



HAL
open science

Editorial: Horizons in Earth science 2022

Derek Keir, Bruce S Lieberman, Valerio Acocella, Wouter Buytaert, Steven L Forman, Michel Grégoire, Kenneth P Kodama, David R Lentz, Carmen Sanchez-Valle

► **To cite this version:**

Derek Keir, Bruce S Lieberman, Valerio Acocella, Wouter Buytaert, Steven L Forman, et al.. Editorial: Horizons in Earth science 2022. *Frontiers in Earth Science*, 2023, 11, pp.1321937. <10.3389/feart.2023.1321937>. <hal-04935464>

HAL Id: hal-04935464

<https://hal.science/hal-04935464v1>

Submitted on 7 Feb 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY 4.0 - Attribution - International License



OPEN ACCESS

EDITED AND REVIEWED BY

Georg Rumpker,
Goethe University Frankfurt, Germany

*CORRESPONDENCE

Derek Keir,
✉ d.keir@soton.ac.uk

RECEIVED 15 October 2023

ACCEPTED 30 October 2023

PUBLISHED 09 November 2023

CITATION

Keir D, Lieberman BS, Acocella V, Buytaert W, Forman SL, Grégoire M, Kodama KP, Lentz DR and Sanchez-Valle C (2023), Editorial: Horizons in Earth science 2022. *Front. Earth Sci.* 11:1321937. doi: 10.3389/feart.2023.1321937

COPYRIGHT

© 2023 Keir, Lieberman, Acocella, Buytaert, Forman, Grégoire, Kodama, Lentz and Sanchez-Valle. This is an open-access article distributed under the terms of the [Creative Commons Attribution License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or reproduction in other forums is permitted, provided the original author(s) and the copyright owner(s) are credited and that the original publication in this journal is cited, in accordance with accepted academic practice. No use, distribution or reproduction is permitted which does not comply with these terms.

Editorial: Horizons in Earth science 2022

Derek Keir^{1,2*}, Bruce S. Lieberman³, Valerio Acocella⁴, Wouter Buytaert⁵, Steven L. Forman⁶, Michel Grégoire⁷, Kenneth P. Kodama⁸, David R. Lentz⁹ and Carmen Sanchez-Valle¹⁰

¹School of Ocean and Earth Science, University of Southampton, Southampton, United Kingdom, ²Dipartimento di Scienze della Terra, Università degli studi Firenze, Florence, Italy, ³Department of Ecology and Evolutionary Biology, Biodiversity Institute, University of Kansas, Lawrence, KS, United States, ⁴Dipartimento di Scienze, Università Degli Studi Roma Tre, Roma, Italy, ⁵Department of Civil and Environmental Engineering, Imperial College London, London, United Kingdom, ⁶Department of Geosciences, Baylor University, Waco, TX, United States, ⁷Geosciences Environnement Toulouse, CNRS-CNES-IRD-UPS, Toulouse, France, ⁸Department of Earth and Environmental Sciences, Lehigh University, Bethlehem, PA, United States, ⁹Department of Earth Science, University of New Brunswick, Fredericton, NB, Canada, ¹⁰Institut für Mineralogie, Universität Münster, Münster, Germany

KEYWORDS

Earth, life, evolution, climate, atmosphere, environment

Editorial on the Research Topic Horizons in Earth science 2022

Earth science in the 21st century is becoming ever more relevant to societal development since it focuses on understanding the processes shaping the planet on which we live. Earth processes are complex, ever changing and include interactions between the oceans, atmosphere, solid Earth and life. Earth science is therefore central to addressing key challenges such as understanding the evolution of life on Earth, identifying and modeling the key interactions that control Earth's climate, and for developing strategies to mitigate against human-induced modification of the natural environment. To help bring the state-of-the-art science to the wider community in an open access Research Topic format, the team of Specialty Chief Editors at Frontiers in Earth Science are delighted to present the inaugural “*Horizons in Earth Science 2022*” article Research Topic. This Research Topic showcases high-impact, authoritative and reader-friendly review articles covering the most topical research at the forefront of the Earth sciences.

With the current rapid rate of global warming, a better understanding of interactions between the major components of the global climate system and how these potentially will change in the future is important. The paper by [Ma and Chen](#) reviews the recent advances in understanding the interactions between the East Asian winter monsoon (EAWM) and the periodic changes in sea-surface temperatures across the east-central equatorial Pacific (known as the El Niño-Southern Oscillation (ENSO)). The relationship between these systems is complex with a warm ENSO phase (i.e., El Niño) winter generally coinciding with a weaker-than-normal EAWM, but with no simple relationship observed during the cool ENSO phases (La Niña) ([Geng et al., 2018](#)). Interaction between the EAWM and ENSO with other major climate systems is likely required to better understand EAWM-ENSO relationships.

Two key research areas currently generating much excitement and interest both within and beyond the field of invertebrate paleontology are skillfully presented in the Research

Topic. In particular, two of those articles, by [Cong](#) and [Potin and Daley](#) respectively, explore in detail some of the fascinating Cambrian animals discovered, as well as consider their implications for understanding the nature of the Cambrian radiation interval from an evolutionary and ecological perspective. Indeed, research into the Cambrian radiation is not just a Research Topic of current interest to the field, but rather has been long standing and fundamental. The Research Topic was brought to the forefront of the field in the modern era by [Gould \(1989\)](#), who amplified the discoveries and documentation presented in [Whittington \(1985\)](#) on the Burgess Shale. [Whittington \(1985\)](#) had in turn described work given in numerous other publications by other authors too numerous to mention, but including especially the extensive work of Derek Briggs, Richard Fortey, and Simon Conway Morris (see roughly contemporaneous high profile accounts of these provided in [Briggs and Fortey, 1989](#); [Morris, 1989](#)). Closely paralleling and following these in time were the phenomenal discoveries on the Chengjiang Biota, and other Cambrian soft-bodied deposits distributed throughout the world.

One key part of research into Cambrian life involves uncovering and describing new taxa, as well as establishing their phylogenetic affinities. Better documenting the animals of the Cambrian radiation, and subjecting these to phylogenetic and other types of analyses, makes it possible to evaluate hypotheses about the nature of evolutionary patterns and processes during the initial proliferation of bilaterian animals in the fossil record. Is there anything special about evolutionary processes during this time, including in terms of greater rapidity of speciation or greater morphological flexibility ([Lieberman, 2003](#))? Without good knowledge of these fossils, their morphologies, and their evolutionary relationships, such a question is impossible to answer.

[Potin and Daley](#) expertly take us on a fascinating deep dive into arguably the most spectacular and distinctive of the animals spawned during the Cambrian radiation: the anomalocaridids, and more broadly, the Radiodonta. These animals, some massive by Cambrian standards, include predators and several other ecological types, and are skillfully discussed and evaluated by the authors. Daley is a world renown expert on the group, and she, along with Potin, illustrates a variety of beautiful specimens, and synthesizes anatomical, phylogenetic, ecological, and biogeographic information on Cambrian and later representatives to produce a truly integrative publication.

[Cong](#) focuses on the discoveries of the Chengjiang biota of China, which have dramatically expanded knowledge beyond what was first uncovered in the Burgess Shale. Cong is an internationally recognized expert on the study of the Chengjiang. With his contribution he skillfully interlays specimens with cladograms, and pays special attention to some of the key problematic fossils from the Chengjiang. He also evaluates potential homologies that connect these, often uncertainly, to known phyla, all in the context of information from anatomy and taphonomy. The problematic fossils considered are some of the most puzzling, yet also fascinating, and this paper brings a very useful and insightful perspective as to how to treat and interpret these. Importantly, even as our knowledge of the life of this time interval continues to grow, certain fundamental questions remain.

Just as paleontology has focused for quite some time on some of the early events in animal evolution, a highly dynamic and growing new area of research has emerged. This research centers on how we can better understand what is happening to life forms today, specifically, the prodigious die off of species referred to as the Biodiversity Crisis, by looking at the fossil record. Indeed, elucidating extinction may have been paleontology's first fundamental contribution to evolutionary theory, and now the analysis and understanding of extinction in the fossil record is given added meaning through the sub-discipline of conservation paleobiology. This Research Topic is skillfully outlined and illuminated in [Walker](#), who is also one of the internationally recognized experts in the field. She usefully applies understanding of conservation of the modern biota to conservation paleobiology. This synthetic perspective includes a highly relevant timeline on the biotic effects of our own species, and some of our close relatives, while laying out a detailed framework for better placing the study of the present in the context of the past: notably upending and inverting the outdated Uniformitarian perspective. This valuable approach will help provide the context for developing predictive approaches for future species survival, using the lens of the past ([Strotz et al., 2018](#)).

Author contributions

DK: Writing—original draft, Writing—review and editing. BL: Writing—original draft, Writing—review and editing. VA: Conceptualization, Writing—review and editing. WB: Writing—review and editing. SF: Writing—review and editing. MG: Writing—review and editing. KK: Writing—review and editing. DL: Writing—review and editing. CS-V: Writing—review and editing.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. The Research Topic Editorial activities of DK were supported in part by the Ministero dell'Università e della Ricerca (MiUR) through PRIN grant 2017P9AT72.

Acknowledgments

We thank the authors for their contributions, and the reviewers and editorial staff for their efforts to pull together this article Research Topic. We also thank the Editorial Office of Frontiers in Earth Science for the kind invitation to create and edit this Research Topic.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated

organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

- Briggs, D. E. G., and Fortey, R. A. (1989). The early radiation and relationships of the major arthropod groups. *Science* 246, 241–243. doi:10.1126/science.246.4927.241
- Geng, X., Zhang, W., Jin, F.-F., and Stuecker, M. F. (2018). A new method for interpreting nonstationary running correlations and its application to the ENSO-EAWM relationship. *Geophys. Res. Lett.* 45, 327–334. doi:10.1002/2017GL076564
- Gould, S. J. (1989). *Wonderful life: the Burgess Shale and the nature of history*. New York, NY: W. W. Norton.
- Lieberman, B. S. (2003). Taking the pulse of the Cambrian radiation. *J. Integr. Comp. Biol.* 43, 229–237. doi:10.1093/icb/43.1.229
- Morris, S. C. (1989). Burgess Shale faunas and the Cambrian explosion. *Science* 246, 339–346. doi:10.1126/science.246.4928.339
- Strotz, L. C., Saupe, E. E., Kimmig, J., and Lieberman, B. S. (2018). Metabolic rates, climate and macroevolution: a case study using Neogene molluscs. *Proc. R. Soc. Ser. B* 285, 1–6. 20181292. doi:10.1098/rspb.2018.1292
- Whittington, H. B. (1985). *The Burgess Shale*. New Haven, CT: Yale University Press.