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The water concentrations and OH incorporation mechanisms of silicate inclusions in diamonds. What information do they provide?

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The water concentrations of nominally anhydrous silicate inclusions in diamonds have the potential to provide information either on the water concentrations of mantle sampled by diamonds, or on the compositions of fluids that precipitate diamonds. In this study we have used FTIR spectroscopy to measure the water concentrations and incorporation mechanisms in inclusions of olivine and pyroxene in diamonds from Australia, Canada, Siberia and India. There are systematic differences in water incorporation mechanism that probably reflect different fluid chemistries and/or oxidation state, but the water concentrations are low, consistent with previous studies [1,2]. Some inclusions also contain phases such as hydrous minerals or fluids, therefore the question arises as to whether the water concentration of the nominally anhydrous minerals (NAMs) are truly representative of the water concentration of the phases at the time of trapping. Is it possible for the NAMs to contain low water concentrations yet coexist with a hydrous fluid under mantle conditions? Or do the NAMs dehydrate in-situ within the inclusions to give a dry NAM + hydrous phase assemblage on ascent and emplacement or during shallow storage in the crust? These questions will be discussed in the light of all data currently available.

[1] Novella, D., Bolfan-Casanova, N., Nestola, F. and Harris, J.W., 2015. H 2 O in olivine and garnet inclusions still trapped in diamonds from the Siberian craton: Implications for the water content of cratonic lithosphere peridotites. Lithos, 230, pp.180-183.

[2] Taylor, L.A., Logvinova, A.M., Howarth, G.H., Liu, Y., Peslier, A.H., Rossman, G.R., Guan, Y., Chen, Y. and Sobolev, N.V., 2016. Low water contents in diamond mineral inclusions: Proto-genetic origin in a dry cratonic lithosphere.Earth and Planetary Science Letters, 433, pp.125-132.