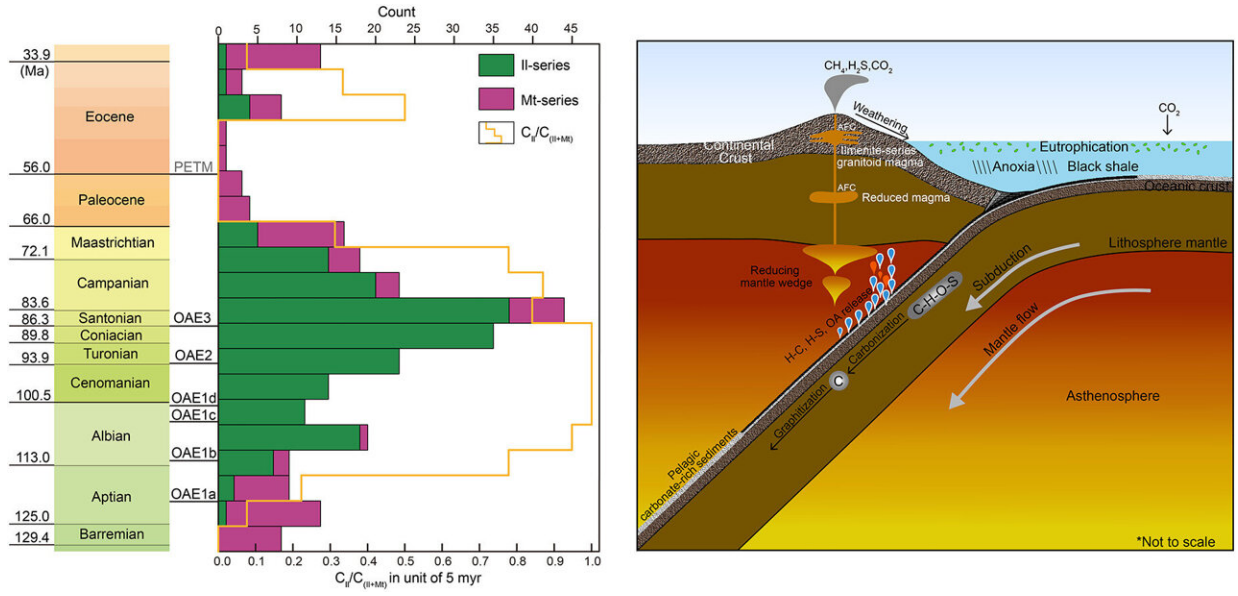
How do oceanic anoxic events affect oxygen fugacity of convergent margin magmas?

January 18 2022, by Li Yuan



Graphical abstract. Credit: DOI: 10.1016/j.lithos.2021.106529

Granitoids are classified into magnetite-series and ilmenite-series, and the former have higher oxygen fugacity than the latter. Magmatic oxygen fugacity is a key factor in controlling the mineralization type.

In general, the arc magmas are oxidized, forming magnetite-series granitoids. However, there are also ilmenite-series granitoids at convergent margins. The controlling factors on the formation of these two series of granitoids are controversial.

Combining the temporal distribution and geochemical compositions of granitoids in Japan, a research team led by Prof. Sun Weidong from the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS) presented new insights into the influence of oceanic anoxic events (OAEs) on the formation of ilmenite-series granitoids in Japan.

The study was published in *Lithos*.

Researchers found that the temporal distributions of ilmenite-series granitoids in Japan have a good correlation with OAEs.

Specifically, the initial appearance of ilmenite-series granitoids in Japan is almost contemporaneous with OAE 1a. Several OAEs occurred consecutively from 120 Ma to 86 Ma, and the proportion of ilmenite-series gradually increased in this period. After OAE 3, the proportion of the magnetite-series granitoids began to increase, which matches with the OAE gap after 86 Ma.

The OAEs occurred frequently in the Cretaceous, forming large amounts of reducing black shales on the ocean floor. The time consistency between the ilmenite-series granitoids and the OAEs indicates a genetic link between them. The different geochemical compositions between these two series granitoids support this hypothesis.

Compared with the magnetite-series granitoids, the ilmenite-series granitoids have lighter S isotope compositions and heavier O isotope compositions, which are similar to the S and O isotope compositions of black shales.

In addition, the ilmenite-series granitoids contain up to several hundred ppm of CH_4 and also rare C_2H_6, while magnetite-series granitoids contain almost no CH_4 and C_2H_6. These also indicate that large amounts of organic-rich sediments are involved in the formation of ilmenite-

series granitoids.

The researchers also found that the Zn/Fe_T ratios of ilmenite-series are higher than those of magnetite-series, indicating that different oxygen fugacity between these two series granitoids came from the magma sources.

These black shales formed during OAEs were subducted into mantle wedge, releasing reducing fluids that lower the oxygen fugacity of mantle and convergent margin magmas, forming ilmenite-series granitoids.

More information: Kun Wang et al, The influence of oceanic anoxic events on convergent margin magmas, *Lithos* (2021). DOI: 10.1016/j.lithos.2021.106529

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