

***MENATHYRIS WILSONI* (BRACHIOPODA), NEW GENUS AND SPECIES FROM THE MIDDLE TRIASSIC (LADINIAN) OF SOUTHERN ISRAEL**

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Abstract: *Menathyris wilsoni* gen. et sp. nov. is described from the Limestone and Marl Member (Early Ladinian) of the Saharonim Formation (early Anisian–late Carnian), at Har Gevanim, Makhtesh Ramon, southern Israel. The Saharonim Formation represents the main transgressive phase of the Middle Triassic. The subunit, from which the shells were collected, contains the molluscs *Neoschizodus laevigatus* (Ziethen), *Myophoriopsis* cf. *subundata* (Schauroth), *Lima* cf. *tellei* Bittner, *Pecten discites* (Schlotheim), *Ostrea montiscaprilis* Klipstein, *Pseudoplacunopsis fissistriata* (Winkler), *Gevanites awadi* (Parnes), and the conodont *Pseudofurnishius murcianus* (Van den Boogaard), the last-mentioned indicative of the Fassanian (Early Ladinian).

Key words: brachiopod, Triassic, Ladinian, Israel, Negev, Sinai Peninsula.

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INTRODUCTION

This paper records part of a long-term study of the Jurassic and Triassic faunas of the Middle East, with emphasis on the Sinai Peninsula, Israel and Jordan. The present study represents a continuation of work on the Triassic rocks and faunas of the Sephardic Province in Makhtesh Ramon, southern Israel. Feldman (2002, 2005) described a new brachiopod species, *Coenothyris oweni*, as well as a brachiopod-dominated community from the Saharonim Formation. The data presented herein permit a palaeoecological analysis of the Saharonim Formation that will result in a better understanding of the palaeobiogeographical context of the faunas within the Sephardic Province and elucidation of the evolutionary history of the brachiopod species within the province.

There have been numerous studies on Muschelkalk (Triassic) brachiopod faunas (Awad, 1946; Popiel-Barczyk and Senkowiczowa, 1989; Pálffy and Török, 1992; Senkowiczowa and Popiel-Barczyk, 1993), although Triassic brachiopods from Israel have been neglected in the literature and the Terebratulida, in general, have been poorly represented in the Triassic (Hagdorn and Sandy, 1998).

The Triassic sequence in Israel consists of mostly marine sediments with evidence of occasional progradations of terrestrial environments and ranges in thickness from 500–1100 m (Druckman, 1966; Parnes, 1986). Shaw (1947) first described the Triassic sequence of Ramon, followed by Zak (1964, 1968) and Druckman (1969, 1974, 1976). The expo-

sure at Har ‘Arif (Negev) was first described by Zemel *et al.* (1956). Eicher (1947) discovered the first unquestionable conodonts of clearly Triassic age from these Sinai and Negev outcrops. Although a detailed description of this fauna (Brozzen, 1956) was first published on the palaeontological and biostratigraphical features of the outcrop, Zak (1957) made the lithostratigraphic subdivision followed in this paper.

In the present paper, a new brachiopod genus and species, *Menathyris wilsoni*, is described from Makhtesh Ramon in southern Israel.

GEOLOGICAL SETTING

The brachiopods described herein were collected from the Saharonim Formation at Makhtesh Ramon, southern Israel (Fig. 1). Makhtesh Ramon is a large (40 km long, 8 km wide), northeast-trending, erosional cirque in the Negev that represents the central breached part of the Ramon anticlinorium, in which sedimentary rocks of Cretaceous to Triassic age are exposed (Sohn, 1968; Feldman, 2002). According to Sohn (1968), Makhtesh Ramon is the largest and southernmost of three breached domes in the Negev, the other two being Hamakhtesh Hagadol (Makhtesh Hathira/Kurnub Anticline) and Hamakhtesh Haqatan (Makhtesh Hazera).

The Saharonim Formation (Fig. 2) consists mostly of carbonates with shale, marl and evaporite beds that represent the main transgressive phase of the Middle Triassic (Benjamini *et al.*, 2005). Zak (1957) subdivided the forma-



Fig. 1. Location map of sample locality in Makhtesh Ramon, southern Israel (Israel grid coordinates 1370/9998-1379/9994). The *Menathyris wilsoni* gen. et sp. nov. horizon is denoted by an "X" (modified from Feldman, 2002)

tion at Makhtesh Ramon, southern Israel, into the following members: (1) the fossiliferous Limestone Member, consisting of meter-thick clay and marly shale horizons, topped by Awad's (1946) "Mottled Scar"; (2) the Limestone and Marl Member, consisting at the base of 9 m of dark, nodular bioturbated micrites, overlain by fossiliferous limestones and marls that represent offshore to intertidal environments of deposition (Parnes, 1975, 1986; Benjamini *et al.*, 2005); (3) the Limestone and Gypsum Member that consists of various lithofacies, such as fine-grained dolomite, foraminiferal and oncoidal limestones, algal stromatolites, and shale, marlstone and gypsum intercalations (Parnes, 1986; Benjamini *et al.*, 2005); and (4) the Limestone Member, seen in several cuestas with gray, bioturbated limestones forming ledges, alternating with gypsiferous shales, dolomicrite and algal stromatolites (Benjamini *et al.*, 2005).

According to Benjamini *et al.* (2005) the lithofacies of the Saharonim Formation indicates, at the end of the Anisian, rapid deepening, followed by an oscillating pattern of facies ranging from deeper marine environments and shallowing progressively through shelf and marginal marine facies.

Associated fauna: The horizon, in which the material was found, also contains the molluscs *Neoschizodus laevigatus* (Ziethen), *Myophoriopsis* cf. *subundata* (Schauroth), *Lima* cf. *tellei* Bitner, *Pecten discites* (Schlotheim), *Ostrea montiscaprilis* Klipstein, *Pseudoplacunopsis fissistriata* (Winkler), *Pseudoplacunopsis fissistriata* (Winkler), *Gevanites awadi* (Parnes), and the conodont *Pseudofurnishius murcianus* (Van den Boogaard), the last-mentioned indicative of the Fassanian (early Ladinian).

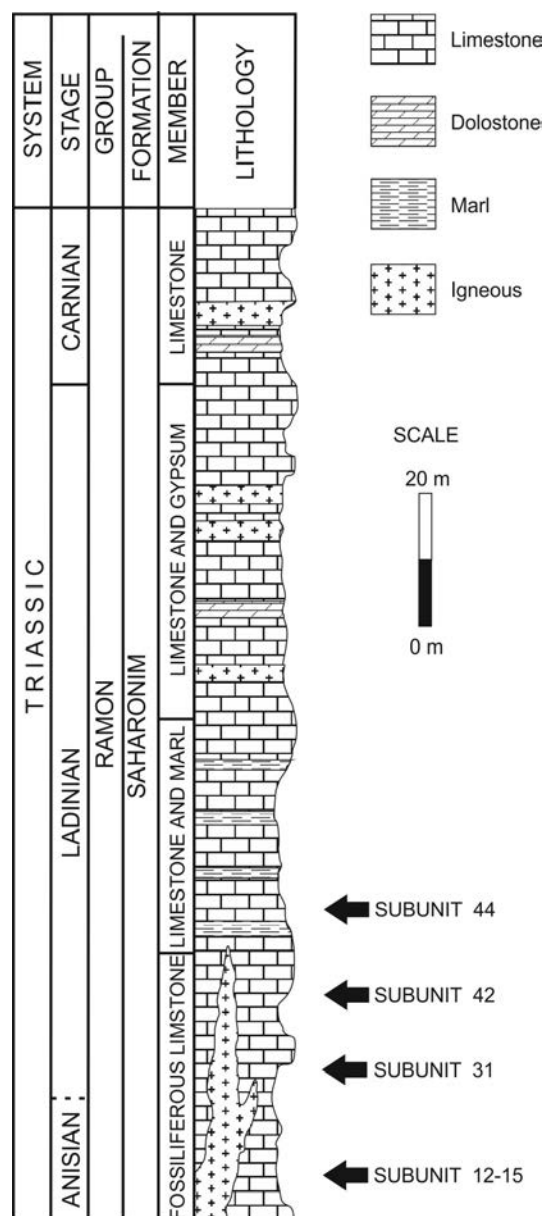


Fig. 2. Stratigraphic section of the Triassic Saharonim Formation at Har Gevanim, Makhtesh Ramon, southern Israel. *Menathyris wilsoni* gen. et sp. nov. was collected from Subunit 44. Subunits 12–15, 31 and 42 represent *Coenothyris oweni* beds (see Feldman, 2002). Subunit designations are after Zak (1964) and Parnes (1975)

MATERIALS AND METHODS

The shells are all articulated. Transverse serial sections were prepared with a WOKO 50P grinding machine with slice-spacing of 100 to 200 μm . Drawings of the specimens were made with a camera lucida and measurements were taken with a digital caliper and rounded off to 0.1 mm. Prior to photographing, the shells were coated with ammonium chloride.

Abbreviations: AMNH, American Museum of Natural History, New York; USNM and NMNH, United States National Museum and National Museum of Natural History, Smithsonian Institution, Washington, D.C.

Measurements: All measurements are in millimeters (mm).

SYSTEMATIC PALAEOONTOLOGY

Subphylum RHYNCHONELLIFORMEA Williams, Carlson, Brunton, Holmer and Popov, 1996
 Class RHYNCHONELLATA Williams, Carlson, Brunton, Holmer and Popov, 1996
 Order TEREBRATULIDA Waagen, 1883
 Suborder TEREBRATELLIDINA Muir-Wood, 1955
 Superfamily ZEILLERIOIDEA Allan, 1940
 Family ZEILLERIIDAE Allan, 1940

Menathyris genus novum

Type species: *Menathyris wilsoni* gen. et sp. nov. by monotypy.
Other species: Genotype species only.
Etymology: In memory of Mena Schemm-Gregory for her important contributions to Palaeozoic and Mesozoic brachiopod palaeontology. Her untimely death has dealt a blow to our profession.
Diagnosis: Small terebratellids subpentagonal to subpyriform in outline, commonly ventribiconvex; shells widest at midlength, anterior commissure ranges from rectimarginate to incipiently uniplicate. Ventral beak low, rounded, foramen small, permesothyrid; sulcus weak, shallow and narrow. Surface smooth with numerous, very fine growth lines, anterior half of shell costate. Cardinal process lacking, small teeth articulate with shallow sockets, hinge plates supported by median septum narrowly triangular in cross section; dental plates not preserved, distal ends of hinge plates give rise to descending branches of brachial loop that broadens to form laterally curving crural processes.
Remarks: *Menathyris* gen. nov. is similar to *Aulacothyris* Douvillé in overall appearance and external morphology but differs in its smaller size, much shallower and narrower sulcus, convexity and costation. The shells are similar to *Zeilleria arethusa* Dubar (see Dubar, 1942, pl. I, figs. 1–6), but differ in outline and costation; *Z. arethusa* is more oval in outline, rather than subpentagonal or subpyriform. The costae of *Z. arethusa* originate at the umbos and are more numerous whereas those of *Menathyris* gen. nov. originate no more than half the distance from the umbo. There is no indication of incipient uniplication in *Z. arethusa*, whereas it is very evident in the new genus. Serial sections suggest a relationship to the Angustothyrididae, but *Menathyris* gen. nov. differs from all of these forms in its smaller size, more distinct costation, and shape of the hinge teeth in cross section. The closest morphotype to *Menathyris* gen. nov. among the angustothyrids is *Angustothyris* Dagens but this genus differs in its robust and almost bulbous hinge teeth, lack of costation, larger size and deeper, U-shaped septalium.

Menathyris gen. nov. is placed in the Zeillerinae, since it most closely resembles the genera therein and is distinctly different from known taxa within the subfamily.

Menathyris wilsoni gen. et sp. nov.
 Figs 3, 4

Included species: Type species only by monotypy.
Diagnosis: As for genus because of monotypy.
Etymology: In honour of Mark A. Wilson for his substantial contri-

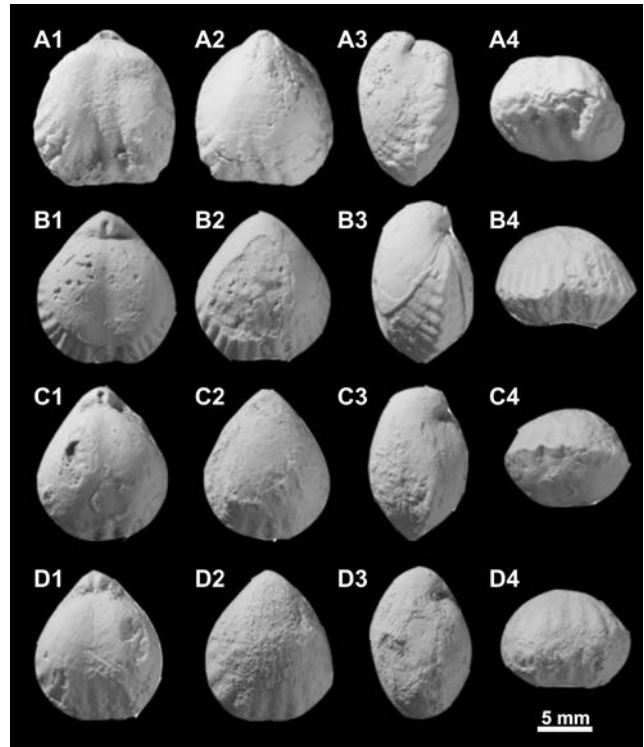


Fig. 3. *Menathyris wilsoni* gen. et sp. nov. **A1–4.** AMNH FI-85660, dorsal, ventral, lateral, anterior views; **B1–4.** AMNH FI-85648, holotype, dorsal, ventral, lateral, anterior views; **C1–4.** AMNH FI-85651, dorsal, ventral, lateral, anterior views; **D1–4.** AMNH FI-85643, dorsal, ventral, lateral, anterior views. All specimens were collected from a hard limestone bed, overlying the *Gevanites* beds, Subunit 44, equivalent to the lower half of the Limestone Marl Member, Saharonim Formation in Makhtesh Ramon, southern Israel (Israel grid coordinates 13725/99954)

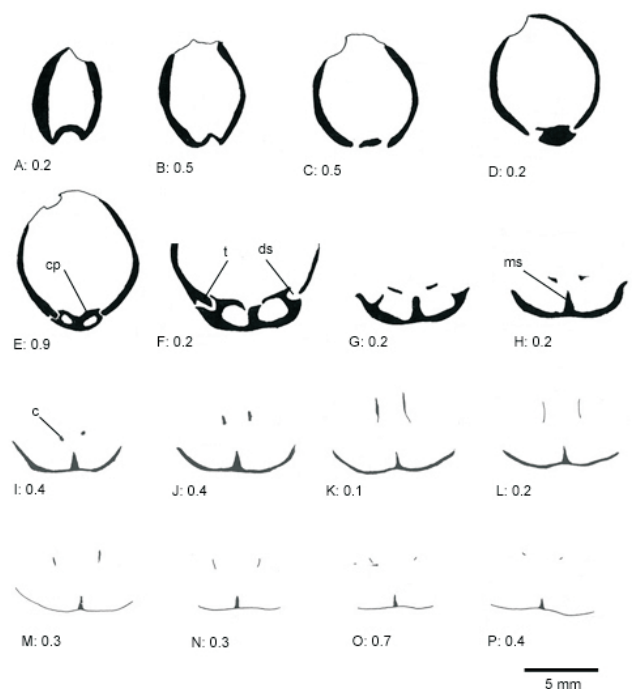


Fig. 4. Serial sections (A–P) of *Menathyris wilsoni* gen. et sp. nov. AMNH FI-85653. Original length of shell was 12.7 mm. Distances are those from the ventral beak and numbers denote distances between sections in mm. The dorsal valve is below. Abbreviations: c – crura, cp – crural process, ds – dental socket, ms – median septum

Table 1

Measurements (in mm) of *Menathyris wilsoni* gen. et sp. nov. from the Ladinian of southern Israel

Specimen	Length [mm]	Width [mm]	Thickness [mm]	Apical Angle [°]
AMNH FI-85643	14.5	11.6	8.9	85
AMNH FI-85644	14.2	11.2	9.1	86
AMNH FI-85645	14.6	13.2	x	74
AMNH FI-85646	11.2	9.2	6.0	84
AMNH FI-85647	11.7	9.0	8.6	82
AMNH FI-85648 holotype	14.0	12.6	8.5	95
AMNH FI-85649	11.9	10.7	6.0	90
AMNH FI-85650	12.6	11.4	8.4	92
AMNH FI-85651	14.9	12.5	9.8	88
AMNH FI-85652	14.4	15.4	x	80
AMNH FI-85653*	12.7	10.5	8.1	78
AMNH FI-85654	17.0	14.0 est	10.9	86
AMNH FI-85655	15.2	12.5	x	90
AMNH FI-85660	13.1	11.5	9.0	97

* – sectioned specimen; x – damaged specimen; est, estimated measurement. Figured specimens: holotype AMNH FI-85648; paratypes AMNH FI-85643, FI-85651, FI-85660

contributions to palaeontology and geology, particularly the evolution and palaeoecology of encrusting and bioeroding invertebrates, as well as the origin and diagenesis of carbonate rocks (especially hardgrounds), calcite sea dynamics, and Pleistocene sea-level change.

Material: The collection consists of 14 specimens; the holotype (AMNH FI-85648) and paratypes (AMNH FI-85643-85647; 85649-85655; 85660) have been placed in repository in the palaeontological collection of the American Museum of Natural History, New York.

Type Locality: The shells were collected from a hard limestone bed overlying the *Gevanites* beds, Subunit 44, Middle Member (of Druckman, 1974) equivalent to the lower half of the Limestone Marl Member (of Parnes *et al.*, 1985; Parnes, 1986), Saharonim Formation in Makhtesh Ramon, southern Israel (GPS coordinates: N30.58587497°, E34.87624599°; Israel grid coordinates 13725/99954). The age of the subunit, according to Parnes *et al.* (1985), is early Ladinian, lying 10 m above the beds containing *Gevanites awadi* Parnes (Fassanian) and 20 m below the beds with *Gevanites epigonus* Parnes and *G. cornutus* Parnes (early Longobardian).

Description: Shells small (Table 1), subpentagonal to pyriform in outline, inequivalve, but ranging from dorsibiconvex to ventribiconvex, anterior commissure mostly rectimarginate, but some valves are incipiently to slightly uniplicate; lateral commissure rectimarginate; umbo substantial, rounded, beak low, suberect to erect, beak ridges rounded, pedicle foramen small, permesothyrid, anterior half of shell costate with about 12–15 costae originating about half to two-thirds of the distance from umbo, sides rounded; surface with numerous, fine concentric growth lines that are eroded on even slightly worn shells.

Pedicle collar present within the first 13 mm of the ventral umbo. No cardinal process developed. Poorly defined peg-like teeth from the ventral valve are inserted into shallow sockets in the dorsal valve. Short, ventrally convex hinge-plates are supported by a low median septum, which persists to well over half the shell length, diminishing near the anterior commissure. Septalium wide and shallow, dental plates not preserved; distal ends of hinge

plates flatten and give rise to descending branches of the brachial loop which broaden to form laterally curving crural processes. A cross-section of the transverse band of the brachial loop was not obtainable.

Remarks: *Terebratula semiplicata* Klipstein (1843, pl. 15, fig. 3) from the Triassic Keuper Marls, St. Cassian, Tyrol, differs from *Menathyris wilsoni* gen. et sp. nov. in its lack of a sulcus (no sulcus on either valve), subelliptical outline, and six costae at the anterior commissure (3 large, 3 small). *Terebratula praemarginata* Klipstein (1843, pl. 15, fig. 6) also from the Triassic Keuper Marls, St. Cassian, Tyrol, differs in its lack of costae at the anterior commissure, erect beak, broad incipient sulcus, very weak, fine growth lines and semispherical general outline. *T. semiplicata* Klipstein is similar to *T. praemarginata* in that both shells are punctate, ventribiconvex and permesothyrid. *Zeilleria itoensis* (see Dubar, 1942, pl. II, figs. 1–8) from the Liassic of Morocco is similar in size (L, 11.9; W, 11.9; T, 10.7) and costation to *Menathyris wilsoni* gen. et sp. nov., but differs in its more biconvex and elongate shells.

Zeilleria sp. from the Lower Pliensbachian of Sterlange, France (NMNH 195551) is larger (L, 25.6; W, 18.7; T, 12.7) than *Menathyris wilsoni* gen. et sp. nov. subpentagonal in outline with sharply defined beak ridges and lacks costation. *Zeilleria* cf. *quadridrifa* Lamarck from the middle Lias of Somerset, United Kingdom (USNM 104824) is considerably larger than *Menathyris* gen. et sp. nov. (L, 28.0; W, 24.0; T, 14.0), has well defined beak ridges, a bilobate outline and lacks costation. *Zeilleria sarthacensis* d'Orbigny from the Hettangian of the United Kingdom (USNM 75593) differs from *Menathyris wilsoni* gen. et sp. nov. in its larger size (L, 18.6; W, 15.1; T, 14.5), well defined beak ridges, a slightly bilobate outline, a telate permesothyrid foramen, and lack of costation. *Somalitela* resembles *Menathyris wilsoni* gen. et sp. nov. in costation, but differs in size (L, 26.9; W, 25.1; T, 17.8), elongate-oval outline, flattened umbo and more angular beak ridges.

Shells of *Parathyridina semiarata* Dubar from the Jurassic (Lotharingian) of Jebel Anrhemour, southwest of Marrakech, Morocco (USNM Acc. 198144) are considerably larger and more globose than *Menathyris* gen. et sp. nov. (L, 26.2; W, 25.2; T, 19.4). One of the shells has 20–21 costae that originate about one-third of the distance from the beak. Two (uncataloged) specimens from the Jurassic (Bajocian) of the Sinai Peninsula, Egypt, have costae that originate half the distance from the beak, but are otherwise similar to the shells from Morocco. Both specimens of *Parathyridina* have a uniplicate anterior commissure with superimposed, alternating costation.

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