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Exploring ocean floor geodiversity in relation to mineral resources in the Pacific Ocean

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There is a growing demand for mineral resources such as metals and rare earth elements, but global terrestrial resources are rapidly declining. Alternatively, the ocean floor provides unprecedented mining potential. However, their occurrences in relation to ocean floor geodiversity is largely unexplored. Therefore, it is unclear what the (irreversible) potential impact of future mining is on ocean floor geodiversity.

Here, we quantify the ocean floor geodiversity of the West-Pacific ocean floor and explore the distribution of three mineral resources: polymetallic sulfides, cobalt-rich ferromanganese crusts and polymetallic nodules. We developed a workflow for the calculation of a geodiversity index composed of openly available geomorphological, sediment thickness, bathymetric and derived ocean floor roughness input data in ArcGIS Pro.

Our results show a large variety in geodiversity on the West-Pacific ocean floor, ranging from very low and low geodiversity on large plateaus and in wide trenches and throughs, to high and very high geodiversity in heterogeneous, patchy environments on shelves, basins and abyssal plains. Regression analysis results indicate that polymetallic sulfides and cobalt-rich ferromanganese crusts positively correlate to the geodiversity index, while polymetallic nodules indicate a negative correlation. Further analysis will focus on refining and expanding this method to a global extent by adding ocean floor age, a possible important factor, into the geodiversity assessment.

Our findings suggest that understanding of ocean floor geodiversity can contribute to promote sustainable mining and support conservation of the ocean floor.