High Precision $\Delta^{17}O$ analysis of cherts – implications for the temperature and $\delta^{18}O$ of ancient oceans

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A controversial issue in Earth science is the change of $\delta^{18}O$ and/or temperature of seawater throughout the past 4 Gyrs. Oxygen isotope studies of ancient marine chemical sediments suggest that the ancient oceans were either very hot (up to 80°C; [1]) or had a low $\delta^{18}O$ (e.g. –12‰; [2]). Alternatively, low $\delta^{18}O$ values are a result of diagenesis [3]. We address this classical problem using high-precision triple O isotope ratios of cherts. Recently, [4] resolved mass-dependent variations in $\Delta^{17}O$ in terrestrial rocks that are related to high- and low-T fractionation processes and reservoir mixing.

We analyzed Archaean, Proterozoic, Phanerozoic and modern cherts from different locations. We have reacted these cherts with BrF_5 in Ni bombs and measured the liberated oxygen in dual inlet mode of MAT253 mass spectrometer. The precision in $\Delta^{17}O$ was about ±10–15 ppm; a little lower than what can be obtained by laser fluorination of silicates and oxides [4].

The Archaean cherts are found to have $\delta^{18}O$ of ~ 16‰ and a $\Delta^{17}O$ of ~ –150 ppm (see [4] for definition of $\Delta^{17}O$). Phanerozoic cherts have $\delta^{18}O$ of about +30‰ and $\Delta^{17}O$ around –250 ppm. The composition of the Proterozoic cherts falls in between these two in the triple isotope space.

We will discuss the results with respect to the temperature and $\delta^{18}O$ of Precambrian and Archaean seawater.

[1] Knauth and Epstein (1976) *GCA* **40**, 1095–1108. [2] Perry (1967) *EPSL* **3**, 62–66. [3] Degens and Epstein (1962) *Bull. Am. Assoc. Petrol. Geol.* **46**, 534–542. [4] Pack and Herwartz (2014) *EPSL* **390**, 138-145.