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BORED AND ENCRUSTED CLASTS IN THE LOWER KIMMERIDGIAN CARBONATES AT SOBKÓW (SW MARGIN OF THE HOLY CROSS MTS., POLAND)

Drążenia i inkrustacje klastów w węglanowych osadach dolnego kimerydu w Sobkowie (SW obrzeżenie Gór Świętokrzyskich)

Leszek Chudzikiewicz & Józef Wieczorek: Bored and encrusted clasts in the Lower Kimmeridgian carbonates at Sobków (SW margin of the Holy Cross Mts., Poland). Ann. Soc. Geol. Poloniae, 55/3–4: 295–306, 1985 Kraków.

Abstract: A layer of biomicrite 30–40 cm thick with bored and encrusted carbonate clasts occurs in a sequence of shallow marine, carbonate, Lower Kimmeridgian sediments exposed in the quarry Sobków, SW margin of the Holy Cross Mts. The clasts display several generations of borings (by pelecypods and polychetes) and encrustations (by serpulids and oysters). The clasts were subject to repeated phases of burial, exhumation and overturning accompanied by succesive colonization by boring and encrusting organisms. The described clasts are examples of early lithification of carbonates in a shallow epicontinental sea, with temporarily lowered accumulation rate, but without a stratigraphic condensation.

Key words: diagenesis, carbonates, borings, encrustations, Upper Jurassic, Poland.

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INTRODUCTION

A section of the Lower Kimmeridgian is exposed in the quarry Sobków, at south-western margin of the Holy Cross Mts. (Fig. 1). The section comprises mainly shallow marine carbonate sediments. Kutek (1968, 1969) distinguished here several informal lithostratigraphic units; the Lowermost Marly horizon, the Lower Oolite, the Banded Limestone member, the Upper Oolite, the Oncolite horizon, and in part Oolite-Platy member. The Lowermost Marly horizon is underlain by a sequence of Bahamian-type deposits, belonging to the so called "Deposits Overlying Chalky Limestones" and to the Chalky Limestone member which are exposed away from the quarry. The Lowermost Marly horizon is Lower Kimmeridgian in age and probably represents the highest part of the *Sutneria platynota* zone (Kutek, 1968). The horizon is ca. ten metres thick and comprises mostly alternating limestone (mainly micritic) and marl or marly clay layers (Fig. 2). The base of this horizon is not exposed in the quarry. In its lower part, marly layers

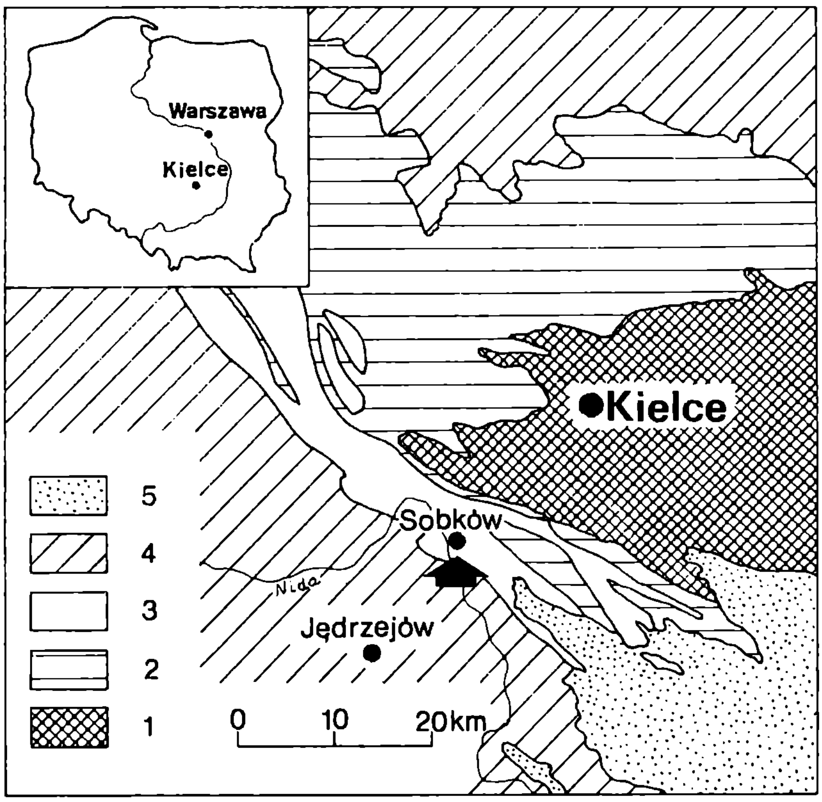

Fig. 1. Situation of the quarry Sobków. *1* – Palaeozoic, *2* – Triassic, *3* – Jurassic, *4* – Cretaceous, *5* – Miocene

are more numerous and in the upper part there appear more layers of micritic, bioclastic and oolitic limestones, the latter sometimes cross-laminated. A characteristic layer of micritic limestone occurs in the highest part of the horizon. Its top is a hardground surface with numerous *Thalassinoides* burrows, pelecypod and polychaete borings filled with oolite sediments of the overlying Lower Oolite complex (Fig. 2).

In the Lowermost Marly horizon there occurs a very distinctive biomicrite layer with numerous carbonate clasts, heavily bored and encrusted. Thorough analysis of these structures revealed several stages of encrusting, reflecting a complex history of the clasts before their ultimate burial. For the sequence in which the layer with bored and encrusted clasts occurs, an elevated rate of sediment accumulation is suggested by the thickness of the *Sutneria platynota* zone, estimated as 100–150 m by Kutek (1968). Neverthelles there are in this sequence some horizons of slowed sedimentation, but not of stratigraphic condensation.

The collection of clasts described in the present paper is housed at the Institute of Geology of the Polish Academy of Sciences, Kraków, and kept under the catalogue number A-V-84.

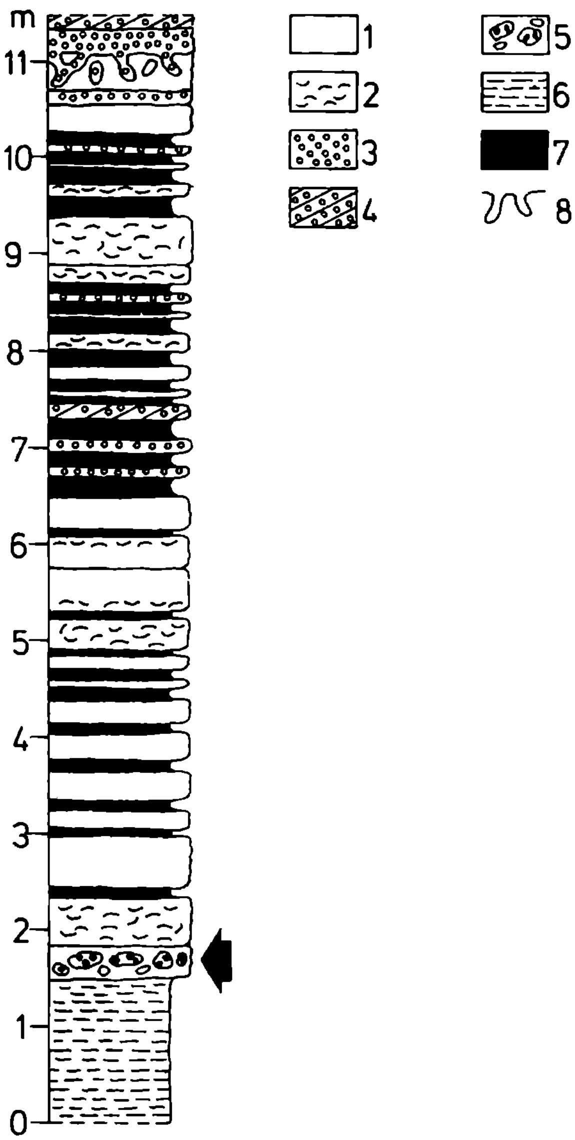

Fig. 2. Fragment of Lowermost Marly Horizon in quarry Sobków. Arrow indicates layer with bored and encrusted clasts. *1* – micritic limestone, *2* – bioclastic limestone, *3* – oolitic limestone, *4* – cross-bedded oolitic limestone, *5* – intraformational conglomerate with bored and encrusted clasts, *6* – calcareous shales, *7* – marls, *8* – *Thalassinoides*-type burrows

LAYER WITH BORED AND ENCRUSTED CLASTS

Bored and encrusted clasts occur in a distinct layer 30–40 cm thick, which exhibits sharp, uneven erosional contact with the underlying calcareous shale. The upper surface of the layer is a nearly flat hardground with truncated clasts. Matrix of the layer is composed of bioturbated micrite (commonly in the upper part) and biomicrite with bioclasts ranging from less than a millimetre to 6 cm in size (Pl. I: 2; Pl. II: 1). Clasts and bioclasts are locally concentrated in the lower part of the layer. Large clasts are commonly oriented obliquely to the bedding surface. Bioclasts are represented by fragments of shells of pelecypods (*Mytilus*, *Pinna*, *Trichites*, oysters and pectens), brachiopods (rhynchonellids, terebratulids), small gastropods, and crinoid ossicles and serpulids. *Trichites* shells show bivalve and polychaete borings, and oyster and serpulid encrustations (Pl. VII: 6). Serpulids occur as encrustations on clasts and in algal-serpulid colonies up to 15 cm in diameter, dispersed in biomicrite matrix. These colonies show oyster encrustations and bivalve borings.

Clasts range from less than a millimetre to 20 cm in diameter and up to 8 cm in high (average 4 – 12 cm in diameter and 2 – 5 cm in high). The smallest clasts are angular to subangular, the larger ones are discoidal (Pl. I: 1) or irregular (Pl. V: 1, 3). The clasts are composed of:

– light to dark grey micrite (commonly bored and encrusted, Pl. I: 2; Pl. II: 1; Pl. V)
– finely laminated grey micrite (occasionally bored, Pl. I: 2)
– greyish-yellow micrite alternated with brown coloured biomicrite with flat parallel and ripple lamination (commonly heavily bored and encrusted, Pl. I: 3; Pl. II: 2; Pl. III: 1)
– grey micrite with thin irregular brown coloured streaks (Pl. II: 1)
– greenish calcareous mudstone (non-bored).

BIOGENIC STRUCTURES IN CLASTS

The studied clasts show burrow structures formed in soft and in firm substrate and borings formed in already hardened substrate (Fig. 9).

BURROWS

Undefined burrows were observed in some clasts (Pl. I: 3; Pl. II: 2). The burrows are elliptical or irregular in section and filled with sediment similar to the surrounding sediment. Occasionally these burrows show concentric and spreite structures. They were formed in soft or in firm substrate. Irregular cavities and crevices represent probably fragments of *Thalassinoides*-type burrows (Figs. 3, 6; Pl. II: 4; Pl. III; Pl. V). Floors and roofs of such crevices are commonly uneven and encrusted by serpulids (Pl. II: 4; Pl. III). Sediment in the burrow filling was bored by bivalves after lithification.

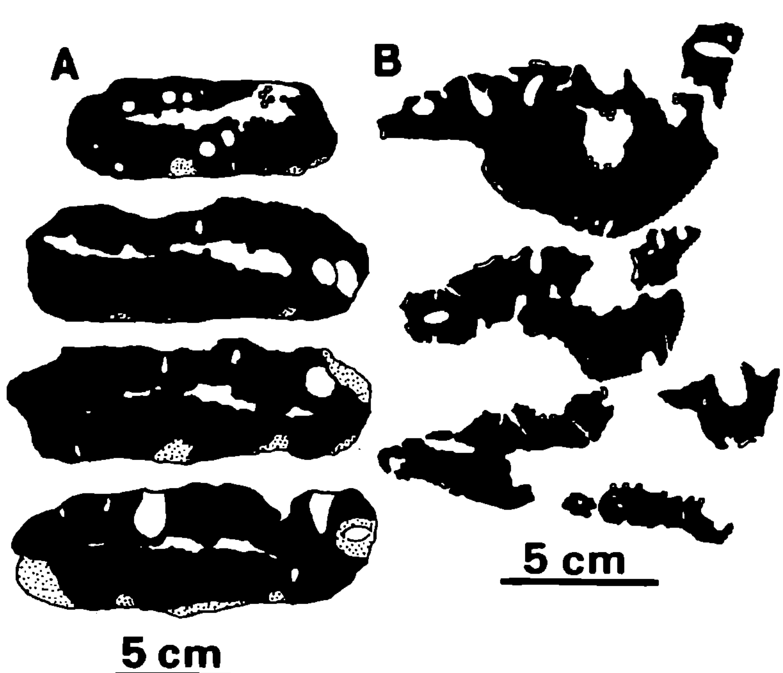

Fig. 3. Vertical serial sections of two bored clasts showing closed and open cavities. Dotted – biogenic layer composed of oysters and serpulids, small circles – serpulids. For details see Pl. II: 4, Pl. III, and Pl. V

BORINGS

B i v a l v e   b o r i n g s. *Lithophaga* and *Gastrochaena* borings were recognized in the studied clasts. Borings are pouch-like in longitudinal section and circular in transverse section. Their length varies from 3 mm to 25 mm (max. 40 mm) and their diameter is from 2 to 15 mm. Orientation of borings is normal or oblique to clast surface. Some borings contain shells of resident bivalves (Figs. 4, 5; Pl. II: 3) occasionally encrusted by serpulids, but in most borings the shells are absent.

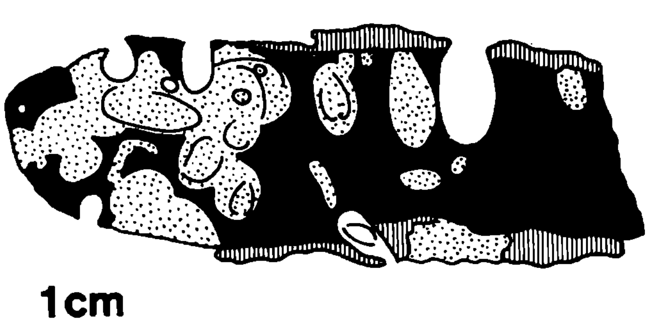

Fig. 4. Strongly bored clast (black) with several generations of bivalve borings and a biogenic layer (vertical rules) composed of oysters and serpulids (see Pl. VI: 6). Partly abraded borings are filled with various sediments (dotted). Some borings cut across the biogenic layer

Walls of empty borings were colonized by a second generation of boring bivalves (Pl. II: 2; Pl. IV: 1; Pl. V: 3), boring polychaetes, encrusting serpulids (Pl. VI: 1, 2, 4) or nestling bivalves. Borings are filled with micrite or biomicrite, commonly different from that forming the clasts or the matrix of the layer. Both empty and

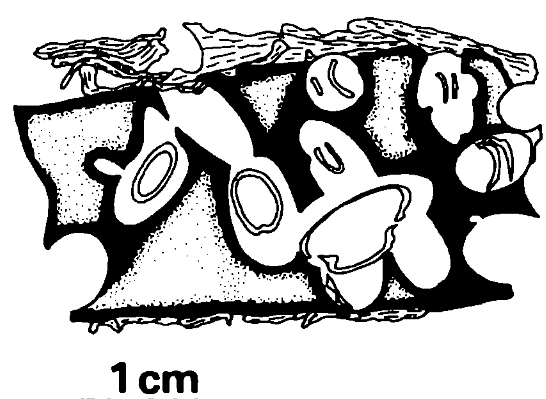

Fig. 5. Vertical section of bored clast showing Fe-stained zone around borings and at clast margin (black and stippled). Some borings with shells of resident bivalves and some with bioclasts. Clast is encrusted by oysters and serpulids which are locally bored by bivalve. See Pl. VII: 1

filled borings were slightly or deeply abraded (Pl. I: 2; Pl. III: 4; Pl. V: 3). Filled borings were penetrated by younger generations of polychaetes (Pl. IV: 3; Pl. VI: 7) and bivalve borings (Pl. II: 3; Pl. III: 1). Superimposed borings form occasionally larger crypts filled with one type of sediment (Pl. II: 3; Pl. VI: 3). In some clasts Fe-stained zones occur around bivalve borings (Fig. 5; Pl. I: 2; Pl. VII: 1).

P o l y c h a e t e   b o r i n g s. Polychaete borings of *Trypanites*-type are represented by straight of curved tunnels, circular in cross section (Pl. II: 3, 4; Pl. III: 1, 4). These tunnels range from 1 mm up to 4 mm in diameter, and from a few mm to 4 cm in length. All borings are filled with micrite. Commonly few generations of these borings are visible.

EPIZOANS

Epizoans are represented usually by serpulids and oysters, occasionally by bryozoans and crinoids. Microstromatolite structures occur sporadically.

S e r p u l i d s. Serpulid tubes are commonly represented by *Cycloserpula*, and occasionally by *Tetraserpula* and *Dorsoserpula*. Two types of *Cycloserpula* occur: small forms with tubes of 0.5 – 1 mm in diameter, a large form with tube

Fig. 6. Vertical section of strongly bored clast (same clast as in Pl. II: 4 and Pl. III). Large cavity in central part of the clast represents probably fragment of *Thalassinoides*-type burrow. *1* – bioturbations, *2* – bivalve borings, *3* – polychaeta borings, *4* – serpulids, *5* – oysters, *6* – microstromatolite structures (see Pl. III: 3)

of 2 – 3 mm in diameter. These tubes are attached to clast surfaces (Figs. 6, 7; Pl. I: 3; Pl. VI: 8; Pl. VII: 3, 5) or to walls of cavities (Figs. 3, 6; Pl. II: 2 – 4; Pl. III; Pl. V; Pl. VII: 2, 4). Some are attached to walls of empty bivalve borings (Pl. VI: 1) and to the sediment partially filling them (Pl. VI: 4). The serpulid tubes show occasionally various stages of abrasion (Pl. VI: 8; Pl. VII: 5). One specimen of *Dorsoserpula* was found attached to a clast surface (Pl. VI: 5). *Tetraserpula* were observed in small cavities encrusting internal sediment surfaces.

O y s t e r s. *Exogyra* and *Liostrea* encrusted surfaces of many clasts (Figs. 5 – 7; Pl. II: 3; Pl. IV; Pl. V; Pl. VII: 1) and occasionally their shells are attached to walls of irregular cavities (Pl. V: 2, 3).

Fig. 7. Strongly bored and encrusted clast with thick biogenic layer (same section as on Pl. IV: 2). *1* – bioturbations, *2* – bivalve borings, *3* – polychaeta borings, *4* – serpulids, *5* – oysters. See also Fig. 8

B r y o z o a n s. Crustose bryozoans are occasionally attached to flat clast surfaces (Pl. VIII: 1, 2) or to the shells of encrusting oysters.

C r i n o i d s. One specimen of violet coloured holdfast of *Apiocrinus* was observed attached to a discoidal bored clast (Pl. VIII: 3, 4). Similar holdfast attached to hardground surface was observed in Upper Oolitic Limestone complex at Mieronice – 20 km NW of Sobków (Pl. VIII: 5).

M i c r o s t r o m a t o l i t e s t r u c t u r e. Some serpulid tubes attached to walls of cavities are overgrown by thin, probably blue-green algal laminated

Fig. 8. Fragment of clast (A) with thick biogenic layer (B). Enlarged fragment of Fig. 7 and Pl. IV: 3. *1* – bivalve borings, *2* – polychaeta borings, *3* – serpulids, *4* – oysters; white, stippled and vertically ruled areas = various types of filling sediments

crusts (Pl. III: 3). Sometimes, such crusts are lining cavity walls entirely (Pl. VI: 5).

Density of polychaete and bivalve borings change from very low to very high. Some clasts show only a few bivalve borings (Pl. I: 2; Pl. II: 1) and others show so intense boring that only small part of clast is not infected by it (Figs. 4, 5; Pl. II: 4; Pl. VI: 6). The clasts exhibit a wide range of development of encrusting fauna. Some clasts show biogenic layer composed of oysters and serpulids ranging from a few mm to 1 cm in thickness (Figs. 4, 7, 8; Pl. IV). In most cases the biogenic layer does not envelop the clast completely. Abraded oysters and serpulids, as well

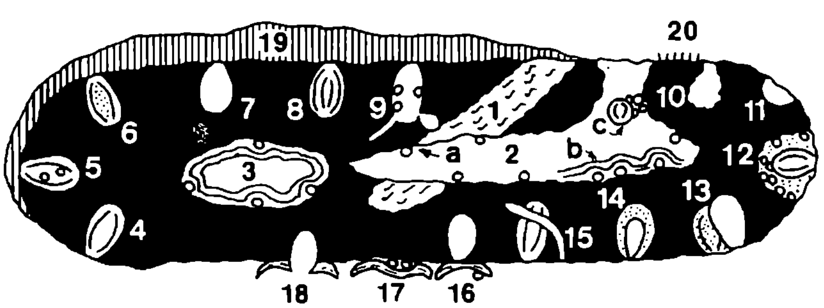

Fig. 9. A schema showing biogenic structures and their mode of preservation in clast (only two generations of borings and encrustations are shown). *1* – bioturbation structures of unknown origin, *2* and *3* – open and closed cavities (probably deformed and enlarged *Thalassinoides*-type burrows) with walls encrusted by serpulids (a), microstromatolite structures (b) and with bivalve borings in filling sediment (c), *4* – bivalve boring (b.b.) with shell of resident bivalve, *5* – b.b. with shell encrusted by serpulids before filling, *6* – b.b. containing shell filled with sediment other than boring, *7* – b.b. without shell, *8* – b.b. with two nestler's shells, *9* – b.b. colonized by serpulids and with second generation of borings (polychaeta, bivalve), *10* – slightly enlarged b.b., *11* – deeply abraded b.b., *12* – cavity encrusted by serpulids, filled with sediment and at last bored by bivalve, *13* – two generations of b. borings, *14* – boring in boring structure, *15* – polychaeta boring cut across b.b., *16* – b.b. overgrown by oyster which is encrusted by serpulids, *17* – encrusting serpulids overgrown by oyster, *18* – oyster cut by b.b., *19* – biogenic layer composed of oysters, serpulids, micrite, and with b. borings, *20* – encrusting bryozoa

as bivalve borings, indicate that the growth of biogenic layer was interrupted. Repeated phases of burial, exhumation and abrasion are indicated by differentiation of sediment between the encrusting shells. Similar biogenic layer was observed on a Jurassic hardground surface by Palmer & Fürsich (1974). They found differences between communities on upward and downward facing hardground surfaces. Studied clasts from Sobków do not show such kind of differentiation. Borings and encrustations are observed commonly on upper and lower surfaces of discoidal clasts and on margins indicating that the clasts were transported and overturned.

CONCLUSIONS

The clasts under consideration originated due to erosion of semi- or well-lithified bottom sediments (Fig. 10). The latter were locally developed as hardgrounds with *Thalassinoides*-type burrows. Fragments of these burrows are visible in some clasts.

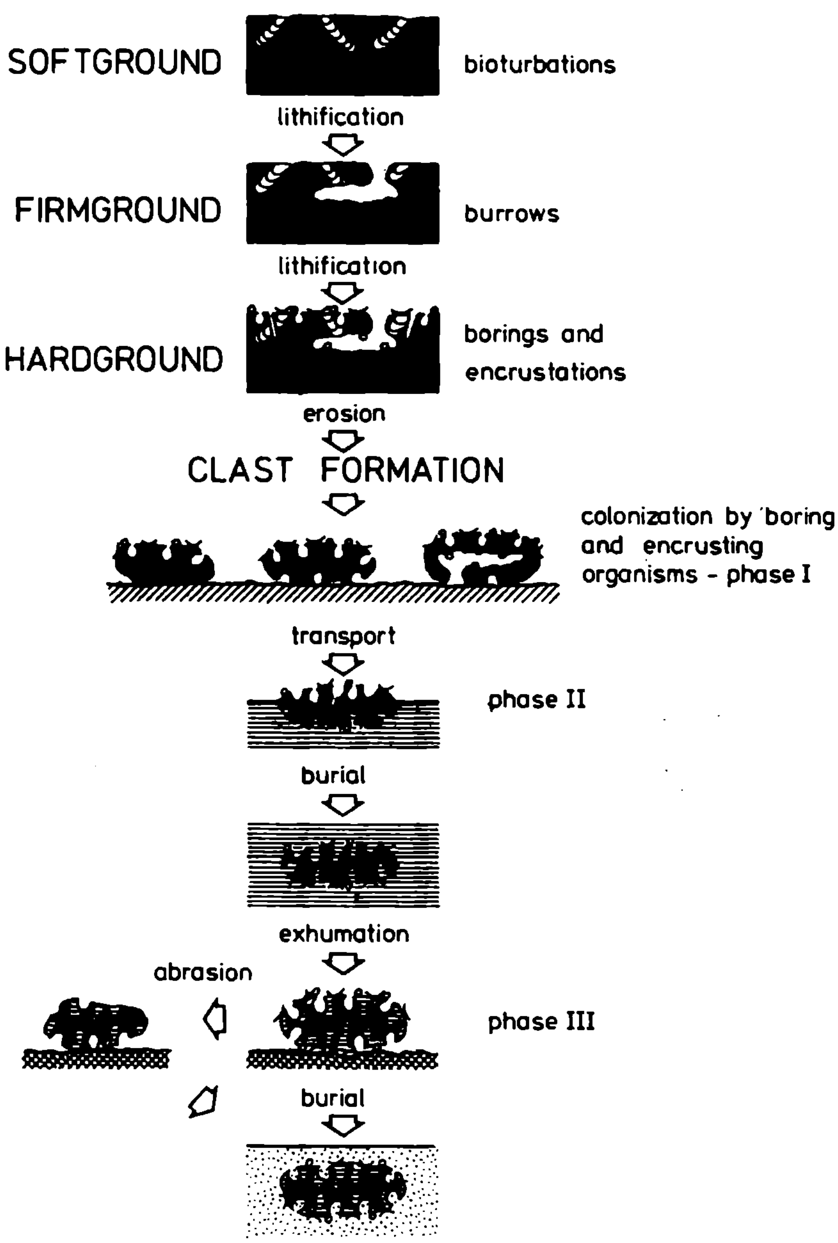

Fig. 10. History of origin of bored and encrusted clasts

The clasts could undergo further lithification at the surface of sediment or somewhat below it. During periods of increased water agitation the clasts were redeposited and abraded, and during the periods of rest were colonized by borers and encrusters. The distribution of the borings and encrustations around the clasts indicates that the clasts were repeatedly overturned. The possibility is not ruled out, however, that the processes of boring and encrustation were initiated already at the hardground surface before its erosion and fragmentation into separate clasts. Even in such a case encrusting and boring on 2–3 surfaces is possible (normal borings on top surface of hardground, inverted borings on walls of *Thalassinoides* burrows or of other cavities: see Kaźmierczak & Pszczółkowski, 1968; Purser, 1969; Palmer & Fürsich, 1974; Gruszczyński, 1979). Some of the clasts from Sobków show features indicative of the so called "hiatus concretions" reported from Jurassic (Voight, 1968; Hallam, 1969; Kaźmierczak, 1974; Baird & Fürsich, 1975; Andersson, 1979; Fürsich, 1979) as well as from Silurian (Cherns, 1980), Devonian (Baird, 1981), and Cretaceous (Kennedy & Klinger, 1972; Kennedy *et al.*, 1977). Hiatus concretions are encrusted clasts with sediment between succesive laminae of encrustation. The sediment was added to the clasts as a result of a diagenetic processes during a temporary burial of clasts in unlithified sediment. Following exhumation, the clasts with the added material could be again encrusted and bored, and then buried again. The accumulation of clasts with a complex history preceding their ultimate burial, indicates prolonged period of the layer formation. For this reason the layer with the clasts is not considered as a result of a single depositional event but rather as an effect of succesive accumulation of clasts from erosion of a hardground forming in nearby area. Such hardgrounds, developing on even small elevation of bottom and laterally transitional to non-lithified sediments, are observed in many carbonate sequences (the Lower Kimmeridgian of the Holy Cross Mts., the Callovian of the Kraków–Wieluń Upland, the Muschelkalk Gogolin Beds of the Kraków–Silesian area). Successive erosion of the hardground and transport of clasts to nearby areas explain the appearance of this the unusual clast-bearing layer. In a similar way Hagdorn (1983) explains the origin of layers of clasts encrusted with abundant *Placunopsis* shells, found in the German Triassic.

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STRESZCZENIE

W kamieniołomie w Sobkowie (fig. 1), w dolnokimerydzkim najniższym poziomie marglistym występuje charakterystyczna ławica biomikrytu z licznymi drążonymi i inkrustowanymi klastami węglanowymi (fig. 2) stanowiąca przedmiot szczegółowej analizy przedstawionej w niniejszej pracy. W klastach stwierdzono kilka generacji drążeń (małży i wieloszczetów) oraz kilka generacji inkrustacji (głównie serpul i ostryg, sporadycznie mszywiołów i liliowców) — fig. 3—9; pl. I—VIII. Przed ostatecznym pogrzebaniem w osadzie klasty przechodziły różne stadia rozwoju obejmujące kilkakrotne pogrzebanie, a następnie odgrzebanie, przetaczanie i kolonizację przez organizmy drążące i inkrustujące (fig. 10). Opisane klasty pochodzą z osadów częściowo lub nawet dobrze zlityfikowanych. Obecność zachowanych w niektórych klastach kawern interpretowanych jako fragmenty kanałów *Thalassinoides* sugeruje, że klasty pochodzą z erozji twardego dna. Nagromadzenie klastów o skomplikowanej historii poprzedzającej ich ostateczne pogrzebanie w osadzie świadczy o dość długim okresie tworzenia się ławicy. Ławica stanowi zdaniem autorów efekt stopniowego gromadzenia się klastów erodowanych z twardego dna rozwijającego się w niedużej odległości. Takie twarde dna, często rozwijające się na małych nawet wyniesieniach podłoża i obocznie prze-

chodzące w osady bez oznak zlityfikowanej powierzchni, są obserwowane w wielu sekwencjach węglanowych (dolny kimeryd obrzeżenia Gór Świętokrzyskich, kelowej Wyżyny Krakowsko-Częstochowskiej i Wyżyny Wieluńskiej, warstwy gogolińskie wapienia muszlowego obszaru śląsko-krakowskiego).

Opisane klasty stanowią przykład wczesnej lityfikacji osadów zachodzącej w płytkowodnym epikontynentalnym zbiorniku w warunkach okresowo zwolnionej sedymentacji.

EXPLANATIONS OF PLATES

Plate I

1. Upper surface of bored and encrusted clast.
2. Fragment of layer with clasts. At top: clast showing fine lamination; at bottom: clast with biogenic layer composed of oysters and serpulids (arrow), and clast with strongly truncated bivalve borings (at right). Polished slab.
3. Vertical section through clast of flat- and ripple-laminated micrite and biomicrite. Lamination is disturbed by burrowing (b). Arrow indicates fragment of thin biogenic layer preserved in a small depression. Polished slab.

Plate II

1. Fragment of clast layer with two bored clasts showing various lithology. Enlarged bivalve boring is visible in upper clast. Arrow indicates eroded fragment of limestone with bivalve boring. Polished slab.
2. Vertical section of flat clast showing ripple lamination, bioturbations (*b*), bivalve borings and small cavity at the lower surface (see Pl. VII: 2). Lower micritic layer is partly eroded. Polished slab.
3. Enlarged fragment of Pl. II: 2. *a* – bivalve boring filled with micrite and detrital sediment, encrusting oyster (*o*) is bored by bivalve (black arrow); *b* – cavity (bivalve boring ?) with floor encrusted by serpulids; *c* – polychaeta boring; *d* – cavity formed by penetration of three generation of boring bivalve; *e* – three generations of bivalve borings, two of them showing geopetal fillings. Polished slab.
4. Vertical section of strongly bored and encrusted clast with open cavity (walls of cavity arrowed). Floor and roof of cavity are encrusted by serpulids. Same clast as in Pl. III. Polished slab.

Plate III

1. Vertical section of bored and encrusted clast (same clast as in Pl. II: 4 and Pl. III: 4). Cavity with walls encrusted by serpulids is visible (see Pl. III: 2). Polished slab.
2. Cavity with floor and roof encrusted by serpulids (enlarged fragment of Pl. III: 1). Cavity is filled with two types of sediment. Arrow indicates serpulids truncated by boring. Polished slab.
3. Fragment of cavity in clast shown on Pl. III: 1. Roof and floor of cavity encrusted by serpulids. Some serpulids are coated by microstromatolitic laminae (arrow). Negative print from thin section.
4. Vertical section of bored and encrusted clast (same clast as in Pl. II: 4 and Pl. III: 1) showing small flattened cavity. Large bivalve boring (upper left) is filled with bioclasts and intraclasts. Arrow indicates strongly truncated bivalve boring. At right side of clast is visible open cavity encrusted by serpulids (see Pl. VII: 4). Polished slab.

Plate IV

1. Upper surface of clast with biogenic layer composed of two generations of encrusting organisms (oysters and serpulids) which were bored by bivalves. Polished slab.
2. Bored clast with thick biogenic layer. See Fig. 7. Polished slab.

3. Lower surface of clast with biogenic layer. Polychaeta boring cutting through earlier bivalve boring (see Fig. 8). Polished slab.

Plate V

1. Fragment of irregular clast showing bivalve borings and cavity (center) encrusted by serpulids. Same clast as in Pl. V: 3. Polished slab.
2. Lower part of open cavity with truncated bivalve boring cutting through serpulid (arrow). Fragment of clast shown on Pl. V: 1, 3; vertical section between these two sections. Polished slab.
3. Fragment of irregular clast (same as Pl. V: 1) showing large open cavity with floor encrusted by serpulids (arrow). Slightly abraded bivalve boring is visible (upper right). Polished slab.

Plate VI

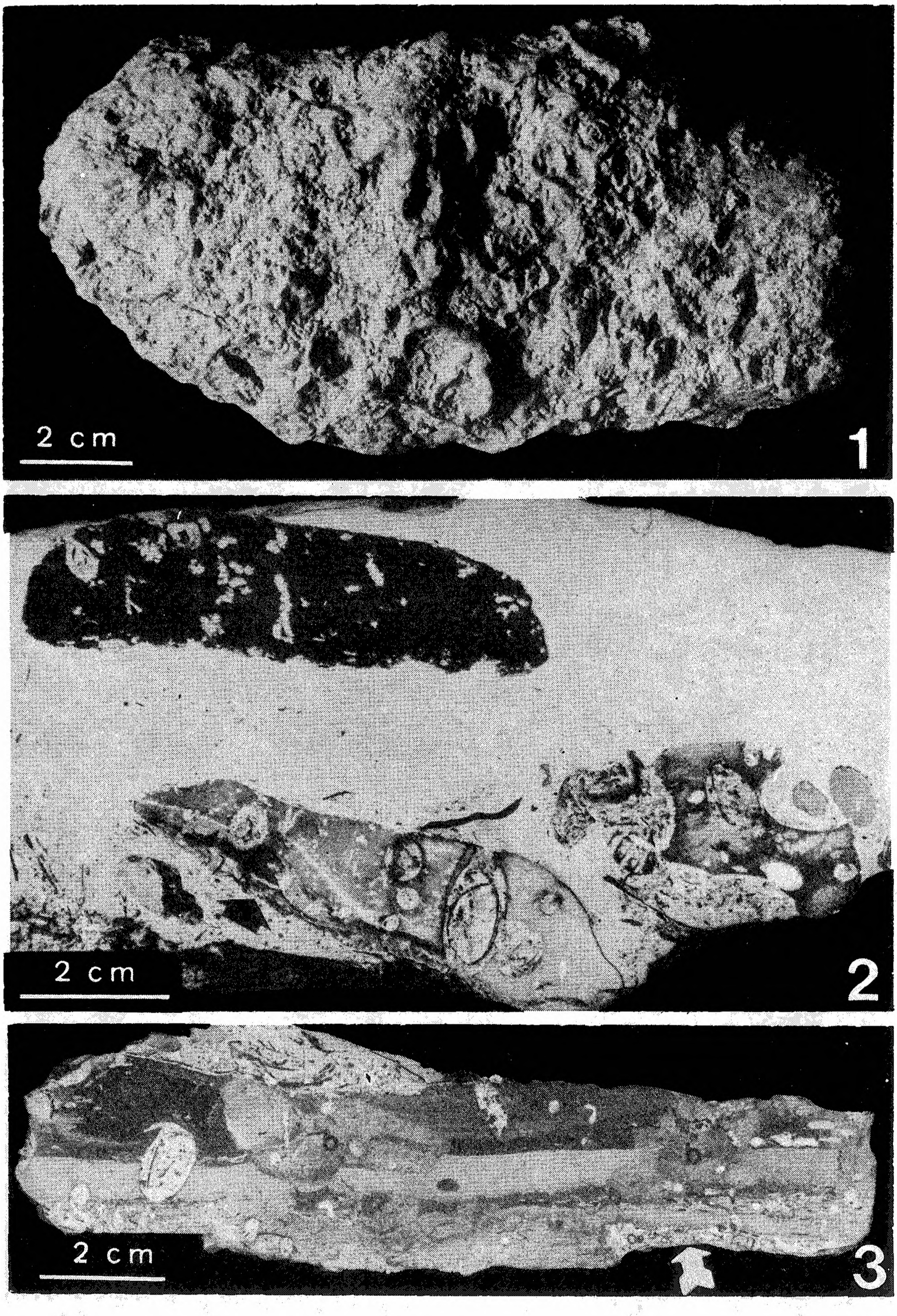
1. Transverse section of two bivalve borings. Boring to right shows encrustation by serpulids. Polished slab.
2. Fragment of clast with two bivalve borings. Lower boring is partly abraded. Upper boring contains deformed shell. Polished slab.
3. Fragment of clast with several generations of bivalve borings. Polished slab.
4. Transverse section of bivalve boring filled with various sediments and showing encrustation by serpulids. Polished slab.
5. Fragment of clast with bivalve boring partly filled with sparite and containing small cavity encrusted by serpulids, and lined with algal laminae (arrow). Large serpulid is attached to the lower surface of the clast. Polished slab.
6. Fragment of strongly bored clast. Fragment of clast shown on Fig. 4. Polished slab.
7. Fragment of clast showing polychaeta borings which cut across bivalve boring. Upper surface of the clast is encrusted by oysters. Polished slab.
8. Fragment of clast (*C*) with abraded colonies of serpulids. Polished slab.

Plate VII

1. Fragment of clast (*C*) with Fe-stained zone around bivalve borings and at the margin of the clast (white areas). See Fig. 5. Encrusting oyster (*O*) is bored by bivalve. Negative print from thin section.
2. Fragment of clast (see Pl. II: 2) with small open cavity encrusted by serpulids. Arrow indicates redeposited "concretions" with bivalve boring encrusted by serpulids. Polished slab.
3. Side margin of clast (shown on Pl. III: 1) showing truncated primary lamination and encrusting serpulids. Polished slab.
4. Open cavity encrusted by serpulids at the side of clast (same clast as Pl. III: 1). Brachiopod shell is visible in cavity. Polished slab.
5. Small clast with partly abraded serpulid colony. Polished slab.
6. Bored and encrusted *Trichites* shell with several generations of bivalve borings and polychaeta borings. Borings cut across biogenic layer and shell (lower surface). White patches, mainly along upper surface of shell – silicified areas. Note abraded boring at right side of the shell. Polished slab.

Plate VIII

1. Clast (*C*) with encrusting bryozoa. Thin section.
2. Clast (*C*) with encrusting bryozoa and serpulids. Thin section.
3. Fragment of large bored clast with attached crinoide holdfast (*C*, black). Polished surface.
4. Fragment of large bored clast (section normal to the surface shown on Pl. VIII: 3). Borings visible on upper and lower surface. Polished surface.
5. Bivalve borings in crinoide holdfast (black) embedded in oolitic grainstone. Holdfast is attached to hardground surface. Polished slab.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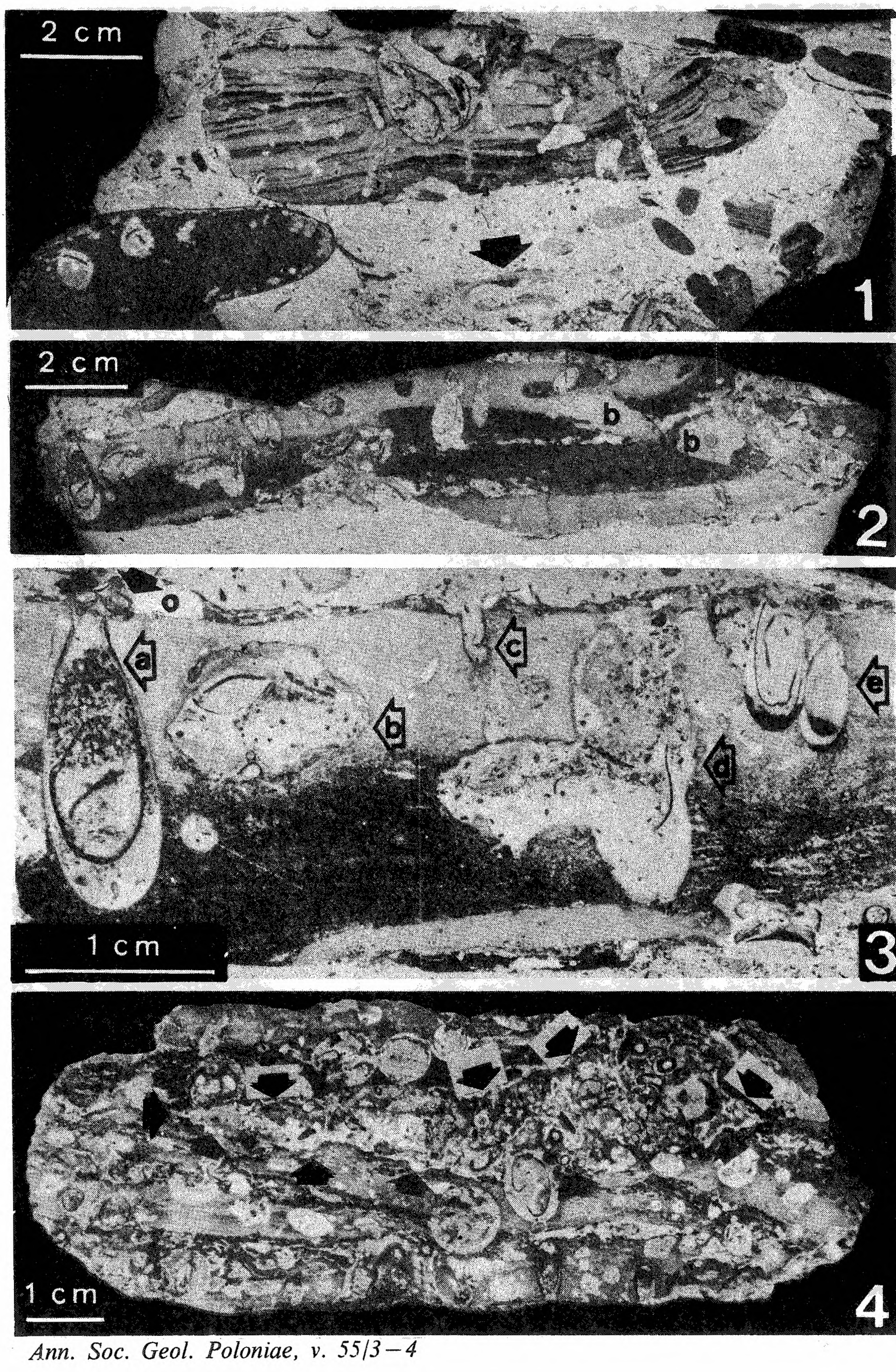
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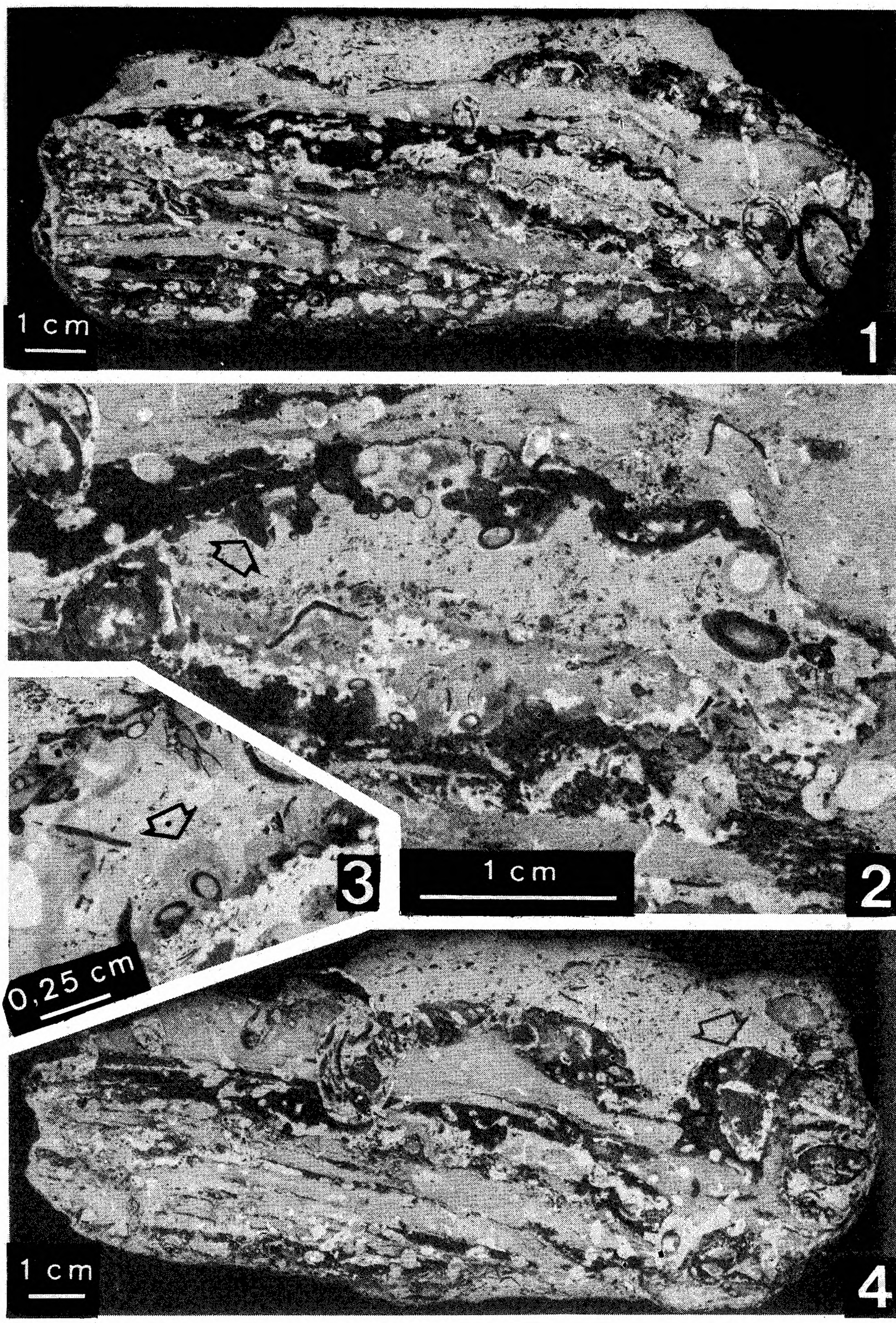
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3
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1 cm
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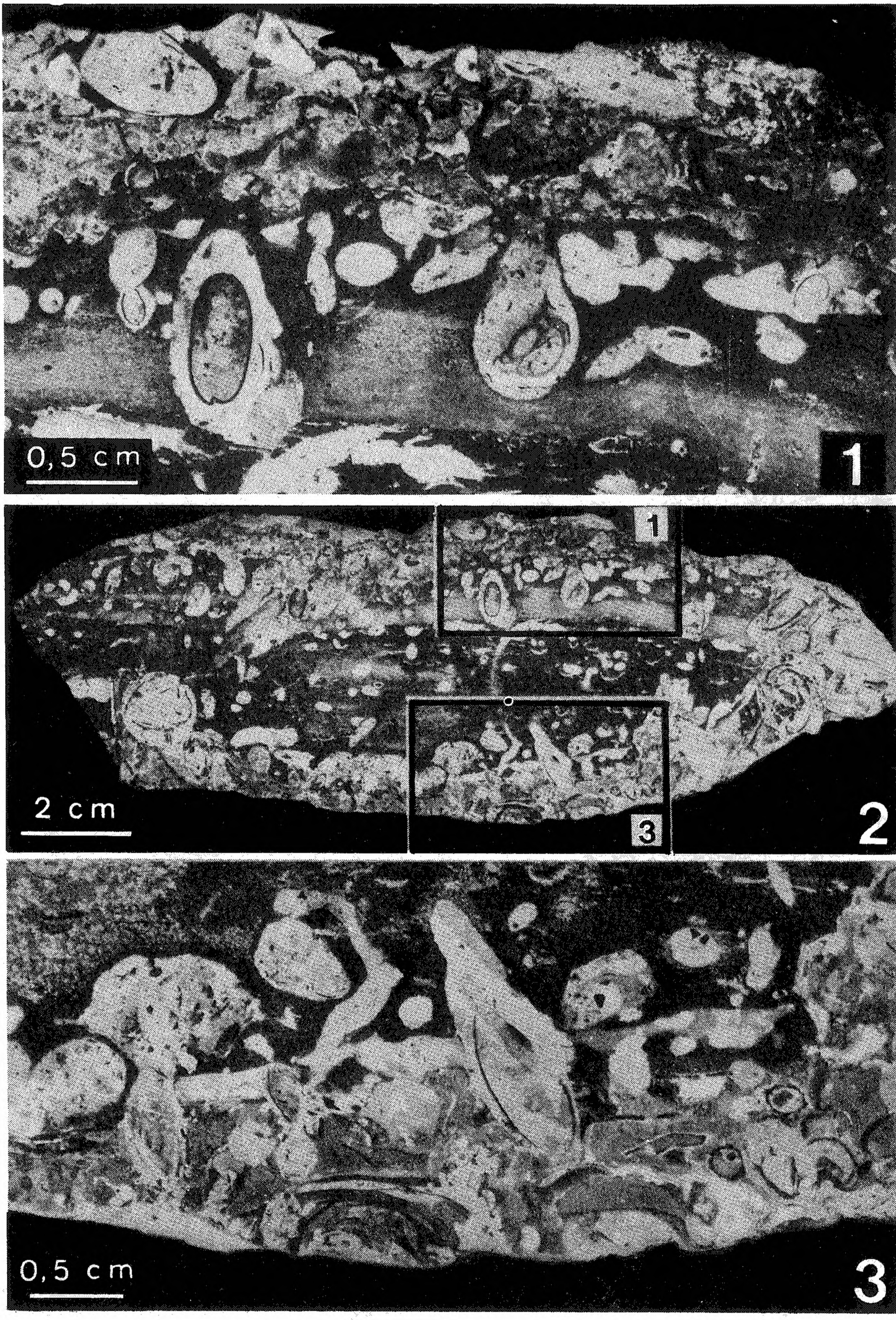
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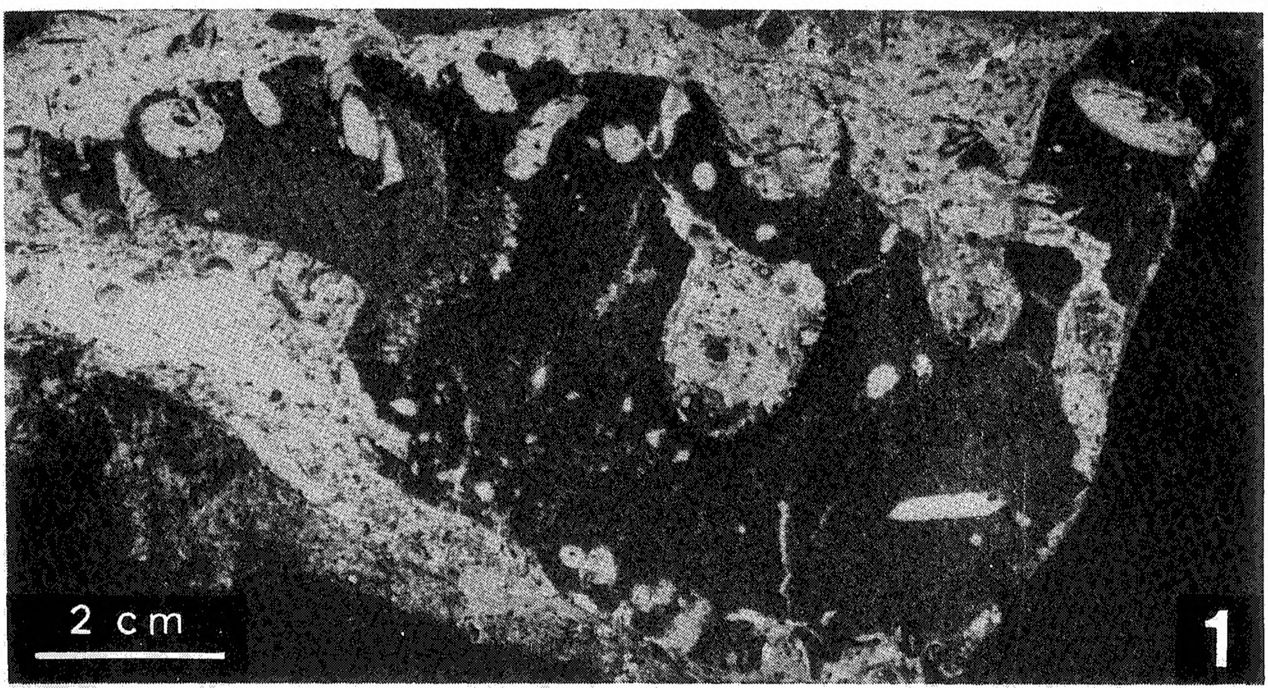
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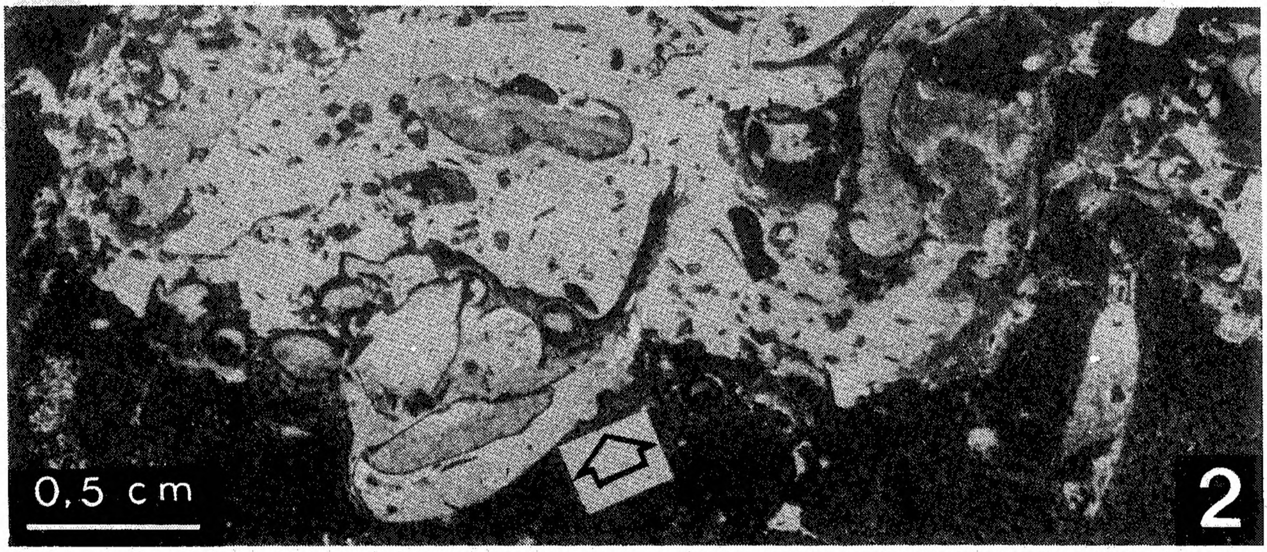
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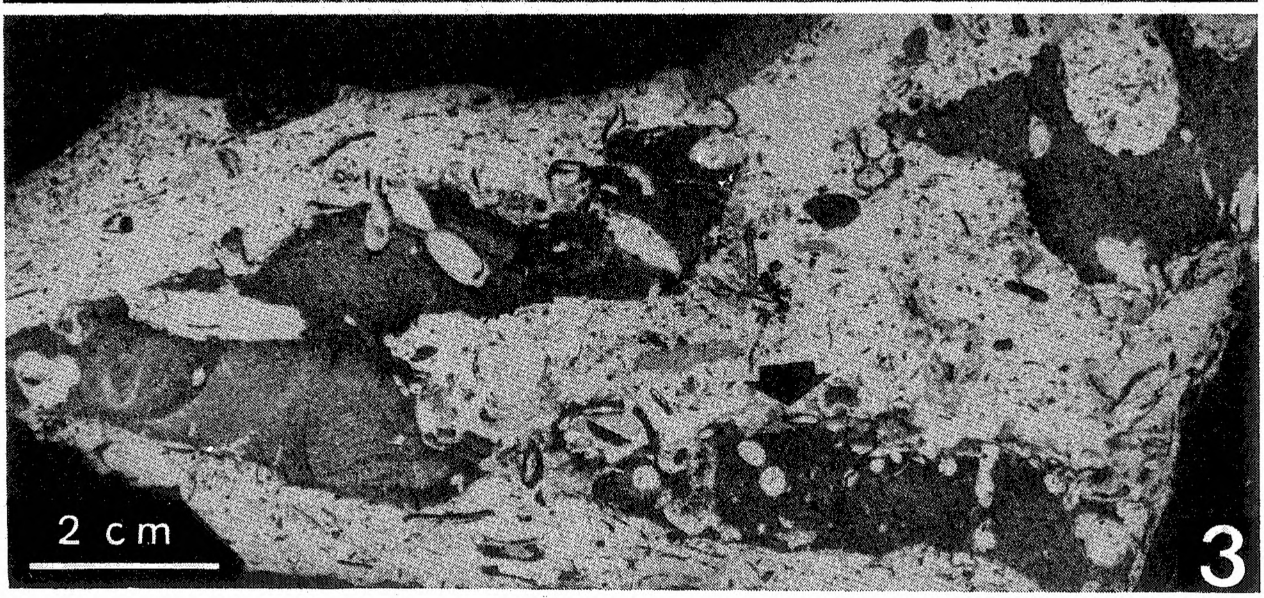
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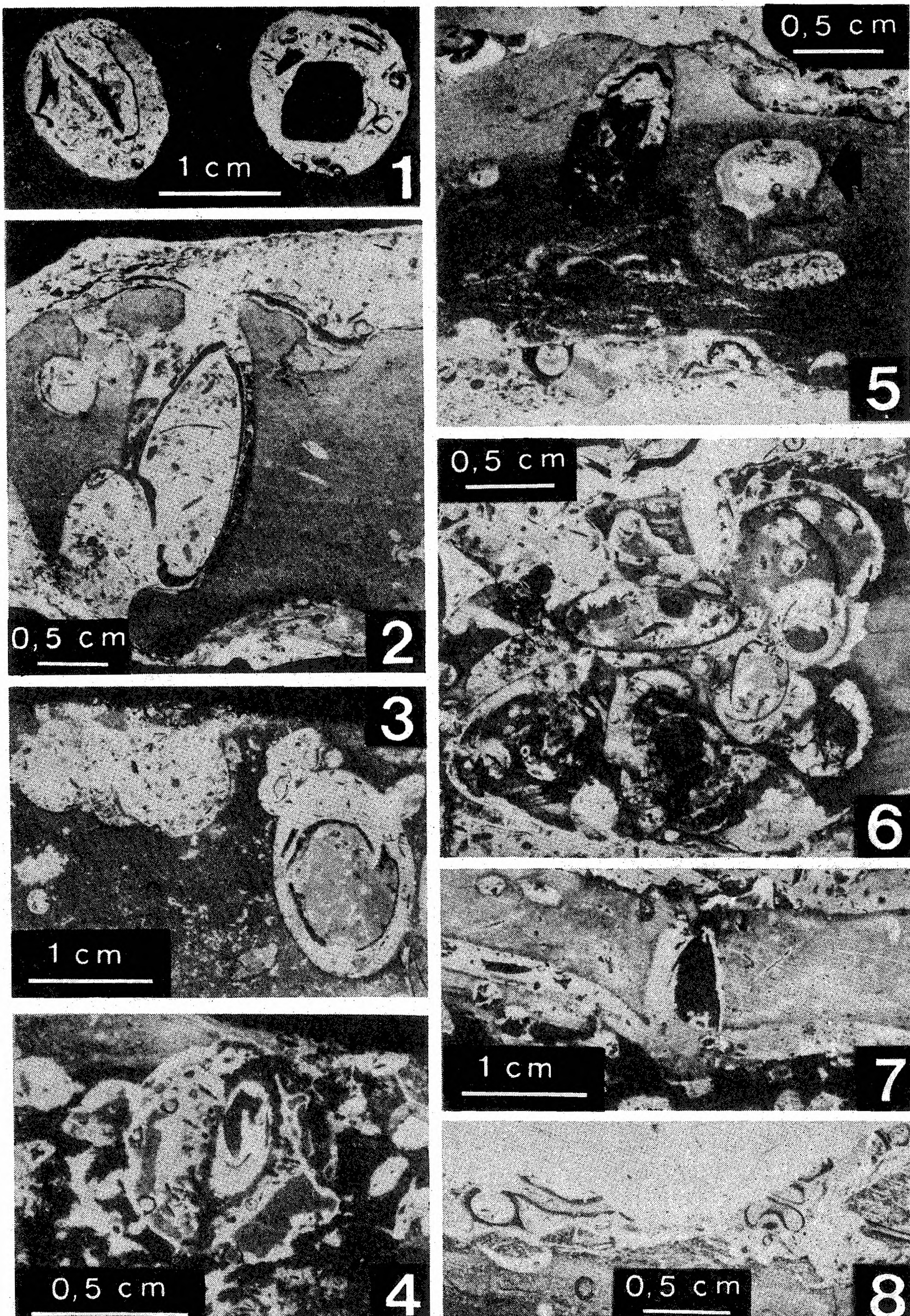
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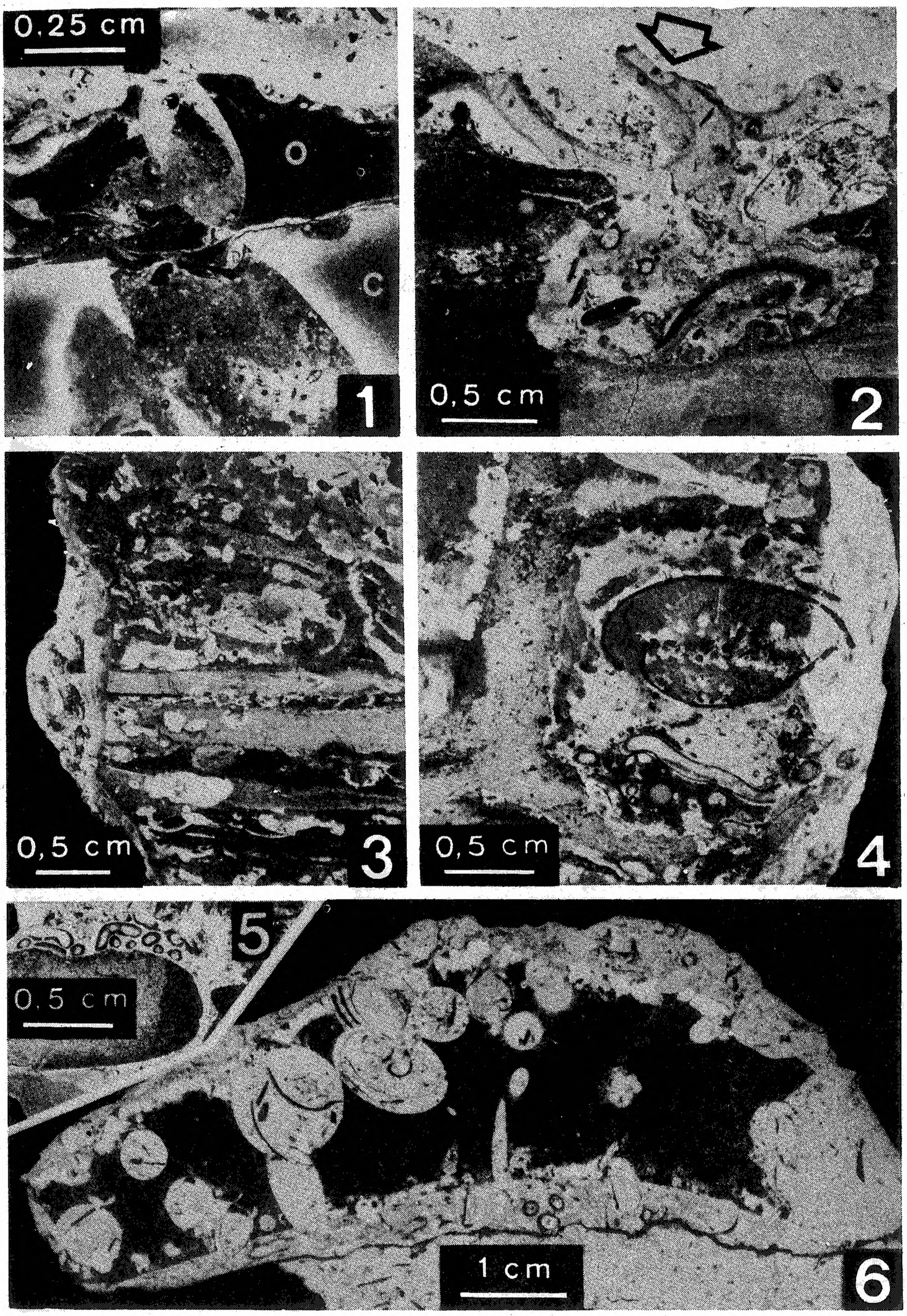
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O
C
1
0,5 cm
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4
5
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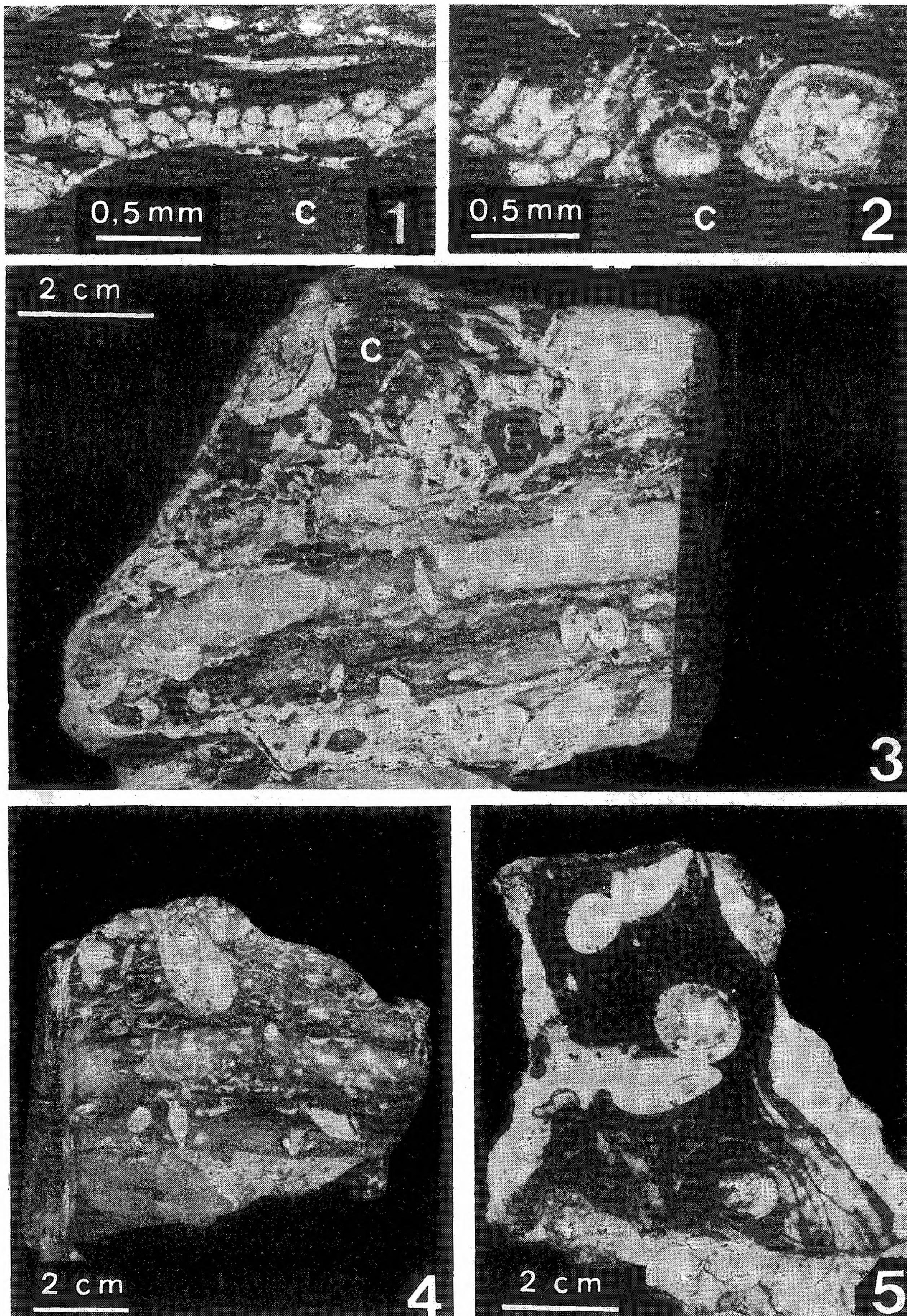
1 cm
6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c
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c
2
2 cm
c
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2 cm
5