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Involutina hungarica (SIDO) from allochthonous Urgonian limestones of the Northern Calcareous Alps and remarks on the genus *Hensonina* MOULLADE & PEYBERNES, 1974

Involutina hungarica (SIDO) aus allochthonen Urgonkalken der Nördlichen Kalkalpen, sowie Bemerkungen zur Gattung *Hensonina* MOULLADE & PEYBERNES, 1974

by

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Abstract

Involutina hungarica (SIDO), the youngest hitherto known representative of the genus *Involutina* TERQUEM, is described from Urgonian limestone pebbles (Uppermost Aptian–Albian) of the Northern Calcareous Alps. The species occurs in biosparites containing mesorbitolinas along with coralline red algae. Although the test shape of *Involutina hungarica* is highly variable, this species is clearly separated from the homeomorphic form *Involutina liassica* (JONES) by a distinctly thicker, more globular test. *Hensonina lenticularis* (HENSON), exhibiting identical dimensions and equivalent stratigraphic range as well as the same facies relevancy, has to be included within the variation range of *Involutina hungarica* (SIDO) since no pore network is detectable in the umbilical region. Hence, the monospecific genus *Hensonina* MOULLADE & PEYBERNES, 1974 is not a valid separate genus, but represents a junior synonym of *Involutina* TERQUEM, 1862.

Zusammenfassung

Involutina hungarica (SIDO), der jüngste Vertreter der Gattung *Involutina* TERQUEM, wird von Urgonkalkgeröllen (oberstes Apt–Alb) der Nördlichen Kalkalpen beschrieben. Mikrofaziell repräsentieren diese Gerölle Biosparite mit Mesorbitolinen und corallinen Rotalgen. Obwohl die Gehäuseform von *Involutina hungarica* sehr variabel ist, kann sie durch ihre mehr globulären Gehäuse von der homoeomorphen Spezies *Involutina liassica* (JONES) eindeutig unterschieden werden. Da die als *Hensonina lenticularis* (HENSON) beschriebenen Formen kein Porennetz in der Umbilikalregion aufweisen, jedoch die gleichen Dimensionen, idente stratigraphische Verbreitung und Biotoppräferenz zeigen, werden sie zu *Involutina hungarica* (SIDO) gestellt. Die monospezifische Gattung *Hensonina* MOULLADE & PEYBERNES, 1974 repräsentiert daher kein eigenständiges gültiges Taxon sondern ein Juniorsynonym von *Involutina* TERQUEM, 1862.

Introduction

Pebbles of Urgonian limestones (Upper Barremian–Albian) occur within different stratigraphic levels in the middle part of the Northern Calcareous Alps (HAGN, 1982). They have been studied with respect to facies analysis, palaeontology and their palaeogeographical significance (SCHLAGINTWEIT, 1990). Pebbles with almost identical facies have also been recently discovered in the eastern part of the Northern Calcareous Alps, in conglomerates of the Gosau Formation of Lilienfeld (WAGREICH & SCHLAGINTWEIT, 1990). A common facies are biosparites with mesorbitolinas and rhodophycean algae of the so-called "Facies du Vimport"; typical forms being *Agardhiellopsis cretacea* LEMOINE, *Paraphyllum primaevum* LEMOINE, *Archaeolithothamnium rude* LEMOINE, and *Kymalithon belgicum* (FOSLIE) LEMOINE & EMBERGER. A typical faunal element of these pebbles in question is the calcareous

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benthic foraminifer *Involutina hungarica* (SIDO). Its redescription, as given in this paper, is necessary since the original description is rather incomplete and because of the controversies in the literature concerning Cretaceous involutinids. The close morphological relationships between the Cretaceous *Involutina hungarica* (SIDO) and the (Upper Triassic ? –) Liassic *Involutina liassica* (JONES) necessitate a comparison and common discussion. The latter species has been treated in detail by PILLER (1978) in his work on Upper Triassic - Liassic involutinids of the Eastern Alps.

Systematic Description

For the generic concept of the Involutinidae see PILLER (1983).

Order Foraminiferida EICHWALD, 1830
Suborder Involutinina HOHENEGGER & PILLER, 1977
Family Involutinidae BÜTSCHLI, 1880
Subfamily Involutininae BÜTSCHLI, 1880
Genus *Involutina* TERQUEM, 1862

Involutina hungarica (SIDO, 1952)
(Pl. 1, Figs. 1–14)

* 1952 *Vaughanina hungarica* n. sp. — SIDO, p. 393, Textfigs. 1–3, Pl. 19, Fig. 25.

1969 *Involutina hungarica* (SIDO) — BRÖNNIMANN & KOEHN-ZANINETTI, p. 73, Fig. 1 D, Pl. 7, Figs. 1–4, Pl. 8, Fig. 2.

1974 *Hensonina lenticularis* (HENSON) — MOULLADE & PEYBERNES, p. 178, Pl. 3, Figs. 6–9.

1976 *Hensonina lenticularis* (HENSON) — BOUROULLEC & DELOFFRE, Pl. 5, Figs. 1–2.

1977 *Hensonina lenticularis* (HENSON) — REY et al., p. 380, Pl. 3, Figs. 15–17.

1979 *Hensonina lenticularis* (HENSON) — AZEMA et al., Pl. 2, Figs. 6, 10.

1985 *Involutina hungarica* (SIDO), *Involutina* sp. — CSASZAR, Pl. 10, Fig. 3, Pl. 11, Fig. 2.

1987 *Hensonina lenticularis* (HENSON) — REITNER, Pl. 9, Fig. 8, Pl. 10, Figs. 2, 7, Pl. 24, Fig. 7, Pl. 27, Figs. 7, 12.

1987 *Involutina liassica* (JONES) — SCHLAGINTWEIT, Pl. 1, Fig. 9.

1989 *Hensonina lenticularis* HENSON — KUSS & MALCHUS, Textfigs. 42–43.

1990 *Involutina* sp.— WAGREICH & SCHLAGINTWEIT, Pl. 2, Fig. 6.

1990 *Involutina* sp. — SCHLAGINTWEIT, p. 66, Pl. 14, Figs. 1–9.

Material: About 100 specimens in thin sections from Urgonian limestone pebbles of the Gosau Formation of Oberwössen/Chiemgau Alps and Florianiberg/Lower Inn Valley. The thin sections are stored at the "Bayerische Staatssammlung für Paläontologie und historische Geologie" in Munich.

Association: Usually with *Orbitolina (Mesorbitolina) texana* (ROEMER), *Orbitolina (Mesorbitolina) subconcava* LEYMERIE and *Charentia cuvillieri* NEUMANN.

Description: Test free, biloculine, consisting of a spherical proloculus followed by a second undivided chamber (deuteroloculus) (Pl. 1, Figs. 6, 14). The coiling is planispiral in 3 to 6 whorls; a slightly oscillating coiling of the deuteroloculus during ontogeny is only rarely observed (Pl. 1, Fig. 1). The studied forms display a wide morphological variation ranging from discoidal (e.g., Pl. 1, Figs. 4, 7) to more globular forms (e.g., Pl. 1, Fig. 1) with all transitions. Thus, the equatorial diameter of the test ranges from 0.36 to 0.9 mm, the axial diameter (thickness) from 0.2 to 0.64 mm, the relation diameter/thickness varies between 0.99 (globular forms) and 3.05 (discoidal forms). In axial sections the inner contour of the micrite-filled deuteroloculus is almost subspherical in the juvenile stage becoming irregular heart-shaped in adult stages (e.g., Pl. 1, Fig. 7). Some specimens with a large proloculus (0.05 to 0.07 mm) and 3 whorls may represent megalospheric forms (Pl. 1, Figs. 7, 10), whereas specimens with tiny proloculi (about 0.04 mm) and mostly 6 whorls could be attributed to the microspheric generation (Pl. 1, Figs. 1, 9). The umbilical region is perforated by simple pores that are arranged perpendicular to the test surface. It should be mentioned that a reticulate pore-network is not developed. Due to recrystallization phenomena, the wall is composed of blocky calcite crystals. Thus, in specimens strongly affected by diagenetic alteration the pores in the umbilical region are no more detectable.

Remarks: Based on isolated specimens SIDO (1952) described a new foraminifer as *Vaughanina hungarica* n. sp. attributed to the family Orbitoididae SCHWAGER from the Aptian of the Transdanubian Central Range/Hungary. In restudying topotype material by thin-section analysis BRÖNNIMANN & KOEHN-ZANINETTI (1969) convincingly demonstrated, however, that it represents an *Involutina*-species with the following characteristics: equatorial diameter 0.6 mm, axial diameter 0.4 mm and 3–4 whorls. Unfortunately the whole morphological variability of *I. hungarica* (SIDO) has not been demonstrated.

I. hungarica versus *I. liassica*

Due to the fact that the Cretaceous *I. hungarica* (Pl. 1) is a homeomorph to the Liassic *I. liassica*

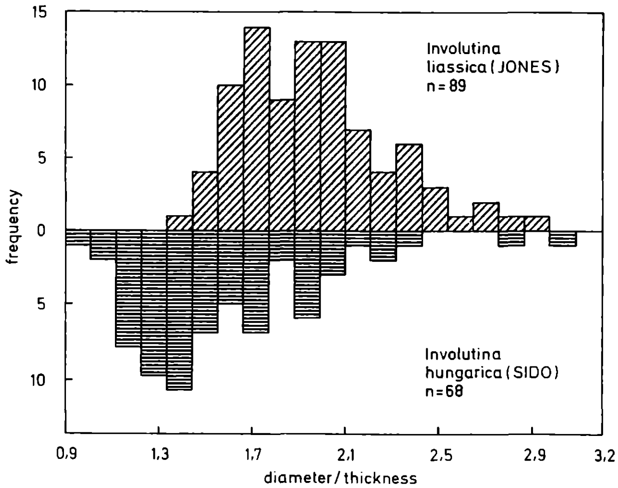

Fig. 1. Frequency distribution of the diameter/thickness ratio of *I. liassica* and *I. hungarica.*

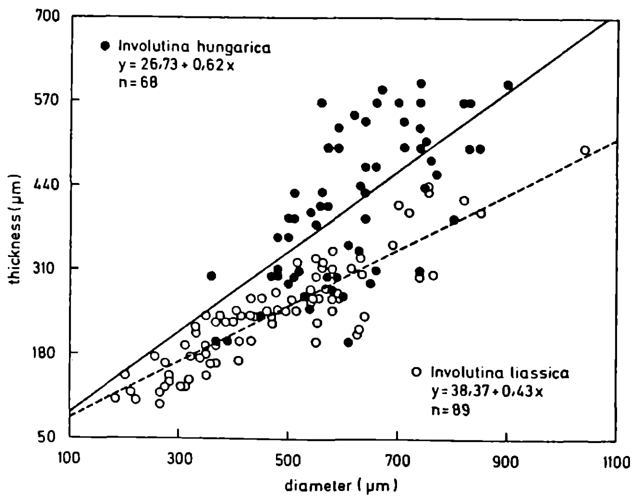

Fig. 2. Linear regression of thickness on diameter of *I. liassica* and *I. hungarica.*

(JONES) (Pl. 2) and the Triassic *I. turgida* KRISTAN, the relationships between these species have to be discussed in more detail.

The distinction of *I. liassica* (JONES) and the Triassic *I. turgida* (KRISTAN) as worked out by PILLER (1978), with the deuteroloculus built by a semi-tube in *I. liassica* and a complete tube in *I. turgida,* is still valid and is supported in the present study. Although the material is not very well preserved, the test formation in the Cretaceous forms *(I. hungarica)* seems to be that of *I. liassica* (by a semi-tube).

BRÖNNIMANN & KOEHN-ZANINETTI (1969:76) emphasized that in *I. hungarica* (SIDO) the contour of the deuteroloculus is triangular instead of being heart-shaped in *I. turgida* KRISTAN (= *I. liassica* sensu PILLER, 1978). But as can be seen on Plates 1 and 2 this feature exhibits a wide range in both species and therefore does not serve as a diagnostic criterion separating different *Involutina*-species (compare also GUSIC, 1975:14; PILLER, 1978). Following BRÖNNIMANN & KOEHN-ZANINETTI (1969) *I. hungarica* (SIDO) should furthermore be characterized by 3 to 4 whorls instead of 3–6 in *I. turgida* KRISTAN (= *I. liassica* sensu PILLER, 1978). As has been stated previously, the small specimens with large proloculus and 3 to 4 whorls seem to represent megalospheric forms; microspheric forms with up to 6 whorls were not been figured and mentioned by BRÖNNIMANN & KOEHN-ZANINETTI (1969). The observation that microspheric individuals of *Involutina*-species are larger and therefore also thicker as the megalospheric tests is already known from Jurassic species (e.g., GUSIC, 1975:17). Therefore, none of the two mentioned characters can be used to separate these two species *(I. hungarica* and *I. liassica).*

Due to the usually poor preservation of the involutinids resulting from aragonite solution (all specimens of Pl. 1), only a few characters of the test can be investigated in thin sections. As discussed above, the general form of the deuteroloculus in cross-section is not a useful character for species separation. However, the basic characters are diameter and thickness and the resulting statistical relationship. A comparison of Liassic and Cretaceous forms on the basis of these characters gives the following results:

Besides 68 individuals of the Urgonian limestones described above, 89 specimens of Liassic limestones from different localities in the Northern Calcareous Alps were measured. A comparison of the diameters (Tab. 1) shows that the Liassic forms possess a much lesser mean than those of the Cretaceous (487.2 vs. 627.4 μm). The variance is, however, much higher in the Liassic group, which is also clearly expressed by the more extreme minimum and maximum values. Upon considering thickness, the mean of the Liassic forms is distinctly less than those of the Cretaceous (249.0 vs. 418.2 μm), and the variance as well as the maximum and the minimum are higher in the Cretaceous group. The diameter/thickness ratio is clearly higher in the Liassic group than those of the Cretaceous (1.97 vs. 1.58), with a higher variance in the Cretaceous forms. Fig. 1 clearly reflects the general higher values for the diameter/thickness ratio in the Liassic group (representing more discoidal tests) and also that the discoidal forms of the Cretaceous are only isolated outliers. The difference of the means of both groups is statistically significant at a level of 95%.

Both groups are also clearly separated on the basis of a regression analysis (Fig. 2). The application of a linear regression model exhibits a distinctly steeper slope of the regression line of the Cretaceous

Table 1. Statistical parameters of diameter, thickness, and diameter/thickness ratio of Liassic and Cretaceous *Involutina*.

age	n	diameter			thickness			d/th		
		mean	s.d.	min-max	mean	s.d.	min-max	mean	s.d.	min-max
Liassic	89	487.2	177.83	184-1040	249.0	85.67	101-500	1.97	0.327	1.37-2.95
Cretaceous	68	627.4	123.26	360-900	418.2	119.60	200-640	1.58	0.401	0.99-3.05

forms (b = 0.6240) compared to that of the Liassic (b = 0.4323), meaning that the former become more globular with increasing diameter, whereas the latter tend to become more discoidal. The intensity of this trend is very strong for the Liassic forms (corr. coef. = 0.8963) and less strong for the Cretaceous group (corr. coef. = 0.6430), which is also reflected by the high variance of the latter (Fig. 2).

In conclusion, a comparison between Liassic and Cretaceous individuals of the genus *Involutina* allows a – statistically significant – separation of these forms, meaning that *I. hungarica* is characterized by more globular tests and *I. liassica* being more discoidal. Additionally, both species are clearly separated by their stratigraphical range.

Remarks on the genus *Hensonina* MOULLADE & PEYBERNES, 1974

In 1947 HENSON described several new species of the genus *Trocholina* PAALZOW from the Jurassic and Cretaceous of the Middle East with *T. lenticularis* nov. sp. and a smaller subspecies *T. lenticularis* var. *minima* with "slightly trochoid coiling" HENSON distinguished a dorsal side with fine reticulate ridges and a ventral side with "a mass of small granules looking like the termination of umbilical pillars" (op. cit.: 452).

MOULLADE & PEYBERNES (1974) described a planispiral foraminifer from the Albian of Spain which they identified with the species established by HENSON (1947). Because of the planispiral coiling and the ornamentation built by a reticulate pore-network they erected the new genus *Hensonina* with the generotype *Trocholina lenticularis* HENSON assigned to the family Involutinidae. The authors also emphasized the close relationship to *Involutina* TERQUEM from which the genus *Hensonina* should be distinguished by "la stade de l'ornamentation bilatérale, constituée d'une réticulation et non par des piliers" (op. cit.: 178, see also diagnosis in LOEBLICH & TAPPAN, 1988). MOULLADE & PEYBERNES furthermore distinguished discoidal specimens with little ornamentation and more globular forms with well developed ornamentation. These observations have also been proved for *I. hungarica* (SIDO).

ARNAUD-VANNEAU et al. (1988) in restudying specimens from Oman demonstrated that the species described by HENSON (1947) represents a *Trocholina* with reticulate ornamentation on the dorsal side and pseudopillars on the ventral side. Following ARNAUD-VANNEAU et al. (1988), the planispiral forms described by MOULLADE & PEYBERNES (1974) as *Hensonina lenticularis* (HENSON) are not identical with *Trocholina lenticularis* HENSON as already assumed earlier by PILLER (1978:65); thus the genus *Hensonina* represents a genus without a generotype.

H. lenticularis has the same test morphology and chamber arrangement, stratigraphic range (Uppermost Aptian–Albian) and also an equivalent facies restriction (high energy environment: REITNER, 1987:68; REY & CUGNY, 1977) as *Involutina hungarica* (SIDO). Moreover, the pore-network in *Hensonina* is not sufficiently detectable on the original figures as given by MOULLADE & PEYBERNES (1974). Thus *Hensonina lenticularis* (HENSON) has to be included within the variation range of *Involutina hungarica* (SIDO); consequently the genus *Hensonina* MOULLADE & PEYBERNES, 1974 represents a junior synonym of *Involutina* TERQUEM as postulated earlier by PILLER (1978:65; 1983:199).

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PLATE 1

Involutina hungarica (SIDO) from Urgonian limestones of the Northern Calcareous Alps.

Fig. 1. Axial section of globular specimen with oscillating plane of coiling (110 x).

Fig. 2. Axial section (85 x).

Fig. 3. Tangential section (85 x).

Figs. 4, 5, 12. Axial sections; specimens with proloculus and initial whorls of deuteroloculus without sediment filling. (4, 5: 85 x; 12: 110 x).

Fig. 6. Equatorial section (110 x).

Figs. 7, 10, 12: Axial sections (110 x).

Fig. 8. Tangential section cutting the umbilical region with well visible pores. (65 x).

Fig. 9. Oblique section cutting the proloculus and all whorls of the deuteroloculus (65 x).

Fig. 11. Tangential-subequatorial section cutting the perforated umbilical region and the last whorl of the deuteroloculus (65 x).

Fig. 13. Tangential section cutting the perforated umbilical region and the last 3 whorls of the deuteroloculus (65 x).

Fig. 14. Equatorial section, slightly oblique (65 x).

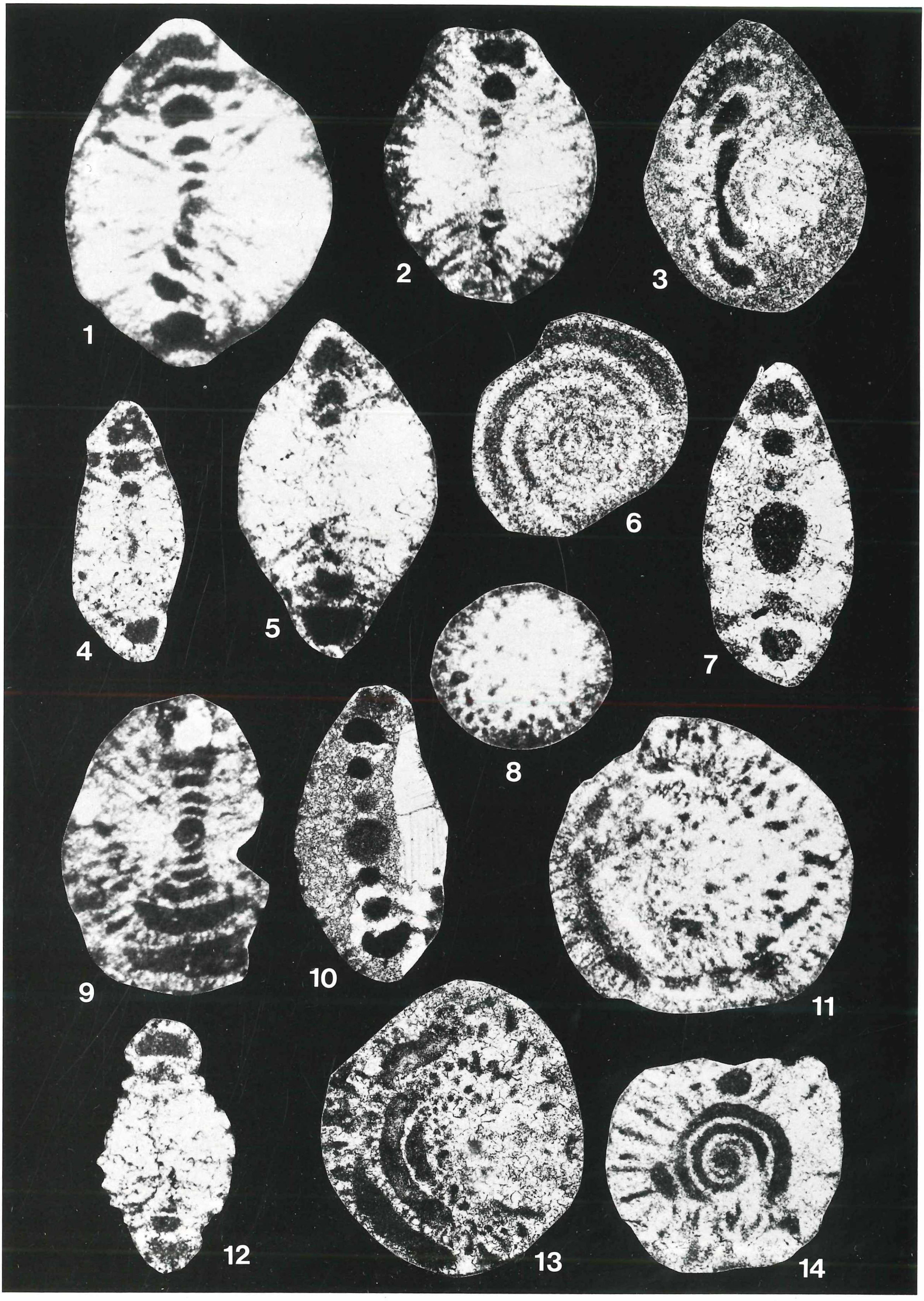
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PLATE 2

Involutina liassica (JONES) from the Liassic of the Northern Calcareous Alps.
(all figures 140 x).

Fig. 1. Subaxial section of well preserved specimen showing lamination type (e.g., semi-tube of deuteroloculus).

Fig. 2. Axial section of megalospheric test.

Fig. 3. Axial section of well preserved specimen showing lamination.

Figs. 4, 5, 8, 9, 10, 12. Axial to subaxial sections of specimens showing variable thickness.

Figs. 6, 7, 11. Slightly oblique (subaxial) sections.

Fig. 13. Equatorial section.


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