



Timing of fluid seepage on summits of Quaker and Conical serpentine mud volcanoes, Mariana forearc: Evidence from U/Th dating of carbonate chimneys

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Serpentinization of forearc mantle along deep faults in the Mariana convergent plate margin permits formation of large active serpentinite mud volcanoes on the overriding plate within 90 km of the trench. Fluid seepage on summits of the mud volcanoes lead to the formation of authigenic carbonate chimneys close to the seafloor. Such carbonate chimneys are unique archives of past fluid seepage and associated environmental parameters. Here, we report U/Th dating and stable carbon and oxygen isotopes of the chimneys from Quaker and Conical serpentine mud volcanoes. The resulting U/Th ages of samples from Quaker Seamount show three time intervals of 11,081 to 10,542 yBP, 5,857 to 5,583 yBP, and 781 to 164 yBP, respectively. By comparison, carbonates from Conical Seamount have U/Th ages between 3,070 yBP and 1,623 yBP. Our results suggest that fluid seepage on the summits of serpentine mud volcanoes are episodic and probably locally controlled. Samples from Quaker seamount show depletion of ^{13}C ($\delta^{13}\text{C} = -7.0\text{--}0.4\text{‰}$ V-PDB), indicating contribution of carbon from anoxic oxidation of abiogenic methane. By contrast, samples from Conical seamount have positive $\delta^{18}\text{O}$ values (0.6–6.3‰), suggesting enrichment of ^{18}O in the seepage fluid. The data obtained provide time integrated variation of seepage fluids and seepage dynamics that are archived in authigenic carbonates. This finding adds to the ongoing multidisciplinary effort to better constrain the environment in the Mariana forearc region and to determine the locally dominant biogeochemical processes.

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