Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.27264

Applications of a new Eu-in-plagioclase-clinopyroxene oxybarometer

NICHOLAS DYGERT[1], EMILY N ETHERIDGE[1], RACHEL E HUK[1] AND DIAN JI[1,2]

[1]University of Tennessee
[2]Rice University

Oxygen fugacities (fO_2s) are calculated from peridotites and cumulate rocks as a function of composition and temperature using mineral exchange reactions, e.g., among olivine, orthopyroxene and spinel and between Fe-Ti oxides and coexisting silicates. However, many cumulate rocks common to planetary interior reservoirs lack the phases necessary for traditional oxybarometeric methods. To address this problem, [1] developed a temperature and composition-dependent predictive model for the partitioning of divalent elements between the clinopyroxene M2 site and coexisting basaltic melt, and an fO_2-dependent clinopyroxene-melt Eu partitioning model and oxybarometer. Coupling the clinopyroxene-melt Eu partitioning model with a published fO_2, composition and temperature dependent plagioclase-melt Eu partitioning model [2], [1] formulated a Eu-in-plagioclase-clinopyroxene oxybarometer applicable to cumulate rocks from terrestrial and lunar systems. We apply the oxybarometer to lunar anorthosites and basalts, oceanic gabbros (Figure), layered intrusions, and lower crustal cumulates to explore fO_2s among these settings and speculate on their origins.

[1] Dygert, N., Ji, D., Etheridge, E.N., 2025. GCA, doi:10.1016/j.gca.2025.02.003.

[2] Dygert, N. et al., 2020. GCA 279, 258-280.

[3] Sun, C., Lissenberg, C.J., 2018. EPSL 478, 165-178.

[4] Müller, S., et al., 2022. JGR-Solid Earth 127, e2021JB022699.

[5] VanTongeren, J.A., Kelemen, P.B., Grove, T.L., 2022. JGR-Solid Earth 127, e2022JB024812.

[6] Grambling, N.L., et al., 2022. JGR-Solid Earth 127, e2021JB022696.