Introduction
On September 20, 2006, Hugo Chávez, then President of the Bolivarian Republic of Venezuela, invoked an analogy as old as it is rooted in the Western imagination. He began one of his most famous speeches before the United Nations General Assembly referring to the smell of sulfur and pointed out the presence of the prince of hell, in this case, to qualify the then president of the United States, George W. Bush: “The Devil himself is in the house”, he stated. The metaphorical link between the Devil and sulfur is certainly not new. Since ancient times this relationship has existed between sulfurous odors, which were related to volcanoes, and these as the gates to the underworld. However, not only sulfur has fed Western imagination, but modern sulfur exploitation also has fascinated historical accounts because of the hardship conditions endure by miners. Sulfur mining exploited at the Andean heights (more than 4,500 meters above sea level) has social and cultural specificities that have their own historical trayectory. This paper presents the Alto Cielo Archaeological Project (ACAP), research carried out between 2014 and 2019 in the Quechua indigenous community of Ollagüe, in northern Chile. The project aimed to document the industrial remains of sulfur extraction dating between 1887 and 1993 to further understand the specificities associated with its mining, a history largely unexplored.

Ollagüe is located at 3,660 meters at the Chile-Bolivia border in the northeastern part of the Antofagasta Region. From the end of the nineteenth century and following the War of the Pacific (1879-1884), which opposed Chile to Peru and Bolivia, Ollagüe witnessed the complex consequences of capitalist expansion and industrialization in Chile, because of the establishment of a modern economic model based on the exploitation of sulfur mines. The ACAP research focuses on analyzing how the sulfur industry was materially expressed and helped to define and constitute the industrial space of Ollagüe. I propose the concept of "material scars" to assess the applicability of the notion of post-preservation and to explore the paradoxes of heritage policies, focusing on the temporal interstices between the ideal orientation of preservation (authenticity), and the reality inherent in the degradation of these industrial mining sites (decay). We highlight the importance of industrial heritage and its role in the collective memory of the local community.

Industrial Mining in Northern Chile
In the northern regions of the country, mining and extractive industries that developed since the end of the nineteenth century reflect the profound changes in the mining industry worldwide, these changes in techniques and scales of production being of major importance. In the nineteenth century, Chilean mining production was concentrated mainly on silver and saltpeter extraction, but from the first quarter of the twentieth century, world demand for raw materials led to the diversification of mineral production and the integration of new regions into this capitalist expansion process. Between 1930 and 1970, Chilean economic development was subsumed under the State’s modernization project,
which gradually moved towards the control of natural resources. Since the economic crisis of 1929 and until the mid-1970s, a new industrialization process was thus supported by investment and centralized State policies. Chilean modernization was thus directed through the expansion of capitalism and industrialization, leading to major demographic and large-scale economic and social changes. This paper examines the role of material culture associated with the process of mining expansion at a local scale and the particularities of a local process, a lesser-known but equally important type of industry: high-altitude sulfur mining.

The Sulfur Camps of Ollagüe

Ollagüe is part of the Puna, a macro-zone of the South-Central Andes. A harsh, arid, cold, and treeless landscape, the Puna constitutes a high-altitude environment between 3,500m and 5,500m. The archaeological research focused on three mining camps: Puquios, Santa Cecilia, and Buenaventura. Fieldwork included documenting the modes of interaction between exploitation sites and settlements (camps, roads, etc.), documenting surface material culture remains and interviewing former workers and inhabitants of these sites.

Puquios

Puquios is located 30 km north of Ollagüe and six kilometers from the border between Chile and Bolivia, at an altitude of 4169m. This site exploited sulfur from the Olca volcano, and it is an old station on a branch forming part of the railway that links Antofagasta with Bolivia. The history of Puquios started at the beginning of the twentieth century. Eight areas were identified according to their function and location. The site includes structures for administrative functions, housing, and industrial facilities, and it is organized around the station (Area 1), an administration space located in the center of the site (figure 1). Built around the railway, the Puquios site presents a four-level spatial organization, which orders the concentration of labor and guides industrial activities. A first level, in the center of the site with well-preserved administrative structures, a second level with domestic spaces directly connected to the first level, a third level with the industrial facilities, and, finally, the fourth level with peripheral shepherd’s domestic spaces.

Figure 1. Puquios station, Area 1 (photo by the author, 2017).
Santa Cecilia
Santa Cecilia is located 8.3 km southeast of Ollagüe and 3.3 km from the Chilean-Bolivian border, at an altitude of 4300m. The site corresponds to a mining camp located on the slope of the Ollagüe volcano, 3.5 km northwest from the sulfur extraction area located on the summits of the volcano. The site was built on an artificial terrace, where the ruins of the camp and its housing facilities can be found today. Santa Cecilia is the smallest of the three sites under study in terms of surface area, comprising 48 architectural units. Three areas show a set of residential and administrative buildings with various functions: mechanical workshop, baths, offices, warehouse and, probably, a kitchen unit and refectory or canteen. The history of the Santa Cecilia site is poorly documented. Activities probably began in the early 1930s and were abandoned in the mid-1970s. The site belonged to the “Sociedad Industrial Azufrera Minera Carrasco”. In the mid-1970s, Santa Cecilia finally closed its operations, and the camp was abandoned.

Buenaventura
Buenaventura is located 5 km southwest of the village of Ollagüe and 6.9 km from the Chile-Bolivia border, at an altitude of 3730m. The site is located in the pampa of Ollagüe, an area characterized by its flat and arid terrain, and a total absence of water sources. The choice of this location is due to its connection with the railway linking Antofagasta to Bolivia, of which Buenaventura was one of its main stations. The history of the Ollagüe volcano exploitation goes back to 1899 when the first application for a mining license to exploit the Ollagüe's sulfur mines was submitted. The Sociedad Azufrera Borlando Ltda. then built the industrial facilities and housing camp of Buenaventura. The Borlando company stopped its operations in 1976, while the site and all its facilities were definitively abandoned in 1982.

We identify eight areas, defined according to their function: industrial and work areas (Areas 1, 2, 6, 7, and 8), housing (Areas 3 and 5), and administration (Areas 3 and 4). A total of 122 architectural units were comprised of the site. Buenaventura shows a spatial organization of radial form, with a residential and administrative center and a periphery in which work and industrial spaces are located.
The Industrial Heritage and Material Scars of Ollagüe

The industrial materiality of Ollagüe shows its insertion into Chile's modernization policy, requiring the incorporation of a set of goods of national and foreign production. Ollagüe’s industrial sites illustrate local histories, the economic forces at play, and the tensions between power structures and local communities. This section builds on a theoretical discussion about these relations, to highlight the heritage phenomenon associated with memory, oblivion, and the post-preservation of industrial ruins. Abandonment aesthetically challenges conventional practices of ordering and shaping modern space, thereby suggesting new ways of relating to both the past and the future. Industrial ruins offer the opportunity to imagine new futures, to rewrite the past, and to discard old assumptions about their degradation. The concept of ruins, or "rubble", as proposed by Gastón Gordillo, is interesting because they appear for Chilean industrial archaeology as a challenge to heritage orthodoxy, in the sense that they focus less on the nostalgic and the aesthetic than on the processes of destruction and economic failure to which they are associated.

Part of the current trend in the academic literature on ruins has focused primarily on their political and aesthetic interpretations. Moreover, we have witnessed a kind of political obsession in the quest to fix in time, to preserve and as far as possible to restore sites to their original state as historical testimonies in themselves (i.e., the authentic). We know the rhetoric well: reconstruction of the past and restoration are notions used to define the needs of a heritage intervention that assumes the desire to keep or return the sites to their original state. This has been the emphasis, for example, of the policies associated with institutional declarations of historic-industrial sites as Historic Monuments and, mainly, of UNESCO's declarations of World Heritage Sites.

Nevertheless, we observe an aesthetic attraction with the reality inherent to the natural degradation of a great majority of sites not categorized as historical monuments, which question the existing relationship between the image of the ruins with the inevitability of the destruction of their material and environmental surroundings (what I call here the decadent). The factors for the latter can be very diverse, although linked to each other, such as the lack of economic resources for the safeguarding and protection of the material remains, financial and real estate speculation that clashes with these interests,
and/or the absence of political will for the protection of the sites. We must assume that there are archaeological sites that cannot be worked from the classical perspective based on the restoration of the authentic under a uniform, vertical and universalistic set of values, without consideration of local historical contexts. Therefore, it is necessary to discuss alternative approaches to preservation that understand the inevitability of destruction as a process and place greater emphasis on decay as an essential archaeological feature that enriches the biography of sites. As Michael Shanks pointed out, "decay is an essential complement to a living past."15

**Post-preservation of Ollagüe’s Industrial Sites**

Caitlin DeSilvey has called post-preservation a set of heritage practices and theoretical reflections that explore the interstices between the ideal preservation orientation and the inherent reality of degradation of historic and archaeological sites16. Taking his proposal, we propose to insert those concerns into the study of a set of sulfur exploitation sites of Ollagüe. We will reflect on how industrial archaeology in Chile can contribute to the heritage discussion on the relationship between real and imaginary forms of representation of modern ruins.

The sulfur camps of Ollagüe revealed varying degrees of preservation. While some were dismantled by the owners themselves once the work was finished (Santa Cecilia), others have been gradually dismantled by the local population to reuse some of their materials (Puquios, Buenaventura). The architectural remains analyzed at the sites provide information on the construction and development of the sites. These materials testify to the constant need for maintenance and repair of the built spaces. They provide information about the dismantling practices of buildings and industrial facilities after they have been abandoned, practices that continue to this day. Our approach to the sites made us see that there should be a complementarity of different narrative forms of heritage preservation, both one that emphasizes stability and conservation, as well as a perspective that accepts change, dismantling, and degradation. It was necessary to reevaluate the traditional paradigm that considers that the only form of preservation of industrial sites has to do with their final moment of activity, which must be fixed and stabilized, and even sanitized, in time. What would be the impact of an archaeological perspective that assumes change rather than stability? If industrial ruins are in a state of permanent transition between their presence and their absence, what theoretical impacts would archaeology of decay have on our conceptions of time? As Laurent Olivier states: "archaeological time does not stop when the sites are abandoned: it continues to work the matter of the vestiges, which are now absorbed in another environment where they imperceptibly maintain the memory of another time"17.

While Ollagüe sulfur camps can be seen as threatened sites, and their significance eroded as their condition deteriorates, I suggest instead that these spaces of deindustrialization do not represent, in any case, a final stage in the abandonment of modern social practices, but on the contrary, they are inserted in new dynamics of "contemporary socio-material practices"18. Is it possible to preserve, in Olivier's words, that "continuous working" of vestiges? What are the implications of a proposal that emphasizes change and decay? What are the scopes of this perspective? I follow Caitlin DeSilvey’s work, who explores and deepens these difficulties and the contradictions that emerge, which are situated in the interstices of active preservation and non-intervention. By proposing a greater recognition of the ways of integrating change instead of denying it, the
author considers that it is possible to reevaluate the meaning and significance of sites in these spaces of temporary transition between the moment of abandonment and the moment of intervention (patrimonial, scientific, or academic). An archaeological approach to transience and uncertainty shows that there are alternative ways of approaching the tangible industrial heritage by focusing on what Jackson calls "intervals of neglect", that is, "an interim of death or rejection before there can be renewal and reform". To emphasize such intervals and change, a post-preservation perspective looks for the appropriate balance between an active intervention (i.e., a traditional look at the authentic) and strategic non-intervention.

Ollagüe's industrial materiality is situated in these “intervals of neglect”, in the temporal interstices between abandonment and reconstruction of their past through future heritage projects. Understanding the role of the memory of ruins in the present, we must consider that the creation in Ollagüe of derelict spaces and abandonment become historical events to the extent that they are the inevitable result of socio-cultural transformations, in this case, of capitalist development at the local level. Ioannis Poulios proposes the “living heritage” approach as a way of challenging even the premise that heritage is a non-renewable resource. He asserts that such heritage can be continually renewed if the social relations and practices that give it meaning over time are revalued: “authenticity is in the present, and is associated mostly with the communities’ (intangible) association with a site". In the Ollagüe sulfur sites, industrial heritage would then be defined not in its condition as a stable material entity, but in the sites' condition of being of the past in the present, but above all in the new relationships and experiences that are established. Industrial vestiges are understood here not as fixed elements in a moment of their life, but as containing a biography of their own with continuities and transformations. Our analysis thus focuses on those changes that go from production to consumption but also on those that move between consumption and destruction (or ruination), which allows exploring the structures of both the socio-technical and the power relations that constitute them.

The new narratives are then presented as an alternative in which the researcher would not hold the monopoly either of interpretation or heritage management. It has been largely demonstrated that by being considered of archaeological interest and categorized as historical monuments, industrial sites will be infused with the rhetoric of official national memory and, as a result, will henceforth be categorized as heritage sites of national interest. As Ollagüe’s industrial sites are situated in a former Bolivian region, these issues of national property become especially relevant. Two effects are generated that deserve attention: the first is the archaeological intervention itself, which also involves us as researchers in the biography of the sites as another historical event of their temporality. The second is the intentions that guide these new narrative forms and the subsequent responses of the State and its institutions, among other agents.

Both the safeguarding and the absence of an official heritage policy are inscribed as simultaneous processes that make it possible to evaluate and explore the changes and transformations of the spaces and material interstices of industrial sites that, on the one hand, cannot be protected following traditional heritage guidelines and, on the other hand, are inevitably and slowly degrading. Objects disintegrate and disappear, reform and regenerate into other entities, to move between different temporalities, opening and activating the past to movement and interpretation. By examining other ways of thinking about heritage conservation, what a new heritage approach suggests is that sites and materials generate meaning not only in their preservation but also in their character of ruin.
and their slow process of degradation, opening the possibilities to adopt a perspective that privileges change rather than stability. If we accept that the processes of decay can be a positive aspect, then there are other ways of approaching narratives and policy reorientations to sites and their vestiges that can complement each other to ensure their preservation. Ollagüe’s industrial materiality is thus understood more as a process and less as an unchanging entity in a permanent physical form. This framework addresses some of the more ambiguous aspects of material presence and its inevitable disappearance, accepting that sites and their material vestiges are not discrete entities, but material elements with continuous cycles of articulation and disarticulation between them.

**Conclusion**

The territorial expansion of the Chilean State after the War of the Pacific (1879-1884) was of a military, political, economic, and cultural nature. It reformulated the national imaginary and established policies of assimilation of the local indigenous populations in the national history. During the twentieth century, the expansion of the mining industry led to an intensification of the dependence of local populations on the capitalist market. During the 1980s, with a drastic reduction in mining activities, the sulfur industry was living its last grandeur days. In 1992, the last camp shut down its operations. It was the tombstone of an industry that completely transforms Ollagüe’s recent past.

As the cycles of life, Ollagüe's industrial sites should be considered as cultural entities that are born, live, and die. The approach of a post-preservation that guides the work of heritage care with a perspective on persistence and not on preservation, would allow us to imagine proposals that consider Ollagüe’s industrial heritage as a creative process in which change can originate something new. From this starting point, challenges open to industrial archaeology that we can preserve without controlling nor monopolizing. The Ollagüe sulfur sites demonstrate that while their abandoned facilities become less and less legible as heritage objects due to their constant degradation, it nevertheless becomes possible to read from the other narratives of their remains: for example, from the biography of the construction materials (irons, cement, bricks, or stones) of dismantled facilities and architectural structures, continuously reused elsewhere. Thus, the history associated with sulfur exploitation persists and the material absence produces new discourses and tensions.

In conclusion, we aim to examine tensions and balances that arise from industrial contexts, experimenting with new archaeological preservation narratives that, in addition to protection and restoration, can highlight the change and degradation of the sites as important aspects of their biography. It offers us a new look against the unidirectional and vertical orientation of the traditional paradigm of heritage preservation, which always implies an alienation of spaces, objects, and practices that are incorporated into the social life of local communities. It is an alienation occurring “cuando el Diablo mete la cola” (“when the Devil tuck his tail”), as ollagüinos often remark.

**Notes**

3 Pinto, Julio, and Luis Ortega, 1990, Expansión minera y desarrollo industrial: un caso de crecimiento asociado (Chile 1850-1914), Santiago, Universidad de Santiago de Chile.


7 Risopatrón, Luis, 1924, Diccionario Geográfico de Chile, Santiago de Chile, Imprenta Universitaria, p. 717.

8 Vila, Tomás, 1939, La industria del azufre en Chile, Santiago, Imprenta Universitaria.


11 DeSilvey, Curated decay.


14 In Chile, two of the seven cultural properties declared World Heritage Sites by UNESCO are industrial sites: the Humberstone and Santa Laura oficinas, industrial sites, in the Tarapacá Region (inscribed in 2005), and the mining town of Sewell in the Libertador General Bernardo O'Higgins Region (inscribed in 2006).


16 DeSilvey, Curated decay.


19 Jackson, John B., 1980, The necessity for ruins, and other topics, Amherst, University of Massachusetts Press, p. 102.


21 Edensor, Industrial ruins.


26 DeSilvey, Curated decay, p. 149.

28 DeSilvey, Curated decay.
29 DeSilvey, Curated decay, p. 159.
30 Rivera and Lorca, Uso social.