The magmatic origin and provenance of Guyana's diamonds: A first look

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Placer diamonds from the Proterozoic and Paleoproterozoic terranes of the Guiana Shield in Guyana, have an enigmatic geochemistry and provenance. Diamonds may be derived from kimberlite intrusions, but no outcrops have been identified in the dense tropical terrain. Alternatively, they may be weathered from 1.79 Ga, NE-SW trending mafic dykes of the Avanavero suite or eroded from 1.95 to 1.78 Ga sandstones and conglomerates of the Roraima Formation into recent alluvial river bed deposits [1]. To resolve these uncertainties, we acquired initial samples of 212 placer diamonds from different locations in Guyana for study. Diamonds range in size from 1.1 mm to 1.7 mm with a mean diameter of 1.3±0.2 mm. Diamonds are primarily dodecahedral to cubic, with lesser octahedral and minor macle forms. The diamonds are colourless to brown and most have a green surface skin. Diamond surfaces show diverse textures, including frosting, edge abrasions, network patterns, and ruts. Dissolution features are common and include point bottom trigons, with a diameter of 21±15 μm. We measured N concentrations using FTIR (measured at 1282 cm^{-1}). Diamonds are Type IaA-IaB with N concentrations of 55 ppm to 210 ppm. Total N ppm vs $\%N_B$ ratios indicate mantle-derived conditions of 1200 ºC and 4.7 GPa. Calculated Shields Parameter shear stresses of 0.0009 dynes/cm^2 to 0.0016 dynes/cm^2 suggest diamonds could be transported in bedloads derived from medium to very coarse sandstones or coarse- to pebble-sized kimberlitic lithics.

Guyana's diamonds are dissimilar to those from other regions of the Guiana Shield. To further this comparison, we studied 8 diamonds from Eastern Venezuela and Western Colombia on loan from the Smithsonian Museum of Natural History. Compared to Venezuelan and Colombian diamonds, Guyana's diamonds are dodecahedral, and have a higher degree of dissolution textures, suggestive of higher fO_2 conditions during kimberlite magma ascent. We will continue to study Guyana's diamonds using a combination of electron microprobe, μXRD, and Raman analyses of inclusions. Taken together we hope to infer the provenance of Guyana's placer diamonds and the petrology of the mantle rocks from which they were derived.

[1] Reis et al. 2017. Braz. J. Geol. 47, 43-57.