# Development of a halite screening protocol for ancient atmosphere

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In recent years there has been considerable attention focussed on the evolution of Earth's atmospheric oxygen and the link to animal life. For several years the application of RSE's and stable isotopes of marines sediments have provided valuable information whereas the first direct measurement of atmospheric oxygen was from halite-hosted fluid inclusions (Blamey et al., 2016) and measured by mass spectrometry. Here we present an evolving screening protocol to evaluate the integrity of halite-hosted inclusion gases.

Our proposed screening protocol is a 8-step sequence that evaluates the primary nature of halite inclusions:

1. Hand examination for primary chevron growth.
2. Thick-section examination of chevron trails as these are destroyed by recrystallization.
3. Inspection for large gas bubbles and for secondary inclusions trails.
4. Geochemical analysis for K, Br,
5. Analysis of RSE's, REE's
6. Isotopes of Sr, D, $^{18}O$ and $^{40}Ar/^{36}Ar$.
7. Measurement of $CH_4$ and $CO_2$.
8. Evaluation of $N_2$-$O_2$-Ar data.

The evaluation of atmospheric $N_2$-$O_2$-Ar signals versus brine ratios is complicated by the equilibrium between N2 and nitrate. At lower $O_2$ levels, less nitrate is available and at its expense, $N_2$ is expected to be greater. This equilibria between $N_2$ and nitrate could imply that atmospheric $N_2$ was greater during the Proterozoic than today, an issue avoided by most paleoatmospheric studies.

If all the above criteria are met, then we are confident that the gas signals measured are unmodified since trapping. By applying these criteria to halite from the Sibley Group of Ontario, the samples and analyses that pass the screening protocol give a 1.4 Ga atmospheric oxygen level of ±2.6% (12% PAL).

**This abstract is too long to be accepted for publication. Please revise it so that it fits into the column on one page.**

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