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UPPER TRIASSIC (NORIAN) CEPHALOPODS FROM THE EKRASAR FORMATION (SHEMSHAK GROUP) OF NORTHERN ALBORZ, IRAN

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Abstract. The following ammonoid and nautiloid taxa are described for the first time from the Upper Triassic succession (Ekrasar Formation, Shemshak Group) of northern Alborz, Iran: *Arcestes* sp., *Arcestes* (*Pararcestes*?) sp., *Thisbites* cf. *agricolae* Mojsisovics, *Stikinoceras* cf. *kerri* Mc Learn, *Griesbachites* sp., *Griesbachites* cf. *pseudomedleyanus* Diener, *Griesbachites* cf. *himalayanus* Wang & He, and *Proclydonautilus*? sp. Palaeobiogeographically, the studied ammonoids are Tethyan in character, and stratigraphically attributed to the lower Lower Norian (*Guembelites jandianus* Zone, possibly also *Malayites paulckei* Zone). The biostratigraphic data of this study demonstrate the diachronous base of the Shemshak Group: it is older in the northern Alborz (lower Lower Norian), but younger in Central Iran and probably also in the southern Alborz (Middle Norian).

Riassunto. I seguenti taxa di ammonoidi e nautiloidi sono descritti per la prima volta da una successione del Triassico superiore nell'Alborz Settentrionale, Iran (Formazione Ekrasar del Gruppo Shemshak). Essi sono: *Arcestes* sp., *Arcestes* (*Pararcestes*?) sp., *Thisbites* cf. *agricolae* Mojsisovics, *Stikinoceras* cf. *kerri* Mc Learn, *Griesbachites* sp., *Griesbachites* cf. *pseudomedleyanus* Diener, *Griesbachites* cf. *himalayanus* Wang & He, e *Proclydonautilus*? sp. Da un punto di vista paleobiogeografico, gli ammonoidi presentano affinità tetidiane, mentre stratigraficamente vengono riferiti alla porzione inferiore del Norico inferiore (Zona a *Guembelites jandianus*, forse anche Zona a *Malayites paulckei*). I dati biostratigrafici forniti da questo studio indicano che la base del Gruppo Shemshak è diacrona. Essa è più antica in Alborz Settentrionale (parte inferiore del Norico inferiore), mentre è più giovane in Iran Centrale e probabilmente anche nell'Alborz meridionale (Norico medio).

Introduction

The Shemshak Group is an up to 4,000 m thick siliciclastic succession, widely distributed in central and northern Iran (Assereto 1966; Seyed-Emami 2003; Fürsich et al. 2009; Fig. 1). Its age ranges from Late Triassic to early Middle Jurassic. On the northern slopes of the Alborz Range the lower part of the group is fully marine and consists of up to 1,000 m of monotonous, dark-grey siltstones and argillaceous siltstones, with few reddish weathering beds of limestone at the base, being named as Ekrasar Formation (Bragin et al. 1976; Aghanabati 1998; Seyed-Emami 2003; Fürsich et al. 2009). The Ekrasar Formation contains a poor marine fauna consisting of bivalves (mostly *Halobia*, but also *Cassianella beyrichii* Bittner, *Mysidioptera* and *Schafhaeutlia*), brachiopods, nautiloids, and ammonoids, which have been attributed to the Carnian and Norian by former investigators (e.g., Bragin et al. 1976; Aghanabati 1998; Seyed-Emami 2003).

Upper Triassic strata from northern Alborz

Upper Triassic strata with marine fossils have been recorded only sporadically from the Alborz Range. The first marine fossils from the Upper Triassic of northern Iran (northern Alborz, southern coast of the Caspian Sea) have been reported by the Demag

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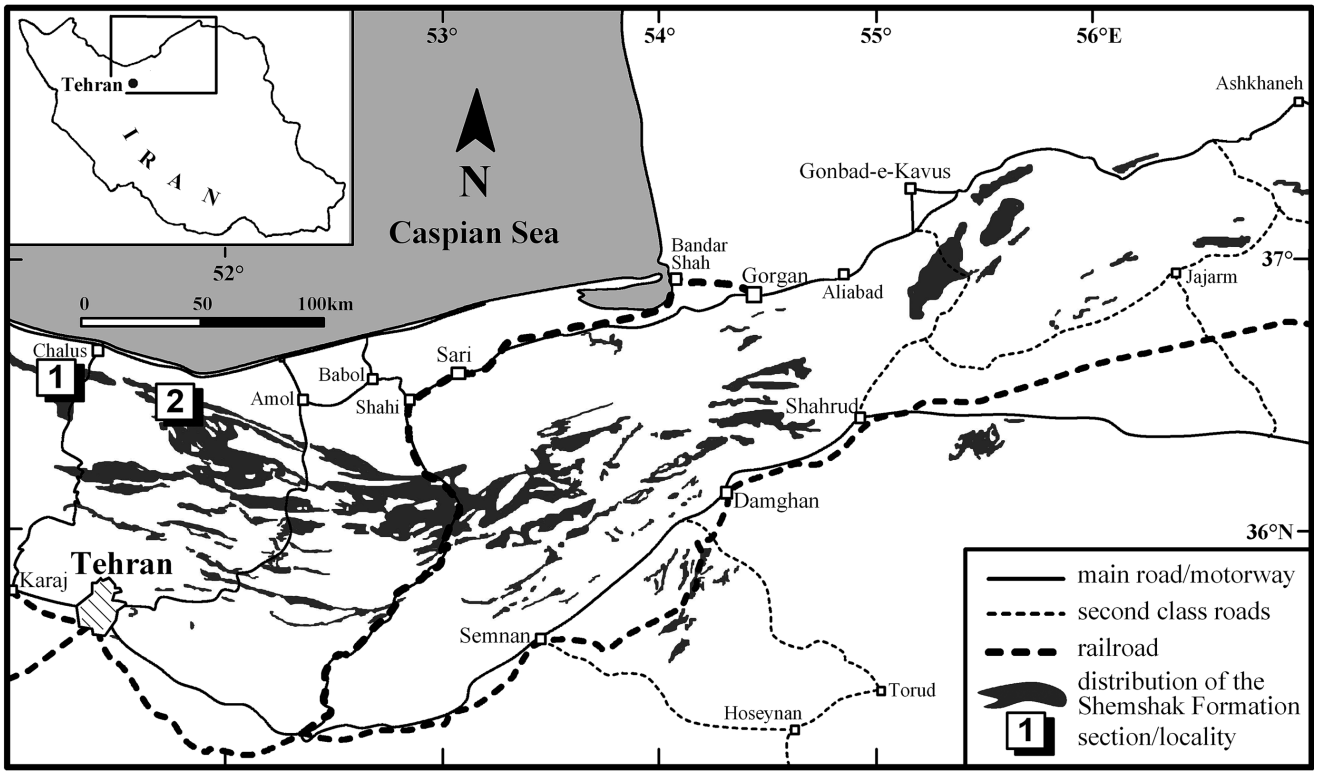


Fig. 1 - Locality map showing the position of the Ekrasar (1) and Galanderud (2) sections as well as the distribution of the Shemshak Group in the Alborz Range of northern Iran.

Consulting Group (1962). From a siliciclastic succession (basal part of the Shemshak Group) at Galanderud (Fig. 1) the group recorded the following bivalves and ammonoids: *Cardita crenata* Münster, *Cassianella gryphaeata* Münster, *Halobia rugosa* Gümbel, *Pseudomonotis* sp., *Megaphyllites* sp., *Juvavites* sp., *Cladiscites* sp., and *Placites* sp., and attributed them to the Carnian and Norian. One tiny Phylloceratidae from the above mentioned collection has subsequently been studied by Wiedmann (1970). It is the holotype of the new genus and species *Phyllytoceras intermedium* (Wiedmann 1970, p. 1010, pl. 10, fig. 5), attributed to the Carnian.

Cartier (1971, p. 32) recorded from yellow to reddish limestones with intercalations of red, argillaceous to silty shales along a hill west of Kalardasht (southwest of Chalus), apart from plant remains, a small marine fauna composed of brachiopods, bivalves, nautiloids, and a tiny ammonite (*Arcestes* sp.), which he attributed to the Middle-Upper Triassic.

Bragin et al. (1976, p. 4) recorded from a monotonous succession of grey siltstones and argillites at Ekrasar ("Ekrasar Suite"), southeast of Ramsar, the following bivalves and ammonoids: *Halobia superba* Mojs., *H.* cf. *bittneri* Kittl, *H.* cf. *austriaca* Mojs., *Cassianella* sp., *Anatomites* cf. *herbichi* Mojs., *Dimorphites* sp., and *Arcestes* cf. *gaytani* (Klipstein) and assigned them a Carnian and Norian age. Repin (1987, pp. 32, 209) assumed the above mentioned bivalves and ammonoids reported by Bragin et al. (1976) from Ekrasar and Galanderud to belong to the Early Norian rather than to the Carnian.

Vahdati Daneshmand (1982) reported a different development of Upper Triassic strata from Paland under the informal name "Paland formation". They overlie, with conformable contact, the Lower and Middle Triassic carbonates of the Elikah Formation.

Vollmer (1987, p. 30) recorded in the basal part of the Shemshak Formation at Galanderud several hundred meters of green-grey argillaceous shales ("Halobienmergel"). The lower, partly reddish 20 m consist of alternations of dark limestones and claystones with halobiids and few fragments of ammonoids, which he attributed to the Carnian and Norian.

Razawi Armagani & Moinsadat (1994) repeated more or less the results of Bragin et al. (1976) and Repin (1987). Dabiri (2002, pp. 92-93) studied the palynomorphs of the lower Shemshak Group (Ekrasar Formation) at Paland and Galanderud. According to him there is a gradual change in the sedimentation pattern between the Elikah and Shemshak formations. Based on dinoflagellates and a few ammonoids (*Thisbites* sp., *Helicites* sp.) he suggested a Norian age. Ghasemi-Nejhad et al. (2004) published the results of the study by Dabiri (2002) and emphasized a Norian-Rhaetian age of the basal Shemshak Group at Galanderud on the basis of dinoflagellate cysts (*Rhaetogonyaulax wigginsii* and *R. rhaetica*). Seyed-Emami (2003) gave an overview of the Triassic of Iran and summarized, among others, the

Upper Triassic occurrences of the northern Alborz as "North Alborz Facies". Seyed-Emami & Wilmsen (2007) recorded a Middle Norian ammonoid faunule from the lower Shemshak Group near Damghan, south of the Alborz range. Finally, Fürsich et al. (2009) provide a new lithostratigraphic scheme for the Shemshak Group of the Alborz Mountain Range.

Material and sections

Altogether 19 specimens, some of them fragmented, and several smaller fragments were available for study. The material comes from the basal Ekrasar Formation, separated as Galanderud Member by Fürsich et al. (2009). This heterolithic carbonate-dominated unit is mainly composed of argillaceous silt, silty marlstone, and bio-wackestone, which contain a scattered fauna of bivalves, gastropods, brachiopods, and ammonoids. Some of the specimens were obtained from two levels within the member at Ekrasar (N 36°46′48″, E 50 32′08″), 13 and 28 m above the base of the member, respectively (Fig. 2). The lower level (050517-6) is the first carbonate intercalation, about 4 m thick, which overlies a succession of red-brown tuff, a bed of iron pisolite, and red-brown bauxitic argillaceous silt. The yellowish-weathering limestone is well-bedded and contains, apart from ammonoids, bivalves, crinoid debris, wood fragments, and the trace fossil *Rhizocorallium irregulare*. Associated is a bed of onco-bio-rudstone at the base and a 1 m thick cross-bedded grainstone with reworked chert pebbles. This limestone unit is followed by about 13 m of argillaceous silt with intercalations of bioclastic silty marlstone beds containing fine plant debris in the upper half. The outcrop ends with a 1 m thick unit of bedded limestone, which corresponds to the upper ammonoid horizon (050517-7).

The remaining ammonoids have been collected from purplish, well bedded, bioclastic calcareous siltstone grading up-section into silty to fine-sandy, bioclastic wacke- and packstone separated by thin silty marl interbeds, which represent the upper Galanderud Member at Galanderud (Fig. 3). The unit is heavily bioturbated by *Zoophycos*. The exposure (N 36°25′58″, E 51°53′51″) is a large road-cut above the village. As the density of ammonoids within these limestones is very low, in-situ collecting was not possible and the specimens were retrieved from the scree. Indeterminate ammonoids occur in the lower Galanderud Member at Galanderud and were also observed at the contact to the underlying Elikah Formation.

Systematic palaeontology

The ammonoids have been classified using the classification of Tozer (1981, 1994). Measurements are given in mm for diameter (D) and in % of diameter for width of umbilicus (U), height (H) and width of whorl (W). The material has provisionally been deposited at the Bayerische Staatssammlung für Paläontologie und Geologie in Münich, Germany.

Class **Cephalopoda** Cuvier, 1792
Subclass **Ammonoidea** Zittel, 1884
Order **Ceratitida** Hyatt, 1884
Superfamily Arcestoidea Mojsisovics, 1875
Family Arcestidae Mojsisovics, 1875

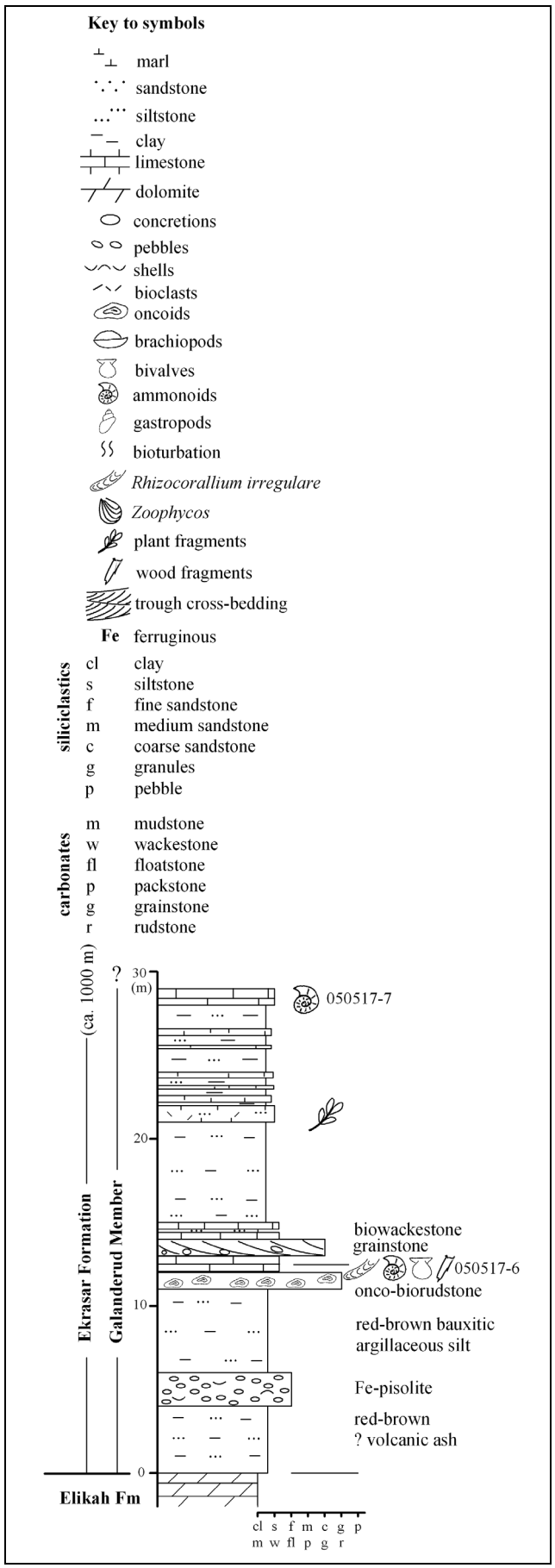


Fig. 2 - Stratigraphic log of the Galanderud Member of the Ekrasar Formation at Ekrasar (for location see Fig. 1).

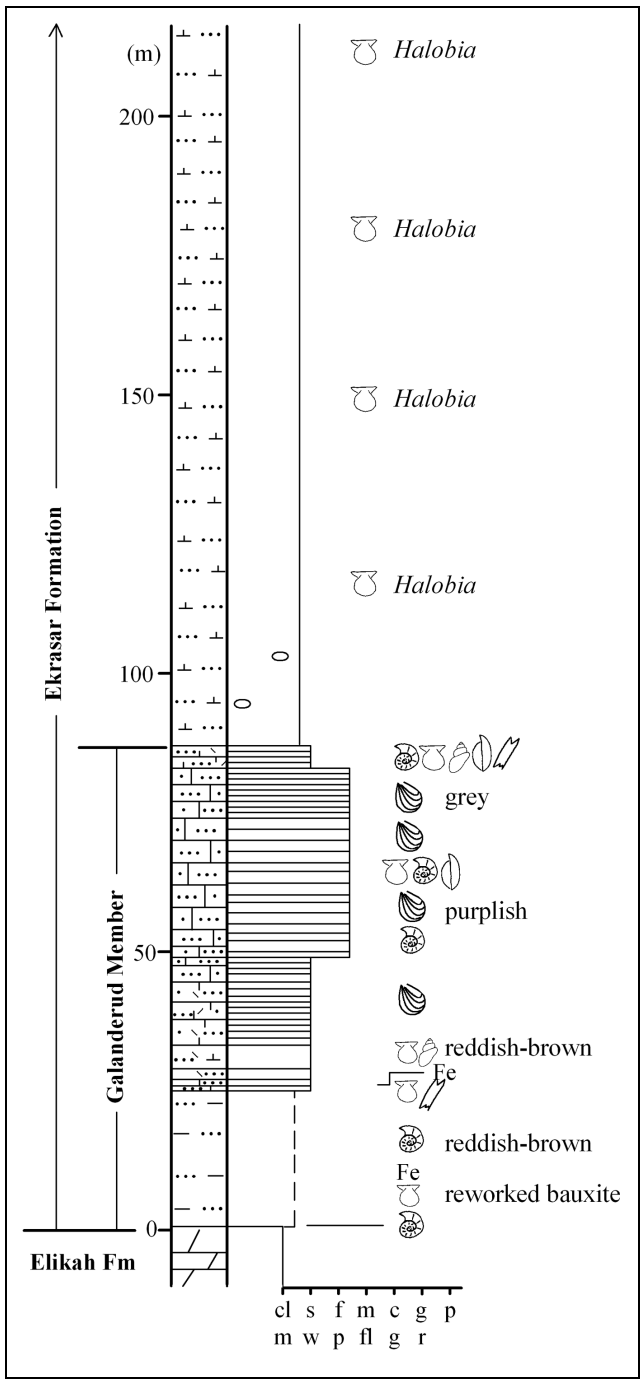


Fig. 3 - Stratigraphic log of the lower Ekrasar Formation (including the Galanderud Member) at Galanderud (for location see Fig. 1, for key to symbols see Fig. 2).

Genus *Arcestes* Suess, 1865

Type species: *Ammonites galeiformis* Hauer, 1850

Arcestes sp.

Pl. 1, fig. 14a-c

Material: One crushed specimen collected from scree of the upper part of the Galanderud member at Galanderud (050516-1-6).

Description: The specimen is probably a rather compressed representative of the Arcestidae. It is smooth, involute with nearly parallel flanks and a slightly arched venter.

Occurrence: With several other taxa from the Galanderud Member (Lower Norian).

Subgenus *Pararcestes* Mojsisovics, 1893

Type species: *Arcestes sublabiatus* Mojsisovics, 1875

Arcestes (Pararcestes?) sp.

Pl. 1, fig. 10a-c

Material: One fully septated internal mould from the scree of the lower Shemshak Group at Baladeh, northern Central Alborz, collected by A. Saidi and M.R. Ghassemi, GSI (89-SA-GH-228).

Description. Smooth, involute and sphaerocone arcestoid with arched venter and whorls considerably wider than high and a broad-ovate to semi-circular whorl cross-section. Only one very shallow constriction could be observed at the beginning of the last preserved whorl. The suture line is complex and ammonitic.

Dimensions

D	U (%)	H (%)	W (%)
22	~8	51	76

Discussion. The inflated and sphaerocone specimen probably belongs to the subgenus *Pararcestes*. A similar form is *Arcestes timorensis* Arthaber (1927, p. 55, pl. 6, figs. 1-3) from the Upper Triassic of the Himalaya and Timor. The tiny specimen of *Arcestes* sp., recorded by Cartier (1971, pp. 32-33, Fig. 4) from west of Kalardasht (southwest of Chalus, northern Alborz) may also belong to this group.

Occurrence. The specimen was collected loosely from the Ekrasar Formation in the Baladeh area.

Superfamily Tropitoidea Mojsisovics, 1875

Family Thisbitidae Spath, 1951

Genus *Thisbites* Mojsisovics, 1893

Type species: *Thisbites agricolae* Mojsisovics, 1893

Thisbites cf. **agricolae** Mojsisovics, 1893

Pl. 1, figs 1-4, 6a-b, 7a-b

cf. *1893 *Thisbites* (*Ceratites*) *Agricolae* Mojsisovics, p. 438, pl. 142, figs. 16-20.

Material: Seven crushed and fragmentary specimens, collected by O. Dabiri from scree of the Galanderud Member at Galanderud (D-4 to D-10); another specimen 13 m above the base of the Galanderud Member at Ekrasar (050517-6-5).

Description. Specimen D-7 (Pl. 1, fig. 4) with a diameter of ca. 14 mm, is an imprint of the inner whorl of a larger specimen with a diameter of ca. 24 mm. At D

= 14 mm it is moderately involute with slightly convex flanks, rounded to distinct shoulders and whorls that are higher than wide. The venter is narrow, flat and nearly smooth, with a very faint and thread-like keel. The ribbing is fine, dense and falcate (there are about 26-28 ribs on the half whorl). Commonly two ribs are joined pair-wise and are faintly bullate at the umbilicus. Ventrolaterally the ribs bend forward and end in small and rounded tubercles before reaching the faint keel. Marginally there is another row of extremely fine tubercles, just below the ultimate one. The two rows of tubercles, even though faint, exist more or less on all specimens.

Discussion. Within the studied specimens the coarseness of the ribs and the strength of the keel vary. Usually, the keel is very weak and rather incipient. Only the specimen D-6 (Pl. 1, fig. 6a-b) has a relatively strong keel. Concerning the weak and thread-like keel and the two rows of marginal tubercles, the specimens look much like *Stikinoceras*, in particular *Stikinoceras kerri* of Mc Learn (1960, p. 58, pl. 3, fig. 2) and Tozer (1994, pl. 109, figs. 20a-c). For more information see the discussion of *Stikinoceras kerri*. From the very similar *Thisbites agricolae* our specimens are distinguished by the rather faint keel (except specimen D-6) and perhaps a greater final size (specimen D-7). It is noteworthy that also Mojsisovics (1893, p. 438) mentions a lower row of faint marginal tubercles.

Our specimens differ from the similar *T. custi* of McLearn (1960, p. 65, pl. 6, figs. 3a-b, 4, 5a-b) and Tozer (1994, p. 230, pl. 108, figs. 5-8) by the two rows of tubercles, the more sinuous and pair-wise ribbing, and the slightly bullate nature of the ribs next to the umbilicus. Another to some extent similar species is *Thisbites charybdis* of Gemmellaro (1904, p. 35, pl. 29, figs. 10-11) and Mc Learn (1960, p. 64, pl. 6, fig. 6; pl. 7, fig. 6).

Occurrence. Probably lowermost Norian Jandianus Zone, which corresponds to the Kerri Zone of North America.

Genus *Stikinoceras* Mc Learn, 1930

Type species: *Stikinoceras kerri* Mc Learn, 1930

Stikinoceas cf. **kerri** Mc Learn, 1930

Pl. 1, figs 5, 8a-b, 9

cf. *1930 *Stikinoceras kerri* Mc Learn, p. 5, pl. 1, fig. 2.

cf. 1960 *Stikinoceras kerri* Mc Learn - Mc Learn, p. 58, pl. 3, figs. 1 a-b, 2 a-c, 3.

cf. 1994 *Stikinoceras kerri* Mc Learn - Tozer, p. 233, pl. 109, figs. 17-20; pl. 119, fig. 1a-b; text-fig. 87a-b.

Material: Several fragmentary specimens from the scree of the upper part of the Galanderud Member at Galanderud (D-2 and D-3) and 13 m above the base of the Galanderud Member at Ekrasar (050517-6-1 to 4).

Description. The fragmentary specimens have a rather broad and rectangular whorl cross-section and a broad and nearly smooth venter with a faint and thread-like keel. The ribs are fairly coarse, slightly sinuous and begin often pair-wise, alternately long and short, at the umbilicus. The longer ribs thicken into faint and incipient bullae, slightly above the umbilicus. All ribs end ventrolaterally into small but distinct and somewhat rounded tubercles. Below the ultimate tubercles, a lower row of very faint marginal tubercles is also present. On the specimen D-2 (Pl. 1, fig. 5) the two last visible ribs project slightly forward and cross the venter.

Discussion. The very faint and thread-like keel, with two rows of ventrolateral tubercles and the slightly bullate ribs close to the umbilicus strongly agree with *S. kerri*. Our specimens resemble much the genus *Thisbites*, being somewhat intermediate between *Thisbites* and *Stikinoceras* by resembling also *Thisbites* cf. *agricolae*, described above from the same beds. Because of the sparse preservation a clear separation of the two genera is not possible (see also Krystyn 1982, p. 11). The main distinction point is the rather strong and well-defined ultimate ventrolateral tubercles at the end of the ribs and the very faint keel of *Stikinoceras*.

Occurrence. So far, the monospecific genus *Stikinoceras* has been only recorded from the Kerri Zone (Jandianus Zone) of North America (see remarks by Krystyn 1982, p.11). This is the first record of the taxon from the Tethys.

Family Juvavitidae Tozer, 1971

Genus *Griesbachites* Mojsisovics, 1896

Type species: *Ammonites medleyanus* Stoliczka, 1865

Griesbachites sp.

Pl. 1, fig. 17a, b

Material: One slightly crushed internal mould with parts of the original shell from the upper part of the Galanderud Member at Galanderud: (050516-1-2).

Description. The incomplete specimen has a diameter of about 40 mm. It is relatively involute, rather compressed and flat with a high-ovate whorl cross-section and a narrow venter. The umbilical shoulder is rounded, with a vertical wall. The ribs are flat, faint and slightly sinuous, single or bifurcating irregularly. Towards the venter the ribs become broader, are alternately slightly bullate, and pass indistinctly over the rather flat venter. On the outer part of the flank of the whorl the ribs pass into fine striae. The suture line can not be seen.

Discussion. The described specimen exhibits similarities to some compressed and less coarsely ribbed species of *Griesbachites* such as *G. laevis* Tozer (1994, p. 238, pl. 114, figs. 5-7). Except for the absence of marginal clavi, our specimen shows also similarities to *Guembelites clavatus* (Mc Learn) of Tozer (1994, p. 240, figs. 1-4). Similarities exist also to certain forms of *Goniono-tites*. However, the marginally slightly bullate ribs speak in favour of *Griesbachites*.

Occurrence. Lower Norian.

Griesbachites cf. **pseudomedleyanus** Diener, 1908

Pl. 1, figs 18a-b, 19a-b

cf. *1908 *Juvavites* (*Griesbachites*) *pseudomedleyanus* Diener, p. 43, pl. 7, figs. 1-2.

cf. 1914 *Griesbachites Pseudomedleyanus costatus* nov. sp. - Welter, p. 97, pl. 13, figs. 11, 14, 16.

cf. 1976 *Griesbachites pseudomedleyanus* Diener - Wang & He, p. 385, pl. 33, figs. 12-16.

Material: Several, mostly fragmentary specimens from the upper part of the Galanderud Member at Galanderud (050516-1-1, 3, 13).

Description. Specimen 050516-1-3 (Pl. 1, fig. 19a-b) is probably the body chamber with greater parts of the original shell preserved. It is involute, depressed to subglobose, with a broad and slightly arched venter and an ovate to semi-circular whorl cross-section. The umbilicus is conic and deep, with the greatest whorl width just above the umbilical border. The ribbing consists of rather flat and slightly sinuous ribs with wide interspaces, becoming broader towards the venter. On the venter the ribs become very faint, flat, and broad. Few ribs are stronger and cross the venter without interruption. Some ribs bear marginally rather coarse and blunt tubercles and then bifurcate irregularly. Towards the end of the preserved whorl the ribs pass into fine striae. Ventrolaterally, on the partly preserved shell, an extremely faint and incipient striation seems to exist.

Specimen 050516-1-1 (Pl. 1, fig. 18a-b) is, with a diameter of about 50 mm, part of the phragmocone and probably the beginning of the body whorl with greater portion of original shell. It is coarsely ribbed, and the ribs bi- or trifurcate within the inner half of the flank. No suture line was observed.

Dimensions

	D	U (%)	H (%)	W (%)
Specimen 050516-1-3	65	~10	~55	~62

Discussion. Specimen 050516-1-3 (Pl. 1, fig. 19a-b) agrees fairly well with *G. pseudomedleyanus*, in particular with the specimen figured by Wang & He (1976, pl. 33, figs. 14-15). Further similar forms are *G. pseudomedleyanus costatus* Welter (pl. 13, figs. 14, 16) and *G. hanni* Mojsisovics of Krystyn (1982, p. 47, pl. 11, fig. 5). Compared with our specimen, the latter seems to be more evolute. The ribbing of specimen 050516-1-3 (Pl. 1, fig. 19a-b) strongly resembles that of *G. borealis* Tozer (1994, pl. 112, fig. 3a-b). However, our specimen is much more depressed and has probably a smaller mature size.

Occurrence. According to Krystyn (1982, p. 46) the genus *Griesbachites* is widely distributed in the Tethys and restricted to the Early Norian Jandianus and Paulckei zones.

Griesbachites cf. **himalayanus** Wang & He, 1976

Pl. 1, figs 11-13, 15a-c

cf. *1976 *Griesbachites himalayanus* nov. sp. Wang & He, p. 386, pl. 34, figs. 1-3, 10-11; text-fig. 53b.

cf. 1982 *Griesbachites himalayanus* Wang & He - Krystyn, p. 46, pl. 11, fig. 4, text-fig. 14.

Material: Six fragmentary specimens from near the top of the Galanderud Member, 28 m above the base, at Ekrasar (050517-7-1 to 6) and one external mould from the scree of the upper Galanderud Member at Galanderud (050516-1-4).

PLATE 1

Upper Triassic cephalopods from the Ekrasar Formation. All figures are in natural size, if not indicated otherwise.

Figs. 1-4, 6a-b, 7a-b - *Thisbites* cf. *agricolae* Mojsisovics. All specimens from Galanderud; 6b, 7a (x1.5); 7b (x 2); 1 (D-5, plaster cast); 2 (D-8); 3 (D-4); 4, (D-7); 6 (D-2); 7 (D-9.); 1-4, 6a, 7a (lateral view); 6b, 7b (ventral view).

Figs. 5, 8a-b, 9 - *Stikinoceras* cf. *kerri* Mc Learn. 5 (D-2, Galanderud, x1.5); 8 (050517-6-1, Ekrasar x1); 9 (D-3, Galanderud x1.5); 8a (lateral view); 5, 8b, 9b (ventral view).

Fig. 10a-c - *Arcestes* (*Pararcestes*?) sp. from Baladeh (89-SA-GH-228); 10a, c (lateral view); 10c (oral view).

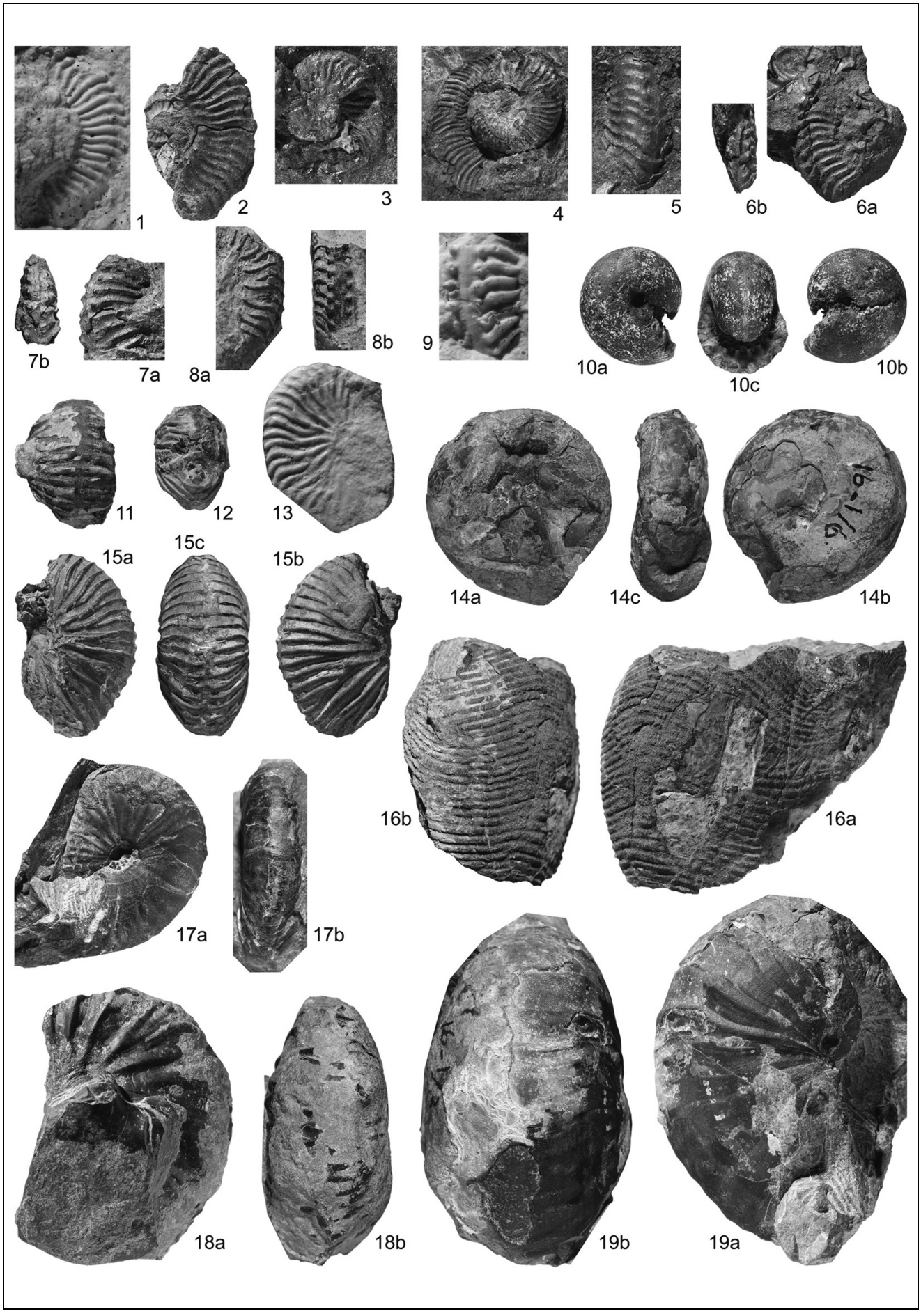
Figs. 11-13, 15a-c - *Griesbachites* cf. *himalayanus* Wang & He; 11 (050517-7-6, Ekrasar, x1.5); 12, (050517-7-5, Ekrasar); 13 (050516-1-4, Galanderud, plaster cast); 15 (050517-7-2, Ekrasar); 13, 15a, b (lateral view); 11, 12, 15c (ventral view).

Fig. 14a-c - *Arcestes* sp. from Galanderud (050516-1-6); 14a, b (lateral view), 14c (ventral view).

Fig. 16a-b - *Proclydonautilus*? sp.; Ekrasar (050517-7-1); 16a (lateral view); 16b (oblique ventral view).

Fig. 17a-b - *Griesbachites* sp., Galanderud (050516-1-2); 17a (lateral view); 17b (ventral view).

Figs. 18a-b, 19a-b - *Griesbachites* cf. *pseudomedleyanus* Diener, Galanderud; 18 (050516-1-1); 19 (050516-1-3); 18a, 19a (lateral view); 18b, 19b (ventral view).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15a
15c
15b
14a
14c
14b
16b
16a
17a
17b
18a
18b
19b
19a

Description. Specimen 050517-7-2 (Pl. 1, fig. 15a-c) is an involute and comparatively depressed *Griesbachites*, with whorls slightly higher than wide and an ovate whorl cross-section. The shoulder is rounded, the venter slightly arched, with a narrow and shallow sulcus. The ribs are rather strong, elevated and slightly flexuous. They begin mostly pair-wise at the umbilicus and bifurcate irregularly about the mid-flank or seldom higher up. The ribs end ventrally at the median sulcus and the ends nearly face each other. On one side of the flank there is a rib with virgatotome branching, being followed by a single rib.

Discussion. The fragmentary samples can be compared fairly well with *G. himalayanus*. In contrast to the latter, the ribs on our specimens do not bend forward ventrally but nearly face each other on both sides of the sulcus. In this respect they look like *G. gerthi* Diener of Krystyn (1982, p. 46, pl. 11, figs. 1-3). However, contrary to *G. gerthi* our specimens exhibit neither constrictions nor marginal tubercles.

Occurrence. According to Krystyn (1982, p. 47) *G. himalayanus* occurs together with *G. gerthi* in the Lower Norian Paulckei Zone of central Nepal (Himalaya).

Subclass **Nautiloidea** Agassiz, 1847

Order **Nautilida** Agassiz, 1847

Superfamily Clydonautiloidea Hyatt in Zittel, 1900

Family Clydonautilidae Hyatt in Zittel, 1900

Genus *Proclydonautilus* Mojsisovics, 1902

Type species: *Nautilus griesbachi* Mojsisovics, 1896

Proclydonautilus? sp.

Pl. 1, fig. 16a-b

Material: Two compressed and fragmentary specimens from the scree of the upper Galanderud Member at Galanderud (050516-1-12) and from near the top of the Galanderud Member, 28 m above the base, at Ekrasar (050517-7-1).

Description. Specimen 050516-1-12 (not figured) is large, strongly compressed and exhibits extremely fine and dense ribbing. Specimen 050517-7-1 (Pl. 1, fig. 16a-b), even though compressed, is better preserved. It is a rather depressed form with rounded shoulders and a broadly arched venter. The ribbing is sinuous and extremely fine and dense. Ventrally the ribs curve bow-wise forward and cross the broad and arched venter without interruption. The suture line can not be seen on any of the two specimens.

Discussion. Although the suture line can not be seen, most probably the two specimens are nautiloids. The fine ribbing and the crenulation of the test may point to the genus *Proclydonautilus*.

Chrono-stratigraphy			Ammonoid biozonation	
			Tethyan (Alps)	**North America** (Brit. Col.)
Upper Triassic	Rhaet.	Low.	*Sagenites reticulatus*	*Paracochloceras amoenum*
	Norian	Upper	*Sagenites quinquepunctatus*	*Gnomohalorites cordilleranus*
		Middle	*Halorites macer*	*Mesohimavites columbianus*
			Himavites hogarti	
			Cyrtopleurites bicrenatus	*Drepanites rutherfordi*
		Lower	*Juvavites magnus*	
			Malayites paulckei	*Malayites dawsoni*
			Guembelites jandianus	*Stickinoceras kerri*
	Carn.	Up.	*Anatropites spinosus*	*Klamathites macrolobatus*

Fig. 4 - Stratigraphic framework of the Norian Stage (compiled after Krystyn 1982; Tozer 1994; Ogg 2004).

Conclusions

The small and poorly preserved ammonoid fauna was collected, together with a few bivalves, from the scree of the upper Galanderud Member of the Ekrasar Formation (Shemshak Group) at Galanderud, and from two levels of the Galanderud Member at Ekrasar (North Alborz; Figs. 1-3). The poor preservation of the fauna and the scarcity of diagnostic and recent literature on Tethyan Upper Triassic (Norian) ammonoids and their biozonation, makes a closer specific identification and chronostratigraphic correlation fairly difficult. Apart from North America, where a detailed chronostratigraphic scheme and ammonoid biozonation for the Late Triassic exists (Silberling & Tozer 1968; Tozer 1967, 1994), the classical occurrences from the Alps, and Timor (Hallstatt facies) often are condensed strata or erratic blocks (Tozer 1971). In addition, the important and comprehensive older monographs (e.g., Mojsisovics 1893, 1896, Diener 1908) still await revision. Nevertheless, the importance of the present ammonoid fauna, being described and figured from the basal Shemshak Group of Iran for the first time, and the scarce available information on such faunas, justifies publication of the present account. So far, the ammonoid fauna of the Ekrasar Formation has a Tethyan character and shows relationships to the western Tethys (Alps, Mediterranean region) as well as to the southern Tethys (Himalaya, Timor) and allows a similar zonation (Fig. 4). Interestingly, stratigraphically and faunistically our fauna can be best compared to that of the Himalayas (Krystyn, 1982), despite the fact the two occur on opposite margins of the Neotethys Ocean.

Based on the available evidence, the described taxa belong largely to the lower Lower Norian *Guembelites jandianus* Zone (Fig. 4). *Griesbachites* cf. *himalayanus* may even indicate the presence of the *Malayites paulckei* Zone of the Tethys (Krystyn 1982). These correspond to the *Stikinoceras kerri* and *Malayites dawsoni* zones of North America (Tozer 1967, 1994; Krystyn 1974, 1982; Krystyn et al. 2002). Of great interest is the presence of *Stikinoceras*, which so far has been known only from North America and apparently this is the first record of the taxon from the Tethys.

Remarkably, the ammonoid faunas from the lower part of the Shemshak Group (Nayband Formation) in east-central Iran all belong to the Middle Norian Bicrenatus and Columbianus zones (Seyed-Emami 1975, 2003; Seyed-Emami & Wilmsen 2007). This indicates that marine conditions persisted in the area of the northern Alborz at a time when in central Iran and probably also in the southern Alborz uplift and subaerial exposure of the vast Middle Triassic carbonate platform (Elikah Formation, Shotori Formation) produced a pronounced gap in deposition (Fürsich et al. 2009; Wilmsen et al. 2009). In future integrated biostratigraphic (ammonoids, halobiids, conodonts, palynomorphs) and magnetostratigraphic studies (Krystyn et al. al. 2002, 2007) of different sites of basal parts of the Shemshak Group in Alborz would help to clarify the exact age. Unfortunately ammonoids and halobiids are very rare and so far no conodonts have been ever found in Upper Triassic strata of Iran.

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