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SPECIAL ISSUE ARTICLE

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The material culture and politics of artifacts in nuclear diplomacy

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SPECIAL ISSUE
Material Culture of Nuclear Diplomacy

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Abstract

This special issue stresses the importance of material culture in diplomatic studies of science and technology. In our studies, objects are considered powerful tokens of complexity in diplomatic encounters and of asymmetry in international relations. The contributors are committed to theorizing about the role of objects in diplomatic exchanges during the postwar period and, at the same time, the role of diplomacy in constituting the materiality of nuclear things. Our approach combines attention to the political and diplomatic nuclear history with recognition of the roles played by nuclear artifacts throughout the whole spectrum of diplomatic activities. On the whole, we argue that the material approach should be located at the center of the study of nuclear history and the diplomatic exchanges that made it possible.

KEYWORDS
diplomatic artifacts, diplomatic studies of science, international affairs, material culture, nuclear diplomacy, nuclear history

Nuclear or not, diplomacy and the transnational circulation of objects go hand in hand. Materiality plays a significant role in intercultural diplomatic encounters. From diplomatic gifts to diplomatic documents and to the architecture of settings for diplomatic negotiations, the focus on material culture provides new insights into the financial, economic, and political history of diplomacy. While the major significance of exchanging artifacts in foreign policy negotiations

is becoming increasingly obvious to diplomatic historians, historians of science could also benefit from investigating the close encounters between scientific material culture and diplomacy.[1]

This special issue of *Centaurus* considers the role of artifacts and the politics they entail against a backdrop of the contemporary historiographical interest on science diplomacy and, especially, on nuclear diplomacy. We argue that when the materialist approach is located at the center of the study of nuclear history and the diplomatic exchanges that made it possible, it allows for a more comprehensive understanding of the co-production of nuclear science and diplomacy.

The idea of co-production has been central in science and technology studies, suggesting "the simultaneous processes through which modern societies form their epistemic and normative understandings of the world."[2] Elsewhere, we have used the notion of co-production as our primary framework for understanding how nuclear science and diplomacy have been closely interdependent, and how to think about the international nuclear order produced by intense diplomatic negotiations, while developments of nuclear knowledge required diplomatic negotiations at the same time. We discussed why historians of science should open the black box of diplomatic practices, and how the diplomatic approach would be pertinent to the history of nuclear science and technology.[3]

Here we stress a complementary aspect to Diplomatic Studies of Science (DSS): the importance of material cultures in nuclear diplomacy. This is an newly emerging interdisciplinary field informed by critical science and technology studies and devoted to analyzing the production and use of science and technology in the context of international relations initiated both by state and non-state actors.[4] The challenge is to understand the complex entanglement of science and diplomacy in a historical context. Our focus on materials and the unfolding of scientific processes on the microlevel allows us to reconceptualize our understanding of diplomacy in its relation to science and technology. Scientific objects are not merely alternative sources that can complement documentary materials in answering the questions posed by history of diplomacy. In our studies, objects—and especially nuclear objects—become powerful tokens of complexity in diplomatic encounters and of asymmetry in international relations.

Historical studies of technology and economic history have long been scrutinizing materials and theorizing about the politics of objects. When, for example, Wiebe Bijker and Trevor Pinch used the bicycle as an exemplar in understanding the social construction of technology, a whole new field of technology studies emerged.[5] Ruth Schwartz Cowan's study of the kitchen introduced a strong focus on feminist technology studies when it revealed that technological changes in the household shifted the burden of domestic labor from men to women.[6] Since then, questions of materiality and artifacts have been central to feminist studies of science and technology, with close connections to questions of the body and the cyborg.[7] Similarly, in economic history, materials and commodities are very often the subjects of trade and commerce. For example, the historian of science Harold Cook has shown how transportation of commodities in commerce was intertwined with global circulation of knowledge.[8] In the history of science and science studies, objects and material cultures in scientific research have been important areas of analysis since the rise of laboratory studies in the 1980s.[9] The historiography of objects has questioned the ways in which mundane things become subjects of scientific inquiry and epistemic entities, while at the same time giving rise to a history of museum collections and a stronger focus on museums as privileged spaces for the production of scientific knowledge.[10]

[1]Throughout the last decade, diplomatic historians have reexamined the history of foreign affairs, especially in the early modern period. See, for example, Adams & Cox (2011); Biedermann, Gerritsen, & Riello (2017); Dittmer (2017); Laver (2020); Mesotten (2017); Rudolph & Metzig (2016); Rudolph (2016).
[2]Jasanoff (n.d.); Jasanoff (2004, 2011). See also Miller & Wyborn (2018).
[3]The essays published here are the partial result of a two-stage workshop held in Hayama, Japan in 2018, and in Athens, Greece in 2019. The first part of this two-stage workshop appears in Ito & Rentetzi (2021).
[4]On the concept of Diplomatic Studies of Science, see Rentetzi (2019); Ito & Rentetzi (2021). The 2021 Gordon Cain Conference of the Science History Institute (https://www.sciencehistory.org/gordon-cain-conference) has named Rentetzi the Cain Conference Fellow and will introduce this new strand of research to the wider history of science community.
[5]Pinch & Bijker (1984).
[6]Cowan (1983).
[7]Haraway (1985); Wajcman (1991); Barad (2007); Alaimo & Hekman (2008).
[8]Cook (2008).
[9]Latour & Woolgar (1979); Shapin & Schaffer (1985); Hannaway (1986); Galison (1987, 1997); Shapin (1988); Morus (2015); Klein & Lefevre (2007).
[10]Star & Griesemer (1989); Rheinberger (1997); Daston (1999); Daston & Galison (2007); Smith & Findlen (2001); Ago (2013); Findlen (2013); Koeppe (2019).

After all, as Carroll Pursell argued as early as 1983, "the history of American technology begins and ends with our material culture."[11] Evidently, the "material turn" we witnessed in the 1980s blurred the boundaries between history of science and history of technology, allowing for greater interdisciplinary blending with history of art as well. The more recent turn to transnational and global history of science created a space for the study of the power of things and their circulation on a global scale. For example, the regulation of drugs and toxicants is a powerful example of how things circulate, are controlled and contained, or are made invisible on a global level.[12] In addition, the study of waste circulation has recently introduced a new strand of research in science and technology studies, which has become known as discard studies. In an era of globalized waste, scholars have started to scrutinize the history of waste management in different countries around the world, the circulation of waste on a global level, and the new body of international environmental law that was constituted to address what became a global challenge.[13]

Objects have been prominent foci for historians of nuclear sciences as well. A wealth of studies—focused on the atomic bomb, radioisotopes, measurement devices, nuclear fuels, reactors, fallouts, and waste—have reminded us that nuclear things are artifacts as well as facts.[14]

Peter Galison's monumental microhistory of the material culture of 20th-century physics has taught us to appreciate the value of cloud chambers, scintillation counters, and bubble chambers in the history of experimentation. Putting the historical focus where it belongs, on the instruments and techniques of the laboratory, Galison's work marked the material turn in history of physics. Maria Rentetzi's *Trafficking Materials* introduced the concept of "trafficking materials" in order to emphasize the fact that radium was circulated, traded, and shared among diverse institutions and disciplines in the early 20th century. With it went people and practices. Angela Creager's *Life Atomic* focused on radioisotopes and provided a fascinating narrative about their industrialization, regulation, and medical impact in the United States during the Cold War and the nuclear science that emerged. Gabrielle Hecht's *Being Nuclear* was the first to put Africa on the nuclear map by focusing on uranium and its mining and trade, as well as questioning what it means to be nuclear.[15] The history of nuclear artifacts could indeed be one of the most productive areas in developing historical narratives that are cross-cultural, transnational, and global. In Langdon Winner's canonical statement of 1980, "artifacts have politics" in the sense that they embody power and authority.[16] Nuclear artifacts do not escape this canon. Quite the opposite. As Bruno Latour argued through the monumental exhibit *Making Things Public*, "the atom bomb is the ultimate THING in which people think of the relation between science and politics."[17]

Among the first nuclear historians who—in addition to thematizing objects and highlighting their epistemological role in nuclear history—explored their role in shaping diplomatic relations in nuclear history is Jonathan Helmreich. His 1989 book *Gathering Rare Ores* clearly demonstrated how competition for atomic materials influenced foreign relations during the Cold War, putting diplomacy center-stage.[18] Susan Lindee studied the 1973 repatriation from the US to Japan of the bodily materials of those killed by the atomic bombs in Hiroshima and Nagasaki. Lindee tracked seven large, wooden boxes, which contained autopsy records, clothing, and human remains, on their trip to Hiroshima and examined them as "pieces of nature" in order to explore "how science makes the body." With consideration of the materiality of the filing system, the autopsy protocols, and the bodily parts themselves, she argued that science makes things natural through complex material, political, and diplomatic processes.[19] John Krige used the radioactive isotope phosphorus-32 to tell the story of the foreign isotope program in the light of the debates

[11]Pursell (1983, p. 304).
[12]Möllers & Dewalt (2016); Krige (2019); Boudia & Jas (2016).
[13]Barsalou & Picard (2018); Yang, Park, Park, & Seo (2015); Hecht (2020). See also the Discard Studies online hub (https://discardstudies.com).
[14]For a few examples, see Gordin (2007); Craig & Radchenko (2008); Creager & Santesmases (2006); Kraft (2006); Boudia (2008); Santesmases (2006); Wittje (2004).
[15]Galison (1997); Rentetzi (2007); Creager (2013); Hecht (2012). See also Rentetzi (2017).
[16]Winner (1980).
[17]Quoted in Hecht (2007, p. 101).
[18]Helmreich (1986). See also Helmreich (2005).
[19]Lindee (1998). Lindee was among the very first scholars to highlight the role of diplomacy in history of science. She focused on radioactive bodily remains as "diplomatic commodities" and "diplomatic objects," arguing that both Japan and the US used them in negotiating their postwar relationship.

between the Atomic Energy Commission and the U.S. Congress. He wove together diplomatic history, history of science, and social history by introducing two fictional but historically plausible people who use the nuclear material in a medical context. Krige's groundbreaking work as a whole has drawn attention to U.S. international science policy after the Second World War, underlining the dominance of the US and its use of science as diplomatic tool for rebuilding European scientific infrastructures.[20]

Building on the historiographical tradition described above, the articles in this issue collectively make the case that objects are not peripheral to political actions. Diplomacy, as we argue elsewhere, is one of the most salient aspects of nuclear history.[21] One distinct focus of this volume, therefore, is on the art and practices of nuclear diplomacy, such as the techniques for managing and controlling debates and the strategies for delicately coming to agreements. Materials are central to these processes. To understand the peculiarities of nuclear discourses, we need to explore materiality. Concomitantly, we shed light on major diplomatic negotiations through our focus on radioactive materials and nuclear artifacts. How did they travel, circulate, interact, and matter? How were they bargained, sold, controlled, and regulated? How were they offered as gifts or access to them denied in the nuclear economy of the Cold War? How did diplomatic practices render them visible or invisible, to allow people to find a way to live with them? Hecht has already raised the crucial question of "what makes things 'nuclear,'" challenging the assumption that what counts as nuclear is self-evident.[22]

Operating under the observation that diplomacy strongly constructs nuclearity (and vice versa), we move one step further to ask "what makes material objects matter to nuclear diplomacy?" Our aim is to highlight the role of nuclear artifacts in diplomatic contexts and to enrich our understanding of diplomatic exchanges by emphasizing the presence of nuclear material culture. In doing so, we reframe the very concept of "diplomacy," which historians of science too often consider self-evident and unproblematic.[23] Not only do we include conventional diplomatic actors such as diplomats and their practices in our narrative of knowledge making, but we also make space for non-state diplomatic actors such as nuclear scientists, engineers, and technicians.[24] We take advantage of the material turn in the history of science to redefine the diplomatic nuclear history of the second half of the 20th century. This line of research aligns well with new developments in diplomatic history that shift focus from the traditional political history in foreign relations to a social history of diplomacy with emphasis on material cultures and non-conventional diplomatic actors.[25]

In this issue, we collectively pursue such new approaches to the history of science, adopt various interdisciplinary theoretical tools, and introduce new theoretical concepts—or synthesize old ones in a new way. The contributors are committed to theorizing about the role of nuclear objects in diplomatic exchanges during the post-Second World War period and, at the same time, about the role of diplomacy in constituting the materiality of nuclear things. We apply an array of old and new concepts—diplomatic gifts, diplomatic objects, diplomatic frameworks, and materialized internationalism—in order to trace the history of things at the intersection of diplomatic and nuclear history.[26] Our approach combines attention to the political and diplomatic nuclear history with recognition of the roles played by nuclear artifacts throughout the whole spectrum of diplomatic activities. This approach directs our attention towards the material culture of nuclear diplomacy as a perspective from which to understand historical processes in science and technology, thereby dramatically affecting our understanding of the latter.

Among the papers included here, some reconsider the role of traditional nuclear artifacts such as nuclear reactors in international nuclear histories, while others focus on radioactive materials circulated on a global scale.

[20]Krige (2005; 2006); Krije, Callahan, & Maharaj (2013). For Krige's most recent article on techno-diplomacy, see Krige (2020).
[21]Ito & Rentetzi (2021).
[22]Hecht (2007, p. 100).
[23]For an elaboration of the term nuclear diplomacy, see Ito & Rentetzi (2021).
[24]For earlier studies that shed light on the diplomatic roles of non-state actors, there is a body of literature on so-called New Diplomacy; see Kelly (2010). See also Kyrtsis & Rentetzi (2021).
[25]Rudolph (2016). See also Bloemendal (2017); Giudici (2018); Knudsen (2016).
[26]On Rentetzi's technoscientific diplomatic gift, see Rentetzi (2021). On diplomatic objects, see Ito (2021).

By following objects, over time and across national borders, these papers reveal the specificities of diplomatic practices and the role of scientific knowledge in diplomatic negotiations.

1 | DESCRIPTION OF INDIVIDUAL CONTRIBUTIONS

Diplomatic actors involved in exchange of nuclear materials and objects are not always sovereign states. The establishment of the United Nations, with its specialized agencies and affiliated organizations, introduced novel and powerful diplomatic non-state actors for the first time. As international relations scholar Thomas Hovet argued in 1963, by practicing multilateral or bloc diplomacy, the UN plays the role of "an instrument of diplomacy."[27] Among the various UN-related organizations, the International Atomic Energy Agency (IAEA), established in 1957, has been key to nuclear diplomacy. Besides its regulatory role, the Agency has been a leading sponsor of scientific studies on the health and environmental effects of nuclear and radiological incidents. Proposing the notion of "materialized internationalism," Toshihiro Higuchi and Jacques E. C. Hymans examine a 1960 dosimetry experiment in Vinča, Yugoslavia.[28] This experiment was organized by the IAEA in response to a reactor criticality incident 2 years earlier. A defining feature of this international research enterprise was the diverse and heterogeneous assortment of research materials and scientific instruments donated or loaned by the United States, Britain, France, and Yugoslavia. Applying the perspective of material culture in diplomacy, the paper illustrates how the IAEA successfully translated the rhetoric of scientific internationalism into a material reality through negotiations with member-states. The case problematizes common assumptions about the reasons why, and the processes through which, international scientific collaborations come into being. The mutual constitution of material requirements and state interests resulted in this major multinational experiment, which also highlights the role of the IAEA as the not-disinterested manager of this process.

Higuchi and Hymans introduce the concept of "materialized internationalism" to argue that the physical and material context of collaborative research is mutually constitutive of its international character. During the Vinča experiment, the material complications significantly altered the incentives of the governments involved in the project. Increasingly allowing the success of the international endeavor to define their perceived national self-interest, the participating governments ended up contributing substantial resources to the project, despite their lingering skepticism about its scientific value. Moreover, the experiment spawned its own set of scientific artifacts, which further inscribed scientific internationalism into the material world of international nuclear cooperation. The material-mediated dialectic of nationalism and internationalism in the dosimetry experiment thus helped the IAEA to place itself at the center of a new global nuclear order, in which international cooperation in nuclear accident dosimetry under IAEA auspices became a routine practice.

Matthew Adamson's paper focuses on a nuclear reactor to shed light on multiple frameworks of relevant diplomatic actors.[29] He proposes the notion of a "diplomatic framework" to understand the case of the "orphaned" TRIGA Mark I reactor in Morocco and the associated acts of diplomacy. Like the Ghanaians depicted by Abena Dove Osseo-Asare, the Moroccans in Adamson's study were not mine-workers but had their own nuclear ambitions.[30] In 1978, the Kingdom of Morocco purchased this research reactor from the US through the IAEA, and the reactor's vessel arrived in Casablanca the year after. Yet the empty reactor vessel sat abandoned in a warehouse, and it was a different reactor which went critical in Morocco two decades later. Adamson solves this mystery by considering the reactor as a "diplomatic object" that emerged within multiple "diplomatic frameworks."

[27]Hovet (1963).
[28]Higuchi & Hymans (2021). For other examples of how internationalism or international collaboration can be materialized in objects, see Zaidi (2018); Dittmer (2017).
[29]Adamson (2020).
[30]Osseo-Asare (2019).

The notion of diplomatic object is proposed by Ito as a Davidsonian move to theorize objects in diplomacy, which diplomatic actors mobilize in order to make them play certain diplomatic functions by exploiting their material traits. Thus, Ito analyzes diplomatic processes involving scientific objects as a question of how diplomatic negotiations turn a scientific object into a diplomatic object.[31] Adamson instead uses the notion of "diplomatic framework" in a fruitful way to advance analyses of diplomatic objects. In this sense, the reactor becomes a diplomatic object malleable enough to be adapted to different frameworks by different actors. For the University Mohammad V, the research reactor was understood primarily within the framework of national technological and scientific development. For the king and the Kingdom, the reactor would also be understood in the frameworks of energy policy and national prestige. The United States understood it within the frameworks of non-proliferation and commercial transactions. As such, it was willingly delivered to Morocco. Yet, when the practicalities of siting the reactor became relevant, new frameworks took prominence with the IAEA's involvement: the frameworks of nuclear safety and security were more significant. As nuclear experts at the University Mohammad V were not able to bear the administrative burdens of complying with the safety requirements of the IAEA, the Moroccan National School for Mineral Industries, in an attempt to save the reactor, was considered as the hosting institution. However, the IAEA rejected the plan due to safety reasons. Morocco successfully obtained a working reactor only after creating a new agency, the National Center for Nuclear Studies, Science, and Techniques, which developed nuclear technology in consultation with the IAEA. The new diplomatic arrangement did not pose any conflict of diplomatic frameworks. Thus, Adamson shows, a diplomatic object becomes viable only when multiple diplomatic frameworks of relevant actors somehow become reconciled with each other.

Lif Lund Jacobsen, Julia Lajus, and Irina Fedorova focus on a seemingly non-nuclear scientific device, the seismograph, one of the quintessential artifacts of the Cold War era. It was a device for eavesdropping, not on human conversations but on nuclear explosions. It was crucial for the two superpowers to monitor each other's compliance with the test ban treaty regime and thereby keep the Cold War cold. Thus, seismographs, besides being key scientific instruments for measuring and identifying seismic events, became contested "diplomatic objects" used to support or challenge foreign policy statements. Hence, seismographs were also offered as diplomatic gifts, not only to improve seismic research worldwide but, more importantly, to impose U.S. technological structures and place obligations on the receiver. Based on Maria Rentetzi's notion of a technoscientific diplomatic gift as an analytic category that materializes the interplay of technoscientific knowledge and international affairs, the authors demonstrate the kind of political strings that were attached to the US's generous offers of seismographs in the early 1960s.[32]

The paper describes how the US used seismographs as diplomatic gifts in exchange for information to create a de facto standard and a worldwide, U.S.-controlled nuclear monitoring network from the 1960s to the 1970s. Seismographs were therefore diplomatic gifts "with strings attached," intended to create political reciprocity and influence negotiations.

The USSR received the same offer but eventually refused it, seeing the US's diplomatic intent clearly. Yet, the USSR needed to have access to the data gathered by the U.S. network lest the USSR be at a diplomatic disadvantage due to the inferior data of their own network. To counteract this, the USSR proposed an exchange of seismographs, as two objects of equal value between academic institutions. Denmark also recognized the political strings attached to the "gift," but accepted it anyway. Combined with the strategic location of Greenland, the seismographic stations given by the US enabled Denmark to participate in test ban negotiations between the two blocs. Inadvertently, this type of object-based diplomacy gave small nations like Denmark, without nuclear weapons, power, or mining resources, a tool to engage in nuclear diplomacy on par with the USA and USSR. Thus, this nuclear object was not just circulated between diplomatic actors but also functioned as a fulcrum for Denmark to advance its negotiations with the superpowers.

[31]Ito (2021); Davidson (1973); Galison (1997, pp. 840–841).
[32]Rentetzi (2021).

Kenji Ito's paper turns to nuclear materials and takes their materiality seriously.[33] It explores the material rather than cultural dimensions of the functions a scientific object performs in nuclear diplomacy. He starts with the dual character of the first shipment of radioisotopes from the United States to occupied Japan in 1950. The U.S. international distribution of radioisotopes after World War II is one of the most prominent examples of nuclear diplomacy of radioactive materials, and has been studied extensively by important scholars.[34] By examining the case of Japan from both the Japanese and U.S. perspectives, Ito first shows a stark contrast between the way the Japanese perceived the inclusion of Japan in the international program of radioisotope distribution, as well as the actual decision-making processes at the U.S. State Department that made it possible.

On the one hand, Japanese scientists like Nishina Yoshio saw the importation of radioisotopes as a godsend that would advance scientific research in their devastated country. They attributed it to the "goodwill" of Americans, especially U.S. scientists. Unlike the later U.S. offer of enriched uranium, to which they immediately saw strings attached, the Japanese media celebrated the importation of radioisotopes as the beginning of the atomic age and of peaceful uses of nuclear power. On the other hand, the U.S. State Department added occupied territories like Germany and Japan to the international distribution program mainly for geopolitical reasons. Doing so in Germany would give the United States a strong propaganda advantage against the USSR. Thus, the radioisotope emerged differently in the different practices of particular historical actors. Among Japanese scientists, it remained a scientific object that was intended to be circulated in the spirit of scientific internationalism to advance scientific knowledge. For U.S. diplomats, it emerged as a "diplomatic object" whose ontological status was primarily diplomatic; the radioisotope was a tool for propaganda in Germany against the Eastern Bloc.[35]

Radioisotopes, however, were not simply interpreted differently by different people. Ito argues that U.S. radioisotopes affected the social organizations, material practices, and cultural environments of nuclear research and development in Japan, in ways not intended by U.S. diplomats nor anticipated by Japanese scientists. In response to the importing of radioisotopes, for example, Japanese scientists needed to create an organizational setup to distribute the materials, train experts to handle them, and disseminate relevant knowledge and data. The importation of radioisotopes was also among the events marking the inception of Japan's dependence on the United States for nuclear knowledge and materials, which would undermine the principle of autonomy that Japanese nuclear physicists sought to maintain in order to safeguard the peaceful development of nuclear power. These consequences happened in spite of the relatively small quantity of materials due to the technoscientific character of radioisotopes, just as the cavity magnetron brought by the Tizard mission caused a seismic shift in radar development in the US during World War II.[36]

These ramifications suggest that when a diplomatic gift is also a scientific object, it can have material effects that defy human intentions, predictions, interpretations, or representations, such that it cannot be adequately conceived either as a Maussian gift based on reciprocity or a Trojan horse. Drawing on Karen Barad's anti-representationalist and posthumanist philosophy of science, Ito proposes expanding the scope of diplomatic studies of the history of science to include not only epistemic and cultural but also material dimensions embodied in objects of diplomacy that sometimes evade human expectations or interpretations.

Clara Florensa's paper brings front and center the co-production not only of science and diplomacy but also of the public visibility of nuclear risk.[37] Following the crash of a U.S. Air Force B-52 bomber with a KC-135 refueling plane, 9 kg of plutonium-239 in the form of nuclear bombs was dropped onto the Spanish village of Palomares in 1966. As a result, 1,100 tons (counting only the amount shipped from Spain) of the contaminated soil and vegetation had to be removed and returned to the United States. Drawing on the notion of "politics of invisibility" that Olga Kuchinskaya, 2014 examines in her study of the Chernobyl accident, Florensa studies how diplomatic negotiations

[33]Ito (2021).
[34]Krige (2005; 2006); Herran (2009); Herran & Roqué (2009); Creager (2009; 2013).
[35]Ito (2021).
[36]Phelps (2010); Sword (1986).
[37]Florensa (2021).

between the US and Spain constructed and deconstructed the "nuclearity" of the soil and made its radioactivity visible or invisible.

In the background stood the alliance between the alleged leader of the free world and one of the remaining fascist regimes. The refueling maneuver that caused the crash was a part of Operation Chrome Dome, in which fleets of U.S. nuclear bombers flew to the very edge of the USSR, with Spain occupying a strategic position as a refueling point. Francoist Spain, desperate for the legitimation of the dictatorship, concluded the Madrid Pacts in 1953, allowing the US to have military bases in Spain and undertake such refueling maneuvers over Spanish soil. The contamination would not only have caused embarrassment to the US, but also damage to Spanish tourism and agriculture exports. Hence, both parties colluded to make the radioactive soil go away. In order to do so, however, they had to work very hard with material objects.

Hundreds of American soldiers were dispatched to search for fallen bombs, and also brought radiation detectors, protective gear, decontamination clothing, and other radiation-related equipment, which materialized the nuclear risk and inadvertently made radiation perceptible to the eyes of lay people. Florensa shows that diplomacy played a central role in the effort to deconstruct the nuclearity of the Palomares accident. The US undertook the clean-up operation, but diplomatic negotiations had to set the targeted radiation criteria beforehand. Loath to set a precedent for an expensive cleanup and appalled by the prospect of the large amount of earth to be disposed of, the Americans insisted on 100,000 cpm as the threshold for removal, whereas Spanish scientists argued for 7,000 cpm. Eventually, the US conceded to set the threshold at 60,000 cmp in the populated area, but 100,000 cmp elsewhere. With the nuclear threshold set, both countries wanted to remove the "nuclear soil" from Spain to avoid making a visible monument to the accident. Unable to find any country to accept the contaminated soil, the only option was to ship it to the US. The US accepted and buried 4,808 barrels of nuclear waste in its Savannah River Site. Ultimately, Florensa's contribution is a wonderful example of how nuclear diplomacy and issues of nuclear visibility were co-produced and strongly entangled, mediated by nuclear materials.

Putting all of our case studies together, these papers reveal that throughout the history of negotiations over nuclear issues, nuclear objects play key roles, together with diplomats and politicians, in the conduct of international affairs. States and other diplomatic bodies, such as international organizations, dispatch and exchange not just actors in science diplomacy—namely diplomats, scientists, engineers, and state administrators—but also nuclear objects across borders. The acts of material exchange are polymorphous, including diplomatic gift-giving, in-kind contribution, purchase, accidental dropping, and removal. Material objects are therefore some of primary factors that affect the ways science and diplomacy are co-produced. Within the transnational context set by the circulation of nuclear technologies, our authors advance and deepen our understanding of nuclear diplomacy by exploring how materials that are so central to nuclear sciences emerge as diplomatic agents in their areas of inquiry. They offer a perspective on diplomatic encounters that are strongly entangled with and conditioned by technoscientific materialities, proving, in the end, that the history of international affairs is inconceivable without the history of science. By engaging with the historiographical approaches that put materiality in the center both of the history of science and the history of diplomacy, the papers in this issue make the case that focusing on nuclear objects, artifacts, and technologies allows for a fruitful collaboration between the disciplines.

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