



Editorial preface to special issue: From rock to time: evolutionary lineages and the calibration of the Chronostratigraphic Scale

Annalisa Ferretti^{a,*}, Marco Balini^b, David A.T. Harper^c, Thomas Servais^d

^a Department of Chemical and Geological Sciences, University of Modena and Reggio Emilia, I-41125 Modena, Italy

^b Department of Earth Sciences "Ardito Desio", University of Milano, I-20133 Milano, Italy

^c Department of Earth Sciences, Durham University, Durham DH1 3LE, UK

^d CNRS, University of Lille, UMR 8198 Evo-Eco-Paleo, F-59000 Lille, France

ARTICLE INFO

Editor: Howard Falcon-Lang

Keywords:

Stratigraphy

Multiproxy approach

Correlation

International Chronostratigraphic Chart

ABSTRACT

The International Chronostratigraphic Chart has been under consideration and construction for more than two hundred years. The integration of multidisciplinary, high-resolution studies, and the correlation of pervasive and recognizable markers, have helped develop and continuously update the chart providing a standardized and global language for stratigraphers. STRATI (International Congress on Stratigraphy) is the main scientific meeting of the International Commission on Stratigraphy (ICS) that takes place every four years and is dedicated to all topics associated with improving and updating chronostratigraphy and geochronology. We note that stratigraphical studies are undertaken by specialists who, primarily, focus on specific Phanerozoic systems, rarely venturing beyond the confines of their adopted time slice. Acknowledging this potential weakness, STRATI attempts to remove the intellectual and geological boundaries (disciplinary, taxonomic and temporal), and engage the wider community to define, discuss, combine and compare the potential and role of stratigraphy today in fine tuning the International Chronostratigraphic Chart, especially its correlation and geochronometry. In this Virtual Special Issue (VSI), we present some of the findings of STRATI2023 held in Lille, France (July 11st-13rd 2023) and attended by 285 participants from over 40 countries. Our intention is to collect the most significant contributions arising from this meeting, complemented by specific research articles in order to guarantee a full coverage of the fields of stratigraphy. We demonstrate that refined applied stratigraphy is now approached through a multiproxy perspective, as highlighted in most studies captured here. The VSI goes further by reexamining fundamental concepts in stratigraphy together with the definition of marine bioevents and the role of vertebrates in biostratigraphy. More broadly, the VSI addresses a range of current topics within stratigraphy to highlight the essential role of modern stratigraphical practice as a prerequisite for all future research in palaeogeography, palaeoclimatology and palaeoecology.

1. Introduction

Modern stratigraphy combines litho-, bio-, chemo-, astro-, magneto- and event stratigraphy. The selected contributions collected in this Virtual Special Issue (VSI) entitled *From rock to time: evolutionary lineages and the calibration of the Chronostratigraphic Scale* include innovative approaches to the stratigraphical challenges of the XXI century and integrate research studies with global reviews on specific topics, in order to provide a comprehensive coverage of the applications that stratigraphy may offer today to the Earth Sciences (Table 1).

Ferretti et al. (2026, this VSI) trace the evolution of geological time concepts. In the late 18th and 19th centuries, geologists recognized

Earth's vast antiquity and organized strata into a global succession using observable breaks and lithologic traits. Fossils, especially the first and last appearances of fossil taxa, underpinned biozonation and fuelled debates between catastrophism and uniformitarianism. The introduction of radioisotopic dating then anchored periods, epochs, and ages to numerical dates. Subsequent use of chemical proxies, magnetic reversal records, and orbital cycles sharpened correlations. Today, stratigraphers combine all these tools to build a finely resolved, global Phanerozoic time scale.

* Corresponding author.

E-mail address: annalisa.ferretti@unimore.it (A. Ferretti).

<https://doi.org/10.1016/j.palaeo.2025.113456>

Received 23 November 2025; Accepted 23 November 2025

Available online 24 November 2025

0031-0182/© 2025 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

2. Content

Among the articles presented in this VSI, biostratigraphic signals provided by some major fossil proxies (acritarchs, calcareous nanofossils, chitinozoans and conodonts) are recorded in the diverse temporal frames of the Phanerozoic and cross calibrated mostly with magnetostratigraphy and chemostratigraphy.

Middle Ordovician Baltica hosts exceptionally diverse, well-preserved lower Palaeozoic acritarchs. Since the 1960s, its taxa have underpinned regional and global biostratigraphy. Calero Gordon et al. (2025, this VSI) studied two Darriwilian Öland sections, revealing gradual shifts in acritarch process length and morphotype abundance that parallel a deep-to-shallow water transition. These findings imply that apparent biostratigraphic signals may instead reflect ecophenotypic adaptation, highlighting the need for a palaeoecological context in stratigraphical correlations.

Erba et al. (2026, this VSI) have introduced an updated calcareous nanofossil biozonation for Cretaceous marine deposits spanning low to mid palaeolatitudes. Drawing on new datasets and a thorough reassessment of the literature, the revised scheme refines 27 CNC (Calcareous Nanofossils Cretaceous) zones from the Berriasian to Maastrichtian stages. It builds on the frameworks of Bralower et al. (1995) and Sissingh (1977), incorporating magneto- and chemostratigraphic calibration. The enhanced resolution strengthens biostratigraphic precision for major palaeoceanographic events and advances global stratigraphical correlation for the Cretaceous System.

The middle Silurian (Homerian) Mulde Biogeochemical Event boasts one of the most precise Palaeozoic chronologies. Benthic and pelagic turnovers align with a double-peaked positive $\delta^{13}\text{C}_{\text{carb}}$ excursion. Five U/Pb dates constrain the first peak (up to +5.5‰) to a few hundred

thousand years. Integrating these ages with intercontinental chronostratigraphic correlations separates local from global drivers. Klock et al. (2025, this VSI) present new bio- and chemostratigraphic data from the USA's Midcontinent Basin across the onset of the event, refining its timing and tying it to Gotland's internationally-important reference sections.

Conodonts are key to Carboniferous biostratigraphy and studies of the late Palaeozoic Ice Age. The globally widespread genus *Gnathodus* is pivotal for Mississippian zonation, yet incomplete P1-element data and complex morphologies have limited its precision. Wang W. et al. (2025, this VSI) scored 48 P1 traits across 34 *Gnathodus* and two *Protognathodus* taxa, resolving two clades: one rooted in *G. praebilineatus* with intricate rostral nodes, the other in *G. semiglaber* bearing a rostral parapet. Statistical Dispersal–Vicariance Analysis points to the eastern Rheic Ocean as the primary cradle of speciation, with currents steering rapid dispersal. This robust phylogeny forms the basis for a refined, high-resolution Mississippian *Gnathodus* zonation.

Bio-events or events of varying scale (e.g., local turnovers, global mass extinctions, Large Igneous Province activity) occurring at irregular intervals are herein used to integrate varied aspects of litho-, bio-, chemo- and sequence stratigraphy, in order to explain the apparent existence of “long-boring” intervals and more “exciting” volatile times.

Brett and Zambito (2026, this VSI) have redefined marine bioevents, which range from 5th-order events of elevated extinction/diversification of many genera and families to 1st-order global biocrises (“Big Five”). The timing of major global bioevents is highly irregular and non-cyclic, with numerous closely spaced events occurring during the early to middle Palaeozoic, the Late Permian-Triassic, and the Cretaceous. Most major extinction events are associated with global warming, elevated sea levels, widespread oceanic hypoxia, and shifts in $\delta^{13}\text{C}$ values from

Table 1

The list of 19 studies comprising this Virtual Special Issue "From rock to time: evolutionary lineages and the calibration of the Chronostratigraphic Scale" highlighting the main topic, the time interval investigated, and the major findings.

Papers	Topic	Time interval	Key results
Ferretti et al. (2026)	Evolution of geological time concepts	Phanerozoic	A review of the history and current concepts of stratigraphical procedures
Calero Gordon et al. (2025)	Ecophenotypic variations in acritarchs	Ordovician	Some morphological changes in acritarch morphotypes do not reflect biostratigraphy but ecological changes
Erba et al. (2026)	Nanofossil biozonation	Cretaceous	An updated calcareous nanofossil biozonation is presented for the Cretaceous, from the Berriasian to the Maastrichtian
Klock et al. (2025)	The Mulde Event	Silurian	New bio- and chemostratigraphic data from the USA's Midcontinent Basin refine the timing and correlation of the Mulde Event
Wang W. et al. (2025)	High-resolution conodont zonation	Carboniferous	A new robust phylogeny allows refined, high-resolution Mississippian <i>Gnathodus</i> biozonation
Brett and Zambito (2026)	Redefinition of marine bioevents	Palaeozoic-Mesozoic	Marine bioevents range from 5 th -order events of elevated extinction/diversification of many genera and families to 1 st -order global biocrises (“Big Five”)
Corradini et al. (2024)	Lochkovian-Pragian Event	Devonian	Description of the Lochkovian-Pragian Event from fourteen sections of the Carnic Alps
Liao and Valenzuela-Ríos (2026)	Conodont biodiversity	Devonian	The Givetian sections of the Spanish Pyrenees reveal periodic diversity changes in the Upper Devonian
Wang Y. et al. (2025)	Upper Palaeozoic glacio-eustatic cycles	Carboniferous	Slope carbonates from South China display a fragmented stratigraphical record during the late Palaeozoic Ice Age
Lucas (2025)	Vertebrate biochronology	Palaeozoic-Mesozoic	A focus on the potential of vertebrate fossils for biostratigraphy
Frýda and Frýdová (2025)	Mulde and <i>lundgreni</i> biotic crises	Silurian	Application of high-resolution trace-metal geochemistry to graptolite-rich shales in the Kosov section (Czech Republic)
Rigo et al. (2024)	end-Triassic extinction geochemistry	Triassic/Jurassic	Continuous geochemical data from a profile from Sicily's Mt. Sparagio subtidal carbonate platform match with biotic turnovers
Tekin et al. (2024)	Carnian Pluvial Event	Triassic	Biochronology ties peak volcanism to the onset of the Carnian Pluvial Event
Abdullahi et al. (2025)	early Eocene Climate Optimum	Eocene	Documentation of the first detailed analysis of the influence of Milankovitch cyclicity on Eocene marine records on the Arabian Plate
Hilgen (2025)	Cenozoic Astronomical Time Scale	Miocene	A refined astrochronology is achieved after tuning core images and gamma-ray attenuation data from the Lower-Middle Miocene
Kuiper et al. (2026)	K/Pg boundary age calibration	Cretaceous/Paleogene	A focus on a re-evaluation of the astronomical tuning of the Fish Canyon sanidine (FCs)
Spiering et al. (2026)	BTB13 (Baringo–Tugen Hills, Kenya) stratigraphy	Pliocene-Pleistocene	Bayesian chronology, magnetostratigraphy, isotope geochemistry, and astrochronologic tuning refine the chronology of the BTB13
Chu et al. (2025)	Quantitative stratigraphy with computational methods	no specific interval	Introduction of HORSE, an optimized method of Horizon Annealing (HA) with parallel computing and genetic algorithms for rapid, large-scale correlation
Lu et al. (2025)	Constrained Optimization (CONOP)	Eocene-Oligocene	Presentation of a high-resolution magneto-foraminiferan time scale by applying CONOP across 11 reference sections

negative to rising trends. Mass radiation and diversification events are predominantly concentrated in the early to middle Palaeozoic Era and exhibit variable correlations with physical environmental changes.

The Lochkovian-Pragian Event witnessed sea levels fall then rise, triggering minor marine extinctions, reduced carbonate production, and sediment shifts. [Corradini et al. \(2024, this VSI\)](#) analyse fourteen Carnic Alps sections across shallow to deep-water settings showing shallow erosion surfaces with megaclasts, mid-depth unconformities erasing intervals, and diachronous deep-basin formation boundaries with scarce fossils, complicating correlation and dating. Larger hiatuses in western, shallow-water areas highlight the Lochkovian sea-level fall and subsequent Pragian transgression. Comparisons across North Gondwana confirm the global significance of this event.

[Liao and Valenzuela-Ríos \(2026, this VSI\)](#) investigate conodont diversity and evolution in the Givetian of the Spanish Pyrenees, highlighting responses to global Devonian palaeoenvironmental events. Diversity peaked in the *ansatus* Zone, with a high evolutionary turnover, then declined into the *latifossatus* Zone. Origination generally exceeded extinction until that point. Major faunal shifts align with the Taghanic and Genesio events, while others had limited regional impacts. The Upper *pumilio* and Frasnian events stimulated diversifications. These results reveal periodic biodiversity changes shaped by both global and regional factors.

During the late Palaeozoic Ice Age, repeated glacio-eustatic cycles fragmented the stratigraphical record while extreme climate swings drove the late Desmoinesian extinction, a surge in *Idiognathodus* diversity, and the collapse of Carboniferous rainforests. [Wang Y. et al. \(2025, this VSI\)](#) examined slope carbonates from South China, spanning conodont zones from upper Moscovian through Gzhelian and including Sr, O and $\delta^{13}\text{C}$ isotope data, and identified successive intervals in the late Moscovian–early Kasimovian: an initial turnover of rainforest biomes; the Desmoinesian extinction accompanied by a burst of *Idiognathodus* radiation; and a 4–6 °C warming event that intensified arid conditions. Trends in strontium and oxygen isotopes further indicate that fluctuations in continental weathering played a pivotal role in driving conodont turnover.

The potential of fossil vertebrates to anchor the geological timescale is explored in the Special Issue.

Since Cuvier, vertebrate fossils have dated and correlated strata. North American land-mammal age, determined by a committee (NALMAs: 1941) launched vertebrate biochronology, spawning land-vertebrate ages and faunachrons. Palaeozoic ichthyoliths aided marine biostratigraphy, while Middle Permian–Triassic tetrapod assemblages enabled broad correlations despite Jurassic provincialism. Cretaceous Western Interior tetrapods refined local scales. Cenozoic mammalian biochronology divides epochs into 1–3 Myr intervals, often out-resolving global chronostratigraphy. [Lucas \(2025, this VSI\)](#) urges expanding vertebrate biochronology across all clades and enhancing stratigraphical data on fossil distributions, offering recommendations for future research.

High-resolution chemostratigraphic records and major excursions in diverse windows of the Phanerozoic are reviewed and tested for trans-regional stratigraphical correlation.

During the Silurian, repeated extinction pulses, carbon-cycle disruptions, and major climatic shifts punctuated Earth's marine environments. The Homerian double-peaked $\delta^{13}\text{C}$ excursion coincided with the cooling-driven Mulde and *lundgreni* biotic crises. [Frýda & Frýdová \(2025, this VSI\)](#) have applied high-resolution redox-sensitive trace-metal geochemistry to graptolite-rich shales in the Kosov section (Prague Basin), spanning the *Cyrtograptus lundgreni* to *Colonograptus deubeli* biozones, and documented a rapid transition to more oxic offshore conditions triggered by glacial sea-level fall. This abrupt oxygenation probably restricted graptolite habitats, precipitating the collapse in *lundgreni* diversity and has shed new light on this Silurian marine crisis.

[Rigo et al. \(2024, this VSI\)](#) demonstrate that at the Triassic/Jurassic boundary (~201.3 Ma), the end-Triassic extinction aligns with three

global negative $\delta^{13}\text{C}_{\text{org}}$ excursions (Precursor, Initial and Main) driven by Central Atlantic Magmatic Province (CAMP) volcanism and Pangean rifting. They present the first continuous $\delta^{13}\text{C}_{\text{org}}$ profile from Sicily's Mt. Sparagio subtidal carbonate platform, spanning Upper Triassic to Lower Jurassic facies. These excursions match local biotic turnovers, enable precise peritidal–pelagic correlations, and highlight the impact of volcanogenic carbon on coastal ecosystems.

An interdisciplinary biochronological and geochemical study by [Tekin et al. \(2024, this VSI\)](#) constrains the Carnian succession in southern Turkey and evaluates the role of Huglu volcanism in the Carnian Pluvial Event (CPE). Palynomorphs, ammonoids, conodonts, radiolarians and ostracodes show platform drowning within <2 Myr of the early Carnian. Huglu Tuffites are subalkaline felsic vitric tuffs and tuffites rich in Th with pronounced negative anomalies, indicating a subduction-related origin. Geochemical data imply Late Triassic back-arc rifting extended the Sorgun Arc and northern Gondwanan Tauride-Anatolide Platform. Prograding deepening rifted back-arc basin deposition culminated in voluminous Huglu eruptions from the late early to late Carnian. Biochronology ties peak volcanism to CPE onset, suggesting it as a trigger.

Astronomical calibration is herein refined in diverse frames of the Astronomical Time Scale.

The Eocene Epoch hosted major climate events like the Paleocene-Eocene Thermal Maximum (PETM), early Eocene Climate Optimum (EECO), and middle Eocene Climate Optimum (MECO). On the Arabian Plate, the EECO coincided with the development of the Dammam Formation, a shallow-water carbonate ramp with cyclic parasequences. [Abdullahi et al. \(2025, this VSI\)](#) investigate the role of Milankovitch forcing in shaping these sequences using Spectral Gamma Ray, Magnetic Susceptibility, and stable isotope data. Results suggest low sedimentation rates and eccentricity-paced deposition linked to astronomical cycles. The EECO signal appears in specific shale and limestone intervals. This is the first detailed analysis of the influence of Milankovitch cyclicity on Eocene marine records in the region.

[Hilgen \(2025, this VSI\)](#) revisits the Cenozoic Astronomical Time Scale (ATS), demonstrating that, despite CENOGRID and GTS2020 calibration, challenges remain. By tuning core images and gamma-ray attenuation data from Lower-Middle Miocene IODP Sites U1335–U1337 (15.5–18.7 Ma) to La2004 eccentricity, a refined astrochronology is achieved. The post-Miocene Climatic Optimum (MCO) aligns with existing $\delta^{18}\text{O}$ models, but pre-MCO intervals diverge by up to ~300 kyr. Validated against CaCO_3 percentages and Site 1264 proxies, the new age model can update the U1337 $\delta^{18}\text{O}$ benthic record in CENOGRID. Integrated stratigraphy proves crucial for enhancing ATS and palaeoclimate reconstructions.

[Kuiper et al. \(2008\)](#) previously assigned the Fish Canyon sanidine (FCs) an age at 28.201 ± 0.046 Ma and the K/Pg boundary at 65.957 ± 0.040 Ma, ages adopted in GTS2012 and GTS2020. Subsequent studies by others, however, generated a ~ 1.5% age scatter, preventing the adoption of a consistent age. [Kuiper et al. \(2026, this VSI\)](#) have re-evaluated the astronomical tuning of the section on which the FCs age of 28.201 Ma is based, combined with a quantitative statistical test of the tuning. A new single crystal U/Pb ID-TIMS zircon has dated the astronomically calibrated Phanerozoic A1 ash bed and the FCT itself, and new astronomical and U/Pb ages of the K/Pg boundary. They confirm the original calibration, but accommodate a slightly younger FCs age of 28.171–28.176 Ma. Their revised K/Pg boundary age is thus ~100 kyr younger, altering correlation of the Deccan Traps. They recommend using 28.201 Ma or 28.171–28.176 Ma for FCs and have urged a community-based effort to refine these critical chronostratigraphic benchmarks.

BTB13 (Baringo–Tugen Hills, Kenya) records Pliocene–Pleistocene hydroclimate. [Spiering et al. \(2026, this VSI\)](#) have refined its Bayesian chronology, anchored by magnetostratigraphy and radioisotopes, by astrochronologic tuning of gamma-ray attenuation and magnetic susceptibility. Deep-lake diatomites and MS (Magnetic Susceptibility)/GD

(Gamma Density) minima align with precession lows and obliquity highs, mirroring intensified North African monsoons at boreal summer insolation peaks. Coincident Mediterranean sapropels confirm an insolation-driven response. Obliquity dominance likely reflects combined equatorial insolation cycles and high-latitude feedbacks.

High-resolution geological timescales are essential for documenting biodiversity and environmental changes. The potential of quantitative stratigraphy combining stratigraphy, statistics, and computer science provides a further global tool that includes all events and minimizes inconsistencies among those records.

Quantitative stratigraphy combines stratigraphical records with computational methods: Constrained Optimization (CONOP) sequences global events but cannot date local occurrences; Horizon Annealing (HA) uses simulated annealing to preserve local stratigraphy. [Chu et al. \(2025, this VSI\)](#) have introduced HORizon SEquencing (HORSE), an optimized method of HA with parallel computing and genetic algorithms for rapid, large-scale correlation. On empirical and synthetic datasets, HORSE outperforms HA in speed, matches CONOP in event sequencing, and uniquely retains local stratigraphical detail for palaeogeographic, palaeoecological, and sampling bias analyses.

[Lu et al. \(2025, this VSI\)](#) present a high-resolution magneto-foraminiferan time scale for the middle Eocene–upper Oligocene by applying CONOP across 11 reference sections. Traditional biostratigraphy relies on just 1–10% of foraminiferan markers, which constrains temporal resolution and hinders quantitative analysis of biotic events. Integrating magnetostratigraphy and 409 additional events into the CONOP composite boosts temporal resolution by an order of magnitude. The authors introduce two new metrics—diachrony and centrality—to evaluate the consistency of events across regions. Their results show that chronological significance increases from small benthic through planktonic to zonal species, whereas large benthic events are biased by endemism, and that incorporating magnetostratigraphic data significantly strengthens stratigraphical correlations.

CRedit authorship contribution statement

Annalisa Ferretti: Conceptualization, Investigation, Project administration, Writing – original draft, Writing – review & editing. **Marco Balini:** Conceptualization, Investigation, Writing – original draft. **David A.T. Harper:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **Thomas Servais:** Conceptualization, Investigation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

We extend our sincere thanks to all the authors who contributed their research to this VSI focused on the subdivision of geological time. We are also deeply grateful to the reviewers for their careful and constructive evaluations, which greatly enhanced the quality of the contributions.

We warmly thank Howard Falcon-Lang and Lucia Angiolini for their excellent guidance throughout the editorial process, which was essential to the successful completion of this volume. Finally, we acknowledge the International Union of Geological Sciences (IUGS) for providing financial support that enabled the STRATI Meeting in Lille, France.

Data availability

The authors confirm that all data necessary for supporting the scientific findings of this paper have been provided.

References

- Abdullahi, M., Khan, T., Aljurf, S., Suleymanov, V., Herlambang, A., Morsilli, M., Al-Ramadan, K., Koeshidayatullah, A., 2025. Assessing Milankovitch forcing during and in the aftermath of the early Eocene climate Optimum: Dammam Formation, Saudi Arabia. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 679, 113298.
- Bralower, T.J., Leckie, R.M., Sliter, W.V., Thierstein, H.R., 1995. An integrated Cretaceous microfossil biostratigraphy. In: Berggren, W.A., Kent, D.V., Aubry, M.-P., Hardenbol, J. (Eds.), *Geochronology, Time Scales and Global Stratigraphic Correlation*, vol. 54. SEPM Spec. Publ., pp. 65–79.
- Brett, C.E., Zambito IV, J.J., 2026. Phanerozoic marine bioevents: a review with applications to stratigraphy and earth history. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* (Under Review).
- Calero Gordon, J.L., Chaigneau, B., Lindskog, A., Eriksson, M.E., Manzano, E.G., Monnet, C., Munnecke, A., Régnier, S., Servais, T., 2025. Acritarch distribution in the Middle Ordovician of Öland, Sweden: Ecostratigraphical or biostratigraphical signal? *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 673, 113005.
- Chu, T., Huang, H., Fan, J., Deng, Y., Xu, T., Qian, C., Xue, K., Sheets, H.D., Stephenson, M.H., Shi, Y., Hou, X., 2025. HORSE: Harmonize regional and global stratigraphic records through horizon sequencing. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 670, 112976.
- Corradini, C., Corrigan, M.G., Pondrelli, M., Spina, A., Suttner, T.J., 2024. The “Lochkovian-Pragian Event” re-assessed: New data from the low latitude shelf of peri-Gondwana. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 656, 112580.
- Erba, E., Miniati, F., Bottini, C., 2026. Revised calcareous nannofossil biozonation of the Cretaceous at low and middle latitudes. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 681, 113407.
- Ferretti, A., Balini, M., Harper, D.A.T., Servais, T., 2026. Cutting time in slices. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 683, 113433.
- Frýda, J., Frýdová, B., 2025. High-resolution records of the mid-Homerian (Silurian) marine chemistry evolution and graptolite biodiversity across the Lundgreni Event reveal what nearly killed the graptolites. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 668, 112866.
- Hilgen, F., 2025. Revised astrochronology for the Lower to Middle Miocene of IODP site U1337. Implications for the Cenozoic megasplICE (CENOGRID). *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 662, 112748.
- Klock, C., McLaughlin, P.L., Paton, T., Bancroft, A.M., Cane, G., VandenBrouck, T.R.A., Emsbo, P., 2025. Onset of the Mulde Biogeochemical Event in the Midcontinent Basin (Silurian, USA). *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 675, 113096.
- Kuiper, K.F., Deino, A., Hilgen, F.J., Krijgsman, W., Renne, P.R., Wijbrans, J.R., 2008. Synchronizing rock clocks of Earth history. *Science* 320, 500–504.
- Kuiper, K.F., Toonenburgh, Z., Wotzlaw, J.-F., Zeeden, C., Sierro, F.J., Davies, J.H.F.L., Sahy, D., Condon, D.J., Hilgen, F.J., 2026. Revisiting the age of the Fish Canyon sandine dating standard. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 682, 113421.
- Liao, J.-C., Valenzuela-Ríos, J.L., 2026. Eifelian (Middle Devonian) to Early Frasnian (Late Devonian) conodonts and strata in the Spanish Central Pyrenees: Global correlations and effects of climatic fluctuations in the biota. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 681, 113378.
- Lu, Z., Fan, J., Wade, B.S., Ogg, J., Alegret, L., Sadler, P.M., Stephenson, M.H., Shi, Y., Qian, C., Xue, K., Fang, P., 2025. Improving the temporal resolution of middle Eocene–late Oligocene foraminifer biomagneto-chronology: Insights from CONOP and chronologic significance of biotic events. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 669, 112929.
- Lucas, S.G., 2025. Fossil vertebrates, biostratigraphy, biochronology and chronostratigraphy. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 667, 112890.
- Rigo, M., Favero, M., Di Stefano, P., Todaro, S., 2024. Organic carbon isotope ($\delta^{13}\text{C}_{\text{org}}$) curve and extinction trends across the Triassic/Jurassic boundary at Mt. Sparagio (Italy): A tool for global correlations between peritidal and pelagic successions. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 654, 112440.
- Sissingh, W., 1977. Biostratigraphy of Cretaceous calcareous 1076 nannoplankton. *Geol. Mijnb.* 56, 37–65.
- Spiering, B.R., Sier, M.J., Hilgen, F.J., 2026. Astronomical climate forcing and tuning of the Baringo core (HSPDP-BTB13-1A), Kenya. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 681, 113377.
- Tekin, U.K., Krystyn, L., Kürschner, W.M., Sayit, K., Okuyucu, C., Forel, M.-B., 2024. Development of the early Carnian deepening upward sequence of the Huglu Unit within the tectonic slices/blocks of the Mersin Mélange, southern Turkey: Biochronologies, geochemistry of volcaniclastics and palaeogeographic implications. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 636, 111964.
- Wang, W., Hu, K., Wang, X., 2025. Temporal and spatial evolution of Mississippian conodonts: A case study. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 661, 112701.
- Wang, Y., Hu, K., Ye, X., Wang, X., 2025. The Middle–Late Pennsylvanian event: Timing and mechanisms. *Palaeogeogr. Palaeoclimatol. Palaeoecol.* 667, 112893.