USE OF MICROBEADS TO ESTIMATE THE ABSOLUTE ABUNDANCE OF NANNOFOSSILS

Hisatake Okada, Dept. of Earth Sciences, Yamagata University, Japan

Unless your project is purely biostratigraphical, and nothing else, it is very important to know the absolute abundance of nannofossils (number/volume of nannofossils per unit volume/weight of sediment) in each sample. Because of the minute size of nannofossils, however, we can not easily obtain an absolute "nannofossil number", as foraminiferal workers can. A realistic alternative for us is to get a relative abundance that can be used as a proxy for the absolute abundance. You can obtain the proxy abundance by counting nannofossils per given area of slide, but only if you can always make slides with uniform and consistent densities, which is almost impossible even for one person, and absolutely impossible between different workers.

Here I would like to introduce a new technique to obtain a proxy value for absolute abundance by mixing a measured weight of microbeads with the sample. The microbeads I have been experimenting with are *MB-10*; these are soda-ash glass spheres (s.g. 2.5g/cm^3) from 2 to 10 μm in diameter. These microbeads have been manufactured as a filler for precision casting. Most packages of microbeads on the market are manufactured for mixing with paint, for use on night-time reflective road markings, these usually contain larger beads (20-40 μm), and are not suitable for our purpose. MB-10 is a new package with a size distribution comparable to that of nannofossils.

Availability: MB-10, which will soon be widely available, is manufactured by Toshiba Ballotini Company, a joint venture between Toshiba (Japan) and Potters Industries Inc. (USA), and Ballotini is a trade name for their microbeads. You can buy MB-10 from distributors in various countries, and the price will be ca 40,000 yen ($320) per 10 kg package. Unfortunately, no smaller pack is offered (at least in Japan), although you may not need more than a few hundred grams of the stuff for your entire career. Please ask the following companies for the name of distributors.

Toshiba Ballotini Co. 3-3-10 Shiba, Minato-Ku, Tokyo 105, Japan.
Tel: 03-3455-2321; FAX: 03-3455-2923
Potter Industries Inc. 377 Route 17, South Hasbrouck Heights, NJ 07604, USA
Tel: 201-288-4700; FAX: 201-288-7696
Potters Ballotini Ltd. Pontefract Road, Barnsley, South Yorkshire, S71 1HJ, UK
Tel: 226-287591; FAX: 226-207615
Potters-Ballotini S. A. z.1. du Pont-Panay, Boite Postale 67, 03500, St. Pourcain-sur Sioule, France.
Tel: 70-45-9499; FAX: 70-45-5780
Potters-Ballotini Gmbh: Morschheimer Strasse 9, Postfach 1226, 6719, Kirchheimbolanden, Germany
Tel: 6352-8484; FAX: 6352-1853

PROCEDURE TO OBTAIN PROXY ABSOLUTE ABUNDANCE VALUE

1) Mix powdered sample with 5 to 10% (by weight) of the glass beads. If your sample is a nanno-ooze and tends to coagulate when wetted, mix a measured amount of carbonate-free clay to prevent coagulation. Both the powdered sample and microbeads have to be accurately weighed. This requires a precision balance with a resolution of 10^{-3}g.

2) Place the mixture into a centrifuge (or test) tube and add an adequate quantity of buffered distilled water.

3) Homogenize the muddy mixture by using a touch-mixer, and make a smear slide (or a spray slide if you like). [N.B. touch-mixers are also referred to as spin-mixers and vortex-mixers, see any laboratory catalogue for details].

4) Count the number of nannofossils under cross-polarized illumination (Fig. 1), and then count the glass beads in the same view-field under phase-contrast illumination (Fig. 2).

Since smaller microbeads are difficult to recognize when mixed with clay minerals, an arbitrary cut-off point of 3 μm is recommended. According to the manufacturer, less than 8 % (by weight) of the beads are smaller than 3 μm in the MB-10 package.

5) Stop counting when the tally of glass beads reaches a predetermined number (e.g. 200 or 500), and calculate the nannofossil / 100 beads ratio.

6) Convert the calculated ratio to a hypothetical standard ratio which is equivalent to the number of nannofossils per 100 glass beads if the mixing ratio of microbeads is 50 % by weight (1 to 1 mixture).

You can modify the bead:sample ratio to suit your preferences and the material. Then so long as step 6 is taken and we use the same glass bead package, we can compare other people's abundance data to our own. Moreover, if we can select a standard sample like PDB for oxygen isotope analysis, we can use different products of microbeads and still express the observed abundance on a common scale; a percentage abundance to the standard sample. Does anybody have a candidate for the standard?

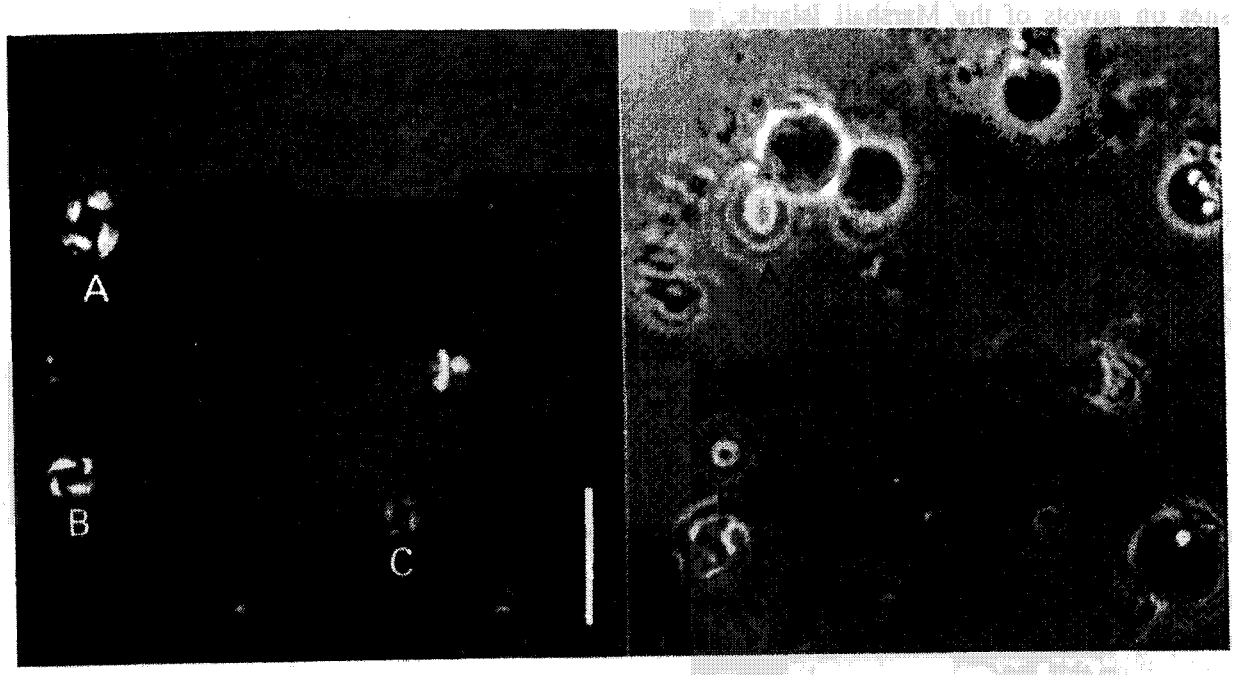

Fig. 1. (left) Middle Pleistocene nannoflora observed under a cross-polarized illumination. Three relatively large placoliths (marked A-C) are observable but no microbead is not recognizable. The scale bar in the lower right corner indicates 10μm.
Fig. 2. (right) The same view field under phase-contrast illumination. Five microbeads are recognizable as dark spheres.