

Olivine in diamond: towards a new tool for constraining entrapment conditions

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Diamond is an extraordinary material of the Earth's deep interior. Its remarkable thermo-elastic properties and chemical stability make it the ideal material to provide crucial insights into the mechanisms of plate tectonics, carbon and volatile cycles, that in turn mean understanding the Earth's geodynamics and the evolution of the atmosphere and the regulation of our climate. However, the information that diamond can provide by itself is mainly related to its formation environment. To determine the depth at which diamonds grow we need to look at what is inside the diamonds: mineral inclusions. Olivine is among the most common mineral phases found within diamonds. However, the state-of-the art is that we have lots of inclusions entrapped in diamonds but mostly surrounded by cracks and with evidence of fluid rims [1;2]. This means that, if they are interpreted naively, the measured inclusion pressures imply that most of these diamonds grew and entrapped olivines in the stability field of graphite [1]. This is clearly wrong, and this indicates that we have to look for the mechanisms that are contributing to the release of the residual inclusion pressure that is not accounted for in the simple elastic geobarometry model successfully used for inclusions in garnets in ultra-high-pressure- metamorphic rocks [3;4].

[1] Angel, R. J. et al. (2022). *Reviews in Mineralogy and Geochemistry*, 88(1), 257-305.

[2] Nimis, P. et al. (2016). *Lithos*, 260, 384-389.

[3] Murri, M. et al. (2018). *American Mineralogist*, 103(11), 1869-1872.

[4] Murri, M. et al. (2022). *Lithos*, 422, 106716.