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# A REVISED METHOD FOR OBSERVING THE SAME NANNOFOSSIL SPECIMENS WITH SCANNING ELECTRON MICROSCOPE AND LIGHT MICROSCOPE

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*Key-words:* New investigation technique, Scanning electron microscope and light microscope, Calcareous nannofossils.

*Riassunto.* Viene descritto un nuovo metodo per l'osservazione degli stessi esemplari di Nannofossili calcarei al microscopio elettronico a scansione e al microscopio ottico. Con questa tecnica è possibile ottenere una completa descrizione delle caratteristiche diagnostiche dei Nannofossili calcarei e di altri microfossili.

*Abstract.* A new method for the observation of the same nannofossil specimens with scanning electron microscope and light microscope, involving the use of a grid, is described. This technique provides a complete analysis of the morphological diagnostic characteristics of calcareous nannofossils and other microfossils.

## Introduction.

In the past few decades calcareous nannofossils have been increasingly studied both for biostratigraphic and paleoceanographic purpose.

Investigation techniques used for nannofloral assemblages analysis include scanning electron microscope (S.E.M.) and light microscope (L.M.). Both methods show advantages and disadvantages. Undoubtedly S.E.M. provides a better resolution of nannofossil ultrastructure, but it is time consuming and unsatisfactory for diagenized (dissolved and / or overgrown) specimens. On the other hand, L.M. requires a rapid and simple preparation, enables a faster investigation and it is successful even for strongly diagenized nannofloras, but prevents the investigator from a complete observation of the ultrastructure.

Most of the nannofossil biostratigraphers apply L.M. techniques for routine investigation, while taxonomists usually prefer S.E.M. Therefore problems may arise when trying to identify species described with S.E.M. observing nannofossils with L.M.

Consequently the best method to study nannofloras should include both S.E.M. and L.M. observation of the same specimens.

In the literature a few methods for the examination of the same nannofossils with both S.E.M. and L.M. are described. Perch-Nielsen (1967) introduced a method which allows L.M. and T.E.M. (Transmition Electron Microscope) study of the same nannofossil specimen. Thierstein et al. (1971) proposed a method for observing the same small object first under S.E.M. and then with L.M. Moshkovitz (1974, 1978) and Greig (1983) showed methods which enable the study of the same specimens first with L.M. and then with S.E.M. A technique for observation of the coccoliths with L.M., T.E.M., and S.E.M. was proposed by Mai (1983).

Recently Gallagher (1988) developed a technique for viewing the same nannofossil specimen in L.M. and S.E.M. using standard preparation materials.

The new method that we describe herein resambles the technique proposed by Thierstein et al. (1971) in that samples are first observed with S.E.M. and later with L.M. However, this new method is much faster because of the use of copper grids (Fig. 1) allowing an easier location of specimens.

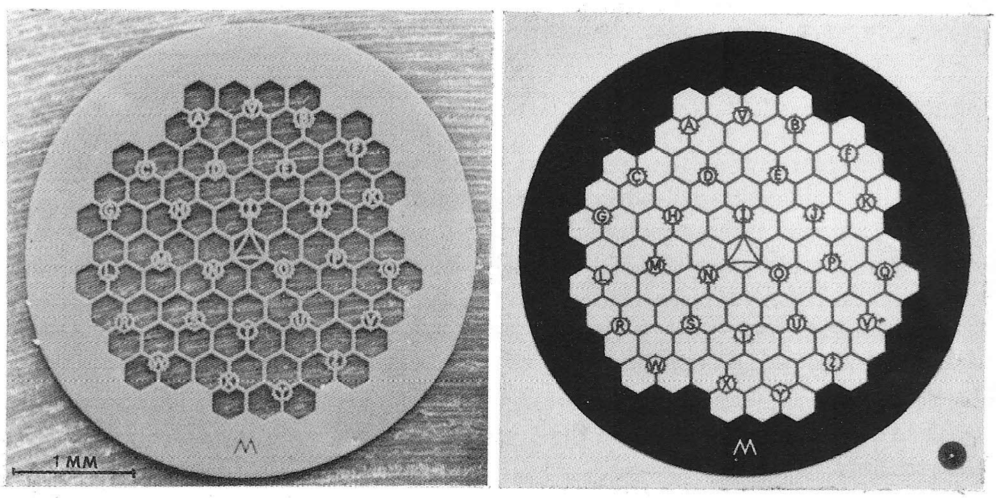


Fig. 1 - Copper grid (type H-6, Maxtaform Finder Grid) used for the proposed technique.

## Method of preparation.

A copper grid (type H-6, Maxtaform Finder Grid) is glued on a circular microscopic cover glass with Kodak photo resist glue (Fig. 2). A nannofossil suspension is then dried on the cover glass plus grid. It is preferable to use a very few drops of diluted

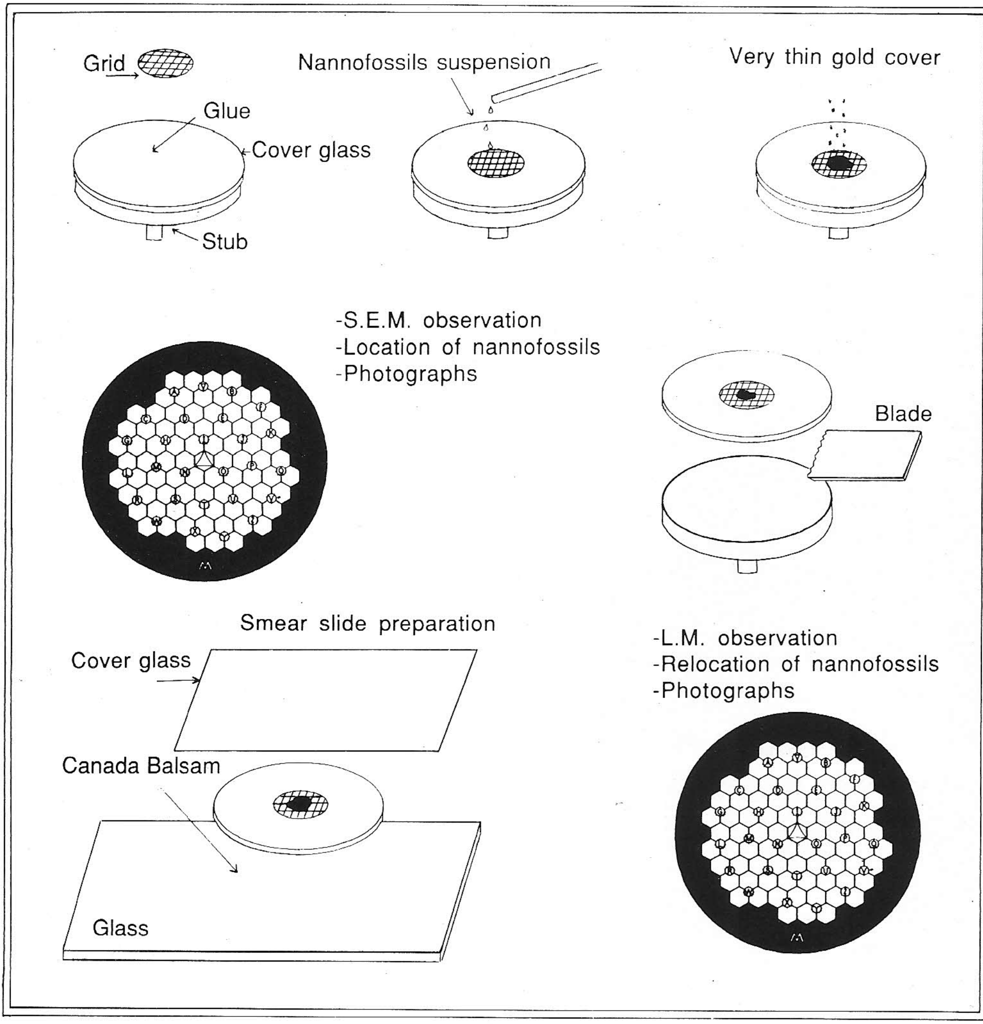


Fig. 2 - Schematic illustration of operating phases.

suspension to make easier the observation. Attention should be paid when coating the sample for S.E.M. analysis: only a very thin layer of gold must be used in order to allow a good transparency for subsequent L.M. observations.

During S.E.M. investigation, nannofossils are carefully located with respect to the grid coordinates and photographed. Particular attention must be paid also to recording the position of other particles which could facilitate the relocation within the cell.

After the sample has been studied with S.E.M. the cover glass is carefully removed with a blade and mounted on a slide with Canada Balsam (Fig. 2).

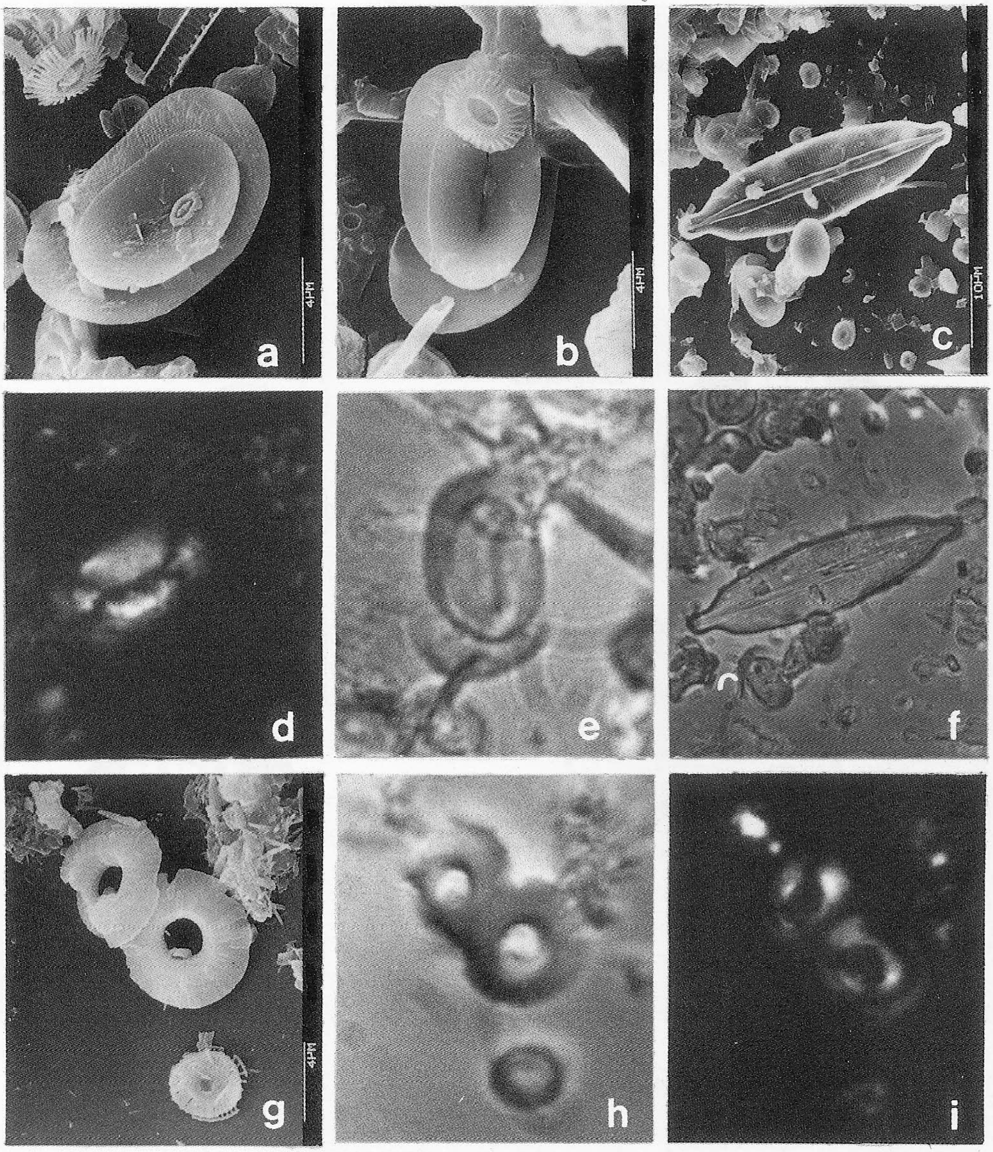


Fig. 3 - Nannofossils and diatom specimens observed both with S.E.M. and L.M. a, d) *Helicosphaera carteri* (Wallich); a = S.E.M.; d = L.M., crossed-nicols; 2400 X. Sample TYRO-87/45-6-62 (Holocene). b, e) *Helicosphaera carteri* (Wallich) and *Emiliania huxleyi* (Lohman); a = S.E.M.; d = L.M., transmitted light; 2400 X. Sample TYRO-87/45-6-62 (Holocene). c, f) Pennate diatom; c = S.E.M.; f = L.M., transmitted light; 800 X. Sample TYRO-87/45-6-62 (Holocene). g-i) *Umbilicosphaera sibogae* (Weber-van Bosse) and *Emiliania huxleyi* (Lohman); g = S.E.M.; h = L.M., transmitted light; 2400 X; i = L.M., crossed-nicols; 2400 X. Sample BAN- 84/23-3-90 (Late Pleistocene).

The observation with L.M. should reveal a light green color when the sample is viewed in transmitted light. The identification of nannofossils determinated with S.E.M. is very fast. In fact, the specimens are easily relocated through grid coordinates, position of other particles, and S.E.M. photographs. Being gold coating sufficiently thin, the nannofossil characteristics can be analysed with transmitted light and crossed nicols (Fig. 3).

## Discussion and conclusions.

The method proposed for the analysis of the same nannofossils with S.E.M. first, and then with L.M., resulted in a fast successful technique.

It has been applied to tens of samples and we could easily relocate under the L.M. all the specimens observed with S.E.M. This method cannot be adopted for quick routine investigations but we believe it very useful for a correct L.M. identification of species described solely with S.E.M. Moreover, the technique is also conceived for a complete and detailed description of new taxa in order to attein a taxonomy avoiding misinterpretations due to the instrumental viewing medium.

The method can be applied to other microfossils such as silicoflagellates and diatoms as shown in Fig. 3.

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## PUBBLICAZIONI DI CARATTERE GENERALE

McKenzie K. G. (Ed.) (1987) - **Shallow Tethys.** *Proceed. Int. Symp. Shallow Tethys 2, Wagga Wagga.* Vol. di 544 pp., $ 58.50, A.A. Balkema, Rotterdam.

Il volume comprende la maggior parte (una quarantina) delle comunicazioni presentate al 2° Congresso Shallow Tethys, tenutosi a Wagga Wagga in Australia nel settembre 1986. Lo spettro temporale interessato è molto vasto, dal Paleozoico al Pliocene.

Il Paleozoico è discusso in una decina di articoli, alcuni dei quali dedicati alla paleobiogeografia di invertebrati (Molluschi, Brachiopodi) e vertebrati, soprattutto Placodermi, in funzione della interpretazione della Tetide paleozoica come barriera o via di migrazione delle faune considerate. Altri articoli sono dedicati invece alla nozione stessa di Tetide durante il Paleozoico.

Il Mesozoico, considerato in dodici articoli, è più marcatamente di indirizzo paleobiogeografico e risulta interessante per un lettore europeo, in quanto sono considerati soprattutto aspetti biogeografici della Tetide orientale, che sono meno consueti per noi. Cito ad esempio l'articolo di Yeats et al., che tratta del Westralian Superbasin e che sintetizza tutta una serie di conoscenze regionali, difficili da raggruppare per un lettore europeo.

Infine il Cenozoico rappresenta il comune denominatore di 14 articoli, tutti basati sul significato biogeografico di associazioni fossili. Sei articoli considerano comunità di Molluschi, sei associazioni di Ostracodi, gli altri Briozoi e Mammiferi carnivori.

Questo volume dà voce anche alla posizione, non del tutto minoritaria in Australia, che stenta a vedere la Tetide paleozoica come una via d'acqua a crosta oceanica. Sulla scia dell'insegnamento di Carey e della sua teoria della Terra in espansione (qui ampiamente riassunta dallo stesso Carey e quindi di comoda consultazione), numerosi autori si chiedono se questo oceano non sia solo un mito. In questa strada iconoclasta alcuni come Ahmad si spingono sino a negare la presenza di un oceano, anche laddove sono conservati consistenti lembi obdotti di ofioliti mesozoiche, come nella catena himalayana.

L'interesse per il volume trascende quindi lo stretto ambito dei paleogeografi e consente ai "Tetidiani ortodossi" di rendersi conto di opinioni alquanto diverse. Certo è che si è fatto del mitico Oceano, sposo della mitica Tetide, il più grande poligamo della storia geologica. Perchè non solo ormai ha più mogli, da Paleotetide a Neotetide, ma anche gli vengono affibbiate delle Tetidi Cenozoiche, che in realtà sono gli oceani derivanti dalla disintegrazione del Gondwana, come ad esempio l'Oceano Indiano. Ma forse anche questa interpretazione non veniva esclusa nel pensiero di Neumayr e Suess quando introdussero il termine di Tetide: la grande via d'acqua in direzione est-ovest, che ha permesso i grandi scambi di organismi marini a nord del supercontinente di Gondwana.

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