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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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Scientific contributions and therein geochemical datasets applied to mantle xenoliths collected from the Jwaneng Diamond Mine in Botswana are very rare, because of the problematic accessibility of the mine and additionally the strong alteration of the xenoliths nodules itself. In this study we present a unique and detailed petrographical, petrological and mineralogical dataset applied to these very extraordinary eclogite nodules from the Jwaneng Diamond Mine. Our results show, for the first time strong evidence for mantle metasomatism in the studied area and additionally we calculated the duration of the mantle metasomatic event, which last ~100 Ma, based on Mg diffusion profiles in garnet. Furthermore, the outcome of our survey show, that the investigated eclogite nodules, has been affected by a mixture of Group I and Group II kimberlites. The formation of Group I kimberlite was caused by the depleted mantle and the development of the later Group II kimberlite by the enriched mantle. The source of the enriched mantle was probably from a megalith, a remnant of a former oceanic crust related to the eastward subduction from the Scotia arc during Jurassic eras. Emplacement of the later mica rich Group II kimberlite leads finally to the explosive eruption kinetics of the kimberlite and consequently to the supersonic uplift of the diamond bearing host rocks. At this point, our results indicates, that supersonic uplift from the Earth´s mantle to the Earth´s surface of the diamondiferous host rocks took place with an velocity of up to ~1200 km/h (333 m/s) after mantle metasomatism took place. This outcome is based on OH diffusion profiles around totally embedded cracks in garnet. We corroborate this high estimate through velocities expected from viscous laminar flow driven by the pressure gradient. We also evaluate the velocity given 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.

The inferred speed of extraction shows that extreme mechanisms must be at work, which potentially starts as a melt filled propagating elastic crack at depth and during ascent accelerates through bubble feedback into its final explosive state.