Evidence for a Hunga Tonga-Type Submarine Eruption in the Bismarck Sea

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In this study, we investigate the source of an ash layer found in sediment core VM33-116 (Lat: -2.9, Long: 148.583), located in the Bismarck Sea. Originally, this research aimed to understand the impact of volcanic ash on biological productivity and climate. However, our findings suggest that the ash layer, dated to approximately 3000–4000 years ago, is most likely from a submarine volcanic eruption similar to the Hunga Tonga eruption of 2022. The ash layer at 39–42 cm depth contains an unusual spherule aggregate and black foraminifera. Experimental work has related the formation of spherule aggregates to the intense lightening in the high-altitude volcanic plume (58 km) produced by submarine eruptions like Hunga Tonga. The black foraminifera are colored by black carbon on the inside of the foraminiferal test- a feature that might imply an increase in biological productivity. Elemental analysis using ITRAX and XRF revealed changes in Fe/Al and Ba/Al ratios, indicating volcanic ash deposition. However, no significant spikes in productivity-related elements (e.g., P, S, or biogenic Si) were observed, suggesting minimal impact on biological productivity. Corrected radiocarbon dating and geochemical analysis points to a submarine rhyolitic volcano located about 90 km from the coring site as the likely source. Other nearby volcanoes, such as Tavui and Rabaul, are probably too distant to account for the ash. Our findings contribute to understanding the sources of volcanic ash in the region and suggest that Hunga Tonga-type underwater eruptions can leave lasting geochemical markers, even across centuries. The presence of spherule aggregates and black foraminifera provides valuable insights into the effects of such eruptions on surrounding marine sediments. Further research is needed to fully understand the relationship between submarine volcanic activity and its impact on biological productivity.