TRACE ELEMENT ANALYSIS OF DIAMOND BY LAM ICPMS: METHODOLOGY AND PRELIMINARY RESULTS

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The trace element composition of diamond may provide information on the conditions and environment of diamond crystallisation. Characterisation of these patterns also may prove useful in recognising diamonds from different sources. Laser Ablation ICPMS is proving to be one of the best techniques for the in situ analysis of trace elements in diamonds, due to its high spatial resolution and low detection limits compared to other more conventional analytical techniques.

We have analysed 115 diamonds for trace elements using a new standardisation technique developed at GEMOC. This technique involves the use of a synthetic custom standard and we have used both synthetic oil and cellulose-based synthetic standards. Carbon was used as the internal standard to correct for ablation yield. The accuracy and precision of the new method was tested by analysing diamonds previously characterised by Neutron Activation Analysis (NAA) and by the Proton Microprobe (PIXE). The diamonds were analysed for trace elements using an Agilent 7500 ICPMS, with either a Merchantek 266nm UV laser or a custom built 213nm laser. The diamonds come from a range of localities including Siberia, Eastern Australia (Wellington and Bingara), Brazil (Juina), Canada (Slave Province) and Thailand. Mineral inclusions were used to classify the diamonds into eclogitic, peridotitic and superdeep parageneses. We have also analysed fibrous diamonds from Jwaneng (Botswana) and Central Africa.

The fibrous diamonds all have very similar chondrite-normalised trace element patterns with moderate LREE enrichment. The patterns strongly resemble those of average carbonatite and average kimberlite but the strong negative HFSE anomalies are more similar to the carbonatite pattern. The analyses of the fibrous diamonds have been used as a basis against which the other diamonds are compared. The superdeep diamonds show negative anomalies in Zr, Ti and Nb, but do not have the negative Pb anomaly as seen in the fibrous diamonds. The diamonds from Juina are more enriched in the LREE than the Slave superdeep diamonds, which have a flatter pattern, similar to that of the fibrous diamonds. Peridotitic diamonds worldwide show REE patterns that are generally flatter than that of the fibrous diamonds and have no Eu anomaly and are depleted in Ni and Co relative to the fibrous diamonds. HFSE anomalies are widely variable. The eclogitic diamonds show a range in REE patterns and look different from the peridotitic and the fibrous diamonds and the patterns vary considerably from area to area.

The broad similarities in trace-element patterns in the samples analysed thus far suggest a genetic relationship to carbonatite-like fluids. However, there appear to be some consistent differences between diamonds of different paragenesis, and between diamonds of similar parageneses from different localities. A larger body of data is required to test these conclusions and further analyses are underway and their results will be reported.