

# The formation of explosive volcanos at the circum-Pacific convergent margin

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The circum-Pacific convergent margin, commonly referred to as the "Ring of Fire," is characterized by abundant volcanic eruptions, though large eruptions are rare and highly destructive. The mechanisms behind the formation of large explosive volcanoes and the identification of potential danger zones remain largely unknown. Our research indicates that the three largest volcanic eruptions since 1900, the Hunga Tonga-Hunga Ha'apai, the Mt. Pinatubo and the Novarupta, are all associated with subduction of volatile-rich sediments and located close to slab windows. Specifically, the Hunga Tonga-Hunga Ha'apai is located near subducting seamount chains, while the Mt. Pinatubo is adjacent to subducting fossil ridges, both of which have water depths much shallower than the carbonate compensation depths (CCD) in the Pacific Ocean. Seismic imaging reveals that a seamount is subducting towards the Novarupta volcano <sup>1</sup>. We suggest that subduction of volatile-rich sediments and the presence of a slab window are the two most important favorable factors for catastrophic eruptions. Slab windows expose the mantle wedge to the hot asthenosphere, which increases temperature and significantly promotes partial melting of the carbonate-fluxed domains, resulting in the formation of volatile-rich magmas that fuel explosive eruptions. Subducted carbonates are also released through hydrothermal vents, which are important for global carbon cycle <sup>2</sup>.

1 Tian, F. F., Wang, K., Xie, G. Z. & Sun, W. D. The formation of explosive volcanos at the circum-Pacific convergent margin during the last century. *Journal of Oceanology and Limnology*, doi:10.1007/s00343-022-2276-x (2023).

2 Tian, F. F. *et al.* The formation of supercritical carbon dioxide hydrothermal vents in the Okinawa Trough. *Sci. Bull.*, doi.org/10.1016/j.scib.2022.1012.1032 (2023).

