

$\delta^{37}\text{Cl}$ values of the solar system

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Multiple sodalite grains within altered CAIs in Allende (CV3) were analyzed for their chlorine isotopic composition using *in situ* ion microprobe analysis. $\delta^{37}\text{Cl}$ values range from -0.39 to -2.09% , averaging to $-1.33 \pm 0.55\%$ ($n = 10$). Isotopic variation within individual CAIs and among the inclusions is within external reproducibility over the analytical session ($\pm 0.25\%$), indicating that sodalite formed from a homogeneous reservoir.

Published $\delta^{37}\text{Cl}$ values fall in two distinct clusters (Fig. 1).

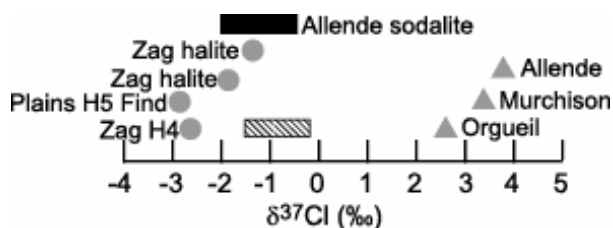


Fig. 1. $\delta^{37}\text{Cl}$ values of meteorites. Sodalite in Allende (black box; this study); Water-soluble extracts (circles; Bridges et al., 2004); Bulk carbonaceous chondrites (triangles; Magenheimer et al., 1994, 1995); Bulk meteorites (dashed box, Bonifacie et al., 2004); terrestrial seawater is 0‰.

These clusters have been used to argue for two distinct reservoirs in the early solar system: an isotopically light parent body brine and heavier chondrite silicate solid (Bridges et al., 2004). If a significant portion of the Cl in Allende is hosted in sodalite, then our data contradict the earlier reported $\sim +4\%$ value, a conclusion supported by Bonifacie *et al.* (2004). We conclude that the solar system average, and by extension, the bulk Earth, have $\delta^{37}\text{Cl}$ values $\leq -1\%$.

References

- Bridges et al., 2004, Meteor. & Planet. Sci, 657-666.
Bonifacie et al., 2004, 14th Goldschmidt Conf., A49.
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Uncoupled C and S biogeochemical cycling in the Neoproterozoic from the Huqf Supergroup, Oman

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Huqf Supergroup strata [$\sim 715 - 540$ Ma] have been analyzed for organic and carbonate $\delta^{13}\text{C}$, as well as $\delta^{34}\text{S}$ from anhydrite and carbonate-associated sulfate (CAS). The Huqf contains a negative excursion in carbonate $\delta^{13}\text{C}$ of $\sim 13\%$ in the Shuram Formation. This “Shuram” excursion extends through $>500\text{m}$ of section, suggesting a long term perturbation to the C cycle.

Sulfate $\delta^{34}\text{S}$ shows little variability throughout the period of the Shuram excursion. There is no indication of a correlation between $\delta^{34}\text{S}$ and carbonate $\delta^{13}\text{C}$ during the Shuram excursion, indicating that the oxidation of depleted carbon responsible for the Shuram $\delta^{13}\text{C}$ excursion was not accompanied by significant oxidation of sulfide. Together, these data are best explained by the oxidation of a vast reservoir of dissolved organic carbon in the deep ocean.

Following the Shuram excursion, sulfate $\delta^{34}\text{S}$ climbs sharply over 6 Myr, reaching a maximum of $\sim 41\%$ just before the Precambrian/Cambrian boundary. This is followed by a slight decrease in $\delta^{34}\text{S}$ in the overlying earliest Cambrian strata. There is no appreciable change in carbonate $\delta^{13}\text{C}$ coincident with or subsequent to the $\sim 20\%$ increase in sulfate $\delta^{34}\text{S}$. This observed rate of change in sulfate $\delta^{34}\text{S}$ ($\sim 3\%/Myr$) indicates low Neoproterozoic sulfate concentrations. The decline in sulfate $\delta^{34}\text{S}$ following the Precambrian/Cambrian boundary suggests a progressive increase in the concentration of seawater sulfate. These data indicate a massive Neoproterozoic reorganization of the global C-S biogeochemical cycles, likely due to oxygenation of the deep ocean.