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## NOBLE GASES IN TERRESTRIAL DIAMONDS: PRELIMINARY RESULTS

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Motivated by exciting, but puzzling, noble gas results in terrestrial diamonds (e.g. high  $^3\text{He}/^4\text{He}$  ratios close to the solar value from industrial class diamonds [Ozima *et al.*, 1983] and low  $^{40}\text{Ar}/^{36}\text{Ar}$  [= 189] from an Arkansas, U.S.A., diamond [Melton and Giardini, 1980]), we undertook the study of noble gases in diamonds from different locations. Although this is ongoing research, we can report preliminary results, some of which require confirmation. We have measured 15 diamond samples: Premier type I; Finsch type II; De Beers pool type I and II; Zaire; Arkansas; Australian (two samples); Brazilian (three); and industrial class diamonds, probably of South African origin (four). One industrial class diamond was successively heated for 30 minutes at 1200, 1700, 2000 and 2050°C. The fractional releases of  $^4\text{He}$  were 0.007, 0.027, 0.964, and 0.002, respectively. All the He was confirmed to be released along with the 2000°C graphitization of the sample. All other samples were graphitized at 2000°C for noble gas analysis.

The  $^3\text{He}/^4\text{He}$  ratios are characterized by a large spread ( $10^4$ ), ranging from values below atmospheric to values in excess of the planetary (but not the solar) ratio. The highest  $^3\text{He}/^4\text{He}$  value ( $1.57 \pm 0.75; \pm 1\sigma$ )  $\times 10^{-4}$  was observed for an Australian colorless diamond composite, while the lowest ( $< 4.5 \times 10^{-8}$ ) was for an Australian colored diamond composite which, interestingly, came from the same kimberlite pipe. The Australian colorless sample gave an imprecise but intriguing  $^{20}\text{Ne}/^{22}\text{Ne}$  ratio ( $12.6 \pm 1.6$ ), close to the solar value. We are planning to measure more Australian samples of greater size in order to increase the precision of the isotopic abundance ratios.

We measured one Arkansas diamond (Smithsonian catalog #125974), which was crushed and analyzed for Ar isotopes by Melton and Giardini but did not yield them a publishable value for the ratio  $^{40}\text{Ar}/^{36}\text{Ar}$ . We found  $^{40}\text{Ar}/^{36}\text{Ar}$  of  $670 \pm 140$  and  $[^{40}\text{Ar}] = 9.4 \pm 2.4 \times 10^{-8}$  ccSTP/g, which conflicts with their results for another Arkansas sample which gave the result quoted above. A high  $^4\text{He}$  concentration ( $= 1.77 \pm 0.05$ )  $\times 10^{-4}$  ccSTP/g was observed from this sample as well as a definite contribution from fissiogenic Xe. The ratio of fissiogenic  $^{136}\text{Xe}$  to  $^4\text{He}$  is  $8.9 \pm 4.5 \times 10^{-10}$ , which agrees within error with the current production ratio for radioactive decay of U and Th (assuming Th/U = 3.3 by weight). The high enrichment of  $^4\text{He}/^{40}\text{Ar}$  ( $> 10^3$  where typical values for mantle-derived materials are 1-20) may indicate that U was enriched relative to K in the source region and/or elementally fractionated during crystallization of the diamond.

None of the samples showed any significant excess  $^{129}\text{Xe}$ .

Melton, C.E. and A.A. Giardini, 1980. *Geophys. Res. Lett.* **7**, 461.

Ozima, M. *et al.*, 1983. *Geochim. Cosmochim. Acta* **47**, 2217.

## FURTHER EVIDENCE FOR EXTENSIVE METASOMMATISM OF THE ALLENDE PARENT BODY

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The Allende meteorite contains a number of minerals which are uncommon to rare in meteorites generally. A significant fraction of these occur with similar textures and compositions in the three major components, chondrules, matrix, and CAI. Minerals in this category include nepheline, sodalite, pentlandite, awaruite, and hercynite.

The simplest interpretation of this observation is that these minerals formed in all components while they were in the same environment and at the same time. If they formed, for example, while matrix was in one environment and chondrules were in another, then