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# PRESERVATION OF SKELETAL MICROSTRUCTURE IN FOSSIL SCLERACTINIA

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This paper presents the results of investigations on the microstructure and chemical composition of the skeletons of fossil hermatypic scleractinian corals (Lower Aptian). In the specimens examined, two modes of preservation of skeletal microstructure have been observed: one — in which aragonite is preserved, and the other in which it is replaced by silica.

**Key words**: Scleractinia, Lower Cretaceous, aragonitic skeleton, silification.
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## INTRODUCTION

The specimens of *Latusastraea exiguis* (de Fromentel, 1862) on which this study is based come from two regions:

1) from Grodziszcze conglomerates of Lower Aptian age. These conglomerates occur in the external Flysh zone of the Polish Carpathians (Morycowa 1964);

2) from marls and sandy marls of Lower Aptian age from the Romanian Eastern Carpathians (Morycowa 1971).

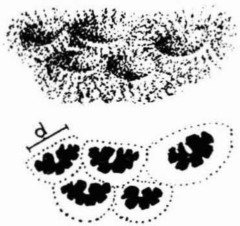
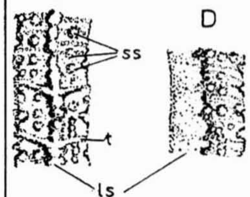
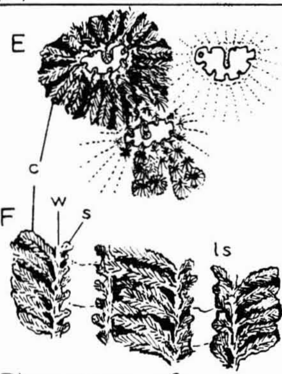
The corals from the Polish Carpathians are penesynchronically redeposited. The corals from the Romanian Carpathians occur in their life position.

Twenty specimens of the species under consideration have been investigated in thin sections with an optical microscope (pl. 9, Table 1), and in broken and polished sections with a scanning electron microscope (pls 9, 10, 12). The chemical and mineralogical composition of the skeletal elements have been determined by chemical, infrared and x-ray analyses (figs 1, 2; pls 11 and 12).

It is known that the skeleton of all Recent Scleractinia is composed of argonite. The fundamental elements are aragonite fibres. The aragonite precipitated by Recent hermatypic and ahermatypic corals contains a considerable amount of strontium — up to 0.88%, and many other trace elements (eg.: Thompson and Livingston 1970; Montanaro-Gallitelli, Morandi and Pirani 1973; John 1974).

Table 1

Morphology and microstructure of *Latusastraea exiguis* (de Fromentel, 1862), emend. Morycowa, 1971

| Syst. Family | Syst. Genus | Morphology of calices (A) corallites in transverse section (B) | Radial elements (costo — septa) | Microstructure within skeleton: in transverse (E) and longitudinal (F) sections | References |
|---|---|---|---|---|---|
| Heterocoeniidae Oppenheim, 1930 emend. Alloiteau, 1962 | Latusastraea d'Orbigny, 1850 emend. Morycowa, 1971 | A B   Plocoid colony. Colony surface between calices granulated. Diameter of calices (d): 0,9 – 1,3 (1,5) mm | C D   Septa – except one – weakly developed; vertically discontinuous, sometimes reduced to spines. Bilateral symmetry | E F   Diameters of: 1. simple trabeculae: 60–120 µm; 2. compound trabeculae on perithecal surface (granules): 160–320 µm | 1. Pleurocoenia exiguis de From.; E. de Fromentel, 1862 – 1887, Pl. 131, fig. 1, 1a, 1b France (Vaucluse): Lower Aptian<br>2. Latusastraea exiguis (de From.); E. Morycowa, 1964, p. 69 – 70, pl. 20, fig. 3a, 3b.<br>3. Latusastraea provincialis (d'Orb.); E. Morycowa, 1964, p 70 – 71, Pl. 19 fig 3a, 3b; pl 20, fig 4.<br>2, 3 Polish Carpathians: Barremian – Lower Aptian<br>4. Latusastraea exiguis (de From.); E. Morycowa, 1971, p. 72 – 74, pl. 14, fig 1; text – fig. 21 – 23 Roumanian Carpathians: Lower Aptian |

*c* costa, *ls* long septum, *s* septum, *ss* septal spine, *t* tabulae, *w* wall

It is generally accepted that all or almost all fossil Scleractinia had aragonite skeletons (Sorauf 1971; Cuif 1972; Montanaro-Gallitelli 1973; Montanaro-Gallitelli, Morandi and Pirani 1973; Beauvais 1973). In most cases however, subsequent diagenetic processes have altered the primary mineralogical and, locally, also the chemical composition of skeletons. Such processes might have altered the structure and texture of skeletons.

From preserved relics of primary microstructure one can reconstruct the original microstructure of skeleton, which is so important for taxonomy. On the other hand, the chemical composition and effects of diagenetic processes give an insight into the life conditions of organisms and reveal the nature of post-depositional alterations.

## RESULTS

Two modes of preservation of the skeletal microstructure have been observed in the specimens investigated: one — in which aragonite is preserved and the other in which it is replaced by silica.

The non-redeposited corals — from the Romanian occurrences have well preserved skeletons (pl. 9) which are made up partly of aragonite. This is indicated by the infrared spectra of carbonate minerals (fig. 1). These skeletons reveal the

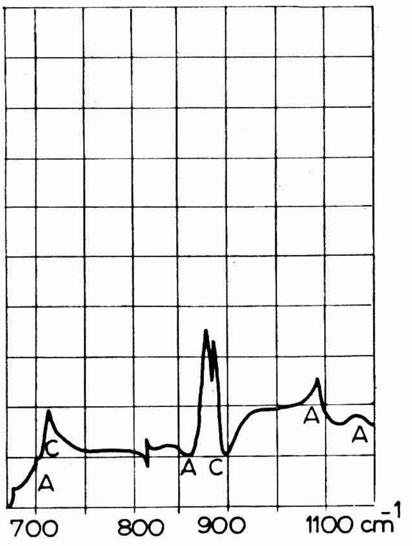


Fig. 1

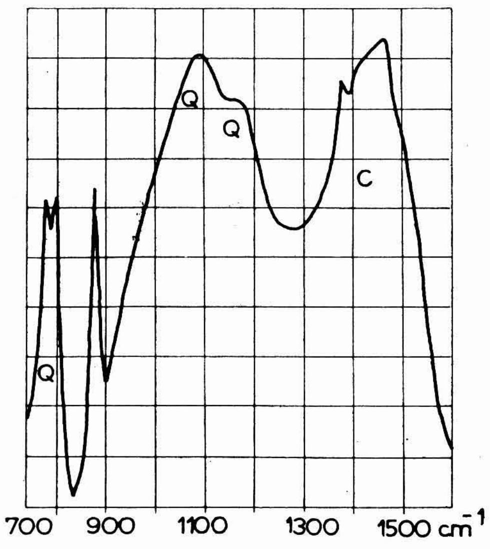


Fig. 2

Fig. 1. Infrared spectrum of aragonite and calcite in the skeleton of *Latusastraea exiguis* (de From.). Romanian Eastern Carpathians (Rarău) — Lower Aptian. *A* — aragonite; *C* — calcite.

Fig. 2. Infrared spectrum of calcite and silica in the skeleton of *Latusastraea exiguis* (de From.). Polish Outer Carpathians (Jastrzębia) — Lower Aptian. *C* — calcium; *Q* — silica.

presence of 0.06%—0.48% Sr. Such a composition indicates that the preserved microstructure is the primary one.

I emphasize this preservation to compare the original aragonite microstructure with the microstructure of the specimens of the same species which were subject to metasomatic replacement by silica. Examples of such replaced and preserved microstructure can be found among the corals from Grodziszcze conglomerates.

The infrared diagram (fig. 2) and the results of x-ray microanalyses (pl. 11; pl. 12: *b*, *c*) show the intensity ratio of calcium and silica within the skeleton of *Latusastraea exiguis* from Grodziszcze beds. The skeleton is partly or totally replaced by silica. Where the skeleton is partly replaced by silica — the most silicified portions are those related to the axes of trabecules (pl. 12: *c*). The majority of cases show skeletal elements with uniform and almost complete silification and well preserved microstructure (pl. 9: 4, 5; pl. 11).

## CONCLUSIONS

1. The microstructure of the skeleton of *Latusastraea exiguis* (de Fromentel) preserved in silica, reflects the primary aragonite microstructure.

2. The process of silification belongs to very early diagenetic transformations (Bathurst 1971; Dapples 1967). Such a process occurred under subaqueous conditions and preceded neomorphic transformations of the skeletons.

3. The silica might have originated from sponge spiculae. It should be noted that the siliceous spiculae are of common occurrence in the Grodziszcze beds.

4. The routes of migration of silica were provided by central empty parts of corallites or by voids between the corallites. Other routes might have been the axes of trabeculae.

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## EXPLANATION OF THE PLATES 9—12

### Plate 9

*Latusastraea exiguis* (de Fromentel)

*1—4* Romanian Eastern Carpathians (Rarău), Lower Aptian,
*5—6* Polish Outer Carpathians (Jastrzębia), Lower Aptian

1. *a* fragment of ramose colony; *b* higher magnification of the same specimen.
2, 3. Transverse sections of corallites with peritheca, showing well-preserved microstructure; centres of calcification are marked as dark areas.
4. Scanning electron micrograph of aragonite crystals in transverse section of trabecula (peritheca).
5. Transverse thin section of colony with well preserved microstructure (aragonite replaced by silica).
6. Transverse thin section of corallite (aragonite replaced by silica).

### Plate 10

*Latusastraea exiguis* (de Fromentel)

Romanian Eastern Carpathians (Rarău), Lower Aptian, SEM micrographs
*a* transverse polished section of corallite; *b*, *c* trabecular structure of costae; *d* center of trabecula.

## Plate 11

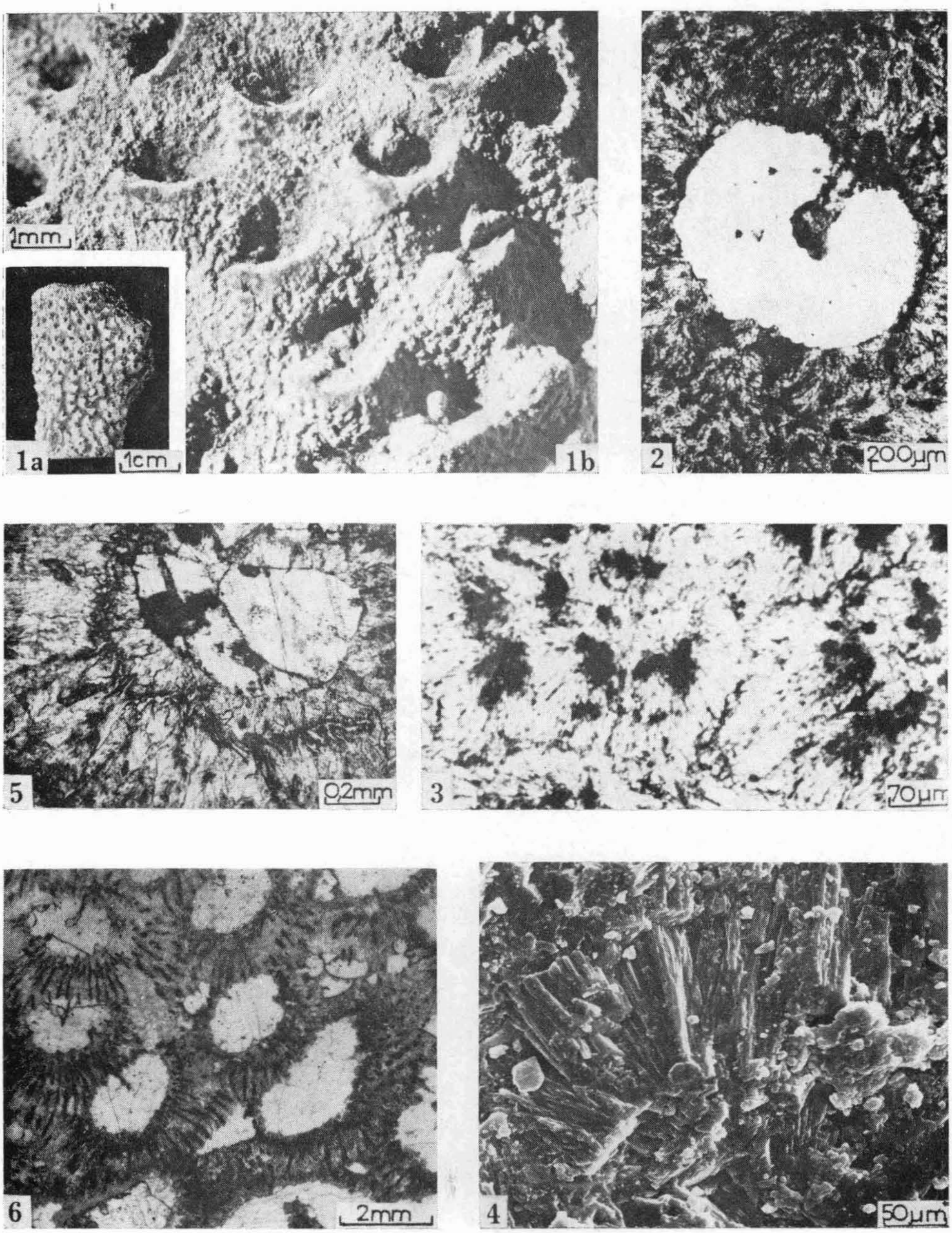
*Latusastraea exiguis* (de Fromentel)
Polish Outer Carpathians (Jastrzębia), Lower Aptian

1. *a* Ca x-ray image of transverse section of corallites; *b* Ca x-ray image of septum and interskeletal space; *c* backscattered electron image (composition) with Ca line profile; *d* Si x-ray image of transverse section of corallites; *e* Si x-ray image of septum and interskeletal space; *f* backscattered electron image (composition) with Si line profile of the same septum.

## Plate 12

*Latusastraea exiguis* (de Fromentel)
Polish Outer Carpathians (Jastrzębia), Lower Aptian

*a* scanning electron micrograph of broken transverse section of two septa; *b* Ca x-ray image; *c* Si x-ray image of the same septa; *d* scanning electron micrograph of trabecular centers (the same septum).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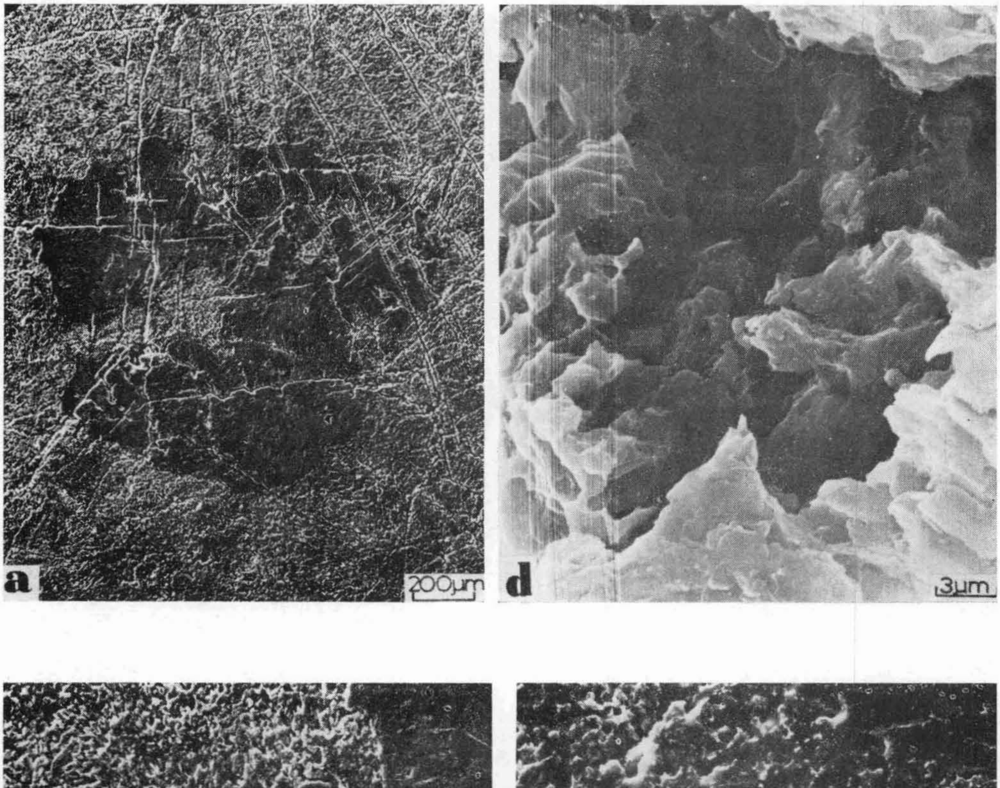
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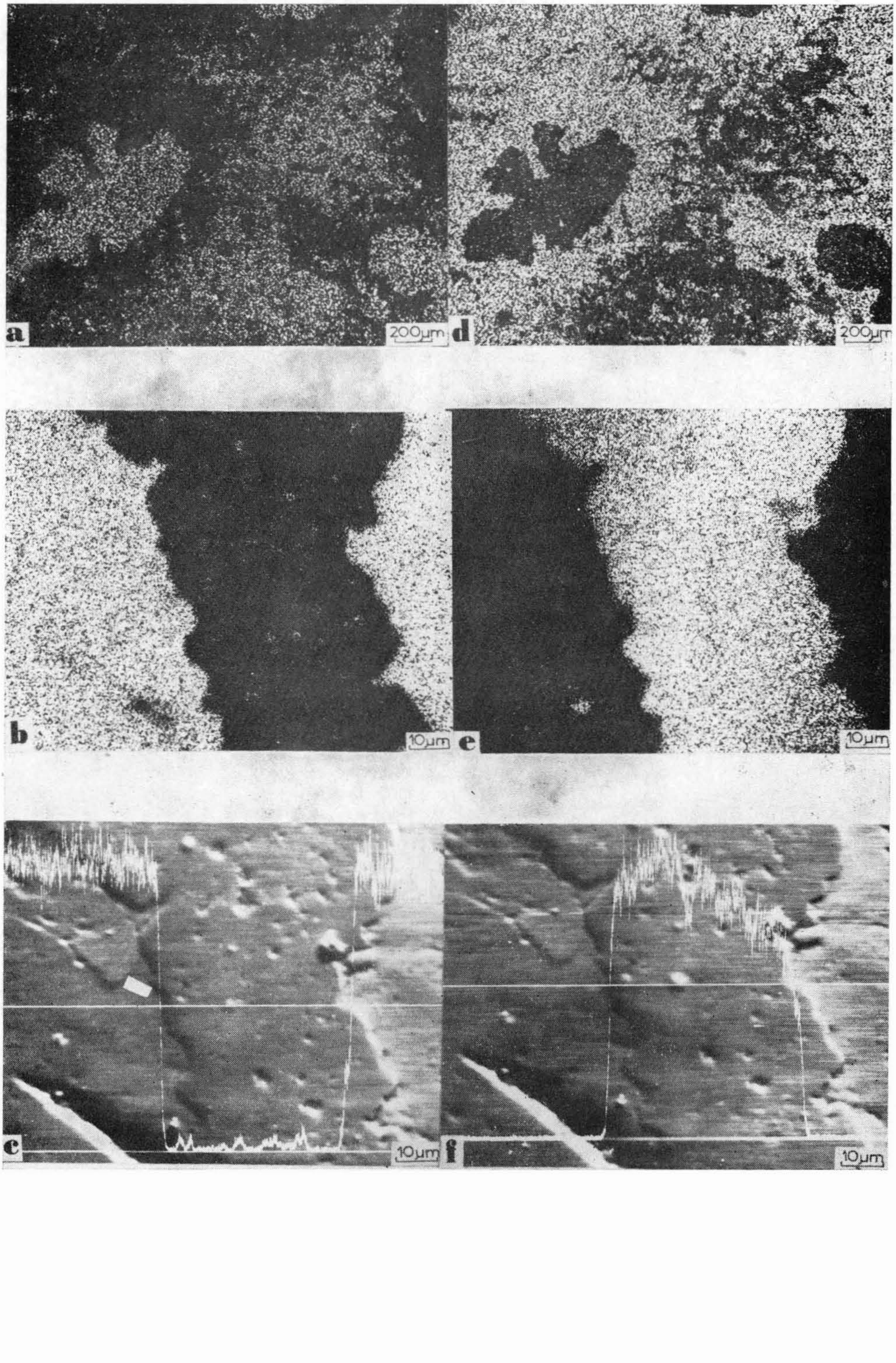
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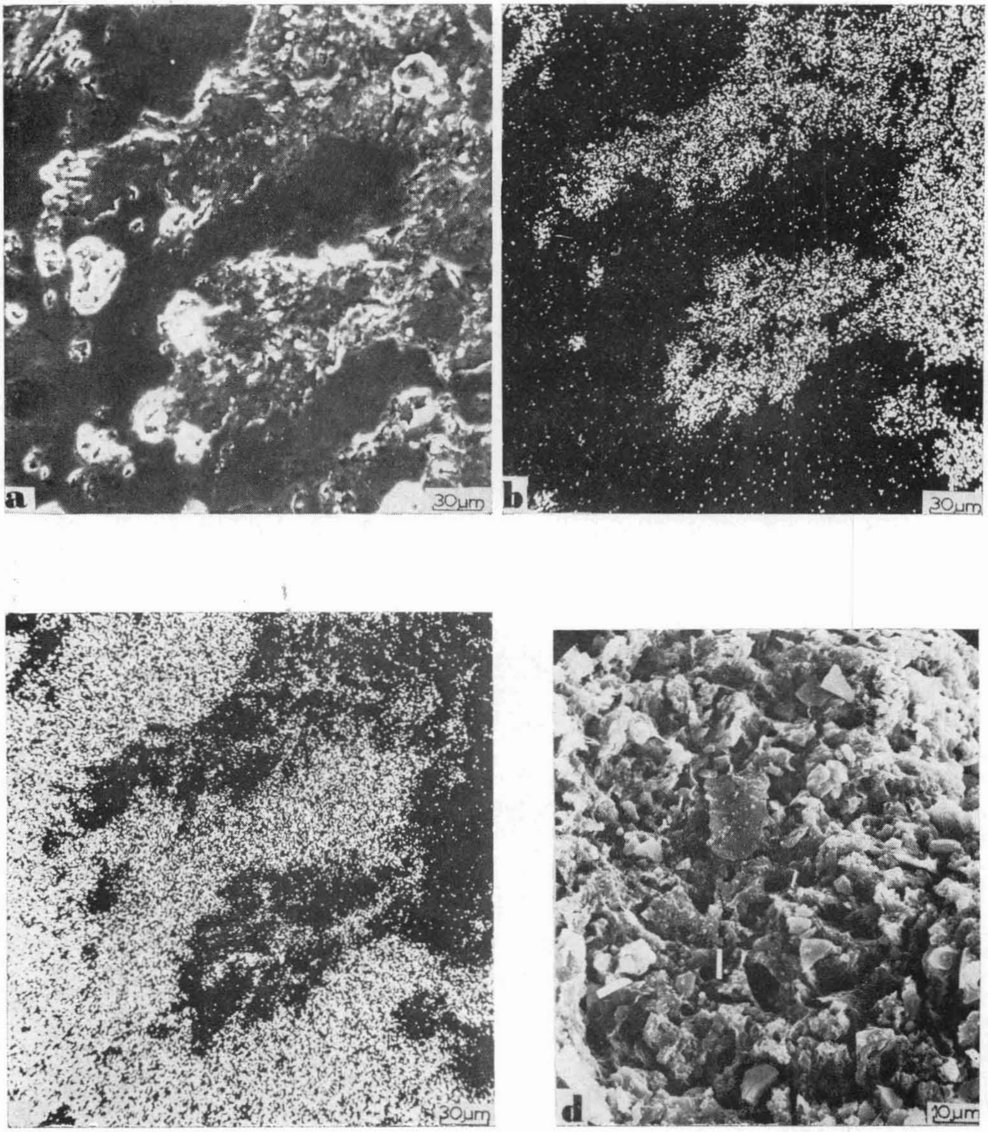
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