

Upper Albian Ammonites from the Losenstein Formation of the Losenstein area (Upper Austria)

von

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Z u s a m m e n f a s s u n g Aus den Losensteiner Schichten von Losenstein und Großbraming in Oberösterreich wird das Vorkommen der Ammoniten *Hysterocheras* cf. *orbignyi* (SPATH) und *Puzosia* cf. *lata* SEITZ beschrieben. Die Stücke sind bruchstückhaft erhalten, aber die ersten bisher aus den Losensteiner Schichten bekannten Ammoniten. Der Aufschluß unterhalb der Ortschaft Losenstein an der Enns ist anhand des *Hysterocheras* eindeutig in die *Mortoniceras inflatum*-Zone des oberen Albiens einzustufen, wobei deren *orbignyi*-Subzone wahrscheinlicher ist.

Die am selben Fundort und im Hölleitengraben bei Großbraming aufgesammelten Bruchstücke von *Puzosia* gehören der *P. mayaroensis*-Gruppe an, die sowohl im Albien als auch im Cenomanien vorkommt. *Puzosia lata*, mit der die vorliegenden Stücke verglichen werden, ist in Frankreich und Sardinien, von wo eine verlässliche Einstufung vorliegt, auf das Albien beschränkt und scheint vor allem im oberen Albien aufzutreten. Die Ammoniteneinstufung wird durch die von KOLLMANN (1976) beschriebenen Gastropoden ergänzt. Diese zeigen an, daß im Hölleitengraben jüngere Schichten aufgeschlossen sind als am Ennsufer von Losenstein.

I n t r o d u c t i o n : The Losenstein Formation, which was named by KOLLMANN (1968) is a Sequence of sandy shales, sandstones and conglomerates described in the older literature under the name of „Cenomanian with Exotic Pebbles”. These „Exotic Pebbles” are well rounded, and consist chiefly of quartz, quartzite, quartz-porphyrite and scarcer diabase and diabase-porphyrite (LÖCSEI, 1974; DIETRICH, 1976). The pebbles are termed „exotic” because their source area is not exposed within the Northern Calcareous Alps but in the Lower East Alpine Sheet. However, pebbles of the same composition occur within the Permian „Verrucano” (DIETRICH, 1976). The Losenstein Formation itself was deposited in synsedimentary synclines in the northern parts of the Northern Calcareous Alps. Among the fossils, larger foraminifera of the genus *Orbitolina* are most abundant. On the basis of their external features, they were identified as *Orbitolina concava* LAMARCK by early workers and the whole sequence was in consequence dated as of Cenomanian age. The only description of molluscs from this sequence was given by SÖHLE (1896) and is in agreement with this dating. Besides this, faunal lists have been published by GEYER (1909), SCHLOSSER (1924), KÜHN (1930) and others. All these lists included a number of Albian elements, but as the total stratigraphical range of these forms was unknown at that time, a Cenomanian date was accepted. (The Upper Cretaceous Gosau forms which are also mentioned are definitely in error). Unfortunately, none of these early collections have survived.

In the Bavarian Alps, a re-examination of sections was initiated by HAGN & ZEIL (1954) and ZEIL (1955). By the means of planktonic foraminifera, the stratigraphic range of the Losenstein Formation was extended M-Albian to L-Turonian. For the area of Losenstein in Upper Austria stratigraphic subdivision based on planktonic foraminifera was described by KOLLMANN (1968). In this area, a type section was selected, and the Formation shown to include rocks of Middle Albian to Middle Cenomanian age.

In addition to the paper by SÖHLE (1896) two papers on the gastropods have been published recently by RAHMAN (1967) and KOLLMANN (1976). In the present paper all the ammonites which have been collected by H.A. KOLLMANN in the area of Losenstein are described. They co-

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me from two localities, the exact position of which is shown on fig. 1 of KOLLMANN (1976). Both localities are within the central part of a syncline of Cretaceous rocks: the position of Losenstein Nr.1 is at the bank of the Enns-river below Losenstein. Hölleitengraben Nr.3 is alongside the same river opposite the house „Lehneralm“.

Systematic Palaeontology

Superfamily Hoplitaceae DOUVILLE, 1890

Family Desmoceratidae ZITTEL, 1895

Subfamily Puzosiinae SPATH, 1922

Genus *Puzosia* BAYLE, 1878

Type species: *Ammonites planulatus* J. de C. SOWERBY, 1827 (non SCHLOTHEIM 1820).

Puzosia cf. *lata* SEITZ

Plate 1, figs. 1a–b, 2a–c).

1847 *Puzosia planulatus* QUENSTEDT (non J. de C. SOWERBY), p.221, pl. 17, figs. 13a–c only.

1931 *Puzosia lata* SEITZ, p.403, pl. 17, fig. 2.

1963 *Puzosia provincialis* var. *crassa* COLLIGNON, p.64, pl. 264, fig. 1155.

1968 *Puzosia lata* SEITZ; WIEDMANN & DIENI, p. 121, pl. 10, fig. 10, pl. 11, fig. 9, text-fig. 76.

Material Two crushed specimens, nos. NHM 1976/1862/1 and 2, the former retaining decorticated aragonitic shell, the latter a composite internal mould of a body chamber fragment. The first is from the Hölleitengraben, the second from the right bank of the Enns below Losenstein.

Description: The small specimen appears to have been rather evolute, with a depressed whorl section and broadly rounded venter. The specimen bears a deep falcoid constriction, which forms a prominent chevron across the siphonal line. Fine, flexuous ribs appear at about mid-flank, are most prominent across the venter, and at least 10 to 16 in number between adjacent constrictions. There were probably between 4 and 6 constrictions per whorl.

The larger specimen has been crushed laterally and it is not possible to decide whether the whorl section was compressed or depressed. Ornament comprises a prominent constriction which is straight and slightly prorsiradiate across the middle of the flanks, flexing slightly forwards towards the venter. On the venter, the constriction is preceded by a strengthened rib. Between constrictions, there are at least 18 ribs, which are best-developed across the venter.

Discussion: The smaller specimen clearly belongs to WIEDMANN & DIENI's (1968) group of *Puzosia mayoriana* (d'ORBIGNY), characterized by 4 to 6 deep sigmoidal constrictions per whorl forming a chevron across the venter, subparallel flanks, broadly-rounded venter and relatively open umbilicus. WIEDMANN & DIENI (1968) included *P. mayoriana*, *P. subplanulata*, *P. provincialis* and *P. lata* in this group. The last named species is characterized by a depressed whorl section with convex flanks, and maximum breadth below mid-flank. These are all features shown by our material, which we therefore assign to *P. cf. lata*, given the poor preservation.

Figured specimens of *Puzosia subplanulata* (SCHLÜTER) (1871, p.4, pl.2, figs.5–7) (= *Ammonites planulatus* J. de C. SOWERBY (non SCHLOTHEIM), 1827, pl. 570, fig.5) and *P. mayoriana* (d'ORBIGNY 1841, p. 267, pl. 79) differ from the smaller specimen before us in being flat-sided, with a compressed whorl section at small diameters.

Puzosia provincialis (PARONA & BONARELLI) (1897, p. 81, pl. 11, fig. 4), of which WIEDMANN & DIENI (1968) regard *P. sharpei* SPATH (1923, p. 46, pl. 1, figs. 11–12, text-fig. 11b) as a junior subjective synonym, is distinguished from typical *P. lata* in having the whorl breadth and whorl height about equal, and maximum width close to the umbilical shoulder. As such, it is difficult to

distinguish from our material, although our smaller specimen gives the impression of having had a more depressed whorl section.

The group of *Puzosia quenstedti* (PARONA & BONARELLI), including *P. communis* SPATH, *P. furnitana* PERVINQUIERE, *P. quenstedti* (PARONA & BONARELLI), *P. media* SEITZ and *P. petkovici* WIEDMANN & DIENI, all differ from our material in having weaker, straighter constrictions, 6 to 7 per whorl, with flattened flanks which converge to a narrowly rounded venter.

O c c u r r e n c e In addition to the present record from Losenstein and Großraming *Puzosia lata* is known from the Middle and Upper Albian of France, Sardinia and Madagascar.

Superfamily Acanthocerataceae HYATT, 1900

Family Brancoceratidae SPATH, 1933

Subfamily Brancoceratinae SPATH, 1933

Genus *Hysterocheras* HYATT, 1900

Type species *Ammonites varicosus* J. de C. SOWERBY, 1824

***Hysterocheras* cf. *orbigny* (SPATH)**

(Plate 1, figs. 3A–C).

- 1841 *Ammonites varicosus* d'ORBIGNY (non J. de C. SOWERBY), p.294, pl. 87, fig. 3 only.
 1847 *Ammonites varicosus* PICTET in PICTET & ROUX (non J. de C. SOWERBY), p.356, pl.9, fig. 3 only.
 ? 1907 *Brancoceratid laferrerei* BOULE, LEMOINE & THEVENIN, p. 25, pl. 9, figs. 6, 6a–b, text-fig. 25.
 1922 *Brancoceratid orbigny* SPATH, p. 22.
 ? 1923 *Schloenbachia aguilerae* BÖSE, p.167, pl. 11, figs. 33–36.
 1929 *Inflatoceras varicosum* var. *multicostata* JAYET, p. 4–9.
 1934 *Hysterocheras orbigny* (SPATH); SPATH, p. 483, pl. 49, figs. 4, 6, pl. 50, figs. 2–5, pl. 52, figs. 2–4, 8, pl. 56, fig. 15, text-figs. 161a–d, 166–169 (cum synonym.).
 ? non. 1934 *Hysterocheras* aff. *orbigny* (SPATH); SPATH, p.483, pl. 54, fig. 8, (= *H. laferrerei* var. *depressa* BREISTROFFER)
 1940 *Hysterocheras laferrerei* var. *orbigny* (SPATH); BREISTROFFER, p. 13.
 1942 *Hysterocheras orbigny* var. *minor* HAAS, p. 26, pl. 2, figs. 18–26, pl. 3, figs. 13–14, pl. 4, figs. 1–5, text-figs. 2f, 3a.
 1947 *Hysterocheras laferrerei* var. *orbigny* (SPATH); BREISTROFFER, p. 53, 91.
 1947 *Hysterocheras laferrerei* var. *multicostata* (JAYET); BREISTROFFER, p. 92.
 1947 *Hysterocheras laferrerei* var. *subcrassicostata* BREISTROFFER, p. 92.
 1968 *Hysterocheras orbigny* (SPATH); WIEDMANN & DIENI, p. 137, pl. 13, figs. 1–3, text-figs. 84–85 (cum synonym.).
 1971 *Hysterocheras orbigny* (SPATH); RENZ, p. 578, pl. 1, figs. 1–2, 4, 6–8, pl. 3, figs. 4–6, text-figs 2a–e, 3a (cum synonym.).
 ? 1971 *Hysterocheras* aff. *aguilerae* (BÖSE); RENZ, p. 582, pl. 1, figs. 9–12, pl. 3, figs. 7–9, text-figs. 2f–i, 3b.
 ? 1971 *Hysterocheras andinum* RENZ, p.591, pl. 3, figs. 1a–c, text-figs. 2u, 3k.

M a t e r i a l A single crushed fragment, NHM 1976/1862/3 retaining aragonitic test from Losenstein, Locality Nr.1.

D e s c r i p t i o n The shell appears to have been moderately evolute, with a subquadrate, possibly slightly depressed, whorl section. Ornament comprises about 9 ribs per quarter whorl, alternately long and short, and about as wide as the interspaces. Long ribs are ornamented by distinct umbilical

tubercles, and appear to have been flexuous, rectiradiate or slightly rursiradiate. On the venter the ribs are projected weakly forwards to meet a weak, low, siphonal keel at right angles. The keel lacks bordering sulci.

D i s c u s s i o n The absence of distinct ventrolateral tubercles and sulci bordering the siphonal keel, together with the weak development of the latter and the small size of the present specimen, all suggest that it is better referred to *Hysterocheras* than *Mortoniceras*.

Amongst *Hysterocheras* species, the estimated 36 ribs per whorl suggest the present specimen is closest to *H. orbigny* (SPATH).

In typical examples of *H. orbigny*, the shell is evolute (umbilicus 42–48 % of the diameter), with a subquadrate, depressed to compressed whorl section ($W/H = 0.88–1.11$). Ornament comprises flexuous, slightly rursiradiate ribs which arise in pairs from rather prominent umbilical bullae, or are alternate long and short in maturity, when the tubercles weaken considerably. There are commonly 30–37 ribs per whorl in adults, generally fewer at earlier growth stages.

As noted by BREISTROFFER (1940, p.13), *Hysterocheras laferrerei* (BOULE, LEMOINE & THEVENIN) does not appear to be specifically distinct from *H. orbigny*, and has priority over SPATH's name. The holotype of *H. laferrerei* is a small (15 mm diameter), slightly crushed shell, rather evolute (umbilicus 42 % of the diameter), with a slightly depressed, subquadrate whorl section. There are about 24 ribs per whorl, generally alternating long and short, occasionally bifurcating from umbilical tubercles. The species thus appears to be based upon juvenile *H. orbigny*, although we hesitate to replace SPATH's well-known and widely-cited name until we have had an opportunity to study the holotype of *H. laferrerei*.

Hysterocheras aguilerae (BÖSE) (1923, p. 167, pl. 11, figs. 33–36) is a moderately evolute species (umbilicus 43 % of the diameter), with a slightly compressed, subquadrate whorl section. There are 16 umbilical tubercles on the outer whorl of the lectotype, from which flexuous ribs arise in pairs. It is doubtful whether this species can be satisfactorily distinguished from *H. orbigny* (fide SPATH 1934, p. 487).

Hysterocheras andinum RENZ (1971, p. 591, pl. 3, figs. 1a–c, text-figs. 2u, 3k) is based upon a single mature specimen with 50 ribs on the outer whorl, and is thus more densely-ribbed than typical *H. orbigny*. However, in general proportions and whorl section it agrees exactly with *H. orbigny*, with which it is associated in a 1 m thick bed, while the penultimate whorl of *H. andinum* has only 37 ribs and, at this stage, is indistinguishable from *H. orbigny*. It may be based on an extreme or gerontic individual.

Hysterocheras binum (J. SOWERBY 1815, p. 208, p. 92, fig. 3; SPATH 1934, p. 478, text-figs. 165a–b), *H. subbinum* SPATH (1934, p. 481, pl. 56, fig. 3) and *H. semileve* HAAS (1942, p. 42, pl. 5, figs. 19a–c) all differ from the present material in being strongly compressed and flat-sided, and in having the ribs weakened considerably at mid-flank. *Hysterocheras intermedium* HAAS (1942, p. 36, pl. 5, figs. 1a–b) and *H. propinquum* HAAS (1942, p. 45, pl. 5, figs. 23a–d) are also strongly compressed flat-sided forms which differ from *H. orbigny* in being much more coarsely ribbed (about 12 ribs per half whorl).

Hysterocheras varicosum (J. de C. SOWERBY 1824, p. 74, pl. 451, fig. 5 only; SPATH 1934, p. 473, text fig. 162) is a much more coarsely and distantly ribbed species, with only 18–24 ribs per whorl.

Hysterocheras carinatum SPATH (1922, p. 99) (nom. nov. pro *Ammonites varicosus* d'ORBIGNY (non J. de C. SOWERBY) 1841, p. 294, pl. 87, fig. 4) is close to *H. orbigny*, but differs from the present material in being strongly compressed and typically has finer, denser ribbing (36–40 per whorl).

Hysterocheras choffati SPATH (1925a, p. 187, pl. 28, figs. 1a–b) has 34 ribs on the final whorl of the holotype and is thus close to our material. In *H. choffati*, however, the keel is lost in maturity and the ribs pass uninterrupted across the venter, whilst the inner whorls have weak ventrolateral tubercles.

Hysterocheras bucklandi (SPATH 1922, p. 99; SPATH 1934, p. 488, pl. 56, fig. 1, text-figs. 169b–c, 170) is close to both *H. choffati* and *H. orbigny*. Indeed, WIEDMANN & DIENI (1968, pl.13,

fig. 3) have figured a specimen of *H. orbigny* which is transitional to *H. bucklandi*, whilst the material referred by RENZ (1971) to the latter species appears to be based upon variants of *H. orbigny*. Moreover, SPATH (1934, p. 489) remarks on passage forms between *H. bucklandi* and *H. orbigny* on the one hand, and *H. orbigny* and *H. choffati* on the other, and we find the separation of these three species difficult. It is possible that only one highly variable species is involved, although further comment on the basis of the poor material before us is unwarranted.

O c c u r r e n c e *Hysterocheras orbigny* is known from the low Upper Albian (*crisatum* to *aurites* subzones, but typically the *orbigny* subzone) of France, Switzerland, southern England, Sardinia, Madagascar, Zuzuland, Angola, Nigeria, Venezuela and possibly Mexico.

Discussion

These three poorly preserved ammonites all indicate a late Albian Age. The *Hysterocheras* dates the Losenstein locality quite definitely as low Upper Albian, *Mortoniceras inflatum*-Zone, and most probably the *orbigny*-subzone.

The *Puzosia* from the Hölleitengraben are less valuable stratigraphic indicators, for the *P. mayoria*-group, to which they are referred, range from Albian to Cenomanian. *P. lata*, with which our specimens are compared is, however, restricted to the Albian where well dated in France and Sardinia, and appears to be most common in the Upper Albian.

The gastropods described by KOLLMANN (1976) indicate that the faunas from the Hölleitengraben area are younger than these in the Enns valley. This is based on the presence of Cephalaspidean gastropods, recorded in the English Upper Greensand, and from the Meule de Bracquignies as *Ringicula corneti* and *Actaeonella sublaevis* BRIART & CORNET. The Nerineid genera *Oligotyxis* and *Plesioptygmatis*, which also occur in the Hölleitengraben outcrops have not been recorded before the Cenomanian but as there is a lack of information on the uppermost Albian gastropods of the Tethyan area this does not in fact contradict the ammonite dating.

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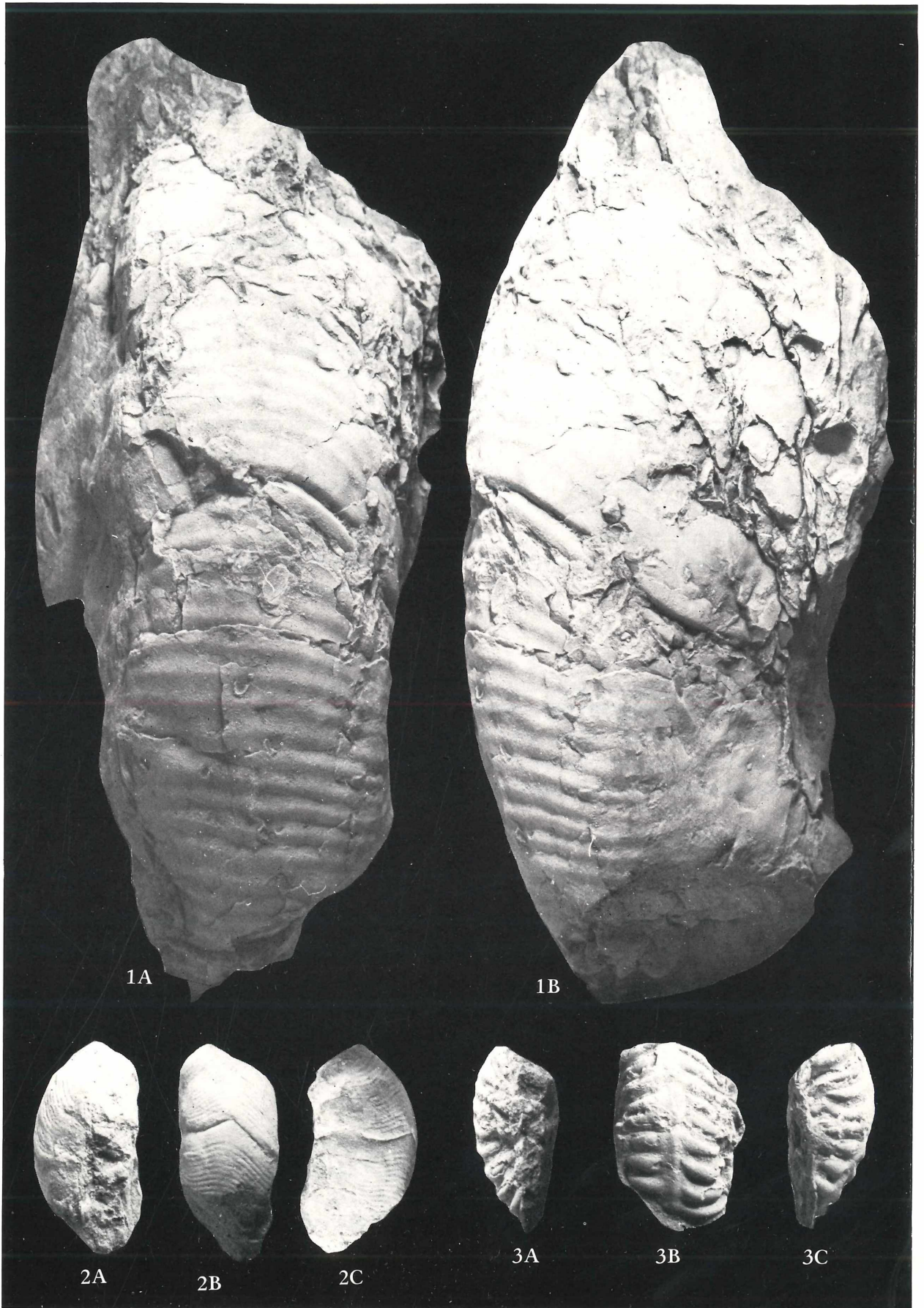
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Explanation of Plate 1

- Figs. 1a, 1b. *Puzosia cf. lata* SEITZ. NHM 1976/1862/1. Hölleitengraben, Großbraming, locality 1; reduced, x 0,7
- Figs. 2a, 2b, 2c. *Puzosia cf. lata* SEITZ. NHM 1976/1862/2. Enns bank, Losenstein; magnified, x 2
- Figs. 3a, 3b, 3c. *Hysterocheras aff. orbigny* SPATH. NHM 1976/1862/3. Enns bank, Losenstein; magnified, x 1,5

Photographs by W. J. Kennedy

All specimens are deposited in the Geologisch-Paläontologische Abteilung, Naturhistorisches Museum Wien (Vienna, Austria).



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