

The GOE and oxygen trends in the Proterozoic atmosphere

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Most data support a rise in oxygen, known as the Great Oxygenation Event (GOE), around 2400 to 2300 Ma. Here we combine results from two independent methods to estimate atmospheric O₂ concentrations during the Precambrian: 1) measurement of oxygen concentrations in sedimentary halite and ooids at four times during the Neoproterozoic and Proterozoic; 2) measurement of the Se/Co ratio in 2037 sedimentary pyrite grains from 310 black shale samples spread throughout the Precambrian. By combining these two approaches we have derived the following relationship:

$$\text{Atmospheric O}_2 \% = 30 \times P / (1 + P),$$

where $P = 10^{[0.89 \times \log(\text{Se/Co}) + 0.07]}$; $r^2 = 0.86$ and Se/Co is measured by LA-ICPMS of sedimentary pyrite [1].

The oxygen curve revealed by this relationship suggests GOE peaked at ~ 1 PAL (Present Atmosphere Level) from 2000 to 1750 Ma, followed by a general decrease to around ~0.05 PAL at ~1000 Ma, with a spike around 1400 Ma. Oxygen then rose gradually through the Ediacaran to reach a maximum of ~1.2 PAL in the early Cambrian. We will present other geological, mineralogical and geochemical evidence to support the peak of GOE at 2000 to 1750 Ma.

[1] Steadman et al., in press, Precambrian Research.