Resolved Analyses of $^{13}CDH_3$ and $^{12}CD_2H_2$ from Taiwan Mud Volcanoes

D, RUMBLE[1], P.-L. WANG[2], L.-H. LIN[3], Y.-T. LIN[3], T.-H. TU[2], J. LABIDI[4], E. D. YOUNG[4]

[1]Geophysical Lab, Washington, DC, USA, drumble@carnegiescience.edu
[2]Inst. Oceanography, NTU, Taipei ,Taiwan
[3]Dept Geoscience, NTU Taipei, Taiwan
[4]Dept. EPSS, UCLA, Los Angeles, CA, USA

We have made resolved analyses of $^{13}CDH_3$ and $^{12}CD_2H_2$ in CH_4 venting from onshore mud volcanoes located along deep thrust faults. The objective of the study is to compare CH_4 generated in different on-shore and off-shore source regions to deepen understanding of the relationship between CH_4's formation and its tectonic environment.

Current Taiwan tectonics have juxtaposed a thick wedge of deeply faulted sediments at the foot of the central mountain range, onshore, with an offshore accretionary prism scraped off from the subducting S. China Sea plate. Schoel plots of $\delta^{13}C_{VPDB}$ vs. δD_{VSMOW} suggest thermogenic CH_4 with $\delta^{13}C$ = -25 to -35 ‰ and δD = -150 to -225 ‰ is rising along faults from heated organic material buried at the foot of the central mountain range. Onshore transitional samples from an outcropping mud diapir have microbial values with $\delta^{13}C$ = -60 and δD = -200. Offshore mud diapirs of the accretionary prism emit biogenic, microbial CH_4 with $\delta^{13}C$ = -65 to -100 ‰ and δD = -160 to -240 ‰. Transitional samples from the upper slope of the accretionary prism venting near an out-of-sequence-thrust have thermogenic $\delta^{13}C$ = -40 and δD = -170 ‰.

Resolved measurements of $^{13}CDH_3$ and $^{12}CD_2H_2$ in methane from 3 onshore mud volcanoes on deep faults give bimodal, concordant equilibrated temperatures of 150 and 250 °C. Samples collected at one vent over a 1-year interval show formation T increasing by 100 °C. An on-land outcropping mud diaper lies below the equilibrium curve suggesting the presence of microbial CH_4.