Short-chain organic acid concentrations and implications for microbial life in active serpentinite mud volcanoes of the Mariana forearc

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During IODP Expedition 366, the JOIDES Resolution drilled into flanks and summits of three active serpentinite mud volcanoes on the Mariana forearc, which differ in distance to the Mariana trench (55-72 km) and therefore also in their distance to the underlying subducting slab (13-18 km). The volcanoes are characterized by distinct compositions of the upwelling mud and fluids, where high pH values up to 12.5 are one evident challenge for possible microbial life in these systems. We measured concentrations of the short-chain organic acids formate, acetate, propionate, butyrate, pyruvate and lactate by 2-dimensional ion chromatography (Glombitza et al. 2014). Total carbon of short-chain organic acids makes up 10 to 30 per cent of total dissolved organic carbon. We observe elevated formate (up to 118 µM) and acetate (up to 55 µM) concentrations downhole at the summit of Asút Tesoru (Site U1496) when compared to its flank sites and summit and flank sites of Fantangisña and Yinazao. In general, formate and acetate concentrations and ratios in summit sites correlate with distance of the mud volcanoes to the trench, and therefore slab. These short-chain organic acids, which are likely produced during serpentinization and subsequent Fisher-Tropsch-type reactions, are favourable substrates for microbial catabolism in marine sediments. We discuss the potential of microbial life using these short-chain organic acids under the harsh conditions present in the serpentinite mud volcanoes of the Mariana forearc.

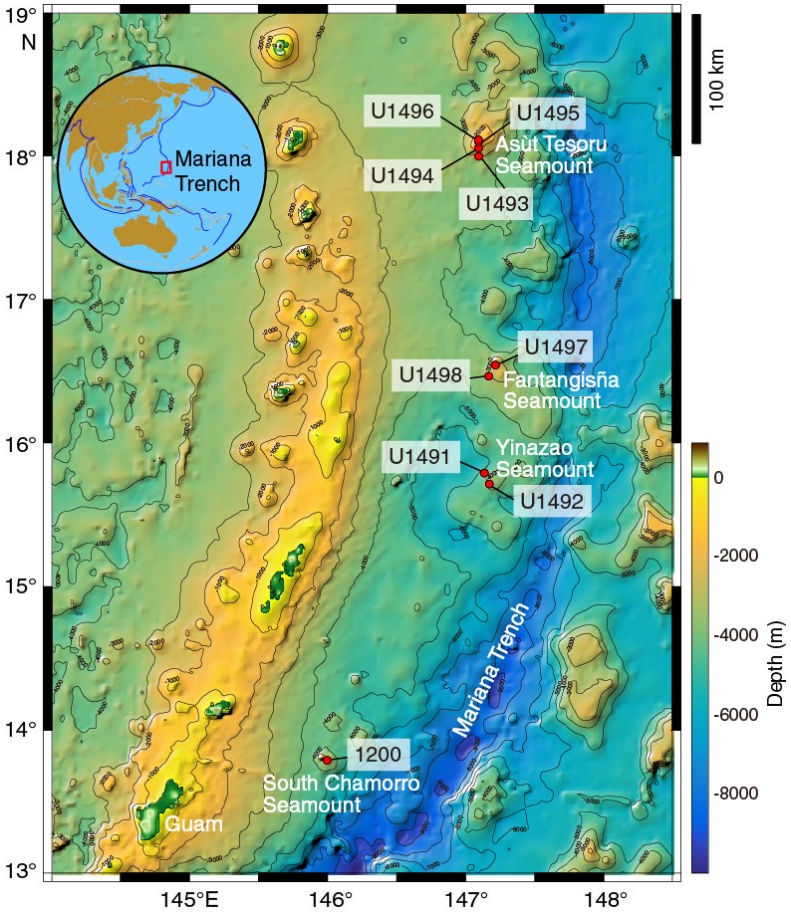

Figure 1. Location map of Sites U1491–U1498 and 1200 on South Chamorro Seamount (Fryer et al. 2018).

REFERENCES

Fryer, P., Wheat, C.G., Williams, T., & the Expedition 366 Scientists 2018: Expedition 366 summary, Proceedings of the International Ocean Discovery Program Volume 366.

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