

End-Permian killer volcanism and double-phased mass extinction

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The end-Permian mass extinction comprises two major steps; the first extinction at the Guadalupian-Lopingian (or Middle-Late Permian) boundary (GLB) and the second at the Permo-Triassic boundary (PTB) per se. The greatest magnitude of the catastrophe throughout the Phanerozoic may have resulted from two separate events occurred within a short time interval less than 10 m.y. The occurrence of acidic tuffs both at the PTB and GLB suggests the enrollment of violent volcanism to the global environmental change across the two remarkable extinction horizons. In particular, a ca. 2 m thick acidic tuff bed occurs exactly at the GLB horizon in many sections in South China. The occurrence of acidic tuff bed from a mid-oceanic paleo-atoll limestone in Japan at the same horizon suggests extensive distribution of air-borne ash over thousands of kilometer. Before the tectonic accretion to the Japan margin in the Middle Jurassic, the atoll-capped paleo-seamount was located in the mid-oceanic domain in the Late Permian, probably more than 3000 km away from the continental margin. This implies that the source volcanism of acidic nature should have been violent enough to spread ash over the western superocean Panthalassa, in addition to the whole South China in the eastern Pangea. The geochemistry of this volcanism supports the violent eruption scenario but it is quite distinct from those of the continental flood basalt such as the Siberian Traps and Emeishan flood basalt that have been often nominated as favorite candidates for the cause of the GLB and PTB events. From a paleoenvironmental aspect, it is noteworthy that the superanoxia in the deep superocean started from the GLB and culminated across the PTB.

New type of gas mass spectrometer for K-Ar dating of Quaternary volcanic rocks

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K-Ar method has been commonly used in Quaternary research. However, argon isotope analyses of historical lavas strongly suggest that the conventional K-Ar method is no more valid for dating of Pleistocene - Holocene rocks. This requires a high sensitive mass spectrometer with multi collector system for argon analysis of rocks with unusual primary isotopic ratios. Recently, Dune Inc. introduced a highly sensitive and miniature gas mass spectrometer of magnetic sector type with an inclined magnetic field from high-energy particle accelerator technology. It is inexpensive compared to conventional Nier type mass spectrometers and its maintenance is much easier. It has also a highly cost performance for modification to the multi collector system. We carried out test analyses of argon from minerals to check stability and reliability of the new gas mass spectrometer, Elfie 103.

Elfie 103 shown in the photo below was connected to a part of purification line of the present mass spectrometric system by Itaya et al. (1991). Our working standard of biotite was analysed with Elfie 103 by isotopic dilution method using a spike 38 argon. The result shows that the age obtained from ca. 70 mg of biotite is within the age variation of 120-130Ma by the present mass spectrometric system though the analyses were carried out under a relatively high blank condition due to insufficient baking - vacuum out time. This new mass spectrometer should be able to be applied to a precise argon analysis of Quaternary volcanic rocks to solve the problem for unusual primary isotopic ratios after the appropriate improvement including three-collector system.

