GEOLOGICA CARPATHICA, 42, 2, BRATISLAVA, APRIL 1991,

111–116

NEW UPPER CRETACEOUS CYST *Pithonella siniformis* n. sp. *(Calciodinellaceae)* FROM EASTERN ALGERIA

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(Manuscript received February 15, 1990; accepted in revised form September 7, 1990)

Abstract: Thin section study of Upper Turonian to Senonian biomicrites, bio-intramicrites and intra-biomicrorudites of the Penitell nappe in eastern Algeria has allowed to describe a new species of Dinoflagellata calcareous cyst with a two-layer, structurally inhomogeneous wall. In the submitted work the new cyst, assigned into the subfamily *Pithonelloideae* KEUPP, 1987, has been denominated *Pithonella siniformis* n. sp.

Key words: Protozoa, Pithonella, Cretaceous, Algeria.

Location and microfacies characteristics of studied sediments

The studied rock material comes from localities 6 km west of Constantine in eastern Algeria (Fig. 1). It is represented by Upper Cretaceous rocks of the Penitell nappe of the Tell Atlas externides in the line Djebel Karkara-Djebel ben Ouataf (for more details see Vila, 1980; map on the page 440, Fig. 162, section p. 438, Fig. 160).

The Lower Senonian here occurs in the form of marly limestones and above in the form of marls which are reported to contain two lithoclast-bearing interlayers (intraformational conglomerates – "conglomérat santonien" and "Campanien microconglomératique"). These interlayers are sometimes jointly termed "conglomeratic or microconglomeratic facies" of Upper Santonian–Lower Campanian age.

From the micropaleontological point of view, the sample set evaluated by us is remarkable by the predominance of planktonic microorganisms, in thin-sections characterized by the *Pithonella* microfacies. In the following text we put forward brief microfacies characteristics of the studied thin-section samples, with the detailed taxonomic determination of the identified microfossils being concentrated in the final part of the article.

The Upper Turonian–Coniacian of this sample set is represented by packed biomicrites (packstones) of microorganogene muddy texture in which numerous calcispherulids and planktonic foraminifers are accompanied by very rare echinoderm segments, fine detritus of thin-walled bivalvian tests, ostracod relics, radiolarians, calcified sponge monaxons, rare fragments of coralline algae, sea urchin spines and benthic foraminifer shells. The muddy ground mass contains a variable portion of the clay fraction. Glauconite is an accessory mineral, calcite veinlets are rare. Locally abundant microstylolites are marked by a dark pigment.

The uppermost Coniacian–Santonian here comprise lithoclastic-textured intra-biomicrorudites with abundant microorganogene and unsorted organodetrital components in the ground mass which bears clear signs of bioturbidity. The microorganogene component of the ground mass is once again made up predominantly of common shells of calcispherulids and planktonic foraminifers. The minor organodetrital component includes echinoderm segments, ostracod relics, fragments of the prismatic layer of bivalvian shells, fragments of coralline algae, fairly small relics of green algae and benthic foraminifer shells damaged in the course of their transport. Blue-green algal microoncolites occur rarely. Biomicrite intraclasts whose facies is similar to that one of sediments of the above-described type are sometimes coated with limonite or, less frequently, are also slightly phosphatized.

The Santonian in the sample set studied by us is represented by coarse-grained bio-intramicrite (packstone), an allodapic intercalation with shallow-water detritus from beds of gray marls. Composition of the microorganogene constituent in this intercalation is similar to that one described in the two above-mentioned cases. Furthermore, it also contains rare radiolarians and blue-green algal microoncolites. The shallow-water organogene detritus is represented by abundant fragments of thick-walled bivalvian shells, numerous echinoderm segments, sea urchin spines, fragments of serpulid tubes, coralline algae, bryozoans and lagenid-foraminifer shells damaged during transport. Relics of *Ethelia alba* PFENDER and shells of agglutinated foraminifers occur very rarely. The muddy ground mass with a clay-mineral admixture contains accessory glauconite grains, epigenetic pyrite as well as phosphate grains. Biomicrite

intraclasts, as far as their facies is concerned, are similar to the above-described biomicrites of the *Pithonella* microfacies.

The Campanian here is documented by a sample of compressed biomicrite and that of intra-biomicrudite with the characteristic above-mentioned assemblage of very abundant *calcispherulid* microfossils and planktonic foraminifers contained in the ground mass. Biomicrite intraclasts with fragments of bivalvian shells, echinoderm segments, sea urchin spines and agglutinated foraminifer shells here attain the size ranging from 1.0 to 3.0 cm.

Taxonomic assignation of foraminifers present in thin-sections of these sediments was studied by J. Salaj of the Geological Institute of Dionýz Štúr, Bratislava. The published works evaluating microstructural characteristics and systematics of the individual genera of calcispherulid microfossils have kindly been given to us by E. Andri of Istituto di Geologia dell'Universita di Genova and H. Keupp, Institut für Paläontologie der Freien Universität, Berlin. The authors of the submitted article wish to thank the above-mentioned colleagues for their assistance.

Technique used

The new species *Pithonella siniformis* n. sp. has been taxonomically distinguished and described in detail by means of thin-section studies in polarized light.

Taxonomic determination of any studied shell in a thin-section is based upon the character of extinction at crossed nicols of the shell-wall structural particles. The presence or absence of dark extinction cross in the calcite wall and its orientation relative to the vertical as well as horizontal axes of the shell section are also of great diagnostic importance in considerations regarding taxonomic assignation of the investigated specimen (Fig. 3A, B, C).

Areal positions of the individual specimens of the newly described species in thin sections were determined by means of coordinates $x-y$ which were read in scales of the arms of the crossed thin section driver manufactured by the firm Meopta.

Systematic part

Class: *Dinophycea* FRITSCH 1929
Order: *Peridiniales* HAECKEL 1894
Family: *Calciodinellaceae* DEFLANDRE 1947 emend. BUJAK et DAVIES 1983
Genus: *Pithonella* LORENZ 1901, emend. BIGNOT et LEZAUD 1964, emend. VILLAIN 1977

Type species: *Pithonella ovalis* (KAUFMANN 1965).

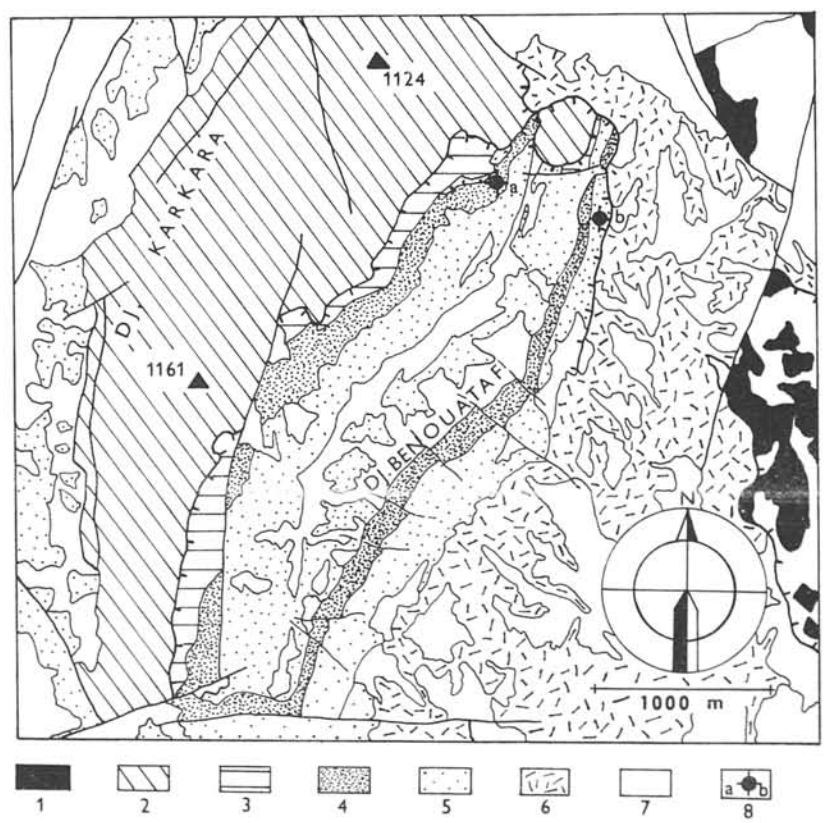

Fig. 1. Geological sketch of the Djebel Karkara – Djebel ben Ouataf area showing location of studied localities.
1 – "exotic Triassic"; 2 – Constantine neriticum nappe (Malm–Cenomanian); 3 to 6 – Penitell nappe of the Tell Atlas externides, 3 – Albian to Turonian, 4 – Lower Senonian intraformational conglomerates, 5 – Upper Santonian to Campanian; 6 – Maastrichtian; 7 – Mio-Pliocene and Quaternary; 8 – studied localities (a, b).
Compiled by J. Řehánek after Vila, 1980, p. 440.

Diagnosis: Ovoid or globular cysts with single or two-layer calcareous wall whose structural particles in the outer, and sometimes also in the inner layer are uniformly oriented obliquely to the wall surface. One or two apertures, mutually opposite within the cyst's vertical axis.

Pithonella siniformis n. sp.
Pl. 1, Figs. 1–9, Text-figs. 2, 3A

Holotype: Specimen shown in Pl. 1, Fig. 1, deposited in thin-section archives, Department of Geology and Paleontol-

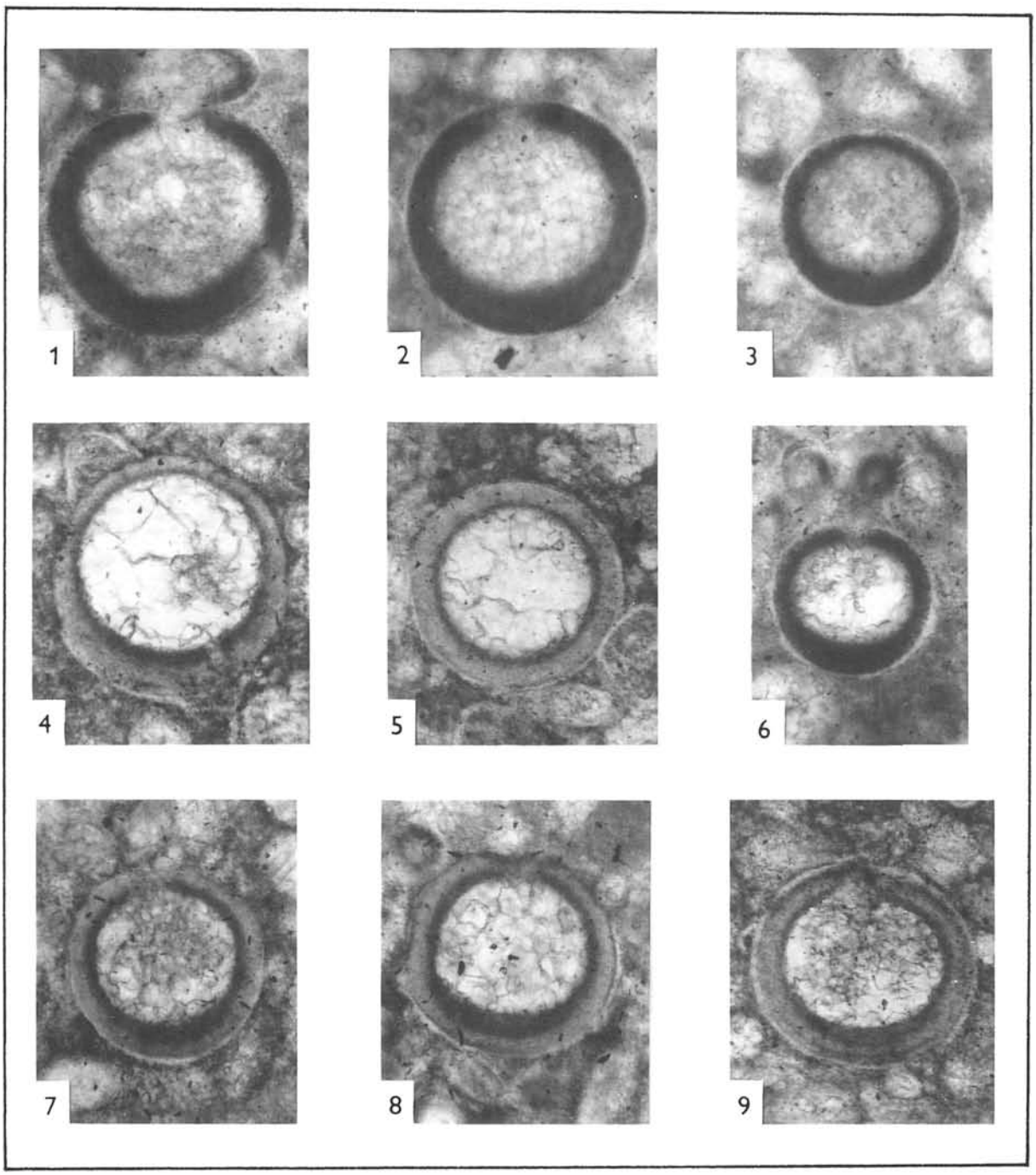

Plate 1. *Pithonella siniformis* n. sp.
Fig. 1 – Holotype, magn. 167 ×; Figs. 2–9. – Paratypes, Fig. 2 magn. 167×, Figs. 3–9 magn. 140×; Figs. 1–3, 6 – Campanian, Djebel ben Ouataf, thin section No. 112; Figs. 4, 5, 9 – Santonian, Djebel Karkara, thin section No. 113; Figs. 7, 8 – Upper Turonian–Coniacian, Djebel Karkara, thin section No. 306.

Photo: J. Řehánek

ogy, Faculty of Natural Sciences, Comenius University, Bratislava. Thin-section No. 112, coordinates $x = 60.1$, $y = 1.8$.

Denomination: According to the latin word sinum – inflated vessel made of loam, formo-to form.

Stratotype: Campanian, packed biomicrite, (muddy microorganogene limestone).

Type locality: Penitell nappe, Djebel ben Ouataf, eastern Algeria.

Material: Some 100–120 specimens in thin-sections of samples from mentioned localities.

Diagnosis: Globular to slightly flattened cyst with an inhomogenous structure of two-layer wall and with one single aperture. Outer light-coloured layer of the wall is of constant thickness and displays axial extinction of structural particles (Text-fig. 3A), whereas the inner dark microcrystalline layer is of variable thickness and its inner structure is chaotic, of porcelain type.

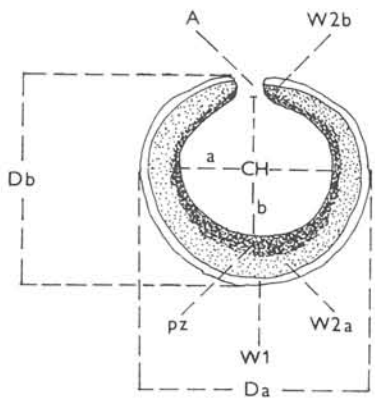

Fig. 2. Basic parameters measured in a thin-section of the cyst *Pithonella siniformis* n. sp.
Da – section width, *Db* – section height, *CHa* – chamber width, *CHb* – chamber height, *W1* – outer layer of the wall, *W2a* – maximum thickness of the inner layer of the wall, *W2b* – minimum thickness of the inner layer of the wall, *pz* – pigment zone, *A* – cyst aperture.

Description: In thin-section the cyst is spherical to, in the vertical axis, slightly flattened, with one aperture whose width ranges from 1/5 to 1/7 of the cyst width. Outer layer of the calcite wall is fairly thin, of constant thickness throughout its circumference, in penetrating light hyaline-textured. At crossed nicols the cross-wire is dark, and very small structural particles extinguish. The inner layer of the wall is microcrystalline. In a section along the vertical axis and cyst aperture, the thickness of the wall is considerably variable, culminating in the pole opposite to the aperture. In penetrating light, the microcrystalline chaotic "porcelain"-textured layer is dark-brown, sometimes yellow-brown, with characteristic zonal pigmentation, the pigment being divided into two zones – lighter-coloured one near the outer margin and much darker one near the inner margin of the layer (Pl. 1, Figs. 4, 5, 7–9). This zonal pigmentation pattern, however, has only been observed in relatively small percentage of the studied specimens of *Pithonella siniformis* n. sp. In reflected light, the inner layer is milky-white, at crossed nicols is dark, without axial extinction. The outer margin of the test sections is even, both layers contacting each other along a distinct discontinuity line in the wall. The chamber is slightly oval, mostly filled up with secondary aggregate calcite, its wall surface being even.

The larger diameter of slightly oval sections (width *Da*) varies from 171.1 to 287.5 μm, the smaller section diameter (height *Db*) amounts to 154.0–267.1 μm, whereas thickness of the wall's outer layer *W1* ranges from 1.5 to 3.4 μm, in places where it became mildly diagenetically thickened even up to 5.1 μm. Minimum thickness of the inner wall near the aperture *(W2b)* is 10.2–13.6 μm, its maximum on the side opposite to the aperture *(W2a)* being 27.3–47.8 μm. The chamber width *(CHa)* ranges from 130.0 to 232.8 μm, chamber height *(CHb)* from 99.3 to 215.6 μm and the aperture *(A)* is from 27.3 to 44.4 μm wide. Technique of measuring basic parameters is given in Text-fig. 2.

Holotype parameters: $Da = 239.6\ \mu m$, $Db = 225.9\ \mu m$, $CHa = 181.3\ \mu m$, $CHb = 164.2\ \mu m$, $W1 = 3.4\ \mu m$, $W2a = 34.2\ \mu m$, $W2b = 17.1\ \mu m$, $A = 44.4\ \mu m$.

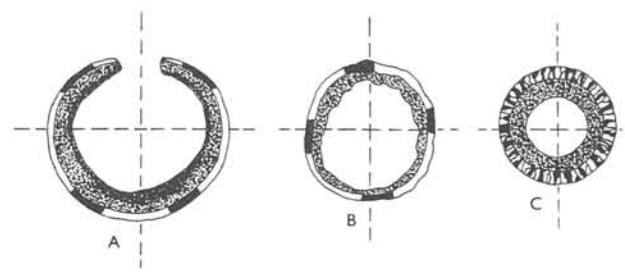

Fig. 3. Principal differences in optical character of the outer, light-coloured layer of the wall, crossed nicols. A – *Pithonella siniformis* n. sp., B – *Stomiosphaerina proxima* ŘEHÁNEK, C – *Crustocadosina* sp.

Diagnosis differentialis: *Crustocadosina callosa* (KNAUER) and *Crustocadosina semiradiata* (WANNER) have much smaller test diameters as well as thicknesses of the outer and inner layers of the wall. Optical character of the outer layer at crossed nicols (Text-fig. 3C) and stratigraphic range of these species are also different.

Obliquipithonella carteri (BOLLI), *O. patriciagreeleyae* (BOLLI) and *O. tanyphloia* (KEUPP) differ mainly in much smaller cyst parameters, different optical character of the wall at crossed nicols and different stratigraphic range.

Stomiosphaerina proxima ŘEHÁNEK has much smaller parameters of test diameter as well as thickness of the both layers of the wall and different character of extinction of the wall's outer layer at crossed nicols (Text-fig. 3B) and different stratigraphic position of the species.

Cross sections of *Pithonella perlonga* ANDRI differ from the described specimens in much smaller chamber diameter, smaller test diameter and smaller thickness of the inner layer of the wall.

Assemblage: **1.** Upper Turonian–Coniacian: *Pithonella siniformis* n. sp., *P. ovalis* (KAUFMANN), *P. sphaerica* (KAUFMANN), *P. perlonga* ANDRI, *Calcisphaerula innominata* BONET, *C. innominata lata* ADAMS, KHALILI

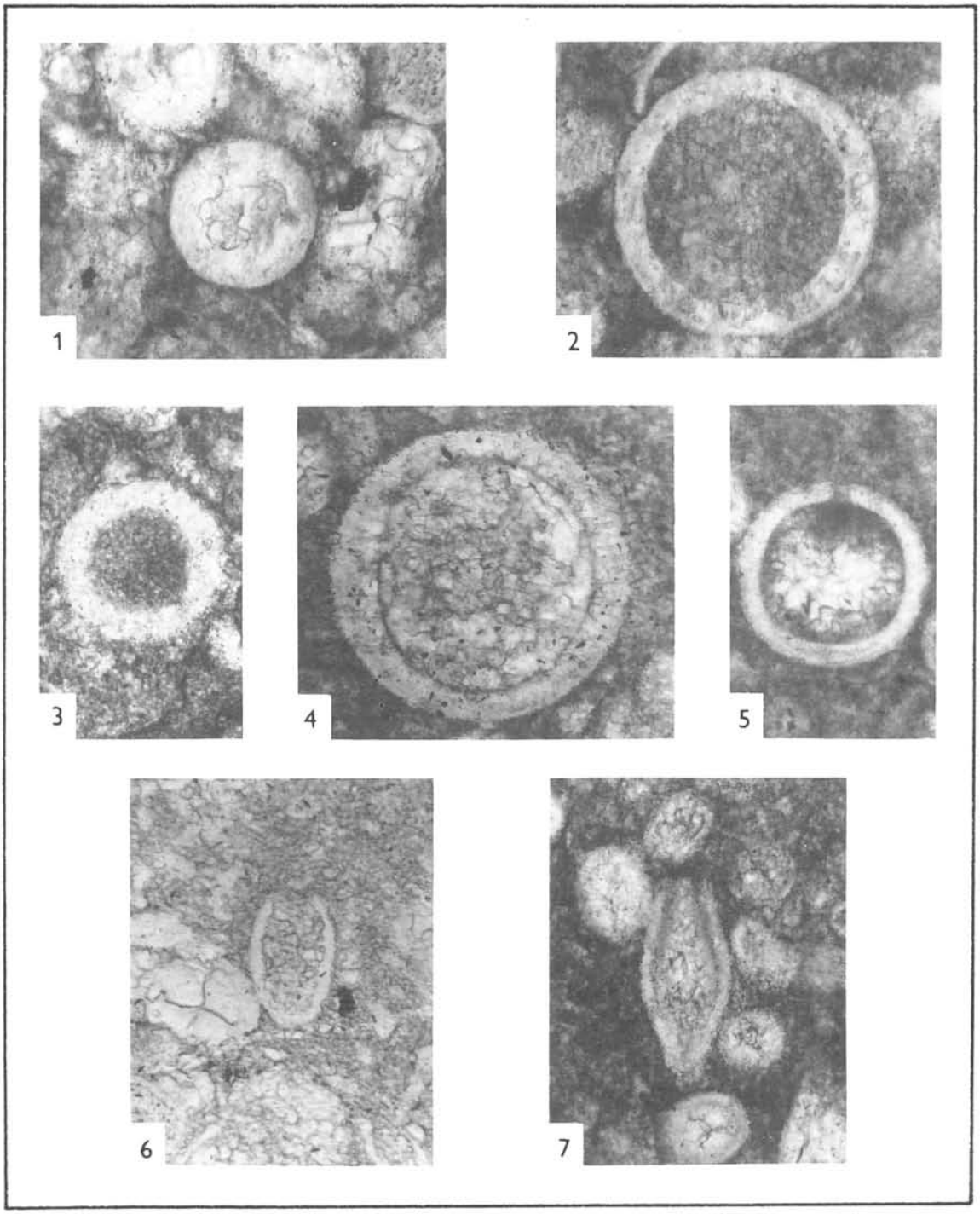

Plate 2. Assemblage of calcispherulid microfossils in thin-sections containing *Pithonella siniformis* n. sp. representatives.
Figs. 1, 3 – *Calcisphaerula innominata* BONET magn. 240×; Fig. 2 – *Calcisphaerula innominata lata* ADAMS, KHALILI, SAID, magn. 240×; Figs. 4, 5 – *Pithonella sphaerica* (KAUFMANN), Fig. 4, magn. 240×; Fig. 5 magn. 167×; Fig. 6 *Pithonella ovalis* (KAUFMANN), magn. 240×; Fig. 7 – *Pithonella perlonga* ANDRI magn. 240×; Figs. 1–3, 5, 7 – uppermost Coniacian–Santonian, Djebel Karkara, thin-section No. 13711; Fig. 4 – Santonian, Djebel Karkara, thin-section No. 113; Fig. 6 – Campanian, Djebel Karkara, thin-section No. 14514;

Photo: J. Řehánek

& SAID, *Marginotruncana pseudolinneiana* PESAGNO, *M. schneegansi* (SIGAL) emend. Caron, *M.* cf. *coldreriensis* (GANDOLFI), *Hedbergella* div. sp., *Heterohelix* sp.; **2.** uppermost Coniacian–Santonian: calcisphaerulid assemblage equals that one given in the preceding point, furthermore *Marginotruncana pseudolinneiana* PESAGNO, *M.* cf. *coronata* BOLLI, *Concavotruncana* cf. *concavata* (BROTZEN), *Heterohelix* cf. *globulosa* (EHRENBERG), *Hedbergella* div. sp., *Lenticulina* sp.; **3.** Santonian: assemblage of calcispherulid microfossils equals those mentioned in paragraphs 1. and 2., moreover *Globotruncana manaurensis* GANDOLFI, *Globotruncanella* sp., *Globotruncana* aff. *arca* (CUSHMAN), *Globotruncanita stuartiformis* (DALBIEZ), *Hedbergella* div. sp., *Heterohelix globulosa* (EHRENBERG), *Lenticulina* (ASTACOLUS) *gosae* (REUSS), *Lenticulina* sp., *Marginotruncana pseudolinneiana* PESAGNO; **4.** Campanian: calcispherulid assemblage equals those given on the three above-mentioned stratigraphic levels, furthermore *Dorothia oxycona* (REUSS), *Globotruncana arca* (CUSHMAN), *G.* cf. *manaurensis* GANDOLFI, *Hedbergella* div. sp., *Heterohelix globulosa* (EHRENBERG), *Marginotruncana pseudolinneiana* PESAGNO.

Translated by L. Böhmer

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