Estonian Journal of Earth Sciences
2023, **72**, 1, 134

https://doi.org/10.3176/earth.2023.58

www.eap.ee/earthsciences
Estonian Academy Publishers

Coupled extinction–regression episodes revisited in mid-oceanic settings for comparative extinction study during the Palaeozoic in view of non-bolide extraterrestrial causes

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ABSTRACT

Major change in the Earth's surface temperature appears to be the most critical and universal factor for inducing coevally multiple kill mechanisms for organisms during the global environmental change episodes. Among the major extinction events during the Phanerozoic, the end-Ordovician episode shares almost the same environmental background with that of the end-Guadalupian (middle Permian). These two major extinction-relevant episodes, however, occurred respectively before and after the mid-Palaeozoic botanical revolution, i.e., the first mass development of land plants/forests. Owing to the enhanced terrestrial photosynthesis, the atmospheric CO_2 content decreased irreversibly from ca. 2800–800 ppm in the Ordovician down to 400–300 ppm in the Permian. This highlights an apparent contradiction between the end-Ordovician glaciation and distinctly high atmospheric pCO_2, which may suggest that one or more agents on global scale were likely responsible for the prominent global cooling besides atmospheric pCO_2 with respect to the greenhouse effect. The same conundrum is much clearer in the cases of Proterozoic snowball Earth events.

Ancient mid-oceanic sedimentary rocks, i.e., deep-sea cherts and atoll carbonates on top of seamounts, are valuable in recording the average regional/global changes of past oceanic domains without receiving tectonic disturbances along continental margins. The Permian mid-oceanic deep-sea cherts and paleo-atoll carbonates in South-West Japan were deposited in the mid-Panthalassa superocean that occupied nearly 70% of the Earth's surface (the rest 30% by Pangea). The latest research results from these unique sedimentary archives in Japan are introduced with particular focus on the hiatus-bearing sea-level drop and a unique signature of extraordinarily high ^{3}He enrichment in the extinction-relevant interval. These new lines of evidence imply non-bolide extraterrestrial agent for driving global cooling/sea-level drop. Comparative discussion with the end-Ordovician episode may open a new window for extinction study.

Received 9 April2023
Accepted 11 May 2023
Available online 14 June 2023

Keywords:
extinction, Permian, Ordovician, global cooling, mid-oceanic hiatus, ^{3}He flux

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Citation:
Isozaki, Y. 2023. Coupled extinction–regression episodes revisited in mid-oceanic settings for comparative extinction study during the Palaeozoic in view of non-bolide extraterrestrial causes. *Estonian Journal of Earth Sciences*, **72**(1), 134. https://doi.org/10.3176/earth.2023.58

14TH ISOS ESTONIA 2023