Study shows first record of oceanic anoxic event 1b in Jiuquan Basin section

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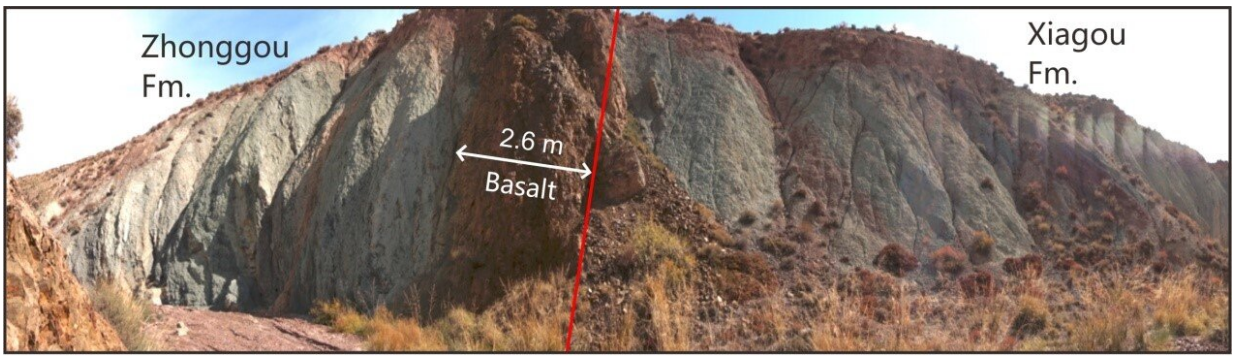

Section photograph showing boundary (red line) of Xiagou and Zhonggou formations in Hanxiagou section. Credit: NIGPAS

The Cretaceous paleo-ocean has experienced multiple phases of Oceanic Anoxic Events (OAEs), characterized by organic carbon enrichment, geochemical indicator anomalies and fossil assemblage changes. It includes three events, namely OAE 1, OAE 2 and OAE 3.

Previous studies of OAE 1b events have been mainly based on marine sediments in western Tethys. Few researches have been conducted on Eurasia, which limits our insight into the response of terrestrial ecosystems to OAE 1b.

Recently, Zhao Xiangdong, a graduate student supervised by Prof. Zheng

Dajin and Zhang Haichun from the Nanjing Institute of Geology and Paleontology of the Chinese Academy of Sciences (NIGPAS), and his collaborators have found the first record of OAE 1b events in the Xiagou Formation and Zhonggou Formation of the Hanxiagou Section in Jiuquan Basin, northwestern China. The results provide direct evidence to link the OAE 1b and terrestrial ecosystem in Eurasia.

The research results were published in *Geological Society, London, Special Publications*.

In this work, the researchers used organic carbon isotope and total organic carbon (TOC) content data analyzed from a terrestrial succession in the Xiagou and Zhonggou Formations (upper Aptian-lower Albian) in order to characterize the OAE1b in the Eurasia continental sediments. They also analyzed Hg concentrations to investigate changes in the flux of volcanic materials to terrestrial environments during the OAE 1b.

On the basis of zircon U-Pb age of 112.4 ± 0.3 Ma for a basalt layer from the lowermost Zhonggou Formation, the three negative $\delta^{13}C_{org}$ excursions well corresponded with the three subevents (Kilian, Paquier, and Leenhardt) of the OAE1b in the Poggio le Guaine (central Italy), Vocontian Basin (SE France) and Santa Rosa Canyon (NE Mexico) Sections. This supported the record of the terrestrial OAE 1b in the Jiuquan Basin.

"Five mercury enrichment intervals in Hg/TOC ratios were recognized in the Hanxiagou Section, showing a high agreement with the previous study in the Poggio le Guaine section," said Zhao. This consistency indicates that mercury in both sections were probably from the same source.

The volcanic eruptions of the Southern Kerguelen Plateau (119.0–109.2 Ma) provided the Hg source and probably triggered the OAE1b

(~114.5–110.5 Ma). The multiple long-term spikes observed in the Hg/TOC profile could further reflect a multiple phase emplacement of the volcanism.

The Hg/TOC spikes and Carbon Isotope Excursions are not strictly at the same positions in both sections, which means a potential decoupling relationship between the global shifts in $\delta^{13}C$ and the volcanic activity (suggested by Hg/TOC). This decoupling relationship may result from another unstable and unknown carbon reservoir (not directly linked to Hg emissions) activated after the volcanism.

More information: Xiangdong Zhao et al, Carbon cycle perturbation and mercury anomalies in terrestrial Oceanic Anoxic Event 1b from Jiuquan Basin, NW China, *Geological Society, London, Special Publications* (2022). DOI: 10.1144/SP521-2021-149

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