Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19386

# Sulphur isotopes and helvine-group minerals in the Larvik Plutonic Complex, Norway (LPC)

**EMIL HOLTUNG GULBRANSEN**[1], HENRIK FRIIS[1], WILLIAM HUTCHISON[2] AND TOM ANDERSEN[3]

[1]Natural History Museum, University of Oslo

[2]School of Earth and Environmental Sciences, University of St Andrews

[3]University of Johannesburg

Presenting Author: e.h.gulbransen@nhm.uio.no

The Larvik Plutonic Complex (LPC) is part of the late Carboniferous to early Permian Oslo Rift in the Southeastern part of Norway. Broadly speaking, the age increases from east to west and the composition changes from quartz-bearing monzonite to felspathoid bearing. There are numerous miaskitic to agpaitic pegmatites in the complex and the origin and source of these pegmatites are still uncertain. Sulphur isotope geochemistry can help unlock the uncertainties around the evolution of the pegmatites. Alkaline pegmatites have never been explored with traditional S-isotope geochemistry, despite its mineralogy being suitable for it. Helvine-group minerals ($Be_3M_4(SiO_4)_3S$), where M = $Fe^{2+}$, Mn or Zn, is a relative common mineral in the pegmatites of the LPC, and rarely occurs together with other S-bearing minerals. Since helvine contains S, it potentially enables the use of S-isotope geochemistry. Despite that the total S (TS) content of helvine (~3.00% TS) being a tenth of common sulphides the method is traditionally applied to, such as sphalerite (~32.00% TS). This is of major significance as the utilization of a new mineral for S-isotope geochemistry unlocks unknown parameters of parageneses where traditional sulphur minerals are absent. The $\delta^{34}S$ content in the helvines of pegmatites on the western boarder (293.0 Ma) of LPC show a high value of 16.45, while the more central areas (292.4 Ma) has a $\delta^{34}S$ of 0.30-0.89. Just outside the western boarder of the LPC there are Proterozoic sediments which might have influenced the high $\delta^{34}S$ through crustal contamination. The $\delta^{34}S$ values of the central LPC indicate a more primary magmatic source. The helvine $\delta^{34}S$ values correlate well with $\delta^{34}S$ values we have obtained from traditional sulphide minerals in the pegmatite. Using geothermometry with well known sulphur fractionation coefficients between coexisting sulphides (galena-sphalerite), new insights to formation temperature of the pegmatites are given. With the utilization of S-isotope geochemistry on helvine-group mineral, a traditional analytical method can now be applied to completely different minerals from a varied range of parageneses, and thereby open for sulphur isotope studies in geological settings devoid of sulphides or sulphates.