Water content of stishovite, majorite, and perovskite inclusions in Juina superdeep diamonds

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The water content of the deep mantle is poorly known, could vary from 'wet' to 'dry', and strongly influences mantle rheology, melting temperature, and electical conductivity. Superdeep (sublithospheric) diamonds from the transition zone and lower mantle potentially provide an opportunity to directly identify the role of water in the deep mantle because they carry silicate, oxide, and sulfide micro-inclusions.

Low N content and Type II diamonds from the 93 Myr old Collier 4 and Juina 5 kimberlite pipes in the Juina field, Brazil show complex growth structures and dominantly light C isotopic compositions (-20‰ to -25‰) likely from recycled subducted components [1]. We measured diverse inclusion assemblages that formerly were stishovite, majorite, and a variety of Ca perovskites for major element compositions with quantitative EDS on a field emission SEM and water content with the DTM NanoSIMS 50L. For SIMS analysis, simultaneous scanning ion imaging of ^{12}C, $^{16}O^{1}H$, ^{18}O, ^{19}F, ^{30}Si and ^{56}Fe was employed and data was reduced using the *L'image* (© LR Nittler, DTM) image-processing software to concentrate on favorable portions of mineral grains and examine how water content varied within host mineralogy on the micro-scale.

H_2O contents (in ppm) vary greatly between inclusions in different diamonds from nominally-anhydrous phases such as olivine (30-60), and ferropericlase (40) to phases known to host water such as coesite (80-90), majorite (80-670 ppm), and Ca-Si-Ti-perovskite (320-4000). Water is preferentaially partitioned into kyanite (300-500) exsolved from stishovite, and cpx (180-4200) exsolved from majorite. These systematics suggest some retention of original water despite the potential for loss to the inclusion-diamond interface and during retrograde recrystallization. The data show water can be subducted to the deep mantle but concentrations are lower than the experimentally-measured water capacity of many of these phases. This suggests either lower aH_2O in diamond-forming fluids/melts (carbonatitic?) or a drier-than-expected mantle transition zone.

[1] Bulanova *et al* (2010) *Cont. Min. Pet.* **160** 489-510.