

REPRESENTATIVES OF THE GENUS *PROTOPENEROPLIS* (FORAMINIFERA) IN THE JURASSIC AND LOWER CRETACEOUS DEPOSITS IN ROMANIA. COMPARISONS WITH OTHER REGIONS OF THE TETHYAN AREA

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Ioan I. BUCUR

University Babeş -Bolyai, Department of Geology, M. Kogălniceanu 1, 3400 Cluj-Napoca

Abstract: The paper presents the occurrences of the three described species of *Protopeneroplis* within Romanian Jurassic and Lower Cretaceous deposits. New occurrences were identified in the West Carpathian Mountains and South Carpathians. Comparisons with other regions of the Tethyan area, a general stratigraphical range and the phyletic relationships among the three species are also emphasized.

Key words: Foraminifera, paleogeography, Jurassic-Cretaceous, Romania, Tethys

Introduction

Within the genus *Protopeneroplis* three species have been described so far: *Protopeneroplis striata* Weinschenk, 1950, *Protopeneroplis ultragranulata* (Gorbachik, 1971 - an older synonym of *Protopeneroplis trochangulata* Septfontaine, 1974) and *Protopeneroplis banatica* Bucur, 1993.

The purpose of this paper is to present the occurrences of the *Protopeneroplis* species within the Jurassic and Lower Cretaceous carbonate deposits in Romania and to emphasize their general stratigraphical range, essentially of the two species occurring in Cretaceous deposits, in comparison with other areas of the Tethyan realm.

The synonymies refer only to the citations not included in previous papers. For more references see Farinacci (1964) and Septfontaine (1974) for *Protopeneroplis striata*; Septfontaine (1974), Bucur (1993) and Bucur et al. (1996) for *Protopeneroplis ultragranulata*; Bucur (1993) for *Protopeneroplis banatica*.

Occurrences of the *Protopeneroplis* species in Romania

***Protopeneroplis striata* WEINSCHENK,
1950 emend FARINACCI, 1964
(Pl.I, Figs.1-12)**

- 1964 - *Protopeneroplis striata* WEINSCHENK - Farinacci, p.44, Figs.2-5 (synonymy list)
- 1969 - *Protopeneroplis striata* WEINSCHENK - Gusic, p.80, Pl.XV, Figs.4-7
- 1969 - *Protopeneroplis striata* WEINSCHENK - Luperto Sinni, p.230, Pl.1, Fig.1
- 1973 - *Protopeneroplis striata* WEINSCHENK - Dragastan et al., p.51
- 1974 - *Protopeneroplis striata* WEINSCHENK Septfontaine, 607, Pl.2, Figs.1-15 (synonymy list)
- 1975 - *Protopeneroplis striata* WEINSCHENK - Dragastan, p.50, Pl.XVI, Fig.1
- 1975 - *Protopeneroplis striata* WEINSCHENK - Dragastan & Neagu, p.35, 36
- 1975 - *Protopeneroplis striata* WEINSCHENK - Vinogradov & Dragastan, p.108
- 1976 - *Protopeneroplis striata* WEINSCHENK - Farinacci, p.153, Pl.1, Fig.1-6

- 1977 - *Protopeneroplis striata* WEINSCHENK Furrer & Septfontaine, p.728, Pl.2, Fig.14
- 1980 - *Protopeneroplis striata* WEINSCHENK - Dragastan, p.147
- 1980 - *Protopeneroplis striata* WEINSCHENK Steiger & Wurm, p.262, Pl.26, Fig.1
- 1981 - *Protopeneroplis striata* WEINSCHENK - Popa, p.244
- 1983 - *Protopeneroplis striata* WEINSCHENK - Pelissié et al., p.481, Pl.1, Figs.22-23
- 1984 - *Protopeneroplis striata* WEINSCHENK - Bernier, p.530, Pl.20, Fig.9
- 1985 - *Protopeneroplis striata* WEINSCHENK - Hüssner, p.158, Pl.19, Fig.7
- 1985 - *Protopeneroplis striata* WEINSCHENK - Mantea, p.33
- 1987 - *Protopeneroplis striata* WEINSCHENK - Barattolo & Pugliese, p.17, Pl. III, Fig.1-7
- 1987 - *Protopeneroplis striata* WEINSCHENK - Bassoullet & Colchen, p.551, Pl.1, Fig.6
- 1987 - *Protopeneroplis striata* WEINSCHENK - Ghiurcă et al., p.56, Pl.II, Figs.4,6
- 1987 - *Protopeneroplis striata* WEINSCHENK - Sotak, p.651, Pl.3, Figs.10-12
- 1987 - *Protopeneroplis striata* WEINSCHENK - Canovic & Kemenci, p.202, pl36, Fig.2
- 1988 - *Protopeneroplis striata* WEINSCHENK - Sartorio & Venturini, p.91
- 1989 - *Protopeneroplis striata* WEINSCHENK - Sotak, p.44, Pl.4, Fig.5
- 1991 - *Protopeneroplis striata* WEINSCHENK - Altiner, p.173, Pl.3, Figs.1-7
- 1991 - *Protopeneroplis striata* WEINSCHENK - Schlagintweit, p.87, Pl.1, Fig.2
- 1992 - *Protopeneroplis striata* WEINSCHENK - Bodeur, Pl.24, Figs.5-6
- 1993 - *Protopeneroplis striata* WEINSCHENK - Bucur et al., p.79, Pl.2, Fig.6
- 1993 - *Protopeneroplis striata* WEINSCHENK - Bucur et al., p.34, Pl.II, Figs.8-10
- 1993 - *Protopeneroplis striata* WEINSCHENK - Tsilar & Velic, p.269, Fig.4
- 1994 - *Protopeneroplis striata* WEINSCHENK -

Chiocchini et al., p.23, Pl.31, Figs.5-13

1994 - *Protopenneroplis striata* WEINSCHENK -

Luperto Sinni & Masse, p.251, Pl.2, Fig. 6-7

1994 - *Protopenneroplis aff. striata* WEINSCHENK

- Luperto Sinni & Masse, p.251, Pl.2, Fig.10

1995 - *Protopenneroplis striata* WEINSCHENK -

Carras, p.43, 117, Fig.471, Pl.25, Figs.1-4

1996 - *Protopenneroplis striata* WEINSCHENK -

Bucur et al., p.66, Pl.3, Figs.8-13

1996 - *Protopenneroplis striata* WEINSCHENK -

Chiocchini & Mancinelli, p.239, Fig.4a-c

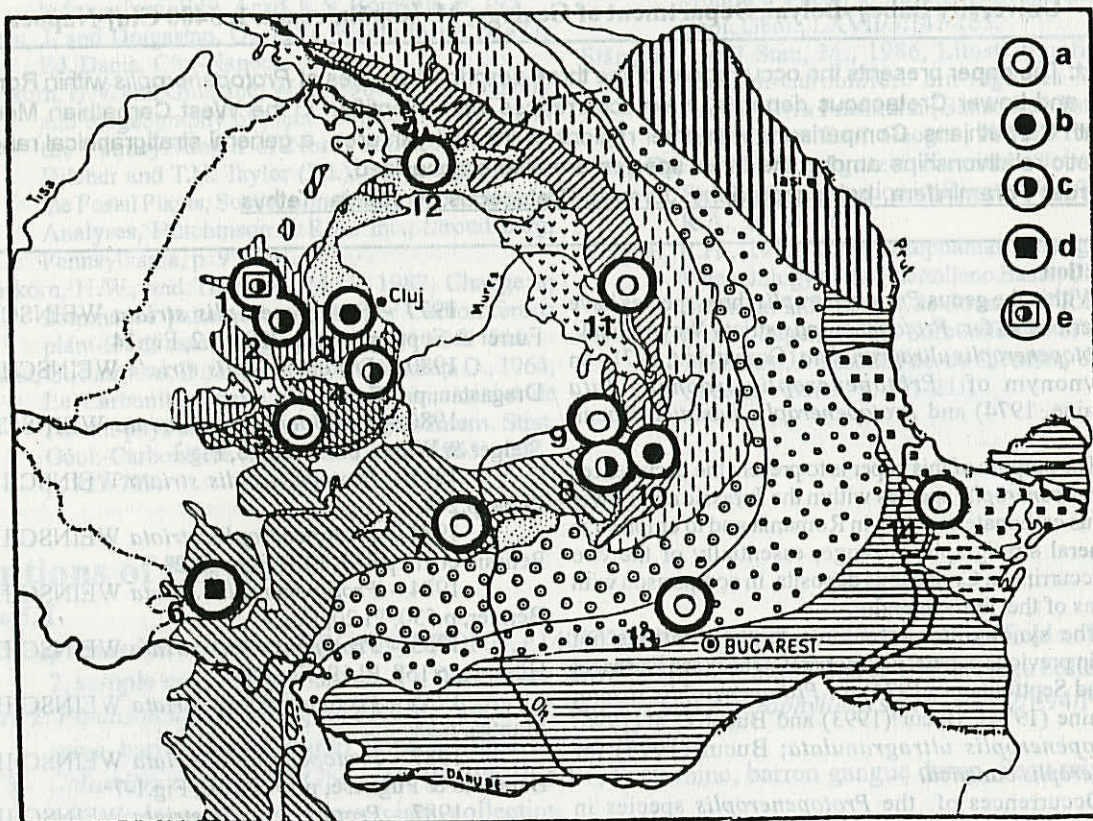


Fig.1 - Occurrences of *Protopenneroplis* species within the Romanian territory

a - *Protopenneroplis striata*; b - *Protopenneroplis ultragranulata*; c - *Protopenneroplis striata* and *Protopenneroplis ultragranulata*; d - *Protopenneroplis ultragranulata* and *Protopenneroplis banatica*; e - *Protopenneroplis striata*, *Protopenneroplis ultragranulata* and *Protopenneroplis banatica*.

1-5 - Apuseni Mountains (1 - Pădurea Craiului; 2 - Bihor; 3 - Hășdate; 4 - Cetea; 5 - Techereu); 6-7 - Southern Carpathians (6 - Resita-Moldova Nouă zone; 7 - Vânturarița massif); 8-12 - Eastern Carpathians (8 - Piatra Craiului, Dâmbovicioara zone; 9 - Persani Mountains; 10 - Ciucas Mountains; 11 - Haghimas Mountains; 12 - Poiana Botizei); 13 - Moesian Platform (Butimanu); 14 - Northern Dobrogea (Cârjelari).

Protopenneroplis striata is a well known and widely spread species in the Middle-Upper Jurassic deposits of the Tethyan realm. It was also reported in Romanian Upper Jurassic carbonates (Fig.1): Dragastan et al. (1973), Dragastan (1975) and Dragastan & Neagu (1975) in the Lower Tithonian of Hăghimaș Mountains (East Carpathians); Vinogradov & Dragastan (1975) in the Tithonian limestones of the central part of the Moesian Platform; Dragastan (1980) in the Upper Tithonian limestones of Vânturarița massif (South Carpathians); Popa (1981) in the Tithonian deposits from the eastern part of Pădurea Craiului (Apuseni Carpathians); Mantea (1985) also in the West Carpathians (Farcu Limestones from Someșul Cald graben). In the recent years

we have found more occurrences of this species in several regions of the Carpathian chain: Southern Apuseni, at Techereu (Ghiurcă et al., 1987) and Cetea (Bucur et al., 1993); in the Northern Apuseni (Pădurea Craiului) (Bucur et al., 1993, and the data in this paper) in Kimmeridgian and Tithonian respectively Farcu and Cornet Limestones (Pl.I, Figs.1-3, 5, 6); in the Klippen zone of the East Carpathians (Botiza region) in Upper Jurassic allodapic limestones (Pl.I, Fig.4); in the Tithonian limestones of the Piatra Craiului massif (Dâmbovicioara zone) (Pl.I, Figs.11-12). Recently we had the opportunity to see individuals of this species in the Oxfordian limestones in Cârjelari (Northern Dobrogea) (Unpublished material from Dr. Eugen Grădinaru, Bucharest).

***Protoperoneplis ultragranulata* (GORBATCHIK, 1971)**
(Pl.I, Figs.13-16; Pl.II, Figs.1-14; Pl.III, Figs.1-3)

- 1971 - *Hoeglundina* (?) *ultragranulata* sp. nov. - Gorbatchik, p.135, Pl.V, Fig.2a-c
 1974 - *Protoperoneplis trochangulata* sp. nov. - Septfontaine, p.608, pl.I, figs. 1-18
 1980 - *Protoperoneplis trochangulata* SEPTFONTAINE - Decrouez & Lombard, p.117, fig.4d
 1987 - *Protoperoneplis trochangulata* SEPTFONTAINE - Boisseau, p.147, pl.3, figs.1-4
 1988 - *Protoperoneplis trochangulata* SEPTFONTAINE - Sartorio & Venturini, p.91
 1988 - *Protoperoneplis trochangulata* SEPTFONTAINE - Zaninetti et al., p.58, pl.2, fig.4
 1989 - *Protoperoneplis trochangulata* SEPTFONTAINE - Sotak, p.44, pl.4, fig.6
 1993 - *Protoperoneplis ultragranulata* (GORBATCHIK) - Bucur, p.214, pl.2, figs.1, 2, 5, 8, 11, 12. (synonymy list)
 1994 - *Protoperoneplis ultragranulata* (GORBATCHIK) - Chiocchini et al., p.17, 23, pl.31, figs.1-11
 1995 - *Protoperoneplis* sp. - Arnaud-Vanneau & Sliter, p.5516, pl.5, figs.8-10
 1995 - *Protoperoneplis trochangulata* SEPTFONTAINE - Carras, p.50, 143, 152, Fig.4/1, pl.38, fig.3; pl.39, fig.5
 NF 1995 - *Protoperoneplis trochangulata* SEPTFONTAINE - Martini & Zaninetti, p.133-135
 1996 - *Protoperoneplis ultragranulata* (GORBATCHIK) - Bucur et al., p.66, 69, pl.3, figs.14-17 (synonymy list)

NF 1997 - *Protoperoneplis ultragranulata* (GORBATCHIK) - Bulot et al., p.175

This species was firstly described and illustrated as *Hoeglundina* (?) *ultragranulata* by Gorbatchik (1971), but it was more known and almost exclusively cited as *P. trochangulata* Septfontaine, 1974. The synonymy of the two species was emphasized by Septfontaine et al. (1991) and undeline also by Bucur (1993).

In Romania, this species was firstly reported by Bucur (1985, 1986) and illustrated by Bucur & Oros (1987) from allodapic Berriasian-Valanginian limestones of the Resita-Moldova Nouă zone (South Carpathians). Subsequently it was found in other regions (Fig.1): Southern Apuseni Mountains, in olistoliths of Lower Cretaceous age in an Upper Cretaceous wildflysh near Hăsdate village (Bucur et al., 1991) and the Upper Jurassic olistoliths from Cetea (Bucur et al., 1993) associated with *P. striata*. It was also found in the Lower Barremian shallow water limestones from Carasova (Resita-Moldova Nouă zone) (Bucur, 1990, 1993). In this paper we present other occurrences from the South Carpathians (Piatra Craiului massif, Upper Tithonian-Berriasian limestones) (Pl.I, figs.13, 16) and Lower Cretaceous limestone blocks in the Albian Ciucas conglomerates (Pl.I, figs.14, 15). In the Northern Apuseni Mountains (Pădurea Craiului) *P. ultragranulata* was found associated with *P. striata* in the Tithonian Cornet Limestones (Pl.II, figs.2,3,5,7).

***Protoperoneplis banatica* BUCUR, 1993**
(Pl.III, figs.4-19)

- ? 1982 - *Protoperoneplis* sp. - Altiner & Decrouez, p.61, pl.III, figs.1-2
 1993 - *Protoperoneplis banatica* n. sp. - Bucur, p.218, pl.1, figs.1-37; pl.2, figs.3, 4, 6, 7, 9, 10, 13) (Synonymy list).

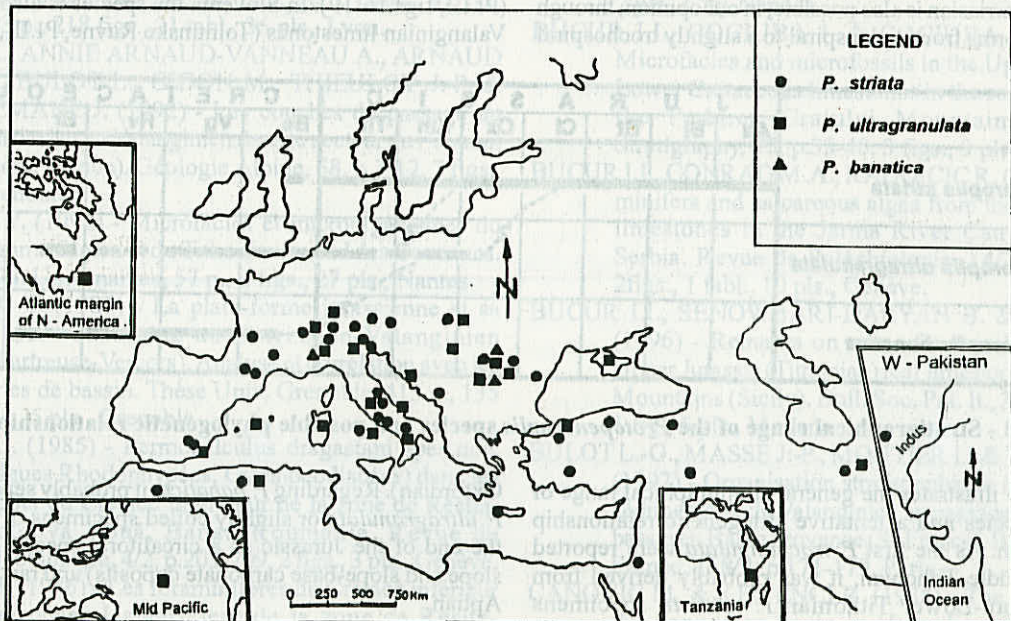


Fig.2 - Geographical range of *Protoperoneplis* species within the Mediterranean realm and other regions of the world, according to Septfontaine (1974) slightly modified and completed with new data. Africa, Mid Pacific and North America not to the given scale.

This species was described from the Valanginian-Hauterivian Valea Lindinei Limestones (Resita-Moldova Nouă zone, South Carpathians) and reported further only by Blanc et al. (1992) in the Valanginian of Se France. Recently we refound this species in other sections of Valea Lindinei Limestones, in the southernmost part of the Resita zone (Danube border) (Pl.III, figs.4-11; Fig.1), in the Berriasian-Valanginian limestones from Jerma (Eastern Serbia, Bucur et al., 1995), in the Aptian limestones from Pădurea Craiului (Apuseni Mountains) (Pl.III, figs.16, 17) as well as in the Lower Cretaceous limestones (Berriasian-Valanginian and Aptian) from Slovenia (unpublished material from Ramin Samiee, Institut of Paleontology Erlangen, Germany, PhD Thesis in preparation).

Geographical range

Fig.2 illustrate the general geographical range of the three *Protopenneroplis* species within the mediterranean domain and Pakistan, according to Septfontaine (1974, Fig.5), completed with new occurrences signaled after 1974 (including Romanian occurrences). Three other interesting occurrences of *Protopenneroplis ultragranulata* were emphasized: Tanzania (Sartorio & Venturini, 1988), the Atlantic margin of North America (Fourcade & Granier, 1989) and the Middle part of Pacific Ocean (Arnaud-Vanneau & Sliter, 1995). Starting from this geographical range we can see that *Protopenneroplis* was spread all over the world, the higher density within the mediterranean realm being a matter of more detailed geological knowledge of this region.

Stratigraphical range and possible phylogenetic relationships

According to Septfontaine (1974) *P. striata* was reported from deposits of Aalenian to Tithonian age. Its presence in Barriasian is also possible, in our opinion, through transitional forms from a planspiral to a slightly trochospiral

coiling. In Romania, the stratigraphical range of *P. striata* is Oxfordian to Upper Tithonian.

P. ultragranulata was mainly reported from Berriasian-Valanginian deposits, but it is present starting with the Middle Tithonian (Heinz & Isenschmid, 1988) up to the Barremian (Bucur, 1993). The presence of this species within Barremian deposits of the Mid Pacific Ocean was confirmed recently by Arnaud-Vanneau & Sliter (1995) (as *Protopenneroplis* sp.).

It is noteworthy to mention that we had the opportunity to examine recently specimens of *Protopenneroplis* from the Upper Jurassic of Turkey (Kale-Gümüşhane region, Eastern Pontides; unpublished material from prof. R. Koch, Erlangen) situated above a level with *Alveosepta jaccardi* (SCHRODT) (Oxfordian age) and having a trochospiral coiling, similar to *P. ultragranulata*. The only difference consist in the smaller dimensions of the Turkish specimens.

In Romania *P. ultragranulata* was found in Lower Cretaceous limestones (Berriasian-Valanginian and Lower Barremian) (Resita zone, South Carpathians; Ciuca, East Carpathians and Hăsdade, Northern Apuseni, in reworked Lower Cretaceous limestones in younger deposits), but also in Tithonian limestones associated with *Protopenneroplis striata* (mainly in the same thin section) in Pădurea Craiului and Bihor Mountains (Northern Apuseni), at Cetea (Southern Apuseni) (Upper Tithonian blocks in younger deposits) and Piatra Craiului (possibly at higher levels than *P. striata*).

P. banatica is the more recently described and less known species of *Protopenneroplis*. Out of Romania (Bucur, 1993) it was only reported from SE France (Blanc et al., 1992) in Valanginian limestones. Recently we found this species in younger (Aptian) deposits in Pădurea Craiului (Northern Apuseni) and in Slovenia (Kanalski Vrh, near Nova Gorica) (Pl.III, figs.16-19). In Slovenia the species is also present in Valanginian limestones (Tolminske Ravne, Pl.III, fig.13).

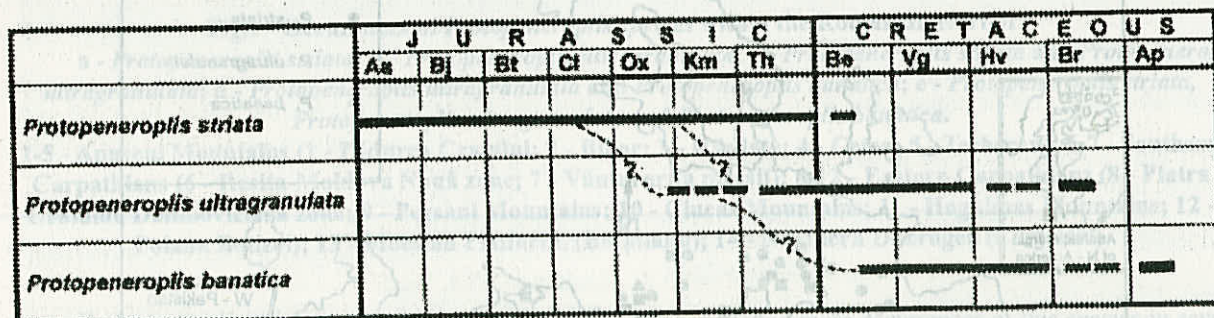


Fig. 3 - Stratigraphical range of the *Protopenneroplis* species and possible phylogenetic relationships.

Fig.3 illustrates the general stratigraphical range of the three species and a tentative filogenetic relationship between them. As the first *P. trochangulata* were reported from the Middle Tithonian, it was probably derived from Kimmeridgian-Lower Tithonian *P. striata* specimens presenting a deviation from the planspiral to slightly trochospiral coiling. However, the Oxfordian specimens from Turkey, very similar to *P. ultragranulata*, make us to think to a earlier detachment of the trochospiral lineage (? Lower

Oxfordian). Regarding *P. banatica*, it probably separates from *P. ultragranulata* or slightly coiled specimens of *P. striata* at the end of the Jurassic as a circalitoral species (related to slope and slope-base carbonate deposits) and range up to the Aptian.

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Protopenneroplis specimens from their material of Slovenia and Turkey. We also thank Roman Koch (Erlangen) and Eugen Gradinaru (Bucharest) for permitting us to examine

thin sections with *Protopenneroplis* from Turkey (Eastern Pontides) and North Dobrogea. Part of this paper was financially supported through the CNCSU grant 62/456.

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Captions of Plates

Plate 6. I

Figs.1-12 - *Protopenneroplis striata* WEYNSCHENK

1-3, 5, 6 - Tithonian, Cornet Limestones, Pădurea Craiului (Apuseni Mountains)

4 - Allodapic limestones, Upper Jurassic Klippen zone, Poiana Botizei

7, 8, 10 - Upper Tithonian, Madonie Mountains, Sicily

9 - Tithonian, Egridir, Taurus Mountains, Turkey

11, 12 - Upper Tithonian, Piatra Craiului massif (Dâmbovicioara zone)

Figs.13-16 - *Protopenneroplis ultragranulata* (GORBATCIK)

13, 16 - Upper Tithonian-?Berriasian, Piatra Craiului massif, Dâmbovicioara zone

14, 15 - Lower Cretaceous blocks in Albian conglomerates, Ciucas Mountains, East Carpathians.

Enlargement: 1-7, 10-16 X 100; 8, 9 X 50

Plate 6. II

Figs.1-14 - *Protopenneroplis ultragranulata* (GORBATCIK)

1 - Upper Tithonian-?Berriasian, Piatra Craiului massif, Dâmbovicioara zone

2, 3, 5, 7 - Tithonian, Cornet Limestones, Pădurea Craiului (Apuseni Mountains)

4 - Upper Tithonian, Madonie Mountains, Sicily

6 - Tithonian, Bihor Mountains (Apuseni Mountains)

8 - Berriasian allodapic limestones, Ilidia, Resita-Moldova Nouă zone, South Carpathians.

9, 11-13 - Berriasian-Valanginian allodapic limestones, Tolminske Ravne, Slovenia

10 - Berriasian-Valanginian limestones, Jerma Canyon, Eastern Serbia

13 - Lower Barremian, Valea Nerei Limestones, Carasova, Resita-Moldova Nouă zone, South Carpathians.

Enlargement: 1-8, 11, 12 X 100; 9, 10, 13, 14 X 75

Plate 6. III

Figs.1-3 - *Protopenneroplis ultragranulata* (GORBATCIK). Berriasian-Valanginian limestones, Tolminske Ravne, Slovenia

Figs.4-19 - *Protopenneroplis banatica* BUCUR

4-11 - Upper Valanginian-Hauterivian, Valea Lindinei Limestones, Resita-Moldova Nouă zone, South Carpathians

12 - Berriasian-Valanginian limestones, Jerma Canyon, Eastern Serbia

13-15 - Berriasian-Valanginian limestones, Tolminske Ravne, Slovenia

16, 17 - Aptian limestones (Upper Pachyodont Limestones), Pădurea Craiului, Apuseni Mountains

18, 19 - Aptian limestones, Kanalski Vrh, Slovenia

Enlargement: 1-4, 6-8, 11, 13, 16, 18, 19 X 100; 14, 15 X 150; 5, 9, 10, 17 X 200