Q037-009 Room: C510 Time: May 29 11:45-12:00

Paleo-environment reconstruction using diatomite from Hiruzen-bara, Okayama Prefecture

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The Middle Pleistocene Hiruzen-bara Formation exposed in Hiruzen-bara Highland, Okayama Prefecture, includes lacustrine varved diatomite formation of about 60 m thickness. It is composed of alternation of about 2mm thick couples of light-colored and dark-colored laminae. Because light-colored lamina is made mostly of Stephanodiscus sp. breeding in winter season, and dark-colored lamina of Cyclotella comta, a single couplet of these laminae is suggested to represent an annual deposit. A fission track age was determined to be 0.52+/-0.11 Ma for zircon from the pumice layer intercalated in the Hiruzen-bara Formation (Ishihara & Miyata, 1999). We collected the diatomite samples and investigated their magnetic property and mineral composition, in order to reconstruct the paleo-environment around the Hiruzen-bara. Six hundred thirty four cubic samples of 8cm3 volume were continuously collected from a outcrop about 13m long, which corresponds to the duration of about 6,500 years considering the mean thickness (2mm) of the laminae. The sampled outcrop contains narrow (a few mm) to wide (several ten cm) bands with chocolate color, brightly white laminae of about 1 mm thickness and rust-colored bands. The susceptibility values of most samples show the positive correlation with the remanent magnetization (RM) intensities. Some samples, however, show high susceptibility value and low RM intensity. Samples with relatively high magnetic property were from near the chocolate-colored band, the white lamina and the rust-colored band. As diatom does not show magnetic property, the magnetic property of samples is brought about by the impurities within diatomite. In order to determine the sort of impurities, finer grains (less than 75 micron meter) separated from 25 pilot samples were analyzed by X-ray diffraction method and the coarser grains (more than 75 micron meter) were observed using polarization-microscope. From X-ray diffraction analysis, quartz (aeolian and/or clastic origin), plagioclase and opal A (diatom) were identified for all the investigated samples, and for some samples chlorite (clastic origin) and siderite (FeCO3, formed in situ) were identified. Siderite was identified for samples with brightly white lamina. From microscopic observation, we identified hornblende, plagioclase, orthopyroxene, clinopyroxene, magnetite and volcanic glasses, which are of volcanic origin.

We concluded from these investigations as follows:

1) Volcanic materials were recognized all over the investigated range. Diatomite formation was developed during the older activity of Daisen Volcano. The volcanic materials identified in diatomite seem to have been brought about from Daisen volcano.

2) Magnetic property of diatomite seems to be shown by the impurities. The positively correlated variation between susceptibility and RM intensity of samples is due to relative content change in volcanic materials, particularly magnetite. As the position of samples with high susceptibility but low RM intensity coincides with the identified range of siderite, the high susceptibility value seems to be due to siderite.

3) Siderite is formed near the bottom surface of lakes under a reduced environment. In summer, for fresh lakes a reduced environment sometimes occurs and therefore siderite is formed. The samples with relatively high content of siderite suggest the presence of relatively intense period of reduced environment in the past.