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The origin, diagenesis and migration of fluids of Shin-Yan-Ny-Hu Mud Volcanoes in southwestern Taiwan

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The terrestrial mud volcano (MV) sources and connects with deep stratum, the investigation for MV is thus critical for energy resource exploration, geohazard, diagenetic processes and atmospheric budget of greenhouse gases. The Shin-Yan-Ny-Hu (22°48'09"N, 120°24'34"E) is a typical subaerial MV in southwestern Taiwan. The chemical compositions of porewate, microbial community, lipid biomarkers and their stable carbon isotopes have been examined. The mud breccia sources, depositional environment, immigration of the fluid and the migration framework of fluid are delineated.

Na^+ in the mud mixed fluids positively correlates to Cl^-, and both are dominant in exhaled fluids, indicating marine water being the original fluid. The lower chlorine concentrations, negative δD and positive $\delta^{18}O$ values of vent fluids indicate that the original fluid was likely have undergone the montmorillonite dehydration resulting in a low salinity fluid in the source area. The K/Na and Na/K geothermometer and isotopic data further estimated the temperature of the fluid formation to be 79-181℃, and corresponding to 2.6 km-6.0 km depth.

The lipid biomarkers in the sediments indicate that the organic matter stemmed from petroleum derivatives, bacteria and terrestrial higher plants. Ph/n-C18 and the plot of Pr/Ph vs. O/C30 Hopane ratio implies that the sediment organic matter has deposited in a marine deltaic sedimentary environment under an oxic depositional environment. The organic matter originated from the formation with a depth of about 4-5 km bsf. The fluid transport framework has been constructed accordingly.

The methane usually originates from degradation of organic matter. Analysis proves that *Aciticlasitic methanogens* is the main methanogenesis pathway, and the highest cumulative methane production of 1228±119.7 mg CH4 kg^{-1} wet soil. ANME couples sulfate reducing bacteria, nitrate reducing bacteria and metal reducing bacteria to consume methane, which mitigates the emission of vent methane. These archaea sources also possible from the paleo marine sediments. Further work is needed to set up the framework of evaluation.