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Middle Triassic Ammonoids from Aghdarband (NE-Iran) and their Paleobiogeographical Significance

By LEOPOLD KRYSTYN & FRANZ TATZREITER*)

With 6 Text-Figures and 4 Plates

NE-Iran
Aghdarband
Lower Anisian
Upper Ladinian
Ammonoids
Northern Tethyan Subprovince

Contents

Zusammenfassung

Aus der Mitteltrias Aghdarbands (Nord-Persien) werden zwei Ammonitenfaunen beschrieben und paläobiogeographisch ausgewertet. Die untere ist unteranisischen (Bithynischen) Alters und besteht aus 10 Gattungen mit 11 Arten, davon zahlreichen neuen: *Pseudohollandites* n. gen. *eurasiaticus* n. sp., *Aghdarbandites* n. gen. *ismidicus, Semibeyrichites* n. gen. *ruttneri* n. sp., *Costigymnites* n. gen. *asiaticus* n. sp., *Gymnites aghdarbandensis* n. sp. Die obere repräsentiert das höchste Ladin (Langobard 3) und ist durch die Dominanz der Gattung *Romanites* gekennzeichnet. Zwischen den beiden Niveaus konnten weder unterladinische noch oberanisische Fossilien nachgewiesen werden. Gestützt auf ein Konglomerat am Top des unteranisischen Ammoniten-Niveaus wird deshalb eine das Oberanis und Unterladin umfassende Schichtlücke zwischen den beiden Faunen postuliert.

Die zwei Ammonitenfaunen zeigen signifikant unterschiedliche paläobiogeographische Beziehungen. Die oberladinische *Romanites*-Fauna ist rein tropisch und pan-tethisch verbreitet. Dagegen besitzt die durch die Dominanz von *Nicomedites* ausgezeichnete und deshalb als *Nicomedites*-Assoziation bezeichnete untere Fauna einen biogeographischen Eigencharakter. Sie beschränkt sich auf einen relativ schmalen, aber den gesamten Südrand des triassischen Laurasiens von der Türkei bis zum Pazifik umfassenden Streifen, der als Nord-Tethys-Subprovinz bezeichnet wird. Diese zumindest im Unteranis eigenständig entwickelte Faunenprovinz ist von der Süd-Tethys-Provinz – oder Tethys-Provinz s. str. – anscheinend durch den Kimmerischen Kontinent getrennt gewesen, der zeitweise als Migrationsbarriere gewirkt haben könnte.

Abstract

Two ammonite faunas from the Middle Triassic of Aghdarband (Northern Iran) are described and evaluated paleobiogeographically. The lower one is of Early Anisian (Bithynian) age and consists of 10 genera with 11 species, several of them are new, i.e.: *Pseudohollandites* n. gen. *eurasiaticus* n. sp., *Aghdarbandites* n. gen. *ismidicus, Semibeyrichites* n. gen. *ruttneri* n. sp., *Costigymnites* n. gen. *asiaticus* n. sp., *Gymnites aghdarbandensis* n. sp. The upper fauna represents the topmost Ladinian (Longobardian 3) and is characterized by the predominance of the genus *Romanites*. Between these two horizons neither Early Ladinian nor Late Anisian fossils

*) Authors' addresses: Ass. Prof. Dr. LEOPOLD KRYSTYN, Institut für Paläontologie, Universitätsstraße 7/II, A-1010 Wien; Dr. FRANZ TATZREITER, Geologische Bundesanstalt, Rasumofskygasse 23, A-1031 Wien.

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could be identified. Based on an occurrence of a conglomerate on top of the Lower Anisian ammonite horizon a stratigraphic gap is postulated comprising the Upper Anisian and Lower Ladinian.

The two ammonite faunas show significantly diverging paleobiogeographical relations. The late Ladinian *Romanites* fauna is purely tropical, occurring all over the Tethys realm. The lower fauna, however, has a paleobiogeographic character of its own. It is characterized by the predominance of *Nicomedites* and, therefore, named *Nicomedites* Association; this association is restricted to a relatively narrow strip which encircles the entire southern edge of Triassic Laurasia from Turkey as far as the Pacific and is designated as North Tethyan Subprovince. This particular faunal province was individualized at least in early Anisian times and was apparently separated from the South Tethyan Province – i. e. Tethys Province s. str. – by the Cimmerian Continent which occasionally may have had the effect of a migration barrier.

1. Introduction

Reports on Triassic ammonoids from Aghdarband are of relatively recent date. The first ammonoids were noted by OBERHAUSER (1960); this material was determined by SIEBER who dated it as Lower Karnian (in OBERHAUSER, 1960, 13). The fauna is housed in the collections of the Geological Survey in Vienna and has been re-examined by us. By faunistic and lithological comparison these ammonoids are referable to the upper or "Fossil Horizon 2" of this paper. Later on, DAVOUDZADEH & SEYED-EMAMI (1972) recorded some Anisian ammonites from Aghdarband which are diagnostic for our lower or "Fossil Horizon 1". In a recent publication, DAVOUDZADEH & SEYED-EMAMI (1982) referred to the close faunistic similarities between Aghdarband and Nakhlak – a region situated some 900 kilometers to the southwest in the centre of Iran. In 1980 RUTTNER gave a short description of the coal mining district of Aghdarband in which the two above mentioned fossil horizons were first recorded. In a subsequent paper RUTTNER (1984) discussed the geological, tectonial and stratigraphical framework of the Aghdarband region.

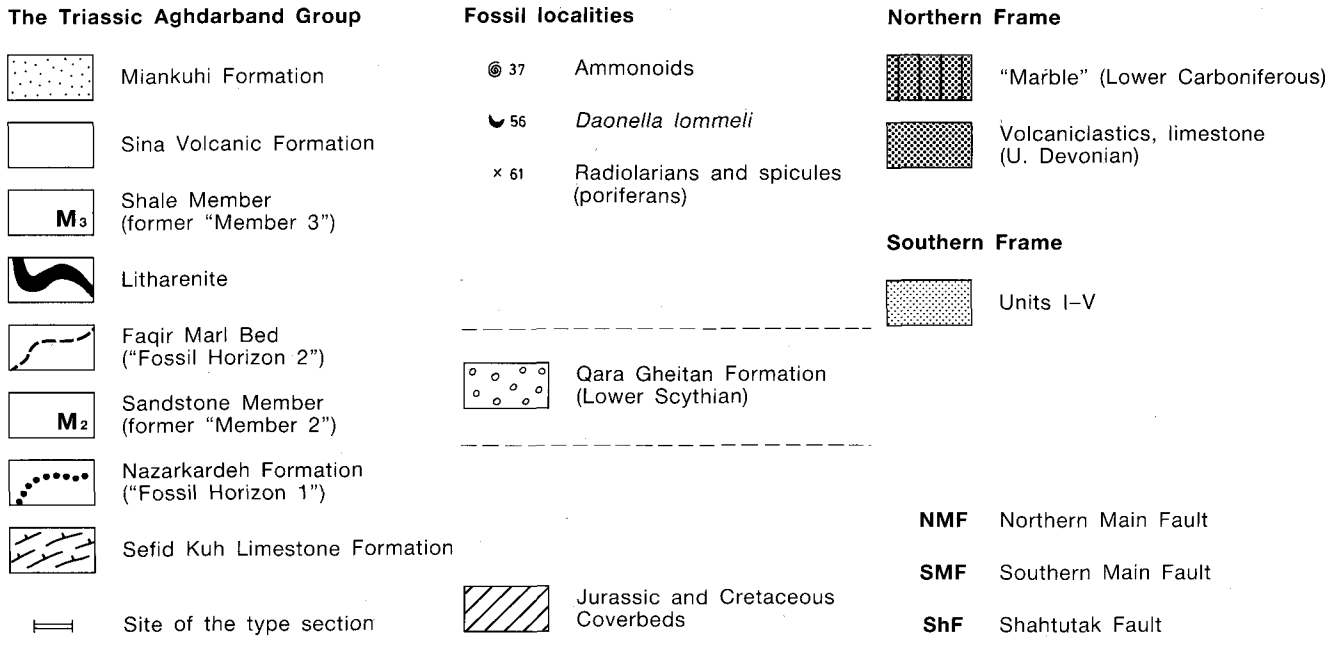
The ammonoids described below were collected by A. RUTTNER, former director of the Geolgoical Survey of Austria, during several years of geological investigations in the small coal-mining district of Aghdarband in Eastern Iran. While mapping the area he discovered various Triassic fossil-bearing levels. Two of them are dominated by cephalopod faunas described in this paper. The geographical location of the fossil sites mentioned in the text are to be found on Fig. 1 and on RUTTNER's geological map in scale 1 : 12.500 in this volume.

2. Stratigraphic and Faunistic Results

RUTTNER's primary goal was an evaluation of the coal deposits in the Aghdarband area. Since he simply had no time for detailed stratigraphic field work, most of the fossils were collected loose from the surface in the course of the mapping campaign. They are mainly internal moulds, and many specimens are partly crushed and weathered. Only in a few cases fragments of the shell are preserved.

Altogether there are three megafossil-bearing levels which represent Lower Anisian (level 1) and Upper Ladinian (levels 2, 3) respectively (see Fig. 2). It is remarkable that there is no fossiliferous proof of Upper Anisian and Lower Ladinian rocks between "Fossil Horizon 1" (level 1) and the first daonellas of the "Daonella Beds" (level 2). With respect of a distinct

Fig. 1.
Sketch map of the Aghdarband area with the position of the Triassic tectonic Slices I to III.
After A.W. RUTTNER (this volume).
K-e-N = Kuh-e-Nazarkardeh; K-e-P = Kuh-e-Palang.



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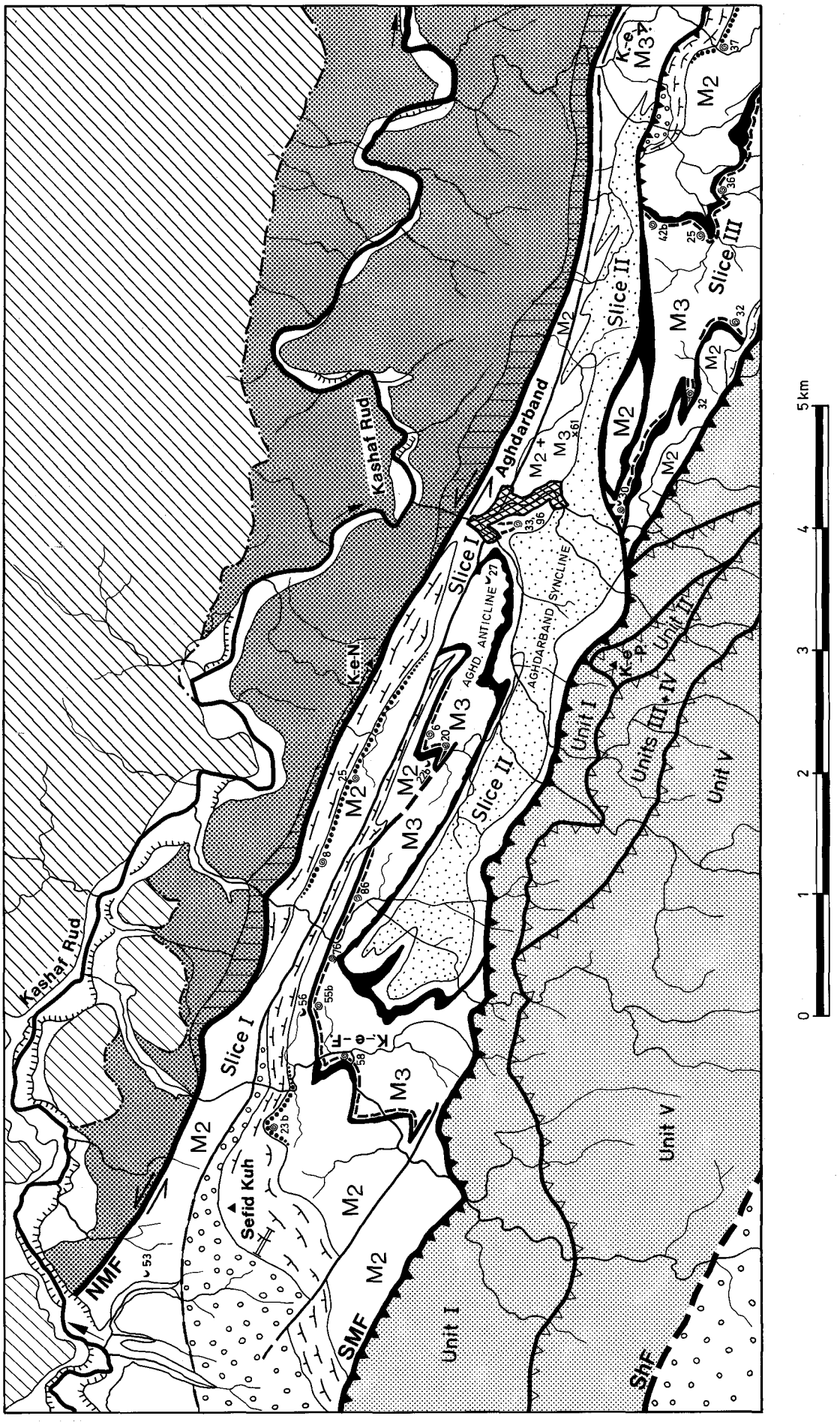

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conglomerate covering transgressively "Fossil Horizon 1" at least in Slice III of the Aghdarband sequence (Kal-e-Anabeh valley), we suspect a stratigraphic gap and a break in sedimentation between the Nazarkardeh Formation and the Sina Formation (Fig. 2). Stratigraphic terms within the Anisian stage are used in the sense of ASSERETO (1974) (see also FANTINI-SESTINI, 1988).

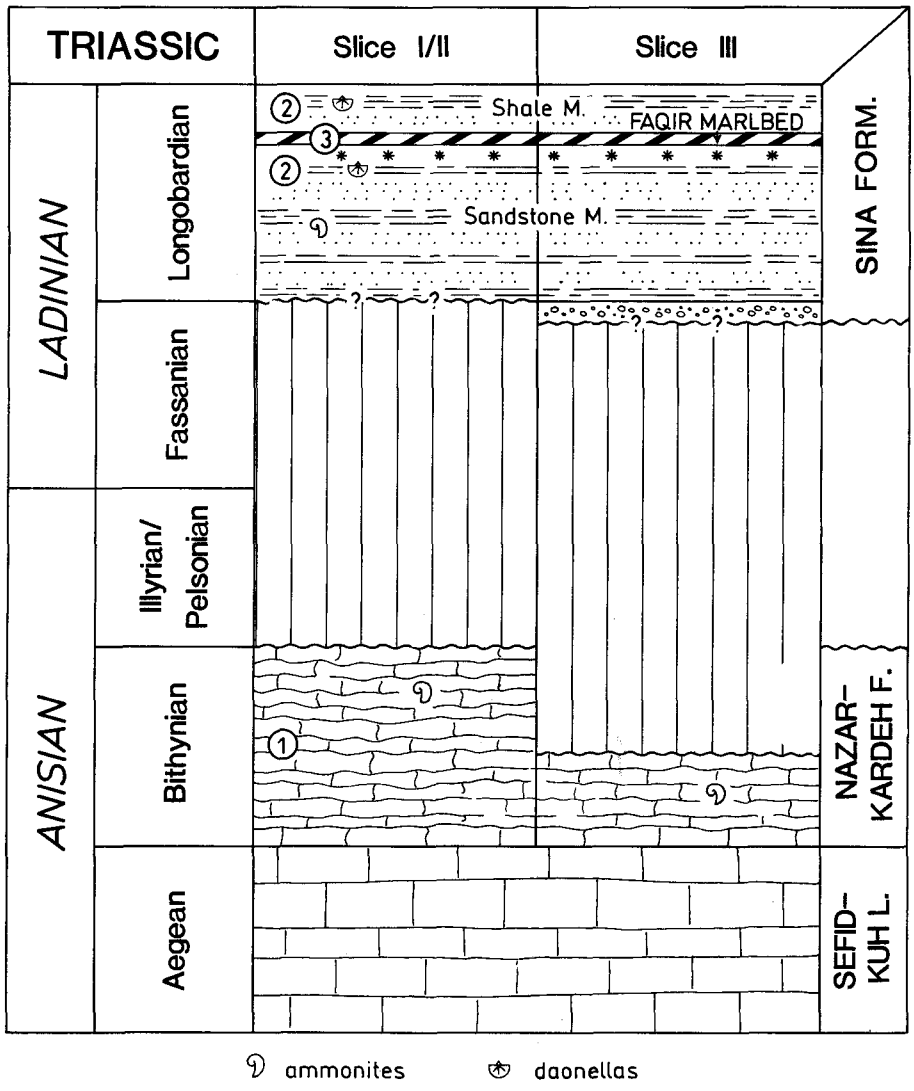
2.1. "Fossil Horizon 1"

It forms the upper part of the Nazarkardeh Formation and consists of greenish-grey nodular and partly siliceous limestone beds alternating with shales and sandstones. The whole sequence has a varying thickness with a maximum of 50 m (RUTTNER, 1980, p. 13). However, at the eastern flank of Sefid Kuh, the sequence may be considerably thinner; it has not been mapped there (RUTTNER, pers. comm.), but its characteristic fauna has been found (sample No. 75/23b).

Fossil Horizon 1 corresponds to the Upper or Bithynian substage of the Lower Anisian and includes two ammonite zones (*Nicomedites osmani, Aghdarbandites* n. gen. *ismidicus*), both represented by their guide species. The ammonoids have not been collected bed by bed. Therefore, and because of widespread folding of the beds, sequential data on their distribution are not available; neither data on the number of fossiliferous beds nor on detailed faunal successions. However, according to the faunas listed below, no zonal mixing can be found within the different samples:

Agh 75/8 : *Nicomedites osmani* TOULA, 1896
Pseudohollandites n. gen. *eurasiaticus* n. sp.
Gymnites aghdarbandensis n. sp.
Costigymnites n. gen. *asiaticus* n. sp.
Procladiscites cf. *proponticus* TOULA, 1896
Agh 75/23b: *Pseudohollandites* n. gen. *eurasiaticus* n. sp.
Agh 75/25 : *Nicomedites osmani*, TOULA, 1896
Pseudohollandites sp.
Leiophyllites suessi (MOJSISOVICS, 1882)
Agh 75/37 : *Aghdarbandites* n. gen. *ismidicus* (ARTHABER, 1915)
Semibeyrichites n. gen. *ruttneri* n. sp.
Gymnites asseretoi TOZER, 1972
"*Japonites*" cf. *kirata* DIENER, 1907
Sturia sansovinii (MOJSISOVICS, 1869)
Procladiscites cf. *proponticus* TOULA, 1896
Psilosturia sp.

Agh 75/8, Agh 75/23b and Agh 75/25 represent the *Osmani* zone, Agh 75/37 the *Ismidicus* zone. Though closely related in age, the faunas of the two zones are geographically widely separated from each other when compared on the geological map (Fig. 1). The sites Agh 75/8, 75/23b and Agh 75/25 with the Lower Bithynian ammonites belong to the tectonic Slices I and II of



Text-Fig. 2.
Middle Triassic stratigraphy of Aghdarband showing the positions of fossil levels 1 + 3. Note the presumed gap in the Upper Anisian and the Lower Ladinian.

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BAUD & STAMPFLI and RUTTNER (this vol.) in the area to the West of Aghdarband village. On the other hand, locality Agh 75/37 with the Upper Bithynian fauna occurs in tectonic Slice III in the area to the East of the village; the Nazarkadeh Formation is overlain there by a distinct conglomerate.

2.2. "Daonella Beds"

Above "Fossil Horizon 1" greenish grey to dark red tuffaceous sandstones of 50–300 m and green tuffaceous shales of 50–300 m form the Sandstone Member and the Shale Member of the Sina Formation. The upper third of the sandstones (Agh 75/22b, Agh/53, Agh 76/56, Agh 76/58) the Faqir Marl Bed (Agh 75/30) and a lower part of the shales (Agh 75/27) contain rare daonellid bivalves and a single ceratitid ammonite.

Agh 75/22b *Daonella* cf. *lommeli* (WISSMANN, 1841)
Agh 75/27 *Daonella lommeli* (WISSMANN, 1841)
Protrachyceras? sp. ind.
Agh 75/30
Agh 76/53 *Daonella tyrolensis* MOJSISOVICS, 1874
Agh 76/56 *Daonella lommeli* (WISSMANN, 1841)
Monophyllites sp. ind.
Agh 76/58 *Gevanites* cf. *zaheri* (FOURON & RAOUGET, 1951)

Both the bivalves (*Daonella lommeli*) and the ammonite (*Gevanites* ? cf. *zahedi*) favour an Upper Ladinian age for the "*Daonella* Beds". A more accurate dating may be provided by "Fossil Horizon 2" which is located just at the base of the Shale Member of the Sina Formation and is of uppermost Ladinian age. This points to a lower Upper Ladinian age for Member 2 and a lowermost Carnian age for the upper part of the Shale Member of the Sina Formation.

2.3. "Fossil Horizon 2"

Located at the base of the Shale Member of the Sina Formation it consists of a red to greenish coloured slightly tuffaceous marl with abundant ammonoids named the Faqir Marl Bed (RUTTNER, this vol.). Its ammonoid fauna ist dominated by the genus *Romanites* and the association may therefore be called *Romanites* fauna. Beside *Romanites* the genus *Lobites* and big nautiloids are frequent.

Agh 75/6, Agh 75/32, Agh 75/33: *Romanites simionescui* KITTL, 1908
Lobites sp.
Orestites sp.
Agh 75/20: *Sphingites* n. sp. 1
Agh 75/30: *Romanites simionescui* KITTL, 1908
Lobites ellipticus (HAUER, 1860)
Agh 75/34, Agh 75/36/3: *Romanites simionescui* KITTL, 1908
Lobites sp.
Orestites ? sp.
Agh 75/35: *Romanites simionescui* KITTL, 1908
Lobites ellipticus (HAUER, 1860)
Orestites ? sp.,
Proarcestes sp.
Agh 75/36, Agh 75/42b: *Romanites simionescui* KITTL, 1908
Lobites cf. *ellipticus* (HAUER, 1860)
Orestites ? sp.

Romanites and *Lobites* are common within Upper Ladinian to Lower Carnian condensed ammonoid faunas of the western Tethys. In the uncondensed sequences of Epidaurus, Greece and Tepeköy, Kocaeli Peninsula (ÖZDEMIR, 1973) the genus *Romanites* is already restricted to the late Upper Ladinian (Longobardian 3). A corresponding age ist suggested for "Fossil Horizon 2", too.

3. Paleobiogeography

(L. KRYSTYN)

Seen from a worldwide viewpoint, Triassic ammonoid deposits on epicontinental platforms are relatively rare outside the Boreal region and mostly restricted to the mobile belts of the Tethys and the Pacific. Even within those, faunas are widely scattered and – if present – seldom rich.

Bearing this in mind it might be similarly astonishing to the reader as it was to us when we achieved the following results. Our attempt has, however, been supported by the fact of an intensive increase of knowledge on Middle Triassic ammonoids form Asia during the last two decades. Distribution data are now available from Turkey (FANTINI-SESTINI, 1988), Iran (TOZER, 1972), the southern USSR (SHEVYREV, 1968), Afghanistan (FARSAN, 1972), northern China (YANG ZUN-YI et al., 1986; WANG-YI-GANG et al., 1986), and the USSR Far East (ZHAKAROV, 1968; OKUNEVA, 1976). For worldwide comparison we could benefit from modern contributions to North America (TOZER, 1967; MC LEARN, 1968; SILBERLING & NICHOLS, 1985; BUCHER, 1989). Less new informations were obtained from the Tethys region (WANG YI-GANG & HE GUO-XIONG, 1976). There we could additionally refer to unpublished sources by one of the authors (LK).

The Lower Anisian and the Upper Ladinian fauna of Aghdarband corresponding to the two ammonoid horizons will be discussed separately because of their highly differing age. They are both of low diversity, the upper one with five genera less diverse than the lower one with eleven genera. The higher diversity of the lower ammonoid horizon is explainable by its approximately double range of time. Though it includes two ammonoid zones its fauna is treated as one sample because of the similar geographic distribution patterns and of the minimal time difference of about one million years.

3.1. Lower Anisian (Bithynian)

The Aghdarband assemblage consists of such widespread genera as *Sturia, Psilosturia, Procladiscites* and *Gymnites*. They are like the new genus *Costigymnites* of minor biogeographic importance at taxon range. At species level *Procladiscites proponticus* is known from Gebze (Turkey) and the Caucasus, *Gymnites asseretoi* from Nakhlak. Furthermore there are *Nicomedites osmani, Pseudohollandites* n. gen. *eurasiaticus, Aghdarbandites ismidicus* and *Semibeyrichites* n. gen. *ruttneri* n. sp. For the purpose of palaeobiogeographic comparisons this assemblage is called the *Nicomedites* fauna.

Nicomedites osmani is known from Gebze, the Caucasus (described as *Hollandites* by SHEVYREV, 1968) and Mt.

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Maduo in Northern China (HE GUO-XIONG et al., 1986). *Nicodemites* most probably is also represented by "*Beyrichites* cf. *rotelliformis*" of OKUNEWA (1976, Pl. 1, Fig. 9) from the Khabarovsk area in the USSR Far East. Rare occurrences of *Nicomedites* are further known from the Himalayas (KRYSTYN, unpublished) but not from the Hallstatt facies of the tropical Tethys (= Tethys branch s. str.). The only report of a *Nicomedites* from Nevada (SILBERLING & NICHOLS, 1985) is not confirmed by us.

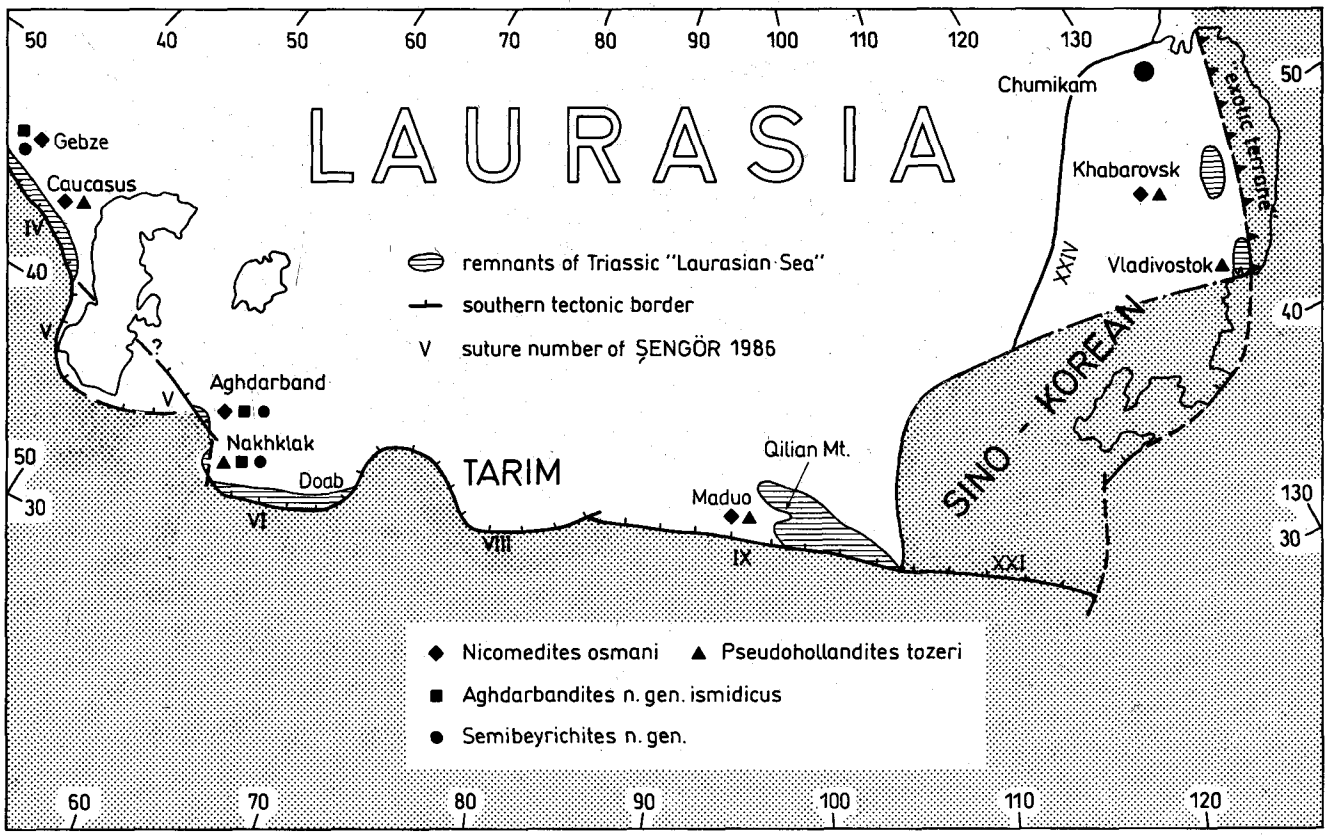
Pseudohollandites n. gen. *eurasiaticus* n. sp. has its closest relative in *Pseudohollandites* n. gen. *tozeri* known from the Caucasus (SHEVYREV, 1968), Nakhlak in Iran (TOZER, 1972), Maduo (HE-GUO-XIONG et al., 1986), Primorje (ZAKAROV, 1968) and Khabarovsk identified there as *Hollandites japonicus* MOJSISOVICS by OKUNEVA (1976, pl. 1, fig. 10). The genus is hitherto unkown from the Tethys branch s. str.

Aghdarbandites n. gen. *ismidicus* is only described from Nakhlak and Gebze where it is fairly common. Its relatively restricted occurrence compared with the one of *Nicomedites osmani* may be explained by the missing of time-equivalent ammonoid bearing levels in the Caucasus and in Central Asia due to subsequent erosion. *Aghdarbandites* n. gen. has not been described from the Tethys branch s. str. and is missing in North America.

Semibeyrichites n. gen. *ruttneri* n. sp. occurs in Nakhlak and the closely allied *Semibeyrichites toulai* of FANTINI-SESTINI, 1988 is common to Gebze. Once more the genus is unknown from the Tethys branch s. str. as well as from North America.

When plotting the data on a present-day map (Fig. 3) they follow a more or less straight east to west trending line of more than 5000 km length from the Black Sea to Central China in a latitude close to 35°N. Around a longitude of 110°E the "line" shows a north–south-directed offset of about 10 degrees of latitudes to the north and continues afterward in east to west direction till Vladivostok (see Text-Fig. 3).

As may be seen from above, the *Nicomedites* fauna forms a distinct and continuous realm which is named here as North Tethyan biogeographical subprovince and which is faunistically clearly separated from the contemporaneous fauna of the South Tethyan subprovince or the Tethys province s. str. The more one follows its traces from the west to the east, the more the two realms are geographically isolated from each other. At its western end (Turkey, Iran) the *Nicomedites* fauna otherwise is – and most probably never was – far away from the Tethys branch s. str. Climate alone may therefore have had only in part an influence on the faunistic differentiation. The assumption of a physical barrier cutting off or diminishing a faunal exchange between the two faunal realms seems to explain better the biogeographic separation. Such a barrier may be found in the presence of an elongated continental block ranging from the western Triassic Tethys to the western Pacific shore boardering thereby the *Nicomedites* fauna to the south. This block needs not necessarily represent a true land mass. A shallow sea filled with restricted tidal to shallow subtidal platform carbonates as for example known from Iran (DAVOUDZADEH & SEYED-EMAMI, 1972; DAVOUDZADEH & SCHMIDT, 1982) would similarly act as a migration barrier for pelagic nectonic organisms such as ammonoids. The idea of isolated continental masses or microplates within the



Text-Fig. 3.
Distribution of the *Nicodemites* fauna during Early Anisian (Bithynian) time.
Paleoposition of Nakhlak according to DAVOUDZADEH & SCHMIDT (1982) after clockwise rotation of the Central Iranian Microcontinent around 110°. Gebze, today part of the western Istanbul Nappe (see SENGÖR, 1984), is interpreted and figured as the paleogeographical lateral continuation of the Caucasus Triassic.

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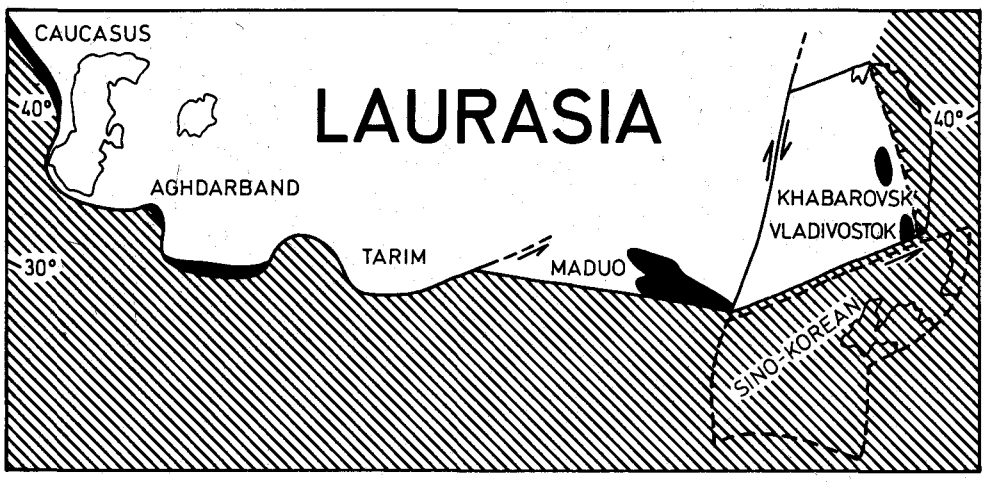

Text-Fig. 4.
Southern outline of Middle Triassic Laurasia by displacing the North China block about 10° to the South. The entirely craton-bounded *Nicodemites* fauna supports the proposed North Tethyan subprovince and a marine connection from the Caucasus to the "Pacific ocean" in at least Lower Anisian time.
Today preserved sediments in black. Note present day latitudes.

originally as broadely oceanic assumed Triassic Tethyan golf (DIETZ & HOLDEN, 1970; SMITH et al., 1981) has gained various supporters within the last decade, and there exist currently several rivalling concepts (DEWEY et al., 1973; STAMPFLI, 1978; SENGÖR, 1979; BOULIN, 1981). But the best conformity with our dispersal pattern is provided by SENGÖR's Cimmerian Continent which is strongly supported by our results.

According to SENGÖR (1984), Cimmeria has accreted to Laurasia in the late Triassic, thereby forming a suture zone which can be traced from Europe through Middle and Eastern Asia close to the Pacific Ocean. On Fig. 3 we have added SENGÖR's main Cimmerian sutures bounding Laurasia to the south during the Triassic. There is a striking coincidence of these sutures with the distribution of the *Nicomedites* fauna just to the north of them at the whole length between the Caucasus and China. Major differences have been registered only in Eastern Asia between Primoryje and the Sea of Okotsk, where SENGÖR's (1986, Fig. 1) sutures XXIII to XXV are located about 500 to 1000 km farther to the west of the *Nicomedites* fauna of Vladivostok and Khabarovsk (see Text-Fig. 3). This requires clarification because the two areas would thereby be excluded from Laurasia and would be transferred to the North China Platform of SENGÖR & HSÜ (1984). As a result they would either become part of Cimmeria (SENGÖR et al., 1985) or a Triassic exotic terrane (SENGÖR et al., 1988). Both interpretations would question the specific bioprovincial importance of the *Nicomedites* fauna but are inacceptable for the reasons mentioned below.

The Triassic rocks from Vladivostok in the south through Khabarovsk to Chumikam in the north must probably have been formed in one continuous sedimentary basin with high clastic and terrigeneous input. They are of marginal character and have been feeded from a main continental hinterland which was directly connected throughout Triassic time. This land had to be located to the west and northwest of the basin because on its eastern side, in Primoryje and Sikutke Alin, allochthonous Triassic rocks of true exotic character like tropical reef limestones (PUNINA, 1987) and oceanic(?) radiolarites (RYBALKA, 1987) are found. As a concequence at least the northern part of the North China Platform till down to Vladivostok should have been Triassic Laurasia (see Text-Fig. 4). The most elegant solution for solving this problem might be a tectonic division of the North China Platform along suture XVI of SENGÖR et al. (1988, Fig. 3) into two independent parts: a northern Laurasian one including Vladivostok, Khabarovsk and Chumikam and a major southern mass also known as Sino-Korean Block of non-Laurasian(?) origin.

3.2. Upper Ladinian (Longobardian)

From the "*Daonella* beds" only a few ammonites have been collected and of these *Gevanites* cf. *zahedi* may be mentioned. It is a ceratite described from northwestern Afghanistan in a zone mentioned as the lateral continuation of the Aghdarband area by SLAVIN (1974). Ladinian ceratites may be of minor palaeobiogeographic value. They occur widespread in relatively shallow water marginal seas and are known for example from the northern (Germanic sea), western (Spain) as well as southern (Israel) epicontinental border of the Tethys. Even from North America (Nevada) germanotype ceratites have been described by SILBERLING (1959, p. 13).

The *Romanites* fauna of the Faqir Marl Bed includes *Romanites simionescui, Lobites ellipticus, Orestites* sp., *Sphingites* n. sp. 1 and *Proarcestes* sp. Most of them are cosmopolitan at least on a Tethyan, *Lobites* and *Proarcestes* even on a worldwide scale. *Romanites simionescui* and the genus *Sphingites* with the pan-Tethyan distribution prove that the Lower Anisian faunal provincialism of the Southern Laurasian sea which may be seen as a North Tethyan subprovince has been reduced during the Upper Ladinian. Whether this improved faunal exchange was triggered by opening of a wider gate to the west or by deepening of parts of Cimmeria (e. g. Pamyr, Northern Tibet) must remain open for the time being.

4. Systematic Paleontology

Order Ceratitida HYATT, 1884
Superfamily Ceratitaceae MOJSISOVICS, 1879
Subfamily Ceratitinae MOJSISOVICS, 1879

Explanation of Abbreviations
GBA = Collection of the Geologische Bundesanstalt, Vienna; DM = diameter of the last whorl; WH = whorl height; h = relative WH; WB = whorl width; b = relative WB; DU = diameter of umbilicus; u = relative DU; LC = length of the body chamber; phc = phragmocon.

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Gevanites ? cf. zaheri
FURON & ROSSET
(Pl. 3, Fig. 1)

+1951 *Ceratites afghanicus* u. sp. var. Zaheri. – FOURON & ROSSET, p. 560, Pl. 1, Fig. 1.

Material: 1 imprint (GBA 1982/61/5).

Discussion: The single specimen has been collected as an imprint on a piece of green tuffaceous sandstone. By using silicon rubber the figured positive print has been made. It shows a laterally compressed, moderately involute, bituberculate shell with a sharp lump-like thickened umbilical shoulder. Due to the unsatisfactory preservation no comments are possible concerning the whorl section and the form of the venter. There are also no traces of the suture line visible.

The sculpture is dominated by two rows of nodes: a lateral one consisting of strong spine-like distant nodes and a marginal row of narrowly placed clavi. This kind of sculpture is most common with many of Middle Triassic ceratitids, and KUMMEL & ERBEN (1968, 104) have already referred *Ceratites afghanicus* to *Progonoceratites*. To our view, a greater similarity exists with the genus *Gevanites* PARNES, 1957. However, due to the fragmentary preservation a generic identification is highly questionable. By its ribless and biturberculate ornamentation and by the narrow umbilicus the specimen nevertheless is very close to *"Ceratites afghanicus* var. *Zaheri"* of FOURON & ROSSET, 1951.

Occurrence: Found in the float of Kale-e-Faqir valley (Agh 76/58); see Fig. 1 and RUTTNER, this vol., Pl. 1. By the described lithology it may be attributed to the near-by exposed Sandstone Member of the Sina Formation with question mark. It is of some stratigraphic importance so far as within Tethyan sequences until now true ceratites have not been found above the Middle Longobardian.

"Ceratites" afghanicus is known from Ladinian rocks of Doab in the western Hindukush (Afghanistan). FARSAN (1972, 139) has compared the Middle Doab Beds containing *"Ceratites" afghanicus* with the Upper Member of the Khenjan Formation at Khenjan. Since the underlying, 100 m thick Middle Member of the Khenjan Formation includes true daonellids, and the Upper Member *Daonella tyrolensis* as well as the ammonoid genus *Mesocladiscites*, at least a basal Upper Ladinian age may be inferred too for the *"Ceratites" afghanicus* level of Doab and Aghdarband.

Subfamily Beyrichtinae SPATH, 1934

Pseudohollandites n. gen.

Type species: *Pseudohollandites* n. gen. *eurasiaticus* n. sp.

Derivatio nominis: On account of the similarity with the genus Hollandites.

Diagnosis: Medium sized, non-tuberculate, single ribbed, moderately evolute, externally well rounded forms. Whorls higher than thick, with well-rounded umbilical shoulder, long and gently convex flanks, short and not well defined ventrolateral shoulder and a broad, gently rounded venter. Adult stage without distinct umbilical egression.

Flanks covered with more or less straight, radiate or slightly prosiradiate pronounced single ribs. Before their ending along the ventrolateral shoulders, the ribs may bend forward, the venter is smooth. The ribs are more distantly spaced on the phragmocone than on the adult body chamber where they may follow much closer. Bifurcation is very rare and restricted to the umbilical region. The ceratitic suture comprises a wide and only slightly denticulated lateral lobe and towards the umbilicus at maximum three in size strongly decreasing umbilical lobes. The saddles are broadly rounded, about as high as thick.

Discussion: As it has been mentioned already by MC LEARN (1968), the genus *Hollandites* is conventionally used in a very broad context. And there are in fact several groups of forms distributed within the Lower Anisian which may have one or more features in common with true *Hollandites.* Nevertheless with the increasing stratigraphic and systematic knowledge on Lower Anisian ammonoid faunas (TOZER, 1972; ASSERETO, 1974; WANG YI-GANG et al., 1976; HE GUO XIONG et al. (1986), SILBERLING & NICHOLS, 1985; BUCHER, 1989; KRYSTYN, unpubl.) the morphological and generic distinction of these groups becomes clearer and better consolidated now.

The diagnostic features of *Hollandites voiti*, the type species of the genus are umbilical nodes, an umbilical edge, sigmoidal ribs which continue on the venter, hinted marginal nodes and an ammonitic suture. Several Himalayan species described by DIENER (1895, 1907 and 1913) as *Hollandites ravana, Hollandites airavata, Hollandites visvakarma* are either conspecific or like *Hollandites roxburghi, Hollandites dungara, Hollandites hidimba* and *Hollandites vyasa* at least congeneric with *Hollandites voiti*. According to unpublished field data from the type region (Spiti) *Hollandites voiti* is common in the topmost Lower Anisian (*Acrochordiceras hyatti* Zone) and may be even restricted to it.

Another *Hollandites* like group of forms is described from the basal Lower Anisian (Caurus Zone) of British Columbia (MCLEARN, 1968). It includes *Hollandites pelletieri, Hollandites humi* and *Hollandites macconelli* which, with respect to the ceratitic suture and the missing umbilical nodes, are clearly different from *Hollandites* s. str. but otherwise are very close to *Pseudohollandites* n. gen. They differ from the genus however in their sculpture composed of numerous twofold dividing sigmoidal ribs continuing on the venter and may represent another independent genus. *Hollandites spivaki*, included into the same group by MC LEARN (1968) has an ammonitic suture and is now referred to *Anagymnotoceras* (see BUCHER, 1989).

Remarks: An undisputed member of the new genus is *Hollandites tozeri* (see ZAKHAROV, 1968; TOZER, 1972). *Hollandites vyasa* (Pl. 7, Figs. 1,2,19,20) and *Anagymnotoceras* cf. *helle* MCLEARN (Pl. 8, Figs. 10–14) of HE GUO-XIONG et al. (1986) may also be representatives of the new genus but seem otherwise to be distinguished by an umbilical edge. One more – however questionable – candidate for *Pseudohollandites* n. gen. is *Ceratites (Ismidites) marmarensis* of ARTHABER (1915, Pl. 12, Fig. 4) which has an umbilical suture with more numerous accessory elements (see below). *"Hollandites" moorei* DIENER 1907 has very similar inner whorls and may be seen as congeneric, despite its strong eggressive adult body chamber (cf. DIENER,

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1907, Pl. 8, Fig. 1). Except for "*Hollandites*" *moorei* all other species of *Hollandites* described by DIENER (1895, 1907, 1913) are either true *Hollandites* or – as *Hollandites cecilii* – probably *Salterites*.

Occurrence: Besides in the Lower Anisian of the Himalayas (DIENER, 1895, 1913) the new genus is well represented in faunas of the Osmani Zone of the "Southern Laurasian Sea" (North Tethyan subprovince) from Turkey (ASSERETO, 1974), Caucasus (SEVYREV, 1968), Iran (TOZER, 1972), China (HE GUO-XIONG et al., 1986) and the Soviet Far East (ZHAKAROV, 1968; OKUNEVA, 1976).

Pseudohollandites n. gen. *eurasiaticus* n. sp.

(Pl. 1, Fig. 9; Pl. 2, Figs. 4–6)

Holotype :The specimen figured Pl. 2, Fig. 6 (GBA 1982/01/4/3).

Type locality: Aghdarband, fossil locality 75/23b (see Fig. 1).

Stratum typicum: Nazarkardeh Formation (Lower ammonite level = "Fossil Horizon 1").

Material: 2 specimens and 2 fragments.

Collection	DM	WH	h	WB	b	DU	u	WB/WH	LC
Holotype GBA 1982/01/4/3	51	21	0.41	17	0.33	17	0.33	0.81	
Paratype GBA 1982/01/4/1	73	30	0.41	22	0.30	?21	0.29	0.73	1/2

Diagnosis: Moderately involute, externally broadly rounded forms with high and relatively flat flanks. The sculpture consists of distantly spaced sharp single ribs which are restricted to the flanks.

Description: Two of the figured specimens, a paratype (Pl. 2, Fig. 4) and the holotype (Pl. 2, Fig. 6) show inner whorls with strong ribs separated by broad intercostal furrows, a sculpture which according to DIENER (1907, p. 66) is characteristic also for *Hollandites moorei*. The sharp single ribs are either radiate (Pl. 2, Fig. 5) or slightly prorsicostate, and bend out a little forward before fading out on the marginal part of the flanks. The venter is arched and without any ornamentation. Different from the other specimens the figured body chamber fragment (Pl. 2, Fig. 5) has more narrowly spaced ribs. The cross section of the whorl is elliptic, higher than wide, with a well rounded umbilical shoulder. The umbilicus is moderately involute and its relative size is more or less constant on the phragmocone and on the body chamber, as can be seen from the holotype.
The fragment figured on Plate 2, Fig. 4 (GBA 1982/01/4/4) shows the external suture line (Pl. 1, Fig. 9) which is characterized by subcircular rounded ceratitic saddles, by a wide lateral lobe and only two umbilical lobes on the flank.

Remarks: Despite the similar inner whorls, "*Hollandites*" *moorei* of DIENER, 1907 differs by the sudden and strong umbilical egression on the final whorl. *Pseudohollandites* n. gen. *tozeri* (ZHAKAROV, 1968) has more, about twice as much, delicate ribs and is more evolute.

Occurrence: Nazarkardeh Formation, Agh 75/23b(1) + Agh 75/8(2) (Bithynian, Osmani zone).

Pseudohollandites n. gen. ? *marmarensis* (ARTHABER, 1915)

(Pl. 2, Fig. 3)

\+ 1915 *Ceratites (Semiornites) marmarensis* Arth. – ARTHABER, p. 123, Pl. 12, Fig. 4.
non 1915 *Ceratites (Semiornites) marmarensis* Arth. Var. – ARTHABER, p. 124. Pl. 12, Fig. 5 (= *Aghdarbandites* n. gen. *ismidicus*).
? 1915 *Ceratites (Hollandites)* sp. indet. – ARTHABER, p. 126, Text.-Fig. 8.
? 1986 *Hollandites Visvakarma* (DIENER. – HE GUO-XIONG et al., p. 225, Pl. 8, Figs. 15,16.

Holotype: The specimen figured by ARTHABER 1915, Pl. 12, Fig. 4.

Type locality: Diliskilessi near Gebze, Kocaeli peninsula (Turkey).

Stratum typicum: Nodular limestone, middle member (ASSERETO 1974).

Material: One phragmocone.

Collection	DM	WH	h	WB	b	DU	u
GBA 1982/01/4/8	22	9	0.41	—	—	5	0.23

Discussion: The small fully chambered and immature fragment shows relatively strong and widely spaced straight to sigmoidal single ribs ending along the ventral margins. The whorl section is much higher than thick with slightly convex flanks, shortly rounded ventrolateral shoulders and a relatively narrow equally rounded venter. The moderately involute umbilicus is bordered by a steeply sloping low umbilical wall passing into a shortly rounded umbilical shoulder. The external suture line has four, well individualized semiammonitic (highly up incised) saddles with only short ceratitic saddle tops.

Remarks: *Ceratites (Semiornites) Marmarensis* Var. of ARTHABER 1915, Pl. 12, Fig. 5 represents a partly strongly weathered specimen. According to its poor kind of preservation the still visible lateral nodes are most remarkable and are in connection with the ventrolateral nodes decisive for the taxonomic transfer of the specimen to *Aghdarbandites* n. gen. *ismidicus*.
Hollandites visvakarma of HE GUO-XIONG et al. 1986 is with respect to general shape, sculpture and suture line very close to *Pseudohollandites* ? *marmarensis*. Its much thicker whorls, however, hinder a full identification.

Occurrence: Nazarkardeh Formation, "Fossil Horizon 1"; Agh 75/37 (Bithynian, Ismidicus Zone).
The species is known from Gebze, where it co-occurs with *Aghdarbandites ismidicus* (KRYSTYN, pers. observations) and with question mark from China (Maduo) where it is described as occurring closely above *Nicomedites* (HE GUO-XIONG et al., 1986, 173).

Aghdarbandites n. gen.

Type species: *Ceratites (Hollandites) ismidicus* ARTHABER.

Derivatio nominis: From Aghdarband (Iran).

Diagnosis: Moderately involute forms with a step-like umbilicus and broad, externally well rounded whorl. Their sculpture is dominated by three rows of nodes of which the umbilical and marginal ones are small. The midlateral nodes are more prominent increasing on the adult body chamber to spine-like

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bullae. Ribs are broad and two-fold branching in the middle of the flanks, bending forward upon that and ending along the well developed marginal shoulders. Suture line ceratitic with well and highly upwards indented lobes and only short rounded saddle tops. Besides the prominent lateral lobe approx. three umbilical lobes are developed. In general outline the suture line of *Aghdarbandites* n. gen. resembles that of *Pseudohollandites ? marmarensis*.

Discussion: Most probably with respect to the strong adult lateral bullae ASSERETO (1974) identified *Ceratites ismidicus* with the genus *Anagymnotoceras*. This genus however is well distinguished from *Aghdarbandites* n. gen. by the missing of lateral and marginal nodes. Moreover *Anagymnotoceras* has bullae-like umbilical nodes which are stronger and wider spaced than in *Aghdarbandites*. Another distinguishing feature may be seen in the ribs continuing to the venter. And last but not least *Anagymnotoceras* is marked by an ammonitic suture line.

Remarks: The new genus is only known by its type species.

Occurrence: For the moment geographically restricted to the Southern Laurasian Sea (North Tethyan subprovince), for further discussion see chapter 3.1.). *Aghdarbandites* n. gen. is the stratigraphic guide to the topmost lower Anisian ammonoid zone of the Tethyan (= tropical) standard.

Aghdarbandites n. gen. *ismidicus* (ARTHABER, 1915)

(Pl. 1, Figs. 6–8; Pl. 3, Figs. 3–5)

+1915 *Ceratites (Hollandites) ismidicus* Arth. – ARTHABER, p. 126, Pl. 12, Fig. 6.
· 1915 *Ceratites (Semiornites) marmarensis* ART. – ARTHABER, Pl. 12, only Fig. 5.
· 1972 *Anagymnotoceras ismidicus* (ARTHABER). – TOZER, Pl. 6, Fig. 1.
· 1988 *Anagymnotoceras ismidicum* (ARTHABER). – FANTINI SESTINI, p. 58, Pl. 11, Fig. 7–9.

Holotype: Original from ARTHABER, 1915, Pl. 12, Fig. 6.

Type locality: Dileskilessi near Gebze (Kocaeli Peninsula, Turkey).

Stratum typicum: Nodular limestone, middle member (ASSERETO, 1974).

Material: 2 specimens, 7 fragments and 2 body chamber fragments, all internal moulds.

Collection	DM	WH	h	WB	b	DU	u	WB/WH	L
GBA 1982/01/2/3	70.5	29.5	0.42	24	0.34	20	0.28	0.81	1/2
GBA 1982/01/2/2	47	22	0.47	14	0.30	11.5	0.24	0.64	Phc.
Holotype	70	30	0.43	23	0.33	18	0.26	0.70	3/8

Description: Two considerable perfectly preserved specimens, one a phragmocone, one with body chamber, show coincidence with the description of the holotype. The inner whorls seem to have single ribs with small umbilical nodes, lateral bullae from which they are slightly projected forward; they end in small marginal nodes. With the penultimate whorl the ribs branch from prominent elevated lateral bullae. The body chamber looses the umbilical and marginal nodes. The lateral bullae become more prominent and the ribs are separated by broader intercostal furrows. Single ribs without bullae are intercalated in the upper part of the flanks.
The shell is moderately involute. Inner whorls with high-rectangular shape, flanks smooth rounded and a little convergent, venter narrow, rounded and separated from the flanks by stiffly curved ventral shoulders. Body chamber with wide slightly rounded venter and distinct ventral shoulders, flanks almost flat. The specimen figured on Pl. 3, Fig. 3 is distinguished by getting the lateral nodes in a very late stage of growth and by its slender cross-section. The external suture line is shown on Pl. 1, Figs. 6–8. It is marked by a prominent lateral lobe followed by three to four umbilical lobes and by highly upwards incised saddles.

Occurrence: Nazarkadeh Formation, "Fossil Horizon 1"; Agh 75/37 (Bithynian, Ismidiucs Zone).
Aghdarbandites nov. gen. *ismidicus* has been established by ASSERETO (1974) as zonal guide for the upper Lower Anisian of the Tethys realm. Until now it is however restricted to the northern subprovince of it, where it is known from Turkey and Iran.

Genus *Nicomedites* TOULA, 1896

Nicomedites osmani TOULA, 1896

(Pl. 1, Fig. 5; Pl. 2, Fig. 1,2)

v + 1896 *Nicomedites Osmani* nov.spec. – TOULA, p. 182, Pl. 22, Fig. 6–11.
v. 1896 *Koninckites Hannibalis* nov. spec. – TOULA, p. 179, Pl. 22, Fig. 1.
v. 1896 *Koninckites Saladini* nov. spec. – TOULA, p. 179, Pl. 22, Fig. 2.
v. 1896 *Nicomedites* (nov. gen.) *Mithridatis* nov. spec. – TOULA, p. 180, Pl. 22, Fig. 3.
v. 1896 *Nicomedites Abu-Bekri* nov. spec. – TOULA, p. 181, Pl. 22, Fig. 5.
v. 1915 *Beyrichites osmani* TOULA sp. – ARTHABER, p. 118, Pl. 11, Figs. 8–10.
? 1968 *Hollandites raricostatus* n. sp. – SHEVYREV, p. 134, Pl. 7, Fig. 7, Text-Fig. 35c.
? 1985 *Nicomedites osmani* TOULA. – WANG YI-GANG, Pl. 64, Figs. 26–28.
· 1986 *Nicomedites barbarossae* (TOULA. – HE GUO-XIONG, WANG YI-GANG & CHEN GUO-LONG, p. 221, Pl. 7, Figs. 7–9.
1986 *Nicomedites* cf. *prusiae* TOULA. – HE GUO-XIONG, WANG YI-GANG & CHEN GUO-LONG, p. 221, Pl. 7, Figs. 10–11, Text-Fig. 23c.
partim 1986 *Beyrichites* cf. *cadoricus* (MOJSISOVICS). – HE GUO-XIONG, WANG YI-GANG & CHEN GUO-LONG, Pl. 7, Figs. 12,13.
? 1986 *Nicomedites* sp. – HE GUO-XIONG, WANG YI-GANG & CHEN GUO-LONG, p. 223, Pl. 7, Figs. 14–18, Text-Fig. 23a.
· 1986 *Hollandites* sp. – HE GUO-XIONG, WANG YI-GANG & CHEN GUO-LONG, p. 226, Pl. 8, Figs. 4–6, Text-Fig. 24b.
? 1986 *Nicomedites osmani* TOULA. – HE GUO-XIONG, WANG YI-GANG & CHEN GUO-LONG, p. 222, Pl. 8, Figs. 7–9, Text-Fig. 23b.
1988 *Nicomedites osmani* TOULA, 1896. – FANTINI-SESTINI, p. 60, Pl. 12, Fig. 3.

Holotype: Original of TOULA, 1896, Pl. 22, Fig. 6.

Type locality: Dileskilessi (Kocaeli Peninsula, Turkey).

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Stratum typicum: Nodular limestone, middle member (ASSERETO, 1974).

Material: 4 specimens and 6 fragments (5 of them are too fragmentary for a full identification).

Collection	DM	WH	h	WB	b	DU	u	WB/WH	LC
GBA 1982/01/3/1	48.5	23	0.47	12.5	0.26	10	0.21	0.54	Phc.
GBA 1982/01/3/2	49	23	0.47	14	0.28	10	0.20	0.61	Phc.

Description: Whorl section compressed, flanks rounded, greatest whorl width slightly below middle of the flanks at the position of the bullae. Venter bluntly rounded, distinct ventrolateral shoulders. Shell moderately involute. Ribs slightly falcoid, distant, weaken at ventrolateral margin, with prominent bullae in the middle of the flanks or little below. They originate normally single at stiff umbilical shoulder. Umbilicus deep with short vertical umbilical wall. Umbilical width is changing during ontogeny and therefore highly variable. Inner whorls are more evolute than middle growth stages which may become relatively involute (see Pl. 2, Fig. 2 and SHEVYREV, 1968). Mature stages become evolute again by a distinct umbilical egression on the last whorl (see TOULA, 1896, Pl. 22, Figs. 9–10).

Discussion: Unfortunately, the holotype as designated by TOULA (1896) is a very imperfect, weathered and crushed phragmocone fragment (Pl. 22, Fig. 6, and not Figs. 7 and 8 as mentioned by ASSERETO, 1974, p. 36).

Another confusion has been introduced by the Treatise where TOULA's 1896 specimen of Pl. 22, Fig. 10 is figured as *Nicomedites osmani* though it was – together with specimen pl. 22, fig. 9 – transferred by ARTHABER (1915, p. 116) to *Nicomedites barbarossae*. However ARTHABER's procedure has not been followed by SPATH (1934, p. 408) and is definitely not followed by us.

The difficulties in separating the two species *Nicomedites osmani* and *Nicomedites barbarossae* were recognized and very carefully discussed already by ARTHABER (1915, p. 116). Nevertheless, ARTHABER could not solve this problem, simply because he had too few specimens and in addition only internal moulds. It must be mentioned that this question can still not be answered satisfactorily because of the lack of sufficient material. But some additional remarks seem to be possible: The type of *Nicomedites barbarossae* is distinguished from *N. osmani* by two features, i. e. the fine and dense ribbing of the body chamber and the missing of a final umbilical egression. This together with the relatively small size of the type are clues to regard *Nicomedites barbarossae* only as an immature representative of *Nicomedites osmani*.

Remarks: Due to the incomplete knowledge of the species and the above described taxonomic confusion, most of the recent identifications on species level seem to be invalid in our opinion. This is especially obvious with respect to the *Nicomedites* specimens described by HE GUO-XIONG, WANG YI-GANG & CHEN GUO-LONG, 1986.

The relatively small and enlarged figured holotype of *Hollandites raricostatus* SHEVYREV, 1968 is well comparable with newly collected internal moulds of *N. osmani* from Gebze.

Occurrence: Nazarkardeh Formation, "Fossil Horizon 1"; Agh 75/8, Agh 75/25 (Bithynian, Osmani Zone).

Nicomedites osmani is the zonal guide for the middle Lower Anisian of the Tethys realm, but is only common in the northern subprovince of it. For further discussion of this problem see chapter 3.1. The species is known from Turkey, U.S.S.R. (Caucasus) and Central China.

Semibeyrichites n. gen.

Type species: *Semibeyrichites* n. gen. *ruttneri* sp.

Derivatio nominis: After semi (gr. half) and *Beyrichites*.

Diagnosis: Shell discoidal, constantly involute during all ontogenetic stages, no umbilical egression of mature body chamber. Venter narrow tabulate to slightly rounded with ventrolateral edges. Whorl section trapezoidal, whorl sides moderately convex, greatest width close to the umbilicus. The ornamentation is weak and consists of distant flat, broad, slightly sigmoidal ribs persisting on the body chamber. Suture ammonitic with a distinct slim and high, deeply incised lateral saddle.

Discussion: Concerning the phragmocone morphology *Semibeyrichites* n. gen. shows affinity to both *Nicomedites* and *Beyrichites* forming an intermediate stage between the two genera. The diagnostic shell differences are mostly confined to the adult. Whereas *Nicomedites* shows an umbilical egression at the beginning of the last whorl, *Semibeyrichites* n. gen. and *Beyrichites* both remain without. *Beyrichites* on the other hand can be separated from *Semibeyrichites* n. gen. by the externally well rounded whorl section lacking the ventrolateral edges. Juvenile specimens of *Nicomedites* and *Beyrichites* are well separable from the new genus by their wider umbilicus. The main difference between the three genera in question is to be found in the external suture line. Whereas *Beyrichites* and *Semibeyrichites* n. gen. have both an ammonitic suture the one of *Nicomedites* is ceratitic marked by well rounded saddle tops. Besides the common similarity, *Beyrichites* and *Semibeyrichites* n. gen. are distinguished in the general outline of the lateral saddle which – because of deep incisions – is high and narrow in *Semibeyrichites* but broad in *Beyrichites*.

Remarks: Until now the new genus is represented only by its type species and by *Nicomedites toulai* of FANTINI SESTINI, 1988 from Gebze. For the latter FANTINI SESTINI (1989) has created a new genus *Kocaelia* based on ARTHABER's (1915) holotype of *"Aspidites" toulaie*. This form and therefore also the genus *Kocaelia* is distinguished from *Semibeyrichites* n. gen. by a nontabulate, well rounded venter and by the less divided suture line (FANTINI SESTINI, 1989, p. 348.

Occurrence: With present state of knowledge restricted to the Ismidicus Zone (upper Lower Anisian) of the Northern Tethyan subprovince where it is known from Turkey and Iran.

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Semibeyrichites n. gen. *ruttneri* n. sp.

(Pl. 1, Figs. 1,10; Pl. 2, Figs. 10,11)

+ 1972 *Nicomedites* cf. *N. toulai* (ARTHABER). – TOZER, Pl. 10, Fig. 14, Text-fig. 4A.
? 1988 *Nicomedites toulai* (ARTHABER, 1914). – FANTINI SESTINI, p. 60, Pl. 12, Fig. 4a,b.

Derivatio nominis: Named in honour of Dr. A. RUTTNER, former director of Geological Survey of Austria and collector of the fauna.

Holotype: The specimen figured on Pl. 2, Fig. 10 (GBA 1982/01/1/2).

Paratypes: The specimens GBA 1982/01/1 and .../3 to /6.

Type locality: Aghdarband, fossil locality Agh 75/37, see Fig. 1 and RUTTNER, this vol., Pl. 1).

Stratum typicum: Nazarkardeh Formation, "Fossil Horizon 1".

Material: 6 specimens and 3 fragments, all internal moulds.

Collection	DM	WH	h	WB	b	DU	u	WB/WH	LC
GBA 1982/01/1/1	117	62	0.53	41.5	0.35	10	0.08	0.67	3/8
GBA 1982/01/1/2	91	48	0.53	29	0.32	7	0.08	0.60	1/2
GBA 1982/01/1/3	73	40	0.55	22	0.30	7	0.10	0.55	Phc.
GBA 1982/01/1/4	72	40	0.56	24	0.33	7	0.10	0.60	Phc.
GBA 1982/01/1/5	58	31	0.53	17	0.29	5	0.09	0.55	Phc.
GBA 1982/01/1/6	37	18		?12		4			

Diagnosis: See diagnosis of *Semibeyrichites* n. gen.

Description: All specimens are internal moulds only. The material from Aghdarband moreover is partly crushed and weathered.

Shell discoidal, involute, venter narrow, tabulate, with very pronounced ventro-lateral shoulders. The venter seems to have weak periodical constrictions, about ten in the last half whorl of the phragmocone. Whorl sides moderately convex, umbilical wall rounded and overhanging, umbilical shoulder well-defined. Umbilicus constantly involute, no umbilical egression on the body chamber. No ornamentation except very weak, but flat and broad falcoid ribs, slightly thickened in the upper half of the flanks. On the inner whorls bifurcation in the middle of the flanks.

The external suture line is figured on Pl. 1, Figs. 1 and 10. It is ammonitic with high and deeply denticulated saddles. According to our material and the specimen figured by TOZER (1972, text-fig. 4A) there are four to five well individualized umbilical (= "auxiliary") lobes.

Remarks: *Semibeyrichites* n. gen. *ruttneri* n. sp. has until now been identified with *Aspidites toulai* ARTHABER, 1915. This species, however, is clearly distinguised by its more rounded, externally non-tabulate cross-section of the whorls, by the final umbilical egression (see ARTHABER, 1915, Pl. 11, Fig. 3) and by the less divided suture line (see ARTHABER, 1915, Text-Fig. 4). *Nicomedites toulai* of FANTINI SESTINI 1988 is congeneric with the here described species. Specifically it differs in the markedly smaller umbilicus and the comparably reduced whorl thickness (see FANTINI SESTINI, 1988, pl. 12, fig. 4a, b).

Occurrence: Nazarkardeh Formation, "Fossil Horizon 1"; Agh 75/37 (Bithynian, *Ismidicus* Zone).

Superfamily Pinacocerataceae MOJSISOVICS, 1879

Family Gymnitidae WAAGEN, 1895

Costigymnites n. gen.

Type species: *Costigymnites* n. gen. *asiaticus* n. sp.

Diagnosis: Evolute compressed forms with arched venter. Inner whorls smooth, medium to adult growth stages ornamented by blunt rectiradiate single ribs on the lower part of the flanks. The suture line is very similar to that of *Gymnites* but with less divided and less numerous auxiliary lobes.

Discussion: Hitherto morphologically similar forms have been described as belonging to the genus *Japonites* MOJSISOVICS, 1893. However, *Ceratites planiplicatus*, the type species of the genus *Japonites*, has an acute venter as already mentioned by MOJSISOVICS (1888, p. 170) and it has numerous rursiradiate ribs which cover also the inner whorls. Within the external suture line of the two genera no significant differences can be observed.

Since the two genera in question are of quite different age they may not be found together. According to BANDO (1964) and new observations from Spiti, Himalaya (KRYSTYN et al., in prep.) *Japonites* seems to be restricted to a time interval close to the Anisian-Ladinian boundary. On the other hand *Costigymnites* n. gen. hitherto is found only in rocks of Lower Anisian age.

Occurrence: Nazarkardeh Formation ("Fossil Horizon 1"); Agh 75/8 and Agh 75/37d (Lower Anisian, Osmani and Ismidicus Zones).

Costigymnites n. gen. *asiaticus* n. sp.

(Pl. 1, Fig. 4; Pl. 3, Fig. 6; Pl. 4, Fig. 7)

Holotype: The specimen figured on Pl. 3, Fig. 6 (GBA 1982/01/9/1).

Locus typicus: Aghdarband, fossil locality Agh 75/8 (see Fig. 1).

Stratum typicum: Nazarkardeh Formation, "Fossil Horizon 1" (Lower Anisian, Bithynian).

Derivatio nominis: Named after its occurrence in Asia.

Material: A complete specimen with the innermost whorls missing (holotype); a fragment (paratype) - both without preserved shell.

Collection	DM	WH	h	WB	b	DU	u	WB/WH	LC
GBA 1982/01/09/1	123	48	—	30		43			
Holotype	92	33	—	23		30			
GBA 1982/01/09/2 Paratype	97	36	—	25	—	—	—	—	—

Diagnosis: Large evolute depressed forms with triangular cross-section, and externally rounded whorls. Inner whorls without sculpture, outer whorls

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covered by broad blunt distant ribs which begin at the umbilicus and which fade above the middle of the flank. The external suture is well denticulated and it resembles that of *Gymnites* but with less auxiliary lobes.

Description: The holotype (Pl. 3, Fig. 6) is a fully chambered specimen ending just at the beginning of the body chamber. The whorls are much higher than thick with flat strongly convergent flanks, a rather narrow rounded venter, steeply sloping low umbilical wall and a shortly rounded well defined umbilical shoulder. The whorls are smooth till the end of the first quarter of the last whorl. The remaining three quarters of the ultimate whorl bear single straight broad blunt ribs. The suture line is ammonitic (Pl. 1, Fig. 4) with high indentations. The lateral lobe (L) is much higher than the lobe U_2 and the two auxiliary lobes are small. The third and fourth lateral saddles are of extraordinary width.

The paratype (Pl. 4, Fig. 4) is an incomplete specimen which is smaller than the holotype. About the half of the last whorl is preserved and there is one third whorl of body chamber. Therefore this specimen may have proceeded into a more mature stage than the holotype. The paratype has the same style of ribbing as the holotype with ribs until the end of the shell. Their number is approximately eight on the last half whorl. The cross-section of the last whorl is close to that of the holotype but it is thicker and externally broadly rounded. The suture line which is not fully visible resembles that of the holotype.

Comparisons: *"Japonites" magnus* WANG & HE, 1976 (Pl. 42, Fig. 5–9) which has the same sculpture and umbilicus, is distinguished by thicker whorls and a ventrally well-rounded cross-section. Moreover this species has a less divided suture line as can be seen on Fig. 65b in WANG & HE, 1976. In their drawing a generic identity of that species with *Costigymnites* n. gen is doubtful.

There are some other evolute gymnitids with ribs originally described by MOJSISOVICS (1882) from Upper Anisian rocks in Europe (e. g. *Gymnites obliquus, G. palmai*). These have whorls with rounded cross-section and they have a sculpture which is restricted to the last whorl – in concrete to the end of phragmocone and to the body chamber. Moreover their suture lines are distinguished by more numberous and equally formed auxiliary lobes.

Occurrence: Nazarkardeh Formation, "Fossil Horizon 1"; Agh 75/8 and Agh 75/37 (Lower Anisian, Osmani and Ismidicus Zones).

Gymnites asseretoi TOZER, 1972

(Pl. 1, Fig. 3; Pl. 4, Figs. 3,5,6)

+ 1972 *Gymnites asseretoi* n. sp. – TOZER, p. 37, Fig. 3 E–F, Pl. 9, Figs. 1,2.

Locus typicus: Anarak region (Central Iran).

Stratum typicum: Baqoroq Formation (Anisian).

Material: 4 specimens (all internal moulds – GBA 1982/01/6/1–4.

Discussion: For full description of the species see TOZER (1972, p. 37). The collected specimens have the same flat discoidal whorls and the same narrow umbilicus as TOZER's type material. The suture (see Pl. 1, Fig. 3) is identical, too. However, there are differences in the strength of the falcoid ribs which are very weak with the Aghdarband specimens.

Remarks: *Gymnites asseretoi* is by the style of ribbing close to *Arctogymnites* and it may represent a forerunner of that genus.

Occurrence: Nazarkardeh Formation, "Fossil Horizon 1"; Agh 75/37 (Lower Anisian, Ismidicus-Zone). The previous record of the species is also from Iran but from somewhat younger beds of Middle to Upper Anisian age (TOZER, 1972).

Gymnites aghdarbandensis n. sp.

(Pl. 1, Fig. 2; Pl. 4, Fig. 4)

Holotype: The specimens figured on Pl. 4, Fig. 9 (GBA 1982/01/7/1).

Locus typicus: Aghdarband; locality Agh 75/8 (see Fig. 1 and RUTTNER, this vol., Pl. 1).

Stratum typicum: Nazarkardeh Formation (Lower Anisian, Bithynian).

Derivatio nominis: Named for the type locality.

Material: 1 specimen (steinkern).

Collection	DM	WH	h	WB	b			W
	77	35	0.45	22	0.29	19	0.25	0.54
	57	26	0.46	15	0.26	17	0.30	—
	42	15	—	10	—	13	—	0.54

Diagnosis: Moderately evolute, slender to compressed forms with small rounded venter, with a prominent umbilical edge and with a perpendicular umbilical wall. The phragmocone is smooth and only the body chamber is sculptured with weak radial single ribs. The suture line apparently resembles that of the genus.

Description: The single specimen is a phragmocone with one third whorl of body chamber. Till the beginning of the last whorl the shell has slowly increasing slender whorls which dip step-like down to the widely open umbilicus. Within this growth stage, whorl height and umbilical width are nearly equal. On the last whorl the umbilicus becomes narrower whereas the whorl height is increasing, a change well visible through the reduction of the index W. The whorl has in cross-section high and gently rounded flanks which are widest at their base, in their lower half parallel and mildly convex towards the shortly rounded venter. The umbilicus is moderately deep with perpendicular slightly overhanging umbilical wall and prominent umbilical edge. The shell is smooth till the end of the phragmocone, the body chamber bears distant radial blunt ribs.

The external suture line (Pl. 1, Fig. 2) has been prepared till the beginning of the auxiliary lobes. It is as highly indentated as with *Gymnites* s. str. and it has a large and wide lateral lobe (L).

Comparisons: There are worldwide no comparable forms known from Lower Anisian beds. The Middle to Upper Anisian *Gymnites humboldti* MOJSISOVICS, 1882 has a very similar form but it is different in its whorl section having the greatest width in the middle of the flank, an equally broadly rounded venter and no um-

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bilical edge. The Upper Anisian *Gymnites religiosus* DIENER, 1908 has a similar whorl section but it can be distinguished by a more narrow umbilicus and by the external suture line. The latter has a divided lateral saddle, characteristical for the genus *Epigymnites* DIENER, 1916.

Occurrence: Nazarkardeh Formation, "Fossil Horizon 1"; Agh 75/8 (Osmani Zone).

Japonites cf. *kirata* DIENER, 1895

(Text-Fig. 5; Pl. 4, Fig. 2)

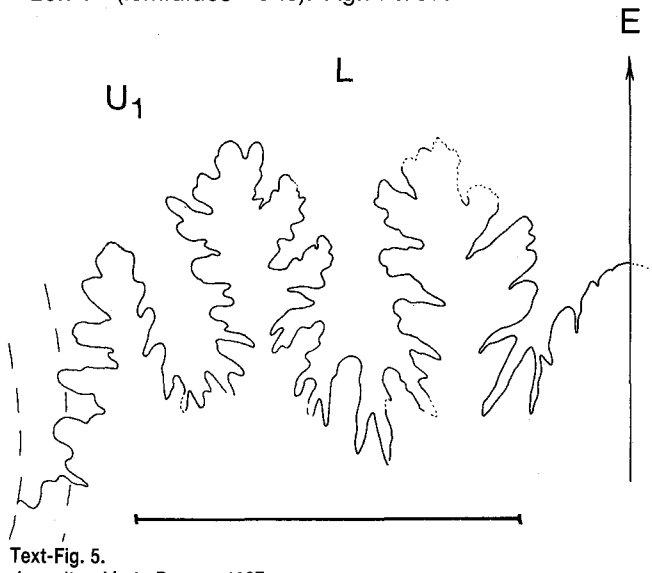
Material: One incomplete weathered phragmocone; GBA 1982/01/8.

Description: Discoidal, compressed, very evolute shell with slightly rounded flanks and arched venter. As the whole specimen is deeply weathered, nothing can be said about ornamentation.

Discussion: From the point of evolution and, comparing whorl height and whorl width of our species is closely related to *Gymnites kirata* DIENER, 1897. The elliptical shape is the only but distinct difference which, however, is interpreted by us to be secondary and artificial, as with many Himalayan fossils due to tectonic distortion.

The suture, although not well preserved, has the three richly denticulated lateral saddles and the broadly and highly incised siphonal saddle typical for gymnitides.

Occurrence: Nazarkardeh Formation, "Fossil Horizon 1" (Ismidiucs zone). Agh 75/37.



Text-Fig. 5.
Japonites kirata DIENER, 1907.
GBA 1982/01/8; Agh 75/73.
Scale: 10 mm.

Family Sphingitidae ARTHABER, 1911

Sphingites n. sp. 1

(Pl. 4, Fig. 1)

· 1915 *Arcestes* cf. *richthofeni* MOJS: – ARTHABER, p. 173, Pl. 7, Fig. 11.

Material: Two steinkerns in the collections of fossil horizon 2.

Discussion: There are two specimens, i. e. an inner nucleus of 21 mm diameter on the one figured on Pl. 4, Fig. 1, which has a one whorl-long body chamber and which may be full grown. It represents most probably a new species distinguished from all previously described species of the genus *Sphingites* by a thicker whorl width, by an elliptic cross section of the whorls and by the relatively involute umbilicus. This is well visible with the figured body chamber whose umbilicus is proportionately even smaller than that of the inner nucleus. Most of the earlier recorded species known from Lower Karnian strata are more evolute and slender (see MOJSISOVICS, 1882). Only the specimen recorded by ARTHABER 1915 as *Arcestes* cf. *richtofeni* resembles *Sphingites* n. sp. 1 closely. ARTHABER's form however, is by no means congeneric with *Arcestes* being more evolute than any representative of that genus. Since ARTHABER's specimen is of the same age as the one from Aghdarband it may well be that a smaller umbilicus is a common feature of Ladinian *sphingitids*.

Occurrence: Sina Formation, Faqir Marl Bed of the Shale Member, "Fossil Horizon 2", Longobardian (Regoledanus Zone) – Agh 75/20 (GBA 1982/01/12/2); Agh 76/55b (GBA 1982/01/12/1).

Family Cladiscitidae ZITTEL, 1884

Procladiscites cf. *proponticus* TOULA, 1896

(Pl. 2, Fig. 8)

Material: 2 specimens.

Discussion: The two specimens are very similar and are apparently closely related to *Procladiscites proponticus*. They differ from this species only by the slender whorl width.

Occurrence: Nazarkardeh Formation, "Fossil Horizon 1" (Bithynian) – Agh 75/8 (GBA 1982/01/10/1), Agh 75/37 (GBA 1982/01/10/2).

Family Joannitidae MOJSISOVICS, 1882

Romanites simionescui KITTL, 1908

(Text-Fig. 6; Pl. 3, Fig. 2)

· *Romanites simionescui* KITTL n. f. KITTL, 1908, p. 55, Pl. 2, Figs. 7,8.

Material: About 20 adult and approximately 40 juvenile specimens; GBA 1982/01/11.

Description: The figured specimen of medium size is the only one with a larger part of the shell preserved. Even that doesn't show the radial folds described by KITTL. Only a partly preserved but fullgrown shell has foldlike ribs in the last quadrant of the body-chamber which cover the upper part of the flanks and the marginal region but do not reach the venter.

The shape, involution and the cross-section of the shells from Aghdarband fit perfectly with the features described by KITTL (1908, p. 55).

The sutureline (Text-Fig. 6) has the same number of elements and the same convex-concave curvature like the holotype. The only difference is the lack of

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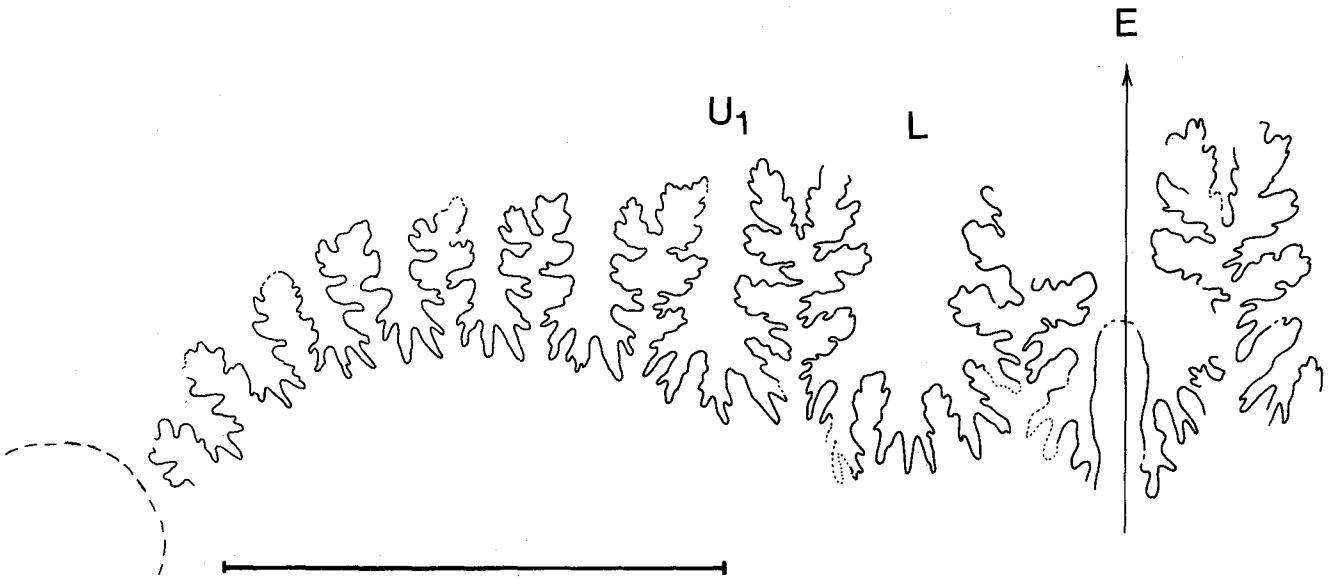

Text-Fig. 6.
Romanites simionescui KITTL, 1908.
GBA 1982/01/11; Agh. 67/69a–b.
Scale: 10 mm.

dimeroid umbilical saddles which resemble that one of arcestids.

Occurrence: Sina Formation, Faqir Marl Bed of the Shale Member, "Fossil Horizon 2", Longobardian 3 (Regoledanus Zone) Agh 75/6, Agh 75/30, Agh 75/32, Agh 75/33, Agh 75/36/3, Agh 75/42b, Agh 76/55b, Agh 76/79a–b, Agh 76/86, Agh 76/96.

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Plate 1

External suture-lines.

Fig. 1: ***Semibeyrichites* n. gen. *ruttneri* n. sp.**
GBA 1982/01/1/6, WH 12,5 mm.

Fig. 2: ***Gymnites aghdarbandensis* n. sp.**
GBA 1982/01/, WH 20 mm.

Fig. 3: ***Gymnites* cf. *asseretoi* TOZER.**
1972 GBA 1982/01/, WH 23 mm.

Fig. 4: ***Costigymnites* n. gen. *asiaticus* n. sp.**
GBA 1982/01/, WH 43 mm.

Fig. 5: ***Nicomedites osmani* TOULA, 1896.**
GBA 1982/01/3/1, WH 14 mm.

***Aghdarbandites* n. gen. *ismidicus* (ARTHABER, 1915).**

Fig. 6: GBA 1982/01/2/2, WH 10 mm.

Fig. 7: GBA 1982/01/2/1, WH 18 mm.

Fig. 8: GBA 1982/01/2/4, WH 23 mm.

Fig. 9: ***Pseudohollandites* n. gen. *eurasiaticus* n. sp..**
GBA 1982/01/4/2, WH 23 mm.

Fig. 10: ***Semibeyrichites* n. gen. *ruttneri* n. sp.**
GBA 1982/01/1/4, WH 26 mm.

Scale 10 mm.
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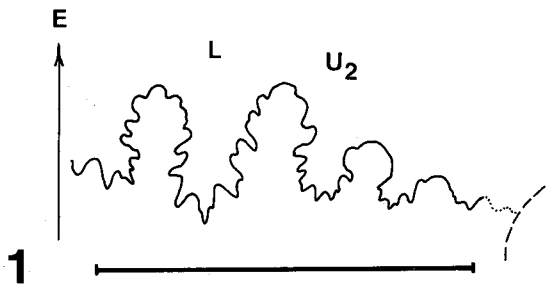

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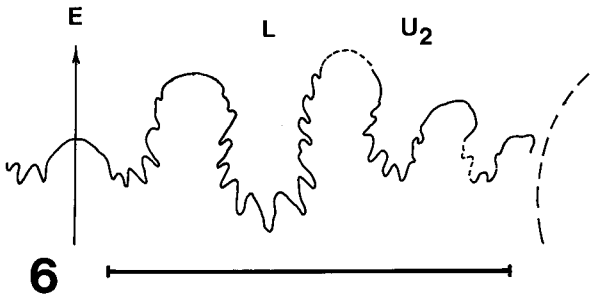

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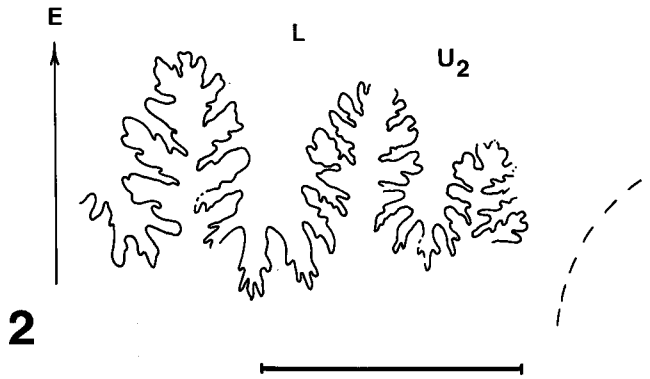

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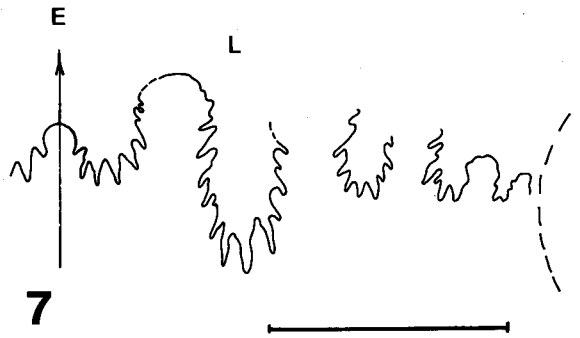

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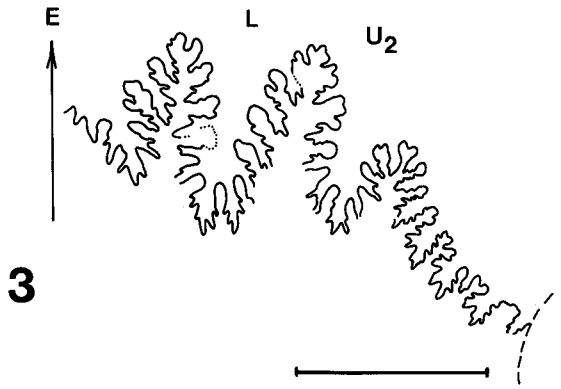

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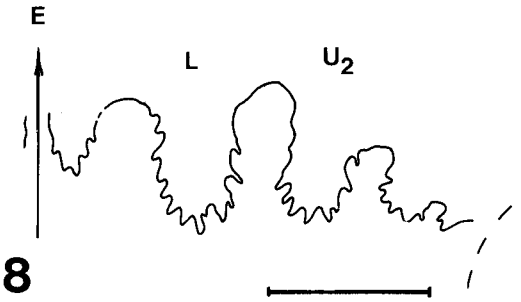

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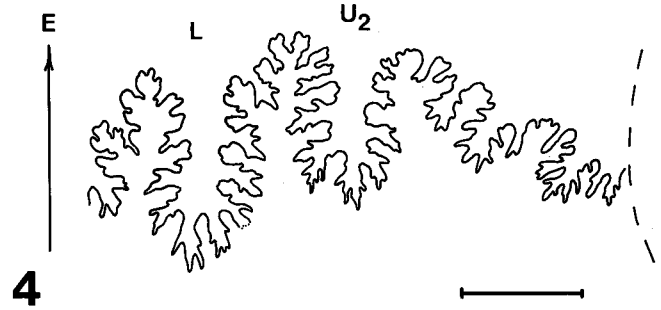

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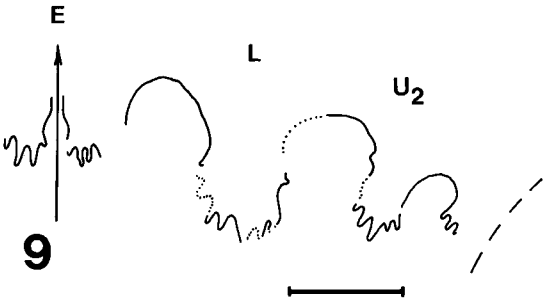

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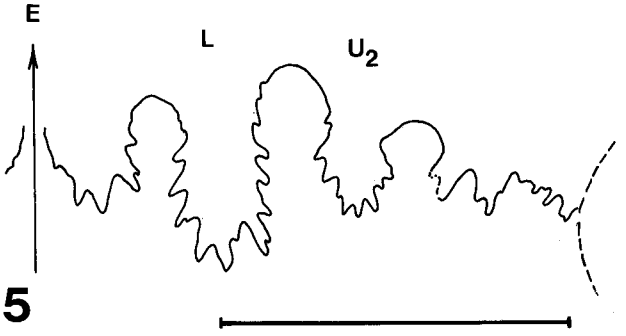

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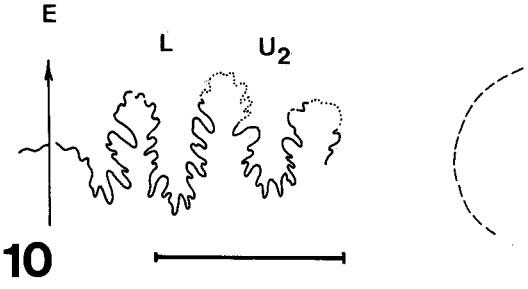

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Plate 2

Fossil Horizon 1 (Bithynian).

Nicomedites osmani **TOULA, 1896.**

Fig. 1: GBA 1982/01/3/2, Agh 75/25.

Fig. 2: GBA 1982/01/3/1, Agh 75/8.

Pseudohollandites **n. gen. ?*marmarensis*** **(ARTHABER, 1915).**

Fig. 3: GBA 1982/01/3/3.

Pseudohollandites **n. gen. *eurasiaticus*** **n. sp.**

Fig. 4: Paratype.
GBA 1982/01/4/2, Agh 75/8.

Fig. 5: Paratype.
GBA 1982/01/4/1, Agh 75/8.

Fig. 6: Holotype.
GBA 1982/01/4/3, Agh 75/23b.

Leiophyllites suessi **(MOJSISOVICS, 1882).**

Fig. 7: GBA 1982/01/13, Agh 75/25.

Procladiscites **cf. *proponticus*** **TOULA, 1892.**

Fig. 8: GBA 1982/01/10/1, Agh 75/8.

Semibeyrichites **n. gen. *ruttneri*** **n. sp.**

Fig. 9: Paratype.
GBA 1982/01/1/6, Agh 75/37.

Fig. 10: Holotype.
GBA 1982/01/1/2, Agh 75/37.

Fig. 11: Paratype.
GBA 1982/01/1/4, Agh 75/37.

Arrow marks end of phragmocone.
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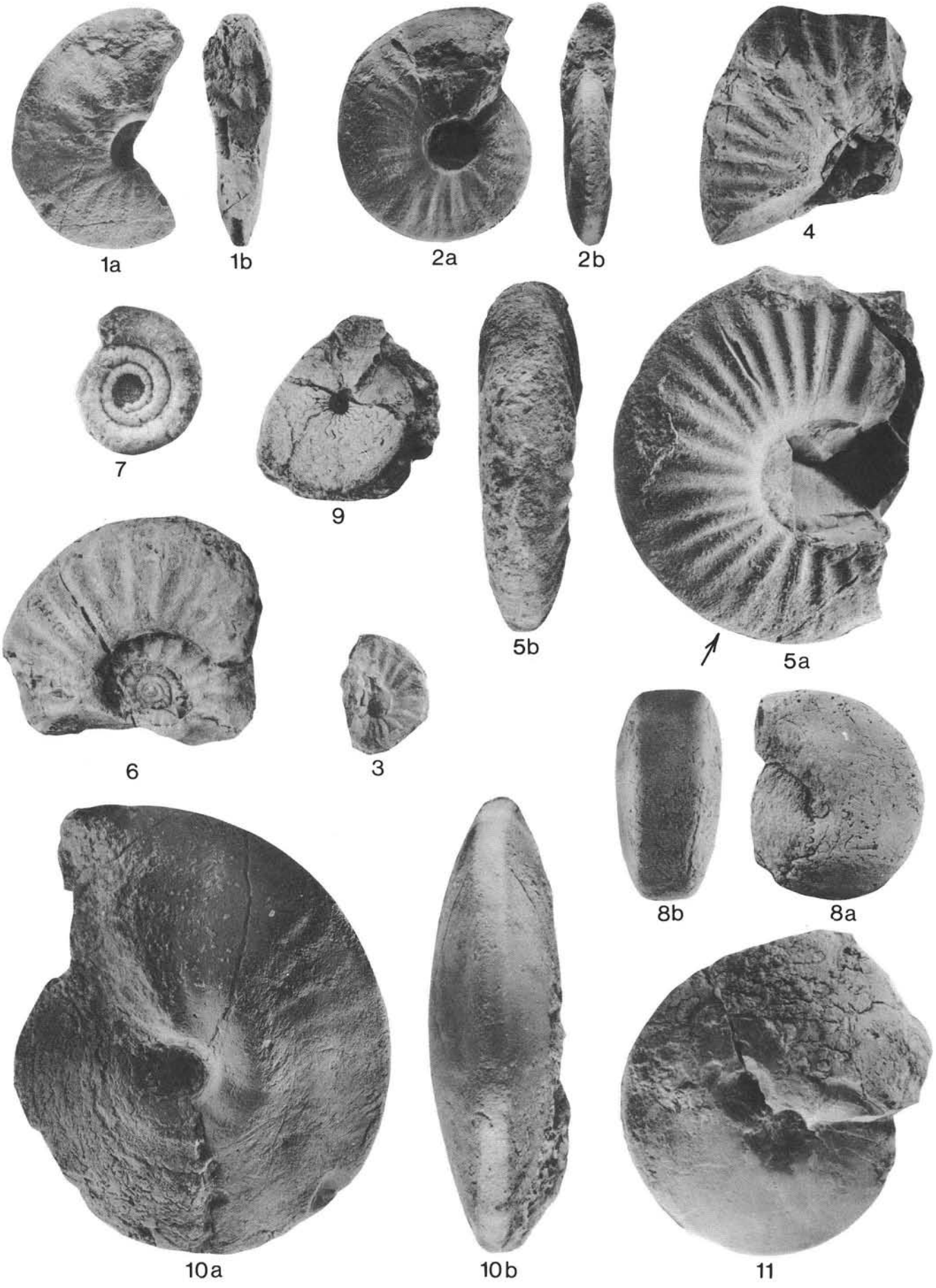

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Plate 3

Fossil Horizon 2 (Longobardian).

***Gevanites*? cf. *zaheri* (FURON & ROSSET, 1958).**
Fig. 1: GBA 1982/01/5/1, Agh 75/53.

***Romanites simionescui* KITTL, 1908.**
Fig. 2: GBA 1982/01/11/1, Agh 75/86.

Fossil Horizon 1 (Bithynian).

***Aghdarbandites* n. gen. *ismidicus* (TOULA, 1896).**
Fig. 3: GBA 1982/01/2/4, Agh 75/37.
Fig. 4: GBA 1982/01/2/3, Agh 75/37.
Fig. 5: GBA 1982/01/2/2, Agh 75/37.

***Costigymnites* n. gen. *asiaticus* n. sp.**
Fig. 6: Holotype.
GBA 1982/01/9/1, Agh 75/8.

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4b

4a

5b

5a

6a

6b

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Plate 4

Fossil Horizon 2 (Longobardian 3).

***Sphingites* n. sp.**
Fig. 1: GBA 1982/01/12/1, Agh 76/55b.

Fossil Horizon 1 (Bithynian).

***"Japonites"* cf. *kirata* DIENER, 1907.**
Fig. 2: GBA 1982/01/8, Agh 75/37.

***Gymnites asseretoi* TOZER, 1972.**
Fig. 3: GBA 1982/01/6/1, Agh 75/37.
Fig. 4: GBA 1982/01/6/2, Agh 75/37.
Fig. 5: GBA 1982/01/6/3,, Agh 75/37.

***Gymnites aghdarbandensis* n. sp..**
Fig. 6: Holotype.
GBA 1982/01/7/1, Agh 75/8.

***Costigymnites* n. gen. *asiaticus* n. sp.**
Fig. 7: Paratype.
GBA 1982/01/9/2, Agh 75/37.

Arrow marks end of phragmocone.
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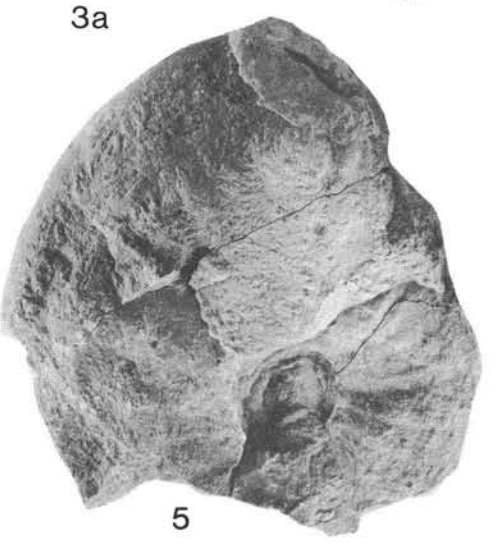

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Autor(en)/Author(s): Krystyn Leopold, Tatzreiter Franz

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