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LARGER GASTROPOD UNITS PRESENT IN THE TRIASSIC OF ST. CASSIAN FORMATION

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ABSTRACT

The sediments of the Upper Triassic (Cordevol, Karn) St. Cassian Formation of the Dolomites (Southern Alpes) contain a large, well preserved fauna of gastropods which mediates between Paleozoic and Mesozoic units. The systematic units present are briefly characterized.

INTRODUCTION

The gastropods from St. Cassian Formation have been described originally by Münster (1841), Laube (1868), Kittl (1891, 1894) and Zardini (1978, 1980, 1985). These authors have named most species and described and figured their adult shells, while the early whorls and shell structure remained unknown. During the last years it was possible to study and document the protoconchs and shell structure of representatives of almost all groups described by these authors. Material for study was to a large extent made available by the late Dr. Rinaldo Zardini from Cortina d' Ampezzo, Italy. Additional material was loaned from the Museum of Natural History in Vienna, Austria and was newly collected near St. Cassian and Cortina d'Ampezzo, Italy.

DATA

The slit-bearing archaeogastropods are represented by two groups separated from each other by the structure of their shells. Those with a nacreous layer in their shell represent the groups of *Dictyotomaria*, *Zygites*, *Kokenella*, *Stuorella* and *Codinella* as Pleurotomariidae, *Temnotropis* as potential haliotidid and *Laubella* as member of the Seguenzioidea (Laubellidae). Also Paleozoic groups with numerous species of *Wortheniella* (Schwardt in prep.), and one species of *Lancedellia*, *Rhaphistomella* and *Gosseletina* as well as the strictly Triassic *Schizogonium* (Pl.1, Fig.1) belong here (Bandel 1991). Those with aragonitic crossed lamellar structure of their shells are represented by three species of *Emarginula*, four species of *Coelocentrus* resembling modern *Guildfordia* in shell shape and the Murchisoniidae closely resembling their Paleozoic relatives (Bandel in prep. a). Archaeogastropods without slit are represented by about 25 species related to modern trochoideans (Bandel in prep. b). Among them planspiral forms like *Wöhrmannia*, *Zardinihelix* and three undescribed forms are nacreous, while *Cortinella* is crossed lamellar, and *Brochidium* is calcitic in structure (Bandel 1988). Precursors to the Jurassic *Discohelix* as well as to the modern Skeneidae are present. Trochoform *Yunnania*, *Ampezzotrochus* and *Eunemopsis* show relation with late Paleozoic species while *Pseudoclanculus* and *Umbonium* look quite "modern". The high spired *Eucycloscala* (Pl.1, Fig. 2) retains four nacreous forms, while the other species of the genus turned out to represent Cerithiimorpha (Bandel & El Nakhal in press, Bandel in prep.c). One species of modern appearance represents the Docoglossa.

Members of the Neritoidea, Neritopsoidea (Pl.1, Fig.3) and Platyceratoidea (Pl.1, Fig.4) all bearing the characteristic larval shell of the Neritomorpha are common. *Orthonychia alatus* is the last known survivor of the platyceratids (Bandel in prep. d). Species with dissolved interior walls as in modern Neritidae still represent a minority. Among Caeonogastropoda the Cerithiimorpha are represented by a number of species (Bandel in prep. c) among them *Ptychostoma* (Pl.1, Fig.6), *Prostylifer* (Pl.1, Fig.5), *Lacunina*, *Omphaloptychia*, *Coelostylina* (Pl.1, Fig.6), *Ladinula* (Pl. 2, Fig.2), and *Ampezzoscala* (Bandel & el Nakhal in press). *Cylindritopsis*, *Euchrysalis* and *Coelochrysalis* are members of the Subulitoidea (Bandel in prep. e). They have a smooth larval shell with strong apertural projection similar to that of *Lacunina* (Pl.2, Fig.1). *Polygyrina* (Pl.2, Fig.10) and *Cassianozyga* (Bandel 1991) are related to Jurassic Stromboidea (Schröder in prep) as well as to Carboniferous species (Herholz, 1990, Yoo 1988). *Purpurina*, *Angularia*, *Purpurinoidea* and *Protuba* resemble neogastropods in shell shape but represent Mesogastropoda perhaps close to the Stromboidea (Schröder in prep, Bandel in prep. f).

The Ctenoglossa are prepresented by Zygopleuridae and Protorculidae (Bandel in press). *Zygopleura* (Pl.2, Fig.5) and *Zardinistylus* are differentiated from gastropods with a very similar adult shell like *Ampezzopleura* by an almost smooth conical larval shell while that of the Protorculidae is well sculptured (Pl.2, Fig.6). Zygopleuridae and Protorculidae connect modern Triphoroidea und Janthinoidea with Paleozoic Pseudozygopleuridae (Knight 1931, 1934). A larval shell of the *Epitonium*-type (Pl.3, Fig.1) connects Carboniferous forms (Herholz 1990) with Cretaceous and modern ones. Heterostropha are represented by several groups of the Allogastropoda as well as the oldest known opisthobranchs. *Amphitomaria* and *Rinaldoconchus* are architectonicoids (Pl. 3, Fig.2) with a good

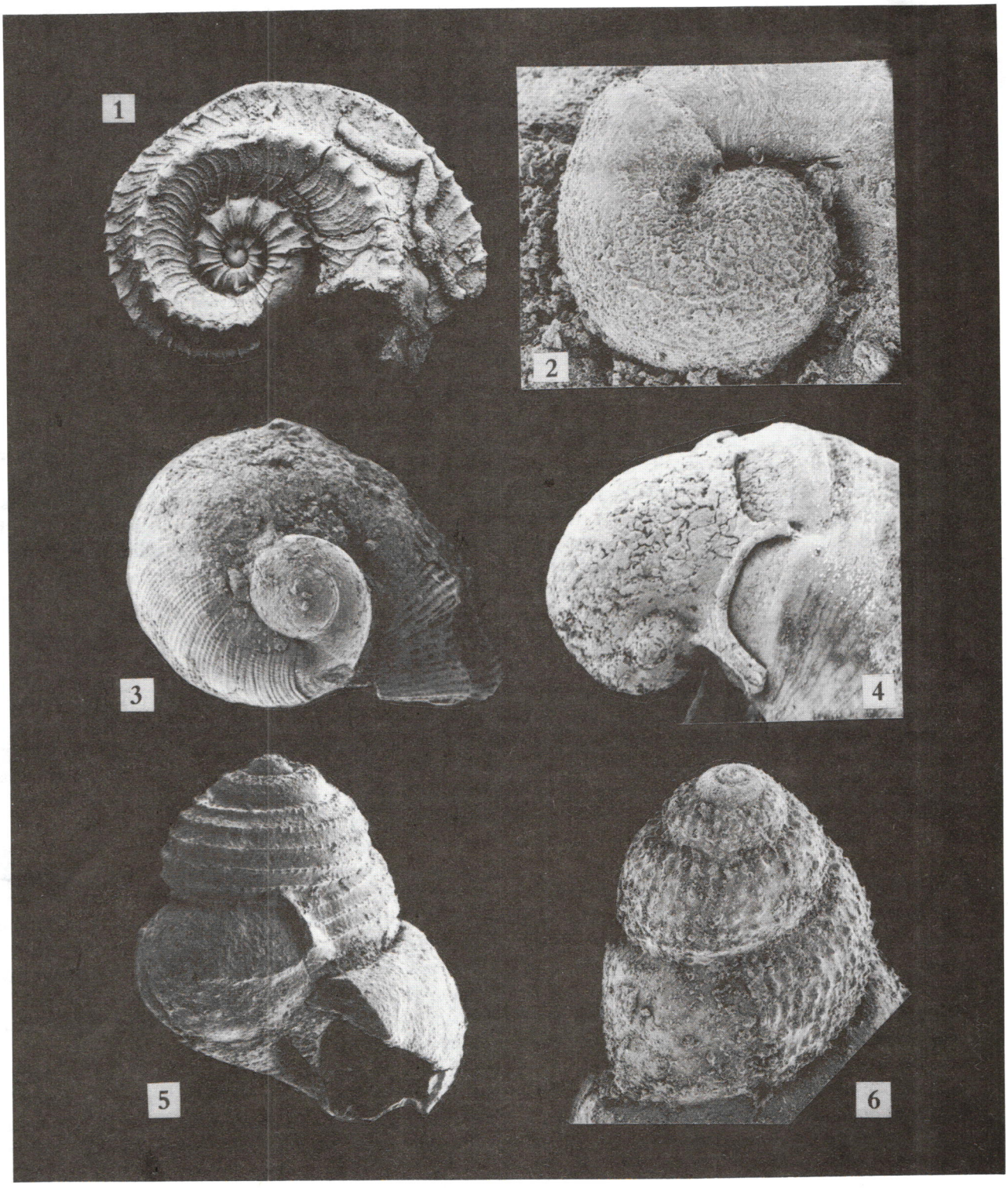

Plate 1

All figures in Plates 1-3 show gastropods from the Triassic St. Cassian Formation.

Fig. 1: Schizogonium with smooth embryonic shell, 1.6 whorls without slit and the gradation into the slit bearing shell is shown. Size of shell 2.4 mm.

Fig. 2: The embryonic shell of *Eucycloscala* is sculptured and preserved the deformation along the fold well. Width of the embryonic shell 0.24 mm.

Fig. 3: Juvenile shell of *Neritopsis* with tightly coiled smooth larval shell with lobed apertural margin. Maximum size of shell 1 mm.

Fig. 4: The last known platyceratid gastropod *Orthonychia alatus* with smooth neritomorph larval shell with 5 hooks projecting from the aperture. Greatest width of the larval shell 0.7 mm.

Fig. 5: The larval shell of *Prostylifer* is strongly sculptured by spiral ridges and its apertural margin projects foreward. Width of larval shell about 0.5 mm.

Fig. 6: The larval shell of *Ptychostoma* is sculptured by spirally arranged rows of tubercules and is about 1 mm high.

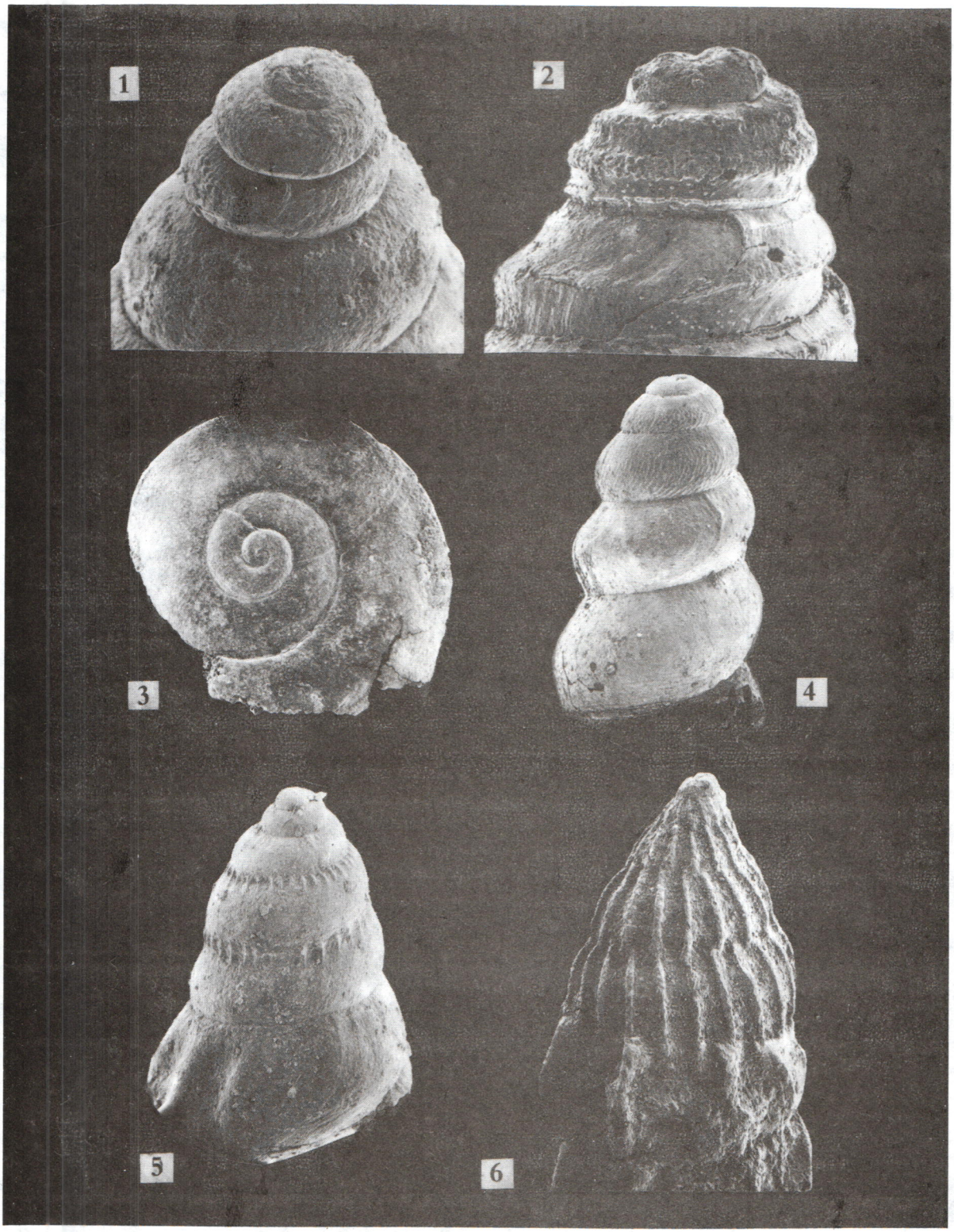

Plate 2

Fig. 1: The larval shell of *Lacunina* is smooth and ends with a strong projection of the aperture. Height of the visible larval shell about 0.25 mm.

Fig. 2: The larval shell of *Ladinula* resembles that of Mesozoic and Recent cerithioids in regard to the spiral ridge,which ends on the top of the apertural projection and the presence of tubercules. Height of visible larval shell 0.25 mm.

Fig. 3: The larval and adult shell of an undescribed allogastropod species resembles that of the modern *Episcynia*. Size of shell 1.2 mm.

Fig. 4: The larval shell of *Polygyrina* is characteristically sculptured by axial rows of tubercules retracing the former contour of the aperture. Transition of larval shell into adult shell is unconspicuous as is found among many Jurassic and modern Stromboidea. Height of shell about 2 mm.

Fig. 5: The larval shell of *Zygopleura* resembles that of many modern cerithiopsids in beeing smooth with exception of a row of tubercules below the suture. Height of shell 0.85 mm.

Fig. 6: The larval shell of *Ampezzopleura* resembles that of some modern Epitoniidae in having strong axial ribs and weak spiral striae. Height of visible larval shell 0.7 mm.

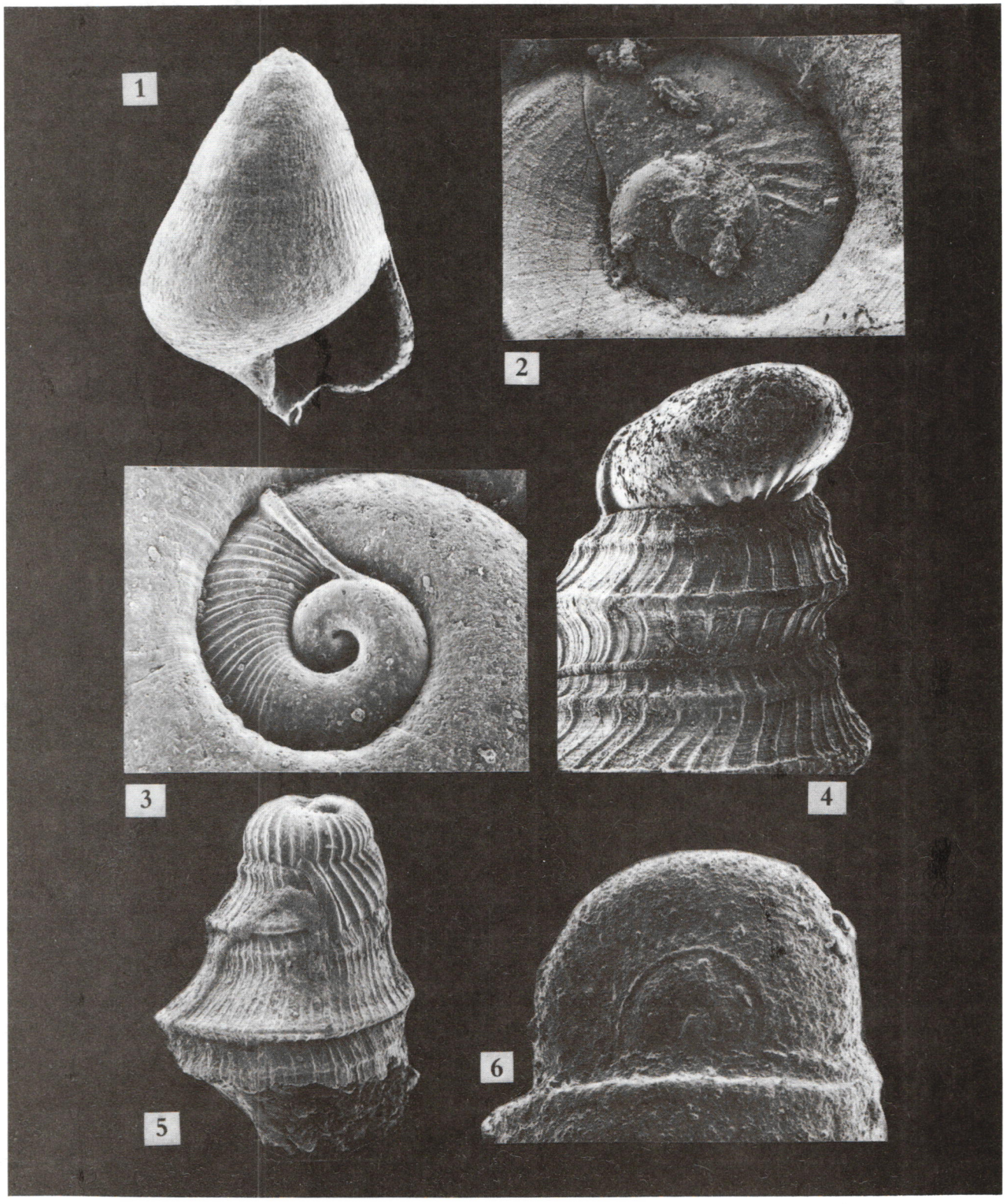

Plate 3

Fig. 1: The larval shell of an epitoniid gastropod with characteristic shape as found today. Fine axial ribs are crossed by more delicate spiral elements and the apertural margin is simple. Height of larval shell about 1.5 mm.

Fig. 2: The sinistral larval shell of *Amphitomaria* has characteristic folds also seen on most modern architectonicid larvae. Folds indicate the portion of the larval shell, where the sinistral whorl grades into the dextral whorl. Larval shell measures 0.27 mm across.

Fig. 3: The sinistral larval shell of undescribed architectonicid has a thicked lip that formed when the veliger larva had reached its final size. Larval shell measures about 0.25 mm across.

Fig. 4: The sinistral larval shell of *Promathilda* rests with an angle larger than 90° on the dextral adult shell. Size of larval shell 0,35 mm.

Fig. 5: The sinistral larval shell of a member of the Tofanellidae changed into a right coil during larval life. Height of the shell about 1 mm. Fig. 6: The sinistral larval shell of *Cylindobullina* is included in the dextral adult shell with a 90° angle. Width of the larval shell 0.35 mm across.

fossil record in Cretaceous and Tertiary time (Bandel, 1988). Several allogastropods are still undescribed (Pl.2, Fig.3, Pl.3, Fig.3) and represent precursors to modern forms as well as to *Provalvata* from the Purbeckian coastal swamps deposits (Jurassic/Cretaceous) (Bandel in press b). The Mathildidae (Pl.3, Fig.4) are present with several species of several lineages which connect with Late Mesozoic forms (Schröder in prep.). Species with smooth, slender shells may represent the early Nerineidae branch of the Heterostropha (Bandel in prep. g). A 180 degree change in coiling within the larval shell is found in the Tofanellidae (Pl.3, Fig.5) (Bandel in prep. g). The characteristic pyramidelloidean relative to modern *Ebala* is present as well as a relative to Paleozoic *Donaldina*. The early Opisthobranchia can be traced to the species of *Cylindrobullina* (Pl.3, Fig. 6).

SUMMARY

A classification scheme adopting Haszprunar's (1988) system as well as that suggested by Ponder & Warén (1988) was connected with own data to include the Triassic gastropods. According to it the Mollusca; Conchifera; Gastropoda; with the first subclass Archaeogastropoda are represented by Pleurotomaroidea (Pl.1, Fig.1), Fissurelloidea, Trochoidea (Pl.1, Fig.2) and Docoglossa. The second subclass Neritomorpha is present with Neritopsidae (Pl.1, Fig.3), Platyceratidae (Pl.1, Fig.4) and Neritidae while the representatives of the subclass Caenogastropoda hold Cerithiimorpha (Pl.1, Fig.5, 6, Pl.2, Fig.1, 2), Loxonematoidea (Pl.2, Fig.4), Stromboidea, Zygopleuroidea (Pl.2, Figs.5,6) and Janthinoidea (Pl.3, Fig.1). The subclass Heterostropha is represented by members of the allogastropods Architectonicoidea (Pl.2, Fig.3, Pl.3, Fig.2, 3), Mathildoidea (Pl.3, Fig.4, 5), Valvatoidea and Pyramidelloidea as well as early Opisthobranchia (Pl.3, Fig.6). Conspicuously absent from the rich Triassic fauna are Caenogastropoda like Tonnoidea, Naticoidea, Cypraeoidea as well as Rissooidea, Littorinoidea and Neogastropoda. Advanced Opisthobranchia and Pyramidelloidea are absent as well. Conspicuously present are a variety of slit-bearing archaeogastropods, small sized Trochoidea, Neritopsidae, Cerithiimorpha, Zygopleuroidea and diverse groups of Allogastropoda. The shallow water fauna of an off-shore carbonate platform in the Tethys Ocean of the Upper Triassic was extremely rich in gastropod species where open ocean and platform met.

ACKNOWLEDGEMENTS

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