Geophysical Research Abstracts, Vol. 7, 09449, 2005
SRef-ID: 1607-7962/gra/EGU05-A-09449

Gas compositions of on-land mud volcanoes and pore-space of submarine sediments in offshore SW Taiwan

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Many mud volcanoes are distributed along the tectonic sutures in southwestern Taiwan. Most active mud volcanoes are exhaling methane-dominated gases with low helium isotopic compositions, which are typical crustal composition. Furthermore, the carbon isotopic compositions of methane gases show both thermogenic and biogenic sources in origin. This implies that there are multiple sources for the gas compositions of on-land mud volcanoes in SW Taiwan.

Gas hydrates are not only closely linked with the global climate changes but also believed as an important energy resource in the future. Usually scientists use the “bottom simulating reflector” (BSR) to survey and explore the potential deposits of gas hydrates in one area. Many clear signals of BSRs have been observed in the offshore southwestern Taiwan. It indicates many gas hydrates may be stored in this area. To search for the evidences of their existence and distributions, we systematically collected bottom waters and cored sediments for dissolved and pore-space gas analysis through five cruises: ORI-697, ORI-718, ORII-1207, ORII-1230, and ORI-732 during 2003 and 2004.

Some unusual high methane concentrations in the dissolved gases of bottom water and drilled core samples are found in SW offshore Taiwan, where usually are located close to the diapir structures. Meanwhile, the methane concentrations of drilled cores display an increasing trend with depth and show dramatic decreasing trend of sulfate concentration of the pore water. Hence, those sites usually exhibit very shallow depth

(less than 1-3 mbsf) of sulfate-methane interface (SMI) and possess high methane anomalies. It can be explained by the extrusion of free gases which may be decomposed from the underneath gas hydrates and/or from deeper gas reservoir.

Carbon isotopic compositions of representative methane gas samples fall into two groups. Samples of first group ragne from -28.3 to 40.0 $^{o}/_{oo}$, which are typical thermogenic gas composition. In contrast, the others show typical biogenic gas composition in the range of -76.6 to -63.1 $^{o}/_{oo}$. The data are similar with those of some venting gases of on-land mud volcanoes in SW Taiwan. It implies that they may be genetic related, i.e., they are mixing products between different sources from different depth. Potential gas hydrates in offshore SW Taiwan are genetically related to the offshore and on-land mud volcanoes. Further detailed investigations and deeper drilled samples are, of course, needed to constrain the sources and reservoirs of the potential gas hydrates in this area.