COANJULA DIAMONDS, NORTHERN TERRITORY, AUSTRALIA.

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Two deposits rich in micro-diamonds occur near Coanjula, N.T. The diamonds are typically 0.2mm and rarely exceed 0.5mm in size.

Two diamond bearing kimberlites occur 120km to the north and 24 ultrabasic volcanic pipes occur within a radius of 60km of the microdiamond deposits.

The Coanjula microdiamonds occur in sediments of the Murphy Metamorphics Group which are dated at 2050 Ma. Extensive drilling and sampling has revealed a deposit of microdiamonds which is 12km long and up to 500m wide. A smaller deposit, 2km long and 300m wide is located 5km to the south. The microdiamond content exceeds one per kilogram in some parts of the deposit.

A porphyritic latite - trachyandesite body 3km long and up to 2km wide, with a chilled margin exhibiting spinifex texture, forms a central core to the larger of the microdiamond deposits. The number of microdiamonds in the sediments increases towards the margins of this volcanic intrusive but samples of the trachyandesite have not contained microdiamonds.

More than 70% of the diamonds are opaque cubes with a fibrous structure. A further 4% are colourless, yellow, or green non-fibrous cubes. The remaining 25% of the diamonds are octahedral, dodecahedral or irregular. This unusual suite of microdiamonds is unlike any recorded from kimberlite or lamproite.

The microdiamonds have been analysed by proton micro-probe for trace elements. Nitrogen content and Carbon Isotope ratios have been determined and micro-inclusions have been extracted and analysed. This work was undertaken to determine if the diamonds are of "metamorphic" origin as it has been reported from the Soviet Union (Shatsky, 1989) that fibrous cubic microdiamonds similar to some of the Coanjula diamonds have been found in metamorphic rocks.

Proton micro-probe analysis of 22 Coanjula diamonds showed a large number of elements present in widely varying concentrations. S, K, Ti and Fe are present at levels of 10-100ppm, V, Cr, Cu, Zn, Pb and Zr occur at 0-10 p.p.m. Normalization to constant Fe content greatly reduces the scatter in the data, indicating that most elements are contained in small inclusions of melts, fluids and daughter minerals. Coanjula microdiamonds have trace element patterns broadly similar to microdiamonds from Argyle lamproite but have higher Ti/Fe for the same K/Ca. Ellendale lamproite microdiamonds have much lower K/Ca ratios than either Argyle or Coanjula microdiamonds.

Fe - normalised Cu and Zn show a positive correlation which may be related to micro-inclusions of sulphides. The similarity of Cu/Zn ratios in microdiamonds from Coanjula, Argyle, Ellendale and Zaire (Mabuji Mayi) suggests that they contain similar sulphides and thus have a similar (i.e. mantle derived) origin.

Forty-four of the opaque cube diamonds from Coanjula have been examined for inclusions. Inclusions were exposed by fracturing, ashing and sectioning the stones. Inclusions vary in size but are usually in the 2 to 5 micron range. Many of the cubes are of composite structure with a massive, irregular core overgrown by a fibrous coat to form a cubic stone. When ashed in air at 600^0C, the massive core burnt before the fibrous overgrowths.

Chrome-magnetite, diopside, jadeite, garnet and mica inclusions have been analysed in-situ in fractured cubes. These inclusions are compositionally similar to eclogitic (Meyer,1987) and calc-silicate (Sobolev,1984) inclusions. Residues after ashing contain both quenched liquid and crystalline phases. Polished sections of the microdiamonds contain primary melt inclusions. A potassic aluminous melt is present as numerous inclusions in the core of one microdiamond (Table 1). The melt data is unlike previously reported compositions (eg Navon et al.,1988) in that titanium is below detection limit.

Twenty seven of the opaque cube diamonds were found to have δ^{13}C values ranging from -10 to $-22.5^0/_{00}$. Eleven of the octahedral/resorbed irregular diamonds had δ^{13}C values from -2.5 to $-21.5\ ^0/_{00}$ but with a distinct sub-group centred at $-4^0/_{00}$. Infra-red spectra were obtained for both opaque cubic and clear irregular diamonds. The spectra indicate a low nitrogen content, the presence of possible type I_b cubic diamonds and some type IaA diamonds in the irregular group.

It is concluded from the nature of the inclusions, the zoned structure of some of the cubes and the range of isotopic compositions that the Coanjula diamonds are of magmatic origin.

Table 1: Composition of melt inclusions in a microdiamond core

Sample	Inc 1	Inc 2	Inc 3	Inc 4	Inc 5	Inc 6	Inc 7	Mean+S.D.
SiO2*	54.66	52.41	53.99	54.13	53.28	55.23	51.54	53.61 + 1.29
TiO2	0.00	0.00	0.17	0.00	0.00	0.00	0.28	0.06 + 0.11
Al2O3	23.46	23.77	23.49	22.74	23.96	22.73	23.49	23.38 + 0.47
Cr2O3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
FeO	4.32	5.61	5.27	4.92	4.32	6.08	5.46	5.14 + 0.66
NiO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
MnO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-
MgO	4.22	3.24	3.03	3.93	3.90	3.96	3.71	3.71 + 0.43
CaO	0.00	0.00	0.00	0.30	0.00	0.00	0.00	-
Na2O	3.89	5.64	1.32	3.01	4.72	0.98	4.96	3.50 + 1.81
K2O	9.44	9.33	12.60	10.65	9.82	11.02	10.46	10.47 + 1.13
Cl	0.00	0.00	0.13	0.32	0.00	0.00	0.09	0.06 + 0.12
Oxide total**	89.28	73.28	69.95	38.04	68.37	69.88	67.22	

* Analyses by Link EDS on a JEOL 6400 SEM, data in wt.%.
** total prior to normalisation to 100wt.% oxides

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