

Roxanne Panchasi “You don’t screw  
with the Sahara”<sup>1</sup>:  
Radioactive Dust  
and the Return of  
the French Imperial  
Repressed

Abstract: In 2021 and 2022, traces of the series of nuclear bombs France detonated in Algeria during the 1960s seemed to ‘come home’ in the form of tons of ‘lightly radioactive’ Saharan sand that filled the atmosphere above and rained down onto surfaces throughout France. Multiple commentators characterized this ‘African dust’ as a postcolonial ‘boomerang,’ the return of a repressed past, a haunting, and a kind of revenge. This article considers closely the range of representations of this Saharan sand in France as material and metaphoric deposits on the contemporary landscape. Pursuing the coincidence of these recent episodes of a recurrent phenomenon with the crisis of the COVID-19 pandemic and a particular moment of reckoning in the history and legacies of French nuclear imperialism in North Africa and the Pacific, the article examines radioactive dust as memorial evidence, toxic residue, and imperial remains.

Keywords: Algeria, France, Sahara, Dust, Nuclear Weapons

<sup>1</sup> My title is borrowed from a *Copenhagen Post* headline from March 1, 2021: “You don’t screw with the Sahara: How Denmark has been caught in the crossfire of a six-decade grudge” (Hamilton 2021).

Dust is the opposite thing to Waste, or at least, the opposite principle to Waste. It is about circularity, the impossibility of things disappearing, or going away, or being gone. Nothing can be destroyed [...] Nothing goes away

(Steedman 2002, 88).

Dust clouds are dispersed, atmospheric events. One could say: diasporic. A spreading, creeping saturation

(Marder 2016, 65).

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## February 1960: Reggane and Paris

On February 13, 1960, television journalist Michel Péricard went out into the streets of Paris, microphone in hand, to interview passersby about a historic event that had taken place early that morning in the Sahara Desert: the detonation of the first French atomic bomb at a firing range near the village of Reggane, close to 1200 kilometres from Algiers and 2500 kilometres from the French capital (INA Officiel 2020). Codenamed *Gerboise bleue*, France's inaugural atmospheric nuclear explosion had a blast yield of 70 kilotons, more than four times the size of the 'Little Boy' bomb the U.S. had dropped on the Japanese city of Hiroshima in 1945. With this operation, the nation entered the *club atomique* [atomic club] of the world's nuclear-weapon states, extending the 'radiance' of its civilian nuclear research and applications since the Second World War to the military field (Hecht 1998; Mongin 2011). "Hurray for France!" President Charles de Gaulle declared in response. "As of this morning, she is stronger and prouder" (Vichney 1960).

Recording for a segment that aired that evening on *Radiodiffusion-télévision française's Journal télévisé du 20H* [8 o'clock evening news], Péricard invited everyday Parisians to share their thoughts *Pour ou contre la bombe atomique?* [For or against the atomic bomb?]. Asked if she knew where the nation's first bomb had exploded, one cheerful woman replied: "In the Sahara!" "Where in the Sahara?" Péricard asked. She laughed, unable to say. "You don't know where Reggane is?" Péricard continued. "No, I've never been," the woman joked. She was certain about one thing, however: "It's very good [...] we're doing what the others are doing!"

After speaking with a few more people who expressed either their approval or concern regarding the costs and dangers of nuclear weapons, Péricard approached one last interlocutor. Other pedestrians, some with umbrellas, went about their business in the background on this cold, wet February day. The man Péricard had stopped affirmed this French bomb

detonation as “a technical and scientific achievement of the first order.” Asked to identify the other states in possession of nuclear weapons, he listed the *club atomique*’s three pre-existing members: “the Americans, the Russians, and the English.” “And you don’t think this could have disastrous consequences for us?” Péricard queried. “Absolutely not,” the man responded. “You don’t think this rain that’s falling is directly related to the bomb?” Péricard pressed. “No, no,” insisted the man. “In my opinion, meteorological conditions and the atomic bomb have absolutely nothing to do with one another.” The two chuckled, bringing the feature to a light-hearted close (INA Officiel 2020).

For these men chatting on a damp Parisian street in 1960, the idea that the weather in France might be affected by the detonation of a nuclear bomb hours earlier in the Sahara seemed comical, even absurd. But while the rain in the French capital that day may not have been caused by the explosion near Reggane, nuclear weapons and climatic conditions were not then, and have never been, mutually exclusive concerns.<sup>2</sup> As anthropologist Joseph Masco has pointed out, the historical “linkage between the atomic bomb and the weather” stretches back to the earliest days of weapons experimentation in the United States (Masco 2014, 80). Temperature, winds, humidity, and precipitation are all factors that can influence the outcomes of a given bomb explosion, particularly those conducted atmospherically.<sup>3</sup> A nuclear bomb, in turn, produces a powerful blast or shock wave, and releases a tremendous amount of thermal energy and radiation. High-velocity winds, extreme pressure in the surrounding air and atmosphere, small earthquakes, and large oceanic waves are some of the ways such explosions can alter weather patterns in the short term (Atomic Archive 1998).

In the days, weeks, and months following a detonation, the spread of fallout and radiation is shaped by changing weather conditions. Clear skies (or not) can cause clouds of radioactive dust in a desert setting to move into and through the atmosphere more (or less) quickly. Rain can precipitate fission products and other radioactive particles (including sand) downwards, contaminating soil, water, and food supplies. Over the longer term, weather variables influence the size of the geographic area affected by a given nuclear explosion and how its residual human and environmental impact shifts over time (Philippe, Schoenberger, and Ahmed 2022).

After *Gerboise bleue*, France’s first atomic bomb detonation in the Sahara, came *Gerboise blanche* in April 1960, *Gerboise rouge* in December, and *Gerboise verte* in April 1961. Following these four initial aerial blasts, France exploded 13 more bombs underground, further south at In Ekker in the Hoggar Mountains. The series of 17 so-called ‘tests’ began during

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<sup>2</sup> A recent study by scientists at the University of Reading suggests that precipitation levels far from nuclear weapons sites may have indeed been affected by the atmospheric bomb detonations of the 1950s and 1960s (Harrison et al. 2020).

<sup>3</sup> Reports of *Gerboise bleue* note that weather conditions, unfavourable before the operation, cleared up by the morning of February 13, 1960. In April 1961, French military and scientific officials attributed the underwhelming results of the *Gerboise verte* detonation to poor weather conditions in part (Revol and Bataille 2002; Tertrais 2013).

the Algerian War and continued—on the other side of Algeria’s independence in 1962—until 1966, when France relocated its nuclear weapons experimentation program to the Pacific.<sup>4</sup> The French finally evacuated the nuclear sites at Reggane and In Ekker in 1967, but the Sahara detonations’ health, environmental, and psychological effects have radiated, quite literally in some ways, for decades since.

In 2021 and 2022, traces of these bomb explosions in Algeria seemed to ‘come home’ to France in the form of tons of Saharan sand that filled the atmosphere above and rained down onto surfaces throughout the country. While these dust incursions were neither the first nor the largest experienced in France, they became the object of an extraordinary fascination inflected with contemporary anxieties about climate change and catastrophe. Darkening skies, carpeting landscapes, and diminishing air quality significantly, these dramatic weather events suggested a looming apocalypse at the height of a global pandemic during which millions of people around the world were suffering and dying from respiratory illness and failure. The sand that had made its way from North Africa to France was also radioactive. And while this feature of migrating Saharan dust was already familiar to scientific researchers well before these episodes, its more public revelation as ‘news’ in France came at a particular moment of crisis and reckoning with the history and legacies of empire, including the human and environmental costs of the nation’s nuclear weapons experimentation in Algeria. As this essay shows, it was the convergence of these factors that made it possible for multiple French and international commentators to frame Saharan dust as a postcolonial reminder, a return of the repressed, and even a form of revenge. In a French political and cultural context haunted by the past and present of the bomb in/and empire, the radioactive dust of 2021 and 2022 held material and moral significance as memorial evidence, toxic residue, and imperial remains.

### February 2021: The Jura Mountains

Early in the morning of February 6, 2021, Pierre Barbey, a radiation protection specialist from Normandy, strapped on a pair of snowshoes and headed out for a hike in the Jura Mountains. As he recalled later, “the snow was white, [but] during the walk everything changed, and it lasted the whole day.” While his companions “were worried by the sight of this ochre sand that covered the ground,” Barbey, a biochemist at the Université de Caen and Vice-President of the French *Association qui contrôle la radioactivité dans l’Ouest (ACRO)*, had experienced a similar occurrence

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<sup>4</sup> A series of plutonium experiments (codenamed *Pollen*) intended to simulate accidents rather than bomb detonations were also conducted during this period. While historical and contemporary sources regularly use the word “test” to distinguish between nuclear weapons or devices detonated for experimental purposes rather than as acts of war *per se*, there is a politics of diminishment to this usage. This is especially true when it comes to the historical dissociation between France’s atmospheric detonations in the Sahara and the Algerian War of Independence during which those detonations took place. See Panchasi, 2019.

many years before (Courageot 2021). Recognizing the substance as sand from the Sahara Desert, he collected a sample from residue that had accumulated on a car and took it back with him to ACRO's lab in Héraultville-Saint-Clair, near Caen, for closer examination.

Barbey and his friends were not the only ones to notice the strange phenomenon. In many parts of France, skies had turned “an unusual color, a little orange, a little yellow, a little metallic” (Fraisie 2021). Throughout the day, national and international weather services reported and attempted to explain the “golden dust” that had fallen to the ground and onto thousands of car windshields across the country (including Burgundy, Franche-Comté, Alsace, the Vosges, the Alps, and the Lyon area), and into Switzerland, Belgium, and other neighboring states (Agence France Presse 2021; Associated Press/AP 2021; Coutures 2021; euronews (en français) 2021; Goudaillier 2021; Morin and Givord 2021; Munier 2021; Shepherd 2021; L'Union 2021). Images of the sand proliferated on social media platforms like Twitter, TikTok, Instagram, and Facebook (Beauchemin 2021; Yahoo News! 2021).<sup>5</sup> In snow-covered regions, the effect was particularly striking (Jenni 2021; Webber 2021). Shona Tate of the British Alpine Ski School in Chamonix described the scene: “A bit like doomsday here today [...] it's raining Sahara sand” (PlanetSKI 2021). “Don't eat the orange snow!” warned the UK's *Daily Mail*, describing the “freak weather incident” that had “turn[ed] the Alps ski resorts deep apricot after being blown thousands of miles from Africa,” by “strong winds” known as sirocco. The publication's website linked to tweets featuring images of “the sky, the snow, looking like a Martian landscape” (Webber 2021). Comparisons to the red planet, where sandstorms are a regular occurrence, abounded in reactions from different quarters (RT International 2021; Thomas 2021).

Ominous and unprecedented for some, these scenes were more familiar to people like Fanta Diarra, President of *L'Association des étudiants maliens de Lyon*. “Many of us said, ‘It's so beautiful.’ It was a bit like we were back home” (Morin and Givord 2021). Abdallah Ag Iksstan, a 33-year-old Nigerien delivery person who was born in the Sahara but lives in Lyon, immediately recognized desert sand as the cause of the heavy colourful skies over the city. “At home in Niger,” he explained, “it's a banal thing, a bit like snow or hail during certain seasons in Europe. We experience this phenomenon during the rainy season from June to August. Sometimes we have violent sandstorms.” These sorts of occurrences did not make him particularly uneasy. “I found it funny because it's unusual here,” he explained. “And I liked it because it reminded me of the country I left four years ago. A little piece of Niger came to join me in France” (Morin and Givord 2021).

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<sup>5</sup> An advanced search on Twitter for “sable Sahara” results in over 80 tweets from February 6, 2023 alone. These include posts from weather outlets and individuals throughout France, along with numerous photographs of tinted skies, snow, and cars covered with sand.

Moving “between anxiety and wonder,” witnesses throughout France described the phenomenon as both “eerie” and “magical,” capturing what they saw in countless photographs and videos posted online (Beauchemin 2021; Le Dauphiné Libéré 2021; Yahoo News! 2021). Some appreciated the picturesque effect; the way the sand’s orange/reddish tint recalled the “sepia” tones of a vintage photograph or postcard (Humbrecht et al. 2021). Others got an “end of the world” or “apocalyptic” feeling that brought to mind futuristic films like Denis Villeneuve’s 2017 *Blade Runner 2049* (Beauchemin 2021; Le Dauphiné Libéré 2021; Jenni 2021; Pauget 2021). The national news outlet *BFM TV*, among others, broadcast scenes of this “science fiction landscape,” noting the spectrum of deep oranges, pinks, and greys in the sky over different French cities. In a segment entitled “*Le sable du Sahara s’invite en France*” [Sand from the Sahara invites itself into France], Stéphane, an amateur photographer, shared his images of Lyon and its landmarks bathed in the unusual light. “I’ve never seen anything like it [...] this yellow in the sky. [...] It makes one think of a post-apocalyptic world” (BFMTV 2021; Gomez 2021).

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Photograph of the rue Gustave Nadau in Lyon by John-Grégoire, February 6, 2021. Creative Commons Attribution-Share Alike 4.0 International Licence.

[https://commons.wikimedia.org/wiki/File:Une\\_rue\\_de\\_Lyon\\_\(France\)\\_sous\\_une\\_couche\\_d%27air\\_saharien.jpg](https://commons.wikimedia.org/wiki/File:Une_rue_de_Lyon_(France)_sous_une_couche_d%27air_saharien.jpg)

The references to the end of the world in these reactions to Saharan dust traded implicitly on widespread concern about climate change that some other observers addressed head on. Meteorologists in France such as Paul Marquis believed that “the sirocco’s arrival in early February [2021]

instead of April” was evidence of global warming (RT International 2021). A journalist’s 2022 description of a subsequent dust occurrence characterized the “amber gloom” caused by Saharan sand as “evocative of forest fires” (Cappucci 2022). Reaching over and again for the imagined catastrophes of science fiction, multiple onlookers also expressed anxiety about the present and possible future environmental and other distresses this strange weather appeared to manifest and foretell. At the same time, these accounts also seemed to derive a certain pleasure from an aesthetics of apocalypse as dramatic spectacle, a set of special effects, like social media filters, and a vibe.

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## **A Long History of ‘African Dust’**

While reactions to the phenomenon in early February 2021 were particularly intense, this was not the first time that sand from the Sahara had blown into France, nor would it be the last. Indeed, two more episodes followed during that month alone, on the 21st and the 28th. Less impressive waves hit France later in the year with another significant episode occurring in the spring of 2022 (Cappucci 2022; Matricon 2021; Le Parisien via Dailymotion 2022). On each of these occasions, witnesses came back to the same tropes: the “strange and distressing” yellows and oranges of darkened skies “as during a solar eclipse” or the “end of the world” (Corre 2022); scenes that felt “spooky,” “apocalyptic,” and “Martian” (Cappucci 2022; In the Vendée 2022; Phillips 2022). And during each instance, images of the curiosity flooded online (Merlier 2022). One Alsatian daily commented with relief: “The apocalypse? Thankfully not!” This weather anomaly was apparently not that uncommon and “more or less spectacular depending on the year” (Dernières nouvelles d’Alsace 2021).

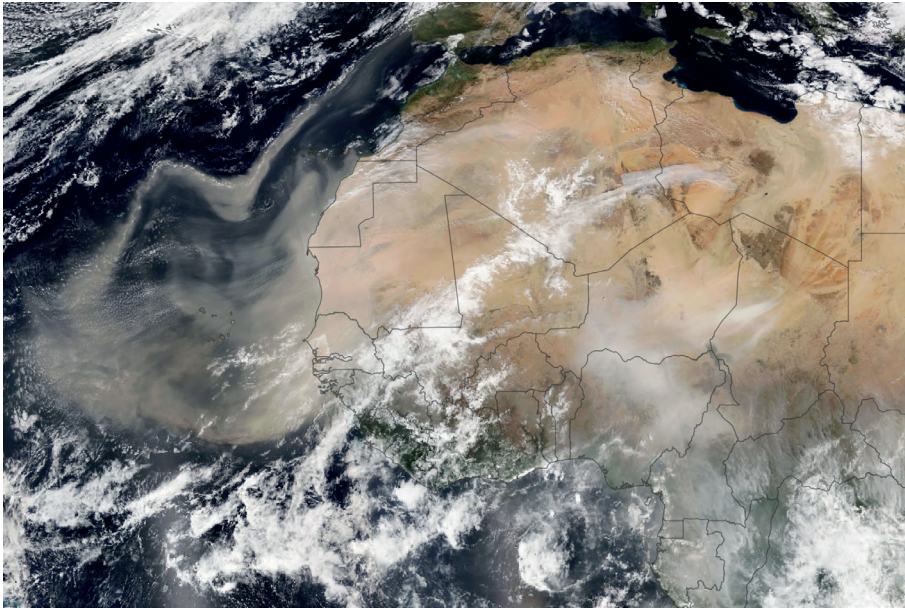
As news outlets explained repeatedly, these events were “surprising, but not really rare in France” (Gindre 2022). Every year, powerful winds lift up millions of tons of Saharan sand into the atmosphere that then travel around the globe. This massive dust migration affects the Earth’s climate and biological systems, degrading air quality and speeding up the melting of snow in colder regions by absorbing more of the sun’s light and heat. The dust also fertilizes the ecosystems through which it travels, including major sites such as the Atlantic Ocean and Amazon rainforest, nourishing plant life with calcium and other minerals and nutrients (Agostini 2019; Calatayud 2021; Lequy et al. 2018; meteo-paris.com 2022). As one 2021 report pointed out, the phenomenon “isn’t all bad,” and could be “good news” for gardeners (RT International 2021). The sirocco that blows south

to north also carries enormous amounts of this Saharan sand into Europe each year, though typically in smaller quantities spread out over longer periods of time. The effects are not usually as pronounced as they were in 2021 when high concentrations of Saharan dust moved into France during a brief period (World Meteorological Association 2021).

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NASA Earth Observatory image of Saharan dust by Lauren Dauphin, February 18, 2021. Public domain. <https://earthobservatory.nasa.gov/images/147952/saharan-dust-heading-for-europe>.

The scientific and wider public interest in these recent episodes was embedded within a longer history of studies of large-scale dust migrations and their impact around the globe. As early as the 1830s, Charles Darwin had taken an interest in patterns of dust moving from the African continent across the Atlantic (Prospero et al. 2021, 1240). Into the twentieth century, scholars continued to study the phenomenon, noticing that certain decades were marked by “increased dustiness” (Evan et al. 2016, 494). Given that North Africa is “the largest and most persistently-active” point of origin for the phenomenon, the Sahara has been a continual focus of this work (Prospero et al. 2021, 1240). In the French context, a “spectacular dust event” in 2004 brought an influx of “huge quantities” of sand particles from the Sahara (Menut, Masson, and Bessagnet 2009). That year, deposits of approximately 500,000 tons blew into Corsica alone. An estimated 2 million tons came through the parts of France south of “a line



from Nantes to Besançon” (Gouthière 2022; Masson et al. 2004, 4). More significant in various ways, this “historic sirocco” became a reference point in discussions of the 2021 and 2022 episodes (Agostini 2019; Chaulet 2021; Roussel 2022; Rozières 2021).

Given that the phenomenon itself was not unusual, and that a much more impressive wave of sand had hit France less than two decades earlier, what accounted for the flurry of scientific, media, and public attention to these more recent instances? Their striking visual effects? Their repeated occurrence during a brief timeframe? The possibilities of widespread dissemination of images via social media platforms, most of which did not yet exist in 2004?<sup>6</sup> These things certainly go part of the way towards explaining the fascination with these fresh bouts of vivid skies, sandy rain, and residue. But the timing of all this mattered deeply for other reasons as well. Polluting the air, the Saharan dust that swept through France in 2021 posed an additional public health problem during a moment of unprecedented crisis. Scientific and medical researchers had been studying the negative effects of Saharan dust migrations for years, linking them to a range of potential health consequences, including the triggering and aggravation of mild to severe respiratory illnesses in adults and children (Gyan et al. 2005; Karanasiou et al. 2012; Masson et al. 2010; Menut, Masson, and Bessagnet 2009; Organisation météorologique mondiale 2017; Perez et al. 2008). But the COVID-19 pandemic completely transformed the landscape of concern and fear regarding the dangers of poor air quality and the airborne spread of disease.

In the coverage following the February 6, 2021 episode, questions arose about the health impact of Saharan dust, particularly with respect to COVID-19 transmission (Calatayud 2021; García-Pando, Perez, and Basart 2021; Hetsch 2021; Pauget 2021; Sprautz and Brault 2022). In addition to respiratory irritation or illness that might be caused by the inhalation of the dust’s fine particulate matter (PM), it was possible that this form of air pollution might exacerbate the spread of the virus, its range of symptoms, and ultimate consequences, including death, for those who become ill. Early on in the pandemic, scientists working in different parts of the world had begun to pose questions about possible Saharan dust-COVID connections. One team of researchers had concluded that “high PM 2.5 concentrations—favored by air temperature inversions or Saharan dust intrusions” were particularly dangerous in the context of the pandemic. According to these experts, “desert dust events [...] can [also] be a vector for fungal diseases, thereby exacerbating COVID-19 morbidity and mortality.” Such studies stressed the importance of “monitor[ing] not only the prevalence of the virus, but also [...] the occurrence of weather situations

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<sup>6</sup> Facebook launched in February 2004, Twitter in 2006, Instagram in 2010, and TikTok in 2016.

that can lead to sudden, very explosive COVID-19 outbreaks” (Rohrer, Flauhaut, and Stoffel 2020, 789). Furthermore, health recommendations during Saharan dust episodes were the same as those for the prevention of the pandemic’s spread: avoiding exposure by remaining indoors and wearing a well-fitted N95 mask (Manceau 2022). Indeed, several news stories in 2021 and 2022 made connections between the two, advising people to take similar measures to fight the twin threats posed by COVID and Saharan dust (Gustave 2022; Septier 2021; Sprautz and Brault 2022).<sup>7</sup>

By 2021, people in France, as elsewhere, were poised to receive and respond to the presence of Saharan dust in the skies above their heads, or on their car windshields, in ways they never had been before. COVID-19 intensified to an unprecedented degree what critic Jean-Thomas Tremblay has referred to as “the respiratory enmeshment of vitality and morbidity” and the material and metaphoric associations between breath and death had become an obsessive preoccupation of the moment (Tremblay 2022, 2). As one writer in *Forbes* commented in 2022, “In an era of COVID-19 virus, dust transport of bacteria and microorganisms certainly takes on new meaning for even the casual observer” (Shepherd 2022). While Saharan dust was not a totally unfamiliar phenomenon, the pandemic had imbued its particles with a whole new menacing physical and psychological significance. Already visually and aesthetically ‘apocalyptic,’ it threatened to take people’s breath away in a truly horrifying sense.

### Return to Sender

A few days before France’s third major Saharan dust episode in February 2021, ACRO—the regional radiation monitoring organisation Pierre Barbey works with—released a communiqué regarding the Saharan dust sample the biochemist had collected earlier that month. Reproducing photographs that Barbey had taken of the tinted snowy Jura landscape and a vehicle covered with fine deposits, the ACRO statement confirmed that the dust “contain[ed] traces of radioactive pollution dating from the atomic bomb tests conducted by France in the 1960s” (ACRO 2021). Having subjected the sample to gamma spectrometry analysis, ACRO’s lab had found traces of cesium-137, a radioactive isotope that does not exist in nature, but is a fission product of nuclear bomb detonations, as well as disasters such as those at Chernobyl in 1986 and the Fukushima Daiichi Nuclear Power Plant in 2011.<sup>8</sup>

Acknowledging the “520 atmospheric nuclear tests” conducted by “the United States, the Soviet Union, the United Kingdom, France, and China” in

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<sup>7</sup> This has also been the case in places where smoke from seasonal forest fires has combined with and contributed to extreme summer heat aggravated by climate change (particularly up and down the West Coast of North America), leading to extremely poor air quality. See, for example, the U.S. Centers for Disease Control and Prevention’s advisory regarding fires and COVID-19 (CDC 2022).

<sup>8</sup> At the time of ACRO’s founding in the wake of the Chernobyl nuclear plant disaster of 1986, Barbey had participated in the analysis of samples of another Saharan dust episode that bore traces of radioactivity.

the decades after the Second World War, ACRO's statement emphasized France's contribution to a global nuclear contamination during this era, the lingering traces of which can be found in bodies and environments all over the planet. This 'new' radiation detected in France was therefore an addition to existing levels of contamination from previous Saharan dust episodes *and* the cumulative effects of the atmospheric nuclear detonations conducted by *all* of the nuclear-weapons powers since 1945 (Higuchi 2020, xi).<sup>9</sup> Chernobyl, Fukushima, and a range of much smaller emissions from civilian nuclear power sites were more and less significant contributors to this base layer of radioactivity that can be found in soil and other samples across the globe. According to one report in 2022, the *Institut de radioprotection et de sûreté nucléaire* (IRSN) has been tracking this generalized radiation in France since at least 2000 (Puaud 2022).

Following ACRO's revelation on February 24, 2021, the radioactivity of Saharan dust became the focus of several reports and provocative headlines 'breaking' the story. French and international news outlets jumped on the quirky tale of Barbey's discovery while snowshoeing and quotes from the biochemist appeared in several articles focused on the radioactivity of his samples (Chaulet 2021; Courageot 2022; France Info 2021; Jenni 2021; Le Parisien 2021). From late February onward, coverage of the dust episodes almost never failed to note the traces of cesium-137 they contained. Journalists also shared repeatedly the conclusions of medical and scientific experts who insisted that the radioactivity of Saharan dust did not pose a health risk for people in France, its levels falling well below doses considered dangerous for the general population. The contamination of these fine particles was "[n]othing serious" and even "tiny," little more than "a historical vestige" (Jenni 2021). In the end, the dust particles were only "lightly radioactive" (Julien 2022; Métro Belgique 2022; SudOuest 2022) and "completely inoffensive as opposed to the air pollution they engender" (Sprautz and Brault 2022).

What made ACRO's 2021 statement and the ensuing public interest remarkable was the fact that the presence of traces of cesium-137 in Saharan sand was something that was already well known to scientists in France, as elsewhere. When the IRSN published its report on the dust events of February 2021 in early March of that year, the organisation was careful to note that, while there had been an increase in levels of radioactivity in the air picked up by its OPERA detection network during these episodes, "they [were] nonetheless lower than those of a similar episode in February 2004" (IRSN 2021). Apparently, during that episode (discussed above), the "values were so high that instruments became unusable" (Menut, Masson, and Bessagnet 2009, 2). Even then, however, experts had determined that

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<sup>9</sup> For more on the notion of a 'global hibakusha,' see "The Human Cost of Nuclear Testing" (ICAN 2022).

poor air quality, rather than radiation exposure *per se*, was the more significant health risk posed by these events (Manceau 2022; Rozières 2021).

Barbey himself had acknowledged that the radioactivity detected in his recent sample was “weak,” insisting, “the point is not to say that the [French] population is in any danger.” In France this pollution was a “passing” and relatively benign phenomenon (Puaud 2022). From the perspective of organizations like ACRO, however, it was the potential memorial function of Saharan sand, rather than its radioactive toxicity *per se*, that gave it historical and political significance decades later. While the exposure to radiation from Saharan sand might be minimal for those in contemporary France who were “very far away” from the source, “this is not at all the case for those nearby populations [...] who live in those regions that, 60 years ago, sustained extremely significant exposures” (Gouthière 2022; see also Baha eddine 2021 and France Info 2021). As Barbey explained to one interviewer, “the [...] people of that region of the Sahara live in this environment that has been polluted for a long time.” It was therefore important to “remember what the origins [of these traces] are and the responsibility of France in these nuclear tests” (France Info 2021).

The Saharan dust that had been photographed all over the nation made apparent what Gabriele Schwab calls “the invisible danger” of radiation (Schwab 2020, 163). As scholars like Akira Mizuta Lippit, Joseph Masco, Peter van Wyck, and Kate Brown have shown, the ‘not seeing’ in the long history of nuclear harm and catastrophe poses a recurrent obstacle to the individual and collective understanding of threat and risk, as well as the possibility of appropriate acknowledgment or anything like justice for the multiple global victims of nuclear bombs and accidents (Brown 2017; Lippit 2005; Masco 2013; van Wyck 2013). Bearing detectable traces that could be linked to France’s nuclear detonations in Algeria, Saharan dust did something rare indeed: it gave that radioactivity visual form, texture, and vibrant colour.

For radiation scientists, however, the question of origins has “constitute[d] an always open discussion” (Menut, Masson, and Bessagnet 2009, 9). Studies of the cesium-137 found in the dust that blew into France in 2004 were able to draw conclusions about the timing of original contamination, but experts were unable to determine the degree to which France’s *Gerboise* atmospheric detonations of 1960–61 are responsible for the radioactivity in question. Apart from the fact that the sand cannot all be traced back to the areas of the Sahara where France detonated its bombs in the 1960s, France was also not the *only* power to contribute to global nuclear contamination during that period. While the French state is certainly responsible for its nuclear weapons activity in Algeria, Saharan

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sand (and its migrating dust) was, like surfaces and bodies around the world, contaminated by the radiation released from bombs detonated atmospherically by multiple states after 1945. That same desert sand has also been exposed to other forms of radiation, including emissions in the wake of major disasters like Chernobyl and Fukushima (Masson et al. 2004; Menut, Masson, and Bessagnet 2009; Masson et al. 2010).

Well aware of these complexities, and careful to reassure the public about low exposure levels and insignificant health consequences, ACRO's 2021 statement nevertheless referred to Saharan dust as a 'boomerang' returning to France. Inspired by the organization's provocative heading, *Nuage de sable du Sahara: une pollution radioactive qui nous revient comme un boomerang* [Cloud of Sand from the Sahara: radioactive pollution that returns like a boomerang], the French and international media ran with the image. The *effet boomerang* [boomerang effect] appeared again and again in stories about this revelation that did not, strictly speaking, contain any new information about the dust's radioactivity (Chaulet 2021; Courageot 2021; Earth Chronicles Life 2021; Papadopoulos 2021). The figure of a boomerang then seemed to clear a path for a proliferation of metaphors of homecoming and haunting. Saharan dust episodes were a "return to sender" of the nuclear contamination of Algeria in countless ways: "like a rubber band in the face," or an "invoice" presented to a "taxpayer" (Julien 2022). Several authors in France and internationally highlighted the dust events as "ironic" (Cereceda 2021; Hamilton 2022; Puaud 2022), reflecting on how "atomic bomb testing and colonial history ha[d] come back to haunt France in the form of a radioactive Saharan dust cloud" (Hale 2021). "Prodigal fallout returns," remarked *futurism.com*'s Dan Robitzski in March 2021, reflecting on this "poignant reminder of the long lasting impact that nuclear fallout can have on an area" (Robitzski 2021). "C'est l'arroseur arrosé," suggested Sébastien Julien of *L'Express* during the March 2022 episode, referring to a Lumière Brothers' 1895 short film in which a boy plays a trick on a gardener who then gets doused with his own hose. The English expression that best captures the sentiment: "The joke's on you/them/us" (Julien 2022).

## Vent de sable

As physicist and theorist Karen Barad has pointed out, the nuclear "event" is one that "refuses to end, that decays with time but will forever continue to happen" (Barad 2017, 69). Decreasing by 50% every 30 years, traces of an element like cesium-137 exist within the "long temporalities" of "the

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nuclear” (Puaud 2022). This half-life is what allows scientists to date radiation levels, linking their remainders to different historical moments, in this case, the atmospheric tests of the 1960s. In this frame, Saharan dust in France was an apparition, a ghost of past and present, and an embodiment of the “nuclear uncanny” (Masco 2013, 30–31; Schwab 2020, 163). Sand bearing the radioactive markers of that era had arrived in France as a memory returns to consciousness, bringing “messages” from a nuclear-imperial space and time that could not and had not been forgotten in Algeria, and should not be forgotten in France (Louni 2021). It was a “scathing reminder of history” (Rioux and Yahiaoui 2021) with legacies that acted like “a slow poison,” (Puaud 2022).

In the coverage of the 2021 and 2022 episodes, Saharan dust became forensic evidence, a souvenir, and a form of karma and/or revenge. Playing on the associations between sand, erosion, time, residue, and harm, different commentators mobilized representations that sedimented easily (Acharya 2021; Courageot 2021; Métro Belgique 2022). In these imaginative tellings, the Sahara was saturated with human attributes, affect, and motivations. “[N]ot content with just modifying the colour of the sky,” the desert had a memory, a will, and a range of emotions including anger and desire (Courrier International 2021). Referring to the ‘vengeance’ of the Sahara, and of Algeria, journalists in France and elsewhere framed these episodes as a kind of postcolonial retaliation (CAREP 2022; Des Groux 2021; Papadopoulou 2021). Just as France had once laid claim to Algeria, Algeria was now laying claim to France. “You don’t screw with the Sahara,” joked one writer, casting Denmark as an innocent bystander “caught in the crossfire” of “an old score” between Algeria and France (Hamilton 2022).

Already troubled by the question of France’s sole vs. shared responsibility for the dust’s radioactive traces, the narrative of a wronged Algeria seeking payback caught on despite the fact that France was not the only country to experience these dust episodes. The skies, snowy landscapes, and car windshields of Spain, Belgium, Switzerland, and even Denmark had also been affected. But just as the media coverage zoomed in on radioactivity, so too did it emphasize France, rather than Europe more broadly, as the dust’s principal destination and target. The point of origin for Saharan dust also became more specific as the story developed. Before the release of ACRO’s February 2021 statement, explanations of the phenomenon had referred to a low-pressure system “off the coast of Morocco” (Agence France Presse 2021; euronews (en français) 2021; S. A. 2021). It was ACRO’s ‘boomerang’ that sealed the deal on a confrontation between two nations, France and Algeria, still haunted in the present by a violent and complicated past.

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Figured as a return of the repressed, the dust episodes that hit France in 2021 and 2022 became re-enactments of the original, traumatic *vents de sable* created by French bombs in Algeria where ‘sandstorm’ is one of the ways local inhabitants describe the detonations that continue to affect their lives to this day (Larbi Benchiha 2008). “[T]heir apocalypse there was one of flames,” wrote Alexis Jenni in *La Croix*. “A half century afterwards,” the journalist went on, “we are reaping the ashes that have not altogether cooled” (Jenni 2021). Voices like Barbey’s and Jenni’s pointed to the constellation of ongoing health and environmental harms resulting from France’s nuclear experiments in the desert. While the history of the nation’s nuclear imperialism in the Sahara had been “silenced for several decades” at home, French veterans and Algerians exposed to radiation have been living with this past for more than a generation (Gomez 2021).

Still struggling into the 2020s to have their demands for recognition and compensation addressed sufficiently, Algerian victims in particular have not benefited from the 2010 *Loi Morin* intended to acknowledge and compensate victims in both the Sahara and the Pacific (Collin and Bouveret 2020; ICAN France 2022; Journal de Dimanche 2022). Of the 1747 applications for compensation filed between 2010 and 2020, only 53 were from Algerians. The 584 dossiers from that period that resulted in some form of restitution for victims includes only one Algerian, a man who served in the French military (Gomez 2021). The requirement that petitioners document their presence at/near Reggane or In Ekker, along with the fact that French was, for 13 years, the sole language of the bureaucracy of recognition and restitution, has made the process more challenging for many victims (RFI 2022). It is therefore not surprising that to date none of the victims from the areas in the Sahara where France actually conducted its bomb experiments have been compensated (CIVEN 2022).

In addition to victims’ exposure to radiation from the French bombs detonated between 1960 and 1966, the Sahara itself was and remains scarred and haunted by those detonations, its sand polluted and vitrified in places by the extreme heat of atmospheric explosions, its mountains contaminated by underground blasts that were not always contained successfully by the galleries intended to hold them (Barrillot 2003).<sup>10</sup> France’s nuclear impact in the region also endures in the form of radioactive waste the former colonial power left behind in 1967 after shifting its nuclear weapons program to the Pacific. Following terms negotiated with the incoming government of what became an independent Algeria in 1962, the French departed without committing to the thorough dismantling of sites, environmental cleanup, or ongoing health monitoring of the local population. Instead, the desert became a burial site for remnants of the

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<sup>10</sup> Recently, the architectural historian Samia Henni has suggested naming the “anthropogenic radioactive geology” of Saharan vitrified sand and nuclear debris “Jerboasite” (Henni 2022).

massive infrastructure the French had built there, a sandy “nuclear crypt” for what is left of the physical plant, technical apparatus and tools, vehicles and materiel, some of which the military had deliberately exposed to the effects of bomb blasts.<sup>11</sup> These discards are what activists Jean-Marie Collin and Patrice Bouveret have called the “hidden face of the French atomic bomb” (Collin and Bouveret 2021). “The nuclear past,” they insist, “must no longer stay profoundly buried in the sand” (Collin and Bouveret 2020, 9). Seeking the release of archives indicating the precise locations of this toxic matter, organizations such as the French *Observatoire des Armements* and the International Campaign to Abolish Nuclear Weapons (ICAN) have been petitioning for years for the French government and military to share what they know, to acknowledge and engage in meaningful reparations with respect to this ongoing environmental contamination.<sup>12</sup> This has included calls for France to ‘repatriate’ its discarded nuclear waste in the Sahara, a material and moral ‘return’ to be initiated by a ‘sender’ willing to assume responsibility for its crimes. Still decaying materially, radioactively, and politically, this (nuclear-) “imperial debris,” is a form of what Ann Stoler terms the “ruins of empire,” remains of a violent past with lasting effects into the present (Stoler 2008, 194).

Long before the Saharan dust episodes of 2021 and 2022, activists and researchers like Collin and Bouveret, and the late Bruno Barrillot, as well as groups representing the interests of victims in France and Algeria, had been working to increase public awareness of the history and legacies of the Saharan detonations, of the violent and unjust past and dangerous potential future of nuclear weapons more broadly. Based in Lyon, the *Observatoire des armements* (originally co-founded by Barrillot and Bouveret) has done remarkable work to archive and disseminate this history. ICAN has been instrumental in bringing to fruition the *Treaty on the Prohibition of Nuclear Weapons* adopted by the United Nations in 2017. In addition to requiring that signatories renounce the development and possession of nuclear weapons, that treaty insists on forms of restitution for victims and outlines responsibilities with respect to the environmental management of nuclear waste (UNODA 2017). Algeria has signed, but not yet ratified, the treaty. France, like the rest of the world’s nuclear-weapon states, has not signed.

The *Treaty on the Prohibition of Nuclear Weapons* went into force on January 22, 2021, two days after renowned historian of Algeria Benjamin Stora submitted a report French President Emmanuel Macron had commissioned him to write. Entitled *Questions mémorielles portant sur la colonisation et la Guerre d’Algérie*, the ‘Stora Report’ revisited the history of French colonialism in Algeria, and especially the events and legacies

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<sup>11</sup> The term is one that Schwab elaborates on in *Radioactive Ghosts* (2020, 230–235).

<sup>12</sup> Additional pressure has come from the release of *Toxique*, a powerful study of the impact of France detonations in Tahiti Nui (‘French Polynesia’) published in 2021 by Sébastien Philippe and Tomas Stadius. Showing fundamental flaws in military and state conclusions about the impact of detonations on local populations and the environment, the work has led a broader reckoning regarding nuclear programs in the Pacific, including the release of archives.



of the Algerian War of Independence. Addressing a number of concerns, including the question of archives, Stora mapped out a set of recommendations for a program of acknowledgment and commemoration between France and Algeria, including a coming to terms with France's nuclear 'tests' in the Sahara. Arguing for the "work of memory, truth, and reconciliation," Stora drew attention to "traces, remnants, and memories" of colonisation and the Algerian War (Stora 2021, 2). According to Stora, the present in which France and Algeria remain tied to one another is one in which the past never "ceases to return" (5). And in this mix of complex experiences and unresolved emotions, there is sometimes "a desire for vengeance" that continues to pull France and Algeria apart as it also binds them together (12).

If the metaphors of return and revenge could be used so readily to narrate episodes of radioactive dust in 2021 and 2022 (the 60<sup>th</sup> anniversary year of Algeria's independence), it was because these figurations were already part of the language of a difficult history between two nations that have grappled with their 'postcolonial' relationship to one another for decades. Meaningful beyond the realm of radioactive particles and effects, a vocabulary of toxicity has played an important role in discussions of the political legacies of empire in both France and Algeria, performing a double duty when it comes to the issue of France's nuclear imperialism in the Sahara (Hamdi 2022). The nuclear and broader colonial past left a "bitter fallout" (Deutsche Welle 2020) that continues to "poison ties" (France 24 2021) and "pollute relations" (Mezahi 2021) between the two countries more than 60 years later.

Algerian observers who followed the Saharan dust events of 2021 and 2022 also made connections between radioactive traces and a broader history of colonial violence and injustice that continues to resonate on both sides of the Mediterranean (Bouzeghrane 2021; L'Expression 2021; Louni 2021; Mohamed K. 2021). Considering the "messages" embedded in the desert sand, journalist Arezki Louni noted the timing of the episode in relationship to ongoing struggles between Algeria and France, particularly when it comes to the nuclear past. "At the moment when the memory file between Algiers and Paris is on the table," Louni wrote, "the old colonial power is haunted by its crimes." According to Louni, the "arrival in France of a cloud of sand from the Sahara, bearing radioactive particles" had "relaunched the debate over the effects of French nuclear weapons tests in Algeria from 1960 to 1966" (Louni 2021). Falling at an important juncture in the negotiation of the nuclear and broader political and cultural past, present, and future, the Saharan dust episodes of 2021 and 2022 made a powerful and particular kind of sense at a moment of critical reckoning

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and convergence. Writing for the Algerian daily *El Watan* on February 28, 2021, the moment of the third major Saharan dust episode in France within a month, journalist Nadia Bouzeghrane linked ACRO's findings to the "Franco-Algerian reconciliation President Macron is seeking." "It's going to take actions, not statements," she insisted (Bouzeghrane 2021). Indeed, the "lightly radioactive" Saharan dust haunting France can only fulfill a meaningful memorial function if these recurrent 'apparitions' become more than a quirky set of weather events with no further consequences. When the social media posts of yellow and ochre skies have received the bulk of their likes and the lineups at local car washes have died down, when the shock of this latest 'revelation' has faded, what new forms of acknowledgement and justice can Algerian victims expect?

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