

DEVONIAN FISHES AND PLANTS OF MIGUASHA, QUEBEC, CANADA, By H.-P. Schultze and R. Cloutier (eds.): Verlag Dr. Friedrich Pfeil, München, 1996. 374 pp. \$52.00 (hardback).

While the major part of this book addresses the fossil fauna of the Escuminac Formation at Miguasha, which includes 19 genera and 21 species, it probably should have included a subtitle referring to the thorny issue of the environmental setting of the formation; a topic first mentioned in the Preface (Chapter 1) and subsequently becoming a recurring theme. Many of the taxonomic chapters are updates of previously described specimens, reflecting the collection of new material and improved understanding of fossil vertebrates, which has developed from the dedicated work carried on at this site since it became a Provincial Park in 1985. The book is developed in part from the impetus resulting from an International Lower Vertebrate meeting held there in 1991, and organized in five parts: Historical Overview; Geology; Paleobotany; Paleozoology, Invertebrates; and Paleozoology, Vertebrates.

Part I (Chapter 2) provides a detailed historical overview. It includes the names of collectors at this locality and repositories of the material, as well as a comprehensive list of publications of Miguasha material. The latter is certainly helpful to a student interested in previous descriptions of the material. The list of now well known scientists involved in the studies at the Miguasha locality is an impressive one and attests to the continuing importance of this site.

Part II (Chapters 3–6) is of particular interest as an innovative approach to the problem of interpreting ancient environments through the use of interdisciplinary studies. In Chapter 3 (Prichonnet et al.), a detailed lithological and sedimentological description leads the authors to conclude that the Escuminac Formation is made up of turbidite sequences and laminated facies, which occur in at least four units, and are associated with deposition during warm and cold seasons. Among the invertebrates, they note the total absence of typical Devonian marine groups, a picture also mirrored by the vertebrates, suggesting to them that the environment of deposition could have been similar to that of the Battery Point Formation, which was deposited in an estuarine setting subject to periodic marine incursions (Pageau and Prichonnet, 1976).

A paleogeographical reconstruction of the eastern North American continent during Devonian time by means of paleomagnetic studies is attempted in Chapter 4 (Seguin). The author points out that paleomagnetic data for the Paleozoic is scarce and remagnetization, overprints, and insufficient data present problems. Despite these difficulties, an effort is made to provide implications for the presence (or absence) of a marine basin at this locality during the time of deposition of the Escuminac, concluding that around the Middle Devonian the Central Mobile Belt, which included the present day Miguasha locality, had accreted to the North American cratonic landmass. Although not stated, one has to presume that this annexation would have eliminated marine influences.

Chidiac (Chapter 5) uses geochemical analysis to show that while boron concentrations in the shales suggest a setting intermediate between fresh and salt-water, the isotopic composition of oxygen and carbon in the carbonates is similar to Devonian marine conditions. The author proposes that the Escuminac Formation is of marine or brackish rather than lacustrine origin.

Chapter 6 (Parent and Cloutier) includes a good overview of fossil occurrence and preservation, and it does answer some of the questions about fossil distribution within the formation, a problem that seems to have been ignored in some of the later chapters. A single temporal paleocommunity is proposed although community structure changed through time in an estuarine environment. Thus part II comes to no clear conclusions about the environment of deposition.

Part III addresses the paleobotany of the Escuminac Formation. Gensel and Barnett-Lawrence (Chapter 7) take particular note of the low

diversity and abundance of the plant megafossils compared to the dispersed spore assemblage. The material is mostly abraded and weathered, but typical of the Late Devonian and unknown prior to the Frasnian. As these are land plants, they must have been transported to shoreline or brackish/marine environments. There are problems with the proper stratigraphic horizon assignments of earlier studies, a theme running through the book, due to the methods of collecting employed in the past. The two plant-bearing horizons contain a very different flora, suggesting that changes in plant composition occurred over time. McGregor (Chapter 8) also proposes that the spores were of terrestrial origin and were not carried far from land. The assemblage does not include marine palynomorphs. The spores are much more diverse than the megafloora, implying that they reflect a greater proportion of the Frasnian regional vegetation.

The invertebrates of the Escuminac Formation are described in Part IV. The chelicerates (Chapter 9, Jeram) include both scorpion and eurypterid material. Their presence adds to the importance of the Escuminac Formation, because of the scarcity of these invertebrates in the fossil record. Jeram points out that while chelicerates were initially marine, by the Late Carboniferous scorpions had made the transition onto land, while eurypterids moved into freshwater environments. In Chapter 10 Martens describes the Conchostraca, small phyllopod crustaceans, which are primarily known from temporary freshwater pools and somewhat brackish environments, such as ponds and lakes with fluctuating water levels. They ranged from the Lower Devonian through the Holocene.

Trace fossils are covered in Chapter 11 (Maples). The author proposes that the low diversity assemblage of ichnofossils may indicate stressed environmental conditions, such as an estuarine setting, where salinity and turbidity changes were not suitable for a diverse fauna. The trace fossils occur in plant-rich mudstone units, in which well preserved, articulated body fossils are rare or absent. Interestingly, much of the material previously referred to trace fossils is here re-interpreted as sedimentary structures. It is suggested that the basin was, at least during part of the deposition, connected to a somewhat distant open sea.

Part V is devoted to the vertebrates, the group for which the formation is best known. Chapter 12 (Schultze) is a brief review of the known vertebrates and their phylogenetic relationships, and is also a useful reference guide to the remaining chapters. The vertebrates are treated in taxonomic sequence with Janvier and Arsenault (Chapter 13) starting with the agnathans, represented by the Osteostraci. Although rare in the Escuminac Formation, the locality is an important one, since to date these are the latest known osteostracans. Originally assigned to four different species, the authors suggest that there may possibly be only three species (*Alaspis rosamundae*, *Escuminaspis laticeps*, Osteostraci, gen. et sp. indet.) of which one, *Escuminaspis laticeps*, may be a juvenile of *A. rosamundae*. The phylogenetic affinity is somewhat obscure, which may be due to the endemic nature of the fishes. In Chapter 14 Janvier addresses the Miguasha “Anaspida.” Although two species, *Endeiolepis aneri* and *Euphanerops longaeus*, have been traditionally assigned to the anaspids on the basis of the hypocercal tail, the author shows that they are probably not anaspids, suggesting instead that they may be more closely related to lampreys.

Only two placoderms are present in the Escuminac Formation (Chapter 15, Vezina); the antiarch *Bothriolepis canadensis* and the arthrodire *Plourdosteus canadensis*. The genus *Bothriolepis* occurs throughout the formation and it would have been helpful to provide information indicating if the species described here had been collected from more than one horizon. A redescription of three acan-