A preliminary report on an experiment for a depositional condition of fine-grained glass-spheres under the unidirectional flow

Miwa Yokokawa[1], Keiko Horiuchi[1]

[1] Lab. Geoenviron., Fac. Info. Sci., OIT

The grain size analyses of the North Atlantic Drift deposit, which was drilled by ODP Leg172, have been used to reconstruct the relative changes in the vertical position and the intensity of Deep Western Boundary Current (DWBC) core during the marine isotope stages 8-10 (Yokokawa and Franz, 2002). During glacial periods (MIS 10.2 and 8.4-8.3), the DWBC core was located at around 2200 m water depth, whereas it deepened to 3000 m or more during warm periods (interglacial stage 9.3 and interstadial 8.5). Between these periods, the DWBC core moved to shallower depth (2500-2800 m) and its intensity increased, which generally provided coarser sediments to a broad depth range from 2100 to 4800 m.

Although grain-size analysis like above enables us to reconstruct the changes in the relative intensity and position of DWBC, there have been no fundamental experimental results to reconstruct the changes in flow velocity. Therefore, we designed an experiment analogue to the deposition from the deep ocean currents. Fine-grained glass-spheres were employed because they are easy to use.

A recirculating flume (12 m in length, 0.20 m in width, and 0.5 m in depth) in Osaka University was used. The size of 97% of glass-spheres was less than 38 micron. Glass-spheres, which had been well-mixed with water, were poured into the unidirectional flow in the flume. The height of the sediment surface was measured continually by an ultrasonic device. The sediment concentration after diffusion throughout the entire flume was 0.77 g/l. The water depth was 25.8 cm and the average velocities at 10cm above the bottom of the flume were 5.6 cm/sec, 9.0 cm/sec, 12.0 cm/sec, 16.1 cm/sec, and 20.0 cm/sec.

After the pour and successive diffusion of glass-spheres, the height of the sediment surface rose rapidly. The rate of rise decreased gradually and then the height kept constant. The height became to decrease slightly at last. Deposition occurred even under a velocity of 20 cm/sec. However, the depositional rate under a velocity of 20 cm/sec during the first 40 minutes was lower compare with those in the other cases. This can be attributed to the decrease of settling velocity because of the horizontal component of the currents.