Plume Winter scenario for the Permo-Triassic boundary biosphere crisis

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The Plume Winter scenario is proposed to explain a possible link among three unusual geologic phenomena occurred across the Permo-Triassic boundary; the existence of Pangea, superanoxia in deep-sea, and mass dying. These three are all unusual in the Phanerozoic but unique to PTB. The coincidence in timing of the initial breakup of Pangea, superanoxia, and biosphere crisis probably indicates a sequence of events triggered by a superplume activity in Earth's mantle. When a plume head penetrated into preexisting continent to break up, partial melting of crust may have generated rhyolitic magma. Unusually violent volcanism induced by plume may have caused 1) formation of dust/aerosol screen, 2) stop of photosynthesis, 3) collapse of food web, 4) mass extinction, and 5) superanoxia.

The end-Permian mass extinction, the greatest in the Phanerozoic, occurred through two distinct steps, i.e., the first big decline in biodiversity across the Guadalupian/Wuchapingian boundary and the well-known main one across the Chanhsingian/Griesbachian boundary. The deep-sea cherts in Japan also recorded changes across the two horizons in fauna, lithofacies and redox. The intercalation of tuff at the two horizons in stratotypes in South China strongly suggests an intimate cause-effect relation between volcanism and extinction. In particular, the ryholitic nature of tuff beds indicates explosive volcanic eruption derived from highly viscous acidic magma rather than contribution from the nearly coeval Siberian flood basalt. The 'Plume Winter' scenario is proposed to explain a possible link among the following three unusual geologic phenomena occurred across the Permo-Triassic boundary (PTB); the existence of Pangea, long-term oxygen depletion in deep-sea (superanoxia), and mass dying. These three are all global in context and unusual in the Phanerozoic but unique to PTB. The coincidence in timing of the initial breakup of Pangea, superanoxia, and biosphere crisis probably indicates a sequence of events triggered by a superplume activity in Earth's mantle. When a plume head penetrated into the bottom of preexisting continent to break up, partial melting of crust may have occurred to generate rhyolitic magma. Unusually violent volcanism associated with continental breakup may have caused 1) formation of dust/aerosol screen, 2) stop of photosynthesis, 3) collapse of food web, 4) mass extinction, and 5) superanoxia. The noble gas evidence for an extraterrestrial impact (Becker et al., 2001) from an errouneously assigned PTB horizonin Japan is not accepted straightforward.