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Barremian-Aptian boundary in the Dambovicioara area (Rumanian Carpathians)

By EMIL AVRAM and MIHAELA CARMEN MELINTE, Bucharest

With 3 plates and 4 figures in the text

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Abstract: The Barremian-Aptian boundary transition in the Dâmbovicioara village area (central part of South Carpathians) and its ammonite and nannoflora content are presented. Beside numerous Tethyan ammonite and nannofloral taxa, these strata contain a new species of *Parancyloceras* (*P. meridionale* AVRAM) and also *Crucibiscutum salebrosum* (BLACK) JAKUBOWSKI, *Sollasites horticus* (STRADNER) CEPEK & HAY, *Zeugrhabdothus sisyphus* (GARTNER) CRUX and *Hemipodorhabdus gorkae* (REINHARDT) GRUN, proving a Boreal incursion into the Carpathian segment of the Tethys, during the Late Barremian.

Zusammenfassung: Die Barreme-Apt-Grenzschichten des Dâmbovicioara-Gebietes (zentraler Teil der Südkarpaten) mit ihren Ammoniten und Nannofossilien werden analysiert. Außer zahlreichen Tethys-Ammoniten und Nannoplankton enthält die Schichtfolge eine neue Art von *Parancyloceras* (*P. meridionale* AVRAM) sowie auch *Crucibiscutum salebrosum* (BLACK) JAKUBOWSKI, *Sollasites horticus* (STRADNER) CEPEK & HAY, *Zeugrhabdothus sisyphus* (GARTNTER) CRUX und *Hemipodorhabdus gorkae* (REINHARDT) GRUN, die einen borealen Einfluß im Karpaten-Abschnitt der Tethys während des oberen Barremes andeuten.

1. Introduction

The Barremian-Aptian boundary beds in Romania are generally poor in fossils (in the East Carpathian flysch) or are badly exposed (in the Svinita area, at the western end of the South Carpathians, near the Danube). In fact, the only area where both adequate outcrops and abundant fossils at the boundary are attained is the Dâmbovicioara area (a region located at the eastern end of the South Carpathians) in a single section: the Muierii Valley (Fig. 1).

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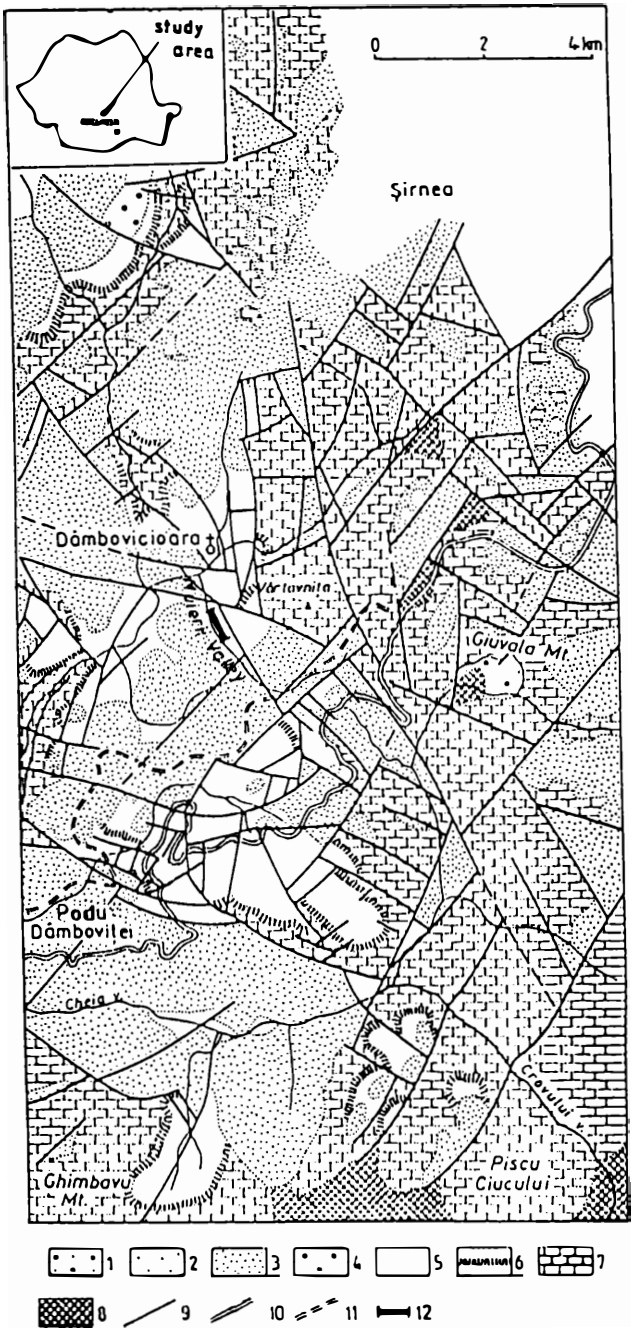


1: Quaternary deposits; 2: Cenomanian; 3: Upper Albian; 4: Upper Aptian; 5, 6: Uppermost Valanginian-Lower Aptian (Dealu Sasului and Valea Muierii Members of the Dâmbovicioara Formation); 7: Middle Jurassic-Lower Valanginian; 8: Leaota crystalline schists; 9: faults; 10: highway; 11: old commercial route; 12: location of studied section.

Fig. 1. Geological map of the Dâmbovicioara area (after PATRULIUS & AVRAM 1976, modified). Inset shows the location of the study area within Romania.

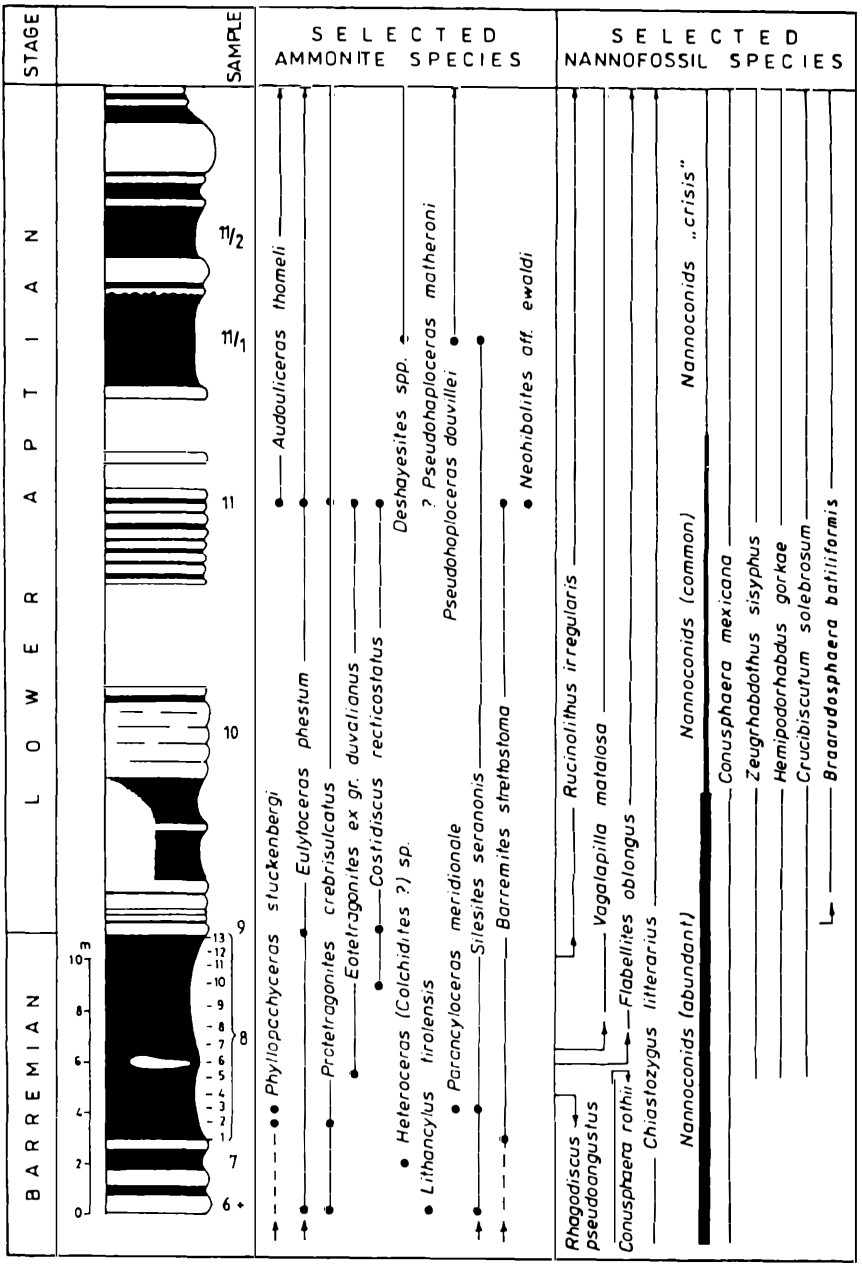


Fig. 2. Ammonite and nannofossil assemblages succession at the Barremian-Aptian boundary on the Muierii valley, Dâmbovicioara region.

In this area, belonging to the central South Carpathians structural units (= Median Dacides, sensu SANDULESCU 1984), the Lower Cretaceous deposits and faunal successions were previously studied by HERBICH (1888), POPOVICI-HATZEG (1898), SIMIONESCU (1898), ONCESCU (1943), PATRULIUS (1969), PATRULIUS & AVRAM (1976) and AVRAM (in press).

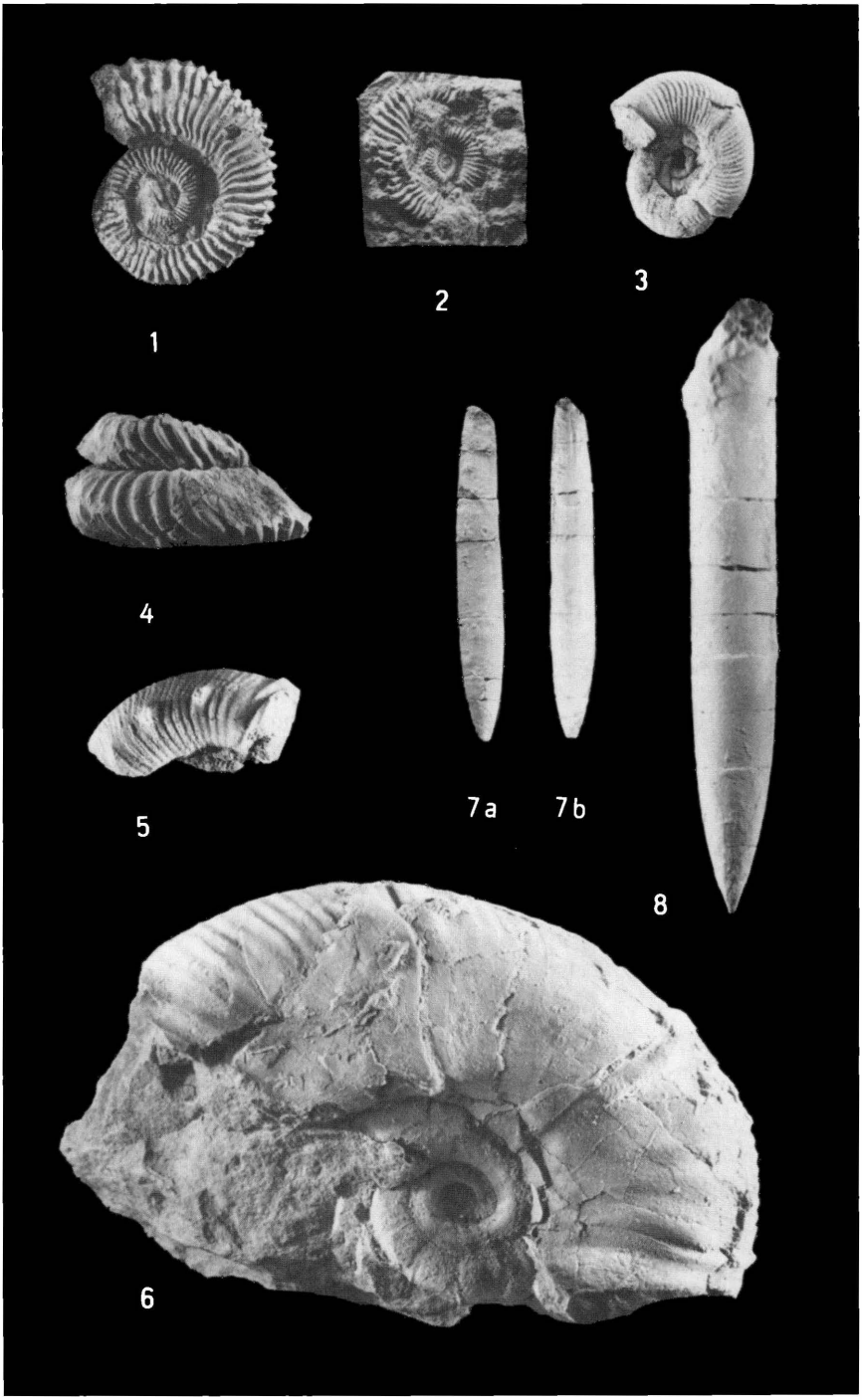
The Barremian-Aptian boundary beds in this area consist of grey marls and marly limestones, with interbeds of reefal-bioclastic calcarenites and calcirudites, belonging to the Barremian-Bedoulian Valea Muierii Member of the Upper Valanginian-Lower Aptian Dâmbovicioara Formation (PATRULIUS & AVRAM 1976).

It is worth mentioning that the repeated records of macrofossils in the Upper Barremian and the Aptian strata in the Muierii Valley led to more or less different lists of species being published by the authors mentioned above; the list presented here (Fig. 2 and Plate 1) results from the revision of the combined collections of PATRULIUS and AVRAM stored in the repository of the Geological Institute of Romania.

From all the faunas recorded in the uppermost Barremian succession in the Muierii Valley section, the most interesting is the occurrence of the ammonite genus *Parancyloceras,* represented by a new species that is closely related to *P. bidentatum* v. KOENEN; it argues for the presence, in the uppermost Barremian in the Central Carpathian area, of boreal (or descendants from boreal) immigrants, in a bed correlatable to the "sea level rise at about the base of the *Giraudi* Zone" suggested by RAWSON (1995). This is also supported by the nannofossil assemblage of the same interval (Fig. 2 and Plate 2), where the presence of several Boreal or Boreal-related species indicates an earlier than previously accepted mixture of Tethyan and Boreal biota.

Plate 1

Figs. 1, 2: *Parancyloceras meridionale* AVRAM. x 1. 1: holotype (IGP 14805); 2: IGP 14806. Both from bed 8/3, Upper Barremian, Muierii Valley.
Figs. 3, 5: *Silesites seranonis* (D'ORBIGNY). x 1. 3: Upper Barremian (bed 6); 5: the last representative of the species recorded in the lowermost Aptian (bed 10), Muierii Valley.
Fig. 4: *Heteroceras* (or *Colchidites?*) sp. x 1. Upper Barremian (bed 7), Muierii Valley.
Fig. 6: *Pseudohaploceras douvillei* (FALLOT). x 1. Lowermost Aptian (bed 11/1), Muierii Valley.
Fig. 7a, b: *Neohibolites* aff. *ewaldi* (STOMBECK) (in ALI-ZADE 1972). x 1. Lowermost Aptian (bed 11), Muierii Valley.
Fig. 8: *Neohibolites ekimbontchevi* STOY. VERG. x 1. Lowermost Aptian (bed 11), Muierii Valley.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2. The cephalopod assemblages at the Barremian-Aptian boundary in the Dâmbovicioara area

This subject was tackled by PATRULIUS & AVRAM (1976), who recognized near the boundary three biozones, each of them containing fossils recorded over a relatively large interval.

These identified biozones are, in ascending order: (1) a biozone with *Lithancyclus, Heteroceras* (?) and *Parancyloceras* (?), a biozone with *Pseudohaploceras matheroni* and *Neohibolites,* and (3) a biozone with *Deshayesites.*

The same authors located the Barremian-Aptian boundary in the level between biozones 1 and 2, where a bed of calcarenite rich in orbitolinids, almost 1 m thick, constitutes a lithologic marker (bed 9 in Fig. 2), above a some 8 m thick marly sequence. These marls (sequence 8 in Fig. 2), which overlie a marly and calcarenite alternation with *Heteroceras* ? *Colchidites* (only a large helix, figured in Plate 1, Fig. 4, was recorded, yielded: *Silesites seranonis* (D'ORBIGNY), *Phyllopachyceras stuckenbergi* (KARAKASH) (= *P. ectocostatum* auct.), *Protetragonites crebrisulcatus* (UHLIG), *Eotetragonites* ex gr. *duvalianus* (D'ORGIBNY), *Costidiscus* cf. *recticostatus* (D'ORBIGNY), *Barremites strettostoma* (UHLIG) and some examples of *Parancyloceras meridionale* AVRAM (locality F 23 in PATRULIUS & AVRAM 1976).

As in the Basses Alpes, France (THOMEL 1964), the first beds above bed 9 (beds 10, 11, 11/1 = locality 24 in PATRULIUS & AVRAM 1976) lack *Deshayesites,* these beds being characterized by *Eulytoceras phestum* (MATHERON), *Protetragonites crebrisulcatus* (UHLIG), *Costidiscus recticostatus* (D'ORBIGNY), *Argvethites godoganiensis* ERISTAVI, *Audouliceras thomeli* AVRAM, *Barremites strettostoma* (UHLIG), *Pseudohaploceras douvillei* (FALLOT), and *?P. matheroni* (D'ORBIGNY), as well as by the last *Silesites seranonis* (D'ORBIGNY) (= Plate 1, Fig. 5), and the first *Neohibolites*: *N.* aff. *ewaldi* (STOMBECK) in ALI-ZADE (1972) (= Plate 1, Figs. 7a-b). The first *Deshayesites* was recorded in bed 11/1, the genus being plentifully represented in the beds 12, 13, etc.

In fact, for the Barremian-Aptian boundary interval, the most important part of the succession is that comprising beds 8, 9 and 10, where the ammonites are relatively rare and few are indicative.

3. The nannofossils at the Barremian-Aptian boundary in Dâmbovicioara

The Barremian-Aptian boundary was recently defined, using nannofossils, in Tethys (ERBA 1994) as the bed immediately above the FAD of *Rucinolithus irregularis* APPLEGATE et al. in COVINGTON & WISE (= the upper part of the *Martelites sarasini* ammonite zone). This species appears in the Muierii Valley in bed 8/12 (Plate 2, Fig. 17), thus confirming the boundary tentatively recognized by PATRULIUS & AVRAM (1976).

The *Nannoconus* species in the boundary beds in the Muierii Valley are generally very common, including: *N. colomii* (DE LAPPARENT) KAMPTNER, *N. steinmannii* KAMPTNER, *N. minutus* BRONNIMANN, *N. bucheri* BRONNIMANN (Plate 2, Fig. 11) and *N. circularis* DERES & ACHERITEGUY (Plate 2, Fig. 14). However, in beds 11, 11/1, 11/2, 12, they became

very rare, in a succession approximately corresponding to the "nannoconid crisis" emphasized by ERBA (1994).

On the other hand, *Flabellites oblongus* (BUKRY) CRUX (Plate 2, Figs. 1, 3), common in the Upper Barremian succession (in the lower part of the *Martelites sarasini* ammonite zone), in the Betic Cordillera, Spain (AGUADO et al. 1992), appears in the Muierii Valley above bed 8/7. The cosmopolitan species *Chiastozygus litterarius* (GORKA) MANIVIT (Plate 2,

	TETHYS (after Erba, 1994)	BOREAL (after Mutterlose, 1991; 1992 and Crux 1989)	Bed no.	CARPATHIANS (Dâmbovicioara area, this paper)
APTIAN	*Rhagodiscus angustus* FO	*Rhagodiscus angustus* FO		
		Flabellites oblongus FO		
	"nannoconid	*Rucinolithus irregularis* FO	11/1	"nannoconid
		Chiastozygus litterarius FO		
			9	*Braarudosphaera batiliformis* FO
BARREMIAN	*Rucinolithus irregularis* FO		8/11	*Rucinolithus irregularis* FO
		Vagalapilla matalosa FO	8/7	*Vagalapilla matalosa* FO
	Flabellites oblongus FO		8/6	*Flabellites oblongus* FO
			8/5	*Conusphaera rothii* LO
			8/4	*Rhagodiscus pseudoangustus* LO
	Chiastozygus litterarius FO			

Fig. 3. Nannofossil events around the Barremian-Aptian boundary in the Tethys and Boreal realms.

Figs. 4, 5), previously considered to be a marker of the Barremian-Aptian boundary, is in fact only an Upper Barremian species, as was also proved by ERBA (1994); in the studied section it was recognized by us in bed 8/1, well below the boundary, between the beds yielding *Heteroceras (Colchidites?)* sp. and those with *Parancyloceras meridionale*.

Rhagodiscus pseudoangustus CRUX, a species signaled in the Boreal Realm, which in Speeton (where it was originally described by CRUX 1984) and in NW Germany was found in the Hauterivian and in the Lower Barremian (up to the *"Hoplocrioceras" fissicostatum* ammonite zone), appears in the Muierii Valley in beds 8/1-8/3; its presence there is due either to an unexpected longevity of this species (immigrated in Tethys during probably the Early Barremian), or to an accidental (and selective) reworking in the beds on which we concentrated our attention.

Vagalapilla matalosa (STOVER) THIERSTEIN was recognized in bed 8/8 and above; as the FAD of this species is located in the Boreal Realm in the Late Barremian (*Parancyloceras denckmanni* ammonite zone at Speeton, CRUX 1987, and *Oxyteuthis germanica* belemnite zone in NW Germany, MUTTERLOSE 1989), it seems that in the Dâmbovicioara area it enters later, very near to the Barremian-Aptian boundary.

Other nannofossil events recorded in the studied area are:

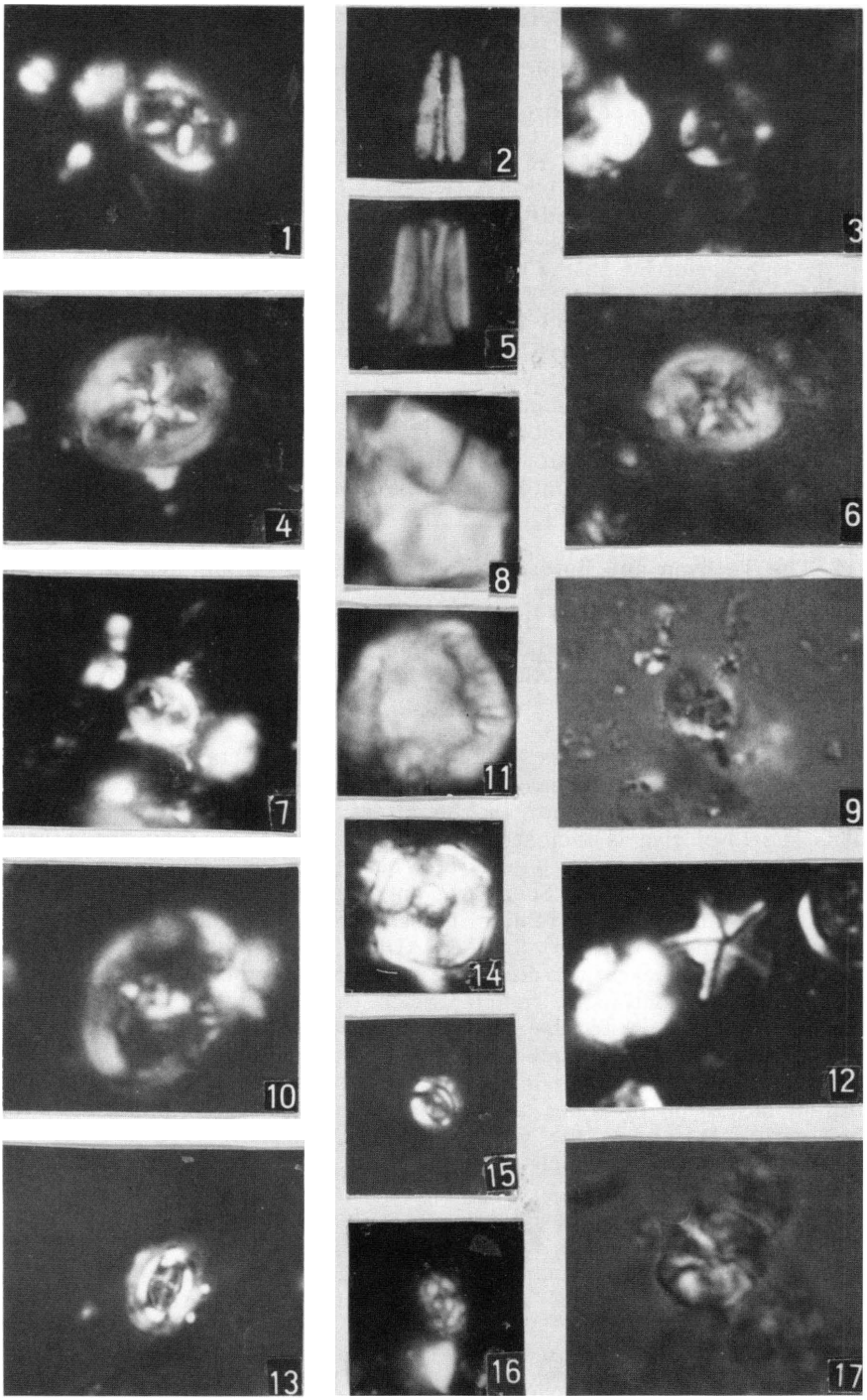
the last occurrence of *Conusphaera rothii* (THIERSTEIN) JAKUBOWSKI (Plate 2, Fig. 6), slightly before the first occurrence of *Flabellites oblongus;*

Conusphaera mexicana TREJO (Plate 2, Fig. 2) and the *Nannoconus* species are persistent above the Barremian-Aptian boundary, not quite common;

Micrantholithus hoschulzii (REINHARDT) THIERSTEIN and *Micrantholithus obtusus* STRADNER (Plate 2, Fig. 12) are also present in the nannofloral assemblages, both in the uppermost Barremian and lowermost Aptian successions;

Plate 2. LM, x 2700.

Figs. 1, 3: *Flabellites oblongus* (BUKRY) CRUX; 1: bed 6; 3: bed 11/1.
Fig. 2: *Conusphaera mexicana* TREJO, bed 11/2.
Figs. 4, 5: *Chiastozygus litterarius* (GORKA) MANIVIT; 4: bed 6, 5: bed 10.
Fig. 6: *Conusphaera rothii* (THIERSTEIN) JAKUBOWSKI, bed 6.
Figs. 7, 9: *Hemipodorhabdus gorkae* (REINHARDT) GRUN. Figs. 7, 9 same specimen, bed 8/2.
Fig. 8: *Braarudosphaera batiliformis* TROELSEN & QUADRIO, bed 9.
Fig. 10: *Zeugrhabdothus sysiphus* (GARTNER) CRUX, bed 8/4.
Fig. 11: *Nannoconus bucheri* BRONNIMANN, bed 9.
Fig. 12: *Micrantholithus obtusus* STRADNER, bed 11/1.
Figs. 13, 15, 16: *Crucibiscutum salebrosum* (BLACK) JAKUBOWSKI. 13: large form, bed 8/11; 15, 16: small forms, 15: bed 8/1, 16: bed 8/3.
Fig. 14: *Nannoconus circularis* DERES & ACHERITEGUY, bed 10.
Fig. 17: *Rucinolithus irregularis* THIERSTEIN, bed 8/12.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the first occurrence of *Braarudosphaera batiliformis* TROELSEN & QUADROS (Plate 2, Fig. 8) in bed 9; its entry is an event which could characterize, in our opinion, the Barremian-Aptian boundary.

Finally, the typical Boreal species: *Zeugrhabdothus sisyphus* (GARTNER) CRUX (Plate 2, Fig. 10), *Crucibiscutum salebrosum* (BLACK) JAKUBOWSKI (Plate 2, Figs. 13, 15, 16), *Sollasites horticus* (STRADNER) CEPEK & HAY, *Hermipodorhabdus gorkae* (REINHARDT) GRUN (Plate 2, Figs. 7, 9), are rare, but recognized throughout the succession between beds 8/1 and 11.

It is noteworthy that *Crucibiscutum salebrosum* is represented both by small specimens (Plate 2, Figs. 15, 16), such as the holotype described by JAKUBOWSKI (1987), and also by large ones (Plate 2, Fig. 13) such as those found by CRUX (1987) in the Hauterivian deposits of the Moorberg, Sarstedt section (NW Germany).

The Boreal species mentioned above have no biostratigraphic significance, but their record across a relatively large succession points to a clear and continuous incursion during the latest Barremian - earliest Aptian from the Boreal Realm into the Carpathian segment of Tethys.

4. The Tethyan and Boreal realms connection during the Late Barremian

The sea level rise in the earliest Aptian, proved by unconformities in southern and eastern England, the North Sea, North Germany and south-eastern France (fide RAWSON 1994), has been recognized for a long time, its consequences being felt in the progressive mixing of the Boreal and Tethyan faunas and floras.

In the last few years palaeontological and stratigraphical data have accumulated, which indicate "another rapid sea level rise, not previously documented in NW Europe" in the latest Barremian (RAWSON 1995a, b). This sea level rise is indicated in the North Sea area by the presence of some Tethyan ammonites (rare *Heteroceras* in the *Parancyloceras bidentatum* ammonite zone at Speeton), an event related by RAWSON (1994, 1995b) to the Late Barremian transgression emphasized in south-eastern France (southern Vercors), by ARNAUD-VANNEAU & VANNEAU (1990).

In spite of the rather different palaeogeographic evolution of the Carpathian area (continuous sedimentation throughout the Barremian and the earliest Aptian, up to the *Deshayesites weissi* ammonite zone), compared to that of eastern England and south-eastern France, in the former region the Late Barremian sea-level rise is also documented by incursions of Boreal biota and by some changes in lithology: in the Muierii Valley, the bed with *Heteroceras* (or *Colchidites*?) is followed by a bed with *Parancyloceras*, a picture which is reminiscent of that presented by RAWSON (1995b) in the case of the Speeton Clay Formation, North Yorkshire. Moreover, in the Dâmbovicioara area the last, marl-dominated sequence of the Barremian stage clearly marks a significant lithological change from the underlying succession (alternations of calcarenites and marls, in beds 20-40 cm thick) presumably documenting a temporary deepening of the sea.

To conclude, the ammonites, nannofloras and lithologies argue for a mixing of Boreal and Tethyan waters and biota during the Late Barremian in the Carpathian segment of the Tethys. However, while the ammonite

species, except *Parancyloceras meridionale,* are all Tethyan, thus proving only a local and relatively short connection between these realms, the nannofossil assemblages, with typical Boreal species in the uppermost Barremian - lowermost Aptian interval (*Zeugrhabdothus sisyphus, Crucibiscutum salebrosum, Sollasites horticus*) or species related to the Upper Barremian of NW Germany and southern England (*Rhagodiscus pseudoangustus, Vagalapilla matalosa*), suggest that the connection was much larger and continuous during the latest Barremian. It thus became apparent that "the nannofloral turnover" (ERBA & MUTTERLOSE 1992) started, at least in the Carpathian area, earlier than previously presumed (during the latest Barremian instead of the earliest Aptian).

5. Systematic description

Parancyloceras meridionale AVRAM
(Plate 1, Figs. 1, 2; Text-Fig. 4a, b)

Holotype: The individual figured in Plate 1, Fig. 1 (AVRAM's collection, IG-P 14805).

Derivatio nominis: The southernmost representative of the genus.

Locus typicus: The Muierii Valley, Dâmbovicioara village area (eastern end of the South Carpathian Median Dacides).

Stratum typicum: Uppermost Barremian (above the bed with *Heteroceras* or *Colchidites*).

Material: Beside the holotype, which is the best preserved, two other specimens (IGP 14806).

Description: The holotype is small, with open plan-spiral coiled shell and oval whorl-section (slightly compressed post-depositionally) with tabulate ventral area; its ornamentation consists of sharp, equal, flexuous ribs which continue without any decrease on venter, and bear small, pointed tubercles at the angular ventral margin; the body chamber length is 1/3 of the last whorl; the aperture seems to be simple; the suture line (Fig. 4) with the median lobe shorter than the lateral lobe and with relatively large saddles.

The other specimens display only a part of the features of the holoe, because of their poorer preservations.

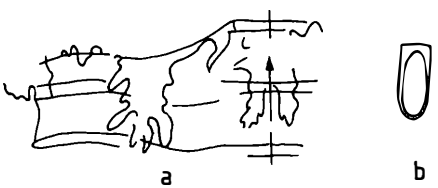

Fig. 4. The whorl section (x 1) and the suture line, at the whorl-height of 7.7 mm of *Parancyloceras meridionale* AVRAM, holotype.

Remarks: The size and lateral view of the ornamentation in *P. meridionale* are almost identical to those of *"Crioceras" puzosianum* D'ORBIGNY (1841, pl. 115 bis, figs. 1, 2). Nevertheless, it is distinguished from all the other species of this genus by the tabulate venter and by the marginal tubercles, which are typical features of *Parancyloceras*. It is closest to *P. bidentatum* v. KOENEN (1902, pl. XXXVIII, figs. 1a, 1b), from which it differs by its more open spire and by denser and flexuous ribbing.

References

AGUADO, R., COMPANY, M., O'DOGHERTY, L., SANDOVAL, J. & TAVERA, J. M. (1992): Biostratigraphic analysis of the pelagic Barremian/Aptian in the Betic Cordillera (southern Spain): preliminary data. Cretaceous Res., **13**: 445-452; London.

ALI-ZADE, A. (1972): Melovye belemnity Azerbajdzhana. 208 pp., 55 text-figs., 34 pls.; Moskwa (Nedra press).

ARNAUD-VANNEAU, A. & ARNAUD, H. (1990): Hauterivian to Lower Aptian carbonate shelf sedimentation and sequence stratigraphy in the Jura and northern Subalpin chains (southern France and Swiss Jura). Spec. Publs. Int. Ass. Sediment., **9**: 203-233, 26 text-figs.; Oxford.

AVRAM, E. (in press): The *Deshayesites* KAZANSKY, 1914 (Ammonoidea) representatives in Romania, a link between the West-European and Caspian assemblages of the genus. IVth Int. Symp. "Cephalopods, present and past", Granada 1996.

CRUX, J. A. (1987): Six new species of calcareous nannofossils from the Lower Cretaceous strata of England and Germany. INA Newsletter, 9: 30-35; London.

(1989): Biostratigraphy and palaeogeographical applications of Lower Cretaceous nannofossils from north-western Europe. In: CRUX, J. A. & VAN HECK, S. E. (eds.): Nannofossils and their applications: 143-211; Chichester/London.

ERBA, E. (1994): Nannofossils and superplumes: the Early Aptian nannoconid crisis. - Paleoceanography, **9**: 480-501; London.

ERBA, E. & MUTTERLOSE, J. (1992): The floral and faunal turnover in the Early Aptian (Early Cretaceous). Abstr. vol., 5th Int. Conf. Global Bio-Events; Göttingen.

HERBICH, F. (1888): Donnés paléontologiques sur les Carpathes Roumaines. - An. Biur. Geol., **3/1**: 178-339, 29 pls.; Bucuresti.

KOENEN, A. v. (1902): Die Ammonitiden des norddeutschen Neokom. Abh. Kgl. preuß. Landesanst. u. Bergakad., NF **24**: 449 pp., 55 pls.; Berlin.

MUTTERLOSE, J. (1991): Das Verteilungs- und Migrations-Muster des kalkigen Nannoplanktons in der Unterkreide (Valangin-Apt) NW-Deutschlands. - Palaeontographica, Abt. B, **221**: 27-152, 32 pls.; Stuttgart.

(1992): Biostratigraphy and paleobiogeography of Early Cretaceous calcareous nannofossils. - Cretaceous Res., **13**: 167-189; London.

ONCESCU, N. (1943): Region de Piatra Craiului - Bucegi. Etude géologique. - An. Inst. Geol. Roum., **32**: 1-124, 9 text-figs., 2 maps; Bucuresti.

PATRULIUS, D. (1969): Geologia Masivului Bucegi si a Culoarului Dâmbovicioara. - 321 pp., 76 text-figs., 6 pls., 2 maps; Bucuresti (Rom. Ac. Sci. Press).

PATRULIUS, D. & AVRAM, E. (1976): Stratigraphie et corrélation des terrains néocomiens et barrêmo-bedouliens du Couloir de Dâmbovicioara (Carpates Orientales). D. S. Inst. Geol. Geof., **62/4**: 135-160, 5 text-figs.; Bucuresti.

POPOVICI-HATZEG, V. (1898): Etude géologique des environs de Campulung et Sinaia (Roumanie). 217 pp., 21 text-figs., 1 map; Paris (Carrée & Naud Press).

RAWSON, P. F. (1994): Sea level changes and their influence on ammonite biogeography in the European Lower Cretaceous. - IIIrd Conf. Int. "Fossili, Evolutione, Ambiente", Pergola 1990. Palaeopelagos Spec. Publs., **1**: 317-326, 3 text-figs.; Roma.

(1995a): The "Boreal" Early Cretaceous (Pre-Aptian) ammonite sequences of NW Europe and their correlation with the western Mediterranean faunas. Mem. Descr. Carta Geol. d'Italia, **51**: 121-131, 2 text-figs.; Roma.

(1995b): Biostratigraphical affinities of NW European Barremian ammonite faunas and their palaeogeographical implications. Mem. Descr. Carta Geol. d'Italia, **51**: 131-136, 4 text-figs.; Roma.

SANDULESCU, M. (1984): Geotectonica Romaniei. 334 pp., 130 text-figs., 2 maps; Bucuresti (Ed. Tehnica).

SIMIONESCU, I. (1898): Studii geologice si paleontologice din Carpatii Sudici. I, Studii geologice asupra bazinului Dâmbovicioara; II, Fauna neocomiana din Bazinul Dâmbovicioara. Publ. fondului Adamache, V, 2: 5-11, 8 pls.; Bucuresti.

THOMEL, G. (1964): Les zones d'ammonites de l'Aptien des Basses Alpes. - C. R. Acad. Sci. Paris, **258/17**: 4308-4310; Paris.

Address of the authors:

Dr. E. AVRAM and Dr. M. C. MELINTE, Geological Institut of Romania, 1 Caransebes str., R-78344 Bucuresti, Romania.