Extraterrestrial mechanism of kimberlite emplacement

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The most popular model of kimberlite formation combines "magma needle" concept with massive degassing which is suppose to form extremely narrow and long pipe which is then filled up with kimberlite matter originating from the mantle and some xenoliths dropped into formed vain from the surface. This class of models left some researchers unconvinced. The pipe must be formed rather rapidly, otherwise it will be blocked in the deep rocks due to high pressure there, moreover there will not be diamonds presents since in slow decompression they will go into graphite. The energy which form the pipe in thermodynamic process must be also dispersed. Thus some other models are formed which includes explosion of reactive gases or electrical force as an additional factor, including near passage of extraterrestrial charged body. We propose another concept: the kimberlite pipe is formed by an impact of small, macroscopic, ultra dense object which existence was proposed in 1984 as a kind of dark matter. Such objects can be present in jets of accretion discs of a black hole and originate from destruction of neutron star during its impact onto black hole or are remains from Big Bang era. The 1 mm^3 volume of such matter can have mass of 10^5t . If it has speed of 400 km/s the kinetic energy is $8*10^{21}$J. On the other hand, the energy which is needed to heat up a 1 m^2 surface tunnel across whole globe to the temperature of about 1 million K is on the order of magnitude of 10^{20}J. This shows that such ultra dense object may have enough kinetic energy to cross whole globe. At such speeds crossing will take several seconds. The shock wave will heat up the formed plasma tunnel but the degassing will remove all materials from it leaving relatively cold straight vain which can be filled by mantle material and xenoliths. We propose that reality of such scenario can be verified by measurements of the isotopic abundances of the elements in the walls of kimberlite on the side of country (host) rock: the neutrons produced from nuclear reactions during whole process will influence the isotopic abundances, and this influence will decrease with the distance from the center of the pipe. Therefore we propose undertaking of such isotopic studies outside the kimberlite pipes in host rocks.

The stable isotopic composition of carbon monoxide from Greenland firn air samples collected at NEEM

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CO plays an important role in tropospheric chemistry. Precise measurement of its isotopic composition from the past is useful in constraining individual source and sink processes and thus its global cycle. High volume air samples from the NEEM EU 2008 S4 & NEEM 2009 S2 boreholes were measured for mole fractions, $\delta^{13}C$ and $\delta^{18}O$ of CO on a continuous-flow isotope ratio mass spectrometric (CF-IRMS) system. This system extracts the CO from the air sample (100 mL-200 mL of air required), converts the CO to CO_2 using Schütze reagent and transfers the CO_2 (derived from CO) via an open-split to the IRMS for isotope analysis. The results are qualitatively similar to the ones published in Wang *et al* [1] but also show differences that will be investigated by firn modelling.

[1] Wang *et al* (2012) *Atmos. Chem. Phys*, **12**, 4365-4377.

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