

***In situ* dating of garnet inclusions in diamond from Venetia, South Africa**

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Diamond formation in the continental lithosphere reflects deep metasomatic processes thought to span much of Earth's history. Therefore, dating diamond formation is of great importance, allowing this activity to be understood within the context of magmatic and tectonic events. Yet, dating of lithospheric diamonds remains extremely challenging and relies on dating of rare inclusions whose isotopic systems are assumed to be isolated by diamond encapsulation. Techniques applied to inclusions in diamond, such as Re-Os (sulfides) and Sm-Nd (garnet), are relatively costly, complex, time-consuming and/or require large sample volumes. As a result, fewer than 50 diamond-forming events are established globally, and these dates are skewed toward diamonds formed in eclogitic substrates. The application of the U-Pb dating system to mantle garnet demonstrates that the U-Pb system is reliable at extremely low U contents (0.05-0.1 µg/g) by *in situ* laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). Here we present U-Pb LA-MC-ICP-MS ages of garnet from a suite of diamonds from Venetia, South Africa.

Previous Sm-Nd dating studies of garnet inclusions in diamond from Venetia indicate two discrete diamond forming events: at ~2.95Ga and ~1.15Ga¹. In contrast, U-Pb isotope data record a discordia age of 665±15Ma (MSWD=1.4; n=10), ~130Ma older than the host kimberlite. A subset of inclusion analyses plot left of the ~665Ma discordia in Tera-Wasserburg space indicative of older age information. We suggest that the U-Pb discordia age records the main age of encapsulation of the garnet within diamonds at Venetia. Older age information retained in some garnet inclusions represent either older growth events or protogenetic ages resulting from incomplete isotopic equilibration with the diamond-forming fluid. This implies inclusions ages from diamond inclusions in Venetia may preserve protogenetic ages not synchronous with diamond growth. Similar mismatches between Re-Os sulfide and U-Pb rutile ages in eclogitic diamond inclusions² suggests diamond ages may not record Archaean and Paleoproterozoic mantle processes.

1 J. M. Koornneef, M. U. Gress, I. L. Chinn, H. A. Jelsma, J. W. Harris and G. R. Davies, *Nat Commun*, DOI:10.1038/s41467-017-00564-x.

2 A. K. Schmitt, T. Zack, E. Kooijman, A. M. Logvinova and N. V. Sobolev, *Lithos*, 2019, **350–351**, 105251.