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Petrography, petrology and mineralogy of eclogite nodules from the Jwaneng Diamond Mine, Botswana. An approach documented by mantle metasomatism, kimberlite emplacement and finally by super sonic uplift of the diamondiferous host rocks

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In this study we present a detailed petrographical, petrological and mineralogical dataset of some extraordinary, metasomatised eclogite nodules from Jwaneng. The eclogites are between 2-5 cm in diameter. Two generations of garnets could be found. Garnet of the first generation (*Grt I*) is rimmed by garnet of a second generation. Garnets of the first generation are completely free of micro-cracks. In contrast to that, garnets of the second generation are made up of much smaller grains and show plenty of open and totally embedded micro-cracks within the sub-grain boundaries. The fragments of garnets of the second generation showing sharp edges and the whole scenery in micro-scale looks like "blasted". Garnet of the second generation is rimmed by phlogopite. Microprobe traverses from core (*Grt I*) to the outermost rim of garnet (*Grt II*) close to the rimming phlogopite showing a strong zonation. X_{Mg} varies between 0.64 (core) and 0.84 (rim), X_{Pyp} varies between 0.39 (core) and 0.76 (rim), X_{Alm} between 0.23 (core) and 0.12 (rim) and X_{Grs} between 0.38 (core) and 0.09 (rim), respectively. A dramatic change in $\delta^{18}O$ values, measured by SIMS, was additionally observed, ranging from 4.72 (core) to 6.10 (rim). The strong change in major element chemistry as well as $\delta^{18}O$ values is interpreted as an effect of mantle metasomatism. These results are confirmed by the unique pattern of the LREE, HFSE and HREE, analysed by LA-ICPMS, from core to the rim in the garnets. The mantle metasomatic effect is also confirmed on OH diffusion profiles, measured by FTIR, around totally embedded cracks in garnet of the second generation. We corroborate this high estimate through velocities expected from viscous laminar flow driven by the pressure gradient. We also evaluate the velocity of the kimberlitic magma upon ascent by the conversion of gravitational potential energy into kinetic energy, which gives an upper kinetic limit and implies high velocities through the drag coefficients needed to support the dense diamond bearing rock fragment in the melt. This robust evidence for near-accoustic wave speed velocity challenges our understanding of the basic mechanisms that can generate deep and fast cracks within the Earth.