ROCZNIK POLSKIEGO TOWARZYSTWA GEOLOGICZNEGO
ANNALES DE LA SOCIÉTÉ GÉOLOGIQUE DE POLOGNE

Vol. XLVIII — 3/4: 533—536 Kraków 1978

Marian A. GASIŃSKI, Anna HANUSIAK, Ryszard TYRANKIEWICZ *

THE Y-MODULATION METHOD IN INVESTIGATIONS OF THE STRUCTURES OF MICROFOSSILS IN SEM

(Pl. I—II and 1 fig.)

Wykorzystanie elektronów wtórnych do modulacji składowej pionowej wiązki monitora w badaniach struktur mikroskamieniałości w mikroskopie skanningowym

(Pl. I—II i 1 fig.)

Abstract. Described is the little known Y-modulation method in SEM. This method allows the elimination of excess information, while at the same time gives as added information about the structure of the specimen. Paper describes Y-modulation method in regards to the investigations of structures of microfossils.

With reference to the simplified description of the operation of the SEM, one can state, that the image projected on the screen by the beam of electrons is characterized by a large amount of details and high resolution. The image is formed through light and dark points, which present the details of the specimen. In some instances an excess amount of details is not necessary and one can use in these cases the Y-modulation method.

In this method an image is obtained, which contains a lesser amount of details to „bring into relief" important surface features. The image here is formed along a line of equal brightness.

The beam of electrons emitted from the electron gun of the monitor is focused on the surface of the luminescent screen. The energy of the electrons striking particles of the phosphor powder causes their luminescence. The image of the electron beam observed on the screen has a point appearance.

* Jagellonian University, Institute of Geological Sciences, Oleandry St. 2a (M.A.C.), Zoological Institute, Laboratory of Electron Microscopy, Krupnicza St. 50 (A.H., R.T.)

In the conventional method this point carries information about the position of the electron beam on the surface of the sample, as well as information on the amount of secondary electrons emitted from the surface. Therefore in the formation of a conventional image, there exists a brightness modulation i.e. when the surface of the specimen emitts a larger amount of secondary electrons a lighter point appears, when a smaller amount is emitted a darker point is formed.

In the Y-modulation method, only the position of the electron beam on the surface of the specimen is determined. However information about the amount of secondary electrons emitted from the surface of the specimen is represented by the deflection of the point in the vertical axis.

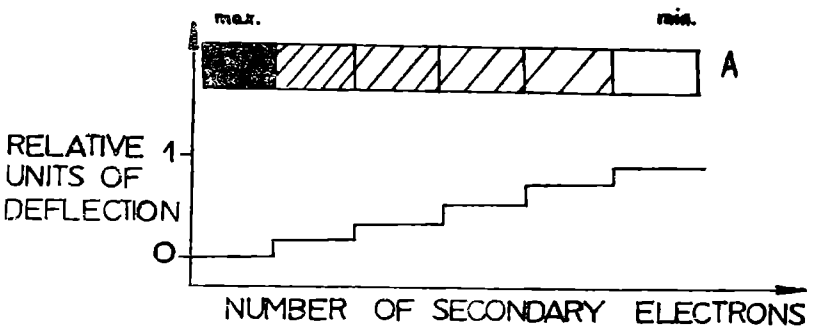


Fig. 1. Diagram showing relative measure of secondary emission (A-rectangles denotes degree of brightness)

Fig. 1. Wykres przedstawiający względną miarę emisji wtórnej (A-prostokąty oznaczają stopień jasności)

Through regulation of the scanning lines to several hundred (100—200 after Hayat, 1975) we eliminate a unnecessarily large amount of details. If we give one extreme level a value of „0" and a second a value of „1" we can mark intermediate levels as having a value of between „0" and „1" (fig. 1). In this manner we hold a relative measure of the secondary emission.

The above described method is especially valuable in analizing surfaces, which are poorly morphologically differentiated. The Y-modulation image is the supplement of the information contained in the conventional image (Pl. I—II).

This image signalizes the surface structure of the specimen, whereas the Y-modulation method by giving a lesser amount of information offers possibility of bringing into view more important features.

The Y-modulation method may be applied for the investigations of microfossils, however to date has been described by only a few authors (Hay, 1971). In connection with investigations of Hemleben (1969) it is evident (particularly in the case of planktic foraminifers) that the microstructure of the test is a very important diagnostic feature. Using the Y-modulation method we may define the microstructure of foraminiferal test more precisely. In addition we may define the degree of con-

vexity and concavity of morphological elements of foraminiferal tests. It seems, that this method may be also adapted for use in other branches of natural sciences.

Acknowledgments. The authors would like to thank Dr. Wincenty Kilarski for allowing the use of the SEM and for critical reading of manuscript. We would also like to thank Dr. Stanisław Geroch for inspiring us to describe this method, and Mr. Michael Kaminski for his help in translation of this text.

Manuscript received XII 1977
accepted IV 1978

REFERENCES — WYKAZ LITERATURY

Gasiński M. A. (1977). Elektronowy mikroskop skaningowy w badaniach mikropaleontologicznych. *Prz. geol.* 2.

Hay W. W. (1971). Scanning Electron Microscopy and Information Transfer in Systematic Micropaleontology. *Scanning Electron Microsc. Syst. evol. appl. Proc. Int. Symp. Reading Engl. 1970, London,* Acad. press pp. 123—143.

Hayat M. A. (ed.) (1975). Principles and techniques of Scanning Electron Microscopy (biological applications). Vol. 3.

Hemleben Ch. (1969). Zur Morphogenese planktonischer Foraminiferen. *Zittelia-na* 1, pp. 91—133.

STRESZCZENIE

W artykule zasygnalizowano mało dotychczas znaną metodę wykorzystania elektronów wtórnych do modulacji składowej pionowej wiązki monitora w badaniach struktur mikroskamieniałości w mikroskopie skaningowym. Metoda ta, w odróżnieniu od metody konwencjonalnej w SEM, polega na tworzeniu obrazu okazu z linii o jednakowej jasności, przy równoczesnym zmniejszeniu ilości linii skanujących (ilość ta może być dowolnie regulowana). W uzupełnieniu do metody konwencjonalnej (Gasiński, 1977) ta metoda może wzbogacić naszą informację o strukturze mikroskamieniałości (zwłaszcza przy powierzchniach o małym zróżnicowaniu morfologicznym).

EXPLANATION OF PLATES — OBJAŚNIENIE PLANSZ

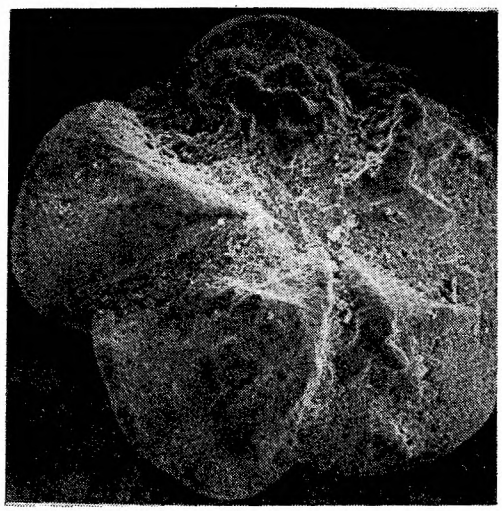
Plate I — Plansza I

Fig. 1. *Rotalipora cushmani* (Morrow) × 110, (a-in Y-modulation)
Fig. 2. *Praeglobotruncana turbinata* (Reichel) × 120 (b-in Y-modul.)
Fig. 3. *Hedbergella brittonensis* Loeblich et Tappan × 200 (b-in Y-modulation)

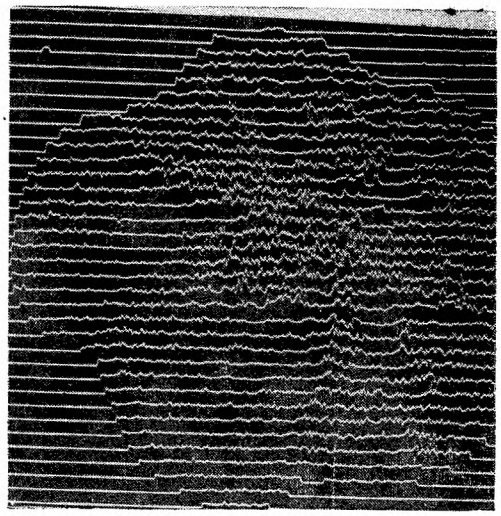
Plate II — Plansza II

Fig. 1. *Rotalipora cushmani* (Morrow) × 110, (a-in Y-modulation)
Fig. 2. Radiolaria × 200 (b, a-in Y-modulation, gradually reduction of thescanning lines, stopniowa redukcja ilości linii skanujących)
Fig. 3. Coccoliths (kokolity) × 10 000 (a-in Y-modulation)

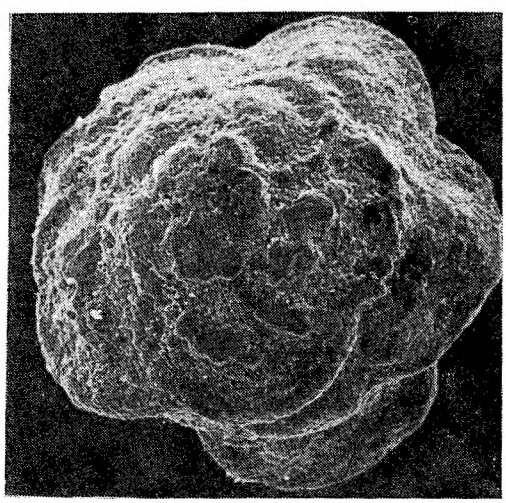
SEM-photomicrographs were made in the Laboratory of Electron Microscopy (Zoological Institute of Jagellonian University) by using SEM JEOL-JSM-35



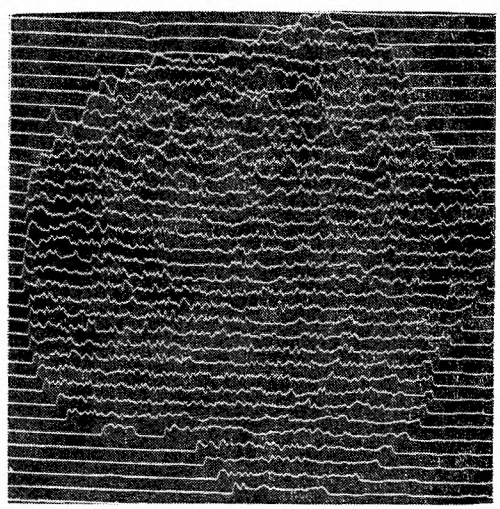
1a



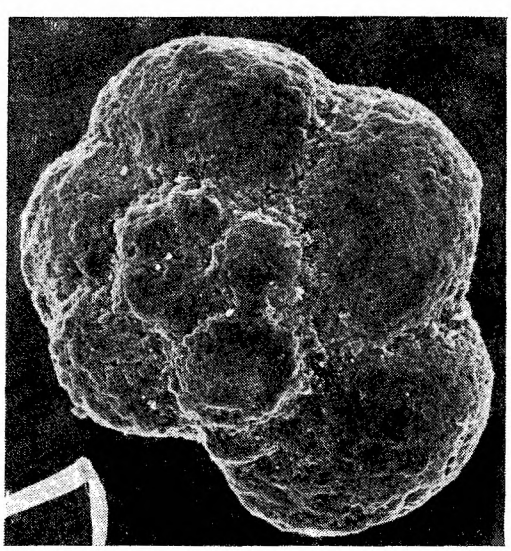
1b



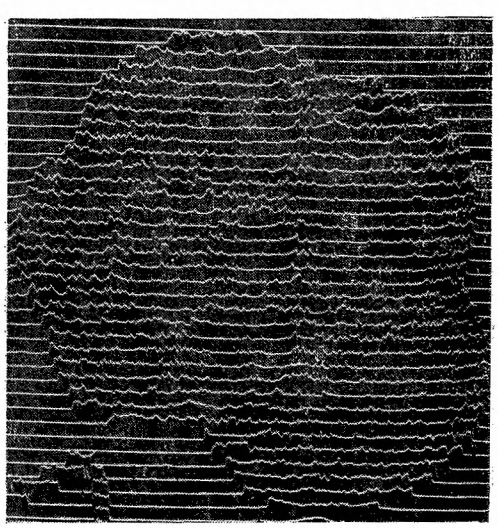
2a



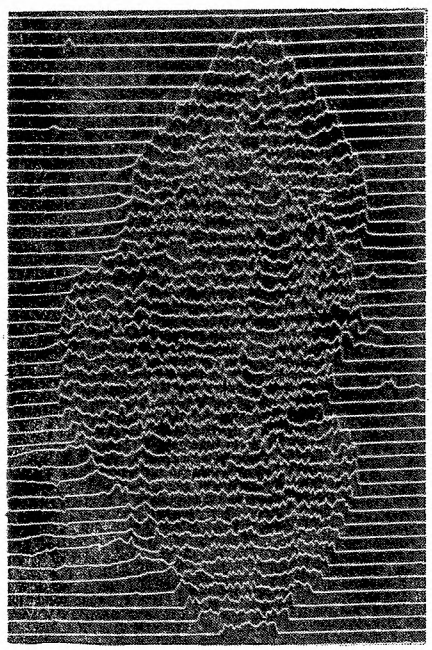
2b



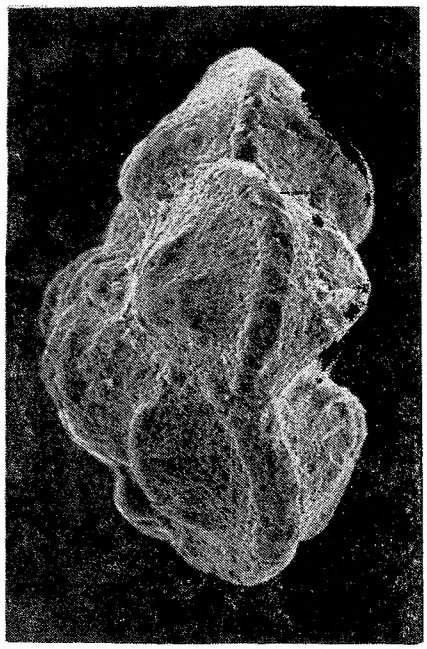
3a



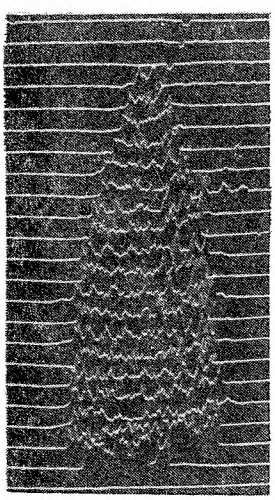
3b



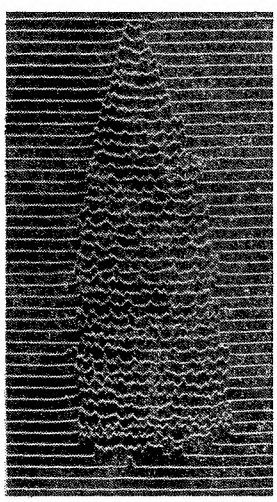
1a



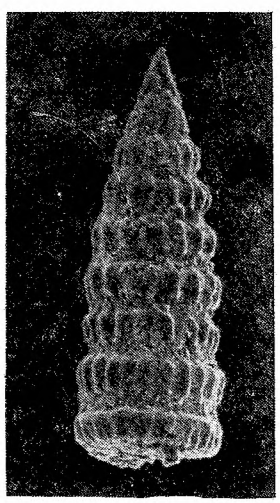
1b



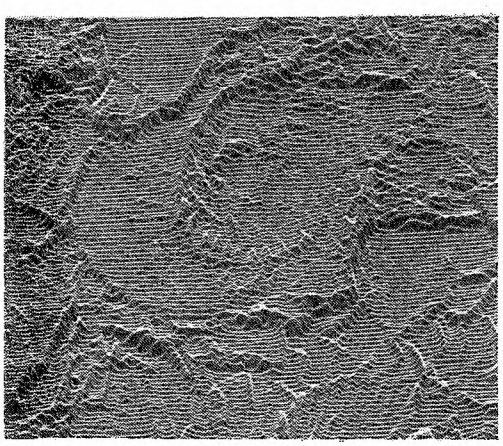
2a



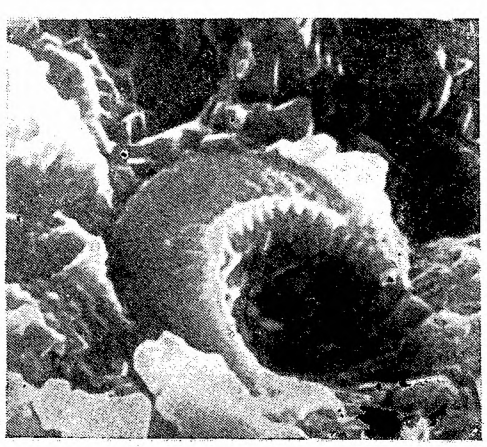
2b



2c



3a



3b