

GEOLOGIE UND PALÄONTOLOGIE

Aptychi associated with ammonites from the Lipica-Formation (Upper Cretaceous, Slovenia)

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(With 5 plates and 2 text-figures)

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Abstract

The co-occurrence of well-preserved aptychi (ammonite lower jaws) along with composite moulds of ammonite shells of the family Placenticeratidae in Upper Cretaceous black limestone from the Slovenian karst leads to the conclusion that shells and aptychi belong together. This is the first record of aptychi in Placenticeratidae.

Keywords: Cephalopods, Placenticeratidae, lower jaws, Upper Cretaceous.

Zusammenfassung

Gemeinsames Vorkommen von gut erhaltenen Aptychen (Ammonitenunterkiefer) mit Skulptursteinkernen von Ammoniten der Familie Placenticeratidae in schwarzen Kalken des Slowenischen Karsts (Oberkreide) läßt annehmen, daß die Funde spezifisch zusammengehören. Dies ist der Erstdachweis von Aptychen bei Placenticeratiden.

Schlüsselwörter: Cephalopoda, Placenticeratidae, Unterkiefer, Oberkreide.

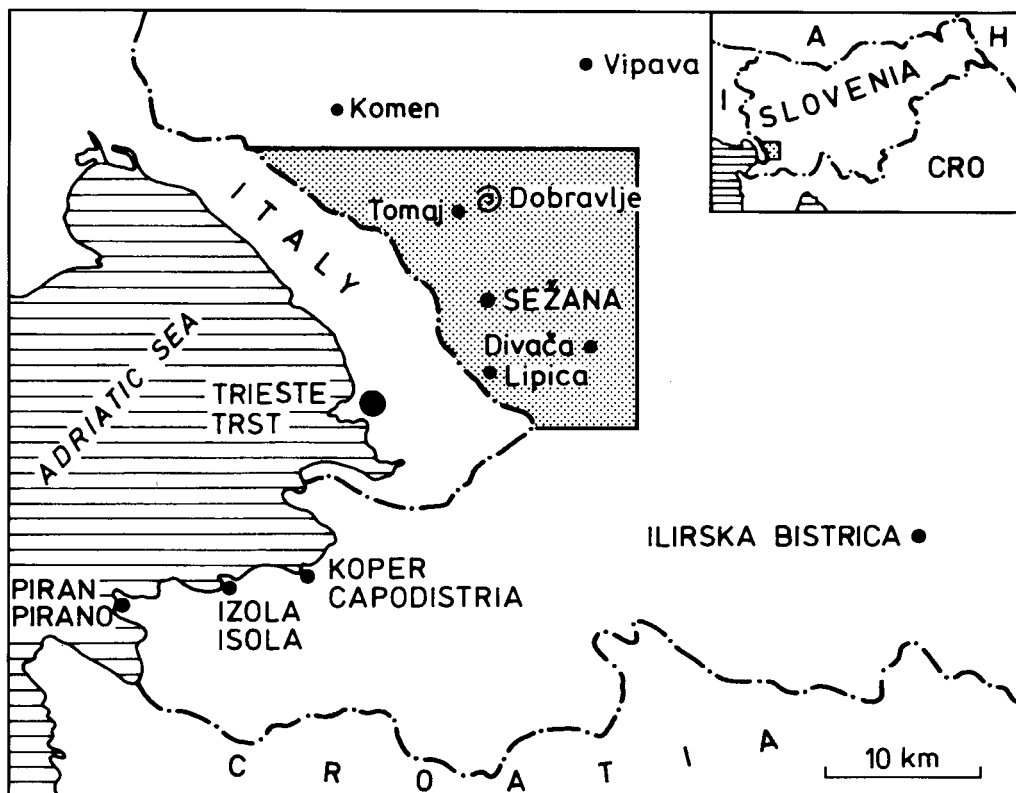
Introduction

The material discussed below was collected during investigations in connection with 1 : 50,000 geological mapping of the southern part of the Triest-Komen (Comen) plateau, near the village of Dobravljje (text-fig. 1). Ammonites and aptychi occur in the platy and laminated black Tomaj limestone, intercalated in the platform carbonate complex of the Lipica Formation. The stratigraphic position of the Tomaj limestone member (text-fig. 2) is demonstrated by the occurrence of the benthic foraminifera *Murgella lata* (LUPERTO-SINNI) below and *Calveziconus lecalvezae* CAUS & CORNELLA above.

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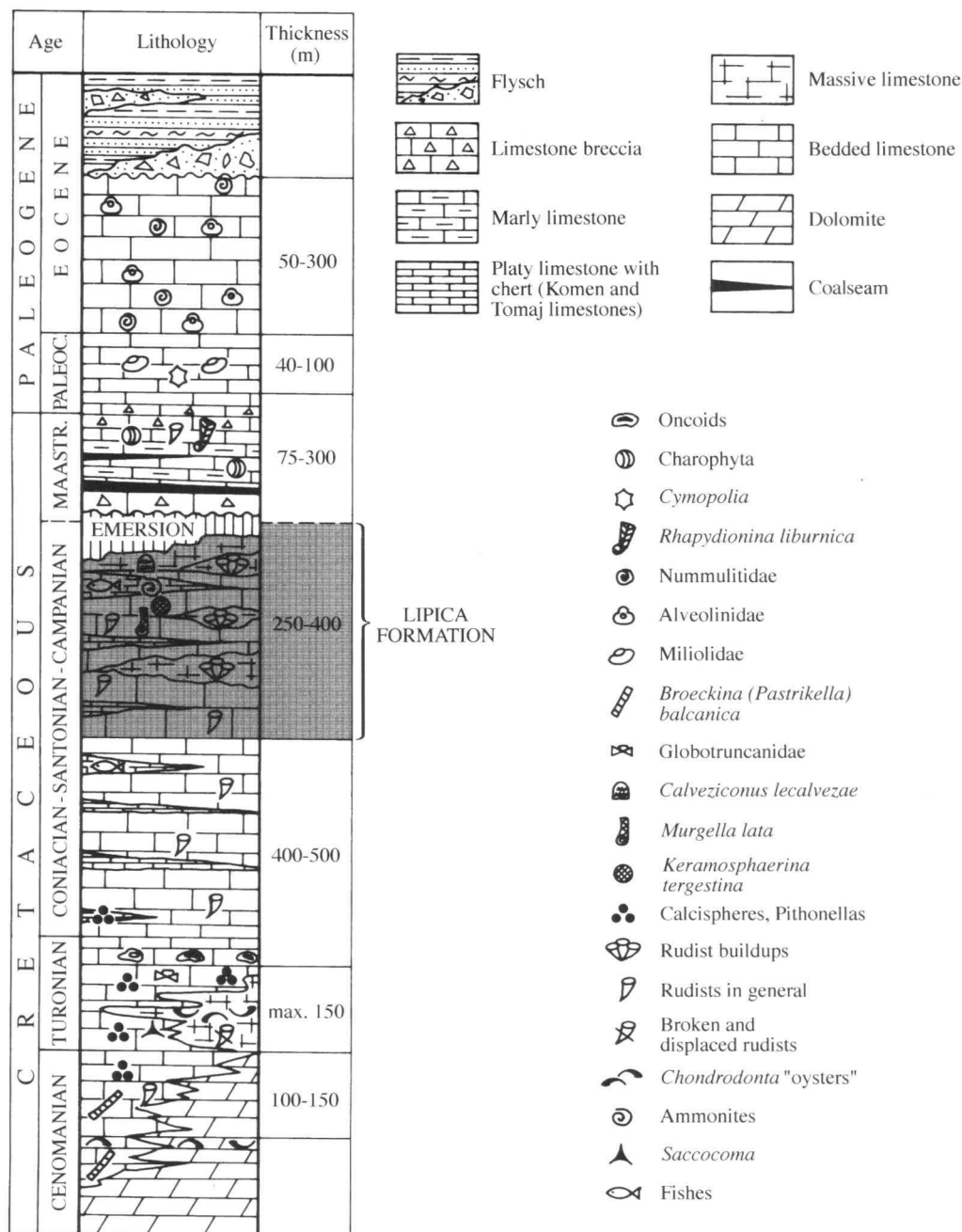


Text-fig. 1. Sketch map of the area studied and position of the fossil site (after B. JURKOVŠEK et al. in press).

Lithostratigraphy and environmental conditions

The Tomaj limestone is a local development of the Santonian–Campanian Lipica Formation (JURKOVŠEK et al. in press). Palaeontological content and conditions of sedimentation are comparable to the Komen limestone (BUSER 1973; OGORELEC et al. 1987; JURKOVŠEK et al. in press); further investigations of the area may lead to redefinition of the Komen and Tomaj limestones as a single lithostratigraphic unit.

The Tomaj limestone consists of several thin-bedded, platy and laminated black limestone intercalations within the platform carbonates of the Triest–Komen plateau. The black or dark grey bituminous Tomaj limestone is a thin-bedded or laminated calcareous biomicrite or intrabiomicrite, varying from mudstone to wackestone. Benthic organisms are scarce. At certain levels pelagic microfossils, fragments of redeposited echinoids, ostracods and "nonskeletal algae" are abundant. The latter two groups generally occur also under conditions of increased salinity and reducing conditions. Reducing conditions are also indicated by the presence of dispersed organic matter and pyrite. Chert occurs in the Tomaj limestone in nodules and thin sheets. Microcrystalline quartz was obviously formed during diagenesis, since almost everywhere primary structures are



Text-fig. 2. Generalized section through the platform carbonate complex of the southern part of the Triest-Komen plateau (after B. JURKOVŠEK et al. in press).

preserved. The total content of chert is estimated at about 10 percent. Deeper water and occasional connection with open marine environments are indicated by pelagic organisms such as calcspheres, pithonellas and at Dobravlje even ammonites and aptychi. Deeper water is also suggested by the presence of intercalations of allodapic limestone with graded bedding and slump textures.

Biostratigraphy

The stratigraphic position of the ammonite bearing site at Dobravlje is indicated by the presence of abundant *Murgella lata* (LUPERTO-SINNI) in the underlying rudist limestone and by *Calveziconus lecalvezae* CAUS & CORNELLA in overlying beds (GUŠIĆ & JELASKA 1990: 26, 34, 41). Based on these two species and the position above the main horizon with *Keramosphaerina tergestina* (STACHE) (text-fig. 2) the ammonite beds of Dobravlje can be dated as Upper Santonian to Campanian. This age is in accordance with the ammonites (see above). It cannot therefore be correlated with the Coniacian anoxic event OAE 3 (JENKYN 1991: 1009, text-fig. 2). Stratigraphic position suggests rather correlation with the Upper Santonian/Campanian sea level rise (HAQ et al. 1987: 1160, 1161; GUŠIĆ & JELASKA 1990: 79).

Systematic palaeontology

Conventions:

All dimensions are given in millimeters; D = diameter, Wh = whorl height, U = diameter of umbilicus, U% = U percentage of D. The terminology of coleoid jaws of CLARKE (1962) as applied by KANIE, TANABE, FUKUDA, HIRANO & OBATA (1978: text-fig. 1), by TANABE, HIRANO & KANIE (1980: text-fig. 1) and by TANABE (1983: text-fig. 1) is followed. MW = maximum length of wing, DW = diameter of wing, HH = height of hood, RA = angle between crests forming the rostrum. The term symphysis for the median line is after ARKELL (1957: fig. 556) for "harmonic margin" (TRAUTH's "Harmonielinie"). In general, aptychi are interpreted as paired winged hard parts of the ammonite animal, independently of their function.

Order Ammonoidea ZITTEL, 1884

Superfamily Hoplitaceae DOUVILLÉ, 1980

Family Placenticeratidae HYATT, 1900

Genus et species indet.

(Plate 2, fig. 1; pls. 3–5)

Material: Four specimens: BJ/1318; BJ/1381/A,B; BJ/1381/C; BJ/1406/A,B. BJ/1381/A,B and BJ/1406/A,B are positive and negative counterparts. Figured and examined specimens are stored in the private paleontological collection of B. JURKOVŠEK at Dol pri Ljubljani (Slovenia) registered at the Slovenian Museum of Natural History (Ljubljana). All are from black limestones of Dobravlje near Tomaj in the Slovenian karst.

Description of the ammonites: All specimens are composite moulds, extremely flattened by compaction and partially coated with a thin carbonate crust. Compaction does not change D, Wh, and U. There is no original shell preserved. All but BJ/1318/A are fragments. Body chambers are preserved in all cases, and the apertures of BJ/1381/A,B and BJ/1318/A are visible. BJ/1406/A,B has the aptychus inside the body chamber, BJ/1381/C has the aptychus near the aperture, but outside the body chamber. All specimens have the general shape of Placenticeratidae. Two specimens show associated roll marks. All four specimens are identic in general shape but varying in sculpture.

BJ/1318/A (pl. 4, fig. 1). This specimen appears to have been completely smooth, apart from three swellings on the body chamber, which could be doubtfully interpreted as umbilical bullae.

A distinct roll mark can be observed from the rim of the slab to the ventral portion of the end of the phragmocone. At the end it shows a fanlike broadening where the ammonite fell onto its side. Faint furrows could be interpreted as prints of longitudinal ventral striae.

BJ/1381/A,B (pl. 2, fig. 1; pl. 3, fig. 2). The siphuncle of this specimen is preserved within the phragmocone. The aperture is slightly curved. The umbilicus is narrow. Three distinctly prorsiradiate umbilical bullae are visible on the adapical part of the body chamber, where the covering crust is broken away. It cannot be determined whether the specimen bore ventrolateral clavi or not. In a distance of 20 mm from the venter opposite to the aperture the fanlike end of the roll mark is visible. A distinct ridge around the end of the roll mark is interpreted as the sediment wall which was squeezed out from the soft seafloor by the rolling ammonite shell. Longitudinal furrows suggest a faint striation of the venter before compaction.

BJ/1381/C (pl. 3, fig. 1). The phragmocone of this specimen is damaged but the body chamber is visible. The aperture is slightly curved. The phragmocone is ornamented by a row of umbilical bullae. A single faint umbilical tubercle is visible on the body chamber. Ventrolateral clavi are preserved on approximately one third of the last volution. The bivalved aptychus is preserved with the concave side upwards 24 mm from the aperture.

BJ/1406/A (pl. 5, figs. 1, 2). The aptychus of this specimen points adapically and is preserved within the body chamber about 35 mm from the aperture. The body chamber is ornamented by a row of prorsiradiate umbilical bullae and by prorsiradiate and slightly curved ribs each of which terminates in a ventrolateral clavus. The venter of this specimen seems to have been otherwise smooth.

Table 1. Dimensions of the ammonites studied.

	D	Wh	U	U%
BJ/1318/A	72	32	19	26,3
BJ/1381/A,B	60	22	16	26,6
BJ/1406/A	55	24	15	27,2
BJ/1381/C	46	20	12	26,0

Discussion: Sexual dimorphism in Placenticeratidae was first documented by SUMMESBERGER (1979). Wide range of variability and sexual dimorphism of the Santonian species *Placenticeras polyopsis* (DUJARDIN) was described by KENNEDY & WRIGHT (1983). Variability of the Campanian *Placenticeras milleri* (HAUER) is described by SCHMIDT (1908) based on a series of 32 topotypes from Kainach in Styria (Austria). This is the geographically closest occurrence of representatives of the Placenticeratidae that may be contemporaneous with the Slovenian material. Sexual dimorphism is also to be presumed between the coarsely ornamented Lower Campanian *Placenticeras bidorsatum* (A. ROEMER) and the smooth "variety" *glaberrima* MÜLLER & WOLLEMAN, 1906. Variability of *P. bidorsatum* is described at length by MÜLLER & WOLLEMAN, 1906: 6, 7). The four Slovenian specimens described above cannot be identified to species level but can be tentatively interpreted as Placenticeratidae of the Lower Campanian "*milleri* - *bidorsatum*" - group.

Aptychi

(Plate 1, figs. 1–11; pl. 2, fig. 2; pl. 3, fig. 1; pl. 5, figs. 1, 2)

Material: 16 specimens, BJ/818/1–12, BJ/1407/1,2, BJ/1406/1, BJ 1381/1. BJ/818/1,2, BJ/818/5,11, BJ/818/8a,8b and BJ/818/5,11 and BJ/818/6,7 are positive and negative counterparts.

Preservation: The specimens are preserved in thin and evenly bedded black limestone rich in organic matter. The (? rhythmic) layers are in some cases less than 1 mm thick. Maximum thickness of a single bed is 14 mm. Black and shiny organic matter (? conchiolin) is preserved at least on the rostrum of most of the specimens. BJ/818/1,2 which are positive and negative, suggest the whole specimen to have been built by organic matter (BJ/818/1). The rostrum of BJ/818/2 only shows organic material. The calcitic (or aragonitic ?) layer is visible in BJ/1401/6, BJ/818/8, BJ/818/4 (small fragments), BJ/818/10 and (?) BJ/818/12. All specimens but BJ/1407/1,2 are flattened by compaction. Several show cracks parallel to the symphysis. One is preserved inside, one outside the body chamber of the accompanying ammonites, the bulk are separated. Co-occurrence of upper jaws could not be observed within the material described. Low energy conditions on the seafloor and the absence of bioturbation made the extraordinary preservation of the ammonite-ptychus association possible. Roll marks are interpreted as indicating low current velocities.

Description: All specimens are double winged and bilaterally symmetrical. In all cases the wings are spread out but in tight contact at the symphysis. The general shape of the wings is mytiloidiform. The obtuse angle of the rostrum, modified by compaction, varies between 106° and 130°. Differences may also be due to compaction. The angle of the uncrushed specimen BJ/1407/2 measures about 100°. Two specimens (pl. 1, figs. 4, 5; 10) show the hooklike curvature of the rostrum.

The specimens are ornamented by concentric undulations (10–12/cm) in equal distances crossing the wing more or less parallel to the posterior rim. The rostra are finer and more densely ornamented (approx. 10 ribs/3 mm).

Dimensions: The maximum length of the wings is 17,4 mm (BJ/1406/1 in BJ/1406 A).

Table 2. Measurements of characteristic elements, abbreviations after CLARKE (1962; see: TANABE 1983: text-fig. 1). All measurements but BJ/1407/2 are from crushed specimens.

	MW	DW	HH	RA
BJ/818/1	14,0	9,7	12,2	53°
BJ/818/3	13,4	9,1	12,1	62,5°
BJ/818/4	11,2	7,4	10,2	57°
BJ/818/5	10,2	5,9	8,8	62°
BJ/818/6	17,7	8,8	15,1	64°
BJ/818/8	10,8	—	9,3	63°
BJ/818/9	—	7,4	9,1	65°
BJ/818/11	9,6	5,7	8,4	63°
BJ/1407/2	5,6	3,8	5,2	50°

Discussion

Double winged specimens of comparable shape are described by TANABE (1983: 678, text-fig. 3, pl. 1, fig. 1d) as lower jaws of the Santonian *Damesites semicostatus* MATSUMOTO (l.c., pl. 1, fig. 3a–c) and the Turonian *Tragodesmocerotoides subcostatus* MATSUMOTO. In both cases the MW to width relation differs from that of the Slovenian material. The lower jaw of the Coniacian *Scalarites mihoensis* WRIGHT & MATSUMOTO (TANABE et al. 1980: text-figs. 1, 2; KANIE et al. 1978, text-fig. 1 B) is very similar to the above described Slovenian material. It differs by its radial ornamentation. The outline of the lower jaw of the Albian *Neogastrolites americanus* (REESIDE & WEYMOUTH) differs in details only (KENNEDY & COBBAN 1976: pl. 3, figs. 3a,b). The lower jaws of the Upper Turonian *Reesidites* from Hokkaido (TANABE & FUKUDA 1987) differ by their wider wings. Shape and ornament is similar visible in the upper jaw element belonging to *Parkinsonia* (LEHMANN 1978: pl. 9, figs. 4, 5). The association of the aptychi with Placenticeratidae is a much stronger argument for interpretation as their lower jaws than is superficial similarity to jaw elements belonging to other ammonites.

Interpretation

According to the interpretation of the Japanese investigators cited above, the aptychi described herein are lower jaws. The presumably dorsally pointing rostra make interpretation as opercula unlikely. Neither the anterior tip nor the posterior margin would even roughly fit the ammonite's aperture. A double function as jaw elements and opercula (KENNEDY & COBBAN 1976: 13; LEHMANN 1985: 24; LEHMANN & KULICKI 1990) may also be excluded in this case.

The position of the aptychus BJ/1406/1 in the body chamber of the ammonite BJ/1406/A,B is a clear indication that the aptychus belongs to the associated shell. Equally, aptychus BJ/1381/1 (pl. 3, fig. 1), situated close to the aperture of the ammonite BJ/1381/C is interpreted as part of the same animal. In both cases ammonites and aptychi belong to a single taxon. Only the more finely and densely ornamented specimen BJ/1407/2 might be separated. The accompanying ammonites are interpreted as a

widely varying taxon of the family Placenticeratidae although generic or even specific identification is impossible due to preservation. Nevertheless, if our identification as Placenticeratidae is correct, this is the first record of aptychi from family.

Acknowledgments

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Plate 1

Placenticeratidae gen. et sp. indet. Dobravlje, Slovenia. Aptychi (lower jaws)

Fig. 1. BJ/818/1; positive.

Fig. 2. BJ/818/2; negative of BJ/818/1.

Fig. 3. BJ 1407/2.

Fig. 4. BJ/818/11; negative of BJ/818/5.

Fig. 5. BJ/818/5; positive.

Fig. 6. BJ/1407/1.

Fig. 7. BJ/818/8a; positive.

Fig. 8. BJ(818/8b; negative of BJ/818/8a.

Fig. 9. BJ/818/3.

Fig. 10. BJ/818/4.

Fig. 11. BJ/818/12.

Figs.1–10: x 3; fig.11: x 5.

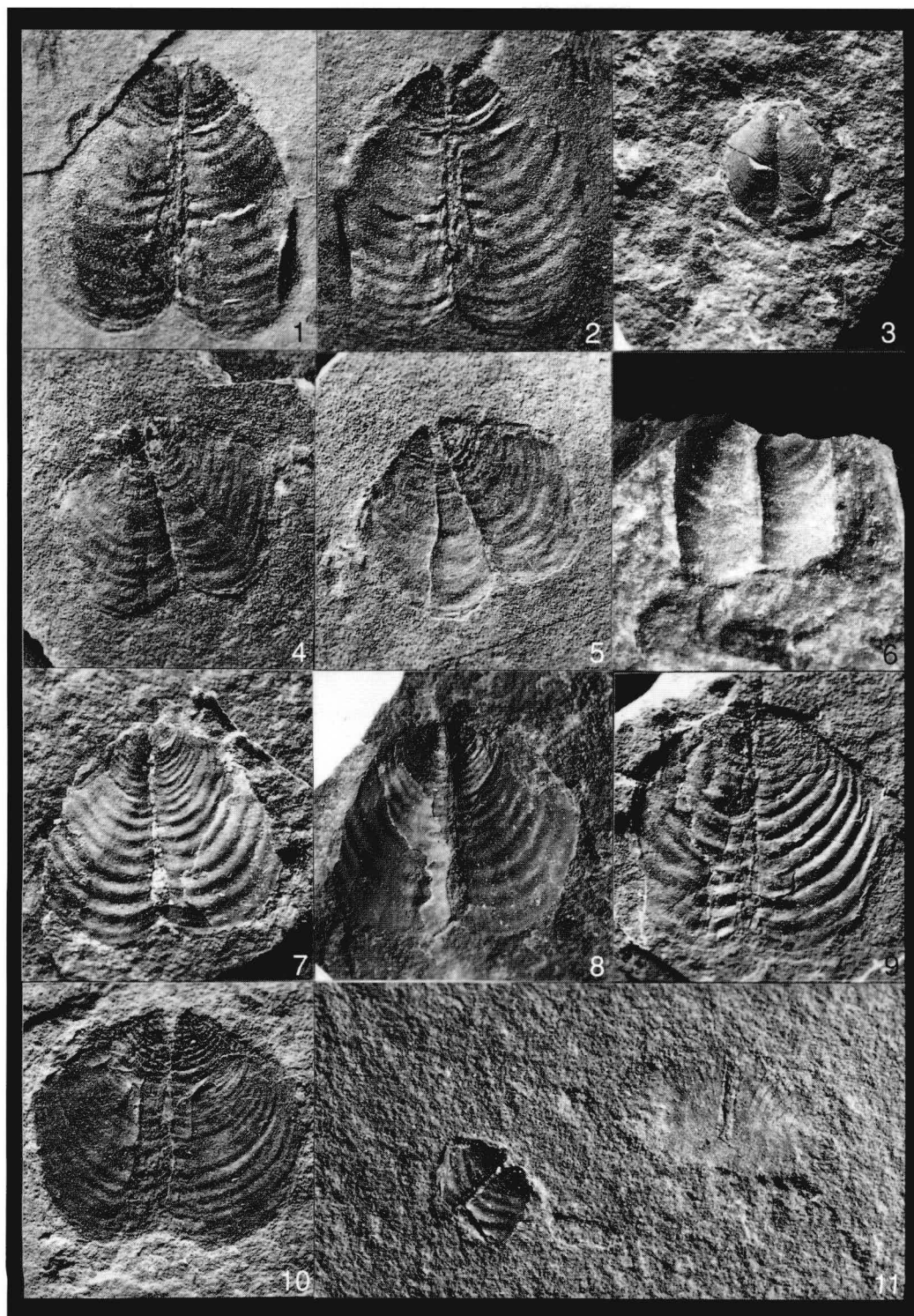


Plate 2

Placenticeratidae gen. et sp. indet. Dobravlje, Slovenia.

Fig. 1. BJ/1381/B; negative of BJ/1381/A. with roll mark; x 1,5.

Fig. 2. BJ/818/9; aptychus, negative; corroded; x 3.



Plate 3

Placenticeratidae gen. et sp. indet. Dobravlje, Slovenia.

Fig. 1. BJ/1381/C; x 1,5.

Fig. 2. BJ/1381/A; positive; x 1,5.



Plate 4

Fig. 1. BJ/1318/A; Placenticeratidae gen. et sp. indet. Dobravlje, Slovenia. Ammonite with roll mark. x 1,5.

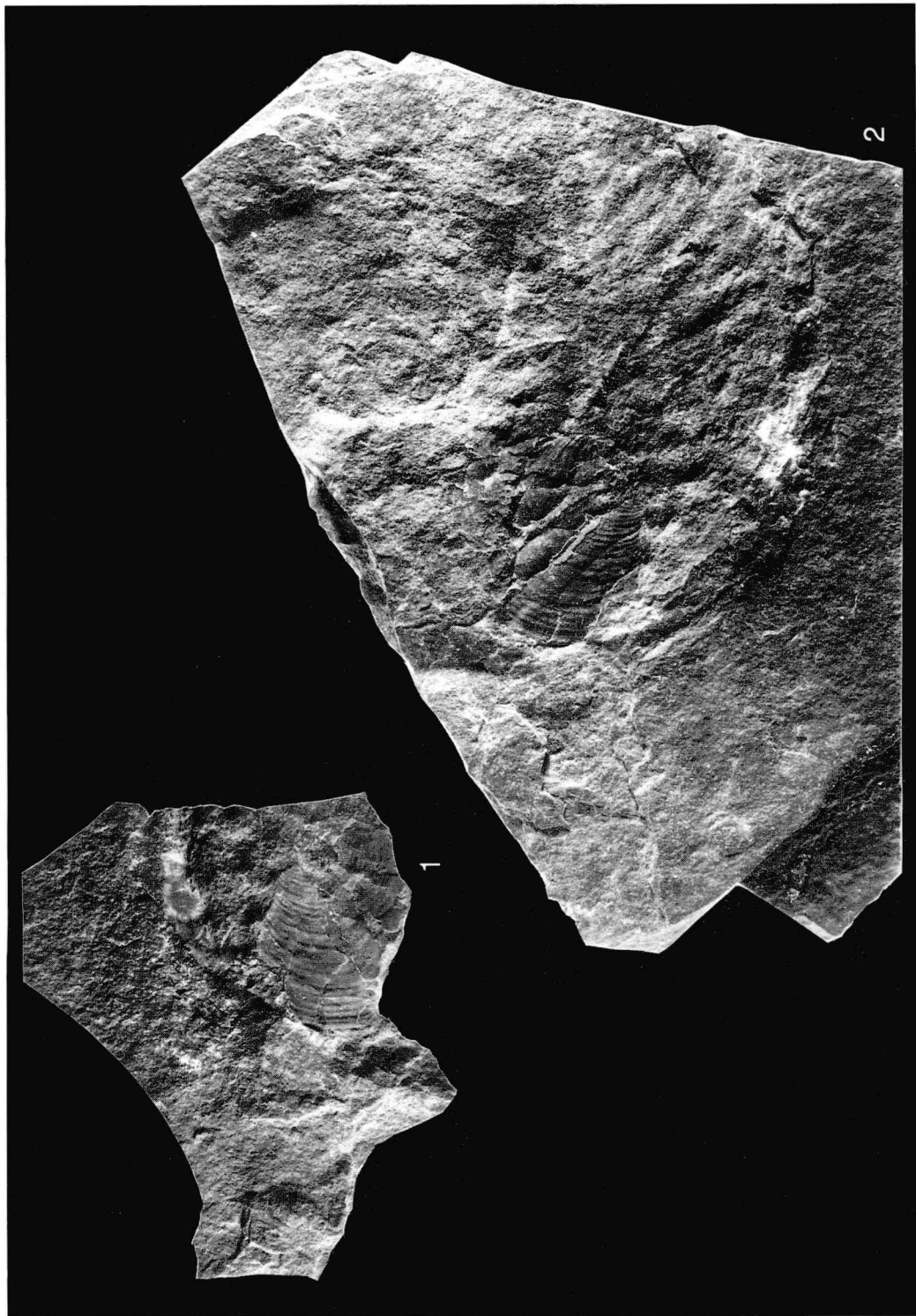


Plate 5

Placenticeratidae gen. et sp. indet. Dobravlje, Slovenia.

Fig. 1. Fragment of body chamber with aptychus (BJ/1406/1). 6 ventrolateral tubercles visible. Counterpart of fig. 2. x 1,5.

Fig. 2. Ammonite (BJ/1406/A) with aptychus (BJ/1406/1) in the body chamber. x 1,5.



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