REE and trace element patterns across the Ediacaran-Cambrian transition, South China

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The Ediacaran and Cambrian interval belong to the most important periods in Earth's history. Deposits from the early Cambrian of the Yangtze Platform in South China represent a valuable source of information for the reconstruction of the evolution of marine palaeo-environments. Concentrations of REE and trace elements in kerogen as well as in bulk rocks from different depositional environments of the Yangtze platform indicate oxic conditions for shallow-water environments, and euxinic conditions in the deeper sea. The oxygenation of the water column of shallow-marine environments is manifested in two oxygenation events, one occurring in the upper Meishucunian and the second in the lower Qiongzhusian. Particularly the second oxygenation event resulted in the change of benthic redox conditions form anoxic to (sub-) oxic, which likely had an impact on the Cambrian explosion of life.

The early Cambrian Ni-Mo-PGE polymetallic ore layer, which occurs in most sections of the Yangtze Platform, shows a considerable enrichment of certain trace elements and coincides with negative $\delta^{13}C_{org}$ values. It is used as a marker for stratigraphic correlation separating the Meishucunian and the Qiongzhusian. Trace metal enrichment in associated black shales further indicates widespread euxinic conditions , although the extreme enrichment of some metals may originally come from hydrothermal plumes associated with spreading ridge volcanism. The results of this study thus provide valuable information about palaeo-environmental changes in the oceans during the Ediacaran-Cambrian transition,which may be used for the stratigraphic division of the Lower Cambrian.

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Magmatic digestion of the crust and the origin of silicic magmas in Iceland: Insights from partially melted crustal xenoliths

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Silicic magmas play a fundamental role in the origin of the continental crust. Whether silicic magmas predominantly result from extensive fractionation of the parental basaltic melts or they originate during partial melting of the older metamorphosed oceanic crust is still a subject of debate.

We studied partially melted, glass-bearing granite to syenite xenoliths from the Tindfjallajökull Pleistocene volcanic complex, SW Iceland. EPMA and LA ICP-MS were used for analysis of major and trace elements, SIMS and single grain laser fluorination methods were applied for zircon dating and O isotope analysis of minerals and glasses. The xenoliths consist of strongly resorbed, partially melted relicts of anorthitic plagioclase and K-rich feldspar (Fsp; Ab_{21-80} An_{1-37} Or_{1-78}, $\delta^{18}O$ = 5.3-6.2‰ given in permil relative to SMOW standard) and rounded quartz (Qz; 5.9-6.8‰) in the mingling colorless (5.5-6.2‰) through pale or light brownish (5.1-5.9‰) to dark-brown magnetic (4.0-5.0‰) interstitial glass matrix. Spongy aggregates and elongated crystals of orthopyroxene (mg# = 62-75, Wo_{1-10} En_{58-77} Fs_{20-36}) and clinopyroxene (mg# = 52-68, Wo_{34-43} En_{31-46} Fs_{16-27}) are common. They probably have crystallized during reaction of hot mafic magmas with surrounding crustal (plagiogranitic?) rocks at T = 800-1100° C. Magnetite (Spl_{1-9} Mag_{58-84} Usp_{14-37}) and rare ilmenite often form clusters with zircon and chevkinite, and together with apatite represent the accessory mineral association.

Many Icelandic lavas have systematically lower in $\delta^{18}O$ (i.e., <5.2-5.6‰) due to their interaction with the upper-crustal rocks altered by meteoric water, but they may contain strongly $\delta^{18}O$-diverse olivines and zircons [1,2]. The important result of this work is that although the studied xenoliths are not low-$\delta^{18}O$, suggesting no interaction with meteoric water, they also contain low- to high-$\delta^{18}O$ (2.2-6.3‰) young zircons (0.18-0.25 ± 0.03 Ma, 2 SD). This may suggest *in-situ* crystallization of the high-$\delta^{18}O$ zircons from the "minute" partial melts under local isotopic equilibrium. On the other hand, part of the zircon cores representing the lower end of the $\delta^{18}O$ range and being out of equilibrium with the interstitial melts could be inherited from the adjacent hydrothermally-altered crustal rocks having low $\delta^{18}O$ values.

[1] Bindeman *et al*. (2008) *GCA* **72**, 4397-4420. [2] Bindeman *et al*. (2012) *Terra Nova* **24**, 227-232.

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