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Preface

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Special issue, 'The Ediacaran System and the Ediacaran–Cambrian Transition': Preface

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This special issue grew out of the 'International Meeting on the Ediacaran System and the Ediacaran–Cambrian transition', held in Guadalupe, Extremadura, Spain, 17–24 October 2019, organized under the auspices of the International Subcommissions on Ediacaran and Cambrian Stratigraphy. It includes a selection of contributions presented at the meeting and invited papers, including reviews and case studies, with the aim of covering a broad range of topics within the scope of the meeting.

Snowball-style glaciations characterized the Cryogenian Period, but regional glaciations are also recorded in Ediacaran successions, the best known being the *c.* 580 Ma Gaskiers glaciation. **Linnemann *et al.*** introduce an 'Upper Ediacaran Glacial Episode' for *c.* 570–560 Ma glacial sediments spread along the northern Gondwanan margin, and argue for the onset of this glaciation close to the end of the Shuram–Wonoka carbon isotope anomaly. **Bridger *et al.*** explore water column redox conditions during deposition of the Miaohe Member in South China, finding evidence for fluctuating conditions, something that has also been reported from many other Ediacaran sites. They discuss environmental stress on early benthic communities and also provide carbon isotope data that support a more solid correlation with the Doushantuo Formation. **Cerri *et al.*** study the evolution of the latest Ediacaran and early Palaeozoic Jaraibas and Parnaíba basins of Brazil, through a detrital zircon-based provenance study. Substantial shifts in both sediment source area and sedimentation styles are documented, and in turn these are related to major events from western Gondwana.

Organic-walled microfossils yield important evidence for early eukaryotic radiations. Internal structures found within large spiny Ediacaran forms have previously been interpreted as representing cell divisions capturing the early growth stages of metazoans, making them some of the earliest fossil evidence for metazoans. Alternatively, these structures have been interpreted as being of non-metazoan origin. **Moczydłowska & Liu** is a contribution that feeds this debate, with the description of exceptionally preserved material of several taxa from the Doushantuo Formation in South China. They conclude that these are best interpreted as early to late ontogenetic stages of non-animal holozoans or algae. Biostratigraphical implications of organic-walled microfossils are discussed by **Agić *et al.***, who report on Ediacaran occurrences of *Granomarginata*, a common Cambrian form, as well as the new flask-shaped microfossil *Lagoenaforma*. Possible implications of this association for terminal Ediacaran biostratigraphy are discussed.

Ediacara-type fossils are attracting ever increasing attention, and are treated in several papers here. **Runnegar** provides a magisterial review of the history and present state of debates on the biological interpretations of Ediacara-type fossils. In agreement with most current research, the author suggests that a metazoan affinity is likely for most forms. This includes *Dickinsonia*, arguably the most emblematic Ediacaran fossil, from which **Ivantsov & Zakrevskaya** describe additional evidence for motility in the form of escape behaviour, stretching and lift-off, as well as adhesion to microbial mats, in exceptionally preserved material from NW Russia. **Gehling & Runnegar** revisit the taphonomy and palaeobiology of a spectacular slab from South Australia that, in addition to *Dickinsonia*, contains, with an intricate taphonomic history, the tubular *Aulozoon* and mat-like erniettomorph *Phyllozoon*. *Aulozoon* is formally described, and *Dickinsonia rex* redescribed. The fractal-like rangeomorpha are another important group of macroscopic Ediacaran fossils. **Butterfield** finds that three-dimensionally preserved *Charnia* from the White Sea possessed a bag-shaped morphology, with internal water-filled compartments interpreted as a hydrostatic exoskeleton. He argues for an eumetazoan affinity for these enigmatic organisms and concludes they were not passive osmotrophs, as had previously been interpreted. **McIlroy *et al.*** provide a detailed study of the intricate nature of branching patterns in the rangeomorph *Beothukis*, deducing a reclining non-osmotrophic mode of life, and more generally questioning the conventional interpretation of rangeomorphs as erect fronds. Palaeopascichnids are a widespread group of non-metazoan macroscopic Ediacaran organisms composed of serial elements. **Kolesnikov & Desiatkin** present an exhaustive study of this group based on a statistical analysis of more than 1000 specimens, with the aim of establishing a more stable taxonomy for the group. They also analyse facies preference and stratigraphical range, and propose *Palaeopascichnus delicatus* as a potential index fossil for future subdivisions of the

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Ediacaran System. Discoidal Ediacaran fossils, often interpreted as hold-fasts, typically have limited morphological detail, and care has to be taken in teasing them apart from structures of a non-biogenic origin. A case study is provided by **Inglez *et al.***, who investigate morphologically complex discoidal structures of probable Ediacaran age from Brazil, previously described as fossils. They instead conclude that non-biological formation from fluid escape is the most likely mechanism behind the formation of these structures. The question of there being Cambrian hold-overs of Ediacara-type organisms, versus their total extinction at that time, is tackled by **Hoyal Cuthill** who, favouring the former scenario, identifies four reasons for the widespread denial of Cambrian survivors. With respect to the frondose biota, the author identifies two extinction events, rather than one: a severe extinction at the Ediacaran–Cambrian transition, with final extirpation some 30 Ma later.

Moving on to the Cambrian record, **Reitner *et al.*** describe hexactinellid and other sponges from Terreneuvian phosphorites of southern Spain, being one of the oldest moderately diverse records of this group. The authors discuss the precipitation of apatite and argue for strong influence of microbial processes in its formation. From NE Spain, **Streng** illustrates new palaeontological and cartographic information from the Codos Beds of the Aluenda Formation. The age of this unit had been controversial, but the report of helcionellid molluscs firmly demonstrates a Cambrian age. **Álvaro & Lorenzo** explore the importance of the Cadomian orogenic collapse linked to extensional episodes in the formation of sedimentary sequences spanning the Ediacaran–Cambrian transition in the Central Iberian Zone, southern Spain, as well as the formation of ironstone and phosphatic levels. **Ebbestad *et al.*** detail the stratigraphical distribution of the tubular fossil *Sabellidites cambriensis* in sections from northern Norway. Combined with new information from trace fossils, its first appearance is shown to closely approximate the base of the Cambrian there, and a similar pattern is found globally. Finally, **Gougeon *et al.*** report on Fortunian (or latest Ediacaran) spirally coiled trace fossils from the Armorican Massif in France, and review the Phanerozoic record of one-way planispiral forms. They find evidence for the early appearance of these trace fossils in onshore settings, with offshore migration during the Ordovician, a trend previously observed in many other types of trace fossils.

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