Preface

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This volume represents a compilation of nine invited submissions to *Transactions of the Royal Society of Edinburgh: Earth Sciences*, concerning 'Chelicerate Palaeobiology and Evolution'.

The *Transactions* have a long tradition of publishing research in this field, from Laurie in 1892 and 1898 to the more recent work of Waterston in 1957, 1964, 1968, 1979 and 1985, Selden in 1981, and various contributions concerning Chelicerata in the 1985 *TRSE* Special Issue on 'Fossil Arthropods as Living Animals' (Dalingwater, Plotnick, van der Hammen and Waterston, Oelofsen & Oosthuizen). This present Special Issue continues this tradition and is dedicated to Dr Charles Waterston, formerly of the National Museum of Scotland, Edinburgh, in recognition of his lasting contribution in this field.

The origin of Chelicerata is addressed by Cotton & Braddy, based on a new cladistic analysis. Chelicerates evolved from within a 'chelicerate-allied' clade of arachnomorph arthropods, as sister group to a paraphyletic group of megacheiran (i.e. 'great-appendage') arthropods, both of these being sister groups to cheloniellids, aglaspidids, *Paleomerus*, *Emeraldella* and *Sidneyia*. This is followed by Tetlie & Moore's description of only the fourth specimen of the stem group chelicerate *Paleomerus hamiltoni* so far discovered from the Lower Cambrian of Sweden, confirming the presence of eleven abdominal segments and a broad tapering telson in this form, supporting assignment to Strabopidae and rendering Paleomeridae redundant.

Regarding aquatic chelicerates, the enigmatic *Bembicosoma pomphicus* from the Lower Silurian of Scotland, finally finds a reliable taxonomic placement within Xiphosura, based on a redescription by Anderson & Moore; ten abdominal segments are confirmed and a previously undescribed specimen figured.

The once rare group of chasmataspids receives two contributions in this volume. The first, by Dunlop, Anderson & Braddy, presents a redescription of *Chasmatasvis laurencii* from the Middle Ordovician of Tennessee. The discovery of Devonian chasmataspids with opisthosomal operculae, coupled with resting traces from the Upper Cambrian of Texas (that may also provide the oldest record of Euchelicerata), renders earlier interpretations of the respiratory system of *C. laurencii* unconvincing. The second chasmataspid contribution, by Tetlie & Braddy, is a description of the first Silurian chasmataspid from the Lower Silurian of Scotland; this new form bridges some of the morphological divide between Ordovician and Devonian taxa, and provides interesting insights into the phylogenetic implications of the genital operculum in eurypterids.

Tollerton reviews Ordovician eurypterids, regarding almost thirty species as pseudofossils! Such a drastic taxonomic revision is likely to have a profound impact on our estimates of eurypterid diversity, distribution and evolution.

Moving on to Arachnida, Pollitt, Braddy & Dunlop describe an abundant phalangiotarbid fauna from the Upper Carboniferous of Writhlington, England, and investigate their phylogenetic position via cladistic analysis; phalangiotarbids resolve as sister group to palpigrades plus the tetrapulmonate arachnids. The first fossil opilioacariform mite and the smallest known solifugid are described from Baltic amber by Dunlop, Wunderlich & Poinar, extending the present day geographic range of these arachnids within Eurasia. Finally, Penney investigates whether the fossil record of spiders tracks that of their principal prey – the insects; although co-evolution between these groups is difficult to demonstrate, spiders certainly appear to have radiated alongside insects.

It is hoped that this volume will provide a synthesis of recent advances and act as a stimulus for further research in this field. As in all fields of palaeontology, new fossil discoveries will continue to yield new data on the diversity of fossil chelicerates.

Taphonomic, ontogenetic and sexual dimorphic factors may have been overlooked in the establishment of some fossil taxa. Taxonomic work will continue for some time to come; systematic revisions of several key groups are required before these data can be incorporated into phylogenetic analyses, and current work on the systematics and phylogeny of xiphosurans, chasmataspids, and eurypterids will certainly reveal new insights.

Further work is required to investigate the relationships within Arachnomorpha and the position of putative ancestral chelicerates. The conflict between molecular and morphological data highlights some unorthodox relationships in chelicerate phylogeny that certainly need to be addressed: the position of pycnogonids, the monophyly of Arachnida, and recent concepts regarding 'Myriochelata' (i.e. Myriapoda plus Chelicerata), to name but a few. It is clear that understanding the phylogeny of fossil (mainly aquatic) taxa is fundamental to interpreting the relationships of modern (mainly terrestrial) chelicerate groups.

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