THE IGNEOUS ROCKS FROM THE COANJULA MICRODIAMOND DEPOSIT, NORTHERN TERRITORY, AUSTRALIA

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INTRODUCTION

The Coanjula microdiamond deposits are located in the northeastern Northern Territory within the North Australian Craton. The microdiamond deposits were discovered in the mid 1980's following a regional gravel sampling program in the Northern Territory (Lee *et al.*, 1994). A subsequent drilling program to follow-up the microdiamond anomalies led to the discovery of several basaltic to potassic-ultrabasic intrusives in the area, all of which are non-diamondiferous. The intrusions are hosted by Lower Proterozoic metagreywackes which are documented to contain abundant microdiamonds (Lee *et al.*, 1994). Based on petrographic, mineral chemical, and geochemical data, three distinct suites of igneous rocks are described and include: 1) basaltic diatremes of alkaline affinity; 2) quench-textured high-K andesites, and 3) high MgO shoshonitic intrusives (kentallenites).

ALKALINE DIATREMES

The alkaline diatremes belong to an alkali-olivine basalt-basanite-nephelinite and leucitite magmatic series. Breccias consist of magmatic materials and country rocks. The Coanjula alkaline diatremes are generally similar to Mesozoic-Tertiary Eastern Australian alkaline diatremes with respect to their morphology, petrography, and geochemistry (notably their high Nb contents), but some mineralogical and geochemical features are unique to Coanjula. For example, in the Coanjula alkaline magma series, aggregates of diopsides having Ti>Al occur obiquitously in the groundmass associated with interstitial alkali feldspars. Diopsides are more consistent in mineral chemistry with those found in lamproites than in any alkaline basalts. The Coanjula series rocks have lower CaO, SiO_2, P_2O_5, Sr and higher abundances of LILE (Rb, Ba, TH, K) than Eastern Australian alkaline series. A preliminary age determination of a kaersutite megacryst from one of the pipes yielded a K-Ar date of 1,665 My.

ANDESITES

The Coanjula andesites are characterized by a quench-texture with skeletal growths of plagioclase and titanomagnetite. They classify chemically as high-K andesites and have trace element abundances suggesting they are related to the kentallenites by fractional crystallization. Trace element compositions of high-K andesites from the Andes and the Sunda Arc are similar to those of Coanjula. The age of the andesites is uncertain, but cross-cutting field relations indicates a tentative range between 1,700-1,800My.

SHOSHONITES

High MgO shoshonitic intrusives with 10-20 wt% MgO occur as discrete plutons, and geochemicaly are related to the andesites. The Coanjula shoshonitic intrusives are most similar in major and trace element abundances to kentallenites from Scotland and Tanzania showing high Ni and Cr contents (~150 and 200ppm, respectively), and high LREE-enrichment (up tp 60 times chondrites). The Scottish kentallinites formed in subduction-related environments and a similar origin can be inferred for the Coanjula shoshonitic intrusives. The age of the shoshonites is not known, although cross-cutting relationships suggest that the Shoshonites are older than the pipes.

METAGREYWACKES

The metagreywackes in the Coanjula area form part of the Lower Proterozoic Murphy metamorphics, and are estimated to be >1,800My. Metagreywackes which host the microdiamonds have a high lithic content. From their geochemistry, interbedded shales appear to be post-Archean. They display a negative Eu anomaly, have $(Gd/Yb)N < 2$ and $Th/Sc < 1$ and have low Cr contents (~120ppm) compared with Archean shales (>200ppm).

DIAMOND SOURCE

The stratigraphic relationship between the three main igneous rock series and the metagreywackes precludes any of the igneous rocks as the host for the microdiamonds as the diamondiferous metagreywackes are older than any of the intrusives. The mineralogy and geochemistry of the igneous rocks further confirms that they are unlikely to be the source for the diamonds as: 1) a fossil Proterozoic geotherm derived from an orthopyroxene xenocryst (1039-1050°C at 10-15kbar) indicates an environment which is too hot for diamond sampling, and 2) mineral chemistry of heavy mineral concentrates from the alkaline diatremes indicates shallow sampling of the spinel lherzolite stability field. The spatial juxtapostion of alkaline and potassic igneous rocks with the Coanjula microdiamonds thus appears to be coincidental and an alternative source for the diamonds remains to be identified.

REFERENCES

Lee, D.C.; Boyd, S.R.; Griffin, B.J.; Griffin, W.L. and Reddicliffe, T. (1994) Coanjula diamonds, Northern Territory, Australia. In: H.O.A. Meyer and O.H. Leonardos, editors. *Diamonds: Characterization, Genesis and Exploration*, Proceedings of the Fifth International Kimberlite Conference, Araxá, Brasil 1991. Companhia de Pesquisa de Recursos Minerais, Brasília, Special Publication 1B, volume 2, 51-68.