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NOTES

ELECTROSTATIC CLEANING TECHNIQUE FOR FABRIC SEM SAMPLES

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During clay fabric investigations of slightly consolidated submarine sediments, a technique was developed for electrostatically cleaning surfaces of scanning electron microscope (SEM) samples. One of the two surfaces resulting from a single fracture of an oven-dried sample was cleaned using the conventional peeling technique (100 applications of cellophane tape; Barden and Sides, 1971) (Fig. 1a). The opposite surface was cleaned using the electrostatic technique now routinely employed in this laboratory (Fig. 1b). Both surfaces were cleaned satisfactorily. In sharp contrast, uncleaned fracture surfaces of this sample (not shown) were noted to be debris-cluttered*. Both micrographs of Fig. 1 show predominately stepped face-to-face arrangement of the particles in regions which appear more dense whereas numerous oblique edge-to-face contacts occur in areas which appear less dense. The relatively greater proportion of the clay particles lying approximately perpendicular to the surface of the peeled sample may be an artifact produced by the cleaning technique. The process of pressing tape against the sample and pulling it away not only removes debris but also may preferentially remove flat-lying particles of the sample or pull them up on edge. Although we have not shown definitively that peeling does produce such an artifact, numerous peeled surfaces have a similar 'lifted' appearance and these features are highly suspect.

Slightly consolidated clay sediments which are prepared using air or oven-drying techniques have been shown to undergo severe stresses and deformation with large reductions in pore space (Yong, 1972; Naymik, 1974). For this reason, in recent investigations of sediment fabric, samples have been prepared by freeze drying or by critical point drying. These less disruptive drying methods result in relatively fragile material when applied to uncemented, high-porosity clay sediments. Consequently, these dried samples may lack sufficient structural integrity for peeling techniques to be applied. Fracture surfaces of such fragile samples can be cleaned using the electrostatic technique (Fig. 2). The micrograph in Fig. 2(a) shows bands running roughly diagonally which have relatively more edge-to-edge (EE) and edge-to-face (EF) particle contacts alternating with bands which have the predominant face-to-face (FF) structure. The EE and EF contacts lead to a structure far more open in appearance than the FF contacts (Fig. 2b).

In electrostatic surface cleaning, loose particles are lifted from the sample in an electrostatic field without any physical contact with the surface. A field of approximately 20 kV/cm at the sample surface is satisfactory. The field is produced in this laboratory by briskly rubbing a piece of cellulose acetate butyrate tubing with a piece of polyester cloth. The charged tubing is then moved slowly over the fracture surface at a distance of about 1 cm. In order to reduce charge build up, the specimen is fractured and attached to the microscope stub before cleaning, and the stub is grounded at least intermittently during cleaning. A sample can be cleaned in less than 1 min. No features have been observed that indicate any disturbance of the clay fabric due to electrostatic cleaning. The electrostatic cleaning technique is rapid and very economical and has performed satisfactorily in routine SEM sample preparation.

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* See also photomicrographs of uncleaned and peeled fractured surface in Tovey and Yan (1973).

REFERENCES

Barden, L. and Sides, G. (1971) Sample disturbance in the determination of clay structure: *Geotech.* **21**, 211–222.

Naymik, T. G. (1974) The effects of drying techniques on clay-rich soil texture. In: *Proc. 32nd Ann. Meeting Electron Microscopy Soc. Am.* (Edited by Arceneaux, C. J.) pp. 466–467. Saint Louis, MO.

Tovey, N. K. and Yan, W. K. (1973) The preparation of soils and other materials for the SEM: *Proc. Int. Symp. Soil Structure*, Gothenberg, Sweden, pp. 59–67.

Yong, R. N. (1972) Soil technology and stabilization. In: *Proc. 4th Asian Regional Conf. Soil Mechanics*, (Edited by Moh, Z. C.) Vol. 2, pp. 111–124. Bangkok, Thailand.

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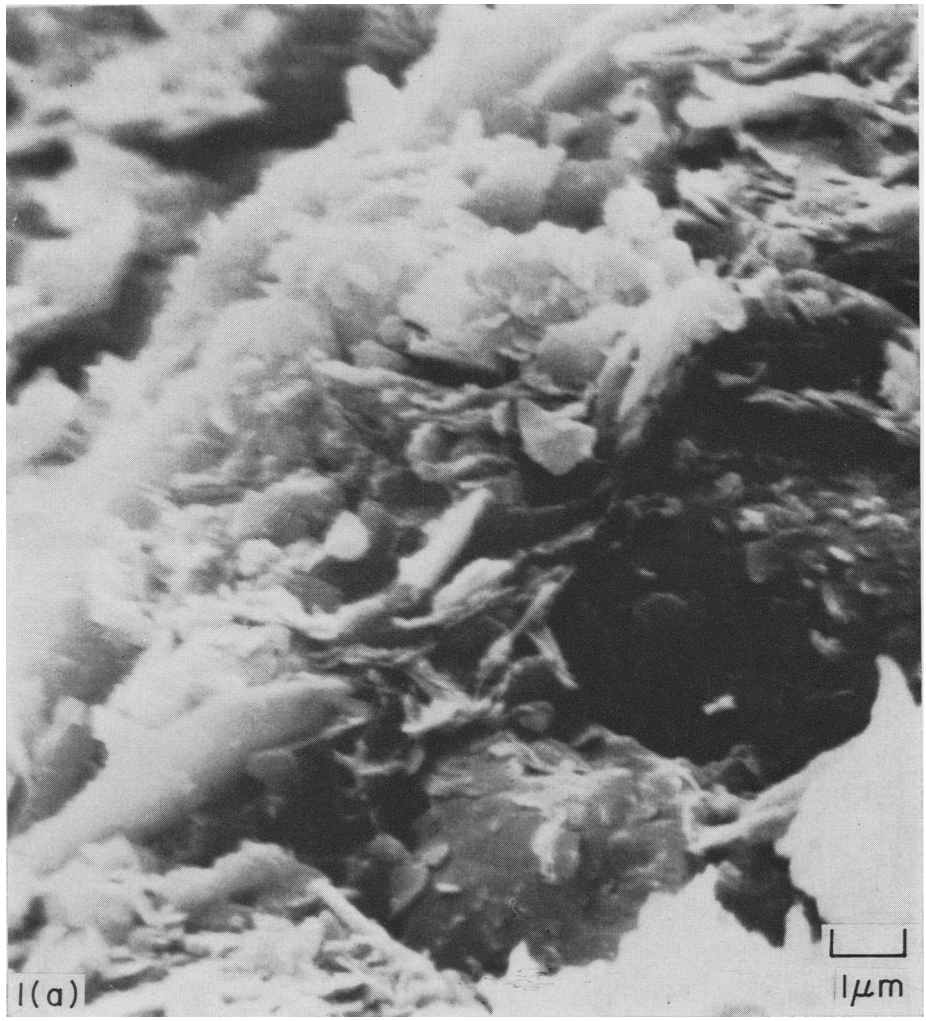
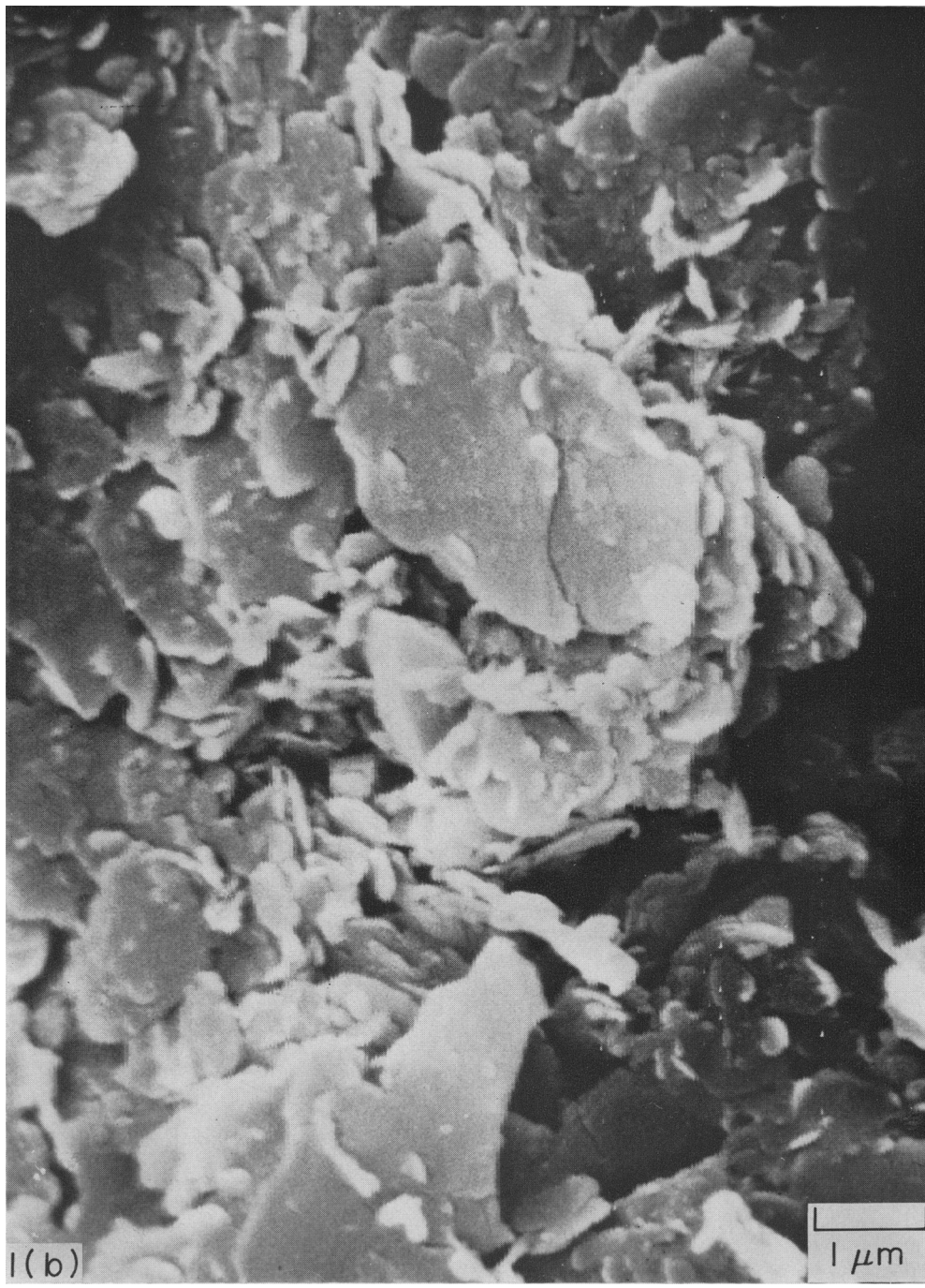


Fig. 1. Opposite surfaces from a fracture of oven-dried continental slope sediment (Wilmington Canyon; (a) peeled, (b) electrostatically cleaned.

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1(b)

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Fig. 2. Critical-point dried, electrostatically cleaned submarine sediment (Mississippi Delta); (a) general view, (b) detail of EE, EF structure (rosette).

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