Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35678

Measuring gases in halite: what does it tell us about the ancient atmospheric oxygen?

NIGEL BLAMEY[1], UWE BRAND[2], AUDREY K. MORRISON[1], MATTHEW HEIZLER[3], AMY LEFEBVRE[4], SORCHA ROUNTREE[5] AND CHRISTOPHE LÉCUYER[6]

[1]The University of Western Ontario
[2]Brock University
[3]New Mexico Bureau of Geology
[4]Northern Ontario School of Medicine University
[5]University of Western Ontario
[6]UMR5276 LGL-TPE, Universite Claude Bernard Lyon1

Discrepancies among paleoatmospheric compositions derived from mass spectrometry of halite-hosted fluid inclusions requires resolution. In addition, the modelling of paleoatmospheric oxygen based on indirect analytical methods or unproven assumptions may lead to erroneous results and the ultimate misdirect of paleoclimate research.

Applying RSE's to sediment from the bottom of the Black Sea would provide an outcome that the Modern atmosphere was anoxic. Therefore, quantifying the fluid inclusion volatiles in halite offers a robust approach to measure "whiffs of old air" (Freyer and Wagener, 1970) thanks to the mineral not being composed of any atmospheric gases in addition to the lack of gas diffusion in halite.

Freyer and Wagener (1970) were the first to measure atmospheric gases trapped within halite. Blamey et al. (2016) presented the first Precambrian atmospheric oxygen values from Neoproterozoic halite from the Officer Basin in Australia. Blamey et al. (2018) followed up by presenting 1.45 Ga, 2.0 Ga, and 2.6 Ga atmospheric oxygen values, followed by a screening protocol (Blamey and Brand, 2019). In 2025, Park and Schaller (2025a) published a gas partitioning approach (MAGPI), and finally MAGI-corrected results of the 1.4 Ga halite (Park & Schaller, 2025b).

Only two labs are currently examining the halite-hosted fluid inclusions and they are at the University of Western Ontario and Rensselaer Polytechnic. We compare and contrast the two approaches used by both labs and examine their advantages and limitations. We present an example from the Neoproterozoic where hopper halite crystals are preserved in dolomite and are crosscut by a secondary halite vein. This case emphasizes the need to support gas measurements with quantitative measurements of the aqueous phase from the halite-hosted fluid inclusions and thus determine if the researcher should approach the atmospheric oxygen content from the gas side or the aqueous side. Both approaches have their merit, but the right samples need to be analyzed.

References

Blamey & Brand, 2019. Gondwana Research, 69, 163-176.
Blamey et al., 2016. Geology, 44, 651-654.
Blamey et al., 2018. Goldschmidt
Freyer, & Wagener, 1970. Z. Naturforsch, 25, 1427-1430.
Park & Schaller, 2025a. Gondwana Research,139, 204–215
Park & Schaller, 2025b. PNAS, 52, e2513030122