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Creating the fossils exposition of the IFSULDEMINAS Natural History Museum, Campus Inconfidentes

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Abstract

Paleontology is an attractive science field, whose study object, the fossils, possesses a high potential to attract public attention. Fossils curation requires a detailed technical process since their collection in the field. Federal Institute of Education, Science and Technology of South of Minas Gerais – IFSULDEMINAS, Campus Inconfidentes participated in an educational field trip in november 2016, for collecting fossils, led by the Federal University of Rio de Janeiro, receiving the donation of around 60 specimens. Then, considering the urgency of a curatorial procedure for the safeguard of such material, we carried out this study aiming to create the fossils exposition of the IFSULDEMINAS Natural History Museum, Inconfidentes municipality, SE Minas Gerais state, Brazil. For that purpose, we have been preparing the fossils, from July of 2018 to date, using adapted tools such as those used by dentists, removing the overarching rock matrix from the specimens with adapted tools, attributed them tomb numbers and exposed them in the Natural History Museum, with informative textual and graphic material. Over 40 specimens were prepared, cataloged and exposed so far, and the exposition is already receiving visitors. In future actions, we intend to implement technologies which will improve both the teaching-learning process and specimens safeguard.

Keywords: Paleontological curation. scientific diffusion. non-formal education.

Introduction

Paleontology is a science with a great capability to integrate different fields of knowledge, thus having high application potential and, also, making possible the introduction of relevant themes in the geosciences (BRASIL, 1998, 2006; MELLO *et al.*, 2005; TEIXEIRA *et al.*, 2006; ALMEIDA *et al.*, 2013). Fossils, the object of study of paleontology, are historically presented to the public through museum expositions, which are responsible for supporting the construction of the cultural identity of societies (WALEWSKI, 2007). In addition, such expositions are developed under some predefined criteria, which include a defined theme, among other parameters that increase its communication ability (COSTA, 2006).

In this sense, fossils appear as a resource with high potential for education and scientific diffusion, due to its attractiveness for the general public (CARVALHO, 2010). Alongside the specialized literature, official documents reaffirm such reality. The National Curricular Parameters (PCN), for example, recommends paleontology for a better understanding of evolutionary biology (BRASIL, 1998; 2006).

IFSULDEMINAS Campus Inconfidentes participated in an educational activity of fossil collection, promoted by Universidade Federal do Rio de Janeiro (UFRJ), at Araripe Basin, Northeastern Brazil, in November 2016. Once collected, the material had to be submitted to the paleontological curation process, which consists in its preparation, cataloging and public exposition (SOCIEDADE DE HISTÓRIA NATURAL, 2019). Thus, due to the urgent need to carefully treat the fossil material, as well as its high scientific and educational importance, this study was developed, focusing on the curation of the received fossils, to support educational and

scientific diffusion actions at the IFSULDEMINAS Campus Inconfidentes Natural History Museum.

Materials and methods

Study area

The Araripe Basin is located between the states of Ceará, Pernambuco and Piauí (Figure 1), having the biggest area of Cretaceous rocks exposed among Northeastern Brazil inner basins, of approximately 12,200 km^2 (CARVALHO & MELO, 2012). The origin of this basin is associated with the Gondwana rift and the Southern Atlantic opening, when many intercontinental sedimentary locations were formed (ASSINE, 2007; CARVALHO & MELO, 2012). Concerning the fossiliferous content, the Araripe Basin is known for its great richness and diversity, with invertebrates, plants, reptiles of living and extinct taxa, microfossils (pollen grains, dinoflagellates, conchostracan and ostracods) and many fish (ARAI & COIMBRA, 1990; CARVALHO & SANTOS, 2005; ARAI, 2006; BRUNO & HESSEL, 2006; BOOS & VEGA, 2011). The history of paleontological research carried out at Araripe shows a large amount of studies developed since the nineteenth century, involving several taxonomic groups, aims and methodologies (CARVALHO & SANTOS, 2005).

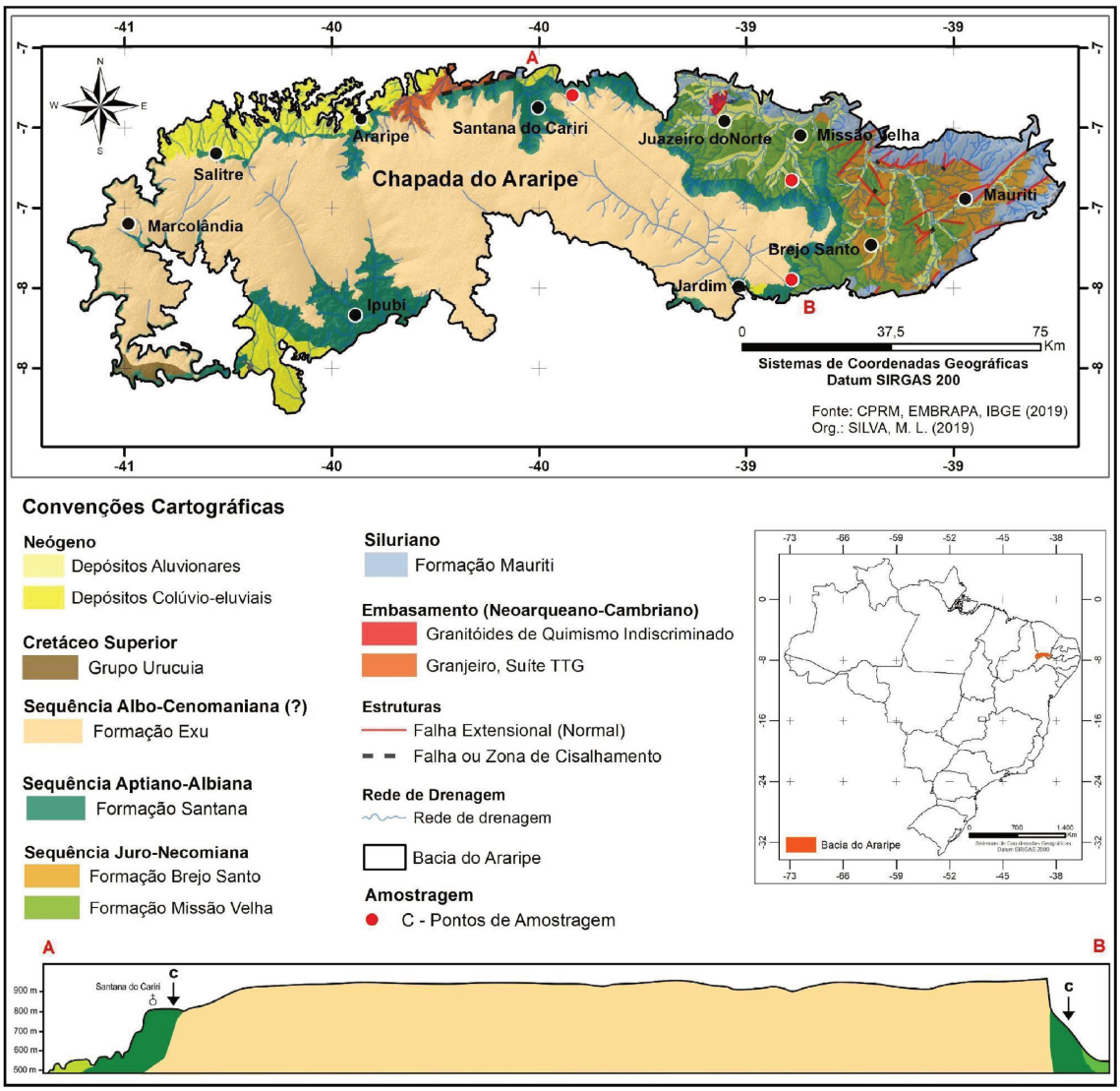
Paleontological curation

Concerning heritage care with fossil material, many steps are needed, from the collection out in the field to forming a paleontological collection (CARVALHO, 2010; KELLNER, 2015). Such practices constitute the paleontological curation, which aims to safeguard the fossil material (CARVALHO, 2010; SOCIEDADE DE HISTÓRIA NATURAL, 2019). Neglecting curation, on the other hand, can seriously damage fossil heritage (KREMNITZ & SANDFORD, 2015). The first step, preparation of fossils, consists in the removal of the fossil material (or its maximum exhibition) from the rock matrix, and holds an essential role for the incorporation of a specimen to a collection. In proportion to the diversity of types of fossils and fossilization processes, however, there are different preparation techniques (TOOMBS & RIXON, 1959; SILVA *et al*., 2015). Due to this matter, the professional in charge of the fossil collection must be technically qualified and able to define which techniques should be used in each circumstance (CARVALHO, 2010). Concerning the importance of an appropriate paleontological curation, the durability of the specimen, which is the biggest goal of the curation work, depends on the action of the environmental agents, physical and chemical, which are different in nature from the original context of the fossil. Therefore, the field collection of a fossil may be understood as the first step of a complex process of heritage care. If not performed adequately, the collected material may be entirely destroyed (*op cit*).

Field and laboratory work

The field activity was undertaken in November 2016 at the Araripe Sedimentary Basin, Northeastern Brazil (Figure 1). Many fossils, among plants and animal macrofossils, microfossils and ichnofossils were collected during the campaign, from which more than 40 specimens were donated to IFSULDEMINAS by Prof Dr Ismar Carvalho de Souza, field supervisor and coordinator of Instituto de Geociências (IGEO), Universidade Federal do Rio de Janeiro (UFRJ). The fossil curation has been undertaken in the Zoology Laboratory, IFSULDEMINAS Campus Inconfidentes, from July 2018 to the present moment. In the fossil preparation, mechanical and chemical techniques were applied in the removal of the rock matrix. Hammers, chisels, brushes, dentist tools, bonder glue (for small repairs in structures on which abrasion resulted in some physical damage to the specimen), a small grinding machine and acetic acid [10%]

Figure 1. Geological and location map of the Araripe Basin, Northeastern Brazil.



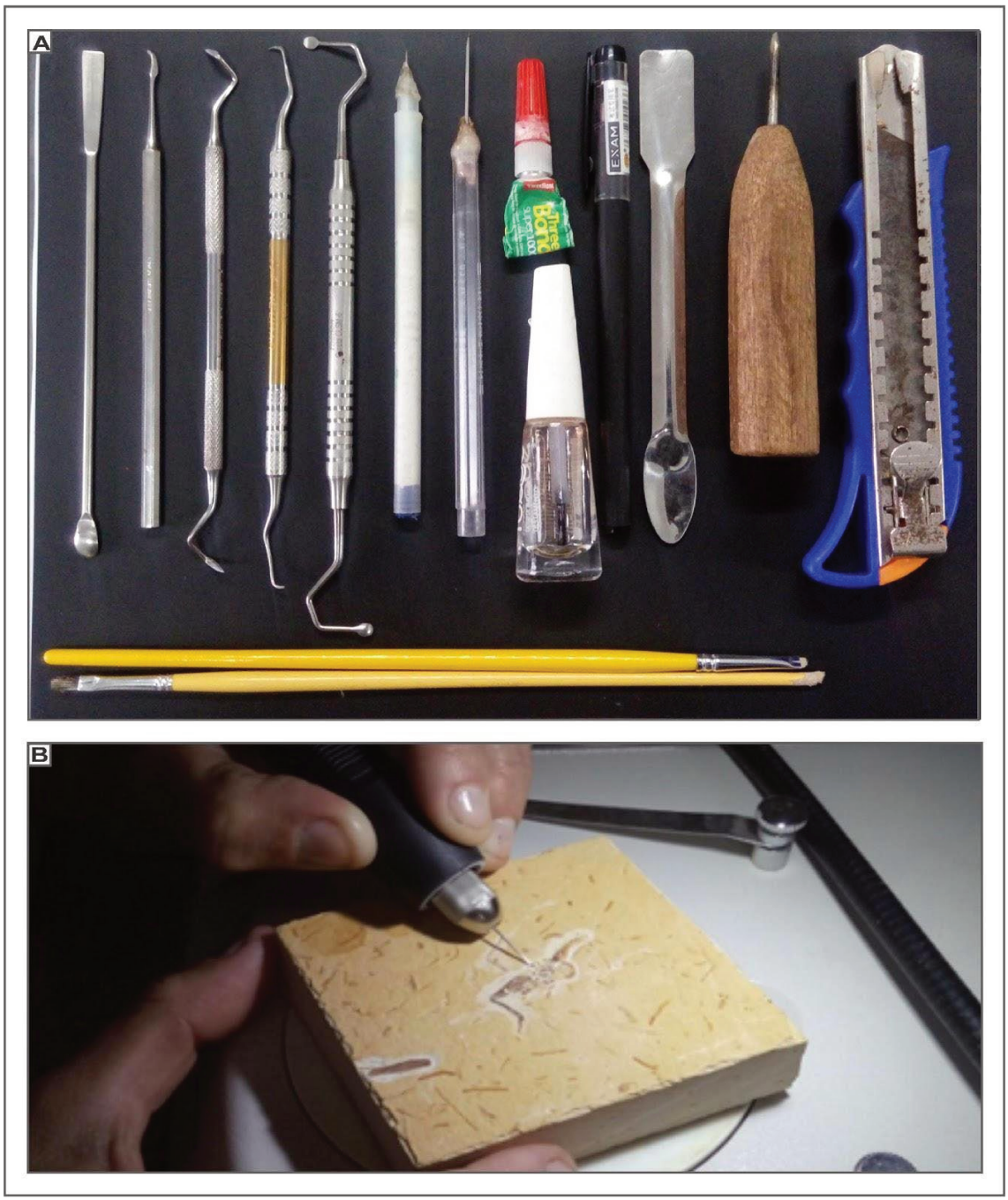
Source: Prepared by the authors (2018).

were used. For the cataloging, a register code was developed and fixed to the specimen using black ink pen and transparent nail polish. The exposition of the fossils is being prepared at the IFSULDEMINAS Natural History Museum, as the curation of the fossils and the preparation of the furniture pieces and the auxiliary informative material for the exposition are finished.

Results and discussion

Around 40 fossils have been prepared so far, through mechanical and chemical processes. The material commonly cited in the specialized literature (Figure 2.A and B) (GREEN, 2001; CARVALHO, 2010; NIZER, 2014; KELLNER, 2015; VASCONCELOS *et al.*, 2016), mostly adapted from other areas, was efficient. Due to the large dimensions of the edge of these instruments, it was possible to use them to search for other biogenic structures under the rock matrix. In contrast, the more detailed work was made with needles inserted in pens. In these cases, it was possible to remove minimum amounts of rock from the specimen, even in its smaller features (Figures 3.A to 3.E). Such

Figure 2. Preparation of fossils for the IFSULDEMINAS Natural History Museum collection. A. Tools and materials employed on the fossil preparation. B. Use of a micro grinding machine on the preparation of a fossil insect.

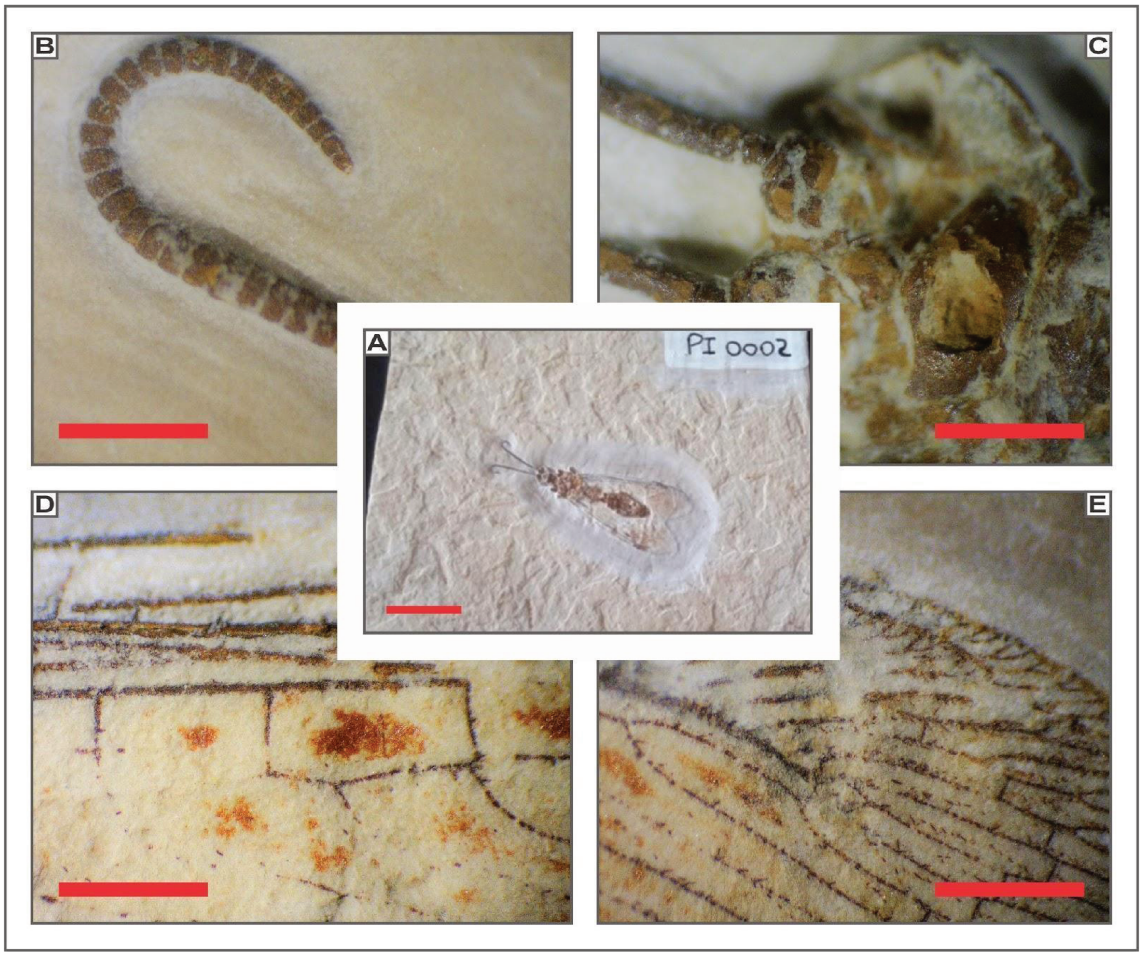


Source: Prepared by the authors (2018).

cases are recurrent in Araripe Basin, due to its taphonomic particularities (CARVALHO & SANTOS, 2005).

It is important to observe these characteristics due to the lithological nature of the fossils in preparation, which is directly related to the technical and theoretical qualifications of the executor (CARVALHO, 2010; SILVA *et al.*, 2015). The grinding machine (SILVA *et al.*, 2015) showed high efficiency for the fast removal of larger quantities of sediment from the fossils. In the case of smaller structures, a needle was

Figure 3. Microphotography of a fossilized insect prepared at IFSULDEMINAS Campus Inconfidentes, with dentist tools and needles (scale bar: 5 mm). A. Anatomical detail of the B. distal and C. proximal portions of the aerials and D. proximal and E. distal portions of the wings of the specimen. The microstructures observed indicate the exceptional preservation state of the fossil (scale bar: 1 mm).



Source: Prepared by the authors (2018).

inserted in the edge of the machine, making it possible to execute delicate work quickly. The acetic acid was adequate as a complement in fossil preparation, when the mechanical tools were too large for the anatomical structures. The acid was used in low concentrations and presented an ability to corrode the rock without damaging the specimens (STEEN 1931, BULLMAN 1931, TOOMBS AND RIXON 1948, 1959; GREEN 2001, TRIPLEHORN *et al.*, 2002; CARVALHO 2010, PADILLA & PARRA S.D., LEAL & BRITTO 2010). To catalog the fossils, a code with information about owner institution, fossil class (paleo vertebrate, paleo invertebrate, plant, ichnofossil or microfossil) and specimen number was created (Figure 4.A, B and C) (CARVALHO, 2010).

Differently from collections with a scientific potential, such as that of the Geology and Paleontology Laboratory (LGP), at the Federal University of Rio Grande (UFRGS), which houses more than 5000 specimens, distributed in 21 taxonomic classes (Diniz et al., 2015), our collection has specifically an educational purpose. However, many subjects both from basic and higher education, may demand non-formal educational resources, and didactical fossil collections may significantly improve learning (e.g. Oliveira, 2014). However, technological

Figure 4. Cataloging of fossils from the IFSULDEMINAS Natural History Museum. A. Some of the specimens prepared and cataloged. The inserted code indicates the register number within the collection. B. First cataloged specimens from paleo botanic (fossil plants) class (bar scale: 1 cm), and C. paleo vertebrate (teleostei). The code indicates, respectively, the institution who owns the piece, the fossil class and register number within the class.

Source: Prepared by the authors (2018).

and methodological applications are important implementations for both educational and scientific collections (see Oliveira et al., 2016 for computerization on a scientific collection). Furthermore Santos *et al*. (2016) present the advantages of using the Microsoft MS ACCESS database for heritage management based on the analysis of paleontological collections. Lima *et al.* (2015), on the other hand, considering the high communication potential as well as the historical and heritage value of paleontological museums, carried out the cataloging of fossils with the support of QR codes.

The exposition at the IFSULDEMINAS Natural History Museum is still being developed, with the preparation of the spaces for the fossils and the informative graphics (according to Costa, 2006; Kremnitz and Sandford, 2015), which must present aspects of ecology, evolution, geology and paleoenvironment. As a final remark, bearing

in mind paleontological curation complexity and the necessary expertise, we reinforce the importance of publishing technical papers. They contribute to the heritage care of the fossils and benefit museum collections as spaces of scientific education and diffusion (Costa, 2006; Walewski, 2007; Barreto *et al.*, 2016). In future studies, we intend to improve the cataloging process, including new technological resources.

Conclusion

Curated specimens were fossilized by substitution, concretion and carbonization, being extremely well preserved in most cases, and sometimes with minimal-sized structures perfectly visible even with diagenesis, as the majority of specimens do not exceed 15 cm in length. This exceptional preservation is better demonstrated by the microphotographies. So this study is expected to contribute in promoting the paleontological heritage of the Araripe Basin in Northeastern Brazil. Furthermore, it constitutes an important action for the safeguard of the fossils received by the IFSULDEMINAS Campus Inconfidentes, besides contributing to the transmission of the history of life on Earth through the public presentation of the prepared fossils, and last, it supports teaching-learning processes at the IFSULDEMINAS Natural History Museum.

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