Scanning Electron Microscopy

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Scanning electron micrographs of the suspended material filtered onto 0.4 μm Cyclopore membrane from 20 l of seawater have been made using a JEOL JSM (820) scanning electron microscope.

In general, the images show both individual and multiple-grain particles with components of both mineral and organic origin. In addition to clastic terrigenous minerals, individual grains within the silt and clay size range (<0.63μm) included single coccoliths, and skeletal fragments of diatoms, radiolaria and sponges. Multiple-grain types include all of the aggregate forms (open, closed and tight) described from the HEBBLE area on the Nova Scotian Rise.

Winter

***Fig.* 7.1** shows particulate material collected from a depth of 2751 m at station OM-8 (CD84, CTD7) in winter and is associated with C_{min}^{c} (clear water minimum; 11μgl^{-1}). The image shows a general scarcity of particles, with those present mainly individual clay particles.

***Fig.* 7.2** shows particulate material collected from a depth of 1134 m at station OM-8 (CD84, CTD7). Transmissometry, nephelometry and gravimetric analysis indicate an INL (41 μgl^{-1}) at this depth. This image is in considerable contrast to the C_{min}^{c} (clear water minimum) picture of ***Fig.* 7.1** in showing abundant individual grains of coccoliths, diatom fragments, clay and silt particles, tight aggregates and some organic debris. Higher magnification images of particles from the BNL of station OM-8 show the presence of diatoms, suggesting downslope transport of material within the BNL.

Summer

Fig.* 7.3** shows particulate material from 500 m at station OM-7 (CD94, CTD15) in summer. This region is below the SNL but within the region of generally enhanced SPM concentrations seen during the cruise. In this case the filter is blocked with large organic patches of mucus some several hundred micrometers in diameter, which on closer examination (Fig.* 7.4**) show embedded particles of silt, clay and coccoliths. The disaggregation of such particles as they fall towards the seabed may be important in generating the seasonal shift in clear water concentrations described above.

***Fig.* 7.5** shows particulate material from clear water at 1847 m at station OM-7 (CD94, CTD14). The difference between this and the winter material in clear water is quite marked. There are abundant individual particles comprising coccoliths, silt and clays together with skeletal fragments of diatoms, radiolaria and sponges. There are also both closed and open form aggregates with some evidence of mucus. The presence of sponge spicules in the samples is of particular interest because the biomass of sponges is notably high between 500-100 m on the slope in the region of enhanced resuspension. The clear water material also reveals a number of faecal pellets (tight aggregates) e.g. ***Fig.* 7.6**. This pellet

~70 μm in diameter appears to have had its peritrophic membrane removed. Similar characteristics are seen in an off-slope sample taken at 2751 m at station OM-8.

***Fig.* 8.1** shows particulate material from 1489 m at station OM10 (CD94, CTD34). This sample corresponds to the peak concentration in the rather weak BNL of ~30 $\mu g l^{-1}$. It shows a greater proportion of individual particles and fewer aggregates than in clear and upper water column samples. The single grains are compositionally similar to the samples from above. Aggregates are present (upper right) but are somewhat smaller than previous. Skeletal fragments of sponges are also present, and a dark blob of mucus is present lower centre where the holes of the filter are covered over.

***Fig.* 8.2** shows particulate material from the BNL at the deepest station (OM-8 CD94, CTD18, 4850 m). It shows a similar composition to the BNL sample from OM10.

Autumn

Fig. 8.3 shows particulate material from 900 m at station OM-6 (DI216, CTD10). This represents material from just below the peak concentration in the INL at this depth. The majority of material is associated with open aggregates comprising coccoliths and silt particles. There are also a number of intact diatoms.

Fig. 8.4 shows particulate material from the BNL at 1186 m of station OM-6 (DI216, CTD10). There are abundant individual grains of silt and clay size. Aggregates of all forms are present. Tight structures are mainly represented by e.g. **Fig. 8.5** which are thought to be either faecal pellets or resuspended lumps of the bed. there appears to be a significant amount of organic debris and some mucus present in these aggregates and this possibly suggests they are faecal pellets.

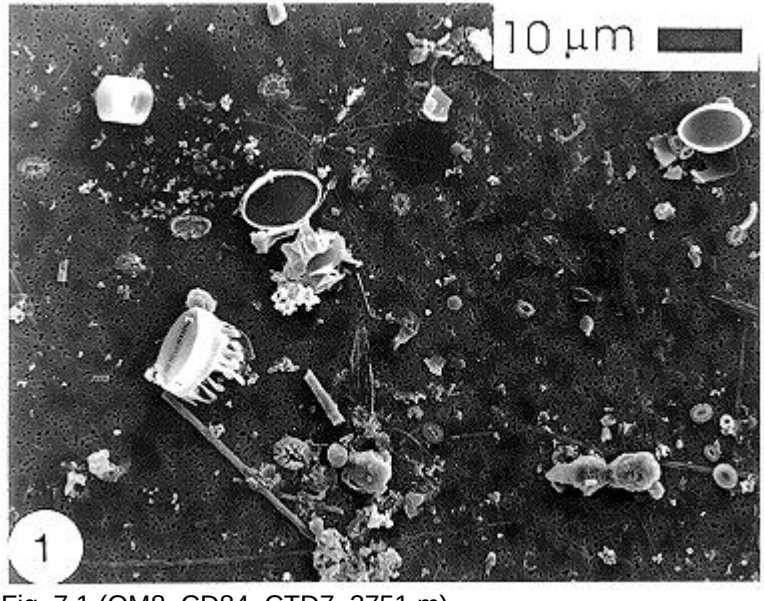

Fig. 7.1 (OM8, CD84, CTD7, 2751 m)

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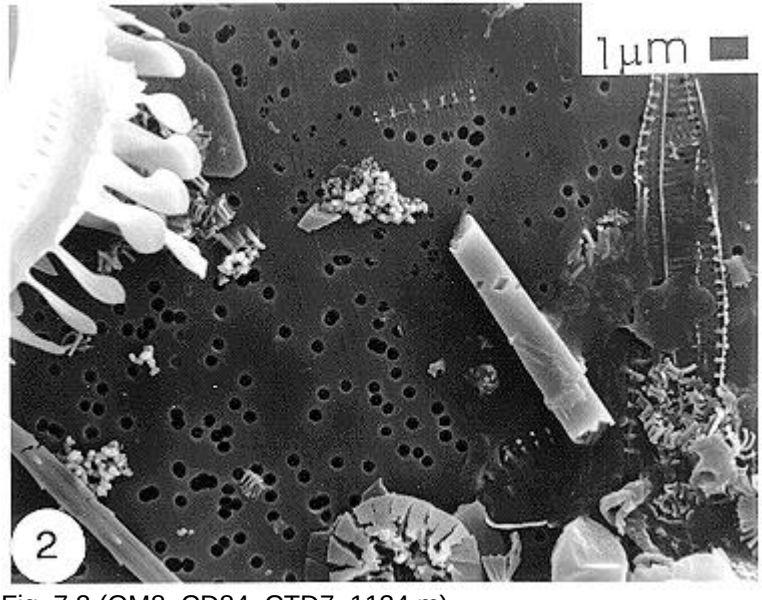

Fig. 7.2 (OM8, CD84, CTD7, 1134 m)

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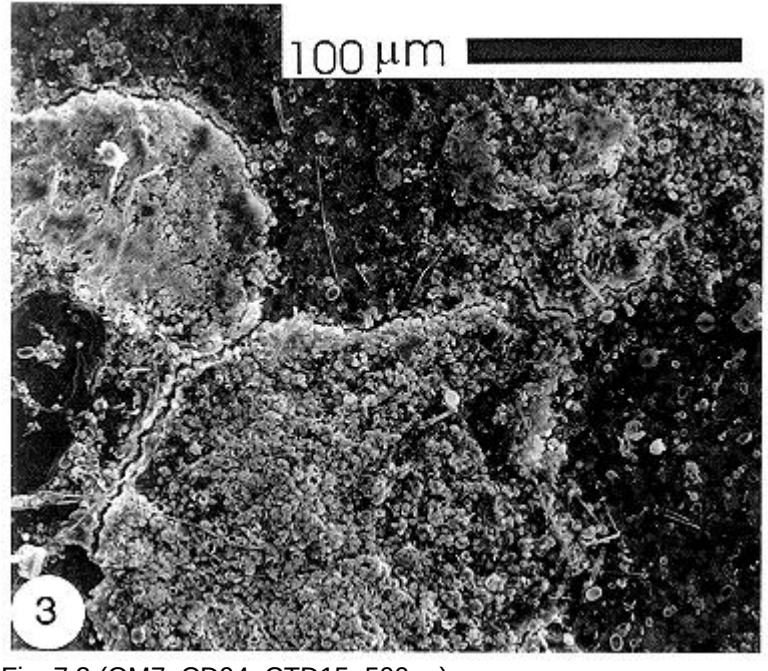

Fig. 7.3 (OM7, CD94, CTD15, 500 m)

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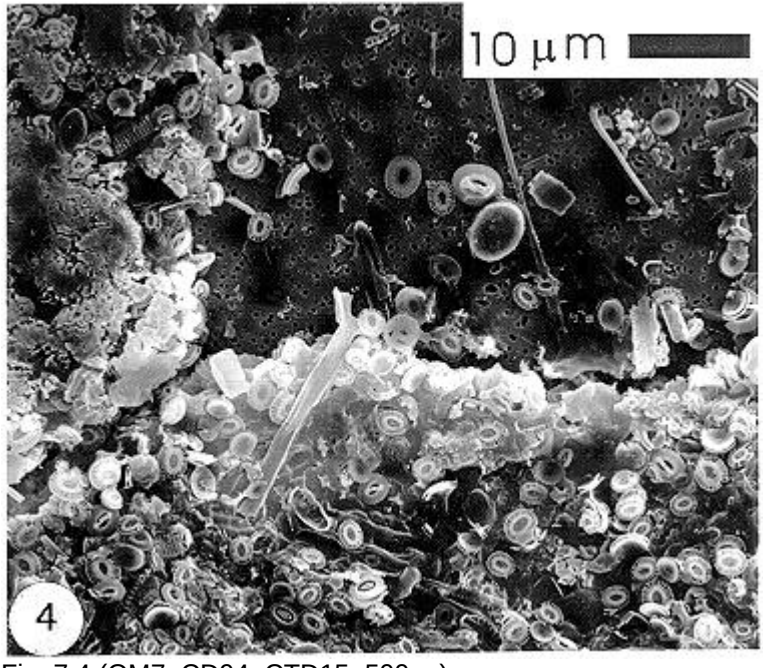

Fig. 7.4 (OM7, CD94, CTD15, 500 m)

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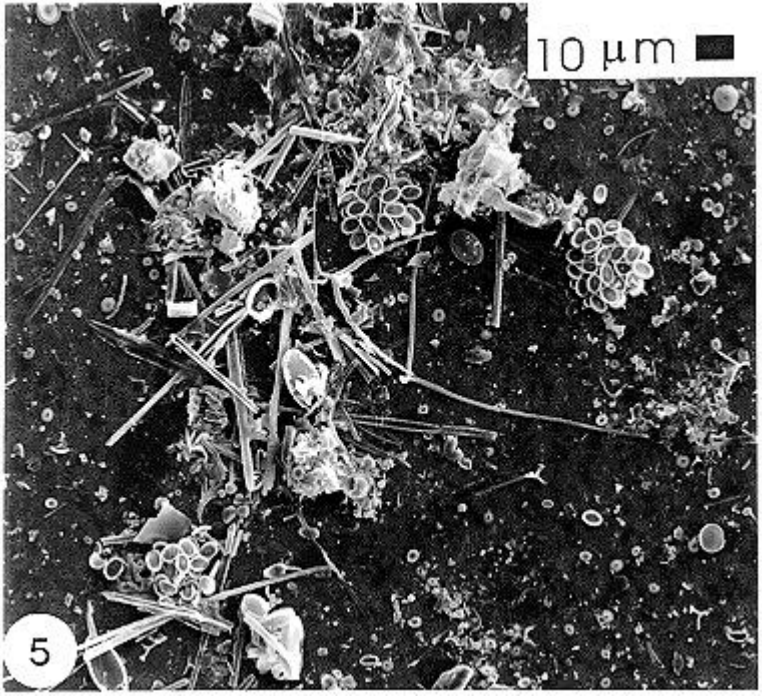

Fig. 7.5 (OM7, CD94, CTD14, 1847 m)

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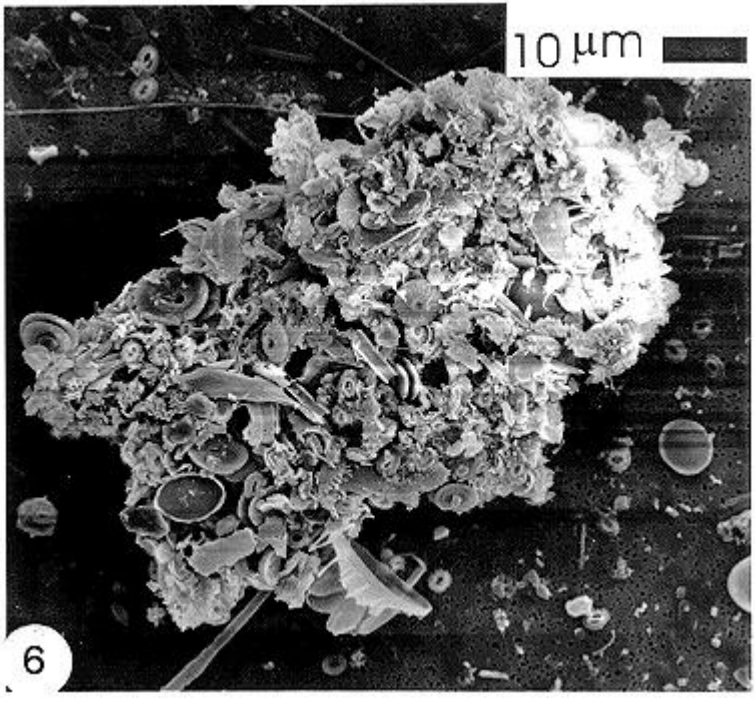

Fig. 7.6 (OM7, CD94, CTD14, 1847 m)

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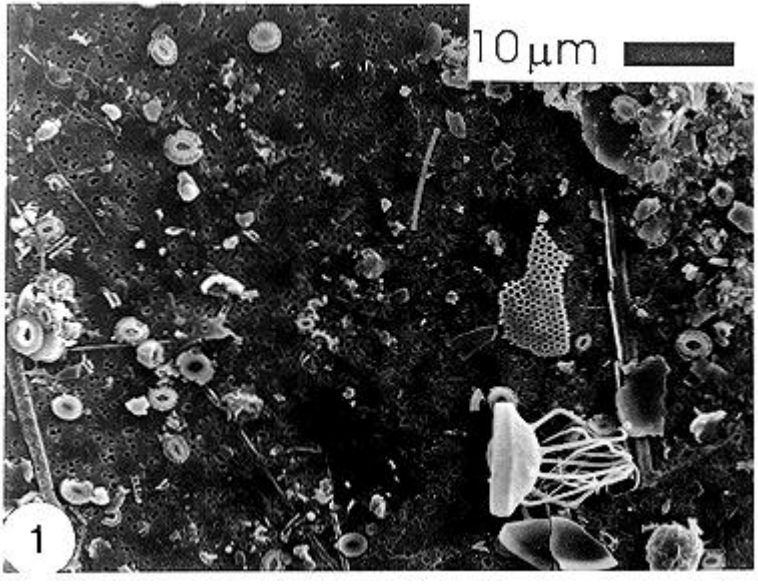

Fig. 8.1 (OM10, CD94, CTD34, 1489 m)

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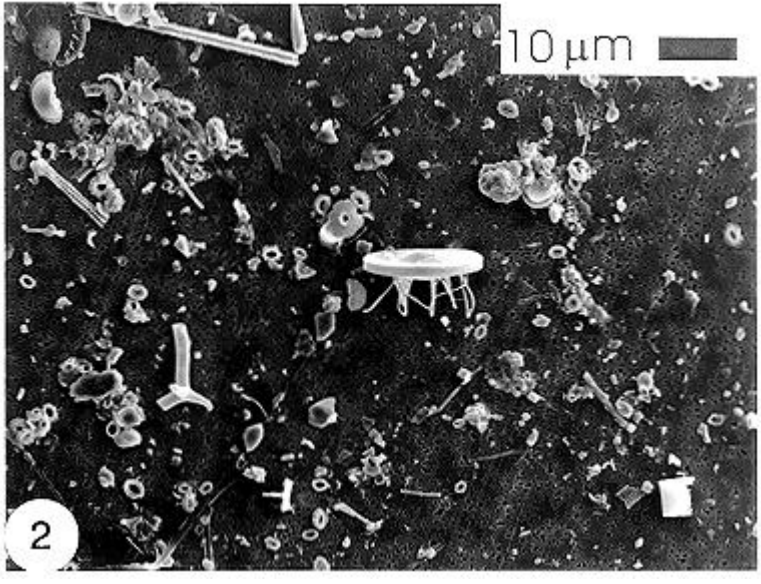

Fig. 8.2 (OM8, CD94, CTD18, 4580 m)

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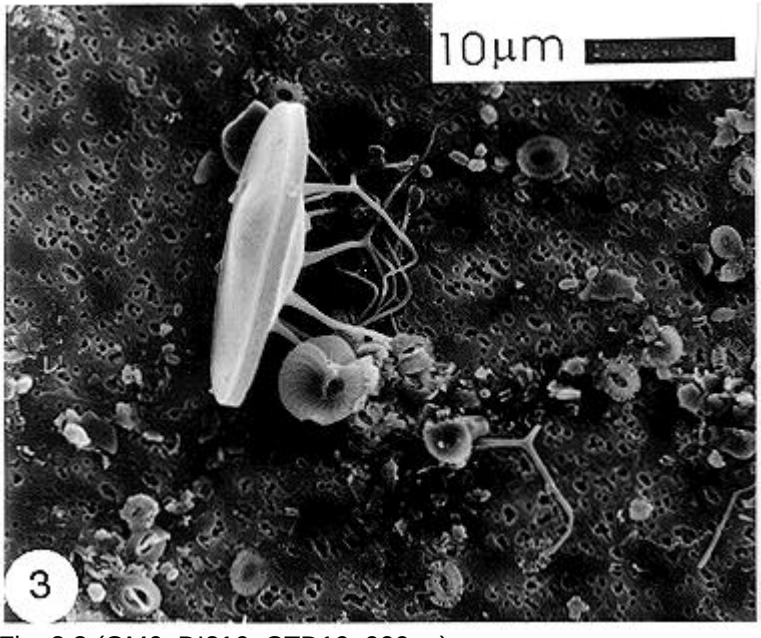

Fig. 8.3 (OM6, DI216, CTD10, 900 m)

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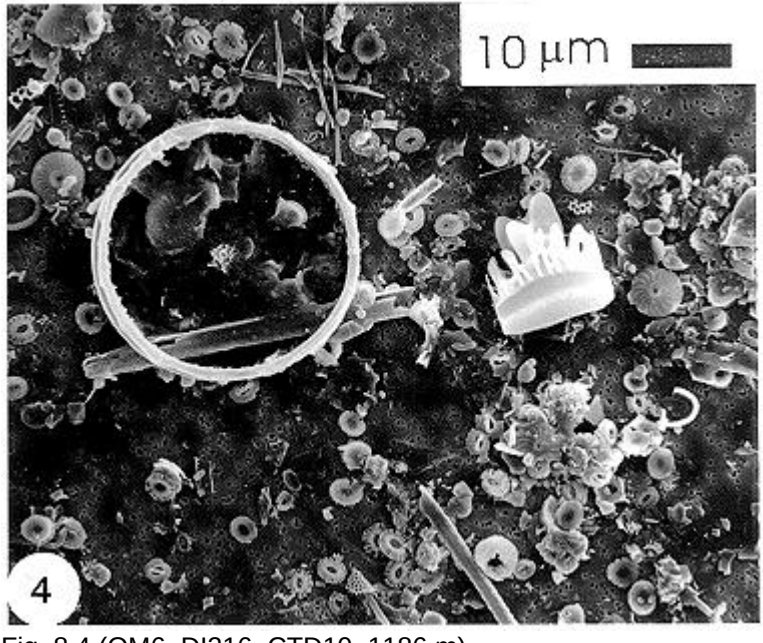

Fig. 8.4 (OM6, DI216, CTD10, 1186 m)

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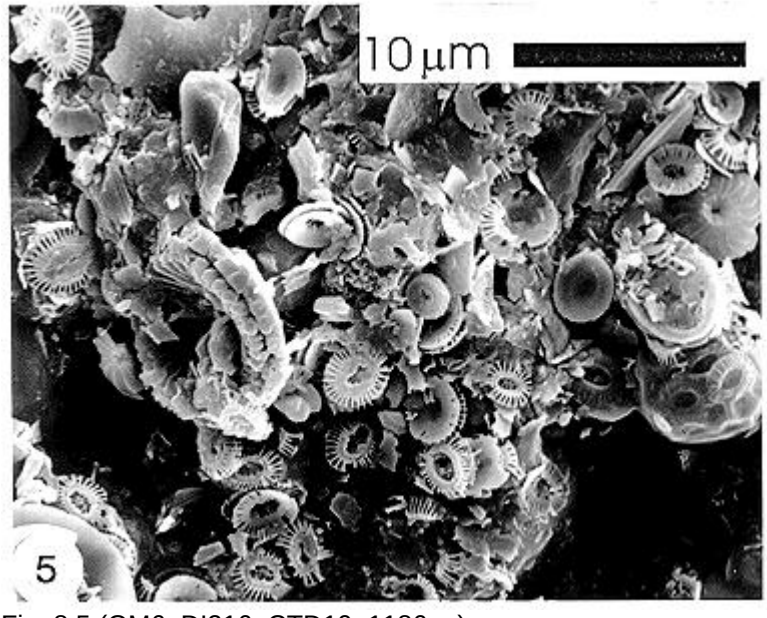

Fig. 8.5 (OM6, DI216, CTD10, 1186 m)

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