

Middle Cambrian *Hadimopanella* from Mila Formation in the Alborz Mountains, northern Iran

WRONA, R. AND HAMDI, B.

Phosphatic, discoidal sclerites with prominent nodes on the upper surface known as hadimopanellid microfossils are described from the Late Cambrian inter-reef calcareous grainstone of the Mila Formation in the Alborz Mountains, northern Iran. This is the first record of the palaeoscolecidan from Iran. Isolated sclerites demonstrate a complex ornamentation characteristic for widely known species of *Hadimopanella* and are interpreted as plate size skeletal elements of *Palaeoscolex* sp.

Isolated button-shaped phosphatic sclerites that include hadimopanellids as problematic microfossils *Hadimopanella* Gedik, 1977, *Lenargyrion* Bengtson, 1977, *Kaimenella* Märss, 1988 and *Milaculum* Müller, 1973 have recently considered to belong to the worm-like organisms of Palaeoscolecida Conway Morris and Robinson, 1986, which have their outer surface covered with tightly arranged sclerites in transverse rows on a narrow annuli (see Kraft and Mergl 1989; Hinz *et al.* 1990; Müller and Hinz-Schallreuter 1993; Conway Morris 1997).

The Mila Formation was defined by Stöcklin *et al.* (1964), which has its type section at the south slope of Mila Kuh, 50 km westsouthwest of Damghan, eastern part of Alborz Mts, (Fig. 1). This formation is well exposed in several outcrops of the Alborz Mountains (Hamdi 1995, fig. 1) and is divided into five lithological members, which consist of dolomites, trilobite bearing limestone, shales and sandstones, from Late Early Cambrian to Lower Ordovician (Assereto 1963; Stöcklin *et al.* 1964). Seven trilobite zones have been distinguished for the Mila Formation and its equivalents in the Mila Group (Kushan 1973; Fortey and Rushton 1976; Wittke 1984) and conodont zonation has been established based on conodont studies (Ruttner *et al.* 1968; Müller 1973a).

The studied and sampled section of the Mila Formation is located 3 km in the north of Shahmirzad along a road cutting, on the southern side of Kuh-e-Kahesh

A total of 58 samples from this section were collected for micropalaeontological investigations and their relative position is indicated on schematic stratigraphic profile at the Shahmirzad section. The chemical preparation of the samples was standard as for conodonts, using 10% acetic or formic acids. Over 300 phosphatic isolated sclerites have been picked up from the residuum of two productive samples.

The specimens of *Hadimopanella* described from Mila Formation without doubt can be assigned to the species *H. oezgueli* Gedik, 1977, because of the similar morphology and number of nodes. Iranian specimens differ slightly in its generally smaller size and lower number of nodes from the Turkish specimens from Upper (or Middle) Cambrian of Karakaya Tepe, Taurus Mountains (Gedik, 1977) and Spanish specimens from Middle Cambrian of Lancara Formation (van den Boogaard, 1983), but they are more similar to Australian, specimens discovered in two fragment of palaeoscolecidan worms cuticle in different form (I and II) from the Middle Mount Murray, late Templetonian (Müller and Hinz-Schallreuter, 1993: fig. 7, D-G). The latter have nodes arranged in a ring around a central node resembling some forms from Iran and Spain (van den Boogaard, 1983, fig. 4a) or *Utahphospha cassiniana* Repetski (1981) and seems to be similar in Müller and Hinz-Schallreuter (1993: p. 567) opinion to *Palaeoscolex sinensis* Hou and Sun, 1988, from the Lower Cambrian Chengjiang. The specimens of Iranian *Hadimopanella* possessing 15 nodes or more may form elongate plates with nodes arranged in rocas and are compatible merely with the *Milaculum* Müller, 1973 plates (Van Boogaard, 1989b; Müller and HinzSchallreuter, 1993).

The described here sclerites markedly differ in morphology and size from those assigned to that genus as *Hapicata* Wrona, 1982 and *H. antarctica* Wrona, 1987, or *H.? coronata* Boogaard, 1989a.

However, palaeoscolecidan remains are widely distributed in Lower Palaeozoic rocks, *Hadimopanella oezgueli* specimens are restricted to the Middle or Upper Cambrian strata, but their usefulness for biozonation is rather low and speculative. More clear is ecological and palaeobiogeographical interpretation of palaeoscolecidians bearing hadimopanellids

plates as a group of biota which were a major component of Cambrian (or even Lower Palaeozoic) benthic communities, often associated with marine around reef inhabitants.

References

- Assereto, R. 1963. The Paleozoic formations in central Alborz (Iran). (Preliminary Note). *Rivista Italiana di Paleontologia e Stratigrafia*, 69, 503-543.
- Bengtson, S. 1977. Early Cambrian button-shaped phosphatic microfossils from the Siberian Platform. *Palaeontology*, 20, 751-762.
- Boogaard, M. van den. 1989a. A problematic microfossils, *Hadimopanella? coronata* sp. nov., from the Ordovician of Estonia. *Rijksmuseum van Geologie en Mineralogie, Series B*, 92, 179-190.
- Boogaard, M. van den. 1989b. Isolated tubercles of some Palaeoscolecida. *Scripta Geologica*, 90, 1-12.
- Conway Morris, S. 1997. The cuticular structure of the 495-Myr-old type species of the fossil worm *Palaeoscolex*, *P. piscatorum* (?Priapulida). *Zoological Journal of the Linnean Society*, 119, 69-82.
- Conway Morris, S. and Robison, R. A. 1997. Middle Cambrian priapulids and other soft-bodied fossils from Utah and Spain. *University of Kansas Paleontological Contributions*, 9, 1-22.
- Foxtey, R. A. and Rushton, W A. 1976. *Chelidonocephalus* trilobite fauna from the Cambrian of Iran. *Bulletin British Museum Natural History (Geology)* 27, 321-340.
- Gedik, I. 1977. Conodont stratigraphy in the Middle Taurus. *Bulletin of the Geological Society of Turkey*, 20, 35-48.
- Hamdi, B. 1995. Precambrian-Cambrian deposits in Iran. *Treatise on the geology of Iran* 20, 1183. (In Farsi, English summary).
- Hinz, I., Kraft, P, Mergl, M. and Müller, K. J. 1990. The problematic *Hadimopanella*, *Kaimenella*, *Milaculum* and Utahphospha identified as sclerites of Palaeoscolecida. *Lethaia* 23, 217-221.
- Hou Xian-Guang and Sun Wei-Guo. 1988 Discovery of Chengjiang fauna at Meishucun, Jinning, Yunnan. *Acta Palaeontologica Sinica*, 27, 1-12. (In Chinese with English summary)
- Kraft, P and Mergl, M. 1989. Worm-like fossils (Palaeoscolecida; ?Chaetognata) from the Lower Ordovician of Bohemia. *Sbornik Geologických Ved Palaentologie*, 30, 9-36.
- Kushan, B. 1973. Stratigraphie und Trilobiten fauna in der Mila-Formation (Mittelkambrium-Tremadoc) im Alborz-Gebirge (N-Iran). *Palaeontographica A* 144, 113-165.

- Märss, T. 1988. Early Palaeozoic hadimopanellids of Estonia and Kirgizia (USSR). *Proceedings of the Academy of Sciences of the Estonian SSP, Geology* 37, 10-17.
- Müller, K. J. 1973a. Late Cambrian and Early Ordovician -Conodonts from Northern Iran. *Geological Survey of Iran, Report* 30, 1-53.
- Müller, K. J. 1973b. *Milaculum* n. g. ein phosphatisches Mikrofossil aus dem Altpaläozoikum. *Paläontologische Zeitschrift* 47, 217-228.
- Müller, K. J. and Hinz-Schallreuter, I. 1993. Palaeoscolecoid worms from the Middle Cambrian of Australia. *Palaeontology* 36, 3, 543-592.
- Repetski, J. E. 1981. An Ordovician occurrence of *Utahphospha* Müller and Miller. *Journal of Paleontology*, 55, 395-400.
- Ruttner, A., Nabavi, M. and Hajian, J. 1968. Geology of the Shirgesth area (Tabas area, East Iran). *Geological Survey of Iran, Report* 4, 1-133.
- Stöcklin, Ruttner, A. and Nabavi, M. 1964. New data on the Lower Palaeozoic and Pre-Cambrian of North Iran. *Geological Survey of Iran, Report* 1, 1-22.
- Wittke, H. W 1984. Middle and Upper Cambrian trilobites from Iran: Their taxonomy, stratigraphy and significance for provincialism. *Palaeontographica A* 183,91-161.
- Wrona, R. 1982. Early Cambrian phosphatic microfossils from southern Spitsbergen (Horsund region). *Palaeontologia Polonica* 43, 9-16.
- Wrona, R. 1987. Cambrian microfossil *Hadimopanella* Gedik from glacial erratics in West Antarctica. In: A. Gazdzicki (ed.) *Palaeontological Results of the Polish Antarctic Expeditions, Part I. Palaeontologia Polonica* 49, 37- 48.