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Fast Track Article

Late Jurassic (Oxfordian, Bifurcatus and Bimammatum zones) ammonites from the eastern Alborz Mountains, Iran; second part

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With 6 figures

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Abstract: This study describes an ammonite assemblage from a section of the Lar Formation at Golbini (N Jajarm, eastern Alborz Mountains, Iran). Twelve taxa from the families Phylloceratidae, Oppeliidae, Glochiceratidae, Aspidoceratidae, Perisphinctidae and Aulacostephanidae have been identified. The fauna is assigned to the Late Oxfordian Bifurcatus and Bimammatum zones. With regard to palaeobiogeography, the ammonite fauna from Golbini is closely related to those from the northern Mediterranean Province (Submediterranean Province), while Boreal elements (Cardioceratidae) are generally extremely rare in the study area and in North Iran.

Key words: ammonites, Late Jurassic, Oxfordian, Lar Formation, Alborz Mountains, Iran.

1. Introduction

The present paper is a continuance of a previous study by SEYED-EMAMI & SCHAIRER (2010). The ammonites have been collected from the same site, section, and formation, i.e. the Lar Formation at Golbini north of Jajarm (Figs. 1, 3) as those for the previous paper, but stem from a part of the section just below the beds with *Epipeltoceras bimammatum*.

In the eastern Alborz Mountains, the Upper Jurassic Lar Formation follows continuously on the Middle Jurassic marls and limestones of the Dalichai Formation and is overlain discontinuously by the red siliciclastics (siltstones, sandstones, and conglomerates) of the Lower Cretaceous Shurijeh Formation (Figs. 2-3). The Lar Formation has a thickness of approximately 500 meters and is predominantly composed of light-grey to cream and occasionally pink, medium to thick-bedded and dense limestones with marl intercalations in the lower part. Generally, a lower, softer member, consisting of thin- to medium-bedded limestones with marly intercalations and an upper member of thick-bedded and cliff-forming limestone can be distinguished. The Lar Formation is part of an extensive carbonate platform that was established in major parts of the Alborz and Koppeh Dagh ranges during the Late Jurassic. Previous studies on the sedimentology, stratigraphy, and Oxfordian ammonite faunas of the Lar Formation are discussed in detail by SEYED-EMAMI & SCHAIRER (2010).

2. Material

The studied ammonite fauna was collected from a some 2-3 meters thick portion of the lower part of the Lar Formation that is positioned a few meters below those beds containing *Epipeltoceras bimammatum* (Fig. 3).The studied section is located in a north-south directed valley north of Golbini, at the southern slope of the Reshteh-e-Zirkamar mountain range (Kuh-e-Kurkhud Quadrangle), ca. 16 km northeast of the small town of Jajarm (N 37° 05' 13", E 56° 44' 41"). According to MAJIDIFARD (2003), the Lar Formation at this locality has a thickness of 414 m, ranging from the Oxfordian to the Tithonian. However,

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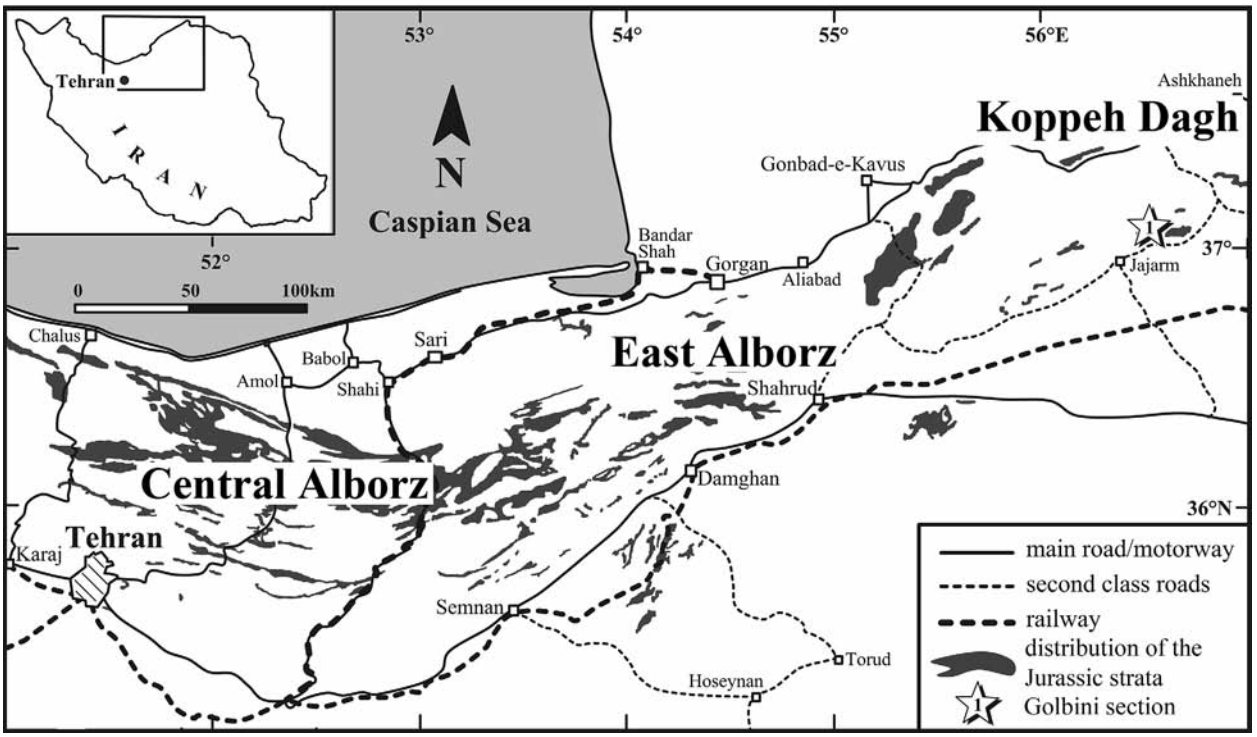

Fig. 1. Geographic sketch map of North Iran (Alborz and Koppeh Dagh Mountain Ranges). The study section at Golbini, north of Jajarm is indicated by [1].

according to our subdivision, the Lar Formation has a thickness of ca. 500 m at the studied section (Fig. 3).

3. Systematic palaeontology

As far as permitted by the preservation of the specimens, measurements of the following parameters are given: diameter (D) in mm; umbilical width (U), whorl height (H), whorl width (W), all in % of diameter; numbers of primary ribs per whorl (PR) and secondary ribs (SR) per 10 primary ribs. [M] = macroconch; [m] = microconch.

The herein studied ammonite fauna is deposited provisionally in the collections of the Bayerische Staatssammlung für Paläontologie und Geologie (BSPG) in Munich, Germany.

Order Ammonoidea Zittel, 1884
Suborder Phylloceratina Arkell, 1950
Family Phylloceratidae Zittel, 1884
Genus *Sowerbyceras* Parona & Bonarelli, 1895

Sowerbyceras tortisulcatum (d'Orbigny, 1841)
Fig. 4 A, B

2010 *Sowerbyceras tortisulcatum* (d'Orbigny, 1841). – Seyed-Emami & Schairer, p. 271, fig. 6a, b (with synonymy therein).

Material: Four compressed and incomplete specimens: Gol. 34-37.

Dimensions:	D	U	H	W
Gol. 34	58	26	46	27

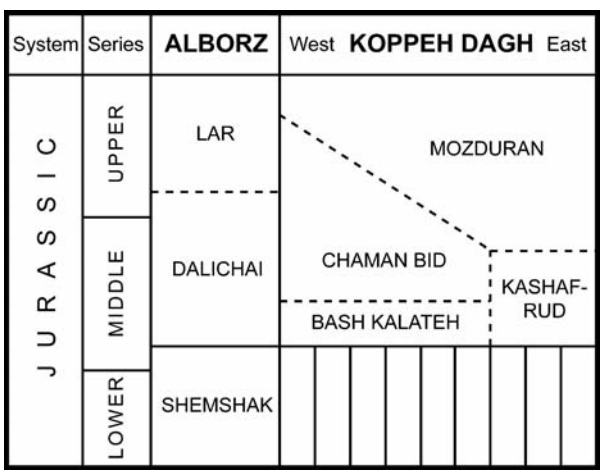

Fig. 2. Lithostratigraphic units (formations) of the Jurassic System in the Alborz and Koppeh Dagh basins.

Description: Gol. 34 is a fairly well-preserved specimen with a total diameter of ~ 60 mm. The body chamber, which is rectangular to high-ovate in cross-section, starts at a diameter of 40 mm. The entire phragmocone is rather compressed. Five constrictions that become flared on the venter are present on the last whorl. For further details and discussion see SEYED-EMAMI & SCHAIRER (2010).

Suborder Ammonitina HYATT, 1889
Family Oppeliidae BONARELLI, 1894
Subfamilly Taramelliceratinae SPATH, 1928
Genus *Taramelliceras* DEL CAMPANA, 1904
Subgenus *Taramelliceras* DEL CAMPANA, 1904

Taramelliceras (*Taramelliceras*) aff. *costatum* (QUENSTEDT, 1849)
Fig. 4 J, K

non 2003 *Taramelliceras* (*Taramelliceras*) aff. *costatum* (QUENSTEDT, 1849). – MAJIDIFARD, p. 93, pl. 3, figs. 7-8.
aff. 2010 *Taramelliceras* (*Taramelliceras*) *costatum* (QUENSTEDT, 1849). – SEYED-EMAMI & SCHAIRER, p. 271, fig. 6c, d (with synonymy therein).

Material: Three specimens: Gol. 46 is strongly compressed; Gol. 47/48 and Gol. 53 are silicon casts.

Dimensions:	D	U	H	W
Gol. 47/48 [M]	82	ca. 8	ca. 58	ca. 25

Description: The figured specimen (Gol. 47/48) is a slightly compressed but nearly complete *Taramelliceras* showing the body chamber (about half of the diameter) and the beginning of the peristome with a diameter of about 85 mm. It is involute with high-ovate whorls in cross section. The greatest width is at about the mid-flank, from where the whorl flanks slope rather steeply towards the umbilicus and less steeply towards the venter. The ribbing pattern is falcate, moderately coarse, and densely spaced. The primary ribs end near to the mid-flank into rather faint nodes and bifurcate. Usually there is one intercalated rib, beginning at about the mid-flank. Ventrolaterally, there are relatively strong, wide-spaced and irregular clavate nodes. Ventrally there are less coarse but rather densely spaced clavi.

Discussion: Specimen Gol. 47/48 (Fig. 4J, K) is distinguished from *T. costatum* by its smaller whorl width and especially by its less coarse ornamentation. Particularly, the ventral clavi are much finer and more densely spaced. On one hand, the ribbing pattern shows similarities to some specimens of *T. costatum*, figured by HÖLDER (1955, pl. 17, fig. 10; pl. 18, fig. 17). On the other hand, the pattern of rather fine and densely spaced clavi resembles that seen in *Streblites externodosum*. The latter, however, has slightly coarser and less numerous ribs on the outer part of the flank. Specimens Gol. 46 and Gol. 53 have a finer ribbing, but much coarser ventrolateral and ventral clavi.

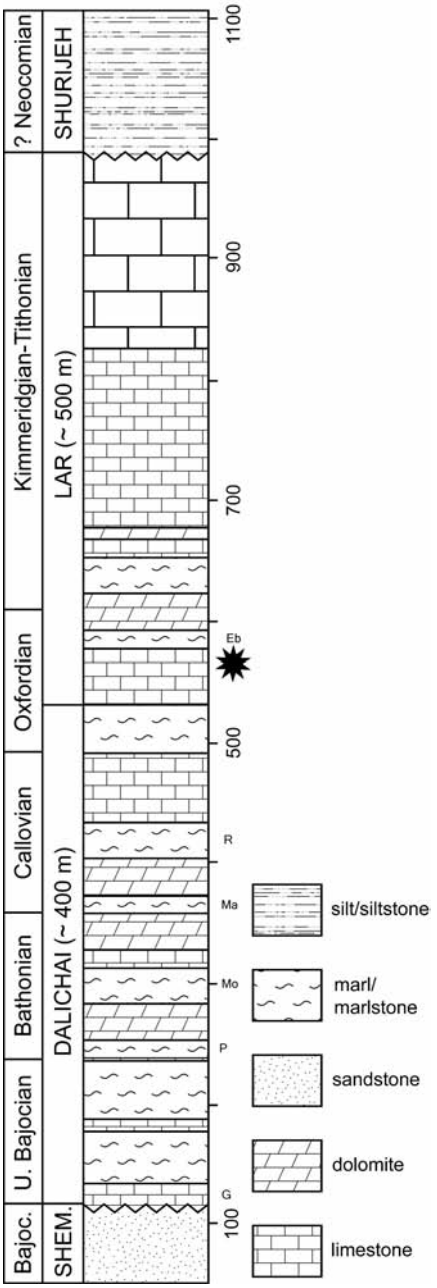

Fig. 3. Idealized stratigraphic log of the Lar Formation at Golbini; modified after MAJIDIFARD (2003). Eb = *Epipeltoceras bimammatum*, G = *Garantiana*, P = *Parkinsonia*, Mo = *Morphoceras*, Ma = *Macrocephalites*, R = *Reineckeia*. The sampling horizon of the described ammonites is indicated by an asterisk.

Age: *Taramelliceras costatum* is usually recorded from the Bimammatum Zone (HÖLDER 1955: 95; SCHLEGELMILCH 1994: 35).

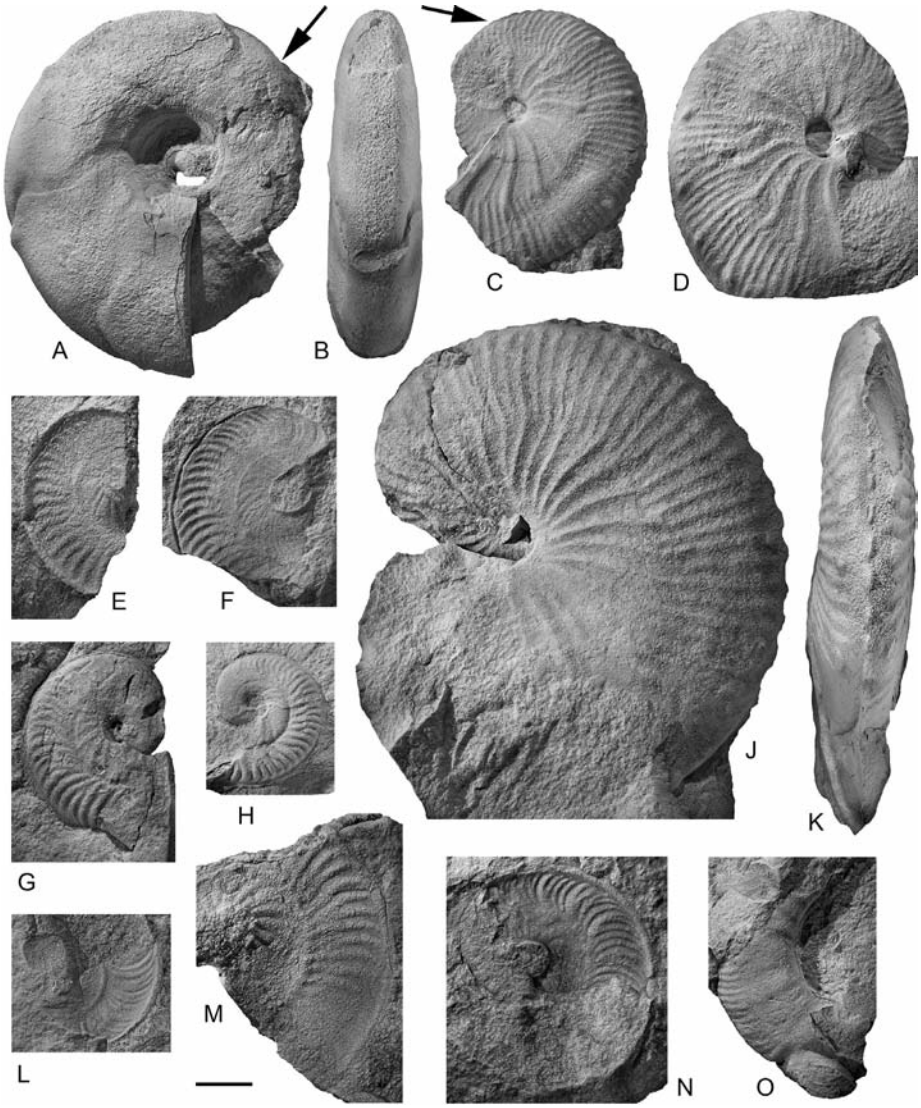

Fig. 4. A-B – *Sowerbyceras tortisulcatum* (D'ORBIGNY, 1841), Gol. 34. **C** – *Streblites externnodosum* (DORN, 1931), Gol. 50. **D** – *Streblites externnodosum* (DORN, 1931), Gol. 49. **E-H, M** – *Ochetoceras (Ochetoceras)* cf. *marantianum* (D'ORBIGNY, 1847). E: Gol. 44; F: Gol. 43; G: Gol. 38a; H: Gol. 39; M: Gol. 45. **J, K** – *Taramelliceras* (*Taramelliceras*) aff. *costatum* (QUENSTEDT, 1849), Gol. 47/48. **L** – *Ochetoceras (Ochetoceras) semifalcatum* (OPPEL, 1863), Gol. 38b. **N** – *Ochetoceras (Ochetoceras) semifalcatum* (OPPEL, 1863), Gol. 41. **O** – *Rasenioides* sp., Gol. 60. All figures in natural size; scale bar = 1 cm; all specimens coated with NH_4Cl.

Subfamily Streblitinae SPATH, 1925
Genus *Streblites* HYATT, 1900

Streblites externnodosus (DORN, 1931)
Fig. 4 C, D

*1931 *Neumayriceras externnodosum* n. sp. – DORN, p. 49, pl. 29, figs. 2, 8, 11-12.
1931 *Neumayriceras callicerum* OPPEL. – DORN, p. 44, pl. 27, figs. 4-10; pl. 28, fig. 2a, 2b.
1955 *Taramelliceras (Strebliticeras) externnodosum* (DORN). – HÖLDER, p. 91, figs. 3/51-55).
1994 *Streblites externnodosus* (DORN 1931) – SCHLEGELMILCH, p. 42, pl. 12, fig. 11.
1998 *Taramelliceras (Strebliticeras) externnodosum* (DORN). – SEYED-EMAMI et al., p. 102, pl. 1, fig. 3.
2003 *Taramelliceras* (?) *externnodosum* (DORN) [M]. – SCHAIRER & SCHLAMPP, p. 19, pl. 1, figs. 7, 10-11.
2009 *Taramelliceras* (*Taramelliceras*) *externnodosum* [M] (Dorn, 1931) – QUEREILHAC, p. 28, pl. 18, figs.1-6 (including a list of synonyms).

Material: Four more or less compressed specimens: Gol. 49-52.

Dimensions:	D	U	H	W
Gol. 49	47	ca. 11	ca. 59	ca. 22 (compressed)
Gol. 50	40	ca. 10	60	ca. 23 (compressed)
Gol. 51	51	11	53	-

Description: Involute Oppeliidae with a rather sharp and slightly overhanging umbilical margin and vertical umbilical wall. The greatest whorl width is at about the mid-flank, from where the flank slopes gently towards the umbilicus and the venter. Although all specimens are compressed it seems that they generally were relatively slim, with a high-ovate, rather discoid whorl cross section. The ribs are biconcave, with distant and relatively strong inner ribs ending at distinct nodes at around the mid-flank, from where they bifurcate. The main ribs, as a continuation of the inner ribs, are stronger and end at distinct ventrolateral nodes. Usually three or four intercalate ribs occur between the main ribs, beginning above the mid-flank. Towards the inner ribs the external ribs are much finer and more densly spaced. At a diameter of 47 mm (Gol. 49) there are about 8 inner ribs and 36 extern ribs on the half of a whorl (ratio ca. 1: 4.5). Ventrally there are dense and fine to very fine (Gol. 49) clavate nodes that look like crenulations.

Discussion: Our specimens show a slightly finer ribbing than the lectotype of *Streblites externnodosus* (Dorn 1931, pl. 29, fig. 8: *Neumayriceras externnodosum*), but correspond well with another specimen figured by Dorn (1931, pl. 37, fig. 7: *Neumayriceras callicerum*). According to Hölder (1955: 91: *Taramelliceras (Strebliticeras) externnodosum* (Dorn)) the latter specimen is synonymous to *Streblites externnodosus*. However, the holotype of *N. callicerum* (= *Ammonites callicerum* Oppel, 1863, figured by Hölder (1955, pl. 16, fig. 5) under the name *Neumayriceras callicerum*) shows a somewhat coarser ribbing pattern. According to Schweigert & Callomon (1997: 13) the subgenus *Strebliticeras* is synonymous to the genus *Streblites* Hyatt, and consequently *Taramelliceras (Strebliticeras) externnodosum* is considered as an early form of *Streblite*s. Schairer & Schlampp (2003: 19) did not agree with this assignment and placed this species into the genus *Taramelliceras* (?). However, the rather slim and discoid shape of this species may rather indicate an assignment to the genus *Streblites*.

Age: Dorn (1931: 49) recorded *Streblites externnodosum* from the Hypselum Zone. Hölder (1955: 93) noted that this species may occur in the entire Bimammatum Zone. Later on, *S. externnodosum* was reported from the Semimammatum Horizon (Hypselum Subzone) (Schweigert & Callomon 1997: 36), the Grossouvrei and Semimammatum subzones (Cariou et al. 1997: 84-85, tab. 10), and the Berrense and Semimammatum subzones (Hypselum Subzone) (Quereilhac 2009). At Golbini *S. externnodosum* was found below the beds with *Epipeltoceras bimammatum*.

Family Glochiceratidae Hyatt, 1900
Subfamily Glochiceratinae Hyatt, 1900
Genus *Ochetoceras* Haug, 1885

Ochetoceras cf. *marantianum* (d'Orbigny, 1847) [M]
Fig. 4E-H, M

cf. 2010 *Ochetoceras marantianum* (d'Orbigny, 1850). – Seyed-Emami & Schairer, p. 273, fig. 6g (with synonymy therein).

Material: Seven small and incomplete specimens: Gol. 38a, Gol. 39, Gol. 40 and Gol. 42-45.

Dimensions:	D	U	H	W
Gol. 39	23	-	-	-
Gol. 38a	28	ca. 14	ca. 53	-

Description: The specimens Gol. 38a (Fig. 4G) and Gol. 39 (Fig. 4H) are small, one-side preserved internal moulds. They are involute with a high ovate whorl cross section and a high, distinct keel. Whether this keel is crenulated or not, cannot be evaluated due to the preservation of the specimens. The greatest whorl thickness is at the lateral groove, just below the mid-flank. From here the flanks slope gently towards umbilicus and venter. The ribbing on the inner part of the flank consists of rather distant, faint and strongly prorsiradiate inner ribs, ending at a distinct lateral groove. The outer ribs are slightly coarser, more numerous and strongly concave-rursiradiate. Frequently these outer ribs bifurcate at indistinct, radial elongated nodes right above the median groove.

Discussion: The specimens from Golbini are distinguished from the closely related *O. canaliculatum* by the strongly rursiradiate outer ribbing pattern and frequent bifurcation of the outer ribs. Certain morphotypes of *O. canaliculatum* figured by Dorn (1931), in particular pl. 31, fig. 5, which is assigned to *O. hispidiforme* by Höroldt (1964: 65), are highly similar to the specimens from Golbini. However, the specimens from Golbini are distinguished from *O. hispidiforme* (Fontannes, 1879) by the strongly rursiradiate outer ribbing and from *O. hispidum* (Oppel, 1863) by distinctly less coarse ribbing. From another similar species, *O. bassae* Fradin, 1947, the specimens from Iran differ in slightly coarser ribbing pattern. All in all, the specimens from Golbini appear more or less intermediate between the quite similar species *O. marantianum*, *O. canaliculatum*, *O. hispidiforme*, and *O. bassae*.

Age: *O. marantianum* was previously recorded from the Bimammatum Zone (Cariou 1997; Schweigert & Callomon 1997).

Ochetoceras semifalcatum (Oppel, 1863)
Fig. 4L, N

*1863 *Ammonites semifalcatum* Oppel. – Oppel, p. 194, pl. 52, fig. 6a, b.

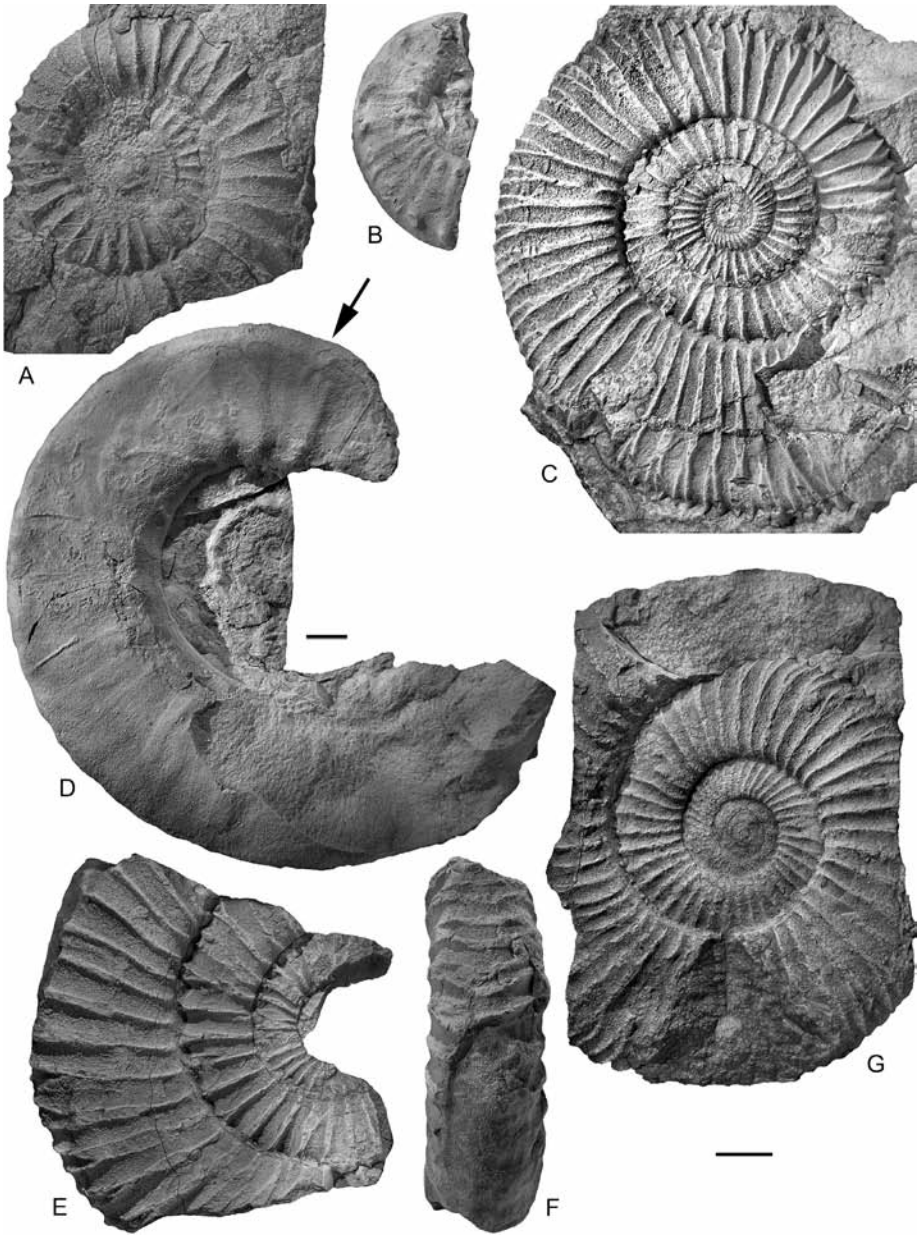

Fig. 5. A – *Microbiplices microbiplex* (Quenstedt, 1887); Gol. 58. **B** – *Euaspidoceras* sp.; Gol. 57. **C** – *Dichotomoceras* sp.; Gol. 55. **D** – ?*Pachypictonia* sp.; Gol. 59. **E-F** – *Dichotomoceras crassum* Enay, 1960; Gol. 56. **G** – *Dichotomoceras bifurcatoides* Enay, 1960; Gol. 54. All figures except 5D in natural size; scale bars = 1 cm; all specimens coated with NH_4Cl.

1931 *Ochetoceras semifalcatum* Oppel. – Dorn, p. 61, pl. 32, figs. 4, 10, 14; pl. 33, figs. 1, 7.
1964 *Ochetoceras* (*Ochetoceras*) *semifalcatum* (Oppel). – Höroldt, p. 63, pl. 3, figs. 8-9.
? 1970 *Ochetoceras canaliculatum* (v. Buch, 1831). – Fantini Sestini & Assereto, p. 212, pl. 19, fig. 3.
1994 *O.* (*O.*) *semifalcatum* (Opp. 1863). – Schlegelmilch, p. 48, pl. 14, fig. 11.
? 2003 *Ochetoceras semifalcatum* (d'Orbigny, 1850). – Majidifard, p. 90, pl. 3, figs. 1, 3.

Material: Two incomplete external moulds (silicon casts): Gol. 38b and Gol. 41.

Description: Relatively involute and discoid *Ochetoceras* with a distinct umbilical margin and a high (serrate?) keel. The greatest whorl thickness is at the relatively shallow median furrow, about the inner third of the flank. The inner flank of Gol. 38b is apparently smooth; however on the inner flank of Gol. 41 very faint, distant and slightly concave prorsiradiate ribs can be recognized. The outer

ribs are concave rursiradiate, rather fine and densely spaced. They bifurcate irregularly on the outer third of the flank or alternate with weaker intercalate ribs.

Discussion: *O. semifalcatum* can be easily recognized by its week umbilical ribbing and the fine, dense, and irregularly bifurcating marginal ribs.

Age: *O. semifalcatum* has apparently a wide stratigraphic range from the Bifurcatus to Planula zones (HÖROLDT 1964: 64; SCHLEGELMILCH 1994: 48). Specimen Gol. 38b and one specimen of *Ochetoceras* cf. *marantianum* are found on a single rock sample and may likely be assigned to the Bifurcatus Zone.

Family Aspidoceratidae ZITTEL, 1895
Subfamily Euaspidoceratinae SPATH, 1931
Genus *Euaspidoceras* SPATH, 1931

Euaspidoceras sp.
Fig. 5B

Material: A single fragmentary and compressed specimen: Gol. 57.

Description: Gol. 57 is a fragmentary but still septate *Euaspidoceras* with a diameter of ca 40 mm. It is relatively evolute with a high rectangular whorl cross section. The ribs are rectiradiate, rather dense with umbilical and slightly stronger ventrolateral tubercles. Few ribs are fibulate. The venter is slightly rounded and nearly smooth. Only few ribs cross indistinctly the venter.

Discussion: Due to the fragmentary nature of the specimen a specific identification is impossible. However, the ribbing pattern and rectangular cross section are similar to those seen in *Euaspidoceras rotari* (OPPEL, 1863) figured in SCHLEGELMILCH (1994, pl. 66, fig. 1).

Family Perisphinctidae STEINMANN, 1890
Genus *Dichotomoceras* BUCKMAN, 1919

Dichotomoceras bifurcatoides ENAY, 1966
Fig. 5G

*1966 *Perisphinctes (Dichotomoceras) bifurcatoides* n. sp. – ENAY, p. 509, pl. 34, figs. 1-4, textfigs. 155-2, 157.
1988 *Perisphinctes (Dichotomoceras) bifurcatoides* ENAY, 1966. – SCHAIRER, p. 41, fig. 1.
1989 *Perisphinctes (Dichotomoceras) bifurcatoides* ENAY, 1966. – SCHAIRER, p. 117, pl. 3, fig. 5.
1994 *Perisphinctes (Dichotomoceras) bifurcatoides* ENAY 1966. – SCHLEGELMILCH, p. 197, pl. 20, fig. 5.
1995 *Dichotomoceras* cf. *bifurcatoides* ENAY. – BRANGER et al., p. 124, pl. 21, fig. 2.
cf. 2003 *Perisphinctes (Dichotomoceras)* cf. *bifurcatoides* ENAY, 1966. – MAJIDIFARD, p. 149, pl. 15, pl. 8.

Material: A single incomplete and slightly compressed specimen: Gol. 54.

Dimensions:	D	U	H	W	PR
Gol. 54	85	38	32	-	40

Description: The specimen seems to be fully septate, with a maximal diameter of about 90 mm. It is moderately evolute. The ribbing is biplicate, with rectiradiate umbilical and prorsiradiate secondary ribs.

Discussion: The umbilical width of our specimen is slightly less than that seen in the specimens figured and those listed as synonyms by ENAY (1966, pl. 34, figs. 1-4). Furthermore the ribbing pattern is slightly coarser than those observed in the specimens of ENAY (1966), but is still within the variability of the species.

Age: According to BRANGER et al. (1995: 46, tab. 4), *Dichotomoceras bifurcatoides* occurs in the Late Oxfordian Stenocycloides Zone (Stenocycloides Subzone), which corresponds to the lower part of the Bifurcatus Zone (Bifurcatoides Horizon) (ENAY 1966: 274; CARIOU et al. 1997: 84, tab. 10).

Dichotomoceras crassum ENAY, 1966
Fig. 5E-F

*1966 *Perisphinctes (Dichotomoceras) crassus* n. sp. – ENAY, p. 507, pl. 33, fig. 8; pl. 34, fig. 5; text-fig. 154.
1988 *Perisphinctes (Dichotomoceras) crassus* ENAY, 1966. – SCHAIRER, p. 43, pl. 2, fig. 5.
1994 *Perisphinctes (Dichotomoceras) crassus* ENAY 1966. – SCHLEGELMILCH, p. 174, pl. 20, fig. 4.
2001 *Perisphinctes* (*Dichotomoceras*) *crassus* ENAY. – ENAY & GYGI, p. 460, pl. 2, figs. 5-11, pl. 3, figs. 1-3.

Material: A single incomplete specimen Gol. 56.

Description: Gol. 56 is an incomplete specimen with four whorls preserved. It is involute with coarse, biplicate ribbing pattern and broad whorls. The umbilical ribs are almost rectiradiate, while the secondary ribs are slightly prorsiradiate. The ribbing pattern largely corresponds to that seen in the holotype, but particularly on the inner whorls it is somewhat more closely spaced. Similarly, the specimen figured by BRANGER et al. (1995, pl. 17, fig. 4; pl. 20, fig. 3) shows a slightly denser ribbing pattern than the holotype of ENAY (1966). Likewise, the specimen from Golbini is somewhat coarser ribbed than *D. crassum* figured by ENAY & GYGI (2001: pl. 2, figs. 5, 10).

Age: According to BRANGER et al. (1995: 46, tab. 4), *Dichotomoceras crassus* occurs in the Late Oxfordian Stenocycloides Zone (Stenocycloides/Grossouvrei subzones), which is correspondent to the Bifurcatus Zone (CARIOU et al. 1997: 84, tab. 10).

Dichotomoceras sp.
Fig. 5C

Material: A single almost complete, slightly compressed specimen: Gol. 55.

Dimensions:	D	U	H	W	PR	SR
Gol. 55	85	42	34	-	45	2.0
—	64	47	34	-	43	2.0

Description: Specimen Gol. 55 has a diameter of approximately 85 mm. The inner whorls are relatively evolute, but the outer ¾ of the last whorl become slightly less evolute. The ribbing pattern is rather dense, with rectiradiate, biplicate primary ribs. The secondary ribs are slightly proverse and inclined towards the primary ribs.

Discussion: With regard to the density of ribbing the specimen from Golbini resembles *Dichotomoceras bifurcatoides* Enay (1966). As a whole, the ribbing pattern is rather similar to that observed in *Dichotomoceras crassus* Enay (1966). However, the specimen from Golbini is distinguished from this and other known species of *Dichotomoceras* by a significantly wider umbilicus.

Family Aulacostephanidae Spath, 1924
Subfamily Pictoniinae Spath, 1924
Genus *Microbiplices* Arkell, 1936

Microbiplices microbiplex (Quenstedt, 1887).
Fig. 5A

1887 *Ammonites microbiplex* – Quenstedt, p. 876, pl. 94, fig. 36.
2003 *Microbiplices microbiplex* (Quenstedt) [m] – Schairer & Schlampp, p. 20, pl. 2, figs. 7-8.

Material: A single incomplete and slightly compressed specimen with only one side preserved: Gol. 58.

Dimensions:	D	U	H	W
Gol. 58	55	48	33	17

Description: Evolute form with rather coarse, sharp and wide-standing ribs. The ribbing is widely rectiradiate, biplicate. The bifurcation point is at about the outer quarter of the flank. On the extern side a few of the secondary ribs project slightly forward, while a major part of them crosses the venter without flexure.

Discussion: The rather slight projection of only a few secondary ribs on the venter seen in this specimen and the absence of a lateral bend at the bifurcation point of the secondary ribs, which is typical for *Dichotomoceras* (Enay & Gygi 2001), argues against assignment to the latter genus.

Age: *M. microbiplex* is reported from the early Late Oxfordian Bifurcatus Zone (Stenocycloides Subzone) (Branger et al. 1995: 46) and Bimammatum Zone (Hypselum Subzone, *Semimammatum* Horizon) (Schweigert & Callomon 1997: 36; Schairer & Schlampp 2003).

Genus *Rasenioides* Schindewolf, 1925 [m]

Rasenioides sp.
Fig. 4O

Material: A single fragment of the ultimate part of the body chamber preserving the complete apophysis: Gol. 60.

Description: The rather small and evolute specimen has the complete peristome with lappet. The lappet is narrow, deep and long. Behind the lappet there is a deep constriction, ventrally bending slightly forward. The ribbing on the preserved small segment of the body whorl consists of strong and stump umbilical ribs splitting, little above the mid-flank, into four to six secondary ribs.

Discussion: The absence of a backward flexure of the primary and secondary ribs and the presence of up to six secondary ribs prevents from an assignment of this specimen to *Mirosphinctes*. In contrast to the species of *Rasenioides* figured by Geyer (1961) and Schlegelmilch (1994), the specimen from Golbini is characterised by a significantly wider umbilicus and a coarser ribbing. Additionally, the dividing point of the ribs is somewhat higher up on the flank.

Genus *Pachypictonia* Schneid, 1940

?*Pachypictonia* sp.
Fig. 5D

Material: A single compressed and fragmentary specimen: Gol. 59.

Dimensions:	D	U	H	W
Gol. 59	124	42	36	-

Description: The poorly preserved specimen has a maximal diameter of ca 135 mm and encompasses a small portion of the phragmocone and ca. ¾ of the body whorl. The ribbing on the body whorl consists of broad, stump and slightly concave-prorsiradiate primary ribs, which divide above the mid-flank into two or three secondary ribs and cross the venter without interruption. On the small visible portion of the inner whorl there are relatively fine, dense, straight and slightly prorsiradiate ribs.

Discussion: In spite of the stump ribbing and the wide umbilicus our specimen shows similarities to *Pachypictonia* sp. in Schairer & Schlampp (2003: 26, pl. 3, fig. 5), but it differs evidently in the smaller end-size. However, the presence of bi- and trifurcated ribs that persist on the venter, several constrictions on the body chamber, and the absence of nodes argue against placing this specimen in *Euaspidoceras* or *Clambites*.

	SCHWEIGERT et al. 1997		CARIOU et al. 1997; QUEREILHAC 2009	
	zone	subzone	zone	subzone
UPPER OXFORDIAN	Bimammatum	Hauffianum	Bimammatum	?
		Bimammatum		Bimammatum
		Hypselum		Berrense
				Semimammatum
	Bifurcatus	Grossouvrei	Bifurcatus	Grossouvrei
		Stenocycloides		Stenocycloides

Fig. 6. Late Oxfordian ammonite biozonation of the Submediterranean Province.

4. Conclusions

The studied ammonite fauna is derived from the lower part of the Lar Formation at Golbini (eastern Alborz) which was previously assigned to the Upper Oxfordian (MAJIDIFARD 2003). The biozonation of the Oxfordian in this area as well as in other parts of North Iran largely corresponds to that applied to the Submediterranean Province (CARIOU et al. 1997; SCHWEIGERT & CALLOMON 1997; QUEREILHAC 2009) (Fig. 6). However, one should bear in mind that the complete stratigraphic range of several taxa may not have been fully evaluated to date. Moreover, occurrences may vary with regard to palaeogeography, palaeolatitude, palaeoclimate, or else environmental parameters (CECCA et al. 2005; PAGE 2008; QUEREILHAC 2009), or simply be mixed in condensed levels. Consequently, the exact biostratigraphic position of the described ammonite fauna from Golbini remains somewhat elusive.

The ammonite fauna from Golbini exhibits a twofold situation. While *Dichotomoceras bifurcatoides*, *D. crassus*, and *Microbiplices microbiplex* are indicative of the Bifurcatus Zone (Stenocycloides Subzone), the Taramelliceratidae (*T.* aff. *costatum*, *Streblites externnodosum*) rather are typical of the lower Bimammatum Zone (Hypselum Subzone = Berrense/Semimammatum subzones; similar *Taramelliceras* may already occur at the base of the Grossouvrei Subzone; pers. comm. P. BRANGER).

Altogether, the fauna comprises the interval from the Bimammatum to Bifurcatus zones and likely corresponds to the Hypselum and Grossouvrei subzones, which is also indicated by the sample position in the section right below the beds with *Epipeltoceras bimammatum*. However, it has to be noted that the fauna was not collected from a single horizon, but from an interval of some two or three meters and may therefore contain elements from slightly different biostratigraphic positions.

As already discussed by SEYED-EMAMII & SCHAIRER (2010), the Oxfordian ammonite fauna from the study area is closely related to those from the epicontinental seas of the northwestern Tethys, and occupies an intermediate position between the Mediterranean and Submediterranean provinces (see also CARIOU et al. 1997; SCHWEIGERT & CALLOMON 1997; PAGE 2008). Boreal ammonites, e.g., Cardioceratidae, have only rarely been reported from the Upper Oxfordian of the eastern Alborz (MAJIDIFARD 2003: 106). As typical for the Upper Jurassic strata of North Iran, Phylloceratidae, Perisphinctidae, and, slightly less abundant, Oppeliidae are the most frequent taxa and account for more than 80 % of the ammonoid fauna in certain levels, e.g., in the studied interval.

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