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The Journey of Pumice: Rock Magnetic and Geochemical Insights from Coastal Stranding Samples

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We investigated the rock magnetic and geochemical properties of a collection of pumice samples gathered from the shores of Japan and France. These pumices exhibit a vitreous matrix with a foam-like texture, resulting in low density that allows them to float and drift far from their point of origin to distant coastlines.

A range of analytical techniques was employed, including major and trace element geochemical analyses, SEM and FEG-SEM imaging, EDS-X analyses, and rock magnetic experiments such as thermomagnetic analyses, hysteresis loops, coercivity measurements, and FORC diagrams. The collected pumices display contrasting geochemical signatures and magnetic properties.

The origin of the Japanese pumices was unambiguously traced to the 2021 Fukutoku-Okanoba (FOB) eruption. In contrast, the origin of the pumices found along the French coastline remained uncertain prior to this study. Their geochemical and magnetic properties place most of them slightly outside the range of natural volcanic pumices. We therefore favor an anthropogenic origin.

The concentrations of elements such as arsenic, mercury, and nickel were analyzed to assess potential biohazard risks associated with these pumices. While some metal levels, such as barium and nickel, were found to exceed European hazardous limits, they remain at trace levels. To further explore possible sources, we used oceanic current modeling, which helped us narrow down likely points of origin for these anthropogenic pumices. This finding raises questions about the drift of floating materials across oceans and their impact on coastal environments.