3.5.P07

Experimental diamond growth in carbonate-KCl: An analogue for the growth of diamond coat in the mantle

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High-pressure, high-temperature diamond growth experiments have been conducted in the system C-K_2CO_3-KCl at 1000-1400°C, 5.3 GPa. KCl is of interest because of the strong effect that halogens have on the phase relations of carbonate-rich systems and because of the occurrence of KCl coexisting with alkali silicate–carbonate fluids in natural coated diamond. Coated diamonds comprise a core of gem quality diamond, surrounded by diamond rich in fluid inclusions. Micro-inclusions in coated diamond samples from the Democratic Republic of Congo contain fluids that vary between three end-member compositions: K-Cl rich, Si-Al-K rich and Ca-P rich. Inclusions close to the boundary between the transparent core and the fibrous coat are particularly enriched in the K-Cl end-member, suggesting a link between KCl and the onset of coat growth. We have used systems C-K_2CO_3-KCl and C-K_2CO_3-H_2O as analogues for carbonate-KCl mantle fluids in diamond growth experiments. Diamond growth is spontaneous, and the run products are analysed by X-Ray Diffraction and Scanning Electron Microscopy.

The presence of KCl reduces liquidus temperature of potassium carbonate, allowing it to act as a solvent catalyst for diamond growth at temperatures below the continental geotherm. It is suggetsted that this is due to disruption of the carbonate lattice by Cl. Chlorine does not effect the diffusion rate of carbon in the carbonate melt. Diamond growth using carbonate solvent catalysts is characterised by a relatively long induction period. However, the addition of KCl also reduced the period for diamond growth in carbonate to <<5 minutes; therefore such induction period appears to be necessary.

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Helium-Neon systematics in OIB and the nature of the source of mantle plumes

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We have designed a new extraction and purification line, fully automated, coupled with our glass mass spectrometer ARESIBO I, equipped with a faraday cup and an ion counting system. The very low CO_2 and ^{40}Ar levels of the machine allow us to analyze the neon isotopic composition in very small samples. We have performed helium and neon analyses on olivine phenocrysts from different oceanic island basalts (St Helena, Gough, Tristan da Cunha, Azores, Kerguelen, Hawaii). Most of the samples present anomalies compared to air for neon (with ratio $^{20}Ne/^{22}Ne$ up to 11.67) and all the data plot between the MORB line (e.g. Sarda et al. 1988) and the Iceland line (e.g. Moreira et al., 2001). Corrected for air $^{21}Ne/^{22}Ne$ ratios (assuming a solar $^{20}Ne/^{22}Ne$) are between 0.036 and 0.081. In a diagram $^{21}Ne/^{22}Ne$c versus 4He/3He, all the OIB plot between the mean MORB composition and a solar like composition, and can be interpreted as a binary mixing with ar parameter (=($^3He/^{22}Ne$)MORB/($^3He/^{22}Ne$) solar) for the hyperbolae around 10 suggesting that mixing between the plume material and the MORB material occur between liquids. Another interpretation is that the $^3He/^{22}Ne$ of the MORB source is higher than the solar $^3He/^{22}Ne$ ratios which appears in contradiction with previous estimates. Our conclusion is that the neon is a more sensitive tracer of primordial material than helium.