fossil studies

MDPI

Editorial

Continuities and Discontinuities of the Fossil Record

Silvério Figueiredo [1,*] and Eric Buffetaut [2]

[1] Universidade Politécnica de Tomar, Quinta do Contador, Estrada da Serra, 2300-313 Tomar, Portugal
[2] Paléospace, 5 Avenue Jean Moulin, 14640 Villers-sur-Mer, France; eric.buffetaut@sfr.fr
* Correspondence: silverio.figueiredo@ipt.pt

The fossil record is simultaneously a testimony of persistence and transformation. Throughout Earth's history, continuity and discontinuity have shaped the evolution of life, the structure of ecosystems, and the geological archives through which we reconstruct the past. Gradual evolutionary trends coexist with abrupt extinctions, environmental crises, and major transitions that punctuate the history of the biosphere. Understanding these processes is fundamental not only for paleontology and geology, but also for reflecting on present-day biodiversity challenges and the future trajectory of life on Earth.

This Special Issue emerges from the International Meeting Continuities and Discontinuities of the Fossil Record, held in April 2024, at Estoril, near Lisbon. The meeting was organized by the Centro Português de Geo-História e Pré-História. It brought together researchers from different scientific fields and countries to discuss the multiple dimensions of continuity and rupture in the fossil, stratigraphic, paleoecological, archeological, and cultural records. By promoting interdisciplinary dialogue, the meeting highlighted how the concept of continuity/discontinuity transcends traditional disciplinary boundaries and contributes to a broader understanding of planetary change.

The 2024 meeting also continued a long-standing scientific tradition initiated nearly three decades earlier. Its roots can be traced back to a seminar organized in 1996 by the Centro Português de Geo-História e Pré-História at Universidade Lusíada of Lisbon, dedicated to the same thematic framework. That pioneering initiative was followed by two additional editions, establishing an important forum for discussion on evolutionary processes, stratigraphic records, paleoenvironmental transformations, and human–environment interactions. The present meeting therefore represents both a continuation of this intellectual legacy and a renewed attempt to address these themes considering contemporary scientific challenges.

The scientific programme reflected the diversity and complexity of the topic. The opening lecture by David H. Grinspoon explored "Cognitive Planetary Transitions" from an astrobiological perspective, proposing reflections on the "Sapiezoic Eon" and humanity's role as a planetary agent. This broad perspective framed many of the discussions that followed, particularly those related to environmental change, biodiversity loss, and the Anthropocene.

Several contributions focused on discontinuities in the evolutionary record, including extinctions and faunal turnovers. Studies ranged from the discontinuous European fossil record of Abelisauridae and the remarkable evolutionary history of Nanhsiungchelys, to analyses of dinosaur ichnology in the Cretaceous formations of Cabo Espichel. Other papers examined continuity through surviving lineages and long-term ecological resilience, emphasizing how some biological groups persisted through multiple environmental crises.

The meeting also highlighted methodological innovations and interdisciplinary approaches. Contributions included the application of magnetic methods to Quaternary

Check for updates

Received: 23 August 2026
Accepted: 27 August 2026
Published: 3 September 2026

Copyright: © 2026 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license.

formations in Algeria, Geographic Information Systems for predictive fossil prospecting in Lourinhã, stable isotope analyses of sediments, and combined paleontological and DNA approaches to Pleistocene and Holocene Ursidae from North Africa. These studies demonstrate how technological developments continue to refine our interpretation of the geological and paleontological record.

Another important dimension of the meeting concerned the relationship between past and present. Sessions dedicated to environment, ecology, and biodiversity emphasized that continuity and discontinuity are not restricted to ancient geological timescales. Modern environmental transformations, anthropogenic pressures, and biodiversity decline may represent indicators of a new global discontinuity. Discussions on human evolution, archeology, rock art, heritage, tourism, and science communication further reinforced the importance of integrating scientific knowledge with cultural and educational perspectives.

The program additionally addressed stratigraphic continuity and rupture through studies of allostratigraphic units, marine terraces, and unexpected fossil occurrences in younger deposits. These contributions remind us that the geological record is inherently incomplete and selective, shaped by processes of preservation, erosion, tectonics, and interpretation. Discontinuity, therefore, is not merely an absence of data, but often a meaningful signal of dynamic Earth processes.

As *Fossil Studies* is a journal specifically dedicated to paleontology, only the paleontological contributions presented during the meeting were selected for inclusion in this Special Issue. These papers were further complemented by additional contributions within the broader field of paleontology and fossil studies, thereby reinforcing the thematic scope of the Special Issue. The diversity of themes and approaches represented in this Special Issue illustrates the richness of paleontological and geo-historical research. Although the meeting itself embraced a wider interdisciplinary perspective, ranging from astrobiology and stratigraphy to heritage dissemination and environmental studies, the present Special Issue focuses primarily on research addressing the fossil record, paleobiology, paleoecology, vertebrate paleontology, ichnology, and related subjects within paleontological sciences.

At a time when humanity faces accelerating environmental change, climate instability, and biodiversity loss, the study of continuities and discontinuities in the fossil record acquires renewed relevance. The fossil record not only documents past crises and recoveries but also provides a long-term framework for interpreting the present and anticipating possible futures. The lessons preserved in geological and biological archives remind us that life on Earth has always been dynamic, resilient, and vulnerable. We hope that this Special Issue will contribute to ongoing scientific discussions and encourage new interdisciplinary collaborations. Above all, it stands as a continuation of a scientific dialogue—initiated decades ago and renewed through the collective efforts of researchers dedicated to understanding the complexity of life's history on our planet.

While some of the papers included in the present Special Issue were initially presented at the 2024 Estoril meeting on Continuities and Discontinuities of the Fossil Record, others were submitted independently. Taken together, they illustrate some of the many aspects of this vast question through a large part of geological time.

Zhiwei Yuan, Lionel Cavin and Haijun Song review the patchy fossil record of coelacanths, a group that has become famous for the "living fossil" status of its living representatives—a fact that in itself highlights the incompleteness of its fossil record.

Michael Gottfried's paper on an Early Cretaceous specimen of the coelacanth Axelrodichthys from Niger illustrates how new discoveries can bridge geographical and chronological gaps in a notoriously incomplete fossil record.

Silvério Figueiredo describes new theropod dinosaur tracks from the Early Cretaceous of Portugal which illustrate the importance of ichnofossils for the reconstruction of the fossil

record of some vertebrate groups, notably by suggesting changes in faunal composition through time.

Chungxiang Li, Ya Li and Junye Ma describe pinnule fossils of an extant South American tree fern from the mid-Cretaceous Myanmar amber, thus showing how the fossil record of extant organisms can reveal unexpected geographical distributions in the past.

Eric Buffetaut reviews the scanty record of dinosaurs from the Cretaceous of Normandy in north-western France, which consists of specimens from marine deposits, illustrating a highly discontinuous record resulting from relatively exceptional preservation in an unusual depositional environment.

Haiyan Tong, Lu Li, Yuzheng Ke and Yanyin Wang describe the fossil record of nanhsiungchelyid turtles in the Nanxiong basin of southern China, suggesting that this family became extinct close to the Cretaceous–Paleogene boundary.

Kostantis Laskos, Georgios Lazaridis, Evangelia Tsoukala, Evangelos Vlachos and Dimitris Kostopoulos report the occurrence of the giraffid *Bramatherium* from the Late Miocene of Greece, a record that has important palaeogeographical and systematic implications for giraffid evolution.

Carlos Neto de Carvalho, Miguel Barroso and Sofia Soares describe a very unusual record of an ammonite gypsum cast in Upper Pliocene river deposits in Portugal, illustrating a highly uncommon taphonomic history.

Juan Yataco, Karina Vanesa Chichkoyan, Hugo Gabriel Nami, Nicole R. Fuller and Jane Wheeler reassess the Late Pleistocene and Early Holocene vertebrate fossil record from Pikimachay Cave in Perú in order to better understand the chronological and taphonomic history of the deposits and their implications for human occupation of the cave.

Conflicts of Interest: The authors declare no conflict of interest.

List of Contributions:

1. Gottfried, M.D. An Early Cretaceous Record of the Mawsoniid Coelacanth Axelrodichthys from Niger. *Foss. Stud*. **2025**, *3*, 16. https://doi.org/10.3390/fossils3040016.
2. Li, C.; Li, Y.; Ma, J. First Fertile Pinnule Fossils of the Extant Southern American Tree Fern Genus Loxsomopsis (Loxomataceae) in Mid-Cretaceous Myanmar Amber. *Foss. Stud.* **2026**, *4*, 8. https://doi.org/10.3390/fossils4020008.
3. Yuan, Z.; Cavin, L.; Song, H. On the Incompleteness of the Coelacanth Fossil Record. *Foss. Stud.* **2025**, *3*, 10. https://doi.org/10.3390/fossils3030010.
4. Buffetaut, E. The Cretaceous Dinosaur Record from Normandy (NW France): A Review. *Foss. Stud*. **2026**, *4*, 5. https://doi.org/10.3390/fossils4010005.
5. de Carvalho, C.N.; Barroso, M.; Soares, S. An Ammonite Preserved in the Upper Pliocene Lower Tejo River Deposits of Quinta Do Conde (Southwest Portugal). *Foss. Stud.* **2025**, *3*, 8. https://doi.org/10.3390/fossils3020008.
6. Laskos, K.; Lazaridis, G.; Tsoukala, E.; Vlachos, E.; Kostopoulos, D.S. First Record of *Bramatherium* Falconer, 1845 (Mammalia: Giraffidae) from the Late Miocene of Greece and the *Helladotherium-Bramatherium* Debate. *Foss. Stud.* **2025**, *3*, 17. https://doi.org/10.3390/fossils3040017.
7. Figueiredo, S.D. Dinosaur Tracks of the Areia do Mastro and Papo-Seco Formations (Lower Cretaceous, Cabo Espichel): Paleobiological and Paleoenvironmental Continuities and Discontinuities. *Foss. Stud*. **2025**, *3*, 18. https://doi.org/10.3390/fossils3040018.
8. Tong, H.; Li, L.; Ke, Y.; Wang, Y. Nanhsiungchelyid Turtles from the Nanxiong Basin, Southern China, and the Cretaceous–Paleogene Mass Extinction. *Foss. Stud*. **2026**, *4*, 6. https://doi.org/10.3390/fossils4010006.
9. Yataco, J.; Chichkoyan, K.V.; Nami, H.G.; Fuller, N.R.; Wheeler, J. Late Pleistocene Fauna of Pikimachay Cave, Ayacucho Basin, Perú: New Insights from Fossil Remains. *Foss. Stud.* **2026**, *4*, 7. https://doi.org/10.3390/fossils4010007.

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.