Mineralogy, O^{18}/O^{16}, and D/H Ratios of Clay-Rich Sediments from Deep Sea Drilling Project Site 180, Aleutian Trench[1]

Eric V. Eslinger[2] and Yeh Hsueh-Wen

Department of Geology, West Georgia College, Carrollton, Georgia 30118
Hawaii Institute of Geophysics, University of Hawaii at Manoa, Honolulu, Hawaii 96822

[1] Hawaii Institute of Geophysics Contribution 1126.

[2] Present address: Cities Service Company, P.O. Box 3908, Tulsa, Oklahoma 74102.

Abstract: Mineralogy, O^{18}/O^{16}, and D/H ratios have been determined in five size fractions (<0.1, 0.1 − 0.5, 0.5 − 1.0, 1.0 − 2.0, and >2.0μm) of seven samples taken from 500 m of Pleistocene deep-sea sediments cored at Deep Sea Drilling Project Site 180 in the Aleutian Trench. The depositional age of the samples spans the last 300,000 years; the samples have been interpreted by others to be continental detritus weathered from a mixed igneous, metamorphic, and sedimentary source area and then deposited by ice-rafting and turbidity currents. The minerals present are quartz, feldspar, illite, chlorite and/or non-expandable vermiculite, and expandable vermiculite and/or mixed-layer illite/expandable vermiculite. The relative amounts of quartz, feldspar, and total clay vary with particle size, but are nearly constant from sample to sample for a given particle size. δO^{18} is values of the four coarser size fractions range from +9.7 to +12.0‰ with variations attributable to changes in quartz/feldspar and clay/(quartz + feldspar) abundances. Values of δO^{18} for the expandable vermiculite-rich <0.1-μm size fraction range from +12.1 to +16.3‰ which indicates some oxygen isotope exchange at surface temperatures between meteoric waters and the parent rock during vermiculite formation. Values of δD range from −46 to −74‰ with variations attributable to changes in amounts of different clay minerals present. There is no mineralogic or isotopic evidence of post-depositional reactions in the coarser size fractions, but a general change in δD of the vermiculite-rich, <0.1-μm size fraction from about −50‰ to about −70‰ with increasing depth may be due either to post-depositional isotopic exchange or to climatic changes in the terrestrial weathering environment.

Key Words: Deep sea sediments • D/H • Isotopic ratios • O^{18}/O^{16} • Provenance

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