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MEGASPORES OF THE UPPER MUSCHELKALK FROM THE  
KOŚCIERZYNA IG-1 BOREHOLE (N. POLAND)

Megaspory górnego wapienia muszlowego z wiercenia Kościerzyna IG-1

**ABSTRACT.** Characteristics of a megaspore assemblage obtained from the highest examined part of the Kościerzyna IG-1 borehole, referred to the Upper Muschelkalk on the basis of its lithology, are presented. This assemblage comprises species hitherto known from the *Dijkstraisporites beutleri* Reinhard assemblage, associated with the Lower-Keuper deposits. Moreover, the spores belonging to *Capillisporites germanicus* Kozur have been found to be prevalent here. This species, known from the Upper Muschelkalk of Thuringia, confirms the validity of the lithostratigraphic correlation. A new species, *Narkisporites formidabilis* n. sp., is also described.

INTRODUCTION

The distribution of stratigraphically important megaspore species in the deposits of the epicontinental Keuper in the territory of Poland has already been discussed in a paper by Marcinkiewicz (1978). Now attention has been given to deposits older than the Keuper — recognized as the Upper Muschelkalk — which have not, as yet, been examined for their content of megaspores.

The studied material was obtained from the Kościerzyna IG-1 borehole, situated in the south-western part of the peri-Baltic syneclide. Twenty-six core samples derived from the whole profile of Muschelkalk bored at a depth from 1115.1 to 1177.3 m were analysed for megaspores. Accumulations of megaspores were found only in seven samples taken at a depth of 1115.1—1125.5 m, in sandy-clayey deposits distinguished on the basis of lithology as the Upper Muschelkalk (Gajewski 1978). Some teeth and scales of fish and oogonium fragments of the Charophyta were also found in this part of the profile. Molluscs — *Myophoria vulgaris* Schlotheim, *Gervillea* sp., etc. — occur, as recorded by Gajewski, in intercalations of marly dolomites.

Some single and badly preserved megaspores as well as snails and

teeth and scales of fish were found in the samples from the lower portion of the profile (1127.8—1177.3 m), including the Middle and Lower Muschelkalk.

The discussed megaspore species are stored in the Laboratory of Palaeobotany, Institute of Geology, in Warsaw.

### RESULTS OF THE STUDY OF MEGASPORES

The section of sediments from 1115.1 to 1125.5 m, distinguished in the Kościerzyna IG-1 borehole on the basis of lithological criteria as the Upper Muschelkalk, is characterized by a great concentration of well-or very well-preserved spores. All together, they form a specifically diversified assemblage, which seems to be of great importance to the determination of the biostratigraphic position of the deposits under study. This assemblage, as a rule, bears general resemblance to the *Dijkstraisporites beutleri* Reinhardt assemblage of the Lower Keuper, which manifests itself in their having some species in common, e.g. *Flabellisporites crinitus* Marcinkiewicz, *Henrisporites delicatus* Marcinkiewicz, *H. triassicus* Kozur, *Tenellisporites marcinkiewiczae* Reinhardt et Fricke and *Verrutriletes marcinkiewiczae* Kozur (Reinhardt 1963; Reinhardt & Fricke 1969; Kozur 1972, 1973; Marcinkiewicz 1978, 1979).

The occurrence of common species shows fairly great quantitative differences, though. It is frequently irregular and not numerous in the deposits of the Lower Keuper, whereas in the Kościerzyna IG-1 profile the occurrence of megaspores belonging to *H. delicatus* Marcinkiewicz and *F. crinitus* Marcinkiewicz is noticeably regular and sometimes abundant.

It can also be seen that the megaspore assemblage under discussion lacks the two most characteristic and commonly encountered elements in the Lower Keuper, i.e. *Dijkstraisporites beutleri* Reinhardt and *Maexisporites meditinctatus* (Reinhardt) Kozur.

On the other hand, the mass occurrence of new species is observed. This is especially true of *Capillisporites germanicus* Kozur, found for the first time in Poland, and *Narkisporites formidabilis* n. sp. As essential quantitative components of the assemblage, these species indicate the occurrence of a megaspore flora, hitherto unknown from Poland, although they are accompanied by certain taxa so far regarded as appropriate to the Keuper (Table 1).

However, only the above-mentioned *C. germanicus* Kozur, the occurrence of which in Thuringia falls, according to Kozur (1973), in the Upper Muschelkalk (member mo<sub>3</sub>), is of essential stratigraphic importance. Since in the profile examined it is met with in all the samples with

Table 1

Muschelkalk								Megasporites of the Upper Muschelkalk from the Kościerzyna IG-1 Borehole (depth in m) + single, ++ frequent, +++ abundant	
Middle & Lower	Upper								
1177.30	1135.50	1125.50	1124.00	1122.00	1120.00	1118.60	1115.10		
+	+	+	++	+++	++	+	+	Capillisporites germanicus Kozur	
		+	++	++	+	++		Flabellitesporites crinitus Marcinkiewicz	
		+	+	+	++		+++	Henrisporites delicatus Marcinkiewicz	
		+	+++	+				Narkisporites formidabilis n.sp.	
		+	++	++	+			Verrutrilites marcinkiewiczae Kozur	
		+			+			Trileites sp	
			++					Henrisporites triassicus Kozur	
				+				?Bothriotrilites grandis Fuglewicz	
	+				+		+	Tennellisporites marcinkiewiczae Reinhardt et Fricke	
+				+	+			Megasporites indeterminate	

megasporites, this might support the inclusion of the highest part of the Kościerzyna IG-1 profile in the Upper Muschelkalk.

Thus approached, the Keuper species found in the assemblage may be treated as precursory elements, the range of which begins in the deposits of Upper Muschelkalk (or in its older members) and next extends into the Lower Keuper.

#### DESCRIPTION OF THE MEGASPORES

##### Genus *Narkisporites* Kannegieser et Kozur 1972

###### *Narkisporites formidabilis* n.sp.

Pl. I, figs. 4a, 4b; Pl. II, fig. 2; Pl. III, figs. 1—3; Pl. IV, figs. 1a, 1b; Pl. V, fig. 4

Holotype. IG 507/94/79M; Pl. I, figs. 4a, 4b.

Locus typicus. Poland, Kościerzyna IG-1 borehole, depth — 1123.0 m.

Stratum typicum. Upper Muschelkalk.

Derivatio nominis. Formidabilis (Lat.) — frightful, grim, formidable.

Description. Spore diameter ranging from 500 to 1130 µm. Spores roundish of triangular-roundish in outline. Trilete rays equal to spore radius in length, shaped as stout lips, 30—180 µm in height. Arcuate ridges in the form of dermoid flange, 35—120 µm wide, with outer margins largely indented. Contact areas large, ornamented with flattened appen-

dages, varying in length, with rounded or pointed ends. Outside the arcuate ridges and on the distal surface of the spore there are single robust appendages, 100—150  $\mu\text{m}$  long and densely distributed. The appendages are broad and flat (about 20—50  $\mu\text{m}$  in breadth), with pointed or blunt tops, sometimes bifid, and show a tendency to unite at the base. They extend straight upwards, being sometimes hooked at ends. Exine 35  $\mu\text{m}$  thick.

**R e m a r k s a n d c o m p a r i s o n .** In general structure the megasporites described resemble those of the species *Narkisporites harrisii* (Reinhardt et Fricke) Kozur, known from the Reed Sandstones of the G.D.R. and Poland (Kozur 1973; Marcinkiewicz 1978), but differ from them in sculpture and larger mean dimensions.

**O c c u r r e n c e .** Poland: Kościerzyna IG-1 (Upper Muschelkalk).

Genus *Capillisporites* Kozur 1973

*Capillisporites germanicus* Kozur

Pl. IV, figs. 2—4; Pl. V, figs. 1, 2

1973 *Capillisporites germanicus* Kozur; Kozur, p. 7, Pl. 1, figs. 2, 6a, b.

**D e s c r i p t i o n .** Megasporites, 400—470  $\mu\text{m}$  in diameter; trilete rays imperceptible, presumably masked by numerous appendages, which densely cover the whole surface of the spore. The appendages are long and flat, uniformly broad (15—20  $\mu\text{m}$ ) all over their length. In the equatorial zone they reach 100—180  $\mu\text{m}$  in length, but do not form a corona. Their tops are rounded, more rarely pointed. They often occur in small separate rows and show a tendency to coalesce along their sides. No arcuate ridges.

**O c c u r r e n c e .** Poland: Kościerzyna IG-1 (Upper Muschelkalk); G.D.R.: Upper Muschelkalk (member mo<sub>3</sub>).

Genus *Henrisporites* (Potonié) Binda et Srivastava 1968 emend.

*Henrisporites delicatus* Marcinkiewicz

Pl. VII, figs. 3, 4; Pl. VIII, figs. 1—4; Pl. IX, figs. 1—4

1978 *Henrisporites delicatus* Marcinkiewicz; Marcinkiewicz, p. 75, Pl. 12, fig. 7; Pl. 13, figs. 1—3; Pl. 14, figs. 1—4.

**R e m a r k s a n d c o m p a r i s o n .** Most of the specimens examined differ from the typical specimens of this species, so far known from a small number of samples of Muschelkalk and Lower Keuper, in

having no spines. This is presumably a secondary phenomenon resulting from the state of preservation of the exine, the other characters of the spores being identical. The specimens with the spines preserved (Pl. VIII, figs. 3a, 3b) do not differ in sculpture from the typical spores of this species, described earlier by the authoress.

In addition, as can be seen from the illustrations presented by Fuglewicz (1977, Pl. 39, fig. 1a, b; Pl. 40, fig. 3), *H. delicatus* Marcinkiewicz bears much general resemblance to *Dijkstraisporites capillatus* Fuglewicz. However, the description given by this last author (pp. 421—422) shows that the size of *D. capillatus* Fuglewicz is considerably larger (400—1100 µm) and its basic morphological characters, i.e. the height of the lips, breadth of the equatorial zone and the length of the hairlike spines are also twice as large as they are in *Henrisporites delicatus* Marcinkiewicz. In the present work the authoress has treated these specimens as separate species, although it may well be that they belong to one species.

**O c c u r r e n c e.** Poland: Upper Muschelkalk, Lower Keuper; Kościerzyna IG-1 (Upper Muschelkalk).

#### Genus *Flabellisporites* Marcinkiewicz 1978

##### *Flabellisporites crinitus* Marcinkiewicz

Pl. VI, figs. 1—4

1978 *Flabellisporites crinitus* Marcinkiewicz; Marcinkiewicz, p. 75, Pl. 11, figs. 1—7; Pl. 12, figs. 1—3.

1979 *Flabellisporites crinitus* Marcinkiewicz; Marcinkiewicz, pp. 212, 213; Pl. 70, figs. 5—7; Pl. 71, fig. 1.

**R e m a r k s a n d c o m p a r i s o n.** The here included megaspores differ from the typical specimens of this species in their somewhat larger mean measurements. The other characters, such as the shape of the trilete rays and the type of exine sculpture are identical.

**O c c u r r e n c e.** Poland: Upper Muschelkalk, Lower Keuper; Kościerzyna IG-1 (Upper Muschelkalk).

#### ACKNOWLEDGMENTS

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## STRESZCZENIE

MEGASPORY GÓRNEGO WAPIENIA MUSZLOWEGO Z WIERCENIA  
KOŚCIERZYNA IG-1

Przedstawiono wyniki badań osadów ilasto-mułowcowych, nawierconych na głębokości 1115,1—1177,3 m w otworze Kościerzyna IG-1. Megaspory znalezione tylko w najwyższym odcinku profilu, na głębokości 1115,1—1125,5 m, zaliczonym na podstawie kryteriów litologicznych do górnego wapienia muszlowego (Gajewska 1978). Łącznie stanowią one zróżnicowany morfologicznie zespół, w którym oznaczono gatunki podawane dotychczas z zespołu megasporowego *Dijkstraisporites beutleri* Reinhardt, charakteryzującego w Polsce i NRD osady kajpru dolnego. Są to: *Henrisporites triassicus* Kozur, *H. delicatus* Marcinkiewicz, *Verrutriletes marcinkiewiczae* Kozur, *Tenellisporites marcinkiewiczae* Reinhardt et Fricke i *Flabellisporites crinitus* Marcinkiewicz. Z drugiej

strony brak tu jest typowych gatunków dla kajpru dolnego, takich jak: *Dijkstraisporites beutleri* Reinhardt i *Maexisporites meditectatus* (Reinhardt) Kozur. Obserwuje się natomiast zjawisko masowej obecności nowych gatunków oznaczonych jako *Capillisporites germanicus* Kozur i *Narkisporites formidabilis* n. sp. Wskazują one na występowanie nowej, nieznanej dotąd w Polsce flory megasporowej. Jednakże istotne znaczenie stratygraficzne ma tylko wspomniany *Capillisporites germanicus* Kozur — gatunek znany z górnego wapienia muszlowego Turynii (Kozur 1973). Ponieważ w zbadanym profilu osadów napotykany jest on we wszystkich pozytywnych próbach, mogłoby to stanowić potwierdzenie słuszności zaliczenia najwyższeego odcinka profilu Kościerzyna IG-1 do wapienia muszlowego górnego.

P l a t e I

*Trileites* sp.

1. Depth 1125.0 m; IG 507/107/79 M,  $\times 150$

*Verrutriletes marcinkiewiczae* Kozur

2. Depth 1124.0 m; IG 507/104/79 M,  $\times 100$

3. Depth 1124.0 m; IG 507/103/79 M,  $\times 100$

*Narkisporites formidabilis* n. sp.

- 4a. Depth 1124.0 m; Holotype, proximal side; IG 507/94/79 M,  $\times 100$

- 4b. Distal side



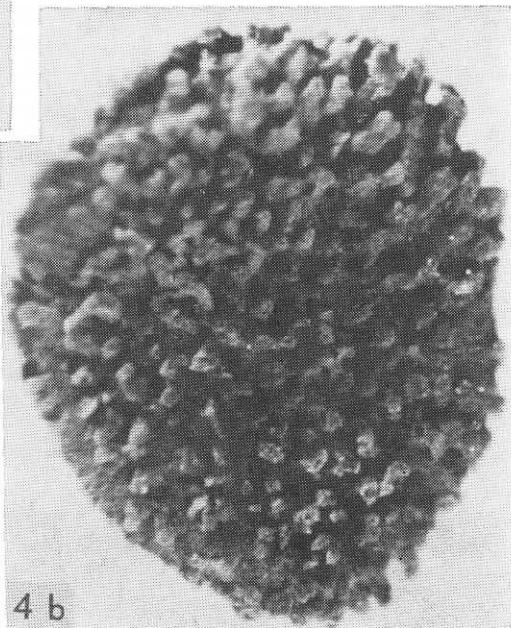
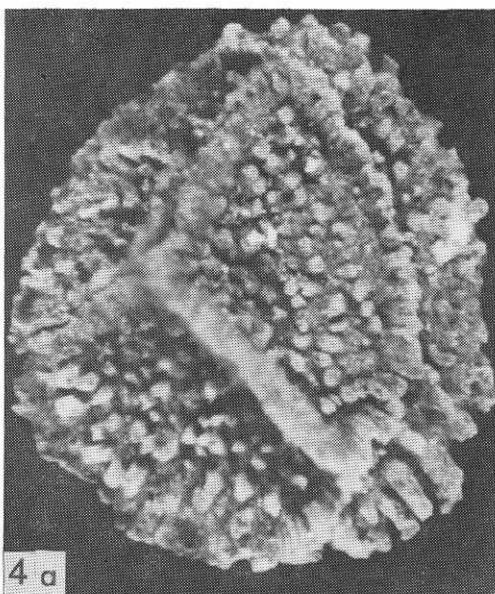
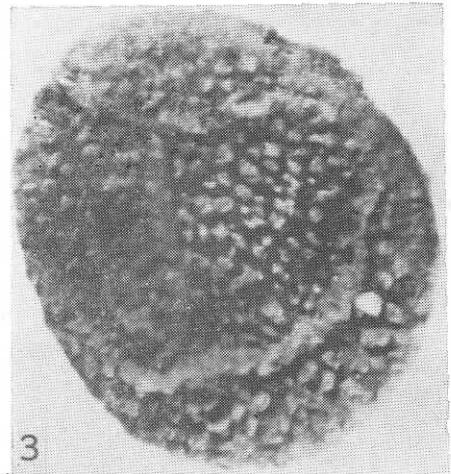
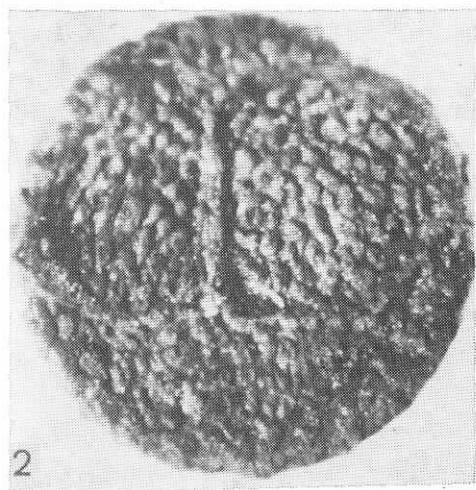


Plate II

*Verrutriletes marcinkiewiczae* Kozur

- 1a. Depth 1124.0 m, proximal side; IG 507/101/79 M,  $\times 100$
- 1b. Distal side
3. Depth 1124.0 m; IG 507/100/79 M,  $\times 100$

*Narkisporites formidabilis* n. sp.

2. Depth 1124.0 m; IG 507/99/79 M,  $\times 75$



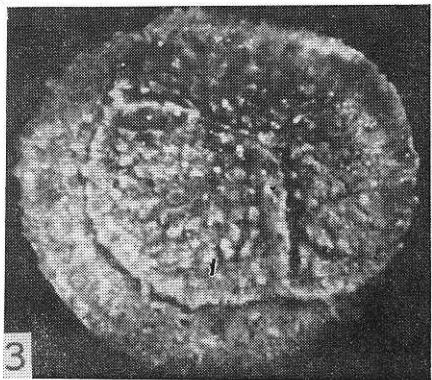
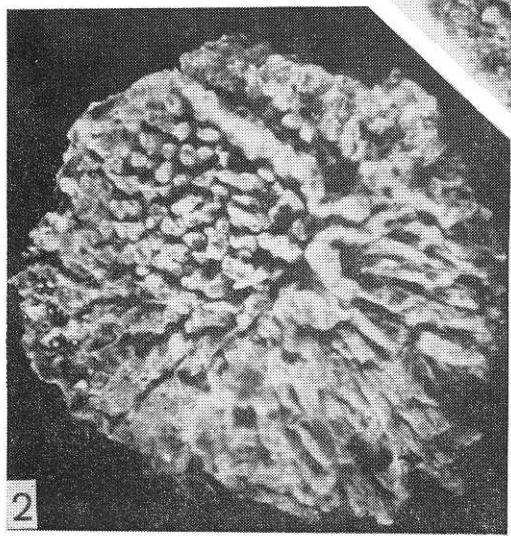
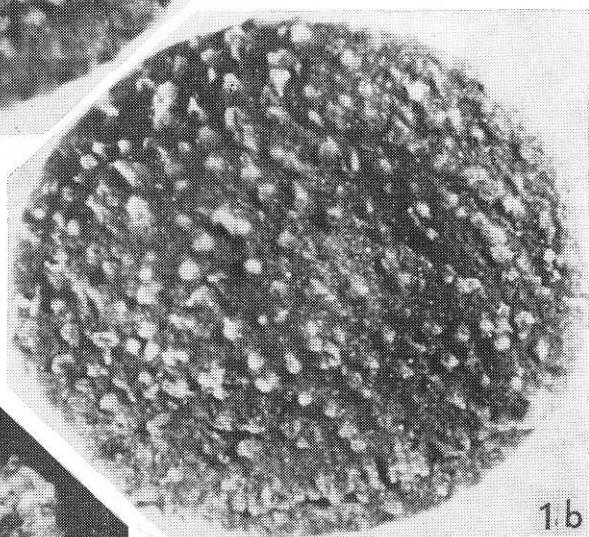
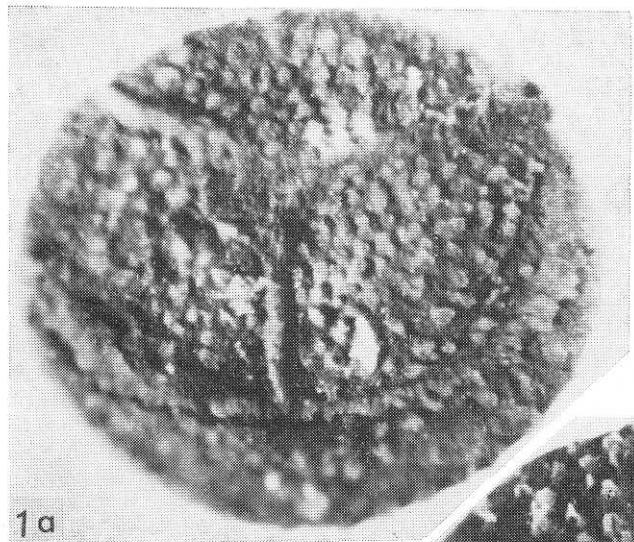
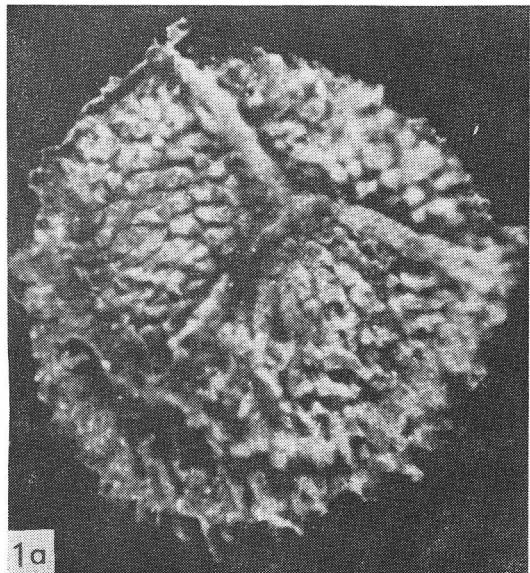


Plate III

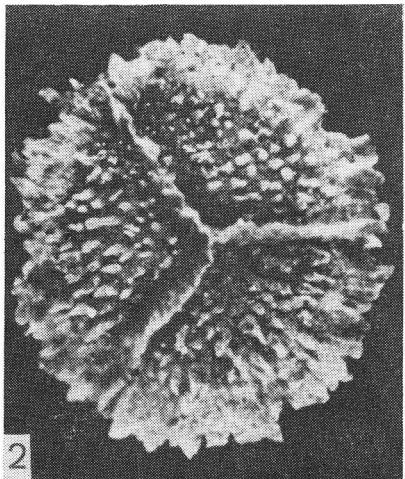
*Narkisporites formidabilis* n. sp.

- 1a. Depth 1124.0 m, proximal side; IG 507/96/79 M,  $\times 75$
- 1b. Distal side
2. Depth 1124.0 m; IG 507/97/79 M,  $\times 100$
3. Depth 1124.0 m; IG 507/95/79 M,  $\times 100$

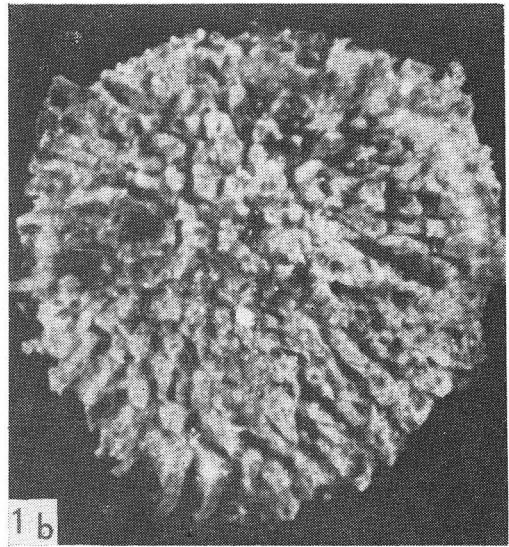




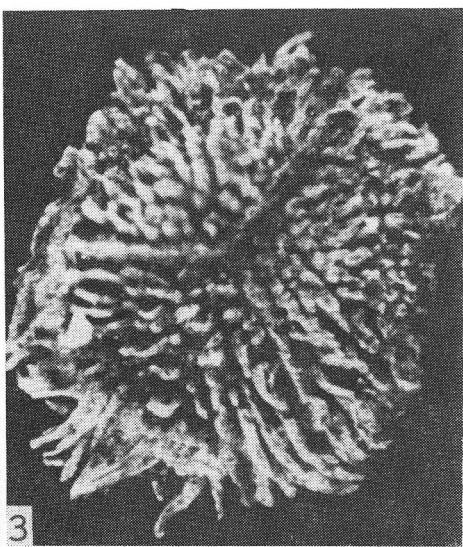
1a



2



1 b



3

Plate IV

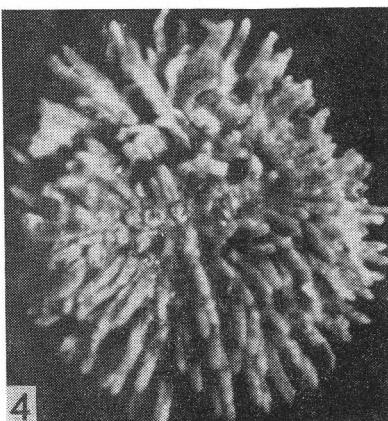
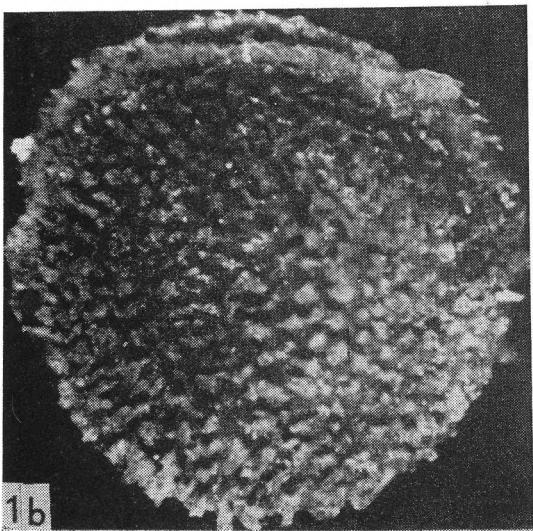
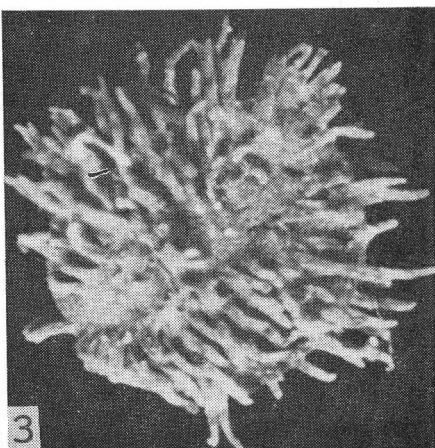
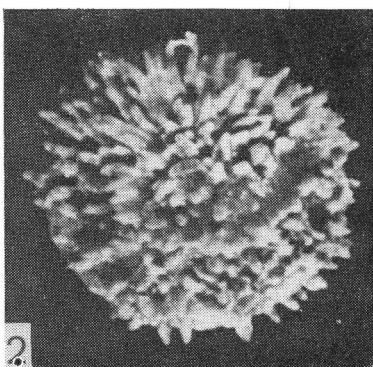
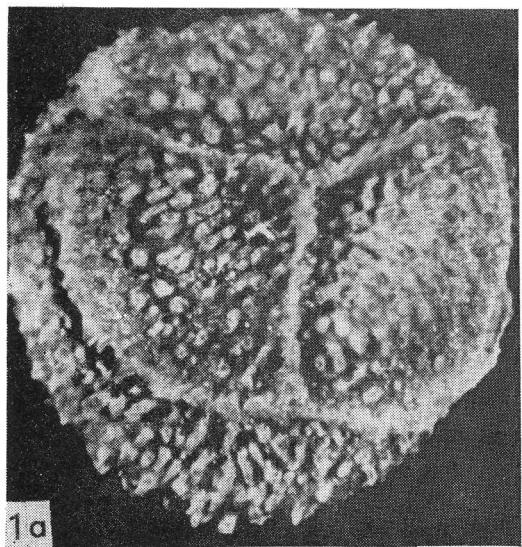
*Narkisporites formidabilis* n. sp.

- 1a. Depth 1124.0 m, proximal side; IG 507/93/79 M,  $\times 75$   
1b. Distal side

*Capillisporites germanicus* Kozur

2. Depth 1122.0 m; IG 507/84/79 M,  $\times 100$   
3. Depth 1122.0 m; IG 507/81/79 M,  $\times 100$   
4. Depth 1122.0 m; IG 507/80/79 M,  $\times 100$





P l a t e V

*Capillisporites germanicus* Kozur

1. Depth 1122.0 m; IG 507/82/79 M,  $\times 100$
- 2a. Depth 1122.0 m; proximal side? distal side?  
IG 507/83/79 M,  $\times 100$
- 2b. Depth 1122.0 m, proximal side? distal side?

? *Bothriotrilletes grandis* Fuglewicz

3. Depth 1120.0 m; IG 507/79/79 M,  $\times 100$

*Narkisporites formidabilis* n. sp.

4. Depth 1124.0 m; IG 507/98/79 M,  $\times 75$



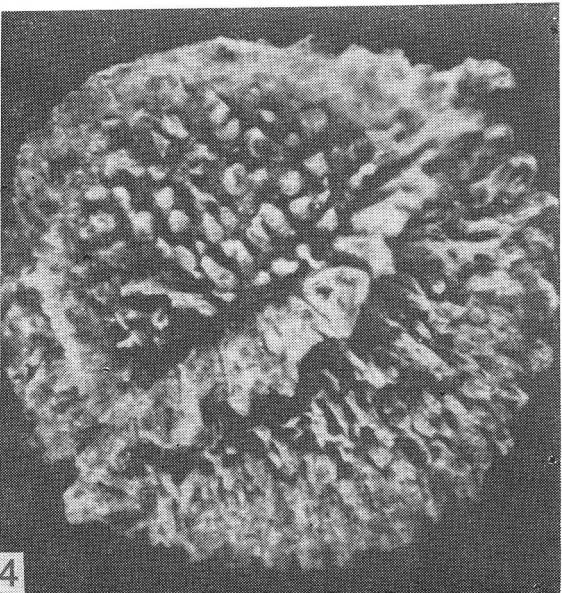
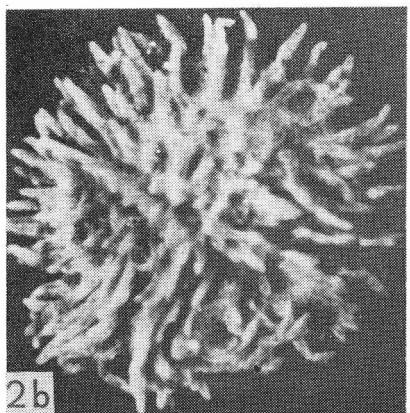
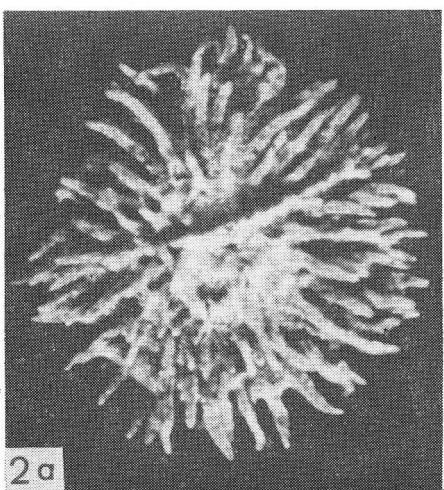
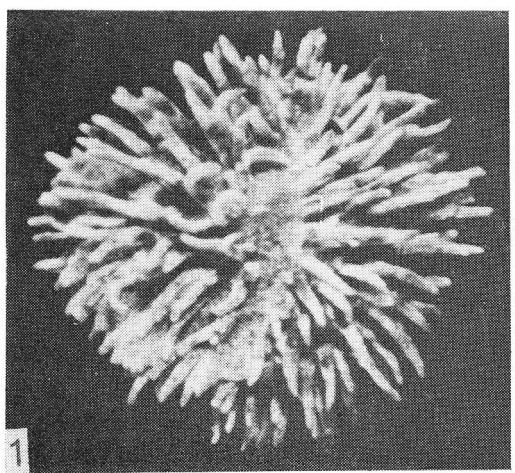


Plate VI

*Flabellisporites crinitus* Marcinkiewicz

1. Depth 1124.0 m; IG 507/92/79 M,  $\times 100$
2. Depth 1124.0 m; IG 507/85/79 M,  $\times 100$
3. Depth 1124.0 m; IG 507/91/79 M,  $\times 100$
4. Depth 1125.0 m; IG 507/117/79 M,  $\times 100$

*Henrisporites triassicus* Kozur

5. Depth 1122.0 m; IG 507/86/79 M,  $\times 100$
6. Depth 1122.0 m; IG 507/88/79 M,  $\times 100$



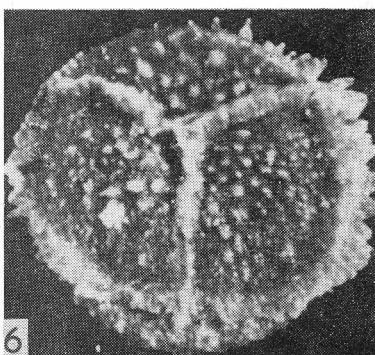
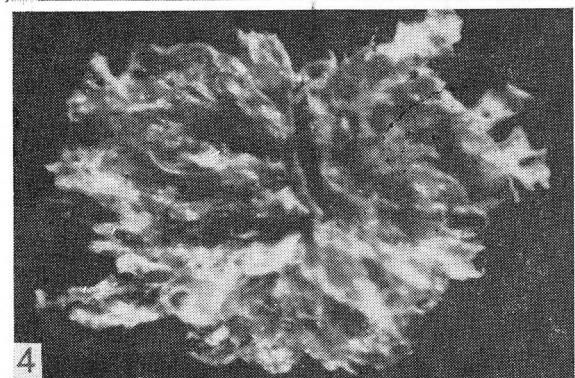
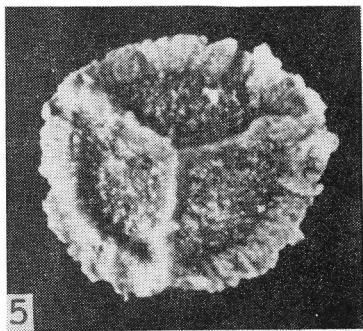
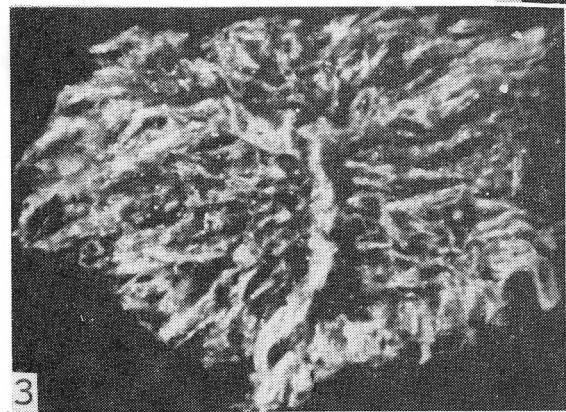
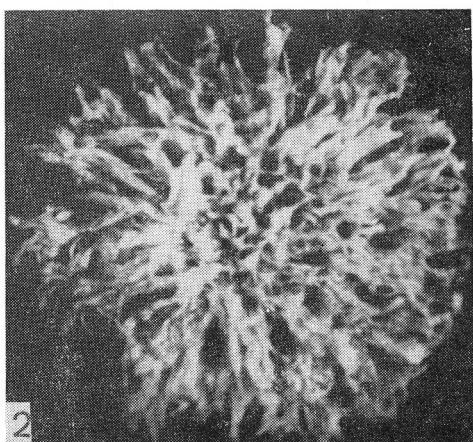
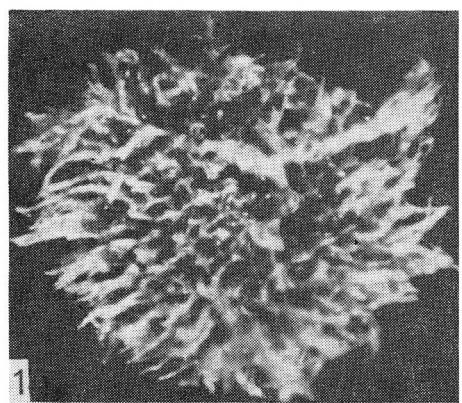


Plate VII

*Henrisporites triassicus* Kozur

- 1a. Depth 1122.0 m, proximal side; IG 507/89/79 M,  $\times 100$
- 1b. Distal side
2. Depth 1122.0 m; IG 507/87/79 M,  $\times 100$

*Henrisporites delicatus* Marcinkiewicz

3. Depth 1115.10 m, spineless specimen; IG 507/110/79 M,  $\times 100$
- 4a. Depth 1115.10 m, proximal side; IG 507/113/79 M,  $\times 100$
- 4b. Distal side with single spines



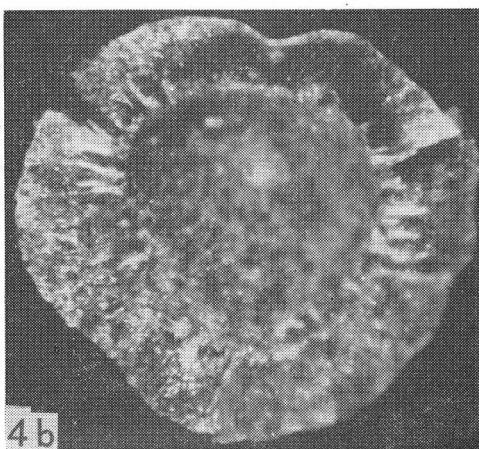
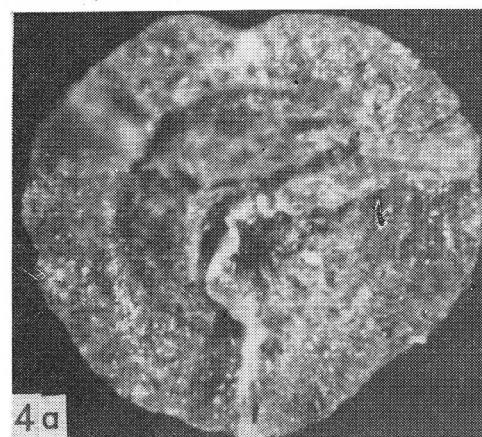
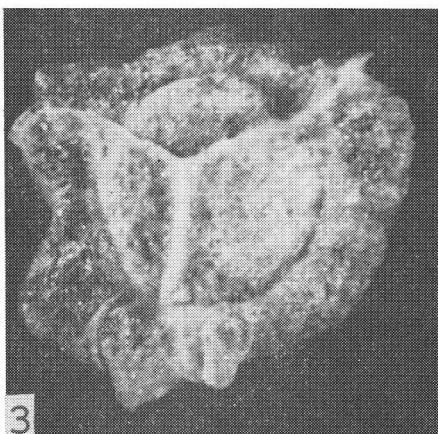
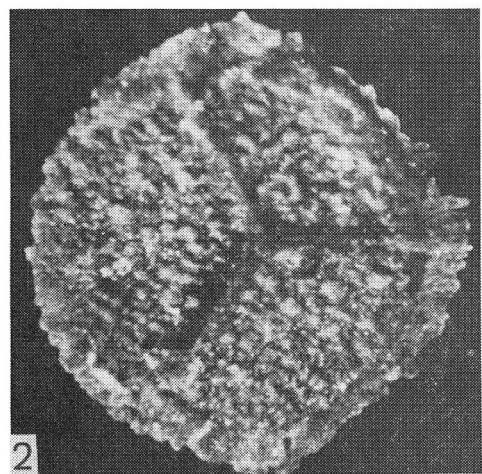
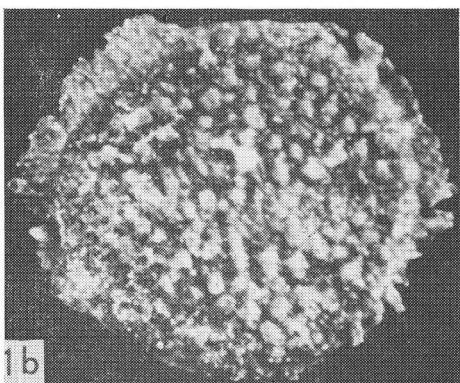
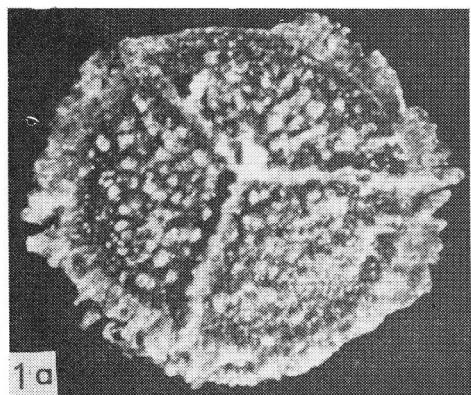


Plate VIII

*Henrisporites delicatus* Marcinkiewicz

1. Depth 1115.10 m, specimen with single spines; IG 507/112/79 M,  $\times 100$
2. Depth 1115.10 m, spineless specimen; IG 507/111/79 M,  $\times 100$
- 3a. Depth 1115.10 m, proximal side, specimen with spines; IG 507/105/79 M,  $\times 100$
- 3b. Distal side
4. Depth 1115.10 m, spineless specimen; IG 507/114/79 M,  $\times 100$



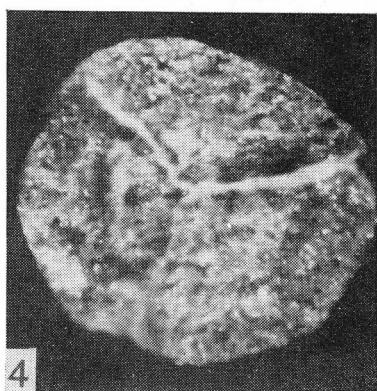
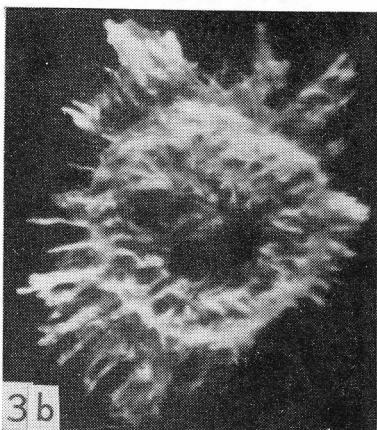
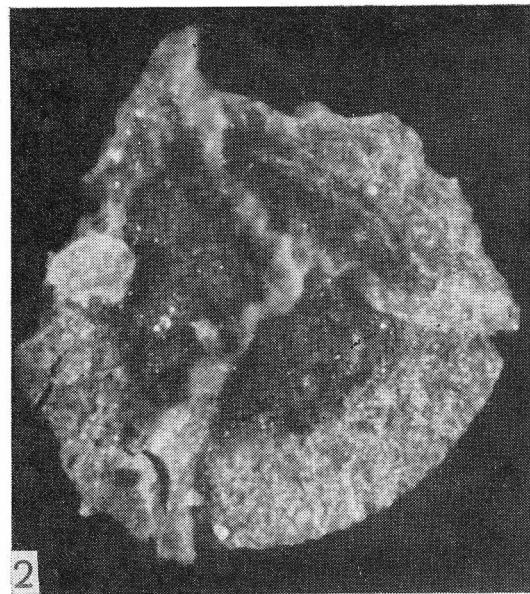
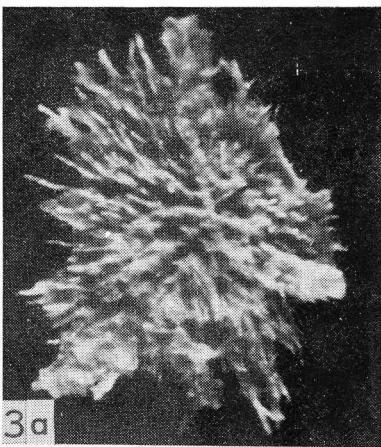
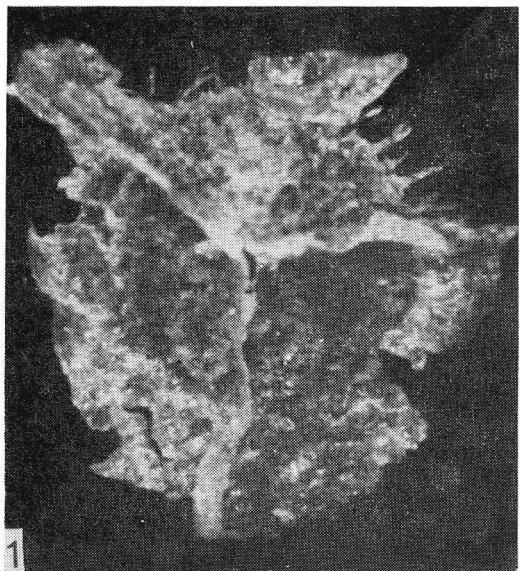


Plate IX

*Henrisporites delicatus* Marcinkiewicz

1. Depth 1115.10 m, in transmitted light; IG 507/a-14/80 M,  $\times 100$
2. Depth 1115.10 m, in transmitted light; IG 507/a-13/80 M,  $\times 100$
3. Depth 1115.10 m, in transmitted light; IG 507/a-16/80 M,  $\times 100$
- 4a. Depth 1115.10 m, proximal side; IG 507/109/79 M,  $\times 100$
- 4b. Distal side with single spines

*Tenelisporites marcinkiewiczae* Reinhardt et Fricke

5. Depth 1115.10 m; IG 507/78/79 M,  $\times 100$



