

Importance of Kenneth Edward Caster (1908–1992) Personal Correspondence and Field Notebooks to the Brazilian Paleontological Heritage

Joana David Caprário de Lima¹ · Luiza Corral Martins de Oliveira Ponciano²

Received: 31 December 2016 / Accepted: 28 June 2017 / Published online: 11 July 2017
© The European Association for Conservation of the Geological Heritage 2017

Abstract The aim of this work is to value Kenneth E. Caster's correspondence and field notebooks as Brazilian paleontological heritage. These data are usually underestimated in the Geosciences, although they have been used in the development of an inventory of the most valuable occurrences of Devonian fossils in NE Brazil. During his academic career, Kenneth E. Caster (1908–1992) worked in several universities, including the University of São Paulo (USP, Brazil), where he was a visiting professor from 1945 to 1947. We analyze more than 2000 documents of his personal correspondence (from 1937 to 1984) and three field notebooks. These documents allow the recovery of historical, educational, and scientific information. They represent an important source of historical value to identify Caster's personal and professional relationships as well as to understand his contribution to establish and improve the first Brazilian institutions related to Paleontology (National Department of Mineral Production; Paranaense Museum; Cultural Center “Euclides da Cunha”; Brazilian Geological Society; Brazilian Paleontological Society; National Petroleum Council). These documents also have educational value, related to the beginning of Paleontology in the Brazilian universities (USP) and the formation of its teaching collections. In the same way, they are an

important source of scientific value to current geological and paleontological research, resulting in the discovery of new fossil localities and additional fossiliferous levels at previously known sites from the Parnaíba and Paraná basins.

Keywords Geoheritage · Scientific heritage · Paleontological heritage · Personal archives · Scientific collections · History of Paleontology

Introduction

Although the use of personal correspondence is well established in social and human sciences, the association of sources like correspondence and field notebooks with current scientific data is still an unfamiliar area of study for geoscientists. Particularly in Paleontology, there are few studies regarding the potential of such documents as material with scientific, educational, and historical value.

The correspondence exchanged by Kenneth E. Caster (1908–1992) in his professional routine as geologist and paleontologist is a type of communication known as scientific. Restricted to members of its own community, scientific communication is related to the production, dissemination, and use of information from the formulation of a research idea to its results, obtained and accepted as part of the universal stock of knowledge (Targino 2000).

In a broader perspective, and similar to our approach in this paper, the relevance of paleontologist Frederico W. Lange's archive (1911–1988) as a source for several studies related to the History of Geosciences can be cited as an example. A significant fraction of Caster's documents originates from correspondence exchanged with Frederico W. Lange, through which we can perceive a network of scientists who contributed to develop knowledge on subjects related to the Brazilian

✉ Luiza Corral Martins de Oliveira Ponciano
luizaponciano@gmail.com

Joana David Caprário de Lima
joana.d.lima@gmail.com

¹ Postgraduate Program in Museology and Heritage (PPG-PMUS, UNIRIO/MAST), Universidade Federal do Estado do Rio de Janeiro, Rio de Janeiro, Brazil

² Laboratório de Tafonomia e Paleoecologia Aplicadas—LABTAPHO, Universidade Federal do Estado do Rio de Janeiro, Avenida Pasteur 458, sala 504, Urca, Rio de Janeiro, RJ CEP 22290-255, Brazil

Paleontology. Lange's archive, when combined with current data, produced several studies (Bosetti et al. 2011; Peyerl et al. 2010, 2012; Peyerl 2014). Those publications corroborate the wide range of values that can be obtained from the analysis of a paleontologist's personal archive. Moreover, it is an important theoretical reference for the development of research based on the archives of Kenneth E. Caster, even considering the friendship reflected in the correspondence exchanged between them.

In the same way, research by Luna Filho (2007) and Marchesotti (2011) about the naturalist Wilhelm Lund (1801–1880) are examples of the use of personal documents in scientific and historical analysis. Regarding the articulation between the scientist's memories and his correspondence, the authors explore the possibilities of this data beyond the mere biographical approach, emphasizing Lund's scientific trajectory as well as the role he played in the local community of Lagoa Santa (State of Minas Gerais). Lopes and Podgorny (2014) also illustrate how the scientific communication between peers—in this case, the publications of Hermann von Ihering (1850–1930) and the correspondence he exchanged with Florentino Ameghino (1854–1911)—is relevant to generate questions, controversies, and conceptions, especially regarding stratigraphic sequences and their chronostratigraphic correlation.

The information we can derive from Kenneth E. Caster's correspondence, especially when combined with data from the field notebooks, represents one of the small pieces of science construction. Considering that scientific heritage is all that involves science, either as a vehicle or as a result of scientific process, these documents contribute to the Brazilian scientific heritage. They are recognized as a legacy worth of being preserved and passed to the next generation. It comprises the material and immaterial media of how and what we know about the universe, which includes “artifacts and specimens, but also laboratories, observatories, landscapes, gardens, collections, *savoir faire*s, research and teaching practices and ethics, documents, and books” (Lourenço and Wilson 2013).

In addition to scientific heritage, Kenneth E. Caster's correspondence and field notebooks are also Brazilian Paleontological Heritage, included in a broader category named *ex situ* Geological Heritage. It includes specimens of geodiversity displaced from their original location to integrate scientific collections of research institutions, and different kinds of records related to collection, conservation, and study of this material, along with other geodiversity elements that have conspicuous scientific, educational, historical, cultural, aesthetic, and other values (Ponciano et al. 2011).

These documents represent an important source of historical value to identify Caster's personal and professional relationships as well as to understand his contribution to establish and improve the first Brazilian institutions related to Paleontology (National Department of Mineral Production;

Paranaense Museum; Cultural Center “Euclides da Cunha”; Brazilian Geological Society; Brazilian Paleontological Society; National Petroleum Council). Caster's documents also have educational value, related to the beginning of Paleontology in the Brazilian universities (University of São Paulo (USP)) and the formation of its teaching collections. In the same way, they are an important source of scientific value to current geological and paleontological research, resulting in the discovery of new fossil localities and additional fossiliferous levels at previously known sites from the Parnaíba and Paraná basins.

Methodology of Analysis of Correspondence and Field Notebooks

In 2012, one of the authors (L.C.M.O.P.) discovered Kenneth E. Caster's correspondence and field notebooks during a period of research on Taphonomy at the University of Cincinnati, with Carlton E. Brett. During 3 months, it was possible to access Kenneth E. Caster's former office, in order to digitally scan the paleontologist's documents (about 2000 letters, three field notebooks, maps, photographs, reports of scientific research, pre-prints of articles and books, postcards, drawings, cartoons, sketches, telegrams, and travel tickets). The criteria used in the selection of correspondence and field notebooks were the relationship, direct or indirect, with Brazil (Fig. 1).

Also during this period, the photographic record of all the Brazilian Devonian fossils that were in the University of Cincinnati's collections and the Geier Collections & Research Center was made. The “Caster collection” consists of Devonian fossils from the Parnaíba and Paraná basins, collected between 1941 (when the first fossils of the Pimenteira Formation were collected) and 1947. These macrofossils were later sent to Kenneth E. Caster, and served as a basis for the first identification of the Devonian age of these rocks, carried out by him after a field trip with Llewellyn I. Price in 1947 (Caster 1948). This material was the object of study of only two dissertations in the University of Cincinnati, which were never published (Ford 1965; Suárez-Riglos 1967). At that time, the Brazilian fossils of “Caster's Collection” were considered lost and the only existing records in Brazil indicated that they were located in Museu de Ciências da Terra (Rio de Janeiro). However, the samples were never found. The discovery occurred by chance when one of the authors decided to look for records of those Brazilian fossils in the documents left by Kenneth E. Caster in his office. The scientific and historical importance of those specimens was pointed out to the curator of the University of Cincinnati's collection, David L. Meyer, and other professors (Carlton E. Brett, Warren D. Huff, Lewis A. Owen, and Barry J. Maynard—Department of Geology). Following this conversation, the Department of Geology

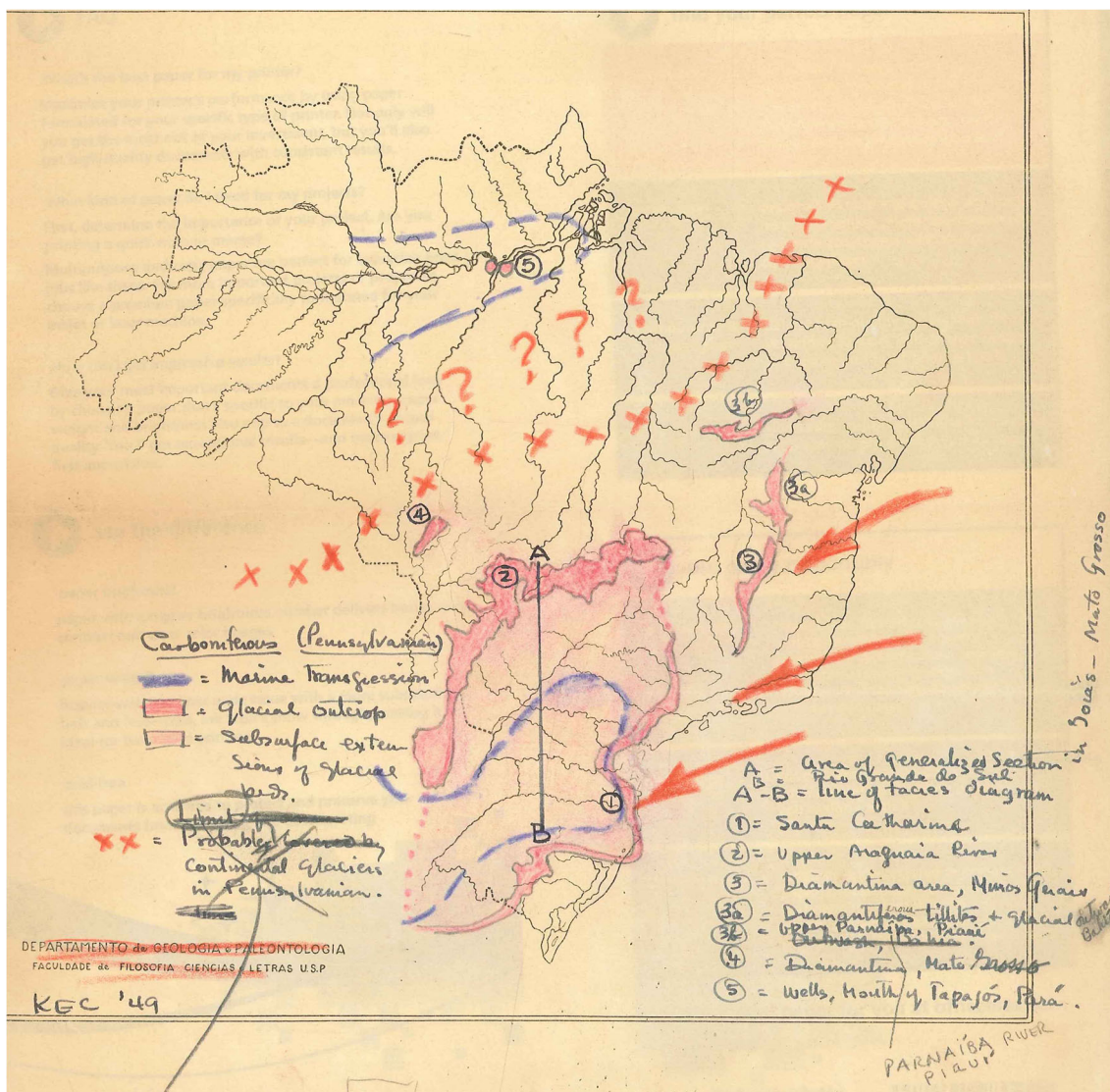


Fig. 1 Map of the Paleozoic Strata from Brazil made by Kenneth E. Caster, 1949

decided to donate the Brazilian fossils of the Caster’s Collection to Museu Nacional (Rio de Janeiro), to be incorporated in the invertebrates fossil’s collection. In 2016, the fossils arrived in Brazil.

Kenneth E. Caster’s correspondence and field notebooks are extremely well organized, by recipient and/or sender, and his organization had been maintained. His office has one of the best private libraries of Paleontology in the world, along with an extensive collection of various materials used in his classes. After the death of the paleontologist in 1992, the office he held at that university was used by another researcher, but remained practically as he had left. We selected the correspondence folders whose names are associated with Brazilian paleontologists or studies involving material collected in the country. The field notebooks were selected based on the name of the sedimentary basin (Parnaíba, Paraná, and Amazonas basins). Although Kenneth E. Caster had remained in Brazil

only between 1945 and 1947, the analysis of his correspondence covered a longer period, from 1937 to 1984, to understand the research and teaching trajectory that preceded and succeeded the visit of the paleontologist to Brazil.

A first general reading of the correspondence allowed the identification of a set of recurring subjects, such as information on research programs, admissions, student exchanges, travel impressions, field trips planned and/or carried out, requests and exchanges of publications, information about developing studies, the pre-prints’ reviews of papers and books, the fossils’ exchanges between museums and universities, and bureaucratic issues related to his admission as a visiting professor in the USP.

For a more detailed analysis of his correspondence, the selection of data was organized according to the following fields: sender, recipient, date, place, relation of the document with other documents (e.g., reply to the letter of March 21,

1945), abstract, paleontological information (collection and exchange of fossils), information related to Kenneth E. Caster's stay in Brazil (work developed, classes, research, field trips), geological information, and other data.

Historical Value of Kenneth E. Caster's Correspondence and Field Notebooks

Kenneth E. Caster (1908–1992) was born in New Albany (Pennsylvania), having studied in Ithaca (New York) at Cornell University. After work as a graduate assistant and then instructor in Geology and Paleontology at Cornell between 1929 and 1935, he taught biology at the State University of New York colleges. In September 1936, he became instructor in Geology and curator of the Geology museum at the University of Cincinnati (Ohio), and by 1952, he was a full professor. In addition to stratigraphic and faunal studies, Kenneth E. Caster's works included papers on Devonian cephalopods, Ordovician eurypterids, and other arthropods; extensive studies of sponges from the Cambrian, Devonian, and Mississippian; jellyfish from the Devonian and Cretaceous; and brachiopods and bivalves from the Ordovician, Devonian, and Mississippian.

During his career, he established several contacts, including with the USP, where he was employed as visiting professor of Paleontology and Historical Geology from 1945 to 1947. In this last year, the Guggenheim fellowship allowed him to travel and study Geology in Brazil and then to be visiting professor at the School of Mines in Medellín, Colombia.

In addition to being a member of several scientific societies and having participated in various activities related to Geology and Paleontology, he received several prizes, scholarships, and distinctions. Regarding distinctions, we single out the Orville A. Derby medal that Kenneth E. Caster received from the Brazilian Geological Survey, in the centennial celebration (1952). Not only his mastery of Paleontology but also his extraordinary teaching and research capacities (with a list of 86 publications), along with his magnetic personality, attracted generations of students to Cincinnati. He supervised 30 master's theses and 25 doctoral dissertations (Pojeta and Pope 1975).

In his direct and indirect contact with several Brazilian institutions, Kenneth E. Caster sought to foster exchanges with North American universities, in order to train professionals capable of incorporating new research methodologies in their institutions. He had a particular interest in the development of Brazilian Paleontology and the international prominence he considered necessary for this area to reach. In this sense, it was his concern and willingness to disseminate internationally not only his research results but also the publications of his peers. Kenneth E. Caster held in great regard the

work developed in Brazil and, as such, encouraged the publication of articles in English, to improve the exposure of Brazilian researches to scientific community.

In the same way, the contact with Frederico W. Lange (born in Ponta Grossa and at that time connected to the Paranaense Museum) had an impact not only on the foundation of the Cultural Center Euclides da Cunha, where Kenneth E. Caster was elected a corresponding partner, but also in the Paranaense Museum itself. Considering him to be one of the best scientists "throughout Latin America and, in his opinion, the best in Brazil," he lamented the periods in which Frederick W. Lange was not publishing his research, even suggesting to third parties that they should compel Frederick W. Lange to "pick up the pen" (letter from Kenneth E. Caster to Faris Antonio S. Michael, April 22, 1952).

From the analysis of the Kenneth E. Caster's correspondence, it is possible to establish his commitment to the dissemination of Paleontology in Brazil. As an example of his desire to develop Brazilian Paleontology research, we can name the interest and his efforts in participating in the foundation of the Brazilian Paleontological Society and the Brazilian Geological Society. During the meeting of the Geological Society of America (GSA), Kenneth E. Caster met with some Brazilian geologists, in view of the foundation of the Brazilian Geological Society, at the time conceived by the GSA as a model. In addition to being elected as one of the five founding members, he was also given the responsibility of choosing 15 Brazilians to fill the "effective members" list, who were responsible for electing the directors and officers of that Society. It was his desire that it would cover all the country's geologists.

In addition to this involvement, Kenneth E. Caster collaborated with the National Petroleum Council (CNP), after leaving Brazil. Several letters were exchanged with Avelino Inácio de Oliveira (at the time, director of the CNP Technical Division) about the field trip to the State of Pará, for which he was hired. Still in Colombia, Kenneth E. Caster's satisfaction with the work he was developing for the CNP was evident: "I would like to tell you how anxious and optimistic I am with the trip to the Amazon and with the results that will be of our mutual interest" (letter from Kenneth E. Caster to Avelino Inácio de Oliveira, July 8, 1948). The extensive field work he developed—following the "Agassiz-Hartt-Katzer" path for about 2 months—resulted in a vast production of papers based on the study of collected fossils (Pojeta and Pope 1975).

In this sense, we can conclude that the contribution of Kenneth E. Caster to the development of Brazilian institutions was made directly—through his participation in research projects and in the development of actions that promoted Paleontology in the country—as well as indirectly, by the incessant support he gave to Brazilian paleontologists, with whom he remained in contact over the years.

Educational Value of Kenneth E. Caster's Correspondence and Field Notebooks

At the end of 1940, Kenneth E. Caster showed interest in spending a period in Brazil, in order to study the Devonian deposits of the country. The possibility of integrating the University of São Paulo as a specialist in Stratigraphy was well received by the professors of the Department of Geology, who saw in his arrival a boost to research in Paleontology in that university. Thus, we can see the joy expressed by André Dreyfus about hiring Kenneth E. Caster in the following passage: “Your name is already well known to us and I assure you that we consider it an honor and a pleasure to have you among us” (letter from André Dreyfus to Kenneth E. Caster, February 3, 1944). The correspondence exchanged throughout 1944 focuses mainly on the negotiations regarding his visit to Brazil, including the following subjects: request for authorizations, information on the salary and type of contract, travel date, financing, necessary documents, and details about the work plan to be developed at the University of São Paulo. All this process was delayed by bureaucratic difficulties, added to the problems of mailing correspondence in time of a world war. Finally, on March 15, 1945, Kenneth E. Caster arrived in Brazil.

The analysis of field notebooks and correspondence exchanged by Kenneth E. Caster during the period in which he remained in the country proves his work in several fields that, taken together, reflect the energy and commitment of this paleontologist to help develop Paleontology teaching and researching in the Department of Geology (USP). In addition to the preparation of Paleontology and Historical Geology classes, Kenneth E. Caster held several lectures and prepared a seminar on North American Stratigraphy for students and professors. In the comments he wrote about his experience in Brazil are the complaints about the scarcity of resources, namely the lack of diversified educational collections and national and international publications that inform and update the students and teachers about what was being produced in the area worldwide.

It soon became clear to Kenneth E. Caster that there was much to be done in Brazil, specifically at USP, to develop the formal university teaching of Geology, and for Paleontology to lead a research agenda of its own in the Geology departments. From the beginning, Kenneth E. Caster tried to find a solution for these problems by asking Arthur Cooper, curator of the United States National Museum (Washington), to donate specimens to an educational Paleontology collection in USP (Fig. 2). At the end of September, Kenneth E. Caster was informed that two cases with 1412 invertebrate fossil specimens would be sent to USP (including about 500 different species), in exchange for South American fossils (letter from Arthur Cooper to Kenneth E. Caster, September 28, 1945). Of note, before leaving Cincinnati, he had the foresight to send to

the University of São Paulo collections of Paleozoic fossils and books that would assist him in the preparation of classes.

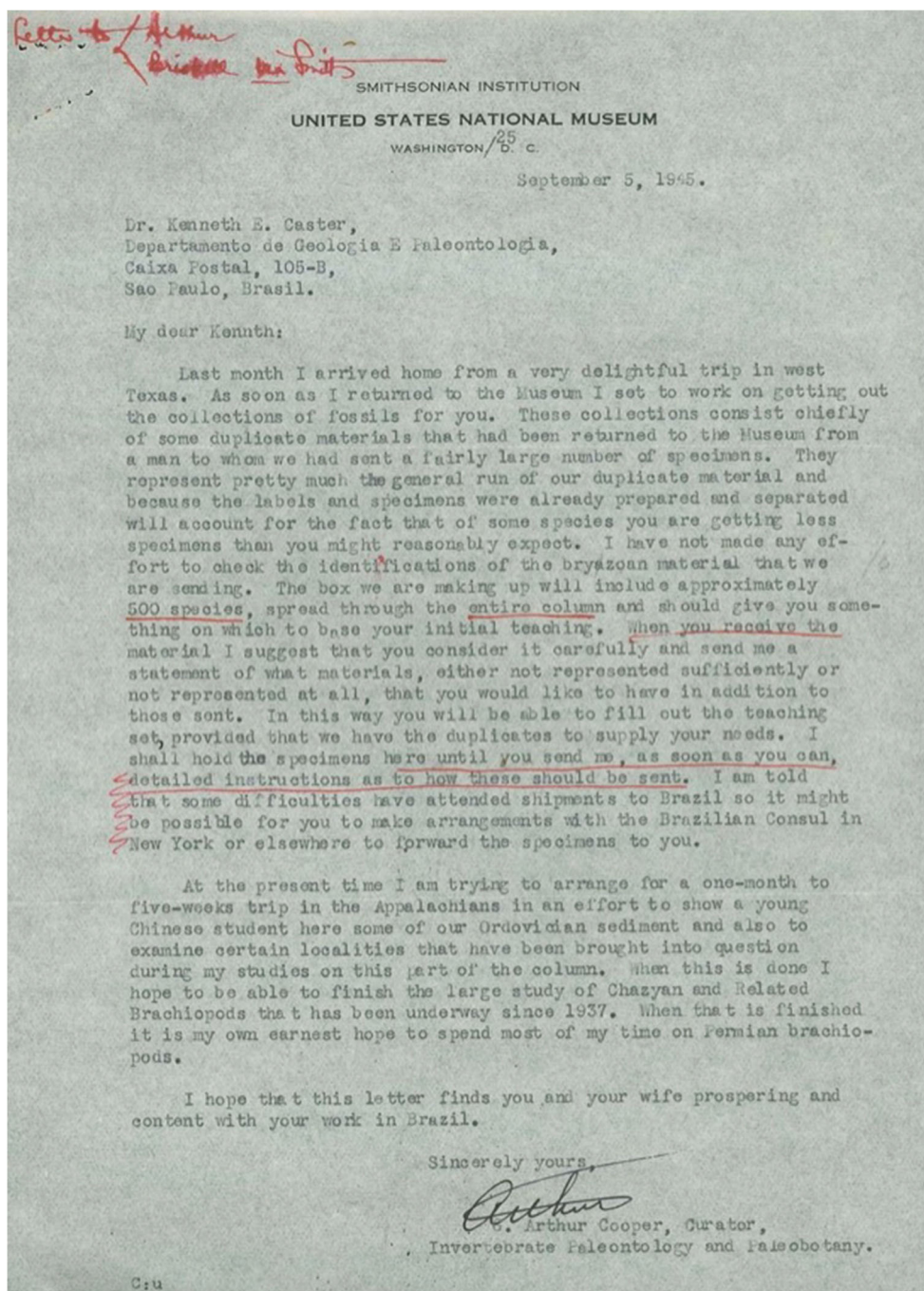
In the same way, over the years, he established several contacts in order to obtain papers, journals, and books for the library of the Faculty of Philosophy, Sciences and Literature (USP). In parallel with the expansion of the USP's collections and library, and taking advantage of the contacts he established, Kenneth E. Caster created a personal library of Brazilian Geology and made it available to the University of Cincinnati. His intention is evident in the numerous requests for publications that were made and then were taken to Cincinnati. By the end of October of 1947, there were about 2000 publications registered in the Faculty's library, still with cataloging in progress (letter from Kenneth E. Caster to Josué Camargo Mendes, October 31, 1947). According to David L. Mayer (personal communication, 2017), the Kenneth E. Caster's correspondence and field notebooks that were in his office (all his personal files) will be transferred to the University of Cincinnati Archives, and the Caster's books will be incorporated into the Geology Library of the same university, in a special section.

Another aspect that stands out from the analysis of Kenneth E. Caster's correspondence and field notebooks is that he was more than a visiting professor. In addition to his important contribution to the Faculty's library, he tried desperately to implement a Paleontology course at USP, which he considered to be the best Department of Geology in Brazil and the only in the country where efforts were being made to build Geology, as opposed to Mining engineering. To this end, he suggested developing educational efforts in the following fields: Structural Geology, Geomorphology, Geological Field Methods, and Sedimentation and Paleontology.

His concern and dedication to the paleontological issues of USP represent a landmark of his passage through the university, which can be seen through the words he addressed to Astrogildo Rodrigues de Mello (at the time, director of the USP's Faculty), after the 3 years of the term granted: “There is no better time than this to express to Your Excellency my sensitivity to the generous welcome and deference granted to me during the three years that I have had the opportunity to live in this Faculty and in this nation and the feeling of sadness in saying goodbye to this university, pressed with my commitments to the university to which I belong, at the opening of the next school year. I am pleased to confess to Your Excellency that it comforts me to feel that the University of São Paulo occupies a very precious place in my heart and the hope that there will still be an opportunity for me to warmly express my affectionate feelings towards Brazil and in particular to this Faculty” (letter from Kenneth E. Caster to Astrogildo Rodrigues de Mello, January 8, 1948).

Kenneth E. Caster's connection with USP continued over the years, even after he left Brazil in January 1948. He remained in contact with his former students from São

Fig. 2 Letter from Arthur Cooper to Kenneth E. Caster, September 28, 1945 (Washington)

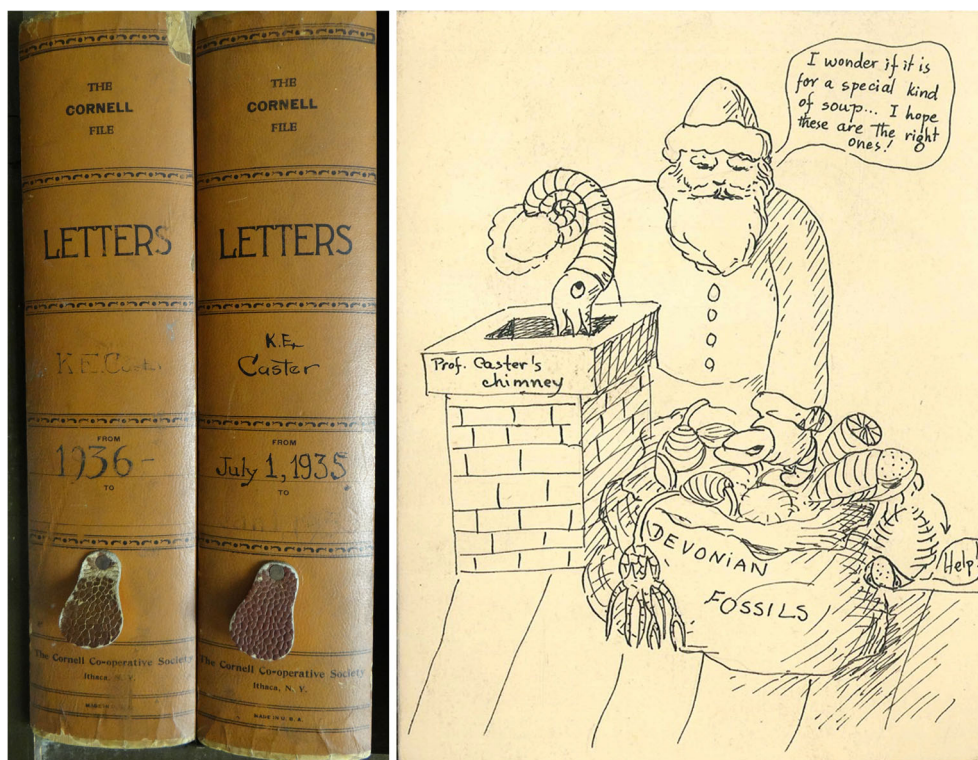


Paulo, from whom he received correspondence, including postcards (Fig. 3). His deep interest and relentless support, not only financial (through the payment of the subscriptions of several international periodicals to the USP's library), are well documented in the communication, maintained until at least the beginning of 1969, the year of the last correspondence's record with Brazil. From 1969 to 1984, the correspondence analyzed are only indirectly related to his time in Brazil, since they relate to information regarding his researches on the Devonian strata in other places he visited.

Scientific Value of Kenneth E. Caster's Correspondence and Field Notebooks

South American stratigraphy and the Brazilian Devonian fossils were areas of great interest to Kenneth E. Caster, who saw in the visit to Brazil the possibility of examining these deposits in the field, in order to complement the correlations with the regions of North America and other countries he had already studied. During his time in Brazil, he traveled to several locations in order to collect fossils and improve the geological

Fig. 3 Example of Kenneth E. Caster’s letter archives and a postcard from a former Brazilian student (from Taguea to Kenneth E. Caster, 1951)



mapping, from north to south, repeating some of the itineraries when he wanted to clarify certain doubts or try to find more material or information he could not get during the first field trip. In his correspondence, he described a significant area of the Brazilian territory. The field trip itineraries include the states of Amazonas, Pará, Maranhão, Piauí, Mato Grosso, Goiás, Minas Gerais, São Paulo, Rio de Janeiro, Paraná, and Rio Grande do Sul. He specially considered the Brazilian Devonian to be very interesting from the paleontological point of view. The information includes the description of stratigraphic sequences observed in the field, the new fossil localities and fossiliferous levels, and the confrontation of theories about the chronostratigraphic attribution of the Brazilian Paleozoic deposits.

The research Kenneth E. Caster developed in Brazil was a relevant contribution to update the South American Geological Map, in which he participated by organizing the geological part of Brazil given his experience acquired through the field works cited previously and subsequent research. As an example, during an excursion to the states of Mato Grosso and Goiás, which lasted about a month and a half and covered approximately 7000 km (by bus, plane, train, horses, and a large part on foot), Kenneth E. Caster analyzed the Devonian strata of these two states and made numerous collections of material in July, 1947. In a letter from Kenneth E. Caster to Arthur Cooper, August 26, 1947, he noticed that the Devonian area on the latest geological maps (including the first edition of the Geological Society of America map) is less

than half the size of the states of Goiás and Mato Grosso. Kenneth E. Caster’s work plans were set out for an in-depth study of the South American Devonian by visiting Argentina, Colombia, Bolivia, and Peru. He intended to visit all state and federal Geological Surveys as well as all the departments of Geology at universities and museums of Latin America.

In 1955, Kenneth E. Caster and Anneliese S. Caster (his wife) traveled for 2 months to Australia and New Zealand, as well as South Africa. The paleontologist considered it necessary to better understand the African faunas and other southern faunas in order to evaluate the geological evolution that he had already observed in the states of Paraná and Piauí (Brazil). From his point of view, much had been published about the relationships between these faunas, by people unfamiliar with the current evidence of field or fossil specimens (letter from Kenneth E. Caster to Avelino Inácio de Oliveira, October 4, 1955). After the analysis of the fossil material he collected, Kenneth E. Caster foresaw the chance of writing a book on the Austral Devonian. Moreover, the field trips to the countries mentioned previously allowed him to observe in the field a large part of the Devonian of the Southern Hemisphere. He also suggested India as his next destination (letter from Kenneth E. Caster to Reinhardt Maack, September 19, 1955).

Kenneth E. Caster’s correspondence and field notebooks have also been used to develop an inventory of the most valuable occurrences of geodiversity (Devonian fossils) in Brazil (Ponciano et al. 2012a, b; 2013). These sites are the most frequently mentioned in the literature (Caster 1947a, b, c,

1948, 1952, 1954a, b, c, 1955; Caster and Mendes 1947; Caster and Petri 1947); some have particular historical value and also document the considerable diversity of taphocoenoses, providing data about the depositional environment, genesis, and age of the fossiliferous deposits. Furthermore, the fossils are better preserved and recorded more comprehensively the faunal and floral variations of the Devonian seas and adjacent fluvio-deltaic environments.

Some of these sites (already considered Paleontological Heritage), as the fossiliferous outcrop of Oiti, a record of a Devonian sea in Northeastern Brazil, are under increasing risk of total or partial deterioration (Fig. 4), mainly due to anthropic activities (Ponciano et al. 2013). The inexistence of a systematic and comprehensive inventory means that the geological evidence that has supported decades of studies and research, and the spending of vast amounts of public and private money, may disappear forever (Brilha 2015).

Having carried out several field trips in Brazil in the 1940s, the analysis of Kenneth E. Caster's field notebooks and detailed description of the name and geographical location of Devonian outcrops in the State of Piauí (comprising the main geological features and geographical references, as local hills, rivers and other landmarks, together with schematic drawings and stratigraphic profiles) resulted in the discovery of new fossil localities (Morro Nossa Senhora dos remédios, Figs. 5 and 6) and additional fossiliferous levels at previously known sites (Morro do cemitério) (Ponciano 2013).

The taphocoenoses of the Pimenteira Formation (State of Piauí) have been characterized as of erratic occurrence

and hosted mainly by sandstones. These initial interpretations have undergone significant changes following Ponciano and Della Fávera (2009) and Ponciano et al. (2012a, b), which revealed new fossiliferous horizons and sites with an array of differing lithologies (siltstones, sandstones, and conglomerates). Formerly considered restricted to the base of sandstones with hummocky cross stratification, macrofossil assemblages of the Passagem Member (Pimenteira Formation) are now demonstrably more abundant and diversified in sandstones with sigmoidal clinoform structures, and also in plane-parallel stratified sandstones and siltstones. The predictive model of Ponciano et al. (2012a) explains the genesis of the Passagem Member's fossil assemblages, their distribution, and modes of preservation, and thus, it can be used in prospecting for new fossil occurrences. It could also provide an auxiliary tool in determining the distribution of potential hydrocarbon reservoirs in the Parnaíba Basin, which has been the subject of revived exploratory efforts in recent years. These studies are related to field trip itineraries based on information retrieved by the analysis of Kenneth E. Caster's field notebooks.

The study of Kenneth E. Caster's documents also complement the analysis of other materials, such as the fossils deposited in scientific collections from Brazil (Museu Nacional, Rio de Janeiro) and the USA (Geier Collections & Research Center, Cincinnati), developed by researchers who want to understand the original geological context from which this material was removed (Fig. 7).

Fig. 4 Example of an outcrop that have already been destroyed by city growth and commercial exploitation (Devonian, Pimenteira Formation, State of Piauí, Brazil, described by Kenneth E. Caster as Morro do Militão, in 1947) (Ponciano 2013)



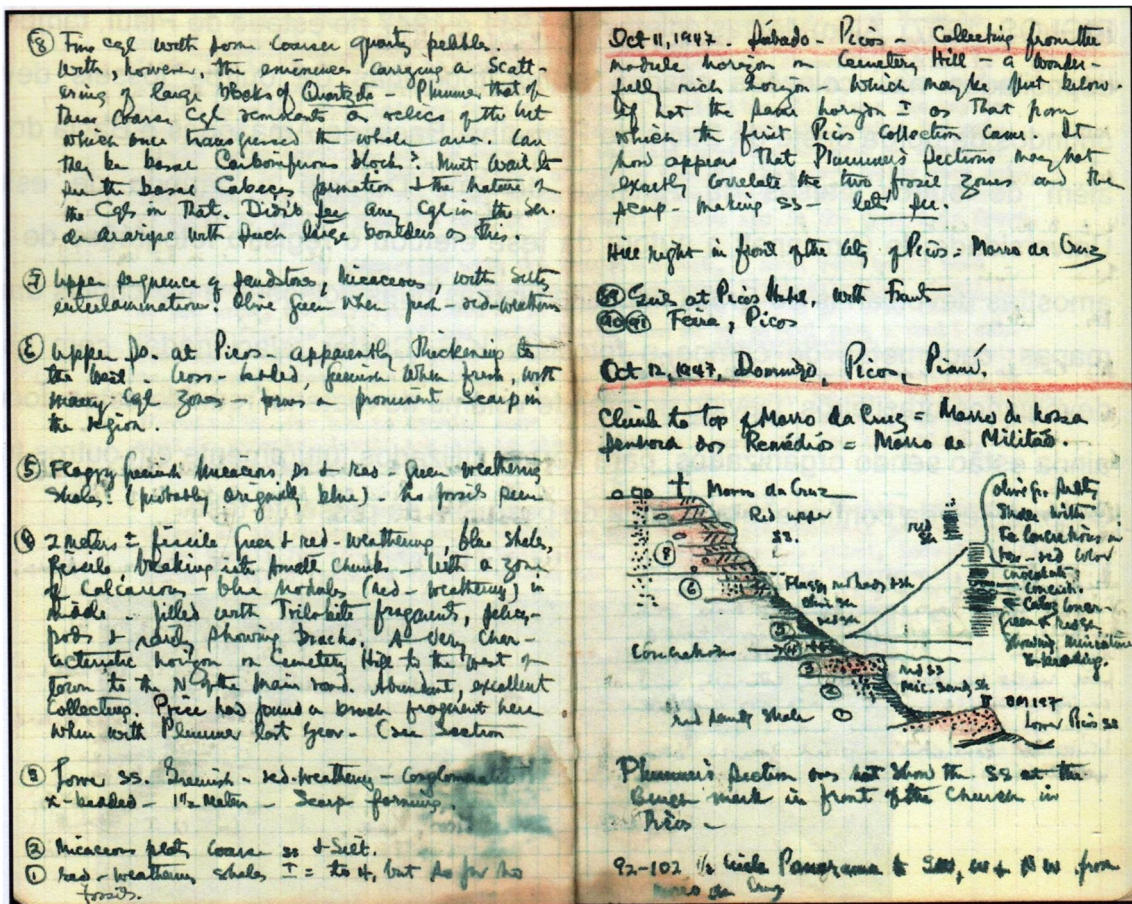


Fig. 5 Field notebook of Kenneth E. Caster with schematic drawing and description of a fossiliferous outcrop (Morro Nossa Senhora dos remédios, Devonian, Pimenteira Formation, State of Piauí, Brazil) (Ponciano 2013)

Kenneth E. Caster selected these Brazilian Devonian fossils for study, and later the National Department of Mineral Production (DNPM) sent the material to the University of Cincinnati. Several difficulties, imposed by bureaucratic issues, resulted in problems during the shipping of these fossils. One aspect well reported in the correspondence is the transference of the collections, which were first sent to the DNPM Geology and Mineralogy Division (Rio de Janeiro), under the care of Llewellyn I. Price, and only later (mid-1949) were shipped to Cincinnati. Kenneth E. Caster planned that the Brazilian fossils he had collected would be sent in duplicate

to the United States National Museum (Washington). These requests, addressed to Brazilian colleagues, occurred at various times and even included return indications to some specific localities for new fossil collections.

The data contained in the correspondence are relevant for the identification of the specimens placed in the collections, and since Paleontology knowledge is based on fossils, the paleontological collections are inseparable from the scientific practices that they have unleashed and from which they are a direct result. Kenneth E. Caster's correspondence with his peers provided descriptions of the outcrops he visited, some



Fig. 6 Present-day condition of the fossiliferous outcrop described by Kenneth E. Caster in 1947 (Morro Nossa Senhora dos remédios, Devonian, Pimenteira Formation, State of Piauí, Brazil) (Ponciano 2013)

Fig. 7 Trilobites from the Devonian, Pimenteira Formation, State of Piauí, Brazil, in the Geier Collections & Research Center (Cincinnati, Ohio) (Ponciano 2013)



explanations about the specimens he collected, and the corresponding research results.

The collection's specimens bear information that finds in conservation and documentation the bases for becoming "sources for scientific research and communication that, in turn, generate and disseminate new information" (Ferrez 1994). Together, the specimens, the associated documentation, and the work that results from them corroborate the relevance of these paleontological collections. According to Ponciano et al. (2011) "documentation systems are as important as the collections themselves, because in them the memory of each specimen is recorded." The collection of fossils and the exchange of specimens with North American universities and museums, identified through the correspondence of Kenneth E. Caster, allowed the disclosure of data on the constitution of these collections and their trajectories.

Through all of the abovementioned, the in-depth knowledge of the correspondence and field notebooks of Kenneth E. Caster is essential to understand the evolution of his paleontological research, contributing to a consideration on the role of this paleontologist in the international scientific community. In addition, the analysis of this correspondence allows us to understand the professional relationships that Kenneth E. Caster established in Brazil, contributing to the Brazilian Paleontological Heritage.

Final Considerations

The analysis of the correspondence and field notebooks of the paleontologist Kenneth E. Caster revealed the historical,

educational, and scientific value of these documents, highlighting the importance of unpublished data, especially in the field of natural sciences, where the study of the scientists' personal files still has a long way to go. As Paleontological Heritage, these documents are as important as other "traditional" geological data (i.e., fossils, fossiliferous sites, etc.).

Kenneth E. Caster's correspondence is a valuable representative of the process of scientific communication, and his documents contributed significantly to researches that are currently being developed in Brazil, besides the History of Paleontology itself. Through the professional relationships he established with his peers, we can appreciate the role Kenneth E. Caster played in the formation of Brazilian paleontological collections, as well as his professional trajectory in the national and worldwide paleontological scene. In general, he established contacts with museums, universities, research institutes, Geological Surveys, Academies of Sciences, and Societies of Paleontology and Geology of almost all countries that present Devonian fossils, establishing a wide network of relationships that contributed to the development of Brazilian Paleontology and its recognition in the field. In this sense, we understand the relevance of scientific communication by providing the "product (scientific production) and producers (researchers) with the necessary visibility and possible credibility in the social environment in which product and producers are inserted" (Targino 2000).

The positive influence of Kenneth E. Caster extends well beyond his physical presence during the 3 years he has lived in the country. The correspondence highlight his distress and

concern for the “future of Paleontology” in Brazil, mixed with energy and optimism for the evolution of this area, only possible thanks to the quality of the people involved, with whom he maintained frequent contact. However, his ability to mobilize those around him in pursuit of the development of Paleontology ended up, for the most part, hindered by financial issues for which USP had no answer. Still, his energy, combined with professional experience and the great network of international relationships, were key elements to implement the abovementioned projects in Brazil, which he considered of great interest for the future of Paleontology and for Brazilian paleontologists.

Being a prestigious and well-accepted geoscientist in both the Brazilian and North American scientific communities, he contributed to the tightening of intellectual exchange between the two countries. He also managed to leave a legacy of scientific production that was recorded through the updating of the geological and paleontological data of the Brazilian territory; the constitution of scientific and educational collections of Brazilian, North American and other South American fossils that were essential for the teaching and research of Paleontology at USP; and the establishment of institutional and personal libraries, due to the remarkable amount of publications he obtained for USP and the University of Cincinnati, for example. At the distance of six decades, the correspondence of Kenneth E. Caster allows us to look, in retrospect, at the timeline of the development of Paleontology in Brazil.

The five approaches (1) Caster’s relationships with Brazil, (2) Caster at USP, (3) development of Brazilian institutions, (4) research in Paleontology and Geology, and (5) the Caster collection, generated by the analysis of these documents, are a clear example of the multiplicity of data that we can extract from the personal archives of geoscientists. In this particular aspect, Kenneth E. Caster’s archives may serve as an alert to Paleontology experts about the potential of unpublished historical documentation. In parallel, it also serves to raise awareness of the role of these specialists in the production of records, contributing to the body of documentary memory of Paleontology in each place and historical moment. To conclude, the unpublished data presented here provide a starting point for a more detailed analysis of each of the five points presented, taking into account the political, economic, and scientific contexts.

Acknowledgments The authors are very grateful to Carlton E. Brett, David L. Mayer, Warren D. Huff, Lewis A. Owen, and Barry J. Maynard (University of Cincinnati/Department of Geology) for allowing the study and scanning of Kenneth E. Caster’s field notebooks and correspondence, and for the donation of Brazilian fossils (“Caster’s Collection”) to the Museu Nacional (Rio de Janeiro). We are also thankful to Brenda Hunda (Cincinnati Museum Center/Geier Collections & Research Center) for allowing the study and loan of Brazilian fossils. The authors appreciate the helpful comments and linguistic revision of the text given by Tim Hobson, Ana Banito, and the two Geoheritage reviewers, which resulted in a much improved manuscript. Funding was provided by FAPERJ (Carlos Chagas Filho Research Support Foundation).

References

- Bosetti EP, Grahn Y, Melo JHG (2011) Essays in honour of Frederico Waldemar Lange, Pioneer of Brazilian Micropaleontology. Interciência, Rio de Janeiro
- Brilha J (2015) Inventory and quantitative assessment of geosites and geodiversity sites: a review. *Geoheritage*. doi:10.1007/s12371-014-0139-3
- Caster KE (1947a) Carboniferous deposits of southern Goiás and Mato Grosso. *Geol Soc America* 58:1171–1172
- Caster KE (1947b) Devonian system in Goiás and Mato Grosso. *Brazil. Geol. Soc. America* 58:1172
- Caster KE, Petri S (1947) Devonian stratigraphy and paleontology of the states of Paraná and São Paulo. *Brazil Geol Soc America* 58:1173
- Caster KE (1947c) Expedição geológica em Goiás e Mato Grosso. *Mineração e Metalurgia* 12:126–127
- Caster KE, Mendes JC (1947) DuToit’s geological comparison of South America with South Africa after twenty years. *Geol Soc America* 58:1173
- Caster KE (1948) Excursão geológica ao Estado do Piauí. *Mineração e Metalurgia* 72:271–274
- Caster KE (1952) Stratigraphic and paleontologic data relevant to the problem of Afro-American ligation during the Paleozoic and Mesozoic. *Am Mus Nat Hist Bull* 99:105–152
- Caster KE (1954a) Brazilian Devonian carroids. *Jour Paleont* 28:511
- Caster KE (1954b) A new carroid echinoderm from the Paraná Devonian. *An Acad Bras Ciênc* 26:123–147
- Caster KE (1954c) Introductory survey of the Brazilian carboniferous. *Bull Amer Paleont* 35(149):1–14
- Caster KE (1955) A Devonian placocystoid echinoderm from Paraná, Brazil. In: Lange FW (ed) *Paleontologia do Paraná*. Curitiba, Brazil, pp 137–148
- Ferrez HD (1994) Documentação museológica: teoria para uma boa prática. In: IPHAN (Cadernos de Ensaio 2). Departamento de Promoção, Rio de Janeiro, pp 65–74
- Luna Filho PE (2007) Peter Whihelm Lund: o auge das suas investigações científicas e a razão para o término das suas pesquisas. Dissertation, University of São Paulo
- Ford D (1965) Devonian fauna in the concretionary Picos Member, Pimenteira Formation (Lower Devonian) Piauí, Brazil. Dissertation, University of Cincinnati
- Lopes MM, Podgorny I (2014) Entre mares e continentes: aspectos da trajetória científica de Hermann von Ihering, 1850–1930. *História, Ciências, Saúde – Manguinhos* 21(3):809–826
- Lourenço M, Wilson L (2013) Scientific heritage: reflections on its nature and new approaches to preservation study and access. *Stud Hist Phil Sci* 44:744–753
- Marchesotti APA (2011) Peter Wilhelm Lund: o naturalista que revelou ao mundo a pré-história brasileira. E-papers Editora, Rio de Janeiro
- Peyerl D, Silva EA, Bosetti EP (2010) O trabalho do paleontólogo Frederico Waldemar Lange (1911–1988) no Museu Paranaense entre 1941 a 1955. *Terræ Didática* 6(1):25–30
- Peyerl D, Bosetti EP, Figueirôa SFM (2012) Frederico Waldemar Lange (1911–1988): trajetória e acervo. In: Silva MCSM, Santos PRE (eds) *Arquivos pessoais: história, preservação e memória da ciência*. Associação dos Arquivistas Brasileiros, Rio de Janeiro, pp 137–150
- Peyerl D (2014) A contribuição do Conselho Nacional do Petróleo e da Petrobras na formação de profissionais para a exploração do petróleo no Brasil. Dissertation, State University of Campinas
- Pojeta J, Pope JK (1975) Studies in paleontology and stratigraphy. *Bulletins of American Paleontology* 67(287):1–13
- Ponciano LCMO, Della Fávera JC (2009) Flood-dominated fluvio-deltaic system: a new depositional model to Cabeças formation, Parnaíba Basin, Piauí. *Brazil An Acad Bras Ciênc* 81:769–780

- Ponciano LCMO, Castro ARSF, Machado DMC et al (2011) Patrimônio Geológico-Paleontológico *in situ* e *ex situ*: Definições, vantagens, desvantagens e estratégias de conservação. In: Carvalho IS et al (eds). *Paleontologia: Cenários de Vida*. Editora Interciência 4:853–869
- Ponciano LCMO, Fonseca VMM, Machado DMC (2012a) Taphofacies analysis of late early Givetian fossil assemblages of the Parnaíba Basin (State of Piauí, northeast Brazil). *Palaeogeography, Palaeoclimatology, Palaeoecology*, v326-328:95-108
- Ponciano LCMO, Castro ARSF, Fonseca VMM et al (2012b) Tafocenoses da Formação Pimenteira, Devoniano da Bacia do Parnaíba, Piauí: Mapeamento, Inventário e Relevância Patrimonial. *Anuário do Instituto de Geociências da UFRJ* 35:5–27
- Ponciano LCMO, Fonseca VMM, Fernandes ACS et al (2013) Afloramento Fossilífero de Oiti, Bacia do Parnaíba, PI—Registro de um mar devoniano no Nordeste do Brasil. In: Winge M, Schobbenhaus C, Souza CRG et al (eds). *Sítios Geológicos e Paleontológicos do Brasil*, 191–200
- Ponciano LCMO (2013) Tafocenoses Mesodevonianas da Bacia do Parnaíba no Estado do Piauí: Análise Tafonômica, Paleoambiental e Patrimonial. Dissertation, Federal University of the State of Rio de Janeiro
- Suárez-Riglos M (1967) Some Devonian fossils from the State of Piauí, Brazil. Dissertation, University of Cincinnati
- Targino MG (2000) Comunicação Científica: uma revisão de seus elementos básicos. *Inf Soc Est* 10(2):37–85