

Geochemistry, Sm-Nd and Rb-Sr isotopic compositions of eclogite in the Lasha terrane, Tibet, and their geological significance

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Eclogite was first discovered in the Lasha terrane, northeast to the Lasha city, Tibet, China. It is located in the north of the Gangdese island arc belt. The eclogite occurs as a 500-600 m thick belt, extending in EW for over 10 km. Most eclogites are massive, coarse-grained and fresh. Three types of eclogite have been recognized, which are rutile eclogite, quartz eclogite and phengite eclogite.

The major elements, trace elements, rare earth elements, Sr-Nd isotopic compositions and Sm-Nd isotopic chronology of some eclogites were obtained in this study. The major elemental compositions and relatively high $\epsilon_{\text{Nd}}(t)$ of about +7.9 for the eclogites suggest that the protoliths of eclogites were ancient basaltic rocks developed in ocean crust, similar with the typical N-MORB, and derived from the depleted mantle. The $(^{87}\text{Sr}/^{86}\text{Sr})_i$ of the eclogites vary over a wide range, from 0.70335~0.70457, which is not closely relevant with the $\epsilon_{\text{Nd}}(305\text{Ma})$ and trace elements. We favor that this irrelevant may be due to the ocean environment of these eclogites developed and the later aqueous alteration after its formation. The Sm-Nd age of 305.5 ± 50 Ma defined by the whole rock is interpreted to represent a developed age, indicating that there was ancient Tethys and its deep subduction in northern Gangdese at early Carboniferous-lately Permian.

Fe isotopes of banded iron formation from Anshan, northeast China

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Fe is the most abundant element engaging in redox chemistry, and is one of the element has been used biologically at very early stage. Thus understand the geochemical cycling of Fe has great implications for the development of an oxygenated atmosphere and the origin of life. Banded iron formations (BIFs) are chemical deposits from oceans. They have potential to preserve paleoceanographic signatures. Here we report the results of an iron isotope study on BIFs from North China Craton.

The BIFs studied were formed at the Archean-Proterozoic transition period (2.5 Ga), and subjected to amphibolite-facies metamorphism. They consist of finely layered alternating beds dominated by magnetite and quartz respectively, with minor amounts of pyrite and hematite. The minerals of magnetite, hematite and pyrite were separated. After purification using anion exchange chromatography, Fe isotope ratios of the mineral separates were measured using a Nu Plasma HR MC-ICPMS in conjunction with a DSN 100 desolvating nebuliser. The results are expressed in ϵ units which are deviations in parts per 10^4 from the same isotope ratios of the reference material IRMM-14. Fe isotope compositions of the mineral separates range in $\epsilon^{57}\text{Fe}/^{54}\text{Fe}$ units from 1.1 to 20.9, 8.6 to 12.5, and 1.3 to 18.5, for pyrite, hematite and magnetite respectively. Another observation is that the Fe isotope compositions of pyrites are systematically heavier than corresponding magnetites in each samples.

The average Fe isotope compositions obtained from BIFs in this study for pyrite and magnetite are unusually high relative to the bulk silicate Earth, other BIFs in Transval and Greenland, and MOR hydrothermal fluids. This suggests that only a small fraction of Fe(II) in sea water has been oxidised to Fe(III) to form the BIFs in Anshan area, which implies an atmosphere with low O_2 contents at the time. Alternatively, this may imply that some fraction of Fe(II) has been precipitated as iron sulfide or carbonate, resulting relative enrichment of heavy isotopes in seawater, prior to the precipitation of BIF. Indeed, some archean pyrite deposits in North China exhibit very light Fe isotope signature.

As the contents of pyrite in the BIFs studied are <1%, the Fe isotope compositions of bulk rocks are predominated by magnetite. The fact that the Fe isotope compositions of pyrites are systematically heavier than corresponding magnetites in each samples suggests that these mineral pairs were re-equilibrated in terms of Fe isotopes during metamorphism.