

Large Hydrogen Hydrothermal System Formed in the Caroline Plate

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A large hydrothermal system driven by serpentinization near the Mussau Trench, in the east Caroline Plate, a small Cenozoic plate located in the western Pacific (1), has been discovered during Expedition 583 of the Natural Science Foundation of China (NSFC). This hydrothermal system consists of twenty large round or oval depressions/pockmarks (Fig. 1). All the pockmarks are round or oval in shape and about 450 to 1800 meters in diameter, with depths ranging from ~ 30 to ~130 meters. It is named “Kunlun” pipe swarm. A peak for dissolved hydrogen at 4132 cm⁻¹ was detected (Fig. 2) with concentrations of 5.9–6.8 millimoles using on site in situ analysis. Clumped nitrogen isotope shows atmospheric ¹⁵N¹⁵N value, suggesting the involvement of atmospheric components, i.e., high concentrations of nitrogen and oxygen gases. Each pockmark has a rim a few meters higher than the surrounding ocean floor. The bottom of these pipes consists of breccias, indicating of explosions. Seawater penetrates into the lithospheric mantle through fractures, forming hydrogen via serpentinization. Meanwhile, oxygen gas is released once seawater penetrates into the hot lithosphere, and mixed with hydrogen gas at the top of fractures sealed by mud layers, resulting in explosions responsible to the formation of large pipes.

References

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