

## *Sutinaites*, A NEW GENUS OF AMMONITE AND NEW AMMONITE SPECIES FROM THE UPPER SCYTHIAN OF MUĆ, CROATIA

VLADIMIR GOLUBIĆ

Natural History Museum, Getaldićeva 13, 21000 Split, Croatia

**Golubić, V.: *Sutinaites*, a new genus of ammonite and new ammonite species from the Upper Scythian of Muć, Croatia. Nat. Croat., Vol. 8, No. 4., 439–451, 1999, Zagreb.**

During many years of research in the locality of the village of Muć a new genus of the Upper Scythian ammonite *Sutinaites* and some new ammonite species were found. The new genus was named after the village of Sutina, a very significant Triassic locality near Muć. The genus is represented by *Sutinaites involutus* n. sp. *Carniolites superior* n. sp., *C. neorichianus* n. sp., *C. planatus* n. sp. and *Pseudokymatites involutus* n. sp. were also found. The new species are elaborated taxonomically and biostratigraphically.

**Key words:** ammonites, new genus *Sutinaites*, new species, Upper Scythian, taxonomy, biostratigraphy, Muć

**Golubić, V.: Novi rod amonita *Sutinaites* i nove vrste amonita gornjeg skita iz Muća u Hrvatskoj. Nat. Croat., Vol. 8, No. 4., 439–451, 1999, Zagreb.**

Tijekom višegodišnjeg istraživanja na lokalitetu selo Muć nađen je novi rod gornje-skitskih amonita *Sutinaites*, te nekoliko novih vrsta amonita. Novi rod je nazvan po selu Sutina, značajnom lokalitetu trijasa pokraj Muća. Novi rod predstavljen je vrstom *Sutinaites involutus* n. sp. Osim novog roda nađene su vrste: *Carniolites superior* n. sp., *C. neorichianus* n. sp., *C. planatus* n. sp. i *Pseudokymatites involutus* n. sp. Nove vrste obrađene su taksonomski i biostratigrafski.

**Ključne riječi:** amoniti, novi rod *Sutinaites*, nove vrste, gornji skit, taksonomija, biostratigrafija, Muć

### INTRODUCTION

During research into Triassic fossil fauna in the area of the village of Muć (Fig. 1) in Central Dalmatia, Croatia, I collected a lot of ammonites, especially of Upper Scythian (Lower Triassic) age. The collection is deposited in the Natural History Museum in Split. New species are generally rare. Most of the species from the locality were collected at the end of the 19th century by Fra J. Malić, professor at the Franciscan Classical Gymnasium in Sinj. This material is deposited in the Naturhistorisches Museum in Vienna, and an account of it was published by KITTL, 1903.



Fig. 1. Geographical position of Muć



The ammonites have mostly been subjected to considerable diagenetic damage, which made taxonomic elaboration more difficult, especially in species with a high level of morphological convergence. In distinguishing *Carniolites* from *Dinarites*, preserved ventral lobes are important. Specimens with a well-preserved ventral side are rare, and hundreds had to be collected in order to find enough preserved specimens. This important fact being borne in mind, it is possible to publish a description of only a few new species of the large number found. This applies especially to the genus *Carniolites*.

## TAXONOMY

Superfamily CERATITACEAE MOJSISOVICS, 1879

Family DINARITIDAE MOJSISOVICS, 1882

Genus *Sutinaites*, n. gen.

The genus was named after the village of Sutina near Muć. It is now represented by only one species that can be determined:

*Sutinaites involutus*, n. gen., n. sp.

Plate I – 1–5, Fig. 2.A

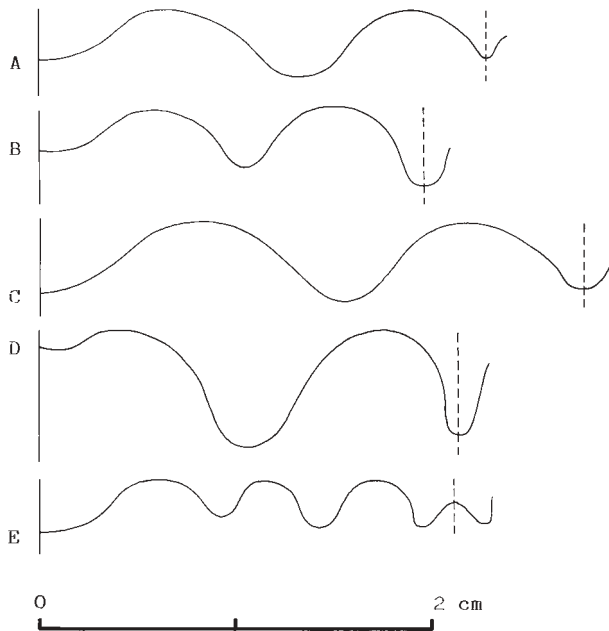


Fig. 2. Sutures: A – *Sutinaites involutus*, B – *Carniolites superior*, C – *C. neorichianus*, D – *C. planatus*, E – *Pseudokymatites involutus*

Holotype: Natural History Museum, Split, Inv. No. 823.

Holotype measurements: whorl diameter 55 mm, umbilical diameter 2 mm, maximum width of the whorl 9.8 mm (GOLUBIĆ, 1997: 242–243, 257; Pl. I, Fig. 6).

*Derivatio nominis*: *involutus* – involute shell.

*Locus typicus*: Muć Gornji, Croatia.

*Stratum typicum*: Upper Scythian marl and clayish limestone.

Diagnosis: Small, smooth, involute ammonite. The whole phragmocone has two ventral edges with a narrow ventral groove between them. There is one, rounded, lateral lobe.

Description: Small, smooth, narrow involute ammonite. Lateral walls, from the seam to the ventral edge, are uniformly slightly rounded. There is a groove between the ventral edges, along the whole length of the coil. Umbilical wall is slightly rounded. Suture is goniatic, very simple: undeveloped lobe at the seam, wide and rounded lateral lobe, and narrow, rounded single ventral lobe.

Seven specimens were found: three adult and four juvenile. External diameter of the largest one is 59 mm.

*S. involutus* has the same suture type as *Carniolites*: simple goniatic suture with a single ventral lobe. Dorsal lobe is also single. The differentiating characteristic of *Sutinaites* in relation to *Carniolites* is the ventral margin of the whorl. *Sutinaites* is probably the result of a certain trend in the evolution of *Carniolites* – an adaptational advantage of a thinner and stronger shell in transition toward a pelagic form.

Beside *S. involutus*, fragments of another *Sutinaites* species (*Sutinaites* sp.) were found (Plate I – 6). It shows a moderately evolute shell, and wider whorls.

Genus *Carniolites* ARTHABER, 1911

*Carniolites superior* n. sp.

Plate I – 7–9, Fig. 2.B

Holotype: Natural History Museum, Split, Inv. No. 827.

Holotype measurements: whorl diameter 50 mm, umbilical diameter 12.2 mm, maximum width of the outer whorl 11 mm (GOLUBIĆ, 1997: 249, 258; Pl. VII, Fig. 2).

*Derivatio nominis*: *superior* – because of its superior position in the Upper Scythian sequence.

*Locus typicus*: Muć Gornji, Croatia.

*Stratum typicum*: clayish and dark biodetritic Upper Scythian limestone.

Diagnosis: Small, smooth, moderately flat, slightly evolute ammonite with straight ventral margin of the whole whorl. Suture very simple, goniatic, with single ventral lobe. There is one, rounded lateral lobe.

Description: Small, smooth, moderately flat, slightly evolute ammonite. Ventral margin of the whole whorl is wide and straight – in juveniles with a sharp transition to the lateral side. Umbilical wall is low, rounded. Lateral wall of the whorl is slightly rounded. Suture is goniatic: undeveloped lobe at the seam, rounded lateral lobe and single, rounded ventral lobe.

More than 20 specimens were found.

*C. superior* is very closely related to *C. carniolicus* (MOJSISOVICS) (syn. *Tirolites carniolicus* MOJSISOVICS, 1882: 65). The main differentiating characteristic of *C. superior* in relation to *C. carniolicus* is the wide, straight, ventral margin of the whole whorl in *C. superior*. *C. superior* covers the whole biostratigraphic range of *C. carniolicus*, and in addition, a few lower and a few upper layers.

*Carniolites neorichianus* n. sp.

Plate II – 5, Fig. 2.C, 3

Holotype: Natural History Museum, Split, Inv. No. 820.

Holotype measurements: whorl diameter 66 mm, umbilical diameter less than 5 mm, maximum width of the outer whorl 11.4 mm (GOLUBIĆ, 1997: 244–245, 257; Pl. VI, Fig. 1).

*Derivatio nominis*: *neorichianus* – after the village of Neorić in the Muć-Sutina valley.

*Locus typicus*: Muć Gornji, Croatia.

*Stratum typicum*: clayish marl and dark biodetritic Upper Scythian limestone.

Diagnosis: Smooth, flat involute ammonite with a rounded ventral side of the whole whorl. Suture very simple, goniatic, with a single ventral lobe. The only lateral lobe is wide, shallow and rounded.

Description: Smooth, flat, involute ammonite. Ventral side of the whole whorl is uniformly rounded. Lateral coil wall is slightly rounded. Umbilical wall is slightly rounded. Suture goniatic: undeveloped lobe at the seam; shallow, wide, rounded, lateral lobe, and a single, rounded ventral lobe.

Four specimens were found.

*C. neorichianus* is very closely related to *C. carniolicus*. The main differential characteristic of *C. neorichianus* in relation to *C. carniolicus* is its involute shell.

*Carniolites planatus* n. sp.

Plate II – 1–4, Fig. 2.D

Holotype: Natural History Museum, Split, Inv. No. 818.

Holotype measurements: whorl diameter 63 mm, umbilical diameter 8.8 mm, maximum width of the outer whorl 6.5 mm (GOLUBIĆ, 1997: 244, 257; Pl. V, Fig. 1).

*Derivatio nominis*: *planatus* – a flat shell.

*Locus typicus*: Muć Gornji, Croatia.

*Stratum typicum*: Upper Scythian marl and clayish limestone.

Diagnosis: Smooth, extremely flat, slightly evolute ammonite. Suture very simple, goniatic, with a single ventral lobe. The only lateral lobe is rounded.

Description: Extremely flat, smooth, slightly evolute ammonite. Ventral margin of the whorl first with a shallow channel, then straight, and slightly rounded towards the end. Umbilical wall slightly rounded. Lateral wall of the whorl slightly

rounded, almost straight. Suture goniatic: slightly developed lobe at the suture, wide rounded lateral lobe, and a single ventral rounded lobe.

Three adult specimens were found, one fragment of an adult phragmocone and two juveniles.

Differentiating characteristic in relation to other *Carniolites* species: extremely flat shell. Very specialized species.

Superfamily NORITACEAE KARPINSKY, 1889

Family MEEKOCERATIDAE WAAGEN, 1895

Genus *Pseudokymatites* SPATH, 1934

*Pseudokymatites involutus* n. sp.

Plate II – 6,7, Fig. 2.E

Holotype: Natural History Museum, Split, Inv. No. 826.

Holotype measurements: whorl diameter 57 mm, umbilical diameter 2 mm, maximum width of the outer coil 12,6 mm (GOLUBIĆ, 1997: 237–238, 256; Pl. II, Fig. 3).

*Derivatio nominis*: *involutus* – involute shell.

*Locus typicus*: Muć Gornji, Croatia.

*Stratum typicum*: Upper Scythian clayish limestone.

FIGURE III



Fig. 3. *Carniolites neorichianus*

Diagnosis: Small, flat, involute ammonite. Ventral margin of the whorl sharp. Suture has two lateral lobes with goniatitic characteristics, and wide, short, ventral lobes.

Description: Small, flat, involute ammonite. Ventral margin of the whorl sharp, slightly rounded towards the end of the life-chamber. Lateral wall of the coil slightly and uniformly rounded. Umbilical wall slightly rounded. Suture: lobe at the seam undeveloped, two lateral lobes clearly rounded – first lateral lobe bigger than the other, ventral lobes relatively big, V-shaped. Lobes with goniatitic characteristics.

Twenty-two specimens were found, nine of them quite well preserved.

*P. involutus* is similar to *P. svilajanus* (KITTL) (syn. *Kymatites svilajanus* KITTL 1903: 69). There are three differentiating characteristics of *P. involutus* in relation to *P. svilajanus*: *P. involutus* is more involute than *P. svilajanus*; the umbilical wall of *P. involutus* is slightly rounded and in *P. svilajanus* steep; the ventral margin of the whorl in *P. involutus* is sharp, and in *P. svilajanus* clearly rounded in the whole whorl.

## BIOSTRATIGRAPHY

New species were found in the following layers of the linear biostratigraphic system of the Upper Scythian (GOLUBIĆ 1996: 173):

*S. involutus*: top layers of the eighth and in the ninth horizon, *C. planatus*: top layers of the eighth and in the ninth horizon, *C. neorichianus*: in the middle of the ninth horizon, *C. superior*: top layers of the eighth and in the ninth and tenth horizon, *P. involutus*: top layers of the sixth horizon (together with *P. svilajanus*).

The biostratigraphic position of *P. involutus*, *S. involutus*, *C. planatus* and *C. neorichianus* in relation to the dominant ammonite species of ten horizons of the standard section of Upper Scythian in Muć is defined in GOLUBIĆ, 1997: 250. A more detailed review of the levels containing ammonites in the upper half of the standard section layers is shown in Fig. 4. The horizons represented are: horizon VII with findings of *Tirolites seminudus* MOJSISOVICS (a), horizon VIII with levels of *Dinarites tirolitoides* KITTL (b) and *Dalmatites morlaccus* KITTL (c), horizon IX with levels of different infraspecific forms of *Carniolites carniolicus* (MOJSISOVICS) (d), and horizon X with one level of »*Tirolites (Hololobus)« monoptychus* KITTL (e). In this, more detailed biostratigraphic review a rare species *P. involutus* is placed together with *Pseudokymatites svilajanus* (KITTL) beneath the lower level with *T. seminudus* under the first more significant appearance of finely grained clastites in thin clay layers. Other species described as new ones in this discussion can be found in the biostratigraphic range from the top level with *D. morlaccus* to the level with »*T. (H.)« monoptychus*. *S. involutus* and *C. planatus* were found a little below the lower level with *C. carniolicus*, around the 310th meter of geological column of a standard section where also *Sutinaites* sp. was found. One damaged specimen of *Sutinaites* sp. was found in the level of the upper level with *C. carniolicus*. *C. superior* was found: be-



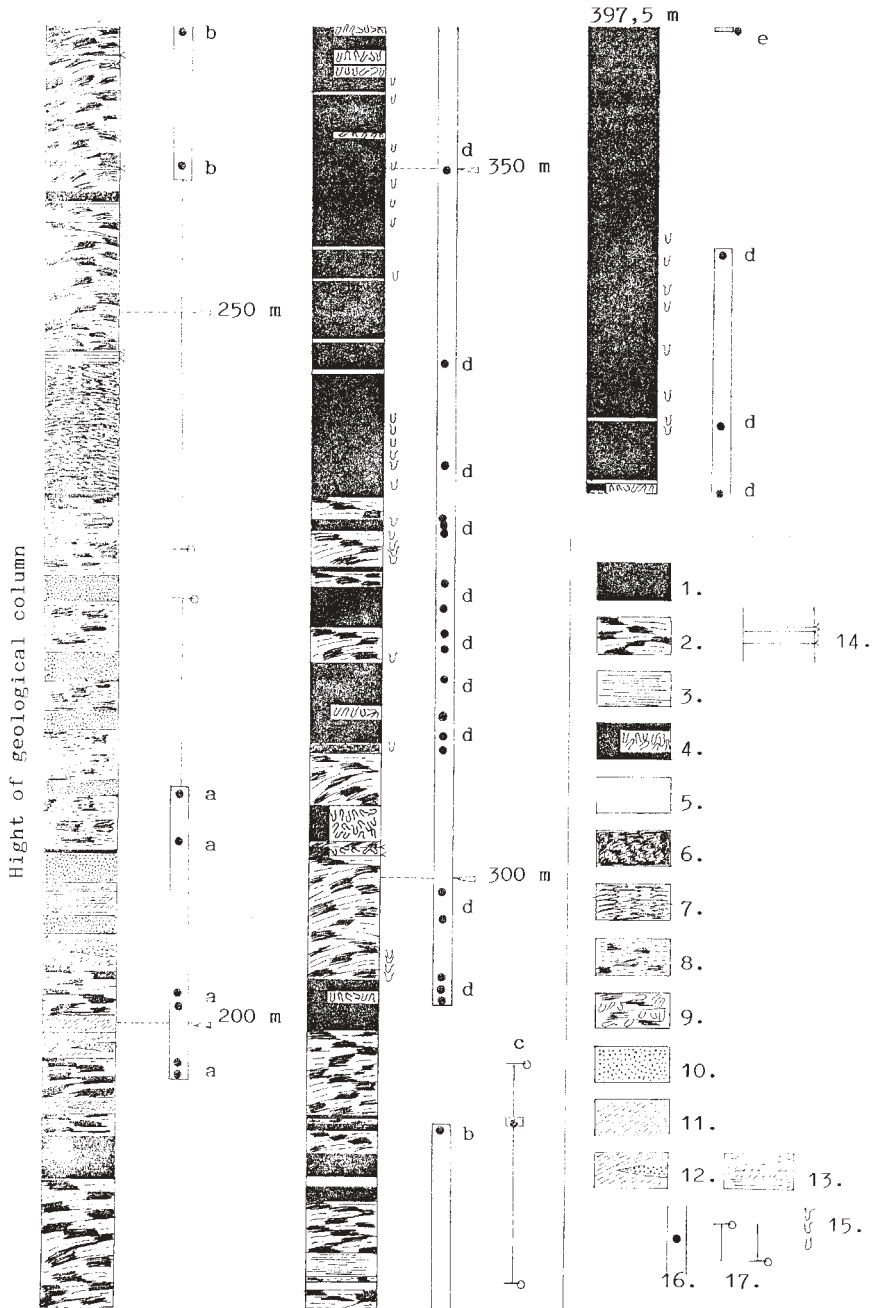


Fig. 4. The biostratigraphic scheme of the lower part of the geological column of the standard section at Muć



tween the upper level of *D. morlaccus* and a lower level of *C. carniolicus*, in a few levels of horizon IX, and more specimens above the upper level of *C. carniolicus*, i.e. horizon X. *C. neorichianus* was found in two levels of the biostratigraphic sequence of *C. carniolicus*. These species are rare, and precise determination of the level of their appearance is necessarily incomplete. All species except for *P. involutus* can be found in the biostratigraphic area of carniolites, i.e. in the area determined by different infraspecific forms of *C. carniolicus*. The aberrations are insignificant and caused by ambient factors in the period of Lower Triassic, as well as in the layers of today's Dinaric area. Discussion of these facts does not belong to this chapter. The question of the fossil markers is still open. Other fossil fauna (except for ammonites) have still not been satisfactorily studied, and determinations are very doubtful. A certain amount of data about them can be found in HERAK *et al.* (1983: 97–102), with a lot of open determinations. The change from the VII to the X horizon is lithologically significant: finely grained silicate clastites (often in a form of turbidites) are characteristic of the VII horizon, and can still be found, but only as silt, in the lower part of the VIII horizon (but not in the standard section); characteristic of the VIII horizon are uniform limestone-clayish layers, and of the IX and X horizon the prevailing limestone layers. This change in layer composition indicates palaeological changes, especially those of physical and oceanographic factors during the Upper Scythian. Characteristic of the layers of the IX horizon is a frequent occurrence of traces of worm life, which in some layers constitutes an important part of the stone; this is connected with the more frequent occurrence of *C. carniolicus*, but not of other ammonite species of the horizon. Lithological characteristics of the geological column are given in the legend in the right bottom part of Fig. 4: 1. limestone, 2. clayish limestone, 3. laminated clay, 4. limestone full of traces of worm life, 5. marl, 6. grained limestone, 7. light, thinly layered limestone, 8. limestone with a lot of silicate silt, 9. clayish limestone, 10. finely grained silicate clastites, 11. laminated silicate silt, 12. laminated silicate silt with pebbles of silicate sandstone, 13. laminated clay with silt, 14. thin pebbles of limestone with clods of gypsum, 15. clayish-limestone and limestone layers with traces of worm life – where it is important to emphasize them because of their frequency, 16. the enclosed part of the horizon with a key ammonite species, 17. lateral occurrence of these ammonites in the horizon – confirmed finds of this species, but rare single specimens marginally from the majority of the find.

## RESULTS OF TAXONOMIC RESEARCH AND DISCUSSION

The topic for discussion is the different views on Upper Scythian ammonite systematics, referring to the subject of this paper. Some researchers do not accept the genus *Carniolites*. They place its type species, *C. carniolicus* (*Tirolites carniolicus* MOJ-SISOVICS 1882) in three different genera: KRYSSTYN (1974: 38–40) in *Tirolites*, SHEVYREV (1968: 168) in *Carniolites*, KUMMEL (1969: 510) in *Dinarites*. The reason for this is the typological characteristics of *C. carniolicus*: the dinaritoide whorl and tirolitoide sculpture. Suture type was not taken into consideration. It was not clear whether it

is original or the result of diagenetic alteration. I investigated this problem in some better preserved specimens of *C. carniolicus* and some other carniolitid species. I found that *Carniolites* specimens have the same suture type that was described in Upper Scythian ammonites by KITTL 1903: 32–33, for *Tirolites (Hololobus) monoptychus* KITTL. I also found that *Carniolites* specimens have a simple goniatic suture with a single ventral and dorsal lobe. It is another question if they are originally goniatic or pseudogoniatic. This is not a diagenetic alteration. I did not solve the question of family. I placed them in the *Dinaritidae*, because KUMMEL (1969) placed the two carniolite species (»*Tirolites*« *carniolicus* and »*T:*« (*Hololobus monoptychus*) in the same family. I accept this classification, but only conditionally – until this question is more adequately solved by paleontological arguments. My personal opinion is that this is a separate family; I would name it *Carniolitidae*. There are other species, accounts of which cannot be published at present because the specimens are damaged. The single ventral lobe is not a good proof. Suture type is a necessary characteristic, but is not enough to determine the family. It remains debatable to which family the genus *Sutinaites* belongs. Generally speaking, European Upper Scythian ammonites were studied mostly as poorly preserved fossil material without biostratigraphic data. Phylogenetic connections were only presumed on the basis of often incompletely observed typological characteristics. Therefore I felt free to classify species according to the typological characteristics examined because the system requires an order. The phylogenetical justifiability of placing the *Carniolites* species in the *Dinaritidae* family is an entirely different question and nothing can be determined for certain at the present time.

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## SAŽETAK

### Novi rod amonita *Sutinaites* i nove vrste amonita gornjeg skita iz Muća u Hrvatskoj

V. Golubić

Istraživanje fosilne faune amonita gornjeg skita u Muću rezultiralo je postavljanjem novog roda *Sutinaites* s tipičnom vrstom *S. involutus*. Nađene su i nove vrste roda *Carniolites*: *C. superior*, *C. neorichianus* i *C. planatus*. Nađena je nova vrsta roda *Pseudokymatites*: *P. involutus*. Holotipovi su deponirani u Prirodoslovnom muzeju u Splitu.

Bitne karakteristike *S. involutus* su: mali amonit s plosnom kućicom, involutan, s jednoliko blago zaobljenim lateralnim zidom zavoja, s kanalom između oštarih ventralnih bridova, te s jednostavnom gonijatitnom suturom s neparnim ventralnim lobom.

*C. superior* i *C. neorichianus* su vrste veoma srodne s *Carniolites carniolicus* (diferencijalne karakteristike u odnosu na *C. carniolicus*: glatki su, *C. superior* ima široki ravni ventralni rub cijele zavojnice, a *C. neorichianus* je involutan). *C. planatus* ima najužu kućicu među dosada poznatim amonitima gornjeg skita.

*P. involutus* je veoma srodan *P. svilajanus*, a razlikuje se od njega po umbikalnom zidu, po oštrom ventralnom rubu zavojnice i po tome što je potpuno involutan.

Biostratigrafski podaci za nove vrste: *S. involutus* i nove vrste roda *Carniolites* nađene su u biostratigrafskom području karniolita a to je gornji dio naslaga g. skita. *P. involutus* nađen je u središnjem dijelu naslaga g. skita zajedno s *P. svilajanus*.



Plate I. 1-5 *Sutinaites involutus*, 6 - *Sutinaites* sp., 7-9 *Carniolites superior*

PLATE II

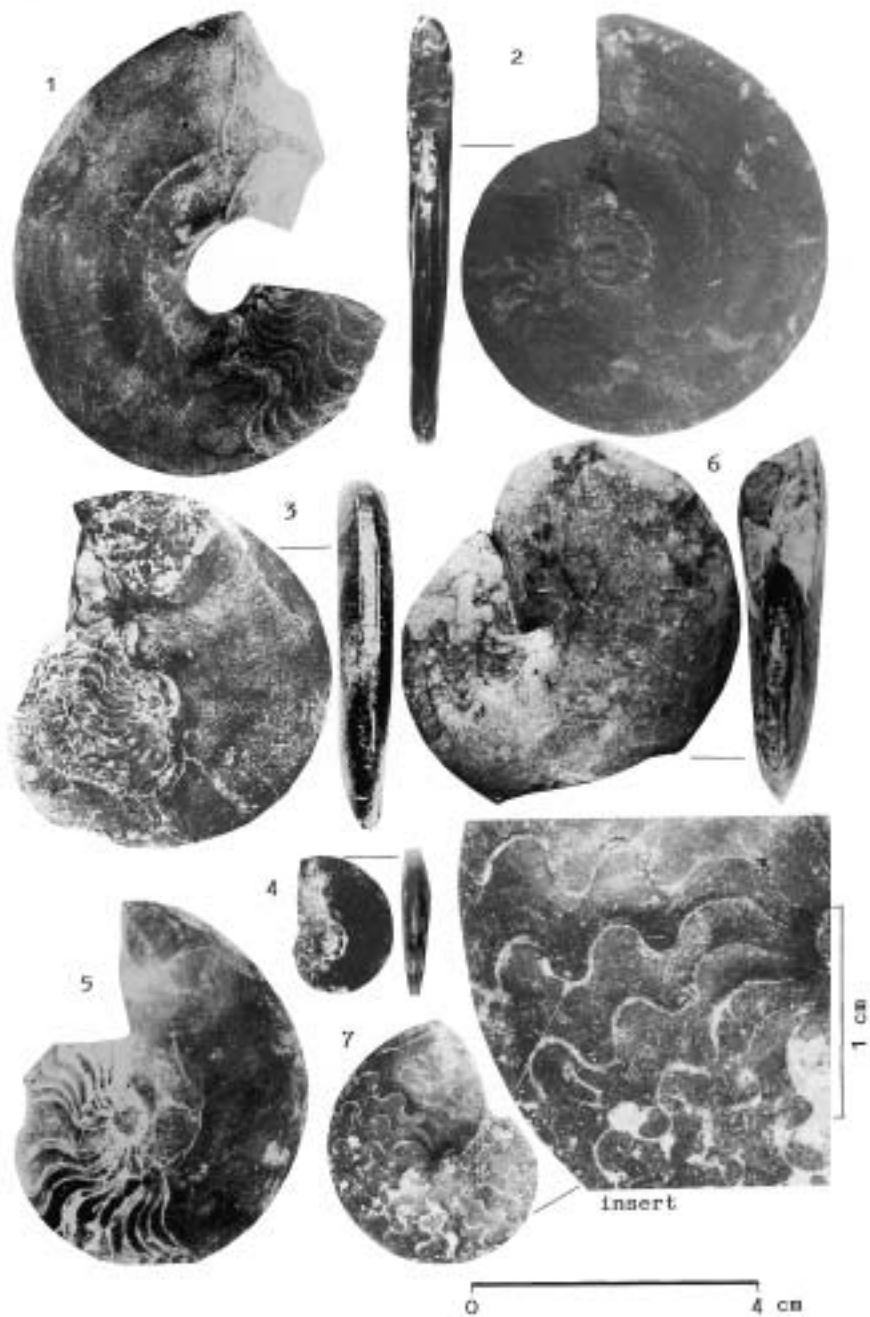


Plate II. 1-4 *Carniolites planatus*, 5 *C. neorichianus*, 6-7 *Pseudokymatites involutus*