Geophysical Research Abstracts
Vol. 17, EGU2015-810-2, 2015
EGU General Assembly 2015

Carbon isotope ratios and impurities in diamonds from Southern Africa

Abiel Kidane (1,2), Monika Koch-Müller (1), Luiz Morales (1), Michael Wiedenbeck (1), and Maarten De Wit (2)
(1) Helmholtz Zentrum Potsdam, Duetsches GeoForschungsZentrum Potsdam, Germany., (2) AEON, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa; at.kidane@gmail.com

We are investigating the sources of diamonds from southern Africa by studying both their carbon isotopic composition and chemical impurities. Our samples include macro-sized diamonds from River Ranch kimberlite in Zimbabwe and the Helam and Klipspringer kimberlitic deposits from South Africa, as well as micro-sized diamonds from Klipspringer and Premier kimberlites in South Africa. We have characterized the samples for their structurally bounded nitrogen, hydrogen and platelets defect using a Fourier Transmission Infrared Spectroscopy (FTIR). Using the DiaMap routine, open source software (Howell et al., 2012), IR spectra were deconvulated and quantified for their nitrogen (A, B and D components) and hydrogen contents. High to moderate nitrogen concentrations (1810 to 400 μg/g; 400 to 50 μg/g respectively) were found in diamonds from Klipspringer and Helam. Moderate to low (<50 μg/g) nitrogen concentrations were observed in diamonds from Premier and River Ranch. Type II diamonds, i.e. diamonds with no N impurities, which are presumed to have been derived from ultramafic sources, are found in the River Ranch deposit. The macro- and micro-size diamonds from the Klipspringer deposit display similar nitrogen defects, with higher nitrogen concentration and more frequent D components found in the macro-size diamonds.
One of the first steps towards reliable carbon isotope studies is the development of calibration materials for SIMS carbon isotopic analyses. We have investigated candidate materials both from a polycrystalline synthetic diamond sheet and two natural gem quality diamonds from Juina (Brazil). Electron-based images of the synthetic diamond sheet, obtained using GFZ Potsdam's dual beam FIB instrument, show many diamond grains with diameters greater than 35 μm. SIMS testing of the isotopic homogeneity of the back and front sides of the synthetic sheets reveal similar 13C/12C ratio within a RSD of <1 ‰ . SIMS isotopic analyses of the two natural diamond RMs yield a constant 13C/12C ratio with RSD of better than 0.5 ‰ . Using the natural diamond as calibratrant, a preliminary result on a selected diamond from the four kimberlitic sample suites yields a δ13C in range between -3 to -7 ‰ .
Reference:
Howell, D., O'Neill, C. J., Grant, K. J., Griffin, W. L., Pearson, N. J., & O'Reilly, S. Y. (2012). μ-FTIR mapping: Distribution of impurities in different types of diamond growth. Diamond and Related Materials, 29, 29–36. doi:10.1016/j.diamond.2012.06.003.