Geochemistry of Mud Breccia and Water from Mud Volcanoes of Andaman Islands, India

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Mud volcanoes (MVs) are very small volcano like geological features that ooze out mud, water and hydrocarbon gases at a much lower temperature (30-40°C) than the real volcanoes. The diameter of MVs ranges from a few centimeters to several meters. Although MVs are observed all over the globe, they are predominantly found in areas of tectonic compression like the subduction zones, and are usually associated with hydrocarbon deposits. MVs of accretionary prisms that tap fluids and clay rich sediments of the slab at shallow levels (2-4 km) can reveal a lot about the subducting material prior to its journey into the mantle.

Andaman and Nicobar Islands form part of a \sim 185 km thick accretionary prism that owe its origin to the subduction of Indian plate under the Burmese plate along the Indonesia-Andaman subduction zone. Several MVs have been reported on the Andaman Islands [1] that constantly ooze mud, water and hydrocarbon gases. We have carried out geochemical studies of mud breccias and water in order to understand the origin of the MVs, and chemically characterize the slab material.

SiO2 content in mud breccias ranges from 48.3 to 52.5wt%, whereas Al2O3 ranges from 15.4 to 16.0wt%. Their low silica, high alumina and high chemical index of alteration (CIA; [2]) suggest that the clay minerals of the mud breccia are predominantly derived from the altered oceanic crust. Such an inference is well supported by the observed 87Sr/86Sr (0.70606 to 0.70986) and 143Nd/144Nd (0.512473 to 0.512561) variations in the mud breccia.

 δ 18O and δ D of the water samples from the MVs respectively ranges from 0.14 ‰ to 2.63 ‰ and -18 ‰ to -28‰ with respect to V-SMOW. The variations of δ 18O and δ D suggest that the sources of the waters are neither the present-day seawater nor the meteoric water. These possibly represent formation waters, and might have been derived from clay minerals deep in the crust along the subduction zone. Keywords: Mud volcanoes, mud breccia, Andaman Islands

References

[1] Dimitrov, L.I., Earth Science Reviews; 59; 49-76 (2002).

[2] Nessbitt H.W. and Young G.W., Nature 299, 715–717 (1982).