had begun to make demands: bonuses for difficult or dangerous work, buses for children to attend school, and so on.[24] Metropolitan experts evidently had not anticipated that Malagasy might take the connections the French had made between technological uplift and postcolonial rupture farther than they had intended [Cooper (1996)]. Using the language of industrial relations and echoing similar claims made by French metropolitan miners, Malagasy demands revealed the 'expectations of modernity' [Ferguson (1999)] created by French rupture-talk and challenged the colonial character of relationships between French and Merina.

Such hints of malaise seemed to fuel Morgaut's summary assessment of the Merina. He saw in them 'an inhibition, a defensiveness, in some even a fundamental combativeness, an aggressive tone that seem very telling about their group'. He acknowledged individual differences – one subject was 'balanced, solid, and full of authority', another was 'picturesque', and a third good at his job but had 'an aggressive [demeanour] that

his "oriental" smile only serves to mask' – but he added that they all manifested 'an anxiety that all the "under-evolved" groups I have encountered exhibit'.[25] Apparently it did not occur to him that the very structure of his encounters with his subjects – the administration of mysterious tests with unclear purposes by a potential colonizer – might produce a certain anxiety! He therefore construed Merina efforts to psych out the test as a form of cheating, not as a reasonable means of responding to pressure. He did not see that what he counted as scientific objectivity (not biasing the results of the test by knowing the questions in advance) constituted yet another colonial conundrum – perhaps even threat – for the Merina.

Indeed, the Merina could not have felt reassured by Morgaut's results, which he presented at the end of his visit. Two Merina attended this presentation. Again, Morgaut's interpretation of their presence invoked cunning and calculation: 'each very different in origin and character, they were very well chosen to bring their commensals [*sic*] reports by two complementary observers'. For someone who fancied himself *the* objective observer, being observed in return was disquieting. Morgaut reported that Ambatomika's median score on his test (expressed as the 'level of practical intelligence') was 30, compared to 39.5 in Cameroon; the highest score was 42, compared to 56 in Cameroon. Morgaut must have felt uncomfortable announcing to his audience of 40 receptive Europeans and 2 cunning Merina that 'contrary to what has sometimes been stated, even the most evolved Malagasy populations do not attain the level of practical intelligence reached by certain African populations who have met with noted industrial success'.[26] All in all, Morgaut concluded, Ambatomika's directors had chosen their technicians and mechanics just right: no one was exceptional, but most were up to the job.

> One can only envisage a normal career path for them. No jumps to a significantly higher rank, for which they lack the preparation – either intellectually, or in terms of character, or culturally.[27]

Thus, the 'psycho' part of the 'psychotechnical' tests served to dampen whatever promotion opportunities technical skills may have opened up. In principle, technology could create a rupture with colonial times by serving as motor for progress. But the speed of progress could be kept in check by invoking other forms of scientific reasoning. Rupture, particularly if it threatened to escape French control, was perhaps not so desirable as all that.

The CEA may have offered Merina economic opportunity, but as long as they remained in Madagascar it did not offer a way to break from colonial rôles, either before or after independence.[28] The Merina at Ambatomika were firmly planted on an ethnotechnical boundary. The ambiguity of this position manifested itself in multiple ways. Racially, Merina were neither black nor white but 'light' – a trait that both they and the French emphasized. Interviews repeatedly confirmed that they considered themselves expatriates in the Androy, and found the experience of living there distasteful at best. But while the French recognized their alienation, the

CEA did not grant them official expatriate status. This was reflected not just in pay, fringe benefits, social functions and spatial arrangement, but also in differential mobility. French *colons* hired by the CEA could expect fast promotions: even those with just a high-school diploma received extensive on-the-job training, and could rise to pilot their own prospecting missions. But Merina with similar (and, at least in one case,[29] better) educational backgrounds could not expect the same opportunities – at least, not as long as they remained on the island. They couldn't even hope to work on equal terms with the French. In 1963, for example, one of the mills needed three skilled shift supervisors. Two Merina technicians could have performed the job, but site directors decided that 'for psychological reasons, it isn't possible to function with 2 Malagasy supervisors and one European'.[30] Once again, 'psychology' worked to justify hierarchies established under colonialism but potentially undermined by strict application of technical merit principles.

Only one path existed toward nominal parity with the French, and that path led out of Madagascar. In the late 1950s, the CEA discovered huge uranium deposits in Gabon and Niger. Expanding nuclear ambitions made it decide to abandon the Malagasy mines.[31] Operations in the south gradually slowed, then stopped permanently in 1969. But some Merina specialists were too valuable to lose. Two had become excellent lab technicians, adept at analysing ore samples from prospecting missions. Another had become a highly skilled mechanic, able to repair almost any piece of equipment under almost any conditions. The CEA recruited a dozen Merina for its African missions.

Moving out of Madagascar offered the CEA Merina a means of conjugating their colonial rôles into a technological future. Take the case of JR, a lab technician who ended up with an international career in the French uranium industry (and who now lives in France, having become a French citizen). After working in the CEA's Antsirabé laboratory for three years, he and eight other Merina were transferred to prospecting operations in Africa. For the next five years, JR split his time between Gabon, the Congo and Niger, heading the mobile laboratory units that tested the soil and rock samples collected by prospectors. He ran the laboratories and trained Africans for lab work. While in Africa, he positioned himself as an expatriate on the same terms as the French, and received official sanction for this status through various fringe benefits. He was housed with the French, socialized in the same circles, and ate the same food. In interviews, he strongly affirmed that his French colleagues viewed him as an equal. Yet he did not have any French employees under his command; all the technicians who worked for him were Africans.[32]

For the Merina who left Madagascar, the postcolonial rupture that French experts had predicated would come about through technological knowledge happened at the price of a more personal rupture – emigration – which they chose but did not entirely shape. The colonial continued to lurk in the postcolonial, and this rupture too carried important continuities. For if these Merina had transcended Malagasy colonial rôles,

their mobility did not entail the abandonment of all colonial relations. Rather, it signalled a conjugation of such relations. They continued to serve in intermediary positions in Africa. Structurally, therefore, their position was the same. And limits on opportunity remained. Merina could now aspire to hold some of the same positions as French expatriates – but they could not hope to rise above French employees in Africa. As in so many other situations, postcoloniality did not entail true rupture, but a more limited reformulation of social and economic relations.

Still, these few Merina had conjugated their technical skills into global mobility. If we step back from micro-level analysis for a moment, we can see how this mobility was buffeted by a confluence of macro-level forces. Colonial conjugation in Madagascar enabled the Merina to learn transportable skills required for work elsewhere. The global reach of France's former empire facilitated uranium exploration on three continents. France's focus on nuclear technology as an instrument of national identity and geopolitical power, and the associated imperative of acquiring as much 'free use' uranium as possible, led it to develop large mines in Africa. Local conditions in Gabon, the Congo and Niger facilitated the Merina serving as sociotechnical intermediaries.

The Tandroy Revisited

Let me now circle back to the third main group involved in Ambatomika: the Tandroy. They are important both in their own right and in helping us understand how the Merina and the French positioned themselves. To this latter end, consider the single passage that Morgaut devoted to them:

> The Antandroy [*sic*] feel at home here, and they make sure others realize that. A poor home, to which they apparently migrated long ago in order to – according to certain ethnographers – escape from the encroachments of the Ambaniandro in other parts of the island. This partly explains their active distrust of the latter, and the harassment [conducted] by a whole series of small demonstrations of hostility that in the end may have no other goal than to keep the Ambaniandro on the defensive by attacking them in the most vulnerable parts of their worried nature. In other places [i.e. Africa], there has certainly been too much insistence on tribal rivalries; here, these seem serious. Still, it's important to make some distinctions: on the collective front, it is hard to see how to reduce [these rivalries]; on the work front, they are doubtless not serious, at least as long as we're talking about daytime work.[33]

These thoughts were based solely on informal observation and constituted the entirety of Morgaut's comments on the Tandroy, since he considered it 'obvious' that, as the 'the most modest elements', they were not worth testing formally.[34] For him, the relevant boundary that defined the Tandroy was not between them and the French (the distance there being too great to contemplate serious comparison), but between them and the Merina. This view prevailed among CEA expatriates and *colons*. One Madagascar 'veteran', for example, told me that the Tandroy viewed the French as liberators from the oppression of the Merina. Given that the Merina had

never ruled the Androy, this was a strange conclusion, apparently taken straight from generic colonial discourse.[35] Another veteran described the Tandroy as sweet, simple people who viewed the French as their protectors.[36] Another told of an incident in which the Ambatomika doctor (a Merina) had refused to rouse himself at 2.00 am to deliver a Tandroy baby, so that the Frenchman himself – with no knowledge of childbirth – had had to attend to the delivery.[37] And so on: French stories about the Tandroy concern Tandroy–Merina relations, never the Tandroy on their own or even direct relations between Tandroy and French.

But relations with the Merina did not frame Tandroy memories of Ambatomika; relations with the French – particularly of the economic kind – did.

For readers unfamiliar with rural communities outside Europe and North America, the most striking fact to emerge from my interviews with Tandroy mineworkers might be this: with only two exceptions, none of the Tandroy who had mined uranium had ever heard of the atomic bomb, let alone nuclear power. Nuclear rupture-talk had not made it to the Androy desert. The Tandroy had therefore spent 10 years working for the CEA without knowing why these French people wanted those rocks. The Tandroy *had* noticed uranothorianite rocks before the arrival of the CEA in their land. They called these rocks 'vatovy' [va-too-vee], the same word used to designate any unusually dense, black rock. And vatovy had had its uses, as ammunition for slingshots and weights for fishing lines. So they knew where to find vatovy, and could direct CEA geologists to promising areas. But for most of my interlocutors, I was the first person to describe atom bombs and nuclear power (explanations which they inevitably demanded after I asked whether they knew what vatovy was for). Typically, people expressed awe at the sheer concept of killing so many people in one blow – Tandroy villages have 30–50 inhabitants – followed by shaking heads and laughter. 'You crazy vazahas', they would say: 'Why do you want this stuff?'

This question provides a sense of how the Tandroy see white people – or 'vazahas' [va-za], to use the Malagasy term. For most Tandroy, a vazaha is a vazaha is a vazaha, and all vazahas are obsessed with rocks. This is an entirely reasonable view: uranium mining was neither the first nor the last form of mining in their region, and my presence was indeed motivated by rocks. I explained over and over again that *I* didn't want vatovy – I just wanted to talk about it. Nevertheless, by my second week there, my presence had sparked rumours that the vazahas might return to mine more vatovy. Perhaps hoping that I was in fact a CEA agent, many of the people I talked to assured me that they would gladly work in vatovy again.

The interviews also made clear that the Tandroy did not view racial issues in the way the French had imagined they did. Over and over again, I asked people to talk about the relationship between different ethnicities at Ambatomika. I always got the same response: there were no troubles between Merina and Tandroy; both groups were Malagasy, so they understood each other. This does not mean that relations between the two

groups were not strained. Probably the Tandroy did 'harass' the Merina in 'small demonstrations of hostility'. But evidently the Tandroy did not feel that the tension was a problem to discuss with vazahas – either at the time, or decades later. If Morgaut's observations carried any truth, then the Tandroy had found ways to establish authority over their space, even when they had the least formal power.

In contrast, the Tandroy *did* discuss differences between themselves and the CEA vazahas: now there was a difference worth dwelling on! And at the heart of this difference lay 'zebus'.

Zebus are a kind of hump-backed oxen. The zebu is sacred, and the most important medium of exchange and measure of wealth in Tandroy society. Accordingly, the most important thing anyone could do with money earned from the CEA was to purchase zebus. Only one of my interlocutors said he used his salary to buy a manufactured luxury (a bicycle), and this only after he had purchased many head of cattle. The primary purpose of these zebus was sacrificial: when family members died, the survivors sacrificed zebu, which were then eaten by others attending the funeral.[38] When I asked one Tandroy man what he told his children about vatovy mining, he replied: 'I tell them to take good care of the zebus we have, because I worked very hard to buy them, and I'm not sure my children would be able to work hard enough to buy as many'.[39] Zebus represented the past, present and future of Tandroy society. Mining vatovy was, above all else, a good way to get more zebus.

But zebus caused problems with the CEA vazahas, because the Tandroy did not share French concepts of land use and ownership. While the Merina understood that Tandroy zebus were best left alone, vazahas apparently did not.[40] Most puzzling was the erection of fences to define private property and to keep zebus – and indeed the Tandroy themselves – off the land around vazaha dwellings. Vazahas sometimes shot zebus who broke through these fences, returning their carcasses to the original owner with a stern warning instead of an elaborate apology. This was an inadequate – not to mention offensive – response, because a zebu that died outside of ritual sacrifice had no value. Vazahas apparently did have some grasp of the ritual value of zebu: when the CEA wanted to mine an area that had ancestral taboos associated with it, it did purchase and sacrifice the requisite number of zebus. But these Frenchmen never applied this understanding to their methods of policing cattle. This, affirmed my Tandroy interlocutors, was the primary difference between vazahas and Malagasy.

The significance of uranium mining for the Tandroy thus had little to do with Malagasy ethnic relations, and even less to do with the nuclear age as we commonly understand it. The Tandroy I talked to all concurred that vatovy mining was gruelling work, in which falling rock and heavy machinery might maim or kill them. But no one remembered wearing radiation-detecting film badges, and they looked puzzled when I asked whether they were told about radiation, 'invisible dangers', and the like.

Nor were they terribly interested: the important dangers were the immediate ones, and they were proud of having survived the ordeal. One man showed me his CEA work certificate, which he had carefully preserved in a plastic bag for nearly 40 years.[41] Another showed me his maimed foot, explaining that it had gotten trapped under a boulder during a rockslide. He managed to shove the boulder off, but his toes had been completely crushed and were barely attached to his foot. Rather than wait hours for help to arrive, he decided to rip them off himself. The damaged foot had become a badge of honour, a prestige amplified by the shoes that he wore (a luxury for most, though a necessity for him).[42] The women who strained nuggets out of alluvial deposits vividly remembered the back-breaking labour of lugging huge containers around.[43] But all asserted that the (relative) prosperity had been worth the hardship. Vatovy mining had bought them herds of zebus, and enabled them to stay at home rather than migrate north like so many other Tandroy. Thanks in part to their large herds, many of the men I interviewed had become the heads of their villages. If the nuclear age structured mobility for French and Merina by enabling them to move up while moving away, for these Tandroy it functioned obversely, enabling them to move up while staying put.

Gabon: Industrial Citizenship

The contrast between the Androy and the Haut-Ogooué could not have been greater. The region where CEA prospectors found uranium in Gabon was on the border between dense rainforest and rolling savannah, near the Congolese border. The size of the deposits also differed: the scale of operations at Mounana exceeded that of southern Madagascar by an order of magnitude. The political context differed too. Colonialism in French Equatorial Africa (AEF) had been particularly violent. The colonial administration itself had not reached very deeply into the region near Mounana, but concessionary mining companies had. There was not much in the way of educational infrastructure: colonialism in Madagascar may have perpetuated ethnotechnical hierarchies, but colonialism in AEF had left all ethnicities in the Haut-Ogooué equally unschooled. Differences in timing mattered as well: by 1958, when the site opened, the end of empire was palpable. Expecting a mother lode at Mounana, and concerned that any enterprise run by the French government might be too easily appropriated by the newly independent state, the CEA decided to join forces with Mokta, a private mining company with considerable colonial experience. Together, they formed the Compagnie des Mines d'Uranium de Franceville, or COMUF, to run the site. Most of the COMUF's expatriate personnel came from one of the two parent institutions. Decisions concerning mining and milling operations often came by triangulating the CEA's fuel needs, its expertise with uranium mining and processing, and Mokta's experience running profitable mines.

The difference in scale – and its ramifications – structured the most important contrasts between the two sites. Ambatomika operated very

much on an *ad hoc* basis. At Mounana, however, site director Xavier des Ligneris engaged in more formal planning. He sought to create a large, long-term industrial workforce. Unsurprisingly, Gabonese workers did not necessarily share his understanding about what that meant, and they often frustrated his efforts to discipline them into proper sociotechnical behaviour. Long-term vision also required close links with the Gabonese state. Beginning in the mid- to late-1960s, these two long-term strategies converged in the practice of 'Gabonization', which eventually became a formal programme that sought to conflate the state's political interests and the COMUF's economic interests. On one level, Gabonization aimed at promoting Gabonese into positions of technical and managerial responsibility (economically desirable for the COMUF since Gabonese commanded much lower salaries and cheaper benefits than expatriates); on another level, it sought to break from the colonial past in order to produce modern, industrialized, national citizens.

Efforts to enact sociotechnical transformation were thus more systematized at the COMUF than they had been at Ambatomika. In the beginning, however, the discourse surrounding those practices from the French end was very similar.

During its first few years, the COMUF imported most of its technicians from the Congo. These men already had the skill base required, since the CEA had trained Congolese workers during the course of its prospecting missions there. The COMUF wanted these men not only for their skill, but also because they had 'modern' lifestyles. Management understood this to mean that they had abandoned their 'traditional' ways, in particular by practising monogamy. These 'éléments évolutifs' did include a few locals (and by the mid-1960s were entirely locals). They contrasted with the rest of the workforce who, in des Ligneris's view, were ...

> ... unsuited to real transformation, continuing to follow their ancient customs, and polygamous as soon as they have the opportunity. Racial rivalries subsist: Bendjabis and Batékés are especially ready to come to blows, and all consider the imported workforce, be they Gabonese or Congolese, as foreigners.[44]

Cleaving to tradition made them irredeemable, unchangeable. Therefore there was no point in placing them in modern housing (as the COMUF had initially planned). Instead, the director proposed grouping them ...

> ... in villages, according to race. Each one would get a small concession on which he could build – depending on his family status (monogamous or polygamous) – one or more huts using local materials (mud and bamboo tiles).[45]

The company would provide these building materials and construct the cabin frames in order to ensure adherence to the 'plan d'urbanisme'. Each worker would get a fixed number of days to complete his dwelling. Polygamists could build huts for their additional wives behind the main cabin, but on their own time and at their own expense.

This proposal differed from the original plan for several reasons, des Ligneris explained. For one thing, many manual labourers had refused to live in the *cité* that the COMUF had built, or had agreed only reluctantly. For another thing, there weren't enough cabins in the *cité* to house all the workers. This measure would 'permit a more rapid reabsorption of the horrible shantytown' in which workers currently lived. In any case, one could never insist too much on the point that . . .

> A large percentage of the manual workers is not improvable, neither from a technical viewpoint nor from a social one. For many years still, they will remain manual workers and they will remain Benjabi or Batéké. In contrast, the small proportion who can evolve technologically will simultaneously evolve in their lifestyles, and can then progress to the worker *cité* built in concrete.[46]

Xavier des Ligneris added that those who progressed sufficiently highly on the sociotechnical ladder would be rewarded by even more trappings of modernity: promotion to the status of 'highly qualified worker' would be 'rewarded by the installation of water and electricity'.[47] Social 'progress' thus inevitably followed technological knowledge; successful rupture was instantiated in modern housing materials. This hope for a tidy, ordered future for the COMUF fitted closely with the rupture-talk the CEA had articulated in its expatriate *Notice* brochure. As they acquired greater technical skills, Africans would evolve, shedding their ethnic identities in order to become modern industrial workers. Tradition was not compatible with industrialization. Progress required breaking with old ways – in particular, by abandoning ethnicity as a primary category of identity. Modernity would replace tribalism, and those who achieved it would live as Europeans, with a single wife, in concrete houses equipped with running water and electricity.

Not surprisingly, Africans had different ideas about how they would live their lives. Not all 'évolués' sought monogamy. The postcolonial state pressured the COMUF to build concrete housing for all its workers (though water and power remained a promotion prize for a long time). The results confirmed des Ligneris's worst nightmares. Households took in their extended families, so that 15 or 20 people might be living in a 2-room house designed for a single nuclear family. People modified their dwellings to suit their needs. They kept livestock in their tiny yards. They grew crops. They used communal water taps for washing as well as drinking. All these actions violated rules, incurring fines and occasionally expulsion.[48] Sometimes Gabonese who couldn't stand the regimentation left of their own accord. Over time, those who quit or were fired created their own village: a community of houses made from discarded corrugated iron, nestled haphazardly in thick vegetation, surrounded by chickens and goats, and ironically dubbed 'Cité du Silence'. 'Silence' was exactly the kind of 'horrible shantytown' that had made des Ligneris shudder.[49]

None the less, the COMUF persisted in attempts to remake the world around it. Directors sought to promote Africans to positions of technical

and managerial responsibility. This was motivated not by idealism or missionary zeal, but by thrift. Expatriates were expensive: they commanded salaries up to 10 times those of Africans, and received supplements for servants, trips home, and boarding schools for older children.[50] Maximizing the number of African employees would cut down considerably on operating costs. Company headquarters had hoped that some of their technological choices would expedite this process. Most notably, the CEA had decided not to produce highly concentrated ore on site, but instead to build a fairly simple plant that would produce 'pre-concentrates', which would then go to France for further processing. Engineers hoped that it would be relatively easy to train African workers to run a simple plant, thereby saving on expatriate salaries.[51]

Matters of cost soon merged with matters of postcolonial politics. By the mid-1960s, the Gabonese state had made it clear that promoting Africans would be politically desirable – even necessary. What had been an *ad hoc* training programme became a sociotechnical project: Gabonization. Viewed from headquarters in France, the main aim remained cost-cutting. Viewed from Mounana, however, Gabonization had many dimensions. In principle, it was a programme to train and promote Gabonese. In practice, it also became a programme to make Gabonese citizens. In principle, it was a programme directed by the COMUF. In practice, it also became a process that happened to, and changed, the COMUF.

From the beginning, Gabonization was conceived in sociotechnical terms. Professional training focused not just on the technical skills required for particular jobs, but also on the discipline required to be a responsible industrial worker.[52] Lessons on timeliness, tidiness, teamwork and following rules were interspersed with demonstrations and practicums on how to use particular pieces of equipment. The goal was to transform the fundamental outlook of the Gabonese worker by stressing 'character traits indispensable to the exercise of responsibility: a taste for a job well done, the importance of the team, a sense of duty. . . . These traits are not part of the natural psychological landscape of young Gabonese'.[53] This enterprise had totalizing ambitions: transforming the psychological outlook of Gabonese also involved transforming domestic sociotechnical practices. A French social worker taught courses on cooking, sewing and housekeeping especially aimed at the wives and daughters of évolués.[54] When a Gabonese man was promoted to the upper echelons – moving from a worker to a 'cadre' – he became entitled to a house in the 'cité des cadres', up on the hill where the Europeans lived. The French could not cope with such a move unless Gabonese wives could keep house European-style: goats in the yard were definitely not on.[55] For the COMUF, Gabonization became a metonym for modernization: carefully controlled mobility.

But the language of Gabonization was fluid enough to accommodate multiple usages, and this fluidity became the means of its transformation. In addition to a process, 'Gabonization' became a result, subject to qualitative and quantitative description. Thus, when an employee was

promoted to 'cadre', both he and his position were completely and successfully 'Gabonized'. Results were measured in statistics.[56] The keeping of statistics itself prompted a (surface) de-racialization of the COMUF's internal categories: personnel rosters went from listing employees as 'Europeans' or 'Africans' to 'expatriates' and 'Gabonese' or (beginning in the 1980s) 'nationals'.[57] These statistics, in turn, served a political purpose for the state, particularly as of the mid-1970s, when the government began demanding hard figures on the COMUF's rate of Gabonization and urging faster progress.[58]

Gradually, then, the state thus conjugated Gabonization into an object of accountability. In the course of this transformation, it became less and less a process controlled by the COMUF, and more and more a terrain on which the company and the state negotiated, cooperated, and clashed. Over time, the state made more demands of the COMUF: improve worker housing, participate financially in regional agricultural projects, hire specific people, and so on. In return, it offered special kinds of assistance – with recruiting and policing. This police presence sent a clear signal that being a cooperative industrial worker also meant being a disciplined citizen of the nation.[59]

Eventually the state decided that it could try to Gabonize the COMUF itself. In 1974, it augmented the COMUF's capitalization by 760 million FCFA,[60] thereby acquiring a 25 percent share in the company.[61] At first, the state's participation seemed to management like an unalloyed benefit: the government's financial participation would also increase its political support, and the influx of capital would allow the company to expand. But the COMUF had not anticipated that Gabon's President, Omar Bongo, would take state participation as a licence to use uranium as a diplomatic tool. Management was taken aback when, in 1975, Bongo promised the Shah of Iran 800 tons of uranium without first consulting the company (never mind checking to see whether it even had 800 tons of ore to spare). This agreement – and others – left the COMUF scrambling to figure out how to satisfy Bongo, fulfil its existing contracts, and still stay in the black.[62]

Gabonization thus sprouted many untidy offshoots. Much more than in Madagascar, the COMUF's rupture-talk had produced expectations and practices of modernity and autonomy that exceeded its control. The professional training programme, for example, shot tendrils all the way into the French nuclear industry. Starting in the late 1960s, demand for uranium slumped. With dozens of nuclear power plants under construction, industry analysts fully expected it to rise again, but in the meantime the CEA asked its suppliers to slow production down. At the COMUF this would have meant laying off workers that the company had spent 266 million FCFA to train.[63] Given chronic recruitment problems, yearly strikes, and the general restlessness of the workforce, the company feared it would not be able to hire the same workers back after the slump had passed. It finally managed to persuade the CEA not to reduce its purchases – and the reductions came out of other mines in the system instead.[64]

Though they may not have realized it, Gabonese workers had acquired a small but definite hold on the French nuclear industry.

Of course, in that particular instance what was good for the workers was even better for the company. But this was not always the case, unsurprisingly. Gabonization, particularly as a metonym for modernization, was anything but a smooth, unidirectional process by which workers became disciplined, industrialized citizens of a nation. Some of its most unruly moments came in negotiations over the very sociotechnical practices that constituted its core. In the remainder of this section, I will examine three instances of these negotiations – the construction of workplace safety, the response of one worker to this construction, and the circumstances surrounding a fatal accident in 1965 – in order to shed light on how COMUF workers experienced, reacted to, and reshaped their own Gabonization.

Worker Safety

Central to the professional training programme promulgated by the COMUF were the practices surrounding worker safety. At least as early as 1961, management drew up a series of safety guidelines that were written up into booklets and distributed to foremen. These ranged from procedures to follow in case of accidents, to everyday precautions against radon inhalation. In all cases, guidelines served as disciplinary practices. Plant workers, for example, were held 'responsible if they transgress the guidelines or do not conform to elementary safety precautions'.[65] But they did not own their own copies of these guidelines – their foremen were the guideline guardians. In any case, for the plant itself the guidelines were fairly vague: unspecified 'elementary safety precautions', 'a few commonsense observations', and recommendations to keep hands away from moving parts and sulphuric acid. In practice, the safety guidelines structured workplace surveillance: workers should obey their supervisors for their own good, and learning discipline mattered for their own safety.

The surveillance dimension of safety practices was particularly pronounced in the case of radiation protection. Like nuclear industry workers everywhere, COMUF employees wore radiation-detecting film badges. In the CEA's metropolitan sites, radiation safety expertise was the domain of special divisions, which made and enforced rules.[66] The COMUF, however, did not have radiation safety experts on its rosters. Instead, ordinary shift supervisors were in charge of ensuring that workers followed rules. Thus, for example, film badges were stored in the supervisor's office, and workers had to pick them up when they punched in and drop them off when they punched out. Supervisors also had to keep a file on each worker, tallying the amount of radon gas he had inhaled.[67] The hierarchies of modern danger mapped neatly on to this (barely) postcolonial situation: paternalism and authority were now sanctioned by dispassionate rationality. The complexity of the technology, and the dangers it involved, conjugated colonial power into industrial discipline.

The codification of danger into disciplinary practices aimed to communicate that danger was a normal, everyday part of mining. From the COMUF's perspective, becoming a modern industrial worker meant accepting these risks as part of the job. A structure of premium pay further reinforced this normalization effort: jobs were classified according to their level of danger (physical hardship, dirty, unhealthy – the latter being jobs that required breathing apparatus), and workers received fixed premiums based on these classifications.[68]

But workers did not necessarily respond to the COMUF's efforts to normalize danger through premiums and disciplinary practices in quite the way it might have hoped. Consider the example of Marcel Lekonaguia, a local man who began mining for the COMUF when he was 17 years old. In the late 1960s, he developed a lung problem which, he was convinced, was caused by working underground. The company doctor asserted that he had nothing more serious than a passing respiratory infection, and granted him some time off the job. But Lekonaguia refused to believe this. At this point, Lekonaguia's version of the story diverges from the documentary evidence produced by management. He and his brother said that they went across the border to the Congo in order to get a second medical opinion, and there Lekonaguia was diagnosed with tuberculosis. According to COMUF documents, a replacement doctor issued an incorrect diagnosis while the regular doctor was on vacation, and the regular doctor never concurred with the diagnosis of TB. Whatever the case, Lekonaguia asserted that the illness was related to working conditions and claimed compensation. When the COMUF refused to give him anything beyond a few months of rest, he wrote to the state's welfare board for help. This, in turn, prompted state officials to demand an explanation from the COMUF – not only concerning Lekonaguia's particular case, but also TB rates at Mounana more generally.[69]

Meanwhile, Lekonaguia became convinced that the film badge that he and other miners had to wear in the mine shaft concealed critical information that would have proved that his illness was workplace-related. Why, he asked, did he have to turn this badge in regularly? He knew that the badges went to France for testing, but as far as he knew the results never came back. (They did in fact come back, but they were never transmitted to the workers.) Why was he not told the results? He would have nothing to lose by hanging on to the badges – at the very least, this act would irritate the COMUF. And with some luck, he would find another way to get the badges tested, thereby proving the link between work and illness. When I interviewed him nearly 30 years later, he was still looking.[70]

My point here does not concern Lekonaguia's true diagnosis, or whether his health problems did in fact relate to mining work: I could not get enough information to settle those questions, and what I did gather was contradictory and imprecise. Rather, the point is that while Lekonaguia did respond to industrial safety as a disciplinary practice, it was an unwelcome one that did not in fact bring him the promised protection. For him, the film badge became a technology of distrust: far from removing the

arbitrariness of colonial power, its opacity simply shifted that power into another register. He had become a modern industrial worker, but not of the sort that the COMUF had sought to encourage. Rather, he had learned about the importance of consulting outside expertise and the possibility of workman's compensation. We might think of his appeals to the state's insurance and welfare funds as a form of self-Gabonization: an assertion that the state had a responsibility to him as a citizen, as well as a responsibility to keep tabs on the COMUF. These appeals also served him personally: although he never did get the full compensation he had demanded, he did manage deeply to annoy the upper levels of COMUF management, all the while attracting too much state attention to be fired. Two decades later, the COMUF awarded him a series of medals for long and faithful service to the company.

A Fatal Accident

Granted, Lekonaguia was exceptional. Individual workers rarely raised such a stink. Collectively, however, they did manage to make their voices heard. By the mid-1970s, they were staging yearly strikes demanding regular promotions and pay raises (which they often obtained, though never as much as they'd asked for). Up until about 1973, however, the vast majority of conflicts and walk-outs were triggered by workplace accidents. Let me dissect one fatal accident and its aftermath. This episode brings together several themes that have run through our story so far. In it, we will see the ambiguous rôle played by the Gabonese state: it claimed to speak for the interests of its citizens, but it provided police to stave off trouble and helped recruit workers after mass resignations. We will see ways in which workers resisted the COMUF's attempt to normalize danger as part of modern, industrialized work. And we will see how the COMUF, with the help of state officials, sought to equate industrialized work with modern citizenship and co-opt sorcery in the service of modernization.

On Friday, 17 December 1965, a team of five Gabonese workers had begun their shift by hacking away at the walls of an underground chamber in the Mounana mine. Without warning, a huge slab of rock crashed down on top of them. One man was killed instantly. Another survived the blow but died in the hospital an hour later from internal haemorrhaging. Two other workers suffered from torn muscles and contusions. Only one escaped unscathed.[71]

This was the first fatal underground accident, and it seriously upset the rest of the workforce. Already, many men had proved extremely reluctant to work in the dark, narrow tunnels of the mine. Local beliefs held that evil spirits lurked underground. Only bad things could come from disturbing them. The accident confirmed these fears. The surviving miners returned above ground to a large crowd, who undressed them and piled their clothes and equipment in the supervisors' office, apparently to signify that the workers would have no more to do with the underground mine. No one showed up for work on Saturday.[72]

At four o'clock that afternoon, des Ligneris called miners to a meeting, and asked whether they expected to resume work on Monday. They did not reply. 'It's very upsetting when one of your friends gets hurt. But they just expect you to carry on as though nothing had happened. It's not right'.[73] At 9.00 pm, state officials showed up on the site to discuss the situation with des Ligneris, accompanied by police troops 'to avoid trouble'.[74]

No one reported for work on Monday morning. In an effort to determine the workers' demands, management questioned the personnel delegates. These delegates – 'évolués' one and all – were designated to facilitate communication between management and labour, and did not include underground miners in their ranks. Not surprisingly, then, miners did not trust them. Nor did they trust labour union delegates: the union had close ties to the state, and the state seemed to be on the side of the COMUF. Preferring to negotiate with spokesmen rather than the whole mass of angry workers, management asked the underground miners to appoint five representatives. At the end of the day, these five men met with high-level government representatives and personnel and union delegates. Xavier des Ligneris reported:

> After several hours of discussion among Gabonese, the Director of Mines invited us to join the meeting and transmitted to me the workers' demands: work would only resume if the monthly salary for miners was uniformly raised by 60,000 francs. I had until the next day to respond.[75]

To the COMUF, this appeared to be a very audacious demand: the monthly income for a miner, including premiums, was less than 10,000 FCFA. But we might interpret it as the conjugation of expectations born from industrial pay practices with local custom. For one thing, local practices dictated that the perpetrator of an accidental death offer a large payment to the victim's family in compensation.[76] For another, if dangerous work was rewarded by a premium, then why not expect a huge premium once that work had proved not just dangerous but fatal?

Of course, the COMUF would never agree to such a huge raise. The next day, des Ligneris declared that he first had to consult with company headquarters and the Gabonese government, but that in any case 'any discussion could only take place after the resumption of work, and after enough time has passed so that there is no relation between the accident and the salary demands'.[77] Clearly, he did not want to set any precedents that linked accidents to pay raises. Accidents, he insisted, were a normal part of industrial life. The COMUF needed workers to accept this without having everyone expect exceptional compensation whenever one person died. The miners who had walked off the job were not mollified. State officials, backed by the chief of police, tried to persuade them to resume work, with no success. Offended by the COMUF's heartlessness and stinginess, 33 miners resigned immediately. Another 30 resigned the following morning and returned to their villages.[78]

In the face of this escalation, the COMUF welcomed a proposal from labour representatives to call in the village heads. A long meeting ensued;

once again, management was not invited. The next day, the village heads asked permission to visit the site of the accident; des Ligneris and some of his lieutenants accompanied them down into the shaft. There are no reports on what happened underground. But the action must have appeased some workers, because a few days later 21 men were back at work. Still, none of the 63 miners who had resigned the previous week had returned, so the mine remained shorthanded.[79]

Meanwhile, the COMUF pursued discussions with state officials in the capital, Libreville. The labour minister agreed to let the COMUF hold off on salary discussions for a few weeks, but insisted that these discussions take place promptly thereafter. Xavier des Ligneris deemed this acceptable for pragmatic reasons: it would 'valorise the mining profession, [otherwise] those who stayed on would consider themselves victims of an injustice and we wouldn't find anyone else to hire'.[80] He remained reluctant, however, to increase the underground premium.

Twelve men who had resigned returned in mid-January; des Ligneris noted that 'after several difficult days during which the workers did as little as possible, they returned to a normal frame of mind'.[81] But his optimism proved premature: a few weeks later, workers had lost whatever enthusiasm they had managed to muster. On any given day, only two-thirds of them showed up. By mid-February, the two months of slowdowns had seriously undermined the COMUF's production schedule. Personnel delegates had reported rumours that the departed miners would not return without higher salaries. At the end of February, management finally agreed to an average salary increase of 13 percent.[82]

This was far less than the workers had asked for, however, and at the end of March the COMUF still needed 39 workers. It turned to state officials for recruitment assistance. Although the company would have preferred to take back trained employees, it had reached the point where it would hire anyone willing to work. Accordingly, with help from local authorities, it devised a series of radio advertisements, aired over a five-day period in five local languages plus French. These adverts reveal how the COMUF and the state sought to construct and manipulate the relationship between industrial work, local customs, and state citizenship. The first advert went as follows:

> Residents of the Haut-Ogooué:
>
> You're looking for work. You want to practise a good trade, in a big Company in the Region. Quickly, go sign up to be an underground Miner at the COMUF. You haven't done so until now, perhaps because you learned that last year we had an accident that caused the death of two workers. This was a workplace accident, such as might happen in any company. Workplace accidents are not more frequent, and you are no more exposed to them than to hunting accidents, road accidents, etc . . . On the contrary, you are protected by safety measures that have been carefully studied and well adapted. In coming to work at Mounana, you will receive direct professional training on the job and you will earn a very good salary. You will therefore learn a very good trade, with a good future in Gabon.[83]

The advertisement thus sought to normalize the accident. The fatalities had not occurred specifically because the work took place underground. Rather, accidents were simply a normal part of industrial work – indeed, a normal part of life. Workers were safer at the COMUF than elsewhere, because safety measures had been carefully elaborated for their protection.

The next three days repeated this message, adding specific details concerning salary, training, and opportunities for promotion. On the fifth day, the advert pulled out all the stops, mixing a cautionary tale of sorcery with an appeal to citizenship:

> Once upon a time, gold prospectors, helped by porters, arrived in the village of Mekambo in Bandzabi country. In this village, under a hut, stood a basket of meat destined for the chief of the county. The porters immediately ate all the meat. The county chief and the other tribal chiefs were unhappy. They had a meeting and decided to cast a spell and engage in diabolical operations so that the seekers of gold would find nothing. And no gold was found in Mekambo. They had to go to Bakota country to find some. Since then, the chiefs and residents of the Mekambo region lament their poverty. They regret their initial act, their intransigence. They especially regret having rescinded all possibility of wealth in the future.
>
> WORKERS OF THE HAUT OGOOUÉ!
>
> Do not act like them. Let your reason be sufficiently strong, and know when to profit from the high salaries of the Compagnie des Mines d'Uranium of Mounana. It's for the good of the Nation and the future of Gabon.[84]

In this story, prospectors were the harbingers of wealth. It was not the whites who violated local customs, but the greedy porters whom they had hired. Still, local villagers should have forgiven this trespass. By using witchcraft, they only ended up depriving themselves of prosperity. Wealth, the message ran, would come to someone – it was inevitable (like modernity). Witchcraft could not stand up to modernity; it could only stop those who practised it from benefiting. In the name of reason and patriotism, workers should abandon their traditional ways, shed their anger and intransigence, and come forth to profit from the COMUF's wealth.

Over the course of the next few months, the COMUF managed to recruit the workers it needed – perhaps thanks to these radio announcements, or perhaps simply because people needed work. But the recruitment levels did not remain stable. For at least the next decade, whenever accidents occurred involving several Gabonese fatalities, recruitment problems resurged. Meanwhile, the COMUF workers had learned how to stage a strike, and they would continue to apply this lesson throughout the 1970s.

Conclusion: Conjugating into the Technological Future

So how did the intertwining of nuclear and postcolonial rupture-talk play out in uranium mining?

In Madagascar it was not the presence, but rather the absence, of nuclear rupture-talk that was striking. There was no larger 'nukespeak' – of either the romantic or the apocalyptic variety – in the Androy desert. Invoking nuclear geopolitics and the radiance of France served ideological purposes in metropolitan uranium mines. But it wouldn't accomplish anything in the Androy. Since the French viewed the Tandroy as irredeemably 'uncivilized', they did not bother trying to enrol them in the culture and politics of nuclearity. Nor did the Malagasy state find much use for uranium diplomacy in the few years between independence and the CEA's departure. In short, there were no channels through which nuclear rupture-talk might have entered Tandroy discourse, or mattered to their lives. Why should the Tandroy have cared about how vazahas living thousands of miles away chose to kill each other, or produce electricity? (How many of those vazahas even knew the Tandroy existed?) In contrast to the places usually included in analyses of the nuclear age, in the Androy staking a claim to nuclearity would not get anyone anywhere.

Yet the absence of nuclear rupture-talk in the Androy was no more innocent than its presence elsewhere. Absence had consequences. The claim-staking aspects of the 'nuclear' – and the 'anti-nuclear' – themselves produce knowledge, such as knowledge about the dangers of radiation. At Ambatomika, such knowledge was entirely controlled by the CEA. Site directors did not feel it worthwhile to explain radiation to the Tandroy: they were just too 'primitive' to comprehend. The radiation detectors that the miners wore carried no referents whatsoever. None of the Tandroy even remembered them. And no follow-up studies of the health of Tandroy uranium miners were ever performed. We may never know the precise health effects of the absence of nuclear-age ontology in the Androy, but given the well-documented health risks of uranium mining elsewhere,[85] we can surmise that the consequences were real.

In Gabon, the COMUF operated on a larger scale, over a longer period of time, and in a more systematized manner. It therefore paid more attention to questions of radiation protection. But it transmitted information about radiation not as knowledge, but as discipline. The company did try to follow international exposure norms, but the absence of a specialized radiation protection division (such as the one to which CEA mines in France had direct access) had the effect of deflecting attention from the special risks of work in a radioactive environment. Nuclear ontology existed in Gabon, but it was weak. Radiation was simply one of several workplace dangers, the management of which required disciplining workers to follow rules. Of course, this flattening suited the COMUF just fine: given how much fear existed already, the last thing management wanted was to create more. All of this helps to situate Marcel Lekonaguia's story. His theories about cause and effect could be dismissed because they did not in fact correspond to accepted knowledge about nuclear risks.[86] He clearly knew that the film badges symbolized, even recorded, danger. But he couldn't make all the necessary links, and his access to external sources of knowledge was so limited as to be meaningless.

From the perspective of Malagasy and Gabonese uranium workers, postcolonial rupture-talk was more salient than the nuclear brand. Postcolonial rupture talk created expectations and opened up possibilities. It also generated tension, when it confronted the reality of colonial continuities embedded in sociotechnical practices that were supposed to be transformative. The CEA and the COMUF sought control over the process of decolonization by trying to establish technological knowledge as a new basis for social relations. While these efforts had roots in the colonial 'civilizing mission', expatriates emphasized the differences between their endeavours and colonial attitudes. Rhetorically, this meant denying racial differentiation and claiming the possibility of boundless upward mobility through the acquisition of technological knowledge.

In practice, however, mobility was bounded in all kinds of ways. Access to knowledge that would promote mobility was controlled by French experts and limited to those deemed appropriately 'evolved'. The skills in question were never purely technical, but always *socio*technical. This hybridity functioned to control mobility. Thus Merina in Madagascar who had acquired the proper technical qualifications still could not fill supervisory positions on the same terms as the French for 'psychological' reasons, and Gabonization was not just about job training, but about creating 'modern' lifestyles. Such sociotechnical practices conjugated colonial power relations into a technological future.

Structurally, the new technological basis for social relations derived from the colonial social order, and at least on a local level it produced very similar results. For those who did not have access to the full range of knowledge, sociotechnical practice could be just as opaque an instrument of power as colonialism. Consider the COMUF's approach to workplace accidents. Making Gabonese into industrial citizens involved inducing them to accept the dangers of modernity as normal. Danger, the company argued, was a regular part of life – but in industrial work it could be controlled. Controlling danger meant controlling the workers' relationship to it, and thus in the end disciplining the workers themselves. For workers, this discipline represented a continuation of colonial power relations.

In one sense, then, the effort to produce industrialized citizens was continuous with colonialism. But miners did not become industrial workers in all the ways the COMUF desired. They responded to modern dangers – and the power relations embedded therein – by keeping film badges, appealing for compensation, walking off the job. These actions did not always achieve the hoped-for results. Nevertheless, workers did manage over time to improve their incomes and working conditions. And they did not succumb to the COMUF's vision of modern citizenship: many did not abandon polygamy, most continued to harbour their extended families, when trouble struck many returned to their villages, and so on. Within certain boundaries, workers thus chose the terms of their industrialization, and their citizenship, and as we saw these choices sometimes had ripple effects on the rest of the uranium industry. As the COMUF Gabonized its workforce, the workforce – and the state – Gabonized the COMUF. The

workers did so by forcing the company to contend with local conditions. The state did so by helping with policing and recruitment, acquiring a significant financial stake in the company, getting involved in international contracts, and demanding that the company account for the rate of Gabonization of the workforce.

For Malagasy and Gabonese uranium workers, the language and experience of decolonization thus trumped the ontology of the nuclear age. Nuclear and postcolonial rupture-talk combined in shaping sociotechnical practices, but what mattered most to them was how these practices conjugated colonial power relations into real and imagined technological futures. The importance of nuclear ontologies lay in the power effects performed by their absence or weakness, and in the distillation of their polarities by postcolonial priorities.

Notes

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1. For a sample of works on the meanings and politics of nuclear development around the world, see: Abraham (1998); Boyer (1985); Cathcart (1994); Cawte (1992); Cohen (1998); Gowing (1974); Hecht (1998); Hewlett & Anderson (1962); Hilgartner et al. (1983); Holloway (1994); Josephson (2000); Lewis & Litai (1988); MacKenzie (1990); Péan (1982); Perkovich (1999); Veldman (1994); Walker (1989); Weart (1988); Winkler (1993); and Wittner (1993).
2. See: Cathcart (1994); Gowing (1974); and Hecht (1998).
3. Over the course of the Cold War, this bimodal positioning became considerably more complex. While the USA and Britain in particular were eager to stop *all* other nation-states from acquiring nuclear weapons, it became particularly undesirable (morally, technologically, politically) for formerly colonized nations – indeed, for any 'underdeveloped' state – to 'go nuclear'. Nations that broke this taboo eventually became known as 'rogue states' [Klare (1995)]. Meanwhile, India framed its nuclear development very much in terms of postcolonial nationalism, thereby radically challenging the bimodal positions defined by European imperial states and the USA [Abraham (1998); Perkovich (1999)].
4. For a sample of studies on the 'civilizing mission', see: Adas (1989); Conklin (1997); and Cooper & Stoler (1997). For the transformation of the 'civilizing mission' into ideologies of development, see: Cooper (1996); Cooper & Packard (1997); and Escobar (1995).
5. A deposit contained only so much minable ore. The exact amount of minable ore, unknown in advance, depended on a conjunction of economic, political, geological and technological considerations.
6. Bourgois (1988) uses the term 'conjugated oppression' to signify the conflation of class and ideology in the oppression of Guaymi plantation workers in Panama. For him, as for me, the metaphor of conjugation suggests a result that is 'more than merely the sum of its constituent parts' (ibid.: 330) – in his example, the conjugation of class and ideology leads to the Guaymi internalizing and performing their own oppression.
7. There is a vast literature on nuclear politics and diplomacy that never goes beyond state archives, and an almost equally vast literature on anti-nuclear activism that never looks

beyond social movements. For examples, see most of the work cited in note 1. A few exceptions to this polarization in subject matter and sources include: Gusterson (1996); Hecht (1998); and Lindee (1994).

8. In addition to Borstelmann (1993), Cawte (1992), Helmreich (1986) and Kuletz (1998), see: Bothwell (1984); Eichstaedt (1994); Moody (1991); Moody (1992); and Owen (1985).
9. See note 6.
10. CEA/DP/DREM, Groupement Afrique-Madagascar, 'Notice d'Information destinée aux Européens susceptibles de partir pour l'Afrique ou Madagascar' (1 February 1963), [Cogéma archives]. Henceforth cited as '*Notice*'; in the following section, the page numbers of quotations from this *Notice* are given in the text in [square brackets].
11. For analyses of relationships between gender and imperialism, see, among others: Clancy-Smith & Gouda (1998); Hunt (1999); Hunt et al. (1997); and Stoler (1995).
12. Although technological sophistication had long served Europeans as a measure of civilization and a justification for colonial rule, concrete attempts to use technical education as a form of uplift belonged to the late colonial/decolonizing era. See: Adas (1989); Cooper (1996); and Cooper & Packard (1997).
13. Note that most Malagasies did and do not think of themselves as African. Academics sometimes include Madagascar in African studies, and sometimes place it in relation to other Indian Ocean islands.
14. In fact these appellations are not perfectly interchangeable, and in general Malagasy ethnic categories are much more complex than this simplified description would suggest. These complexities do not bear directly on my analysis, however. For a more nuanced analysis of Malagasy ethnicities, and in particular the political construction of the 'Merina' ethnic category, see Larson (1996).
15. The exact provenance of the name 'Ambatomika' remains obscured by legend. Some say a Frenchman forged the name; others, a Merina. The prefix 'amb' means 'where there is'; 'bat' means 'rock'; and mica could often be found in the same place as uranium or thorium ore. So 'Ambatomika' signifies 'the place where there are atomic and mica rocks' [interviews and Paucard (1992)].
16. Ambatomika was hardly the only workplace to correlate class, ethnicity and task in its work hierarchies. Examples abound; for a close parallel, see Bourgois (1988) and Bourgois (1989).
17. CEA, Mission de Madagascar, Service 'R', Groupe Géologique G-3, 'Rapport sur la Campagne Géologique de Mandoto – Miandrivako (Avril-Juillet 1948)', 2 [Cogéma archives].
18. Interviews: LG (F); JM & GM (F); see also Robert Bodu, 'Compte-rendu de mission mars 1960' (DREM, 12 July 1960) [Cogéma archives].
19. Interview: PR (F).
20. The quotations in this paragraph are from: CEA/DREM, 'Compte-rendu de mission du 16 au 27 Avril 1958 à Madagascar' (19 May 1958), 19 [Cogéma archives].
21. Marc Edmond Morgaut, 'Mission à Madagascar pour le Commissariat à l'Energie Atomique du 11 au 21 novembre 1958', 5 [Cogéma archives].
22. Ibid., 3–4.
23. CEA/DREM, op. cit. note 20, 20.
24. Ibid.
25. Quotations from Morgaut, op. cit. note 21, 8.
26. Ibid., 4, 7.
27. Ibid., 8.
28. Indeed, it is striking that in Ambatomika documents and interviews, Madagascar's independence in 1960 does not figure at all.
29. Interviews: JR1(F), JR2(F), JM(F).
30. Michel Gruet, 'Mission à Madagascar, 7 Septembre – 21 Octobre 1963; Compte-rendu abrégé' (4 November 1963), 3 [Cogéma archives].
31. A new deposit had been found about a hundred kilometres away from Ambatomika, in Betioky. In the early 1960s, the engineers began to move operations there. The Betioky

site resembled Ambatomika's in quantity and quality, though, and could not compete with the finds in central Africa.
32. Interviews: JR1(F), JR2(F).
33. Morgaut, op. cit. note 21, 4.
34. Ibid.
35. Interview: YL(F).
36. Interview: JB(F/P).
37. Interview: JM & GM (F).
38. For more on Tandroy rituals involving zebu, see Heurtebize (1997). A good deal has been written on the political and cultural economy of cattle in Africa. One especially interesting example that also addresses issues surrounding the construction of 'development' and 'underdevelopment' in ways relevant to the present paper is Ferguson (1994).
39. Interview: F(M).
40. Indeed, the Tandroy way with zebus continues to cause consternation among other Malagasies today, as was plentifully evident from remarks made to me during my visit to Madagascar.
41. Interview: T(M).
42. Interview: J(M).
43. Interview: T(M).
44. Xavier des Ligneris, sm n. 27 (9 January 1961), Directeur des Exploitations à M. le Directeur Général, 'Effectifs – Logements – Budget 1961', 1 [GH: personnel data, COMUF archives].
45. Ibid.
46. Ibid., 2.
47. Ibid.
48. Examples in: 'Note de Service à MM. les Responsables du marché' (8 April 1963); 'Note d'Information à tous les Agents' (19 February 1964); 'Note de Service n. 49 à MM. les adhérents et invités du Cercle des Employés' (27 May 1964); 'Rapport d'Activités, Service Social' (1967) [GH: social life/living; COMUF archives].
49. Interview: JM(G).
50. 'Etudes Effectifs', 1960–70 [GH: personnel data; COMUF archives].
51. Lucien Gabillat, 'Etude' (13 March 1962) [GH: personnel data; COMUF archives]. See also Bodu (1994).
52. The core of Gabonization was an increasingly formalized 'professional training' programme, officially beginning in 1964 with a training programme for plant workers. In 1965, miners joined the programme. In 1968, a literacy programme was added. By 1973, 140 men had passed through the plant programme, 468 through the mining programme, and 337 through the literacy programme.
53. Memo, N. Morin to M. Durand, RF/sc – n. 0746/70, n.d., 'Objet: Formation professionnelle,' 2 [GH: formation professionnelle; COMUF archives].
54. 'Rapport du Service Social' (1962–63); 'Rapport d'Activités, Service Social' (1967). [GH: social life/living; COMUF archives].
55. Interview: MM(G).
56. Progress was steady but slow. Gabonese did not fill half of all 'cadres' posts until 1982, and even then there were still twice as many expatriates as Gabonese in the 'cadre supérieur' category: Christophe Lindzondo, 'Une approche du contrat social de la COMUF', rapport de stage (1984) [GH: personnel data; COMUF archives].
57. COMUF, *Budgets* and *Rapports d'Activité*, 1965–75 [GH: Budgets/RAs; COMUF archives].
58. M. Harel to M. le secrétaire d'état auprès du Premier Ministre Chargé des Participations, des Relations avec les Etablissements Publics et Sociétés d'Etat (26 May 1975) [GH: personnel data; COMUF archives].
59. Telex correspondence from H. Basset to Peccia-Galletto (1975); 'Grève des 3–4 Janvier 1975, Déroulement des Faits' (13 January 1975) [GH: grèves 1970s; COMUF archives].

60. Francs of the African Financial Community; this currency was tied to the French franc.
61. COMUF, 'Plan Quinquennal 1975' (31 May 1974) [GH: plans quinquennaux, 1975–79; COMUF archives].
62. 'Entretien avec M. Ampana, 28–29 Nov. 1975'; 'Compte-rendu des négociations entre le Gouvernement Gabonais – COMUF – et l'Organisation Iranienne de l'Energie Atomique' (1976) and associated memos; Edouard Alexis M'Bouy-Boutzit, 'Confidentiel-Secret Note à la haute attention de Monsieur le Président de la République' (6 January 1976); correspondence between H. Basset and Edouard Alexis M'Bouy-Boutzit, 1976–77; 'Agreement between the Compagnie des Mines d'Uranium de Franceville "COMUF" (Gabon) and Atomic Energy Organization of Iran' (draft, probably September 1976); misc. telex correspondence 1976–78 [GH: Iran contract; COMUF archives].
63. 'Rapport de la formation professionnelle avec la gabonisation des employés' (16 February 1973) [GH: formation professionnelle; COMUF archives].
64. N. Morin, 'Ventes au CEA' (29 May 1970); 'Conséquences financières d'une réduction d'activité de Mounana' (11 June 1970); Ch. Guizol, 'CR fait par M. de Courlon de nos entretiens du 28 Juillet 1970 – Programme quadriennal 1970–1974 du 21.7.70' (20 August 1970); J. Peccia-Galletto to Ch. Guizol (6 July 1970); COMUF, 'Plan de Decennal' (21 June 1971); J. de Courlon, 'Eléments d'un programme d'exploitation équlibre' (21 July 1971) [GH: Programs 1968–71; COMUF archives].
65. 'Consignes générales de sécurité à l'usine', officially drawn up on 8 May 1961 by Xavier des Ligneris, and approved by Directeur des Mines du Gabon (1 June 1961) [GH: working conditions; COMUF archives].
66. See Hecht (1998): Chapter 5. On radiation protection in the USA, see: Hacker (1987); Hacker (1994); Walker (1992); and Walker (2000).
67. 'Consignes relatives à la protection contre les dangers de la radioactivité au jour et au fond', officially drawn up on 5 May 1961 by Xavier des Ligneris, and approved by Directeur des Mines du Gabon (1 June 1961) [GH: working conditions; COMUF archives]; Henri Pello, Memo (26 September 1966), 'Stockage et Distribution des Films Detecteurs de Radioactivité' [GH: personnel data; COMUF archives].
68. 'Convention passée entre la Compagnie des Mines d'Uranium de Franceville et les Représentants des Travailleurs (Délégués du Syndicat UTMG, Section de Mounana)' (1 April 1965) [GH: personnel data; COMUF archives].
69. Interview: ML & DO (G); Christian Guizol to Directeur Général de la Caisse Gabonaise de la Prévoyance Sociale (19 October 1970), Objet: Allocations familiales de M. Lekonaguia Marcel; Christian Guizol to Directeur Général de la Caisse Gabonaise de la Prévoyance Sociale (26 October 1970), Objet: Monsieur Lekonaguia; J.C. Andrault to Docteur C. Gantin (27 October 1970) [GH: working conditions; COMUF archives].
70. Interview: ML & DO (G).
71. Xavier des Ligneris to M. le Président, Memo, 'Accident Chambre 5' (18 December 1965) [GH: working conditions; COMUF archives].
72. Xavier des Ligneris to M. le Président, Memo (27 December 1965), 'Suites de l'accident du 17 Décembre 1965' [GH: working conditions; COMUF archives].
73. Interview: ZB & IB (G).
74. Xavier des Ligneris, Memo, op. cit. note 72.
75. Ibid.
76. Interview: JM(G). Note that the COMUF did in fact offer a substantial cash settlement to the parents of the two men who had died.
77. Xavier des Ligneris, Memo, op. cit. note 72.
78. Ibid.
79. Ibid.
80. Ibid.
81. Xavier des Ligneris to M. le Président, Memo (12 January 1966), 'Situation du personnel ouvrier de la mine' [GH: working conditions; COMUF archives].

82. Xavier des Ligneris to M. le Président, Memo (18 February 1966), 'Effectif Mine' [GH: working conditions; COMUF archives]; Jacques Peccia-Galleto to M. le Directeur des Exploitations (16 February 1966); Xavier des Ligneris to Jacques Peccia-Galleto (24 February 1966), BG/AP n. 1549 [GH: personnel data; COMUF archives].
83. 'Avis Radio' (March 1966) [GH: personnel data; COMUF archives].
84. Ibid.
85. See, for example: Dropkin & Clark (1992); Walker (1992).
86. Not even anti-nuclear activists have ever suggested a relationship between radiation exposure and tuberculosis.

References

Primary Sources

Compagnie Générale des Matières Nucléaires (Cogéma), Razès, France. In the 1970s the Cogéma took over the management of France's nuclear fuel cycle from the Commissariat à l'Energie Atomique (CEA). It consequently houses all documentation pertaining to the CEA's mining operations in Madagascar from 1946 to 1969 (when CEA mining ceased). These include monthly reports on mining operations, employment records, several in-house sociological studies commissioned to analyse race and ethnic relations in the mines, and more. The papers are not, however, catalogued in any way identifiable to the public: accessing documents involves telling the records manager what one is interested in, and hoping for the best. As a result, citations here do not include box numbers – only document titles. Abbreviations found in references: DP (Direction des Productions); DREM = Département des Recherches Minières.

Compagnie des Mines d'Uranium de Franceville (COMUF), Gabon. During my visit in 1998, the COMUF had a vast collection documenting over 40 years of its activities. Documents included employment and medical records, weekly reports on mining operations and work organization, blueprints and operations manuals for the yellowcake factory, reports on living conditions and social relations by the company's social worker, labour union files, correspondence pertaining to all levels of activity, and much more. These were not catalogued in any way. Furthermore, the chances that these papers survived the closure of the mine in 1999 are extremely slim; when I was there, the company was planning to destroy them. I was allowed unlimited copying, and was thus able to reconstitute a very small part of these archives in my personal collection. Citations to these papers therefore include references to my filing system (indicated by 'GH') rather than the COMUF's, since this is the only realistic method to retrieve and consult any of these papers.

Interviews

I conducted all the interviews cited in France (1998 and 2001), Gabon (1998), and Madagascar (1998). Interview subjects included French geologists, engineers, and managers; Gabonese workers, technicians, and managers; Malagasy workers and technicians. Because permission to quote by name was not always available, I have used a private letter coding system to identify sources in the endnotes.

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Gabrielle Hecht is the author of *The Radiance of France: Nuclear Power and National Identity after World War II* (MIT Press, 1998) and co-editor of *Technologies of Power* (MIT Press, 2001). Her current research is on uranium

mining in colonial and postcolonial contexts, including Madagascar, Gabon, South Africa, Namibia, and native lands in Australia and North America.

Address: Department of History, University of Michigan, 1029 Tisch Hall, Ann Arbor, Michigan 48109–1003, USA; fax: +1 734 647 4881; email: hechtg@umich.edu