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LATE PALEOZOIC FOSSILS FROM PEBBLES IN THE SAN CAYETANO FORMATION, SIERRA DEL ROSARIO, CUBA

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Abstract: Late Paleozoic Foraminiferida and Bryozoa have been found in silicified limestone pebbles collected from the sandstones of the San Cayetano Formation in the Sierra del Rosario (western Cuba). All but one specimen of Foraminiferida belong to the Fusulinacea and include *Schwagerina* sp. and *Parafusulina* sp. One specimen of *Tetrataxis* sp. has been found together with the bryozoan *Rhabdomeson* sp. The schwagerinids are of Permian (probably Leonardian) age, and the other fossils are of Carboniferous or Permian age. The fossiliferous pebbles were derived from Late Paleozoic rocks located at least some hundred kilometers from the San Cayetano basin during Middle Jurassic to Oxfordian time. The schwagerinid-bearing pebble of Permian age could have been transported from Central America, southwestern North America or northwestern South America (?).

Key words: Foraminiferida, Late Paleozoic, Middle-Upper Jurassic, Cuba.

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INTRODUCTION

In the present paper the first occurrence of Late Paleozoic fossils in Cuba is reported. These fossils were found in pebbles collected from the San Cayetano Formation (Middle Jurassic-Middle Oxfordian) of the Sierra del Rosario in western Cuba (Fig. 1). Besides the characteristics of fossils, this study also deals with the problem of provenance of the fossil-bearing pebbles.

The oldest fossils yet found in Cuba are of Jurassic age and also were reported from the San Cayetano Formation. The Jurassic fossils collected in this formation include plant remains (Vachrameev, 1966), pelecypods and ammonites. Ammonites of Middle Oxfordian age were found in the uppermost part of the San Cayetano Formation in the Sierra del Rosario (Myczyński & Pszczółkowski, 1976). Pelecypods occurring in the clastic sediments of this formation in the Sierra de los Organos were assigned to the Middle Jurassic and Oxfordian (Krömmelbein, 1956; Torre, 1960; Pugaczewska, 1978). No older fauna was identified although the San Cayetano Formation in the Sierra

de los Organos is considered to be ?Lower Jurassic to Middle Oxfordian in age (Furrazola-Bermúdez *et al.*, 1964; Khudoley & Meyerhoff, 1971; Pszczółkowski, 1978).

The present author has found Late Paleozoic fossils in a few pebbles collected from the sandstones of the upper part of the San Cayetano Formation in the Cinco Pesos area (Fig. 1). The fossiliferous pebbles were

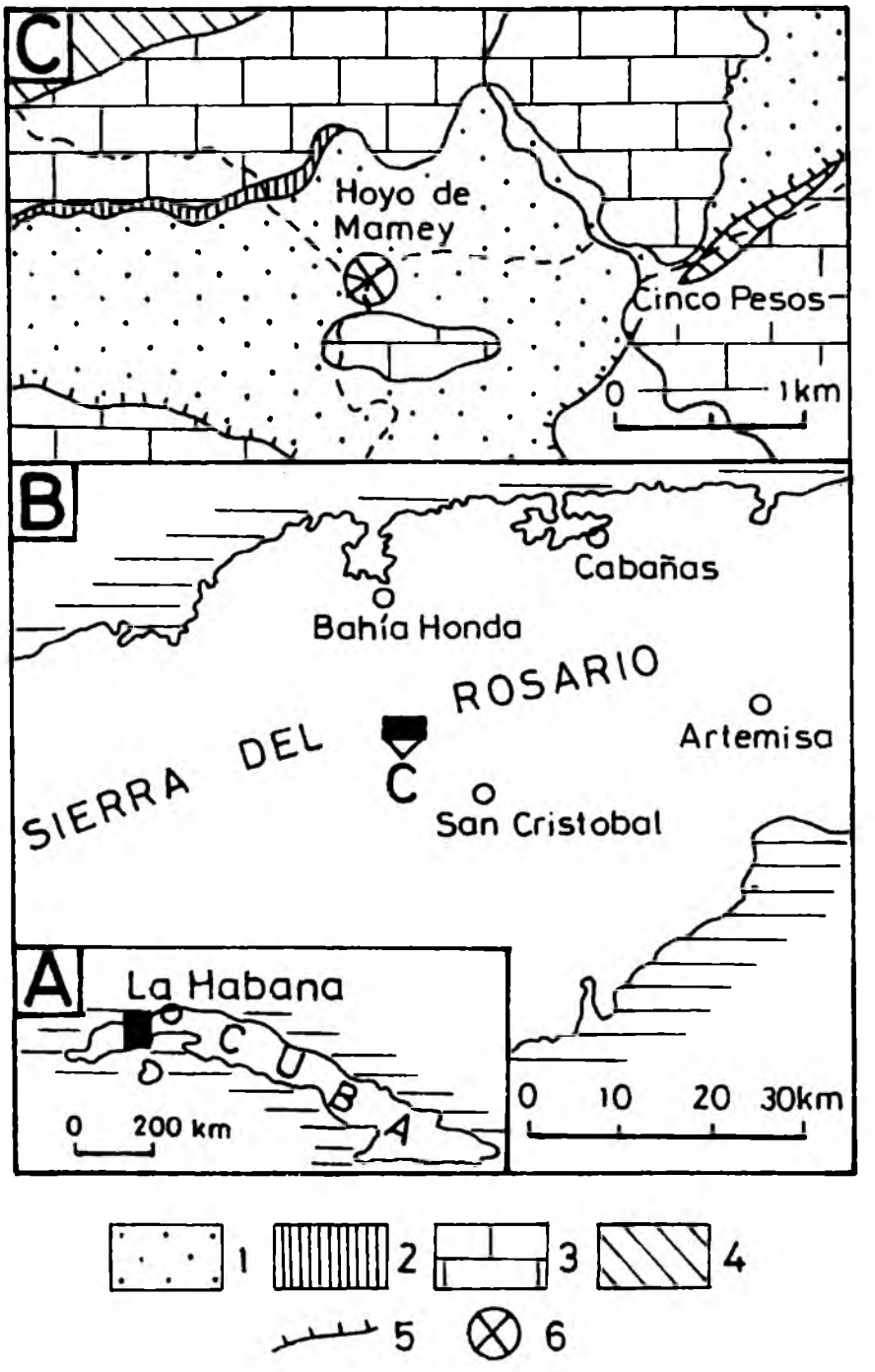

Fig. 1. A – Location of Sierra del Rosario in Cuba (black area is presented in B); B – location map of Cinco Pesos area in Sierra del Rosario; C – generalized geologic map of Cinco Pesos area: *1* – San Cayetano Fm. (Middle Jurassic–Middle Oxfordian); *2* – Francisco Fm. (Middle Oxfordian); *3* – Artemisa Fm. (Upper Oxfordian–Hauterivian); *4* – post-Hauterivian sediments (Lower Cretaceous–Lower Eocene); *5* – overthrust; *6* – location of outcrop where pebbles containing Late Paleozoic fossils have been found

found at the Hoyo de Mamey locality, 1,250 m west of the San Cristóbal – Bahia Honda road. These fossil-bearing clasts occur in thick-bedded sandstones of the upper part of the San Cayetano Formation, approximately 100 m below the upper boundary of this lithostratigraphic unit (Fig. 2). The pebbles are scattered within thick sandstone beds or are concentrated at their bases. The pebbly sandstones belong to facies I defined as thick-bedded coarse-grained chaotic and graded sandstones by Haczewski (1976). The San Cayetano Formation of the Cinco Pesos area belongs to the southern stratigraphic sequence of the Sierra del Rosario (Pszczółkowski, 1977, 1978).

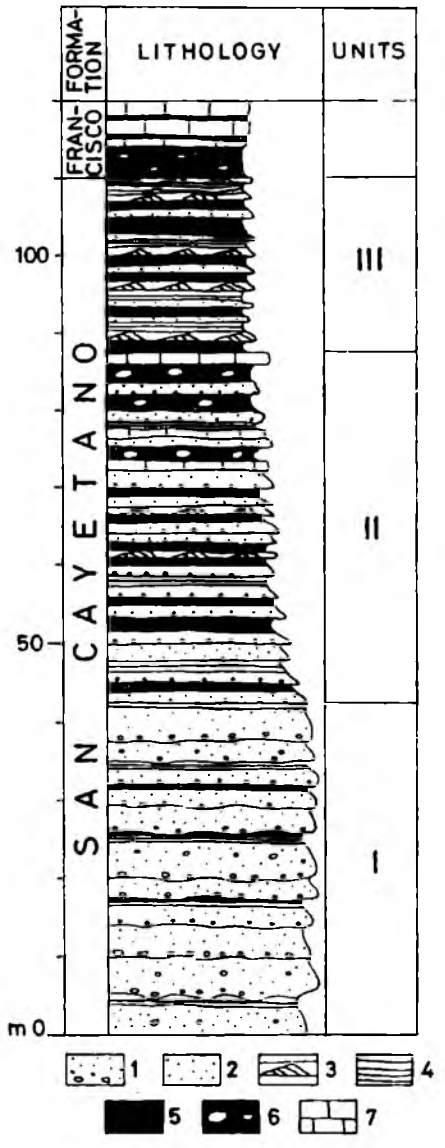

Fig. 2. Lithostratigraphic column of upper part of San Cayetano Fm. in Cinco Pesos area, Sierra del Rosario. Lithologic symbols: *1* – coarse-grained sandstones with pebbles; *2* – medium grained sandstones; *3* – fine-grained sandstones with ripple bedding; *4* – siltstones; *5* – shales; *6* – shales with calcareous concretions; *7* – limestones; lithologic units: *I* – thick-bedded sandstones; *II* – sandstones and shales with limestone interbeds and calcareous concretions; *III* – shales, siltstones and fine-grained sandstones with ripple bedding. Unit *I* corresponds to facies I of Haczewski (1976). Fossiliferous pebbles have been found in lower part of this unit

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The author is indebted to Professor M. Lys (St. Cloud, France) for his helpful comment on the photographs of Schwagerinidae from Cuba and to Docent J. Dzik (Institute of Paleobiology, Polish Academy of Sciences in Warsaw) for identification of some bryozoan fragments. Thanks are due to Mrs. J. Soboń-Podgórska, M. Sc. (Upper Silesian Branch of the State Geological Institute in Sosnowiec) for identification of *Tetrataxis* sp. Comments and help of Professor R. Conil (Université de Louvain, Belgium) and Dr S. Skompski (Institute of Geology of the Warsaw University) are gratefully appreciated. The author is also grateful to Docent J. Lefeld for improvement of the English text.

PEBBLES

The fossiliferous pebbles are silicified bluish-gray limestone, sometimes light brown at the surface due to weathering. The longer axis reaches 4 cm for the largest of these pebbles. The fossils were found in five pebbles only. One of them is a silicified fusulinid-bearing limestone (Pl. I: 1). Two other pebbles are silicified bioclastic limestones with Bryozoa and Foraminiferida fragments (Pl. I: 2, 3). The other pebbles (Pl. I: 4, 5) are highly weathered silicified limestones with a few tiny bryozoan chips and other unrecognizable bioclasts. The silicified limestone clasts probably constitute 1 to 2 percent of all pebbles larger than 1 cm, although a statistically valid counting was not done. The majority of the pebbles are vein quartz, but metaquartzite and quartz sandstone clasts are also relatively abundant. There are some clasts of unfossiliferous chert and silicified volcanic rocks too. The largest pebbles reach 7 cm in length. Very rare unstable constituents, such as quartz-micaceous slates, occur among the pebbles smaller than 1 cm. It seems that the fossil-bearing limestone clasts are present in this mature to supermature pebble suite due to their heavy silicification only.

FOSSILS

The silicified limestone pebbles contain Foraminiferida and Bryozoa fragments. All but one specimen of Foraminiferida belong to the superfamily Fusulinacea. The fossils could be studied in thin sections only. The largest fossil in the pebbles is a fusulinacean 7 mm long. One incomplete specimen was identified as *Schwagerina* sp. (Pl. II: 8) and other three specimens have been assigned to the genus *Parafusulina* Dunbar and Skinner, 1931 (Pl. II: 1a, 1b, 2, 4). All of these schwagerinids come from one pebble (Pl. I: 1), cut by three distinct thin sections. The other specimens of Fusulinacea (Pl. II: 3, 5, 6; Fig. 3) are assigned to the family Schwagerinidae Dunbar and Henbest, 1930. One

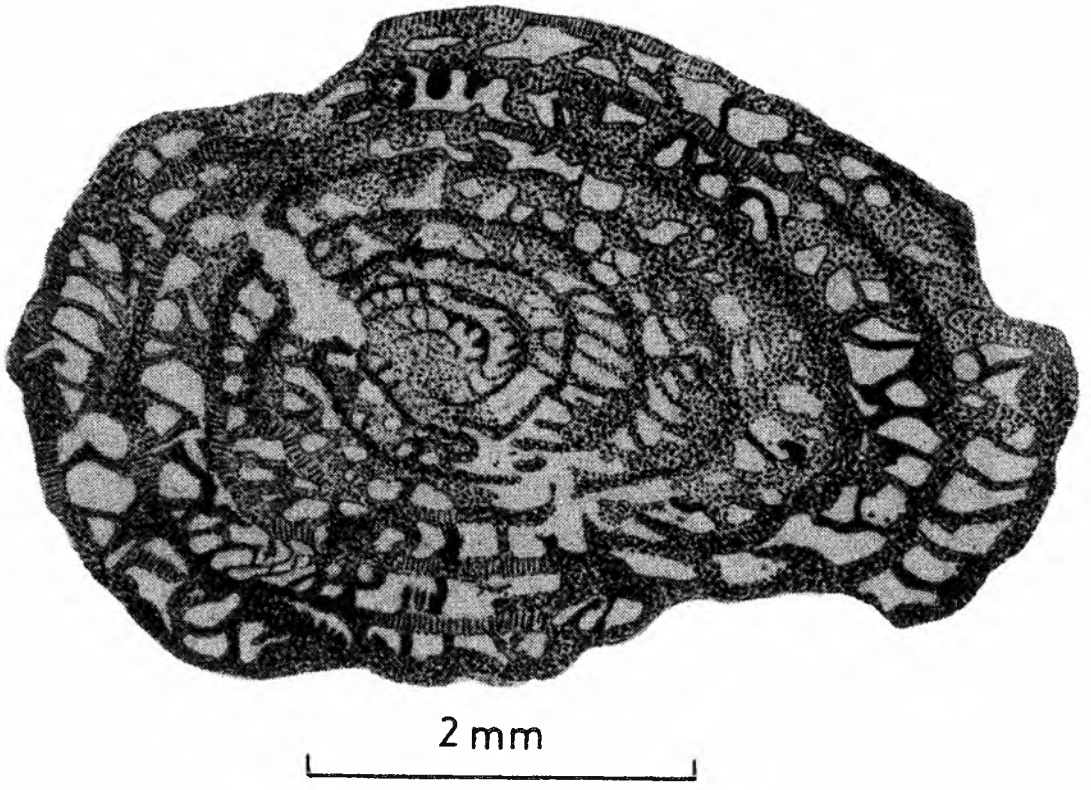

Fig. 3. Schwagerinidae, gen. indet.; oblique section of mature specimen. Wall structure is preserved in some parts of shell only (drawing from microphotograph). This specimen was cut in schwagerinid-bearing pebble of Permian silicified limestone

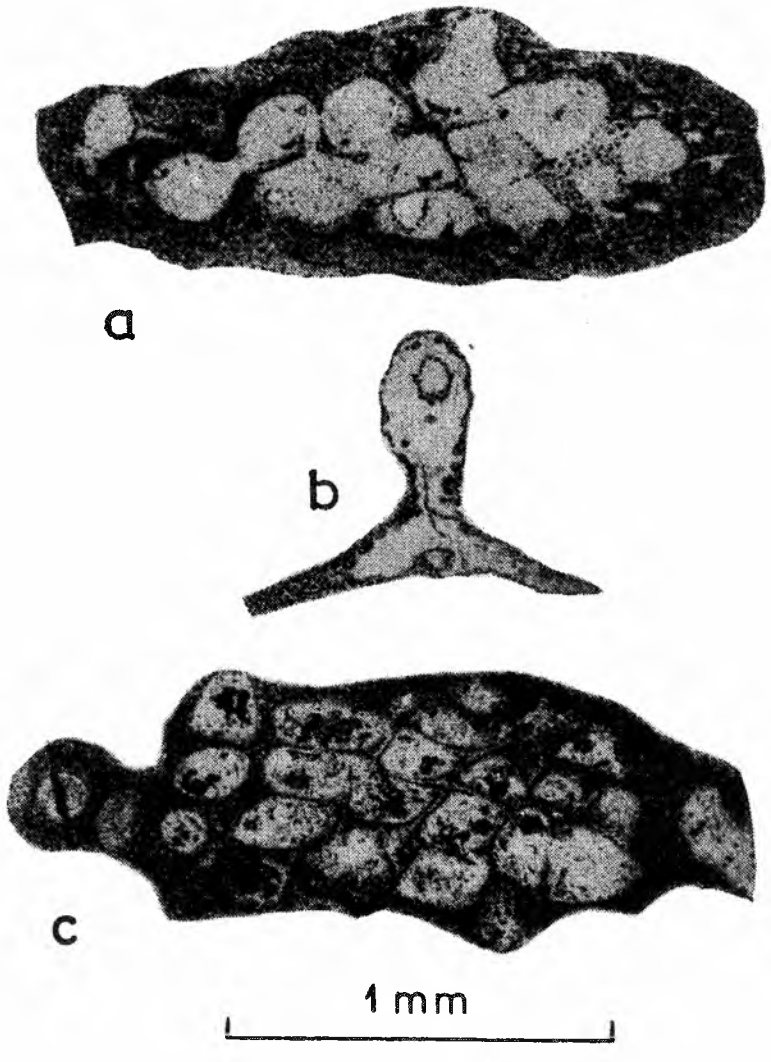

Fig. 4 Bryozoan fragments (Rhabdomesidae?) occurring in pebbles figured in Pl. I: 2, 3, 5; drawing from microphotographs

specimen was identified as *Tetrataxis* sp. by Mrs. J. Soboń-Podgórska. The genus *Tetrataxis* Ehrenberg, 1854 belongs to the Fusulinida (Tetrataxacea).

The bryozoan fragments (Pl. II: 9—11; Fig. 4) are abundant in two pebbles (Pl. I: 2, 3). One of these fragments was identified as *Rhabdomeson* sp. (Pl. II: 9) and another one as *Rhabdomeson* (?) sp. (Pl. II: 11) by Docent J. Dzik.

THE AGE OF THE FOSSILS

The schwagerinids found in one of the pebbles (Pl. I: 1) are of Permian age. The genus *Schwagerina* von Möller, 1877 is known from the Permian in America (Thompson, 1964; Ross, 1967). The specimen of *Schwagerina* sp. (Pl. II: 8) is broadly similar to the *S. guembeli* and *S. gruperaensis* group of late Early Permian (Leonardian) age (see Ross, 1979). The genus *Parafusulina* Dunbar and Skinner, 1931 is of late Early Permian to Late Permian age (Ross, 1967). According to Professor M. Lys (written information, October 30, 1987) the age of this schwagerinid assemblage is Leonardian and corresponds to the Late Sakmarian-Artinskian in Europe. However, the Cuban specimens assigned to the genus *Parafusulina* are also similar to some species considered to be Guadalupian (early Late Permian) in age, such as *P. erratoseptata* Kling, 1960 and *P. sapperi* Dunbar, 1939 from Guatemala (Ross, 1979).

The fossils identified in one of the silicified bioclastic limestone pebbles (Pl. I: 2) are of Late Paleozoic (Carboniferous or Permian) age. According to Loeblich & Tappan (1964) the genus *Tetrataxis* Ehrenberg, 1854 is known from the Carboniferous to Triassic. The genus *Rhabdomeson* Young, 1874 is known from the Mississippian to Permian (Bassler, 1953). The specimens of *Rhabdomeson* sp. and *Tetrataxis* sp. occur in the same pebble (Pl. I: 2), so the Late Paleozoic age of this clast is rather well established. In another pebble (Pl. I: 3) two parallel sections of fusulinaceans were cut. They belong to the Schwagerinidae (Pl. II: 5), defining its age as Late Carboniferous or Permian. The age of sparse fossils found in the two remaining pebbles (Pl. I: 4, 5) could not be determined, although the presence of some bryozoan fragments (Fig. 4c) suggests their Late Paleozoic origin.

PROVENANCE OF THE FOSSILIFEROUS PEBBLES

The fossil-bearing silicified pebbles found in the upper part of the San Cayetano Formation were derived from the Late Paleozoic carbonate rocks. The fossiliferous clasts are rare in the mature pebble suite in the Cinco Pesos area of the Sierra del Rosario. This means that these clasts were transported a long distance from their source area. The lack of non-silicified fossiliferous limestone pebbles eliminates the possibility of a local (intrabasinal) source for the Late Paleozoic fossil-bearing clasts. Consequently, the source for these

clasts was probably a limestone sequence of Late Paleozoic age some hundred kilometers (or even more) away from the San Cayetano basin during Middle Jurassic to Oxfordian time.

In the Gulf of Mexico-Caribbean region the Permian fusulinids are known from northwestern South America (Mérida Andes, Serranía de Perijá), Central America, northern Mexico and southwestern North America (Ross, 1979). Species characteristic for any particular area were not identified among the few silicified fusulinid specimens detected so far in the pebbles from the San Cayetano Formation. Nevertheless, the general aspect of the Cuban schwagerinids makes them closer to the Permian faunas of Central America and southwestern North America than to South America fusulinids. *Tetrataxis* has been reported from Late Paleozoic rocks in Belize, Central America (Ross, 1962a). The bryozoan genus *Rhabdomeson* is known from Permian rocks of West Texas and from the Carboniferous of Alabama (Blake, 1976). Neither genus – *Tetrataxis* and *Rhabdomeson* – was reported from northwestern

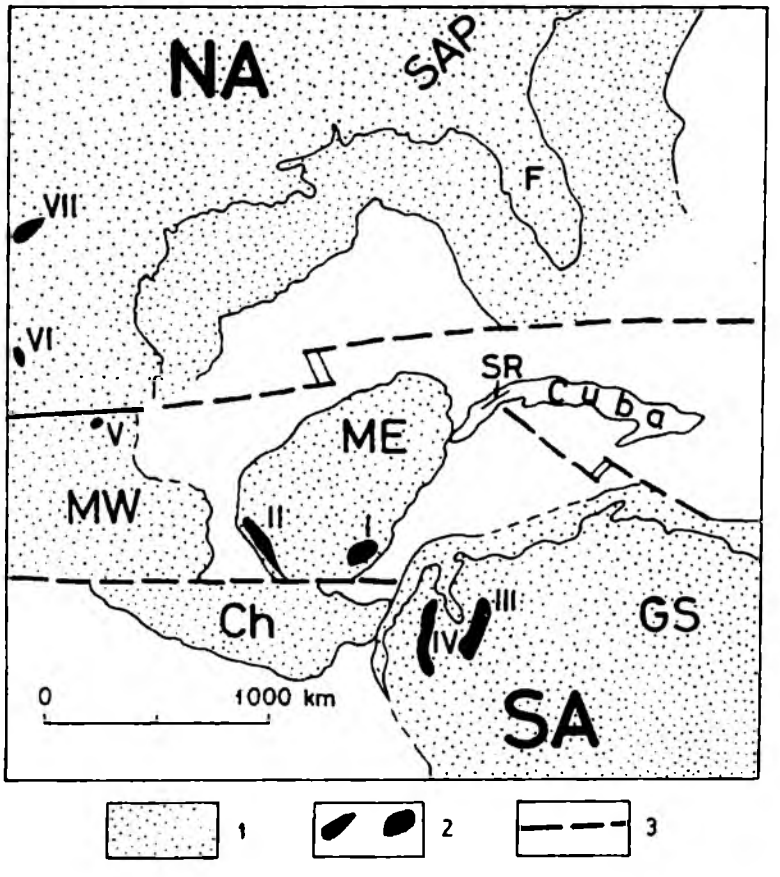

Fig. 5. Generalized paleogeography of Gulf of Mexico–Caribbean region for late Middle Jurassic (Callovian), mainly after Anderson & Schmidt (1983); data concerning the outcrops of the Permian rocks were taken from various sources. *1* – crustal blocks; *2* – Permian outcrops; *3* – faults (megashears): *I* – Maya Mountains, *II* – Chiapas–Guatemala, *III* – Mérida Andes, *IV* – Serranía de Perijá, *V* – Ciudad Victoria Tamaulipas, *VI* – Las Delicias, Coahuila, *VII* – Glass Mountains, Texas; *NA* – North America, *SA* – South America, *Ch* – Chortis block, *ME* – Maya East block, *MW* – Maya West block, *SR* – Sierra del Rosario, *GS* – Guyana shield, *SAP* – southern Appalachians, *F* – Florida

South America (see Pierce *et al.*, 1961 and Ross, 1978). However, other bryozoans (*Fenestella* sp., *Fenestrellina* sp., *Fistulipora* sp., and *Rhombopora* sp.) have been identified in the Permian Palmarito Formation from the Mérida Andes in Venezuela (Pierce *et al.*, 1961). Local conglomerates with fusulinid-bearing limestone pebbles were reported from the Jurassic-Lower Cretaceous Todos Santos Formation in Guatemala (Burkart & Clemons, 1972) and from the La Quinta Formation (Triassic-Jurassic) in the Mérida Andes (Thompson & Miller, 1949; Pierce *et al.*, 1961).

The schwagerinid-bearing pebble (Pl. I: 1) could be derived from Permian rocks occurring in Central America, southwestern North America, or northwestern South America (Fig. 5). In contrast, it is far less probable that this pebble and possibly other fossiliferous clasts too, was derived from the Guyana shield, from Florida or the southern Appalachians. Permian fusulinids are not known from those areas (see Thompson, 1964; Ross, 1967; Gobbet, 1973). Paleogeographic reconstructions of the Late Paleozoic rocks (Ross, 1979; Anderson & Schmidt, 1983) put some constraints on possible locations of the source areas for the clastic material of the San Cayetano Formation in western Cuba. During Callovian – Middle Oxfordian time this material was more likely transported from the west or southwest than from the Guyana shield (Fig. 5). The paleocurrent measurements done by Haczewski (1976) in the San Cayetano Formation indicate transport from the south or SSW, while the fusulinid affinities seem to locate the source area in southwestern North America and/or Central America rather than in South America. A plate-tectonic reconstruction of Middle America and the Gulf of Mexico-Caribbean Sea region during Callovian time proposed by Anderson & Schmidt (1983) favours the detritus supply for the San Cayetano Formation from the Maya East (Yucatán) block (see also Fig. 5). This preference could de even stronger for the Oxfordian (Pszczółkowski, 1987).

CONCLUSIONS

Foraminiferida and Bryozoa from the silicified pebbles in the upper part of the San Cayetano Formation in the Sierra del Rosario are the oldest fossils yet found in Cuba. These pebbles yielded some specimens of Schwagerinidae, one specimen of *Tetrataxis* sp. and bryozoan fragments (*Rhabdomeson* sp.) of Late Paleozoic age. The schwagerinid assemblage with *Parafusulina* sp. and *Schwagerina* sp. is of Permian (probably Leonardian) age. The provenance of the fossiliferous pebbles probably was at least some hundreds kilometers away from the San Cayetano basin during Middle to early Late Jurassic time. The schwagerinid-bearing clast could derive from Permian rocks located in Central America, southwestern North America, or in northwestern South America (?). In contrast, Permian fusulinids are not known from the Guyana shield, Florida and the southern Appalachians.

PALEONTOLOGICAL DESCRIPTIONS OF SOME SPECIMENS OF SCHWAGERINIDAE

Schwagerina sp.

Pl. II: 8

Description. Oblique axial section of incomplete specimen 5 mm long and 2.5 mm wide. Shell fusiform with slightly rounded poles in 4th and 5th (?) volutions. Shell expands regularly attaining 5 volutions. The first three volutions have sharply pointed poles and convex lateral slopes. Proloculus large, subspherical; its outside diameter is 0.36 mm. Heights of the first to fifth volutions 0.14, 0.14, 0.19, 0.25 and 0.29 mm respectively. The spirotheca is composed of a thin tectum and well developed keriotheca. The thickness of spirotheca in the inner volutions is 0.04 mm, but in the outermost volution it attains 0.08 mm. The septal folds are triangles. The tunnel is rather narrow in the early volutions and becomes wider in later volutions. Heavy secondary deposits are concentrated in the first 3 volutions.

Remarks. As far as preservation permits comparisons, this specimen is similar to *S. guembeli* Dunbar and Skinner, 1937 from the Glass Mountains, Texas (Ross, 1960, 1962b) in general shape, size and wall thickness, although this species has a smaller proloculus. The shape and secondary deposits of the Cuban specimen are also similar to *S. gruperaensis* Thompson and Miller, 1944 from Belize (Ross, 1962a, pl. 46: 1–9).

Occurrence. This specimen was found in a pebble from the upper part of the San Cayetano Formation in the Sierra del Rosario.

Parafusulina sp.

Pl. II: 1a, 1b, 2, 4

Description. Three specimens are assigned to the genus *Parafusulina* Dunbar and Skinner, 1931. They were found in the same pebble and thin section (Pl. II: 1). One of these specimens was cut axially, the other two are tangential sections. The axial section (Pl. II: 1a) shows a shell 5.6 mm long and 1.8 mm wide; it is slightly damaged near the poles. The shell has a fusiform profile, somewhat depressed at one side, with convex lateral slopes and rounded poles. This specimen is composed of the proloculus and 4 volutions. The wall of the proloculus is partly destroyed and the ellipsoidal hollow, 0.40 mm in diameter, is filled with a mosaic of coarser quartz crystals. The first two volutions have sharply pointed poles. The form ratio of the last two volutions is 2.9 and 3.3. The spirotheca is of schwagerine type with a relatively thin tectum and a prominent alveolar keriotheca (Pl. II: 1b). The thickness of the spirotheca in the first to fourth volutions is 0.04, 0.04, 0.05 and 0.06–0.08 mm, respectively. The septa are fluted throughout length of the shell. The triangular to arch-like septal folds often extend to the tops of the chambers. The closed chamberlets have triangular to oval outlines. Secondary deposits heavily coat the septal folds in the first three volutions. The tunnel is poorly visible because of heavy secondary deposits. Chomata are not discernible.

One of the tangentially cut specimens (Pl. II: 2) is 7 mm long and 2.4 wide; however, it is not complete. The outline of the shell is moderately elongated. The spirothecal wall of schwagerine type is composed of a poorly visible tectum and a prominent alveolar keriotheca. In the central part of the inner volution there are a few poorly developed cuniculi. The other tangential section (Pl. II: 4) is oblique and the details of the shell structure are rather obscure. Nevertheless, the fluting of the septa is visible in the inner volutions.

Remarks. The moderately elongated shape and the presence of a few poorly developed cuniculi in the tangential section indicate for the genus *Parafusulina* Dunbar and Skinner, 1931. Typical representatives of this genus are highly elongated, large forms attaining 7 to 8 volutions with well developed cuniculi (see Thompson & Miller, 1944, 1949; Thompson, 1964; Ross, 1963). However, some primitive species of *Parafusulina* developed low cuniculi visible only in the outer 1–3

volutions (Ross, 1960). The Cuban specimens resemble the inner volutions of *P. erratoseptata* Kling, 1960 from Guatemala (see Kling, 1960, pl. 80: 4–6, pl. 82: 1). In their size and shape the Cuban specimens may be also compared with *P. brooksensis* Ross, 1960, from the Hess Formation of the Glass Mountains in Texas (Ross, 1960). The large proloculus (slightly damaged) and the type of septal folding in the axially cut specimen (Pl. II: 1a) resemble those of *P. onoraensis* Dunbar, 1939 and *P. sapperi* Dunbar, 1939, from Sonora (Mexico) and Guatemala, respectively (see Dunbar, 1939a, b). According to Professor M. Lys (written information, October 30, 1987) the Cuban specimens are broadly similar to the following species: *P. biconica* Skinner, *P. brevis* Skinner, *P. diabloensis* (Dunbar and Skinner), *P. sonoraensis* Dunbar and *P. visseri* Reichel.

Occurrence. The above described specimens have been found in one pebble from the upper part of the San Cayetano Formation in the Sierra del Rosario.

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Resumen

FÓSILES DEL PALEOZOICO TARDÍO DE LOS GUIJARROS COLECTADOS DE LA FORMACIÓN SAN CAYETANO EN LA SIERRA DEL ROSARIO, CUBA

Andrzej Pszczółkowski

En el presente trabajo se describen los primeros fósiles del Paleozoico Tardío encontrados en Cuba. El autor ha hallado a estos fósiles en algunos guijarros colectados en las areniscas de la parte superior de la Formación San Cayetano en el área de Cinco Pesos, a unos 1250 m al oeste de la carretera de San Cristóbal a Bahia Honda (Fig. 1) Estos guijarros con los fósiles paleozoicos han sido encontrados en la localidad Hoyo de Mamey, aproximadamente a 100 m por debajo del tope de la Formación San Cayetano (Fig. 2). Las areniscas con los guijarros fueron definidos por Haczewski (1976) como facies I.

Los fósiles aparecen en 5 guijarros. Uno de ellos se presenta como la caliza silicificada con fusulinidos (Lám. I: 1). Otros dos guijarros se caracterizan como las calizas bioclásticas fuertemente silicificadas, con los fragmentos de Bryozoa y algunos foraminíferidos (Lám. I: 2, 3). Los demas clastos (Lám. I: 4, 5) estan formados por una caliza silicificada muy intemperizada que contiene raros fragmentos de Bryozoa y otros bioclastos no identificables. La mayor parte de los guijarros en las areniscas se compone de cuarzo de veta y de metacuarcita. Al parecer, los guijarros de calizas con los fósiles aparecen en este conjunto maduro de los clastos, solamente por causa de sufuerte silicificación.

Salvo un ejemplar, todos los foraminíferidos encontrados en los guijarros pertenecen a la superfamilia Fusulinacea. Un foraminíferido fue determinado como *Schwagerina* sp. (Lám. II: 8) y otros tres feuron asignados al género *Parafusulina* Dunbar y Skinner, 1931 (Lám. II: 1a, 1b, 2, 4). Estos schwagerinidos provienen de un guijarro (Lám. I: 1) cortado por tres diferentes secciones delgadas. Otros ejemplares de Fusulinacea (Lám. II: 3, 5, 6; Fig. 3) pertenecen a la familia Schwagerinidae Dunbar y Henbest, 1930, pero su determinación generica no fue posible. Un foraminíferido fue identificado como *Tetrataxis* sp. por la Lic. J. Soboń-Podgórska. El género *Tetrataxis* Ehrenberg, 1854 se incluye a Fusulinida (Tetrataxacea). Los fragmentos de Bryozoa (Lám. II: 9—11; Fig. 4) son abundantes en dos guijarros (Lám. I: 2, 3). Uno de estos fragmentos fue identificado como *Rhabdomeson* sp. (Lám. II: 9) y otro como *Rhabdomeson*? sp. (Lám. II: 11) por el Docent J. Dzik.

Los schwagernindos detectados en uno de los guijarros (Lám. I: 1) son de la edad pérmica. El ejemplar de *Schwagerina* sp. (Lám. II: 8) es parecido al grupo de *S. guembeli* y *S. gruperaensis* del Pérmico Temprano tardío (Leonardiano). El género *Parafusulina* es de edad Pérmico Temprano tardío hasta el Pérmico Tardío temprano (Ross, 1967). Según el Profesor M. Lys (información en el escrito, del 30 de octubre, 1987) la edad de los schwagerinidos en consideración es Leonardiano. Los fósiles encontrados en uno de los guijarros de caliza bioclástica silicificada (Lám. I: 2) se asignan al Paleozoico Tardío (Carbonífero o Pérmico). El género *Tetrataxis* se conoce desde el Carbonífero hasta el Triásico. El género *Rhabdomeson* Young y Young, 1874 es conocido desde el Misisipiano hasta el Pérmico (Bassler, 1953). El otro guijarro (Lám. I: 3) contiene algunos fragmentos de Schwagerinidae (Lám. II: 5) los cuales definen su edad como el Carbonífero Tardío o el Pérmico. Algunos bioclastos encontrados en los demas guijarros (Lám. I: 4, 5) pertenecen a Bryozoa (Fig. 4c), así como a unos restos no identificados. Por consiguiente, la edad de estos fósiles no fue determinada, aunque puede ser también el Paleozoico Tardío.

Los clastos fosiliferos son raros en el conjunto de guijarros que se encuentran en la parte superior de la Formación San Cayetano, en los alrededores de Cinco Pesos. Evidentemente dichos clastos fueron transportados de una fuente distante del material terrígeno, situada a algunos cientos de kilometros (o más?) de la cuenca de San Cayetano, durante el Jurásico Medio—Oxfordiano Medio. Los fusulínidos pérmicos se conocen en la parte noroccidental de América del Sur (Andes de Mérida, Serranía de Perijá), en la América Central y et norte de México, así como en la region suroccidental de América del Norte (Ross, 1979). El aspecto general de los schwagerinidos cubanos se parece más a los fósiles del Pérmico de la América Central y de América del Norte (parte suroccidental) que a los fusulínidos de América del Sur. El brizoario *Rhadomeson* sp. fue reportado de las rocas pérmicas de Texas occidental y en el Carbonífero de Alabama (Blake, 1976). El guijarro con los schwagerinidos pudo estar derivado de las rocas pérmicas de la América

Central, de la parte SW de América del Norte o, alternativamente, de la parte NW de América del Sur. Al contrario, su procedencia es mucho menos probable que sea del Escudo de Guayana, de Florida o del extremo suroccidental de Apalaches, porque los fusulínidos pérmicos no se conocen en estas áreas. Por tanto, durante el Calloviano—Oxfordiano Medio, el material clástico de la Formación San Cayetano pudo estar transportado no desde el Escudo de Guayana, sino del oeste o SW, es decir, sobre todo del bloque de Maya Este (Fig. 5).

Streszczenie

PÓŹNOPALEOZOICZNE SKAMIENIAŁOŚCI Z OTOCZAKÓW W FORMACJI SAN CAYETANO, SIERRA DEL ROSARIO, KUBA

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Późnopaleozoiczne otwornice i mszywioły zostały znalezione w kilku otoczakach skrzemionkowanych wapieni zebranych z piaskowców jurajskiej formacji San Cayetano w Sierra del Rosario, w zachodniej części Kuby. Są to najstarsze skamieniałości stwierdzone do tej pory na Kubie. Otoczaki zawierające wspomniane skamieniałości występują w górnej części formacji San Cayetano, około 100 m poniżej jej stropu. W szlifach wykonanych z otoczaków autor stwierdził obecność kilku okazów fuzulinidów z rodziny Schwagerinidae. Nieliczny zaspół schwagerinidów obejmuje 3 okazy zaliczone do rodzaju *Parafusulina* Dunbar et Skinner, 1931 oraz 1 okaz *Schwagerina* sp. Wymienione fuzulinidy są wieku permskiego (prawdopodobnie leonard) i występują w jednym otoczaku skrzemionkowanego wapienia. Jeden z fuzulinidów, znaleziony w innym otoczaku, został oznaczony przez Mgr J. Soboń-Podgórską jako *Tetrataxis* sp. Szczątki mszywiołów są licznie reprezentowane w dwóch innych otoczakach wapieni skrzemionkowanych. Wśród nich został zidentyfikowany rodzaj *Rhabdomeson* Young et Young, 1874 (oznaczenie Docenta J. Dzika), znany z karbonu i permu.

Otoczaki zawierające późnopaleozoiczne otwornice i mszywioły pochodzą najprawdopodobniej z obszaru źródłowego odległego co najmniej o kilkaset kilometrów od basenu sedymentacyjnego formacji San Cayetano w jurze środkowej i we wczesnym oksfordzie. Otoczak skrzemionkowanego wapienia permskiego mógł zostać przyniesiony z terenu Ameryki Środkowej, z południowo-zachodniej części Ameryki Północnej lub z północno-zachodniej części Ameryki Południowej (?). Permskie fuzulinidy nie są natomiast znane na obszarach tarczy Gujany, Florydy i południowych Appalachów. W związku z tym materiał klastyczny młodszych ogniw formacji San Cayetano mógł być transportowany z zachodu lub południowego zachodu.

EXPLANATIONS OF PLATES

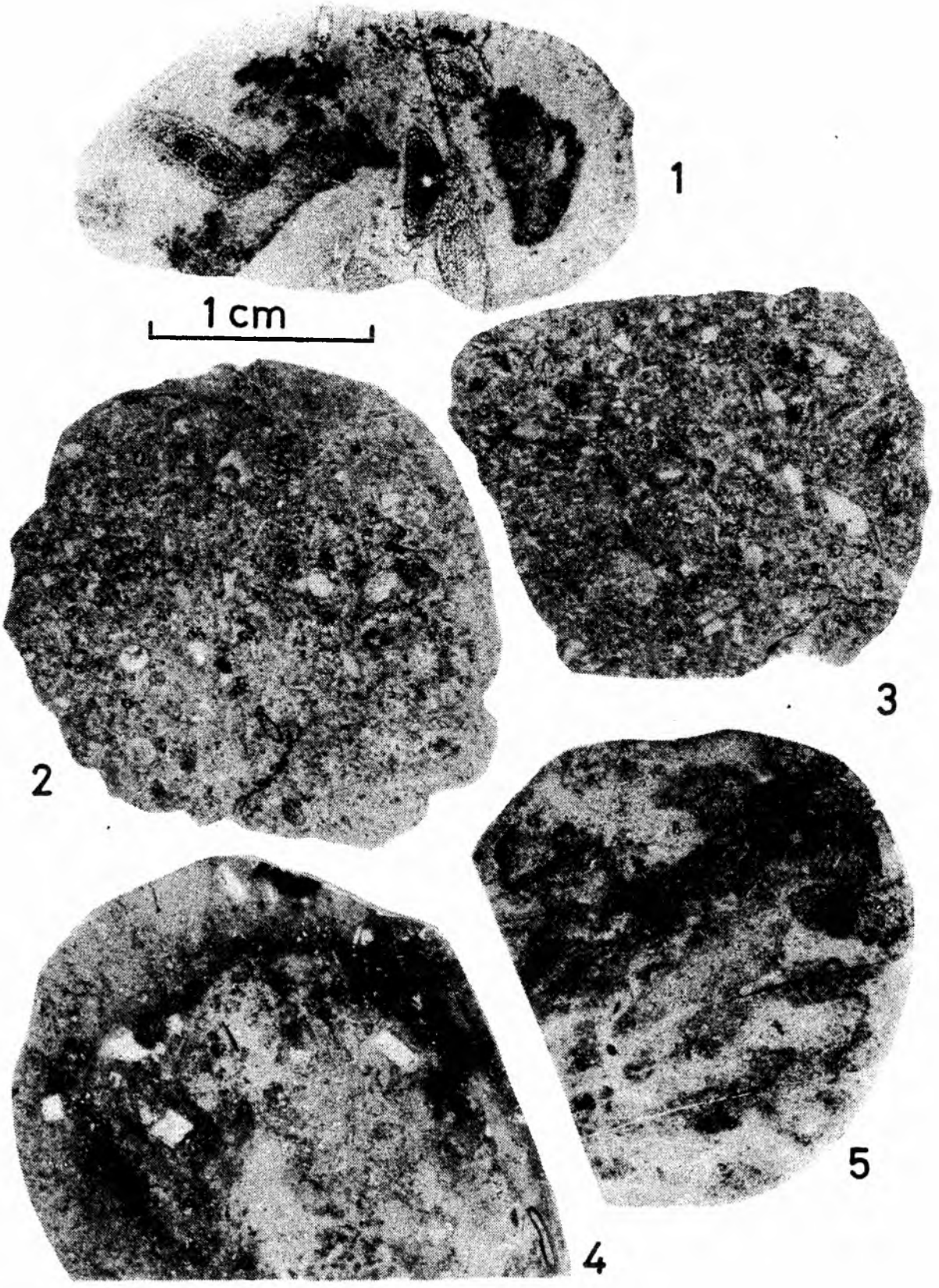
Plate I

1 – Silicified limestone pebble containing Schwagerinidae; thin section, unpolarized light
2 – Silicified bioclastic limestone pebble containing Bryozoa fragments and rare Foraminiferida (*Tetrataxis* sp.) thin section, unpolarized light
3 – Silicified bioclastic limestone pebble with Bryozoa fragments and rare Schwagerinidae; thin section, unpolarized light
4 – Fragment of the weathered silicified limestone pebble with few bryozoan chips and unrecognizable bioclasts; thin section, unpolarized light
5 – Fragment of weathered silicified limestone pebble with few bryozoan chips and tiny problematic organic structures: thin section, unpolarized light

All pebbles have been found in the upper part of the San Cayetano Formation at the Hoyo de Mamey locality in the Sierra del Rosario.

Plate II

1a – *Parafusulina* sp., axial section, × 15
1b – Enlarged fragment of 1a, showing details of shell structure (wall, septa and tunnel), × 40
2 – *Parafusulina* sp., tangential section, × 10
3 – Schwagerinidae, gen. indet., oblique tagential section, × 10
4 – *Parafusulina* sp., slightly oblique tangential section, × 10
5 – Schwagerinidae, gen. indet., parallel section, × 43
6 – Schwagerinidae, gen. indet., oblique section, × 10
7 – *Tetrataxis* sp., × 43
8 – *Schwagerina* sp., oblique axial section, × 12
9 – *Rhabdomeson* sp., × 43
10 – Bryozoa fragment, × 43
11 – *Rhabdomeson*? sp., × 30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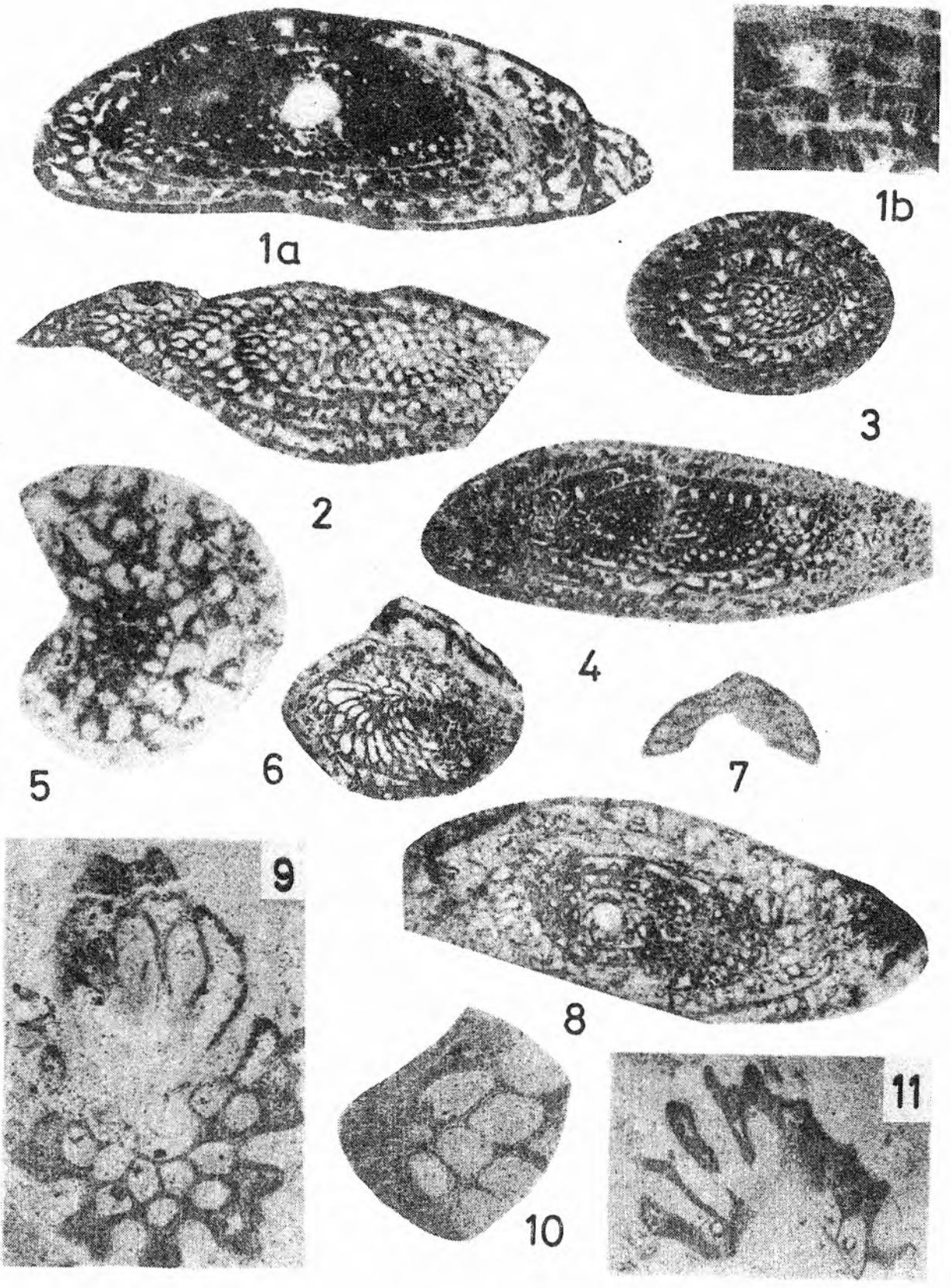
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