A distinct geological collection: the *Litoteca* IGc/USP and its museological processes

Uma coleção geológica distinta: a Litoteca IGc/USP e seus processos museológicos

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Abstract: Science and technology collections are intrinsic to their kind of knowledge produced by society in all areas of knowledge. They are interlinked to the professionals' memory and practices in spaces of production, scientific dynamics, technological development and teaching. Geological collections, as part of the science and technology collections, are witness of the scientific process, mostly originating in an academic environment. This heritage is commonly found within Brazilian universities, being analysed here through the case study of the practices of the *Litoteca* IGc/USP, a laboratory belonging to the *Museu de Geociências* (Geosciences Museum), *Instituto de Geociências*, *Universidade de São Paulo* (Geosciences Institute at the University of São Paulo – IGc/USP). The life cycle of this heritage is intrinsic to various curation and management actions involving everything from the decision-making process to the most common actions of backing, identifying and processing information. The aim of this article is to demonstrate the process of the lithological property incorporated into an *ex-situ* collection, valued and then recognized as a museum document. The result of this processing is connected to scientific communication activities that attest to the property's belonging to a collection, reinforcing its links and social function.

Keywords: Documentation. Scientific communication. Geological heritage. Museology.

Resumo: As coleções de ciência e tecnologia estão relacionadas aos saberes científico e tecnológico fabricados pela sociedade em todas as áreas do conhecimento. Referem-se à memória e à pratica dos profissionais em espaços de produção deste conhecimento, à dinâmica científica, ao desenvolvimento tecnológico e ao ensino. As coleções geológicas, como parte das coleções de ciência e tecnologia, são testemunhos do processo científico, originárias em sua maioria em ambiente acadêmico. Este patrimônio é comumente encontrado dentro das universidades brasileiras, sendo aqui analisado por meio do estudo de caso das práticas da Litoteca IGc/USP, um laboratório pertencente ao Museu de Geociências, do Instituto de Geociências, da Universidade de São Paulo (IGc/USP). O ciclo de vida deste patrimônio é intrínseco a diversas ações de curadoria e gestão que envolvem desde o processo de tomada de decisão até as ações mais corriqueiras de lastreamento, identificação e tratamento de informação. O objetivo deste artigo é demonstrar o processo do bem litológico incorporado a uma coleção *ex-situ*, valorado e então reconhecido como documento museológico. O resultado desse processamento está conectado às atividades de divulgação científica que atestam o pertencimento do bem a uma coleção, reforçando seus vínculos e sua função social.

Palavras-chave: Documentação. Divulgação científica. Patrimônio geológico. Museologia.

Lima, J. T. M., & Sborja, C. H. (2022). A distinct geological collection: the *Litoteca* IGc/USP and its museological processes. *Boletim do Museu Paraense Emílio Goeldi. Ciências Naturais*, *17*(2), 491-508. http://doi.org/10.46357/bcnaturais.v17i2.799

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Recebido em 25/09/2021
Aprovado em 02/08/2022
Responsabilidade editorial: Milena Marília Nogueira de Andrade

INTRODUCTION

Heritage theory is intrinsic to the societal habits of a moment. There are many ordinary objects with the potential to become heritage. Nonetheless, only a minority of them are accurately identified, collected, documented[1], and preserved. A particular object or a group can be understood within many different scenarios (J. T. Lima & Carvalho, 2020a). The recognition and valuation of these potential heritage objects is vital for their preservation.

The human being's relationship with the objects around themselves are permeated by the idea 'where before there was equality in their coexistence with nature, today there is a transformation of nature into an object'. Objects, whether manufactured or natural, are appropriated by humanity, which attributes values to them (Dohmann, 2010). These objects, when plentiful of values and meanings, including the desire to transmit them to future generations, can be considered heritage.

Objects in collections are full of value and meaning, therefore, heritage. Once an object is properly valued, it can be considered a cultural good. In other words, a cultural or scientific good is an object that has undergone a valuation process and belongs to a museological context (J. T. Lima & Carvalho, 2020a). To improve our perception of collections and their preservation, it is fundamental to recognize how their values are attributed and mainly to determine how the construction of cultural meanings takes place in the analysis' process (J. T. Lima & Carvalho, 2020a). The object can assume the role of interpreter, symbol, or message, in addition to having a value, a meaning, and a potential for contextual links (Bellaigue, 1992; Figueiredo, 2014). The collector is an interlocutor between society and the purpose of its preservation. The valuation processes can be summarised as: collections are representations of memory, as they carry values assigned by the ones who collected it (individual or social group). A symbolic value can be attributed from the collector after the dissociation from an object and its value of use, establishing exceptionality to this object. Collections also involve values assigned by those who assembled or preserve them (J. T. Lima & Carvalho, 2020a; Ribeiro, 2010).

Natural sciences use samples for research, teaching, and outreach in university environments. It is common for a field of research to directly result in the formation of collections, which can later serve as a teaching tool or as a reference (Almeida, 2001). It is traditional among academic fields to create and maintain collections, in their most diverse classification (J. T. Lima & Carvalho, 2020b).

This article addresses issues mostly related to scientific and geological heritage. As a unified legacy, scientific heritage can be considered the identity a group intends to preserve and divide with its community. Some examples are: material and immaterial knowledge about life, nature, and the universe (Lourenço & Wilson, 2013; J. T. Lima & Carvalho, 2020a). Their cultural collections are the aftereffect of the knowledge produced by humanity. They relate to the memory and practices of professionals facilitating the production of scientific knowledge, technological development, and teaching (Araújo et al., 2017; J. T. Lima & Carvalho, 2020a). The variety and number of scientific collections with geological goods around the world is recognized, however this article does not intend to account for such a vast comparison. The reality reported here is limited to the case studies described throughout the text, thus allowing for a better situational analysis, using Brazil as a focus.

In Brazil, universities contribute substantially to the construction of cultural and scientific heritage. Universities, as well as laboratories and research centers, play a significant role in the production and preservation of Brazilian scientific goods (Araújo & Granato, 2017). This method is governed by several reasons, among them the extensive amount of

[1] Documentation in this article refers to the museological documentation practise. However, the full term will not be used since the connection between *Litotecas* and museums is not mandatory.

samples derived from field work, one of the most common forms of acquisition of rocks, minerals or fossils by geosciences (J. T. Lima & Carvalho, 2020a). However, it should be noted that the role of geological scientific collections in Brazil is not limited to the university environment.

Wherever these geological goods are stored, the methodologies involved in their preservation must be described. Regarding the physical aspects, what can be observed in Brazil is scientific collections are stored without much variation in material packaging. Considering the objectives of the scientific collection and not its forms of physical storage, it can be said that collections differ mainly in their ways of providing information and in the segmentation of their audiences. There are scientific collections with: educational purposes (for all school levels), which are designed and made available for use in the classroom; focused on the dissemination of knowledge and displayed in museums and cultural centres; as well as the ones aiming to preserve and access the knowledge produced. According to each purpose, the ways in which content is made available also change: educational kits offered in the classroom; exclusive content for social media; interactive exhibitions in museums; guided visits to museums and research facilities; among others.

The most diverse uses reported allow us to identify multiple potential audiences. The question then is how can scientific collections serve both specialized and general audiences? Preserving, documenting, and disseminating the lithological collection of scientific value produced by geoscience researchers increases the transparency of their research, as it allows any citizen to consult the material used and derived from the studies, as well as allowing for counter-proof in case of questioning results. It also allows other researchers whose subjects are related to the themes of the samples to easily access information already produced, being able to quote, consult, and avoid repetition of works. This way, donors have easy access to the material, being able to review and quote their samples with practicality, as well as having the results of their research organized, preserved, and managed by trained and specialized teams, stored in a place specifically designed for this purpose. Focusing on the case study in question, the Brazilian reality is a scenario where the management of geological collections has many obstacles, with a diversity of practices to be improved, as in any other field (Haag & Henriques, 2016). "Collections of geological heritage require preservation actions, such as inventories, conservation status assessments, and monitoring" (J. T. Lima & Carvalho, 2020b, p. 3). Here is where the practices comparing scientific collections in traditional museums differ from the *litotecas.*

WHAT ARE *LITOTECAS*?

Scientific collections in Brazil are numerous and diverse, and so are the technical treatments given to the objects associated with them. The *Litoteca* IGc/USP project was created in 2015 by geoscientists professors who aimed primarily at archiving samples to preserve the scientific legacy of the Geosciences Institute of the University of São Paulo (Azevedo, 2018). There are no records of the existence of a similar project in Brazil. In this article, we will analyze the *Litoteca* IGc/USP through the activities of museological documentation and communication.

The term *litoteca* can be defined through its etymology where 'lithos' means rock and 'teak' means storage location, in Portuguese it is the same resemblance as library (*biblioteca*). *Litoteca* is usually associated with a place where the scientific goods inserted in it have not undergone documentation and valuation. In these cases, it is common to understand the place as a space of transition between the collection and the opportunity to research the scientific good. The scientific goods inserted in this context tend to have more similar processes to the educational collections (J. T. Lima & Carvalho, 2020b).

The term *Litoteca*, as well as collection, can be used by any instance and by any institution. In Brazil, there are *Litotecas* at Federal and State levels, showing a diversity of bodies not necessarily public that can keep scientific

goods in their possession in places with this denomination. Most universities with geology courses have the potential to obtain a *Litoteca*, so that a study like this, focused on universities, brings a differentiated perception, but not necessarily unique.

There is a difference in the preservation, documentation and communication between the geological collections and the ones called *litotecas* (geological archives), in universities. This difference is similar to the one found between the scientific and educational collections. Scientific research collections (those whose objects function for scientific research) tend to have more of these processes due to their proximity to museological institutions, as opposed to the educational (in which the objects serve as practical cases for classes) and *litotecas* ones (J. T. Lima & Carvalho, 2020b).

The processes for preserving research collections and *litotecas* are complementary. Most *litotecas*, in Brazil, have minimal technical treatment of their scientific goods, because their function is confused with temporary deposits. As soon as the selected goods arrive from the acquisition, they are inventoried and stored in these places. The prospect of use for scientific purposes is distant, so the preservation and documentation treatment that would be given to these goods during or after their research never happens. The reason why this occurs is motivated by several justifications, among them are the lack of sufficient investment that prevents the hiring of professionals and students to exercise such demand and even the little interest on the part of the university in the results of this type of research, to the detriment of others that have greater scientific communication. This reality causes problems such as accumulation, little or no communication and the most worrying of all, the non-valuation of cultural goods. As explained earlier, to give value to an object is to define its importance to society and therefore its need for preservation. The non-valuation of this good would be the equivalent of owning an object with potential for a scientific good, for example, and failing to preserve it simply because one did not recognize its social or scientific importance. In fact, this little museological, documentary or preservative treatment, leads in the long run to the potential loss of information that ends up invalidating the good as well as scientific heritage. Planning and acting on documentation and communication methodologies for these goods can be the key to their valuation and perpetuation.

The differences between these types of collection do not end in the nomenclature. The potential of museums as instruments for scientific communication is widely recognized (Sborja & J. T. Lima, 2020; Kellner, 2005; Paula et al., 2013). One of the most effective ways of disseminating heritage is the museum exhibition, through the exploration of the educational potential of the cultural goods belonging to these collections (Sborja & J. T. Lima, 2020; Azevedo et al., 2020).

Museum collections usually occupy a significant exhibition space, this being their main relationship with the visiting public: exposed, contextualized and identified objects being freely appreciated by admirers. In a *litoteca*, the exhibition space and the consequent physical exposure of the samples are not the main objective. The preservation and documentation of the geosciences collections are their primary function. In this way, most *litoteca*'s spaces are exclusively dedicated to the storage and treatment of samples. Communication and visitation occur as a result of the valuation process to which every scientific collection should be submitted.

Geological collections, including *litotecas*, have great potential in several areas of research, only achieved when information of origin and collection is available, highlighting the role of the institutions that safeguard these collections. They can assist in the understanding of events such as exploration trips and in the complexity of relationships between collectors and specialists (J. D. Lima & Granato, 2017). Geological collections are a record of the history of science, whose function serves to trace the underlying scientific paradigm and also as material for the future comparison study (Wever & Guiraud, 2018; Azevedo, 2018).

THE *LITOTECA* FROM THE IGC/USP

The *Litoteca* IGc/USP, is a unique place in Brazil (Figure 1). Its reality can be perceived as role model in many aspects to be discussed in this paper. Brazilian *litotecas* differ greatly in this respect, some of them store all potentially searchable material collected in the field work. The *Litoteca* IGc/USP has in its management and preservation process communication and documentation procedures bringing it closer to the musealised collections, distancing it from the *litotecas* whose mission is limited to the catalogue and safeguarding procedures (Sborja & J. T. Lima, 2020). With the incorporation of the *Litoteca* IGc/USP as a laboratory of the Geosciences Museum, in 2016, the influences of museology, which previously occurred in an almost intuitive way, deepen, culminating in a review of the acquisition methodology and operational procedures starting in 2019 and still in progress.

The *Litoteca* of the *Instituto de Geociências* (Institute of Geosciences - IGc) at the *Universidade de São Paulo* (USP) was planned in 2013 and implemented in 2015, with the coordination of Prof. Dr. Valdecir de Assis Janasi, then director of IGc/USP. The objective was to develop a strategic project aiming to preserve and communicate the scientific heritage of this institution. To this end, a technical employee was appointed to administer the collection (geographer), two internship grants (geologists or mining and energy engineers), a permanent commission of five IGc/USP professors as managers and a professor appointed as curator, in addition to the technical leadership exercised by a museologist, emphasizing multidisciplinary work as the basis of the decision-making process.

To better understand the need to create a controlled, organized and expertly managed storage space, the volume of material to which reference is made, it is necessary to know a little about IGc/USP. The Institute of Geosciences and Astronomy of the *Universidade de São Paulo* was created in 1969. This place is a national and international reference in research and training of human resources, having graduated a total of 1,954 geologists by the end of 2016, data taken from the report of the Institute's Board of Directors (IGc/USP, 2016). The Institute played a fundamental role in the training of the first doctors at Brazilian universities, who today are responsible for the nucleation of postgraduate courses in the country (IGc/USP, 2016; Sborja & J. T. Lima, 2020).

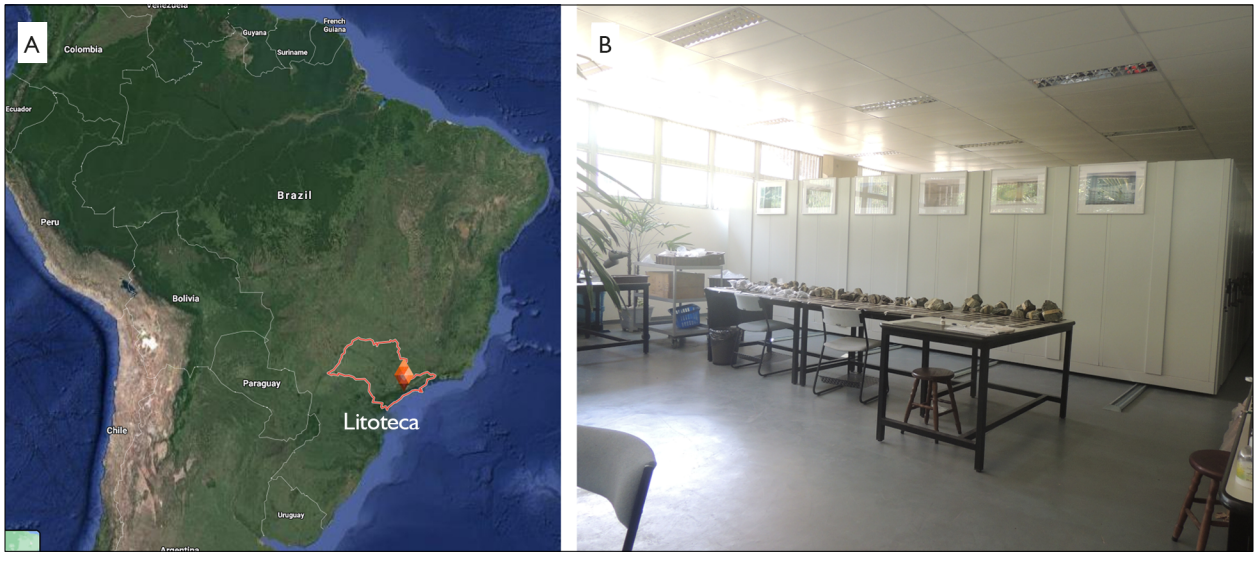

Figure 1. Images to contextualize the *Litoteca* in relation to its place in the world and its accommodations: A) location of the *Litoteca*, on the Brazilian Map and some other South American Countries, with emphasis on the State of São Paulo; B) interior of the IGc/USP *Litoteca*, giving focus to the sliding cabinets. Map: GoogleMap Edited by the authors (2020). Photo: Sborja (2020).

With its own space for storage, treatment and consultation of different types of materials, its own specialized team and a virtual catalogue open to public consultations, *Litoteca* IGc/USP manages the most important scientific samples produced by the IGc/USP technical staff. When the *Litoteca* IGc/USP did not exist, the samples were arranged by the Institute in ways that were not favourable to access and preservation of information.

The *Litoteca* IGc/USP started operating in 2015, since then there has been an important movement in the Geosciences Institute for improvements in the treatment of all stored collections. The three largest and most used sample storage spaces have been renovated and reorganized, including the acquisition of sliding shelves, an expensive piece of equipment to be purchased in Brazil's difficult economic times. It cannot be proved that such modifications are directly derived from the presence of the *Litoteca* IGc/USP, but the positive changes were noted and very welcome.

It should be noted the Institute of Geosciences has specific and structured locations for the storage of minerals, fossils and rocks for educational use or belonging to active research. To the *Litoteca* IGc/USP, the acquisition of samples is exclusive of materials with relevant scientific information, whose research has been finalized and published. Thus, the researcher (donor) is able to provide his/her collection for documentation, preservation and communication.

It is crucial to highlight that we currently have samples in our collection that were obtained from research that was conducted with at least one USP member participating as a writer, researcher, or advisor, and that research may have been conducted at USP or in other national and international institutions.

During the design of the project, two parameters were defined to be used as models by *Litoteca* IGc/USP: the documentation and filing processes used by the scientific collection of the Laboratory of Systematic Palaeontology of the Department of Sedimentary and Environmental Geology of IGc/USP, and the book cataloguing system and database for public consultation used by the Integrated Library System at the same university. Clearly demonstrating that from the beginning the intentions were to maintain an interdisciplinary way of working.

It is also imperative to understand the existing legislation that supports this collection. The *Universidade de São Paulo* houses about 16 Museums and Cultural Centres (USP, 2020). There is no single inner regulation for all this scientific and cultural heritage, however, during the development of the *Litoteca* IGc/USP project, consultations were made with some professionals from USP units whose work with collections management is respected and recognized by professionals in the field, such as the USP Integrated Library System, the USP Archaeology and Ethnology Museum and some USP Teaching Units collections, such as the Escola de Artes Ciências e Humanidades/USP's Tecidoteca, the Faculdade de Arquitetura e Urbanismo/USP Collection's database and the IGc Paleontological collection/USP. Thus, the basis for the operational procedures of *Litoteca* IGc/USP, was formed (IGc/USP, 2020).

In the scientific collection of IGc/USP there are various samples of rocks, minerals or fossils aggregated to, as well as derived materials, such as petrographic sheets, mineral concentrates and pulverized elements, maps and field notebooks all linked to published scientific research and of academic relevance recognised by the management committee of *Litoteca* IGc/USP (Sborja & J. T. Lima, 2020).

There are 38 collections from different areas of relevance geoscience, across the planet. About 90% of the rocks now available are from Brazil, but we also have samples from Uruguay, Paraguay, French Guiana, and samples from the Colombian Andean region are also being incorporated.

There are 2,588 items registered in the *Litoteca* IGc/USP virtual database. Each item consists of seven metadata (title, subject, description, author, provenance, editor, date); five attached files, in media (photos, tables, graphs and maps); between three to six tags and geolocation,

when such information is available in the search. The items are distributed in their collections each composed of other seven metadata (title, subject, description, author, provenance, date, rights) and varying in composition from 3 to 339 items. The items describe the main sample donated by the researcher, which may be accompanied by petrographic sheets, mineral concentrates and pulverized elements, maps and field notebooks, depending on the material made available by the donor of the collection. Such supplemental items are not yet catalogued and made available virtually since the idea of incorporating them into the rest of the collection is recent. When the collection has such undocumented materials, we have an average of 2 field notebooks, 50 slides and 20 bottles of pulverized materials per collection. The inclusion of these materials in the virtual database is part of the work schedule of the *Litoteca* IGc/USP when the on-site activities returned with the end of the Covid-19 Pandemic.

The large volume of archived material and information documented and made available to the public is also a differentiating factor of *Litoteca* IGc/USP from other Brazilian collections: over two and a half thousand items are published and available on our website, with dozens of pieces of information linked to each one, such as description, photographs, tables, maps, tags, researchers' resumes, links to published works and relationship with other similar copies, in open access format under a Creative Commons license (CC BY). Considering the *Litoteca* IGc/USP database, which has an impressive volume of scientific information available for public consultation; the defined copyright license is very broad, aiming to allow the maximum development of the dissemination of its collections.

The review of the documentation methodology at *Litoteca* IGc/USP, started in 2019, includes the acquisition, together with the rock samples, of original personal documents from the donors, such as: field notebooks, photographs, original publications not available on the internet and materials used during the research (Figure 2). They begin to be used, incorporated and related to the documentation of the heritage, adding historical value and allowing the public to create an affective bond, in addition to the scientific one, with the collections and the *Litoteca* IGc/USP.

Add to this, the historical potential of the donated material, as research is not only done with samples, laboratories and analyses, there is also a human, political, economic and historical context involving each study. Thus, in the case of the *Litoteca* IGc/USP, it is considered essential to incorporate the researcher's personal material into the collection to help compose the referred research context

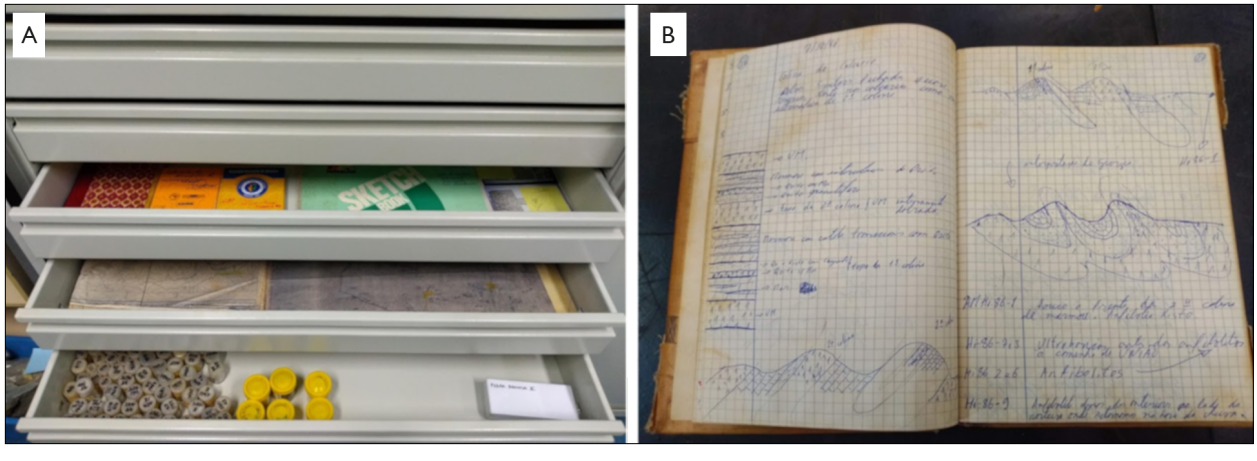

Figure 2. Some of the scientific goods that make up the collections of the *Litoteca* IGc/USP: A) archive of delicate and historical material; B) field notebook belonging to Professor Ciro Teixeira Correia, Cana Brava Collection. Photos: Sborja (2020).

increases the transparency and the respectability of the research carried out, since it allows the free consultation of the researched and stored samples, whether to prove published data, collaborate on new studies or even serve as a source for counter-proofs.

Field notebooks play an extremely important role in this stage. They must be preserved together with the scientific goods and their content, whenever possible documented with the help of the collectors themselves in the shortest possible period, aiming at maintaining the information integrity (Mansur et al., 2013). Documents such as field notes, correspondence, catalogues, maps and photographs provide information on the acquisition, provenance and use of samples. The archiving (digital or physical) must be part of the curatorial and documentation process, as the information provided is irreplaceable and increases the value of the collection (Cundiff, 2011).

"The tradition of possession and collection of unusual, ancient and interesting objects by political and religious figures has happened throughout history, including those linked to great discoveries and technological advances" (J. T. Lima & Carvalho, 2020a, p. 3). There is still no research that reports separately the construction and foundation of *litotecas,* in Brazil, or in a separate context to those of scientific collections. The history of scientific collections cannot be easily dissociated from the history of universities and higher education, these relations are not limited to the collections' origin, but also to other important periods (J. T. Lima & Carvalho, 2020a). It is worth mentioning that although associated with *litotecas*, they are not restricted to the university environment.

In this paper it will be discussed how the communication and documentation processes at the *Litoteca* IGc/USP, can be considered as a new approach to *litotecas*. Now the objectives and history of the *Litoteca* IGc/USP are clarified, we can then enter a comparison with the *litotecas* in the next topic. For this purpose, we will present research at the macro level, comparing the practices and concepts used at the national level, and afterwards at the state level.

METHODOLOGY

Seeking to learn about other *litotecas* in Brazil, two methods for data acquisition were selected. The first is an excerpt made from data collected from doctoral research in curatorial and preservation policies, from the graduate program in geology at the Federal University of Rio de Janeiro, developed by the researcher Jéssica Tarine M. Lima, from 2017 to 2020. To better clarify the current national panorama of geology collections, with regard to the documentation and communication processes a group of collections were interviewed about their curatorial practices, including the ways in which they communicate, document, and preserve their scientific goods. In this context, 17 geological collections (Table 1) were researched, belonging to 13 different universities, distributed across 7 states and the Federal District, thus showing a remarkable variety of realities.

Several factors contributed to the absence of some states with significant geology collections, including the fact that some of the collections Dr. Jéssica Tarine (2021) interviewed were listed as mixed collections that included both paleontology and geology. In these situations, the collections were disregarded for the profile of this article because they revealed realities outside of *litotecas*. Sometimes the interview subjects were unwilling to participate, and other times the study plan could not accommodate the dialogues with the curators' schedules.

Among this group, only two used the title of *litoteca*, instead of collection. The term, although common in Brazilian institutions, has in itself a connotation that distances it from the traditional notion of collection.

Knowing that other *litotecas* could be reached in other ways that were not included in the methodology above, we sought to complement it with a virtual survey. Such methodology was chosen because the protocols for action against COVID-19 were already in place. The aim was to understand the reality of these related collections and some technical information, as well as in the first one (Table 2).

Table 1. Table informing the collections visited, their holding institutions and the states in which they are located.

	Collection name	Institution	States
1	*Mineralogia*	*Universidade Federal do Rio de Janeiro - Museu Nacional*	Rio de Janeiro
2	*Geologia Econômica*	*Universidade Federal do Rio de Janeiro - Museu Nacional*	Rio de Janeiro
3	*Rochas Sedimentares*	*Universidade Federal do Rio de Janeiro - Museu Nacional*	Rio de Janeiro
4	*Museu de Geociências*	*Universidade de Brasília*	Distrito Federal
5	*Museu de Minerais e Rochas*	*Universidade Federal de Pernambuco*	Pernambuco
6	*Petrologia Ígnea e Metamórfica*	*Universidade Estadual do Rio de Janeiro*	Rio de Janeiro
7	*Coleção de Mineralogia e Petrologia*	*Pontifícia Universidade Católica do Rio Grande do Sul*	Rio Grande do Sul
8	*Coleção de Geologia*	*Universidade Federal de Alagoas*	Alagoas
9	*Coleção de Minerais*	*Universidade Estadual de Feira de Santana*	Bahia
10	*Coleção de Geologia*	*Universidade Federal de Ouro Preto*	Minas Gerais
11	*Coleção de Geologia*	*Universidade Federal de Minas Gerais*	Minas Gerais
12	*Coleção de Minerais e Rochas*	*Universidade do Vale do Rio dos Sinos*	Minas Gerais
13	*Coleção de Minerais, Minérios e Rochas*	*Universidade Estadual Paulista*	São Paulo
14	*Litoteca*	*Universidade Estadual Paulista*	São Paulo
15	*Litoteca*	*Universidade de São Paulo*	São Paulo
16	*Museu de Geociências*	*Universidade de São Paulo*	São Paulo
17	*Mineralogia*	*Universidade Estadual do Rio de Janeiro*	Rio de Janeiro

Table 2. Table informing the online collections, their holding institutions and the states in which they are located.

	Collection name	Institution	States and cities
1	*Litoteca* of the Paleomagnetism Laboratory	Institute of Astronomy, Geophysics and Atmospheric Sciences – *Universidade de São Paulo*	São Paulo
2	The *litoteca* of the Heinz Ebert Minerals, Ores and Rocks Museum	*Universidade do Estado de São Paulo "Júlio de Mesquita Filho"*	São Paulo
3	The *litoteca* Network of the Mineral Resources Research Company	Geological Survey of Brazil - Ministry of Mines and Energy	São Paulo Belém Rio Grande do Sul Caeté Feira de Santana Goiânia Manaus Rio Grande do Norte Rondônia Piauí
4	The *litoteca* Laboratory of the Geological Institute of the State of São Paulo	Institute of the State of São Paulo	São Paulo

RESULTS AND ANALYSIS

The collected data enabled a comparison between the listed collections and the *Litoteca* IGc/USP itself. Below we will see through different aspects and parameters the means by which the *Litoteca* IGc/USP stands out among the others.

In the *Litoteca* of the Paleomagnetism Laboratory of the Institute of Astronomy, Geophysics and Atmospheric Sciences – USP (Paleomagnetism Laboratory, 2020), its technicians and teachers were linked to the laboratory, but not exclusively responsible for the documentation and management of its *litoteca* collection. The *litoteca* of the Heinz Ebert Minerals, Ores and Rocks Museum - Department of Petrology and Metallogeny of the Institute of Geosciences and Exact Sciences, belonging to the *Universidade do Estado de São Paulo "Júlio de Mesquita Filho"* (Museu de Minerais, Minérios e Rochas Heinz Ebert, 2020), does not have its own team in document management.

The *litoteca* Network of the Mineral Resources Research Company - Geological Survey of Brazil - Ministry of Mines and Energy, has 10 regional *litoteca* distributed throughout Brazil, in different construction phases (Serviço Geológico do Brasil, 2020). The *litoteca* Laboratory of the Geological Institute of the State of São Paulo, had its project started in 2010 but still not concluded until the present date (Instituto Geológico de São Paulo, 2020). Thus, it does not have enough information to compare the realities experienced.

In São Paulo, the state where the *Litoteca* IGc/USP is located, there are technical parameters stipulated by the *Sistema Estadual de Museus de São Paulo* (SISEM, São Paulo State Museum System) that aim to guide the structure of each museum regarding its institutional organization and the provision of community services (Sistema Estadual de Museus de São Paulo, 2020). They are divided between the axes: Management and Governance, Safeguarding Collections, and Communication and Services to the Public. Overall, there are 85 cumulative parameters that must be followed by all museums in the state. However, this type of regulation does not exist when it comes to university collections without a museological link.

The Geosciences Museum is dedicated to fulfilling a large percentage of these parameters, and as a result of such work, *Litoteca* IGc/USP ends up mirroring some of these in its management, which are not identified in the other researched *litotecas*. Some of these technical parameters are: statute and regulations; permanent staff of professionals trained in the field and working (including a museologist in technical supervision); commission and curator; updated and publicized inventory; annual report; documentation; database for registration of the collection; database for public consultation; holding temporary exhibitions and a specific area for assisting researchers.

At a certain level, we can analyse the *Litoteca* IGc/USP as a model for curating research collections. Their practices, here highlighted those of documentation and communication, are exemplary and may be better discussed below.

Two aspects were analysed in order to emphasize the importance of the actions developed by *Litoteca* IGc/USP: documentation and communication. The first, understood both by the inventory process and by the use of a database (Figure 3), is a relatively common action, with only two collections reporting not using this method. Despite the large adherence, approximately 56% of the interviewees declared the inventory, although existing, is not complete. This is attributed to factors such as the lack of labour and the large volume of scientific goods present in institutions where field acquisition is frequent, and that they cannot achieve a balance between inputs and technical treatment. In this regard, *Litoteca* IGc/USP, has in its mission the definition of only incorporating completed research, thus not encountering such difficulties.

The implementation of databases, preferably with a virtual interface allowing in addition the control and documentation of collections and their communication, is an essential tool for preservation policies. Among the analysed, only 17% had this type of technology and 39%

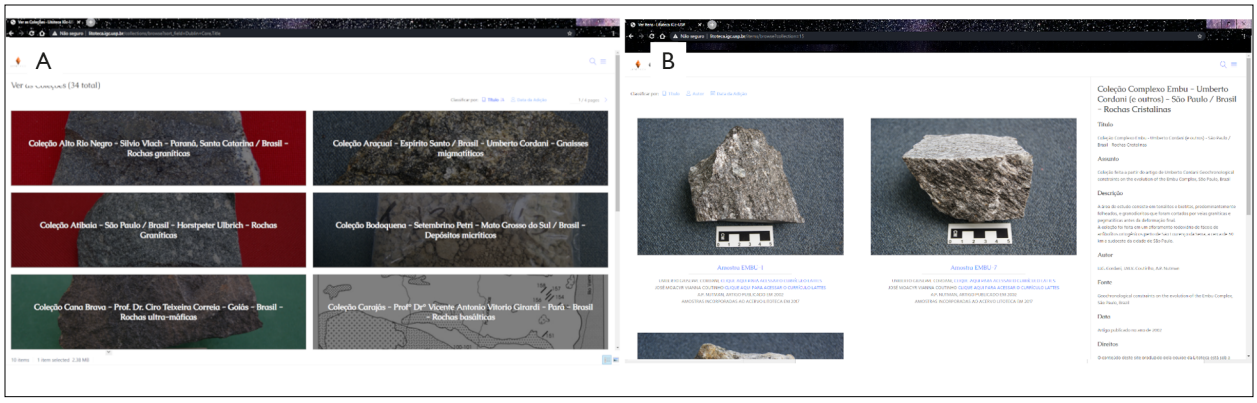

Figure 3. Screemshoot from the official page (LITOLAB, n. d.) of *Litoteca* USP: A) collections available for search; B) Cana Brava Collection, Prof. Dr. Ciro Teixeira Correia, Goiás, Brazil - Ultramafic rocks.

had databases that did not interact with the demands of communication. The *Litoteca* IGc/USP was created with the mission of disseminating its heritage, and so it is one step ahead of the other collections studied.

Communication is an essential part of the process of valuing collections. Initiatives to disseminate geology to society in general, in Brazil, have existed for decades. However, it was only at the beginning of the 21st century that systematic geological communication projects began to be structured in the country. Most of them are based on the making of interpretive panels and leaflets on the geological evolution of monuments with landscape, scientific or tourist importance and have been structured as statewide projects (Mansur et al., 2013). Unfortunately, most of these actions are focused on heritage in-situ.

Aiming to understand this reality for ex-situ collections, one turned to the existence of policies for dissemination in university geological collections. Communication policies (actions previously planned by statute or regulation) are still a novelty in the scope of these places: 71% of those interviewed do not have in their official documents actions to publicize their collections. Again, the *Litoteca* IGc/USP stands out, incorporating this concern into its activities.

Most of the Brazilian *litotecas* researched for this article store samples of relevant research potential. A differential of the *Litoteca* IGc/USP is its acquisition methodology. The basic premises for a collection to be a candidate for incorporation are to have recognized scientific relevance and information linked to each acquired sample. All objects included in the collection of *Litoteca* IGc/USP have research data (such as dissertations, theses and published articles) linked and documented.

The *Litoteca* IGc/USP, has many of its practices going in a different direction from the others in Brazil. For instance, fieldwork in geosciences is long, expensive and physically arduous for researchers. Thus, each trip to the study site is optimized to the maximum in the collection of samples, causing the acquisition of a lot of material, which is not always used in its entirety in research. Brazilian *litotecas* differ greatly in this respect, some of them store all potentially searchable material collected in field work. To consider the incorporated geological collections as museological collections and not as material intended for simple physical archiving is another factor that differentiates the work of *Litoteca* IGc/USP in relation to the other storage locations located in the country mentioned in this article.

The potentialities in the use of the *litotecas* are innumerable, as well as the variety of the public that consults them: in the case of the *Litoteca* IGc/USP, there are uses of the donors themselves to consult their samples and collect fragments for reanalysis and publication in new papers, when new equipment appears to enable

more accurate analysis; consultations by students of undergraduate courses, to use the material available online in the production of didactic content for high school classes; geoscience researchers with ongoing research who need access to samples for citation or use in new analyses to be published; curators and managers of lithological collections interested in storage references and sample documentation and, considering the *Litoteca* IGc/USP, a place which stores rock specimens of high geological relevance, researchers in search of potential new types of minerals embedded in the samples seek fragments for analysis. A visitable, accessible, organized and disseminated collection without public restrictions offers infinite potential for use.

Since 2014, Brazil has faced a severe political and economic crisis, which has been reflected directly in investments in research and teaching institutions, such as the institutions that house the laboratories and geological collections mentioned in this article. As a consequence, we have budget and human resource cuts in almost all the projects described here, including the *Litoteca* IGc/USP itself. We believe it is important to produce a reference bibliography on the work carried out by *Litoteca* IGc/USP to provide technical support to all researchers who wish to optimize the preservation and communication of their scientific collections and heritage.

GENERAL DISCUSSION

USP is a public and free university, whose funds come from state taxes on the circulation of goods and provision of interstate and intercity transportation and communication services. Its research, in addition to its own financing, is also paid for by state, federal and state funding agencies. Being mostly funded by the citizens' money, the demand from the population on the relevance of their investments and the respective return to society is huge. Thus, demonstrating the importance of the work that *Litoteca* IGc/USP does is fundamental. By directing part of the focus of the work towards the dissemination and investing in the humanization of the scientific collection, adding material that captivates feelings of belonging, affection and identification with the public and with university administrators, we seek an approach that aims to perpetuate the work and the existence of the laboratory.

Respect for and preservation of the scientific heritage managed by the *Litoteca* IGc/USP is reflected in its practices. The valuation of the collection takes place in an effort to add, besides what is expected from a rock archive, other categories of information to the samples, such as the publication of geolocation, photos, summaries of published material, academic curricula of researchers, creation of tags, as well as making such information accessible. The valuation of the *Litoteca* IGc/USP expands to the field of dissemination, using the potential of being part of the Museum of Geosciences such as, participating in exhibitions, events, posting on social media and giving interviews for media outlets.

COMMUNICATION AS A PROCESS

The *Litoteca* IGc/USP, despite being recognized as a research collection, deviates from the reality present in the analysed ones across the national territory, in sharing a university management. In Brazil, linking a scientific collection aimed at the academic public to a museum improves the preservation process. The communication of the *Litoteca* IGc/USP in parallel with the activities of the Geosciences Museum, ends up creating processes of affinity and identification with the public that were not thought of at the beginning of the project.

The *Litoteca* IGc/USP was designed to store scientific collections aimed at academic research, mainly of students, researchers and university professors. However, with the communication and link to the Geosciences Museum, the interest of people beyond the primary target audience was aroused, both in terms of school education and cultural purposes. Interested people and connoisseurs of geosciences of different ages and education ended up liking the project and making personal visits to its space or even conducting research

on the site. The creation of affective bonds between visitors and the collection is extraordinary and now it is also stimulated by the inclusion of the donors' personal material, such as photographs, field notes, notes, maps and testimonials, resources that arouse interest and create bonds of belonging between the public and the collection.

The importance of making the *Litoteca* IGc/USP part of the Geoscience Museum has long been recognized by the technical and administrative staff. With a significant production, even though it has several storage spaces, there was a lack of a specific location, with an exclusive physical and human infrastructure. It used to not have oriented preservation and communication of the vast scientific collection derived from its many researches. It was impossible to make that amount of information available to the public.

Different practices do not necessarily mean better, as each reality will point to a solution. All the publicity work carried out by the team at *Litoteca* IGc/USP, which made a project primarily developed to be a rock preservation archive and which resulted in a museological-geological collection, makes the existence of such a project unique. One must also consider that having their research organized, preserved and managed by a trained and specialized team, in a space developed especially for this purpose, linked to a museum of excellence in one of the largest Universities in Latin America. This relationship allows sample donors to constantly contribute with suggestions and constructive criticism, as well as the institutional network of professionals from museums, cultural centres and courses related to the area whose guidance and advice are requested and contribute to the constant improvement of the processes used by *Litoteca* IGc/USP.

Strengthening ties with society has been a recurring theme within USP, reflected in all its pillars: Teaching, Research, Culture and Extension. Communication is the most efficient way to perform such a task. Every time we have the discussion, in some parts of society, about the funds destined for the public university, we feel the reflexes, positive or negative, of the dissemination works carried out The Rio de Janeiro Charter (2017) calls attention to the importance of encouraging the involvement of society in the preservation of the Cultural Heritage of Science and Technology (PCC&T), adopting a dialogical and participatory process (MAST, 2017). It is important to reinforce the value of communication practices of the collections, whether for the internal public or external to universities (Novaes, 2018; Lourenço & Wilson, 2013). The knowledge of the scientific heritage's existence is fundamental to its preservation. Scientific heritage cannot be preserved, much less used if the society do not know what exists and where. A collection without communication is not a complete one (J. T. Lima & Carvalho, 2020b).

In addition to its own website, the *Litoteca* IGc/USP in the administrative link with the Museum allows the use of its social networks to complement the dissemination of the collection. The Facebook account "Museu de Geociências - USP" has more than 4,700 followers with some publications reaching almost 35 thousand people and an Instagram profile "@MuseudeGeocienciasUSP" has more than 3000 followers (data obtained on 10.13.2020). Posts about the *Litoteca* IGc/USP appear on the Museum's social networks.

The *Litoteca* IGc/USP sporadically participates in temporary exhibitions of the Museum, presenting its collection of both rocks and donors' memories. The last participation took place at the end of 2019, in the exhibition "Primavera dos Museus", showcase "Inside the Museum - A *Litoteca*". It had the opportunity to interact with samples of rocks, slides and original field notes from the donor teachers.

In June 2016, the *Litoteca* IGc/USP's team were interviewed (Figure 4) by a journalism student at the School of Communication and Arts at USP for the purpose of mandatory course work. The interview resulted in a video available on the *Litoteca* website and on the Museum's YouTube channel (Museu de Geociências IGc USP, 2018). More technically, the production of scientific articles published in scientific journals has also been adopted in 2020 as a means of communication by *Litoteca* IGc/USP.

Figure 4. Interview for the *Escola de Comunicação e Artes* at USP, in order to publicize the collection: A) making the video of a scene from the promotional video produced (B). Photos: Sborja (2020).

As a laboratory administratively linked to the Geosciences Museum, the *Litoteca* IGc/USP benefits from the fact that the Museum is an enduring institution that has been in existence for almost 100 years, popular and very dear to its visitors, with a wide presence in the digital communication channels, such as: a YouTube channel, Facebook account, Instagram, website, group visitation schedule, events calendar and various temporary exhibitions, in addition to being constantly sought to give interviews and technical advice to TV teams. The popularity of the Museum can be verified by its ratings, comments and notes made by visitors and available for public consultation on sites suc as: tripadvisor, google, facebook and Instagram, where they are very positive.

The regular participation in the USP statistics yearbook, which takes into account information from both physical and virtual visitors as well as consultants of the Museum's collection, is another piece of data that supports the positive mentioned here. According to the information given to the Égida office, the final year taken into consideration before shutdown due to the Covid-19 Pandemic, 2019, had over 20,000 visitors (Azevedo et al., 2020). Social media platforms continually change their subscriber counts, but as of July 2022, our Instagram account had 5407 followers, Facebook had 6,891 thousand, and our website was the most popular page on the Instituto de Geociências USP webpage. These are substantial numbers in the context of USP museums.

Thus, in addition to its own website, the *Litoteca* IGc/USP appropriates the possibilities offered by the Museum and participates in temporary exhibitions and events, when the theme coincides, has an interview video on Youtube, incorporated into the Museum channel, and its collection is the subject of regular posts on Facebook and Instagram.

In order to measure the public reached by the Geosciences Museum and which the *Litoteca* IGc/USP benefits from, in terms of dissemination, we sought information from the direction of the museum. In 2019, the Geosciences Museum received 19,377 visitors, divided into: scheduled group visits and monitoring, making 15,441 people, and individual visits and spontaneous, whose number reached 3,936 visitors. The groups are generally composed of students from schools, universities, foundations and Non-governmental Organizations, whose prior appointment is requested with the intention of providing monitors to provide a better use of the visitation. The frequency of groups varies according to the Brazilian school calendar, being concentrated in the months of April to June and August to November. In the rest of the year, from January to March and in July, during school holidays, sporadic visits are held (Information provided by Miriam Della Posta de Azevedo, Technical Head of the Geosciences Museum).

IDENTIFICATION, DOCUMENTATION AND BEYOND

The *Litoteca* IGc/USP currently plays a fundamental role in preserving not only the material heritage derived from research, but also its intangible heritage. The preservation and documentation of materials collected by researchers in field work in an organized and permanent way.

The documentation offers an overview of the heritage life before it entered the collection. This is the most difficult stage in the life of an object to be recovered, since when the documentation is present in the incorporation process, most of the time there is no concern to preserve its data prior to this moment (Azevedo, 2018). The proper documentation of an object is essential in every step of it inside a laboratory. This can only be achieved if the professional working directly with them maintain a concise logical record. This practice provides an invaluable database for other scientists who wish to re-examine, analyse or preserve (Green, 2001).

The collection's relationship with the Geosciences Museum enabled several actions, among them the collection valuation process itself has been revised. The importance of the geological good was not explicit in its documentation, so as of 2020, information is being included in each description allowing the researcher unfamiliar with the specific language of geology to quickly identify the importance of the research for the university and for the geosciences in general.

If the collection's function is scientific research, all data related to research conceived with such goods must also be documented. Information such as articles and published theses are essential for some researchers, just as the data of the collection can be essential in the formation of taphonomic research.

Although documentation is a common practice for collections in museums, as previously said for *litotecas* in the Brazilian context, a complete version of it is not common for a collection considered transitory. The documentation of geology collections in universities is an interdisciplinary preservation action. This process consists of several stages, each with challenges that affect the curators every day. It is noteworthy that the identification of scientific goods must be done by a specialist in the area to which it belongs, whether in-house or external. Nevertheless, in such a diverse field, it is not possible to expect a single professional to play the role of many. It is expected that interdisciplinary work is considered paramount, however, this is not an easy reality to be applied. The *Litoteca* IGc/USP understands the work of participatory documentation through the inclusion of the academic community and the donor in the acquisition process is essential to integrate it into the university environment and to conclude its social role as scientific heritage.

All practices mentioned here are subject to replication. Some curators of Brazilian collections sporadically visit or consult us interested in replicating our processes in collections that they manage. The interest covers what software we use, what processes are applied in the filing of the samples as well as looking for equipment references. *Litoteca* IGc/USP provides the necessary consultancy and maintains a permanently open channel for clarifying doubts.

Since its creation, the *Litoteca* IGc/USP has been developing projects that heighten its concern with actions to preserve and disseminate scientific knowledge. A proposal is being developed to change the name of the laboratory (Sborja & J. T. Lima, 2020), from *Litoteca* IGc/USP to the Laboratory for the Preservation of the Lithological Collection (LITOLAB). LITOLAB, diverge from other Brazilian *liotecas*, it has in its management and preservation practices communication and documentation procedures bringing it closer to musealised collections, distancing it from the *liotecas* whose activities are limited to catalogue and preserve. Through such a process, the geological samples turns into documents and the musealised archive becomes a preservation laboratory (Sborja & Lima, 2020).

Understanding that the reality reported here is not easy to achieve, we intend to encourage and show other

curators that even in the face of adversity the benefits for both the national heritage and the institution are immeasurable. It is noted the great difficulty encountered by the *litotecas* surveyed is the maintenance of their own, exclusive technical team in their management. The scientific collections of geosciences have a very large sample volume, which would require their own team to properly perform the documentation processes. At the moment, it is noted that not even the projects in progress have been concluded.

CONCLUSION

Documentation is one of the main ways of safeguarding a scientific good. It is the most complete way of collecting and making data available about the good and its relations with the collection. Documenting the samples, with as much possible information, is extremely important for the preservation of lithological goods.

In this case, it is possible to assume that the concepts of preservation and valuation are intrinsic to each other. The many values attributed to an object, such as: economic, political, cultural, scientific, spiritual and aesthetics, reinforce the need to preserve. The lithological heritage of the *Litoteca* IGc/USP, like many others, is in the process of valuation from the moment it is incorporated into the collection. There is no way to maintain the social and scientific function of a geological collection without having its management, documentation and dissemination processes reviewed, with a view to maintaining the coherence of its communication.

The *Litoteca* IGc/USP is still an isolated example when compared to the reality of other *litotecas* in Brazil, however it is precisely in its individuality that a new management methodology is modelled, where the function of a geological collection goes beyond the physical preservation of the objects. Such examples can be followed by any other collections that have at their heart the desire to improve their practices. The incorporation of museological practices such as documentation, communication, preservation and valuation, derived from its connection as a laboratory of the Geosciences Museum, makes the *Litoteca* IGc/USP project different in terms of the management of geological scientific collections in the context of the country.

The changes described throughout the article reflect the perception of the management of *Litoteca* IGc/USP in addition to the archiving of the sample: it is not just a matter of storing a rock to preserve research data, this sample must also be communicated, accessed and appreciated. The link of researchers to their collections is not limited to the scientific context, but also expands to the human and personal perspective, so preservation can be effective and lasting. By including in the collection materials enabling the creation of an affective bond, of feeling of belonging, it is possible to allow the self-identification of the visitor or reader with the researcher/donor of the collection. An administrative procedure that makes the preservation of samples mandatory does not have as much influence as the valuation inflicted by the creation of the feeling of belonging to the public. The geological scientific production of IGc/USP belongs to all citizens, carries history, work, time and dedication of many researchers, in addition to having used public funding in an underdeveloped country whose majority of taxpayers who fund Brazilian scientific research are not even aware of the uses of their money.

Public funding of science developed by the *Universidade de São Paulo* makes the results of research a heritage of Brazilian society. Therefore, it is extremely important to preserve it and make it accessible to the general public in addition to the academic and scientific. The purpose of *Litoteca* IGc/USP in not merely archiving rock samples, but preserving, disseminating and making them available in the broadest and most democratic way possible. This is the result of a university policy of extension practiced by the laboratory and the Museum of Geosciences, and stimulated by the University itself.

All the actions described here have the potential to be replicated in the most diverse geological collections. Society preserves what it attributes some value to. The development of the feeling of belonging through the actions of valuing geological cultural goods practiced by *Litoteca*

IGc/USP aims at the democratization of knowledge, stimulating society to realize that the contents offered and the research produced in the academic environment directly affect in everyone's daily life.

ACKNOWLEDGMENTS

We would like to thank Dr. Ismar de Souza Carvalho for his support as an advisor in the PhD Research. We are also grateful to the contributions given by the curators of the collections interviewed as part of the PhD Research, Dr. Fabiano R. L. Faulstich (*Coleção de Mineralogia - Museu Nacional*), Dr. Renato R. C. Ramos (*Coleção de Geologia Econômica e Rochas Sedimentares - Museu Nacional*), Dra. Eliane Guedes (*Museu Nacional - Universidade Federal do Rio de Janeiro*), Dra. Paola Barbosa, Dr. Ricardo Lourenço Pinto (*Museu de Geociências - Universidade de Brasília*), Dr. Lauro Cézar Montefauco L. Santos, Adriano Edney S. de Oliveira (*Museu de Minerais e Rochas - Universidade Federal de Pernambuco*), Dra. Camila Cardoso Nogueira (*Coleção de Petrologia Ígnea e Metamórfica - Universidade do Estado do Rio de Janeiro*), Dr. Marco Brandalise (*Coleção de Mineralogia e Petrologia*, *Pontifícia Universidade Católica do Rio Grande do Sul*), Dra. Ana Paula (*Coleção de Geologia - Universidade Federal de Alagoas*), Dr. Osvaldo Edson Borges Martins Jr. (*Coleção de Minerais - Universidade Estadual de Feira de Santana*), Prof. Edson Fialho (*Coleção de Geologia - Universidade Federal de Ouro Preto*), André Leandro Silva (*Coleção de Geologia - Universidade Federal de Minas Gerais*), Dr. Rodrigo Scalise Horodyski (*Coleção de Paleontologia do Laboratório de História da Vida e da Terra - Universidade do Vale do Rio dos Sinos*), Dr. Marcos Henrique (*Coleção de Minerais e Rochas - Universidade Federal de Uberlândia*), Dr. Guilhermo Navarro (*Coleção de Minerais e Litoteca, Minérios e Rochas - Universidade Estadual Paulista*), Miriam Della Posta de Azevedo (*Museu de Geociências - Universidade de São Paulo*), Dr. Anderson Costa e Sr. Maria Gabriela (*Coleção de Mineralogia - Universidade do Estado do Rio de Janeiro*). We also thank Daniel G. F. Correa for his helpful reviews and suggestions.

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AUTHORS' CONTRIBUTIONS

J. T. M. Lima contributed to conceptualization, data curation, investigation, validation, formal analysis, methodology, supervision, translation of material, and writing (original draft, review and editing); and C. H. Sborja to conceptualization, data curation, and writing (original draft, review and editing).