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From exhibiting minerals to narrating extraction: reflections from Lisbon's National Museum of Science and Natural History

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ABSTRACT

This paper focuses on two mineral exhibitions currently held at the National Museum of Natural History and Science (MUHNAC) and aims to explore the cultural and social narratives underlying these displays, as well as the process through which minerals are discursively transformed into valuable resources and disconnected from histories of labour, colonialism and ecological degradation. Investigating mineral collections provides a lens for analysing the entanglement between mineral resources and the production of national and imperial imaginaries, and the intersection between heritage-making, nation and resources. This paper is based on site visits, technologies of display, textual discourse analysis and extensive conversations with MUHNAC staff. It also draws on consultations of archival material and theoretical frameworks from museum studies, critical heritage studies, and energy humanities. We contend that critically examining the role that mineral collections in museums have played in normalising notions of progress, modernity and nationalism and their association with resource extraction could encourage a reconsideration of how these heritage institutions could contribute to action for climate empowerment and to just green transition.

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Introduction

Sparkling under museum lights, mineral collections capture the imagination as treasures of the earth from around the world, admired for their form, colour and rarity. In museums, they are displayed as scientific objects, with their chemical and structural compositions explained. They are also framed within narratives of national wealth, scientific and technological achievement and economic progress. However, they are often disconnected from their histories of labour, colonialism and ecological degradation (Hearth and Robbins 2024; Hide 2024; Yusoff 2024).

Focused on two mineral exhibitions – *Minerals: Identify, Classify* and *Jewels of the Earth: Panasqueira Ore* – currently held at the National Museum of Natural History and Science in Lisbon (MUHNAC), this paper aims to explore the cultural and social

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narratives and the processes through which minerals are discursively transformed into valuable resources and disconnected from their histories. Investigating mineral collections provides a lens for analysing the entanglement between mineral resources and the production of national and imperial imaginaries, and the intersections between heritage-making, nation and resources. Within the context of this special issue focused on 'Carbon Heritages', we concur that critically examining the role that mineral collections in museums have played in normalising notions of progress, modernity and nationalism, and their association with resource extraction could encourage a reconsideration of how these heritage institutions could contribute to action for climate empowerment (see also e.g. Cameron 2024; Cameron and Neilson 2015; Harrison and Sterling 2021, 2023; Sanders et al. 2023) and to just green transitions (Dias et al. 2024).

This paper is written at a time of major reconsideration of the role of mineral collections in museums (e.g. Gelsthorpe 2021; Hearth and Robbins 2022; papers in Armstrong and Sharp 2024) and of 'natural history' collections and specimens more generally (e.g. Ashby 2024; Ashby and Machin 2021; Das and Lowe 2018; Ghosh 2021; Jørgensen 2025). The introduction to a recent special issue of *Museum and Society* titled 'Mobilizing Museum Minerals: Critical Approaches to Mineralogical Collections', addresses the interpretation and displays of mineral collections, noting, 'their transformative potential in an era of rising ecological injustice' (Armstrong and Sharp 2024, 1), and the necessity of 'climate-informed' museum practices in (3). It therefore emphasises the need to 'educate and inspire social action around urgent issues like carbon emissions, water pollution, loss of biodiversity, and climate disasters' (3).

In response, this paper analyses the two mineral exhibitions from two lenses. First, by examining the discursive effects of 'museal silences', a term coined by Mason and Sayner (2018). Building on Ehrenhaus's (1988) definition of silence – as not merely 'the absence of speech' or a 'gap', but as a form of communication that 'non-verbally' speaks – Mason and Sayner (2018) emphasise the importance of examining the purpose of silences: what is omitted, who is responsible for this omission and why. They argue that silences may result from curatorial decisions, institutional constraints, or visitor expectations. Museums may either act as active agents within these dynamics or be subject to external forces. Therefore, 'not all silences are the same' (Mason and Sayner 2018, 13). In short, museal silence is a dynamic and layered concept that plays a crucial role in remembrance processes. Shaped by various cultural and contextual factors, museal silences are characterised by multiple forms and functions within museum spaces.

Second, by drawing on Armstrong and Oromeng's insights on the notion of labour as 'an analytical device' (Armstrong and Oromeng 2024, 26), notably on three different types of labour at work in museums: of extraction, mobility, and maintenance. As the authors point out, 'a focus on labour complicates the histories and futures of heritage-making by highlighting the people, processes, and knowledge systems that underpin the extraction, scientific identification, cataloguing, acquisition, and care of specimens in their journeys from the Earth to within the museum' (26). Nevertheless, examining mineral collections solely through the lens of labour can be misleading, as this approach adopts an anthropocentric perspective that can obscure the ecological consequences of extraction – such as habitat destruction, waste production, pollution, loss of biodiversity and depletion of resources – ultimately leading to ecological silences.

Applying these two concepts to the analysis of exhibitions enables us to consider how the MUHNAC, as a natural history museum, somehow perpetuates the 'divide between "natural" and "cultural" domains' and 'the persistence of such divisions in contemporary contexts' (Schorch and Thomas 2024, 47; and in relation to heritage more generally, Harrison 2015), detracting from the ways in which nature is itself a socio-historical construction of capitalism's particular contradictions (Moore 2015).

The paper is based on exhibition analysis, notably on the technologies of display (display cases and immersive reconstructions), the textual technologies of interpretation (labels and captions, display panels of text and exhibition script) and the technologies of layout (Rose 2001). It draws on Mieke Bal's insights on 'the ways in which a discourse-oriented perspective can be useful for reflection on what museums do with their exhibitions' (Bal 1996, 10). Site visits took place extensively between November 2024 and February 2025, and sporadically since then, these visits were both *unguided* and *guided*, accompanied by curators and technical staff (science communicators) for clarification and incorporation of professional insights – which implied extended and frequent conversations with museum professionals, including management, staff and curators of art and geology. Visits were also made to the mineral storage area. In addition, the paper draws on consultations of archival material to introduce a historical dimension to the analysis of the exhibitions, and on theoretical frameworks from Museum Studies, Critical Heritage Studies and Energy Humanities.

Focusing on the MUHNAC mineral exhibitions, this paper argues that the representation of mineral collections systematically omits key aspects such as provenance, labour (notably colonial labour), colonial legacies and environmental consequences. These omissions are not incidental but are instead shaped by curatorial, institutional and historical factors, including cataloguing practices and financial constraints. Consequently, the exhibitions risk perpetuating extractivist[1] and national narratives, thereby limiting the museum's potential for social engagement. However, the paper also moves beyond criticism, identifying specific limitations and suggesting directions for future curatorial practice to align the museum with sustainable approaches to green transition. The authors are currently involved in ongoing MUHNAC sessions aimed at reflecting on exhibition practices and revising content.

Exhibition:'Minerals: Identify, Classify'

The MUHNAC – one of Portugal's most historically significant institutions and originating from the 18th-century Royal Museum of Natural History – is a university museum affiliated with the University of Lisbon. It operates as a public cultural institution, catering to a diverse audience including students, researchers, academics, families, tourists and science enthusiasts. On 18 March 1978, a devastating fire destroyed approximately 80% of the museum's mineralogical, petrological and palaeontological collections. Over half of the original mineral collection and its associated documentation were lost (Póvoas 2020, 33; Póvoas et al. 2011).[2] This led to replacing the collection on display with a completely new one, following the museum's policy of not exhibiting undocumented specimens. MUHNAC's current mineral collection comprises around 11,000 specimens, most of which are kept in storage. These include specimens rescued from the fire and

others acquired through purchases or donations from international museums, private collectors and mining companies, who showed solidarity following the incident.

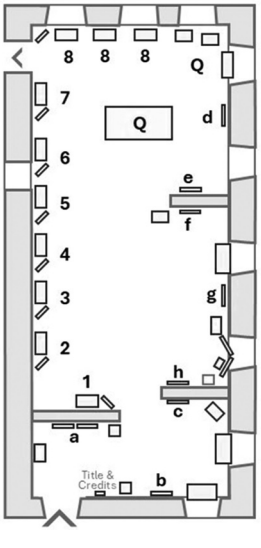
Inaugurated in 2001, the main mineral exhibition at MUHNAC has a clear pedagogical aim: to highlight the two fundamental scientific processes behind collecting practices – identification and classification. According to MUHNAC's website,[3] the exhibition seeks to develop 'a taste for mineralogy' with specimens brought in from around the world. Besides presenting minerals as scientific objects crucial for understanding the evolution of the Earth, they are promoted as 'beautiful' and 'valuable' resources, 'the foundation of economic and social life throughout history'. The website invites visitors to 'explore a little more about each of the minerals: name, composition, use, origin; or simply enjoy the immense beauty of the specimens on display'. This makes the exhibition appealing to a wide range of audiences, including casual observers, amateurs and educators.

The design of the exhibition balances educational content with aesthetic appreciation (Figure 1). Upon entering the space, visitors are greeted by neutral grey walls coated in raw concrete, which evoke the atmosphere of a mine. This stark, industrial, *béton brut* aesthetic contrasts with sleek glass display boxes – containing mineralogical specimens, scientific instruments, reference materials, book reproductions and text panels, which are set against white partitions. The visual contrast accentuates the minerals' perceived value, presenting them as precious and desirable objects from around the world.

The space is conceptually divided into three sections:[4] the introductory area, the history of mineral classificatory systems and the systematics of minerals. In the introductory area, the three panels highlight a variety of criteria used to identify and classify minerals, ranging from physical and optical properties, such as hardness, density, brightness and colour to internal structure and chemical composition. The diversity of techniques and tools used to identify them is also covered, ranging from the naked eye to X-rays. Panel b explains how minerals are named, either based on their physical properties or chemical composition or after a location or person. In the latter case, three minerals were named after prominent mineral researchers: *Andradite* –a nesosilicate named after José Bonifácio de Andrada e Silva (1763–1838), a Brazilian naturalist who worked in Portugal as the Intendant General of Mines and Metals of the Kingdom; *Thadeuite* – a phosphate named after Décio Thadeu who studied the Panasqueira mines and worked for Beralt Tin and Wolfram Ltd mine company throughout the 1950s and *Leiteite* – an Oxide from the Tsumeb Mine, Namibia, named in 1977 after Luis Teixeira Leite, a mineral collector and a close collaborator with MUHNAC, playing a central role in the creation of the International Fair of Minerals, Gems, and Fossils in 1988.

The second section presents different systems of mineralogical classification in chronological order, based on utility, observable physical properties, and chemical criteria (according to E.S. Dana's *A Textbook of Mineralogy*, 1916, was later developed by Strunz and Dana's followers throughout the 20th century), structure, or both chemical composition and atomic structure (developed by, among others, Lima de Faria in 1983). This section also displays several objects such as a small glass box containing Torbern Bergman's book *Manuel du minéralogiste* (1792), based on a classification system that used chemical criteria; mineral identification tools from the 19th and early 20th centuries, such as chemical reagents, rock slabs, a petrographic microscope and a field kit containing the Mohs scale. Another notable item is the first Portuguese book on





Box 1 – Native Elements

Box 2 – Sulphides and Sulfosalts

Box 3 – Oxides, Hydroxides and Halogens

Box 4 – Carbonates, Nitrates and Borates

Box 5 – Sulphates and Chromates

Box 6 – Tungstates and Molybdates

Box 7 – Phosphates, Arsenates and Vanadates

Boxes 8 – Silicates

Q – Quartz collections

Panel a – Minerals, Crystals

Panel b – Identifying

Panel c – Classifying

Panel d – Classification based on utility

Panel e – Classification based on observable physical properties

Panel f – Classification based on chemical criteria

Panel g – Classification based on both chemical composition and atomic structure

Panel h – Classification based only on structure

Figure 1. 'Minerals: identify, Classify' exhibition (photo by the author 17.11.2024, plan © archive of MUHNAC-ULISBOA, edited by the Authors).

mineralogy, written by Manuel José Barajona in 1823. There are also reproductions of scientific articles from the 1950s and 1960s which were published in the *Bulletin of the Mineralogical and Geological Museum and Laboratory*.

The systematics of minerals constitute the central focus of the exhibition. Minerals from various locations and countries are organised into eight groups according to the classification of *Dana's New Mineralogy* (Gaines et al. 1997, 8th edition), as listed in the plan. The centrepieces of the exhibition are a giant tectosilicate from the Naipa Mine in Alto Ligonha, Mozambique, and a massive amethyst quartz geode from Rio Grande do Sul in Brazil.

The mineral kingdom, human labour and the environment

The exhibition reveals three interconnected regimes of value: scientific, national (and, by extension, imperial) and economic, framed as a natural resource. Scientifically, it aims to present mineral identification and classification as universally scientific practices, thus embracing a linear narrative of progress and knowledge accumulation. The exhibition tends to perpetuate the idea that minerals are neutral scientific objects and reinforces the narrative that frames mineral classification as a purely technical process that produces standardised knowledge devoid of human interventions. As Echterhölter (2022) has pointed out, western scientific classification relies on binary concepts, such as 'organic versus inorganic' and 'nature versus artifice' – frameworks that effectively exclude people and human activity (2022, 16–17).

However, the process of identifying and classifying a mineral specimen is deeply rooted in national and imperial histories – constituting the second dimension of value. As we have pointed out, minerals were named after prominent individuals who discovered and identified them in the course of their professional activities, as administrative officials in former colonies or as employees of mining companies in Portugal. The exhibition celebrates both Portuguese contributions to mineralogical science, including publications and instruments, as well as minerals named after Portuguese researchers and listed by the International Mineralogical Association (IMA).[5] However, the scientific framing solely based on the processes of identification, classification and standardisation (based on the IMA list), risks what Richardson and Weszkalnys refer to as 'physical abstraction' (2014, 14), whereby mineral specimens are presented as having been unearthed naturally, without human involvement, as if they were 'given and ready for human use' (Richardson and Weszkalnys 2014, 14). This separation between human and nature and the absence of any reference to the people involved in extracting and transporting minerals from the mining sites to the museum ignores what Armstrong and Oromeng referred to as the 'labour of extraction' and the 'labour of mobility' (2024, 26). It is striking that two enormous minerals from former Portuguese colonies, Mozambique and Brazil, are centrepieces at the exhibition yet presented as mere natural objects with no human or nonhuman contexts provided. By contrast, at the Museo delle Civiltà in Rome, Pireddu (2024) describes presenting mineral specimens 'as art and artefacts of civilization' and explaining how 'mining has affected the landscape and lives of many human and nonhuman communities in Italy and abroad' (212) as being the main challenge of the 2022 exhibition *Animals, Plants, Rocks and Minerals': The ISPRA Collections, Towards a Multi-Species Museum*.

The value of the mineral specimens is emphasised by subtle cues based on their provenance, rarity, aesthetic appeal, size, location and utility. This is explicit in both in the labelling method, which highlights the countries of origin and presents the collection as having been 'unearthed' and sourced from around the world, and in the panels which emphasise their utility (Panel d) and refer to them as 'precious stones' (Panel e), underscoring their physical and economic values. The exhibition's webpage describes minerals as 'valuable', implying that they have an inherent value yet disregarding how values (financial, economic and aesthetic) are assigned to them. In other words, as Richardson and Weszkalnys point out, 'natural resources are not "out there" ready to be seized upon and utilized'; rather they become resources through human agency (2014, 16). Furthermore, by attributing cultural and social value to specimens, museums play a part in the transformation of minerals into resources. This results in a dual system of valuation: resources are sources of value, and values must be found within them. Ultimately, by preserving and valorising mineral specimens, museums shed light on the process of creating value – an aspect emphasised by Paterson and Witcomb (2021) in their approach to colonial Western Australian collections. For Paterson and Witcomb, conceptualising 'collections as resources involves a recognition of a structural relationship between the generation of values and the treatment of collections as extractable commodities' (2021, 198). The fact that the mineral *Leiteite* was named in 1977 after a private collector and future organiser of the fair is significant in terms of the relationship between value creation and commodification.

By focusing solely on the physical and chemical properties of the specimens, the exhibition neglects social information and the environmental dimensions of mineral extraction, as well as the history of the institution itself. This kind of 'museal silence' (Mason and Sayner 2018) is caused by cataloguing practices common in science museums (Hearth and Robbins 2024), where metadata is limited to the mineral's name, scientific classification, country of origin and, in some cases, the donor or seller. Detailed provenance information, including specifics on labour conditions, extraction and transportation processes and the identities of those involved, is largely absent. These omissions stem from the conventional practices in science museums of treating nature and humans as separate entities, and, in MUHNAC's case, they are further aggravated by the loss of collections and documentation due to the 1978 fire.

Undiscussed histories: fire at the museum and loss of colonial material

Another important silence of the museum's history that visitors may overlook is the fire. The ornate room in which the mineral collection once stood, complete with wood flooring, painted ceilings and carved columns, was reduced to ruins and later reconstructed in a modern, raw concrete style. Today, a salvaged pillar segment is located near the entrance, left unlabelled and the story of the fire remains undisclosed (Figure 2).

These untold stories are nevertheless evoked through temporary art exhibitions, which are intended to complement and invigorate MUHNAC's current displays. In line with broader trends in science museums, such artistic interventions are increasingly being used in temporary exhibitions to challenge institutional discourses and offer alternative perspectives on controversial issues. As art curator, Sofia Marçal (2025, 120) argues, the MUHNAC has recently become 'an interdisciplinary place where contemporary art



Figure 2. Mineralogy room in 1958 (before the fire – photo by Abreu Nunes) and in 1978 (following the fire – photo by Fernando Barriga) © MUHNAC-ULISBOA.



Figure 3. Displayed pillar from the original Mineralogy room (photo by the authors 11.02.2025) located outside the mineral exhibition (No.1 to the right of the photograph). The exit from exhibition 2 and entrance to exhibition 3 can be seen on the left.

exhibitions permeate the museum's various spaces'. She claims that this approach 'can attract new visitors, cross audiences, create new sensibilities, and dissolve the archaic boundaries between art and science'.

It is worth noting that a previous temporary exhibition engaged with the fire and its aftermath. The *Souvenirs of Fire* exhibition (2019) by Slovak artist Katarína Poliačiková presented carbonised fossils that had survived in the central space of the *Minerals: Identify, Classify* exhibition. The artist explains that, due to the fire, '[t]he fossils lost their scientific value in the flames and had never been exhibited again'.[6] By highlighting the emotional significance of these damaged specimens for museum staff, Poliačiková's intervention challenges traditional value hierarchies, offering a more inclusive approach to heritage, which recognises loss, trauma and physical change as essential elements of an object's narrative. This demonstrates the role of contemporary art in reinterpreting museum collections and drawing attention to significant aspects of heritage that are frequently overlooked and excluded in scientific displays.

Another 'museal silence' is related to MUHNAC's colonial legacy. The history of the Portuguese Colonial Empire Room, which was inaugurated in 1936 and was devoted to promoting resources and their extraction in former Portuguese colonies, has also been erased (Brandão, Póvoas, and Lopes 2015). According to Alfredo Machado e Costa, a former director of the museum, the room's primary function was to showcase the colonies' resources and demonstrate the motivating factor behind the search for valuable mineral deposits: colonisation. Designed as a 'tribute to the Empire and its founders, for their conquest and pacification' (Costa 1937, 39), the colonial room displayed petrographic and geological collections as well as rocks and fossils; as for the mineral collection, it amounted to 130 specimens, most of which

were from Angola and Mozambique, with a few from Cape Verde (Brandão, Póvoas, and Lopes 2015, 16). According to Liliana Póvoas, the former geology curator, only 5,000 of the 15,000 specimens survived the fire and were recovered and placed in the museum's storage area. Of these 5,000 specimens, 429 are labelled 'colonial', indicating that they are from former Portuguese colonies. The remaining specimens are labelled 'Portuguese' or 'foreign'. It is somewhat surprising to find this designation based on provenance in the storage room, given the end of the Portuguese Empire in the wake of the 1974 revolution. Yet these labels reveal that cataloguing practices often uncritically reproduce classifications created during the colonial era, thereby shaping the ways in which specimens are analysed and interpreted, perpetuating colonial frameworks even decades after decolonisation.

Only one piece from the colonial period is on display in one of the museum's corridors: the monumental native copper block (Figure 4), described as a 'piece of native copper with a mixture of iron ore weighing 2,666 pounds (1,209 kg)' which was brought from Brazil and deposited at the Royal Museum of Natural History and Botanical Garden of Ajuda in 1768.[7] The piece has a Latin inscription, which provided translation reads: 'During the reign of Maria I and Peter III a piece of native copper with a mixture of iron ore weighing 2666 pounds was discovered in Bahia County near the town of Cachoeira and deposited in the Museum of the Prince of Brazil 1782'. In the background, a panel explains its composition (97% copper and 3% iron), weight and the meaning of the term 'Museum of the Prince of Brazil'.[8] Below this text, there is a reproduction of Domingos Vandelli's[9] 1797 paper describing the object, along with a coloured photograph of the retrieval site, Mamocabo, located on a river alluvial fan.



Figure 4. The native copper block (photo by the author 28.01.2025).

Surprisingly, despite the rich history of the Native copper block, there is no mention of Brazil as a Portuguese colony at the time. The museum's website, which featured the copper block as 'item of the month' in December 2023, describes it only as 'an object with a strong

historical symbolism that takes us back to the origins of the Museum' and includes details about the historical context of the discovery and the composition, based on the inscription and Vandelli's characterisation and the meaning of the term native – a native element, in the chemical sense, 'that it is natural and does not result from any human procedure'.[10] However, it makes no mention of the controversies surrounding its discovery,[11] nor the logistical challenges and physical labour involved in transporting such a massive piece from Brazil to Portugal.

Such omissions contribute to the concealment of the underlying colonial histories of the museum's collections and perpetuate the erasure of colonial violence from the scientific records. As Das and Lowe (2018) and Gelsthorpe (2021) argue, the historical entanglement of science, empire and race must be critically addressed in how museums interpret their collections. Ashby (2024) further asserts that tracing colonial legacies in museum collections entails:

> to identify, research, and address imbalances in the history of museum formation that result from colonial structures of power and exploitation, and the narratives used to interpret them, as well as consider the ongoing impacts of these imbalances for audiences today (57).

MUHNAC's current Director, Marta Lourenço, acknowledges that 'narrative approaches in exhibitions were often didactic, linear, and unproblematic. Historical, social, and political contexts were generally absent – let alone controversies. This has begun to change over the past two decades' (Lourenço and Sousa Dias 2017, 395). Indeed, the museum has been addressing its colonial legacy and establishing itself as a leading venue for discussions on decoloniality and the decolonisation of museum practices by hosting temporary exhibitions, workshops, seminars and public events.[12] *The Photographic Impulse: (Dis)arranging the Colonial Archive* exhibition (originally scheduled to take place between 21 December 2022 to 31 May 2023, but still going ahead) – the result of a partnership between the museum and a university team – presents 'a decolonial reading of the images and scientific objects from the geodesy and anthropology expeditions to the territories colonised by Portugal' between the end of the 19th century and 1974.[13] It features an interactive 'Mural of Contradictions' bearing the phrase: '(De)Colonisation is Full of Good Intentions'. Next, a panel invites visitors to reflect on the complexities and contradictions of decolonisation and decoloniality and to add post-its to the mural. This effort signals MUHNAC's commitment to engaging visitors with contemporary and controversial issues and forging meaningful links between the colonial past and the postcolonial present.

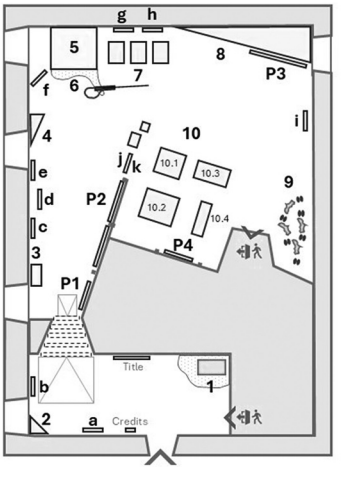
Exhibition:'Jewels of the Earth: panasqueira ore'

Three years after the opening of the mineral exhibition, MUHNAC brought in a new exhibition from Porto, originally conceptualised by the Department of Mines at the Faculty of Engineering of the University of Porto and displayed there between 2003 and 2004 (Póvoas et al. 2005). The new exhibition, inaugurated in 2004, is devoted to the Panasqueira mine, which is located in the Beira Interior region in the north of Portugal, the exhibition focusses on the ore's specificity due to particular geological circumstances of the Central Iberian Zone (Figure 5).[14]

While the Porto exhibition focused solely on mining techniques and miners' experiences, with a sterile, white-walled design (Póvoas et al. 2005), the Lisbon version provides an

immersive sensory experience. This begins with a dark entrance featuring a mine waggon, accompanied by emotional, textual and visual elements. These include an excerpt from *Minas de San Francisco* (1946), by the medical doctor and writer Fernando Namora reflecting on the harsh daily lives of miners and a statue of Saint Barbara, patron saint of miners. Visitors then pass through a narrow, lantern-lit tunnel that leads to the main gallery. Here, minerals are displayed at the centre, surrounded by informative panels, instruments and maquettes (Póvoas et al. 2005, 2).





1 – Mine wagon
2 – Statue of St. Barbra
3 – Pre-existing rocks: schists and greywackes of Beiras
4 – Case 1
5 – Mine simulation
6 – Equipment
7 – Exploration Methods
8 – Case 2
9 – Mine outfits
10 – Mineral collection
10.1 Oxide and silicate phase
10.2 Main sulphide phase
10.3 Transition phase
10.4 Final carbonate phase

Panel a – Quote by Fernando Namora
Panel b – traditions... and superstitions
Panel c – Panasqueira: the mine
Panel d – Panasqueira: the geology
Panel e – Panasqueira: the veins
Panel f – Panasqueira: the history of mining
Panel g – Panasqueira: exploration methods
Panel h –Panasqueira: the dismantling
Panel i – Panasqueira: the preparation of ores
Panel j – Panasqueira: the ore
Panel k – Panasqueira: the minerals
Photo 1 – 3x3 photos (vertical) – 1
Photo 2 – Two aspects of veins
Photo 3 – Heaps of the Panasqueira Mines
Photo 4 – 3x3 photos (horizontal) – 2

Figure 5. 'Jewels of the Earth: panasqueira ore' exhibition (photo by the authors 17.11.2024, plan © archive of MUHNAC-ULISBOA, edited by the Author).

Nine informative panels provide geographical and geological context (Panel d), historical context of the mine (Panels c, e, f and g), information about the ore (Panel j) and its formation (Panel k), details of mineral processing (Panel i) and an overview of how dismantling techniques evolved (Panel h). The mine is described on panel j in the following terms:

> The Panasqueira Mine is internationally renowned for the beauty, size and quality of the crystals in its mineral paragenesis. No one is indifferent to the shapes, colours, dimensions and combination of the minerals in this mine, a true gift from nature to man.

It also notes that the wolframite crystals are 'sought after by museums and collectors all over the world' and highlights the discovery of two minerals 'new to science': *Thadeuite* and *Panasqueiraite* (examples of which are also displayed in *Minerals: Identify and Classify*). Three coloured photographs show miners recovering crystals from geode cavities.

Focusing on the historical aspects, Panel c introduces the mine as 'the only working tungsten mine in Europe and one of the few in the world'. Panel e discusses the extraction of cassiterite in Roman times to produce tin and cites the 'first written reference to the Panasqueira mines' in the *Descriptive Catalogue of the Mines Section* (1889). Panel f traces the history of mining in the area from Roman times to the present day. It identifies 1912 as a turning point that led to a significant increase in extraction, which peaked during both World Wars. Using human labour as an indicator of mining activity, it notes that Beralt Tin & Wolfram Ltd employed 800 workers during WWI, with a further 1,000 prospecting independently (working by the kilo). By the time of World War II, the workforce had reached 10,000 (Póvoas et al. 2005, 4). The panel features two black-and-white photographs: one shows a woman digging by hand and the other shows a man carrying minerals in a straw basket. Photographs and drawings illustrate how horses were used to pull mine waggons. Panel g charts the technological developments that took place from manual labour to the introduction of air compressors and blasting methods in the 1940s, which were adopted to reduce costs and risk.

Besides panels, the exhibition features a mine tunnel installation framed by a wooden structure with a printed backdrop and gravel on the floor. Donated pieces by Beralt Tin & Wolfram are on display, including mining tools and maquettes illustrating dismantling techniques. Additionally, a display case contains a sample of raw ore alongside concentrates extracted from it, including tin, copper and tungsten. Various applications of wolfram (tungsten carbide) are shown below, including tools (some of which are provided by Atlas Copco), lamps, ballpoint pen tips and military items, such as a 1937 Portuguese Mauser and a dagger. Next, to these is an image taken by the exhibition's curator and geologist, Fernando Barriga, showing the waste heap resulting from discarded material. On the opposite side is a suspended installation displaying miners' uniforms, helmets, boots and headlamps. This appears to be a memorial to the miners, but there is no accompanying explanation. The exhibition's focal point is the mineral specimens, which are arranged in four display cases according to their formation phases.

Forging a valuable heritage

The expression 'jewels of the earth' is used in the exhibition's title, and 'a true gift from nature to man' in Panel j. The use of these terms indicates the type of approach conveyed by the exhibition. While the Panasqueira deposit is the result of a geological formation, the minerals extracted – such as wolframite and cassiterite, from which tungsten is obtained – are nevertheless made culturally and economically valuable. However, the minerals are presented as merely 'natural' findings, as if they were waiting to be discovered. This obscures the profound socio-environmental impacts of extractive industries and their applications, ranging from everyday objects to supplying the global arms industry.

The mining company – the mine was operated by Beralt Tin & Wolfram Ltd from 1901 to 2016 and is now operated by Almonty Industries – provided ores, maquettes and tools for the exhibition, as well as technical consultation. However, the museum retained full curatorial control over the exhibition's content and interpretation. Accordingly, this collaboration with the mining company cannot be considered as an example of 'museums being silenced by external powers', in the light of Mason and Sayner's typology (2018). Yet, despite this autonomy, the exhibition misses an opportunity to explore the social realities of the mine, both past and present, by contrasting the social consequences of extraction with its economic contributions. This could include information on the current number of miners working there (around 300), the festivities associated with the Santa Bárbara and the chapel built in her honour in 1923 and the first woman to be admitted to work at the mine in 2023 due to labour shortages. On the contrary, through its immersive setting, textual communication and displays of models, instruments and minerals donated by the mining company, the exhibition promotes extractive industries and thus contributes to cultivating extractivist mentalities as well as national and social imaginaries.

Furthermore, once these mineral specimens are incorporated into the museum, they acquire additional symbolic, aesthetic and commercial value. This makes them doubly worthy – they are financially valuable and worthy of display. The fact that the information in panel j refers to the way in which 'wolframite crystals are sought after by museums and collectors all over the world' indicates the transformation of minerals into commodities. As Paterson and Witcomb pointed out, 'the extractive ideology [. . .] involved processes of value-adding, to produce resources that could be commodified and put to productive uses through economic strategies including exchange, sale and display' (2021, 218). It is therefore no accident that during the 'XXXVII International Fair of Minerals, Gems, and Fossils' (5–8 December 2024), hosted at the MUHNAC's entrance hall, a specific stand was devoted to the Panasqueira ore (Figure 6).



Figure 6. Panasqueira ores sold at the XXXVII International Fair of minerals, Gems, and fossils (photos by the authors, 06.12.2024).

As Panasqueira mine is the only active tungsten mine in Europe with over 120 years of operation, it has become a symbol of national identity and pride. As Póvoas et al. (2005, 7) observe, Panasqueira's heritage value extends beyond its resources to encompass the extraction methods, tools and technical expertise that establish it as a benchmark for technical heritage and industrial archaeology. The mine's long-standing role in the country's history, from its rural beginnings to the development

of an industrialised economy, has shaped the national imaginary formed over the course of more than a century, to the extent that natural resources are equated with national resources (Yusoff 2024, 238) or patrimonies. Thus, Panasqueira exemplifies the intertwining of resources, nation-building and heritage as defining symbols of Portugal's industrial history, collective memory and national identity. This echoes the 'resource-state nexus', a term coined by Bridge (2014) which aimed 'to capture the recursive character of scientific and political practice around resource-making and state-making projects' (2014, 119). Bridge argues that both resources and the state should be regarded as both outcomes and tools of modernity. This implies considering how they 'come to be – i.e. the formative processes through which resources and states are generated' (2014, 119). In other words, the extraction of resources shapes a nation's social and cultural imaginaries of its past and how the future is conceived. By devoting a special exhibition to the Panasqueira mine, the MUHNAC, as a heritage institution, plays a central role in the various processes of resource exploration and extraction that are fundamental to national-building projects.

Moreover, the fact that a rare mineral was discovered there and named *Panasqueiraite* after the location helped put the country on the map of the international network. It is widely accepted in museum studies literature that museums are vehicles for representing nations and fostering a sense of belonging (e.g. McLean 1998). In the case of this exhibition, rather than merely reflecting a shared sense of belonging and ideas of nationhood, it contributes to the production of national energy imaginaries. The fact that the exhibition is hosted at MUHNAC, a national museum, is by no means a coincidence.

However, this celebratory approach runs the risk of romanticising the history of mining and normalising extractive practices. This overlooks the human and environmental costs involved, with fleeting mentions of silicosis, working by the kilo and waste heaps presented as an aesthetically pleasing industrial landscape without any critical reflection on environmental damage. Analysis of the written panels reveals that information on social conditions and labour extraction is minimal. The meaning of 'working by the kilo' (trabalho ao quilo) is not explained, despite this being a system in which locals, mainly subsistence farmers, were paid based on the quantity of minerals they extracted by hand under precarious and physically demanding conditions. As for the labour involved in transporting minerals – moving them from extraction sites to markets and museum collections – only the use of horses to pull mine waggons is mentioned briefly (Panel f).

Similarly, the environmental consequences are underrepresented. Although Panel I and the photograph titled 'Heaps of the Panasqueira Mines' refer to waste accumulation, they do so in purely technical terms and fail to address the cumulative impact of extraction, processing, transportation and waste disposal on ecosystems and local communities. The only quantitative detail provided – 'For each ton of treated ore, 3–4 kg of concentrate are obtained. The rest constitutes the waste heap' – is a caption printed in dark orange, barely legible in dim lighting. Although the colour choice, inspired by mining uniforms (Póvoas et al. 2005), shapes the aesthetic, it also contributes to visual obscurity – a *silence by design* (Mason and Sayner 2018). The long-term environmental impacts, such as water contamination, public health risks resulting from exposure to toxic elements

(Candeias et al. 2014), unstable slag heaps and arsenic accumulation in the Zêzere River are not mentioned.[15] A more comprehensive treatment of these issues would provide a broader context for Panasqueira within the global history of resource extraction. This would highlight the long-lasting impact of extractivism on people's way of life and the environment.

Although it could be argued that the Panasqueira exhibition addresses social and environmental issues to some extent, there is a clear physical and conceptual distinction between this exhibition and *Minerals: Identify, Classify*. Despite both exhibitions being on the ground floor and close to each other, visitors must exit *Minerals: Identify, Classify*, cross the *Plants and People* exhibition, walk through a corridor to reach *Jewels of the Earth: Panasqueira Ore*, where they will find the dark entrance on their right (see Figure 3). This makes access to the Panasqueira exhibition entirely optional, with the risk of visitors missing it altogether and any opportunity to learn about the social and environmental realities of extraction. Thematically, there is a stark contrast between the aesthetic appeal of *Minerals: Identify, Classify* and the darker, grittier mining histories explored in *Jewels of the Earth*, histories that are brought to life through the exhibition's immersive design. This separation creates a significant rupture in the narrative, severing minerals from their mining histories and disconnecting the beauty of minerals from the harsh realities of their extraction. This, in turn, results in the sidelining of social and environmental dimensions. These dimensions are manifested in the design itself through what is made visible, what is given a lower priority, and what is absent, an example of 'silence by design', as outlined in Mason and Sayner's (2018) framework.

Photographic collection: 'photographs taken from the drawer'

Eighteen years after the inauguration of the Panasqueira exhibition, a photographic installation was added in 2022. This was the result of a collaboration between photographer Luís Pavão and art curator Sofia Marçal. In an interview with the authors, Marçal recounted the story of how she came to display Pavão's long-forgotten photographs of the Panasqueira mining site, taken in December 1974. The aim was to 'protagonise and humanise the mine and bring faces to it'. Around 60 photographs were digitised, and Marçal and Pavão selected 18 that they considered to be 'the most beautiful and representative'. Pavão envisaged a simple presentation, with the images printed without frames and pinned directly to two walls: one by the tunnel, close to the exhibition entrance and the other in the centre of the exhibition space. The aim was to subtly 'contaminate' the space, in Marçal's words, by introducing art into an otherwise science-focused display. While the photographs are displayed completely unlabelled, the exhibition provides a room sheet. It mentions past misogynistic mining superstitions that prevented women from entering the mine, and highlights health hazards such as silicosis, as illustrated in one of Pavão's photographs that shows an X-ray of a miner's damaged lungs. It also quotes Pavão as saying: 'The 25th of April had already happened, but it had not yet reached the mine', capturing the persistence of exploitative labour conditions just a few months after the end of Portugal's authoritarian regime.

Although the photography exhibition introduces a powerful human element, it leaves key questions unanswered. The contrast between miners smiling for the camera and those with unguarded, weary expressions, hints at hardship, yet nothing is said about their lives or the systemic economic inequalities they endured. The photographs also feature people from diverse ethnic backgrounds. The lack of contextualisation obscures, for example, how during the 1960s and 1970s, labour shortages led to labourers being recruited from Cape Verde, a former Portuguese colony. Providing further contextualisation would demonstrate the connections, through the labour force, between the metropole and the colonies. It would also highlight the impact of colonialism, capitalism and racial inequalities on the mining industry, as well as its social consequences and economic dependence on extractive industries.

With this photographic exhibition, and like the other artistic interventions mentioned above, MUHNAC demonstrates its willingness to engage in more inclusive and reflective curatorial practices. The institution also seeks to address, via temporary artistic residencies and its PANC (Art, Nature and Science Programme) exhibitions, some of the silences of its history, notably the 1978 fire, as well as ecological concerns and colonial legacies. However, one might ask why these controversial issues are being addressed by means of artistic approaches that engage only the artists and leave the museum's authority unquestioned. Decolonial initiatives have been criticised for using temporary artistic interventions to introduce changes to museum narratives without modifying permanent exhibitions. Conceived as 'proxies for embodied acts of resistance', it is important to consider that artistic interventions might end up deploying 'a kind of deception by cloaking their subversive messages in the familiar languages of classical Western arts' (Philipps 2021, 200). While temporary artistic interventions can complement existing museum exhibitions by drawing attention to contemporary issues, fostering visitor engagement, raising questions and encouraging reflection, they should not be considered a solution nor a substitute for revising content. Rather, they are better positioned as part of a transitional phase, signalling a broader, sustained, and ongoing process of institutional transformation.

Conclusions

Our examination of MUHNAC's mineral exhibitions has revealed three types of silence: gaps in historical records, scope limitations and silence by design. The analysis also highlighted how the labour involved in mineral extraction and mobility is often overlooked. As mentioned in the introduction, the authors are currently involved in a working group led by the museum director, comprising staff and invited researchers from various disciplines, including History, the History of Science, Anthropology, and Museum Studies. The group aims to review the content of some exhibits and the language used on the panels, as well as establish guidelines for future initiatives.

Regarding our case study, proposals to revise the label content of the Native Copper Block – currently there is, to use Bal's words, a 'tension' between the specimen displayed and the caption accompanying it (Bal 1996, 10) – and to establish conceptual links and transitions through display panels to bridge the gap between the two mineral collections, are under consideration. The same applies to our proposal to incorporate geographical maps detailing the minerals' origins and the locations of their associated mines. These

maps would not only illustrate the minerals' journeys to the museum but also shed light on the global reach of Portugal's extractive industries, particularly in former colonies where exploitative labour practices and colonial infrastructures sustained the mining economy.

Furthermore, engaging mineral collections in dialogue with zoological, geological and botanical collections allow us to explore the extractive aspects of MUHNAC's holdings and identify the similarities and differences between mineral extraction and other collections. Beyond their shared history of exploiting land resources, particularly in former Portuguese colonies, this would expand the scope by highlighting the links between colonialism and climate change (Ghosh 2021), and between decolonisation and decarbonisation (Harvey 2023; Modest and Augustat 2023). It should be noted that the museum is currently hosting workshops, seminars, public events and community-led visits, as well as developing projects with descendant communities and diasporas. These efforts demonstrate a growing commitment to linking historical and colonial legacies with present-day challenges.

Despite acknowledging the need to implement changes, the museum is facing problems related to the lack of funding, recruitment of qualified staff and renovating its current exhibits. However, updating the content of the exhibits by adding new panels could be the first feasible change. For example, regarding the Panasqueira exhibition, which mostly dates back to 2003, it would be useful to inform visitors about the current situation of the mine and its changing social context. Establishing connections with the past, present and the future would highlight the relevance of the mine in the current European context of the rush for tungsten for rearmament; it is worth noting that the European Commission's Critical Raw Materials Act considered tungsten a critical raw material in 2025.[16] Given that the Panasqueira tungsten reserves guarantee at least another 15 years of activity, and immigrants currently make up 15% of the workforce, it is indeed timely to update the exhibition content.

Public education centres and museums are crucial places for discussing environmental issues and contributing to sustainable development (e.g. Cameron 2024; Cameron and Neilson 2015; Harrison and Sterling 2021; McGhie 2021). Additionally, university museums, as the aforementioned special issue of *Museum and Society* issue (2024) argue, can play a key role in challenging public perceptions of climate change, sustainable resource extraction and the impact of mining. MUHNAC is well placed to encourage critical engagement with the socio-historical dimensions of mineral extraction, and to develop more inclusive and engaging narratives. As Cameron et al. pointed out, 'Collections can convey new stories that articulate how objects might serve as material expressions of climate change' (2023, 63; see also Harrison and Sterling 2023). Providing knowledge of the historical and social dimensions of mineral collections, and fostering critical awareness of the legacies of extraction, could enable museums to become agents of climate action. This would promote cultural change and contribute meaningfully to sustainable futures.

Notes

1. On the conceptual distinction between resource extraction and extractivism 'as the cultural and ideological rationale that either motivates extraction or is the consequence of it', see (Szeman and Wenzel 2021).
2. Póvoas et al. (2011) explain that the data loss prevented 'an exact quantification of losses'. Galopim de Carvalho and Lopes (1987), estimate that 70% of the mineral collection was lost.
3. https://www.museus.ulisboa.pt/minerais-identificar-classificar
4. *Catálogo. Minerais: Identificar e Classificar. Roteiro*, observation, and personal conversation with Liliana Póvoas.
5. On the International Mineralogical Association see (de Fourestier 2002).
6. https://katarinapol.com/portfolio/souvenirs-of-fire/
7. https://museus.ulisboa.pt/bloco-de-cobre-nativo
8. Referring to the Royal Museum of Natural History and Botanical Gardens of Ajuda, which is the original name and the institutional ancestor of the MUHNAC.
9. Domingos Vandelli was between 1768 and 1810 director of the Royal Museum of Natural History and Botanical Gardens of Ajuda.
10. https://museus.ulisboa.pt/bloco-de-cobre-nativo
11. These controversies are still going on today raising questions about the authenticity of this piece and the existence of copper mines in the Bahia region (see de Paula Garcia et al. 2021).
12. MUHNAC has led and welcomed several initiatives on the legacy of European colonialism. https://museus.ulisboa.pt/contested-desires-constructive-dialogues For the past year, a series of online seminars, titled *Conversas sobre Coleções Coloniais* (Conversations on Colonial Collections), has been discussing the emerging projects on 'problematisation, re-signification and restitution'. https://www.youtube.com/playlist?list=PLF_FzNTG1jyoX74LYkxeTVIgzqK_LqKRx
13. https://www.museus.ulisboa.pt/exposicao-impulso-fotografico
14. https://www.museus.ulisboa.pt/joias-da-terra-o-o-minerio-da-panasqueira
15. https://minob.org/portugues/mina-da-panasqueira.html
16. https://expresso.pt/economia/2025-05-01-aos-127-anos-as-minas-da-panasqueira-ganham-uma-nova-vida-em-parte-devido-a-corrida-ao-rearmamento-da-europa-21306dfa.

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