THEME REVIEW

Charnia's 50th Birthday - Again

The famous fossils from the late Precambrian, *Charnia masoni* and *Charniodiscus concentricus*, were formally named and described in 1958, and a wealth of literature has appeared in the last year or so. Members who wish to keep abreast of the subject may find it useful to consult the following.

The Rise and Fall of the Ediacaran Biota, by P. Vickers-Rich & P. Komarower (editors) 2007. Geological Society Special Publication 286, 456 pp. ISBN 978-1-86239-233-5. £95 (members of the Geological Society £47-50) +£4 p & p.

This is a collection of 38 papers presented at two symposia, one at Prato, near Florence, in 2004 and the other at Kyoto, Japan, in 2006. The papers record recent studies of the stratigraphic and tectonic setting of Neoproterozoic rocks before discussing the many impression fossils in the Ediacaran period (roughly 635 to 543 million years ago), some in areas where they have not previously been recorded, e.g. Argentina and Iran. However, the themes of their evolutionary origin and their extinction, as implied by the title, are not really covered and remain speculative. Several papers discuss the various frondose fossils and there is a useful analysis of the different types of discoid impressions, though the diagram of *Cyclomedusa* shows radial markings as well as concentric in contrast to the usual diagnosis of concentric markings only. A paper on *Kimberella* from the White Sea area of Russia concludes that it was a grazing or predatory mollusc, demonstrating that the biota was not entirely sessile. Particularly welcome are papers on *Charnia* by Laflamme et al., on the variety of discoid fossils by MacGabhann et al., on the probable molluscs from the White Sea region of Russia by Fedonkin et al., and on a possible siphonophoran by Fedonkin and Ivantsov demonstrating that biota was not entirely made of fronds and discs. Though obviously they are complex metazoans, no links between single-celled acritarchs and multicellular organisms have yet been found in the fossil record. Regarding fronds, most were bilateral, but some had three or even four vanes, and it is not easy to see how the latter gathered their nourishment. MacGabhann presents an argument that most if not all discs were holdfasts, but does that mean that the 30 cm diameter discs in Charnwood Forest were super-holdfasts of giant fronds?

While neither the digestive systems nor the reproduction strategies of the fronds can yet be demonstrated, most contributors seem to agree that they gained their nourishment from the water column either by absorbing it directly from sea-water or by catching and consuming particulate matter: the latter method might imply polyps eating plankton but no evidence for polyps has been presented yet. The suggestion of growth of lilo-like mattresses within the sea-floor sediment as argued by Seilacher seems to be out of favour today. Whether the varied length of the fronds reflects a tiered ecology at different water depths is uncertain. There is also doubt as to whether the assemblages in different lithologies reflect a chronological replacement, i.e. diversification with time, or a shallow to deep environmental but synchronous pattern.

Among the topics somewhat marginal to the palaeontological theme is correlation of Ediacaran strata over much of central Australia, partly based on a layer of ejecta from a meteorite, the Acraman event at c.570 Ma. As a whole the book contains essential reading for those interested in Metazoan evolution, but it has a few papers which could have been omitted. e.g. Cambrian Radiolaria.

Ediacaran Biota on Bonavista Peninsula, Newfoundland, by H.J. Hofmann, S.J. O'Brien & A.F. King, 2008. Journal of Paleontology, vol.82, no.1, pp.1-36.

The fossils from some 36 new localities in an area some 300-400 km northwest of the classic Mistaken Point are recorded here. The same stratigraphic units are found here and the fossils are spread through over 1000 m of strata. The lowest beds are of similar age to the volcani-clastic beds of the Blackbrook Formation (Iveshead Member) whilst the upper beds can be correlated with the fossiliferous Woodhouse Beds in Charnwood Forest. *Ivesheadia* and *Blackbrookia* are recorded though the illustrations of the latter are far from convincing.

Spindle-shaped Ediacara fossils from the Mistaken Point assemblage, Avalon Zone. Newfoundland by J.G. Gehling & G. Narbonne, 2007. Canadian Journal of Earth Sciences, vol.44, no.3, pp.367-387.

The abundant but enigmatic organisms found but neither named nor described in detail 40 years ago by Anderson and his student Misra are here named *Fractofusus misrai* and *F. andersoni*. Detailed descriptions with the aid of retro-deformation (i.e. taking out the distorting effects of tectonic deformation) are provided together with statistical analyses based on over 3000 specimens obtained through some 1500 m of beds. Some bed surfaces carry hundreds of specimens. The two species differ in size and shape, *F. misrai* being larger and narrower than *F. andersoni*. They are only known from Newfoundland though a single doubtful and poorly preserved specimen in Charnwood Forest might be an example. No head, tail or means of support can be recognized and the organisms seemed to have rested on the sea-floor with an inflated, possibly quilted structure. Identical upper and lower surfaces bear fractal arrangements of frondlets, each similar to a small scale *Charnia;* this arrangement could only have operated if the organism was flipped over at intervals. As they occur in deep-water sediments any form of photosynthesis seems to be precluded. While most specimens exhibit just the two vane surfaces, the authors discuss the possibility of varieties with three and four-vanes, though it is difficult to see how these functioned. Although classified with *Charnia* etc in the Rangeomorpha, the nature of the organism remains even more puzzling than the frondose fossils.

Ediacaran fronds, by M. Laflamme, & G. Narbonne, 2008. Palaeogeography, Palaeo-climatology and Palaeoecology, vol.258, pp.162-179. (Brief summary in *Geology Today,* vol.24, no.3, May 2008, pp.93-94).

Using some hundreds of specimens from around the world, eight shape morphologies are noted but the fossils are categorized in four generic groups on the basis of their branching pattern: *Arborea* with little evidence of secondary divisions (*Arborea* has elsewhere been relegated to the status of a species within the genus *Charniodiscus)*; *Charnia* has secondary modular elements; *Rangea* has tertiary branching and *Swartpuntia* has close-packed tubular branches. Their architecture may reflect exploitation of different levels in the water column, but no other evidence of the mode of feeding or of reproduction has been found. The captions to the photographs of *Charnia* and *Charniodiscus* wrongly refer to these fossils having been found in Bradgate Park; in fact the type locality is the North Quarry on the Golf Course near Woodhouse Eaves and the type specimens are in Leicester City Museum.

The Vendian (Ediacaran) in the geological record: enigmas in geology's prelude to the Cambrian explosion, by G.J.H. McCall, 2006. Earth Science Reviews, vol.77, pp.1-229.

Joe McCall has here provided a comprehensive review of the literature up to about 2004, with many illustrations taken from the relevant journals. He has included notes on pre-Ediacaran fossils such as stromatolites. He has unfortunately used the obsolete stratigraphic terminology for the Charnian succession.

The Rise of Animals: Evolution and Diversification of the Animal Kingdom, by M.A. Fedonkin, J.G. Gehling, K. Grey, G. Narbonne & P. Vickers-Rich, 2008. Johns Hopkins University Press, Baltimore, 326 pp. ISBN 13-978-0-8018-8679-9. £50.

This a lavishly illustrated book (many in colour) summarizing pretty well all what one could want to know about the Ediacaran Biota, with coverage of the relevant Precambrian environments, Proterozoic glaciations and the potential effects of "snow-ball" or the more likely "slush-ball" Earth. The possible effects of changes of salinity and excursions from the norm of the carbon-13 isotope may mark major environmental impacts on evolution in post-slush-ball times. There are comments on the few pre-Ediacaran fossils found so far, both discs and a few dubious trails. It is suggested that some of the flattened forms such as *Dickinsonia* grazed on microbial mats though if the microbes were photosynthetic the mats are difficult to reconcile with the deep-water occurrences. Possible precursors to the well-known Phanerozoic phyla such as *Tribrachidium* are discussed though the frondose organisms seem to have no obvious links to the later phyla.

The greater part of the book deals in turn with the areas with Ediacaran fossils, notably Newfoundland, South Australia, Namibia, various parts of Russia including the White Sea, Podolia, Siberia and the Urals, and several localities in N.W. Canada. A chapter discusses locations with fewer records of Ediacaran fossils and includes Charnwood Forest (which gets only four pages), Carmarthen, Argentina, China, Iran, India and Mongolia. A few sediments of Ediacaran age are limestones and these sometimes include "reefs" with abundant small conical *Cloudina* and other small shelly fossils of unknown affinity: examples are known in Namibia, California and Siberia. Notes on stromatolites, which have been regarded as marker fossils in Precambrian stratigraphy, are included. There is a chapter on microbes, with a short discussion of the carbonaceous discs of *Chuaria*, once mistakenly regarded as primitive brachiopods but now thought to represent mega-acritarchs. *Chuaria* was first recorded in the Grand Canyon in c.800 million year old strata, though this is not discussed. The genus has been recorded in many other areas including Iran and Canada. Many of the classic areas with Ediacaran fossils are remote with complex logistics even to reach them, and the problems of access and field work are outlined. Some personal backgrounds to the discoverers and researchers are presented making the book a very readable account of the growth of a subject which did not really exist 50 years ago.

There is an illustrated alphabetical index to more than a hundred Ediacaran fossils now known, though a few have been named too recently to be included, e.g. the spindle-shaped fossil, so common in Newfoundland, now known as *Fractofusus,* is not mentioned. The index also has the peculiarity of the photographs of both *Marywadea* and *Spriggina* are of the same specimen! A few other mistakes have crept in: localities 25 and 26 appear twice on the map on page 49; many of the photographs have no scale; the photo of your reviewer on page 186 is reversed. It would have been useful to have geological maps of many of the areas described instead of the minute location maps. The frontispiece (repeated on page 260) of a reconstruction of an Ediacaran sea floor is so anaemic that it is difficult to make out the detail, though the dust jacket has the same picture in full colour. There is a comprehensive bibliography. Fedonkin et al's book is probably the "best buy" on the subject available.

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