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A Late Coniacian Ammonite from the Lower Part of the Sayyarim Formation near Elat (Southern Israel)

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Abstract

The Coniacian ammonite genus *Metatissotia* was found in situ at Wadi Taba, eastern Sinai, Egypt (5 km southwest of Elat, Israel) 39 m above the base of the Sayyarim Formation, which contains *Dicarinella concavata concavata* (Brotzen) at its lower part. This formation overlies the Zihor Formation containing Late Coniacian ammonites at its top. The Coniacian–Santonian boundary is placed just above this *Metatissotia*, extending the range of *D. concavata concavata* in the Middle East down into the Late Coniacian (at least) as recorded from other regions of the Tethys.

Introduction

Two poorly-preserved, large ammonites (Fig. 1: 1 & 3), identified as *Metatissotia* sp. were found (by G. Honig) in a single layer within the upper part of the Sandstone Member of the Sayyarim Formation (Fig. 7) at Wadi Taba (eastern Sinai, Egypt), 5 km southwest of Elat (Israeli grid 1386/8815). Both specimens were embedded in a bioclastic (mainly oyster fragments) limestone containing a varying amount of quartz grains. Some parts of this limestone, as well as the internal whorls of the ammonites, are silicified. This slightly sandy limestone overlies a sandstone sequence and is overlain by an alternation of limestone, dolostone, marl, chert, porcellanite and phosphorite beds (Fig. 7). This latter variegated unit forms the top of the Sandstone Member, overlain by the Laminated Chert Member, above which lies the Second Chalk Member (Steinitz, 1974; partly emended and redrawn here as Fig. 7). The Sayyarim Formation overlies the Zihor Formation which contains Upper Coniacian ammonites at its top. No ammonites have hitherto been found in the lower part of the Sayyarim Formation; therefore, it was previously assumed to be of Santonian age (Bartov et al., 1972, fig. 7) as suggested by the presence of *Dicarinella concavata concavata* (Brotzen) and *D. concavata primitiva* Dalbiez in the First Chalk Member (identified by Prof. Z. Reiss, Hebrew University of Jerusalem; Fig. 7). Barr (1972) placed the boundary between the *D. concavata concavata*

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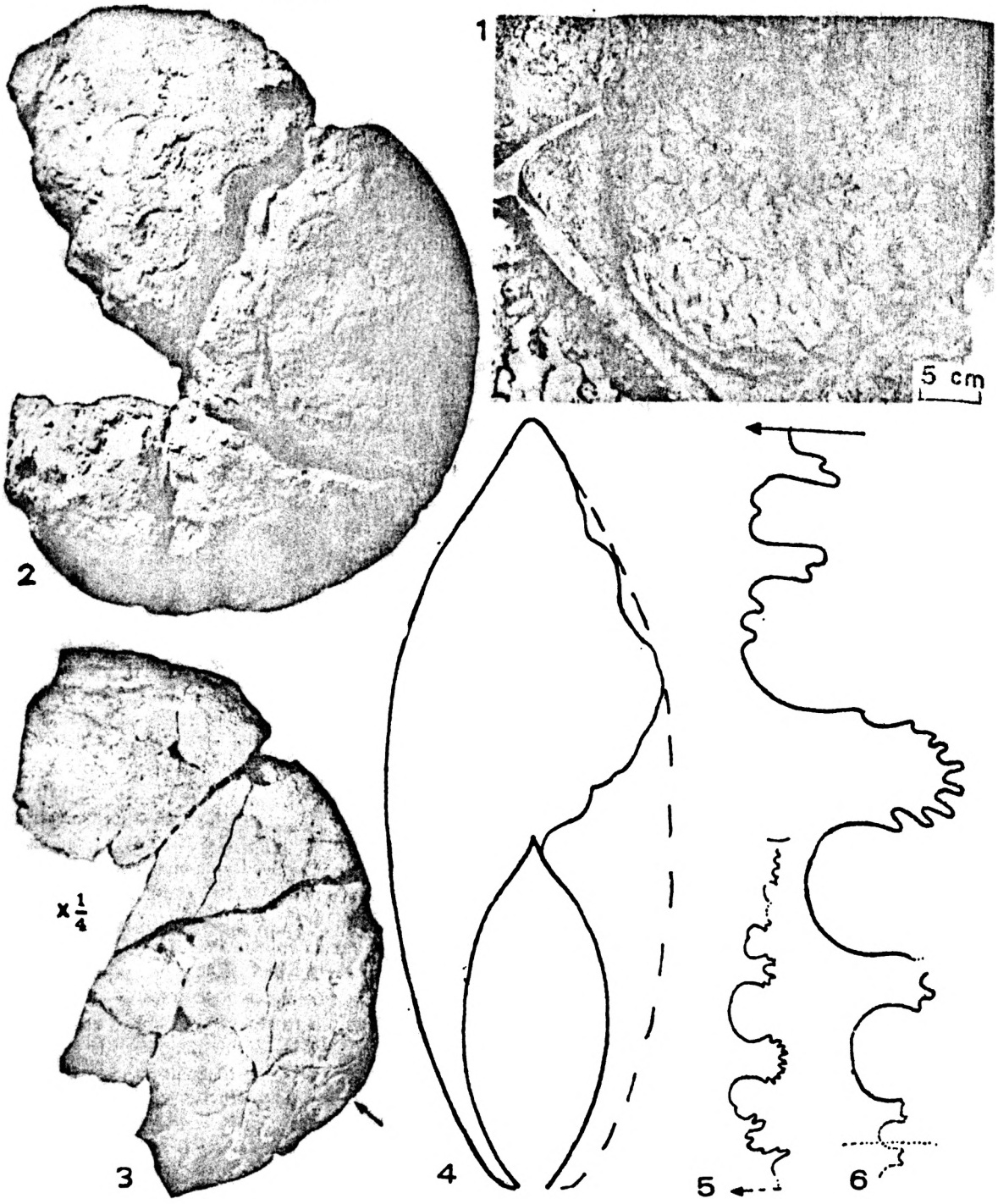

Figs. 1–6. *Metatissotia* sp., Late Coniacian, collected near Elat (southern Israel). 1. Large phragmocone (diam 31 cm) embedded in rock at Wadi Taba (E Sinai, Egypt, 5 km SW of Elat) from which fragment (3) was obtained. 2 & 5. Phragmocone (HU-33542; coll. Y. Eyal), X 1, found not in situ at Nahal Shehoret (8 km NW of Elat) showing lateral ribs and the sutures (see (5), X 1). 3. End of phragmocone and part of body-chamber (HU-35477) from Wadi Taba, X ¼ 4. Whorl section of the outer and the preceding inner volution, from fragment (3). 6. Suture line of specimen HU-35477, x 1.

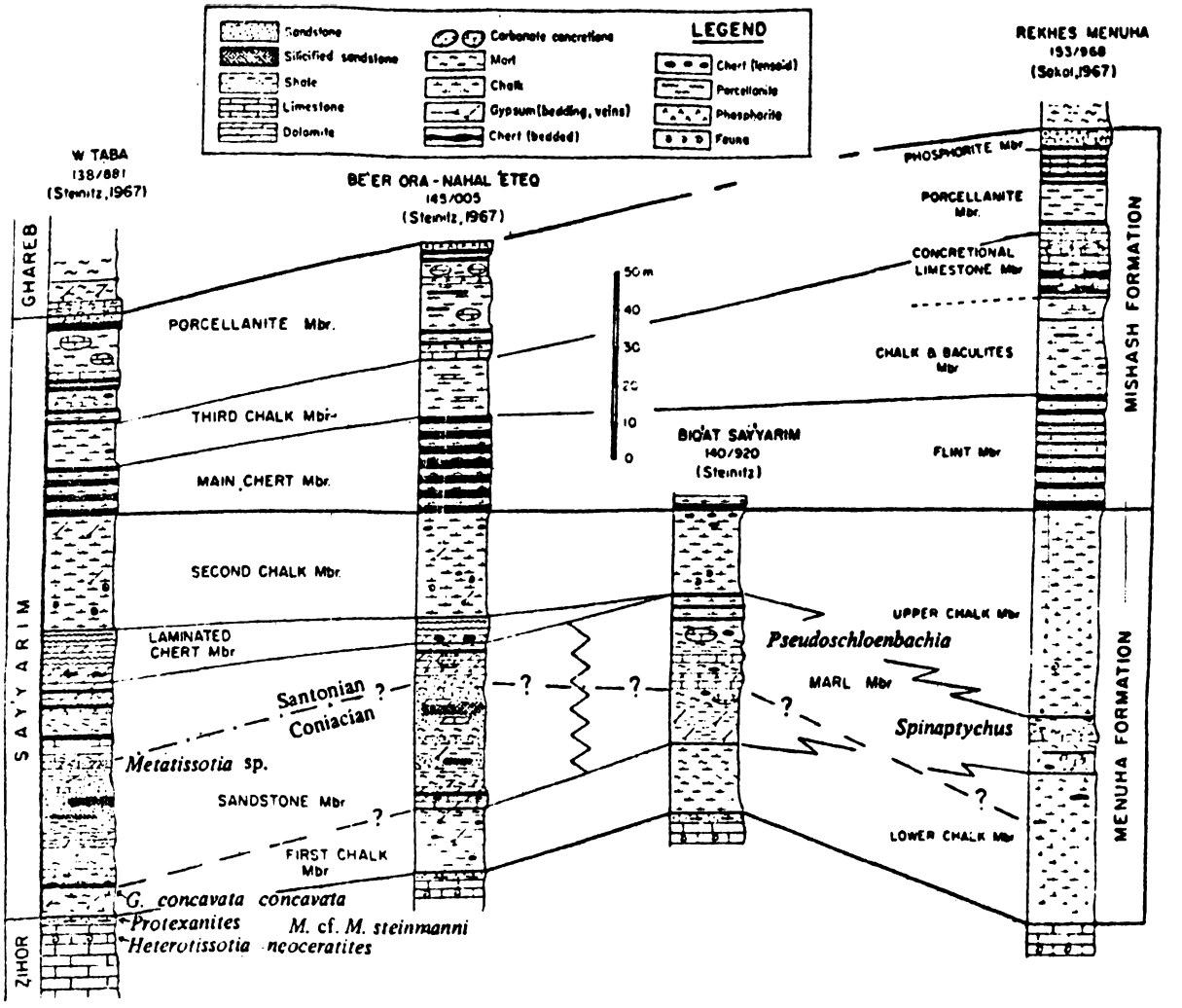

Fig. 7. Lithostratigraphic correlation of the members of the Sayyarim, Menuha and Mishash formations in southern Israel (no horizontal scale; emended from Steinitz, 1974). The Coniacian–Santonian boundary at Wadi Taba is tentatively traced to adjacent sections (dashed and pointed line), taking into consideration the weak biostratigraphic control there.

Zone and the *Globotruncanita elevata* Zone at the Coniacian–Santonian, and Sigal, 1977, at the Santonian–Campanian boundary. At present most authors, as represented by van Hinte (1976), insert it between the Lower and the Upper Santonian. This Santonian age was corroborated by the occurrence of imprints of *Pseudoschloenbachia* spp. on the external surface of large limestone concretions embedded in marl (found 36 km north of Elat at Biq'at Sayyarim; Fig. 7), lithostratigraphically probably correlative to the marls in the upper part of the Sandstone Member above the provenance of the *Metatissotia* (Fig. 7).

Since *Metatissotia* is regarded as a Coniacian genus its occurrence 39 m above the base of the Sayyarim Formation is of great significance for the local stratigraphy. Its position 32 m above *D. concavata concavata* adds evidence from the Middle East of the existence of this subspecies during the Coniacian as has been recorded from other places by, for example, de Klasz (1961), Donze et al. (1970) and Barr (1972). Therefore, all other occurrences of *D. concavata concavata* in the lower part of the Sayyarim, Menuha or En Zetim formations may also indicate a Late Coniacian age.

The Coniacian–Santonian Boundary

Picard et al. (1947) recorded macrofossils from the Upper Cretaceous section at Wadi Abu Had (Eastern Desert of Egypt; 28°2′ N, 32°24′ E; measured by E.J. Foley, III.1942). There, above limestone beds with the ammonite *Coilopoceras* of Late Turonian age follows a sequence of sandstone and clay with three layers containing Late Coniacian *Metatissotia*: at 51, 65 and 90 m above the base of the sandy unit (= Matulla Formation; see Lewy, 1975). At Wadi Sudr (west-central Sinai) two such *Metatissotia* levels have been observed (Lewy, 1975). At the top of the Zihor Formation in the Wadi Taba region (2 km northeast of Wadi Taba, at Nahal Rehav'am; Lewy, 1975) *Metatissotia* sp. cf. *M. steinmanni* Lissón and *Protexanites* spp. occur in a sandy-glauconitic chalk layer. It paraconformably overlies a layer of glauconitic, bioclastic limestone with *Heterotissotia neoceratites* Peron (Fig. 7). These two Upper Coniacian ammonite levels are overlain by the *Metatissotia* sp. described here (above the First Chalk Member at Wadi Taba), which forms the third Upper Coniacian ammonite level as at Wadi Abu Had.

Oysters with imprints of the Late Coniacian ammonite *Protexanites* were found in the lower part of the Menuha Formation (= First Chalk Member; Bartov et al., 1972) at Har Mapeq in southern Israel, at Tamad in central Sinai (Lewy, 1975, p. 31) and recently at Nahal Ya'alon (coll. A. Lifshitz, coord. 160/945, between Biq'at Sayyarim and Rekhes Menuha in southern Israel; Fig. 7), suggesting that the chalk facies of the Mount Scopus Group (above the Judea Group with the Zihor Formation at the top) started to accumulate in Late Coniacian times. Such a Late Coniacian age for the lower part of the chalk facies is now indicated by the occurrence of *Metatissotia* sp. at Taba. It enables us to date the lower part of the Sayyarim Formation as Late Coniacian and to suggest a new position for the Coniacian–Santonian boundary in this sequence just above this ammonite (Fig. 7). Thus the Coniacian sequence in southern Israel is more than doubled, from nearly 30 m (most of the Zihor Formation) to some 70 m.

The nearly 30 m thick sandy unit between the *D. concavata* bearing First Chalk Member and the *Metatissotia* in the Elat region decreases northward and disappears between Nahal Eteq and Biq'at Sayyarim, where it may be correlative to the lower part of the Marl Member (Fig. 7). Planktic foraminiferids attributed to the Early Santonian occur more to the north in the upper part of the Lower Chalk Member and accordingly the Coniacian–Santonian boundary was inserted within this chalk unit (Fig. 7). This boundary, as tentatively traced in Figure 7 throughout southern Israel, presents several problems which are still under study. The main one lies in the exclusively Coniacian age of *Metatissotia* which till now has not been recorded from any well-defined Santonian beds and, therefore, is assumed to characterize the Coniacian only.

Paleontological Description

Metatissotia sp.
Figs. 1–6

Description. Two partly damaged specimens were found not in situ near Elat by Y. Eyal (Ben Gurion University, Be'er Sheva). They have diameters of 10.5 cm (HU-33542) and 12.0 cm (HU-29515), a lenticular to lanceolate whorl section with rounded flanks and low rounded ribs which terminate at low, rounded (not clavate at least above the preserved diameter of 7 cm) ventrolateral tubercles (Fig. 2). These tubercles form a rounded ventrolateral shoulder followed ventrad by a high, fastigate and carinate venter. The suture line of specimen HU-33542 (Fig. 5) shows a divided external branch of the first lateral saddle, whereas specimen HU-29515 has an entire one.

Specimen HU-35477 was found in situ at Wadi Taba beside another large (diam 31 cm), very fragile, nearly complete phragmocone, which was left in the rock (Fig. 1) due to its fragmentary and corroded nature. The collected specimen is half a volution of a gerontic stage at a diameter of 29.5 cm (Fig. 3). It consists of the last part of the phragmocone (45°) and the body chamber (130°). The partly exposed inner whorl (Fig. 4) shows a lenticular whorl section with rounded flanks, low, rounded ribs and a fastigate-carinate venter. The last suture (Fig. 6) has a high first lateral saddle, relatively higher than in the young stage of the same specimen, as well as in one of the other two smaller specimens (Fig. 5).

Discussion. Specimen HU-33542 is partly silicified, as are the inner whorls of the large specimen HU-35477. The filling of the body chamber of specimen HU-29515 consists of bioclastic (oyster fragments) limestone with quartz grains, similar to the sediment in which specimen HU-35477 was found in situ. These lithological affinities corroborate the assumption that the two specimens found not in situ

originated from the same level as that of the specimens from Wadi Taba.

Our *Metatissotia* sp. is represented by adult and gerontic stages which resemble *M. ewaldi* (Buch) from Dieulefit (Drôme, France), illustrated by Buch (1850, pl. 6, figs. 6–7). This latter specimen has a lenticular shape with rounded flanks gradually converging towards the keeled venter. A faint ventrolateral rounded shoulder is formed by the termination of the lateral low ribs in weak, clavate tubercles. *M. robini* (Thiollière, 1848) (from the same locality and stratigraphic level), which is regarded as a junior synonym of *M. ewaldi* (Buch, 1847) (see Eck, 1914; Reyment, 1958), lacks any ornament except for a ventrolateral, angular, continuous shoulder. *M. ewaldi* (including *M. robini*), described after 1850 from Dieulefit or from a similar level in that vicinity, as well as from elsewhere in France, Austria and Spain (e.g. Grossouvre, 1894; Martinez, 1982; Reyment, 1958; Sénesse, 1937; Wiedmann & Kauffman, 1978; Wiedmann, 1979) are characterized by a rather pronounced row of ventrolateral clavate tubercles which separate the fastigate venter from the weakly rounded flanks. Grossouvre (1894, p. 41) and Sénesse (1937, p. 35, pl. 10, fig. 2; pl. 11, fig. 3) observed the great variability in the intensity of the ribbing and the tuberculation which affected the general shape of the conchs, although Reyment (1958, p. 38) assumed that post-burial deformation may have flattened the flanks of his specimens. Eck (1914) and Douvillé (1928) recorded this species from Egypt, but without any illustrations. Only a suture line was drawn by Douvillé (1928, fig. 22) belonging to a corroded specimen from a limestone bed of assumed Campanian age (ibid., p. 33).

Although our specimens resemble the original *ewaldi* of Buch (1850) they differ from the present-day concept of this species. The stratigraphic position of the specimens from Wadi Taba is much younger than the Middle Coniacian age attributed to *M. ewaldi* in Europe. Additional better-preserved specimens comprising the early ontogenetic stages are needed for the specific identification of this *Metatissotia*.

Age. Metatissotia sp. occurs high above the early Late Coniacian *Heterotissotia neoceratites* Peron and the Late Coniacian *Metatissotia* sp. cf. *M. steinmanni* Lissón and *Protexanites* sp. (Lewy, 1975) and is therefore attributed to the latest Coniacian.

Material and Occurrence. Specimen HU-33542 is from Nahal Shehoret and HU-29515 from near Wadi Taba (both found not in situ near Elat by Y. Eyal, Ben Gurion University, Be'er Sheva). HU-35477 was collected by G. Honig at Wadi Taba, eastern Sinai, Egypt (Israeli grid 1386/8815), 39 m above the base of the Sayyarim Formation. All specimens are deposited in the collections of the Hebrew University of Jerusalem.

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