Unlocking the Potential of Oceanic Natural Hydrogen

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Natural hydrogen has significant potential as a future clean energy resource, and exploration activities have been conducted worldwide in various onshore settings over the past decade. The most prominent exploration targets are iron-rich rocks and/or mantle-derived rocks that are exposed at or occur near the Earth’ s surface. In some regions, mantle rocks have been tectonically uplifted. These geological settings commonly host a fundamental natural process—water–rock interaction—known as serpentinization, which generates hydrogen.
In addition to natural occurrences, stimulated hydrogen production based on water–rock reactions are being tested in several locations; however, large-scale commercial production has not yet been realized. In this study, we propose the utilization of oceanic mantle rocks, such as peridotite, which constitute a major component of the oceanic lithosphere and are widely distributed beneath the oceanic crust. Serpentinization beneath the seafloor requires appropriate availability of water and suitable temperature conditions. Based on these requirements, we identify several geological settings as potential target categories: (1) outer-rise regions, (2) tectonic inversion zones, (3) accretionary prisms, (4) fore-arc basins, and (5) ocean core complexes.
Among the identified targets, ocean core complexes are particularly promising for future expeditions involving integrated geological, geophysical, and geochemical investigations to evaluate their potential as stimulated natural hydrogen resources. We discuss the advantages of focusing on ocean core complexes and present our initial considerations.

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