

THE BOA ESPERANÇA AND CANA VERDE PIPES, CÓRREGO D'ANTA, MINAS GERAIS, BRAZIL.

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INTRODUCTION

The Corrego D'anta region, located 200km northwest of Belo Horizonte, Minas Gerais state, was originally prospected for kimberlites by small private Brazilian companies in the late 1970's. Five "kimberlites": Boa Esperança; Inga, Quartel, Almeida and Cana Verde, are known to occur within a larger area referred to as the Bambuí province (Barbosa, 1983; Location 10 of Fig. 1, Tompkins, 1991, this volume). This paper describes the geology, bulk rock geochemistry and, mineralogy of -2mm, +0.25mm heavy mineral concentrates (HMC) from the Boa Esperança and Cana Verde pipes.

Both pipes are situated along a major NW-SE trending lineament (lineament. 125° AZ; Bardet, 1977) that extends from the Amazônico craton in the NW, to Rio de Janeiro in the SE. In the region of Minas Gerais, it is referred to as the Alto Paranaíba Arch. The two pipes are separated by a distance of 22km, with the Cana Verde pipe located closer to the cratonic nucleus of the São Francisco craton. They intrude the southwestern edge of the São Francisco craton, but within the boundaries of the larger Paramirim craton as defined by Almeida (1981). This area was consolidated during the Jequií event (2,700my), but partially reworked during the Transamazônico (2,000 my) and Brasiliano (450-700 my) events. The pipes post-date a period of Jurassic rifting along lineament 125° AZ and throughout Brazil. In Brazil, magmatic rocks intruded during this period include kimberlites, carbonatites, "lamproites", and other related rocks. Cana Verde and Boa Esperança are, therefore, considered to be Lower Cretaceous in age, or younger.

BOA ESPERANÇA

The Boa Esperança pipe is intruded into fine-grained laminated siltstones of the Upper Proterozoic Bambuí Group. It crops out within a dry drainage basin that is only seasonally active. Field mapping of the intrusion has shown it to have an elongated configuration of at least 220m in length, with an average width of 55m, or about 1.2 hectares in area.

Exposure of the intrusion in an old excavation pit identifies the rock as a dark-green micaceous breccia. It contains abundant country rock clasts, as well as altered pyrope garnet-bearing ultramafic xenoliths. Due to the altered nature of the rock petrographic studies are not informative.

Bulk rock analysis of altered breccia at the surface shows it to be an ultramafic rock with MgO=16.71 wt%, Ni=950ppm, and fairly rich in incompatible trace elements such as Ba (742ppm), and Sr (892ppm). Apart from SiO₂ and Al₂O₃, which are possibly affected by country rock contamination, the analyses fall within the range of average kimberlite (Mitchell, 1986).

Diamond indicator minerals (DIM) in HMC include: relatively common, red-purple chrome-pyrope; emerald-green chrome-diopside; a few chrome-rich spinels and; rare Mg-Cr-ilmenites. Other minerals include: almandine; pale-green Cr-poor diopside; Ti-magnetite and, rare apatite. No micro-diamonds were recovered, but insufficient material was processed to view this as a reliable indication of diamond potential.

Cr-pyrope compositions are lherzolitic to wehrlitic (Sobolev et al., 1973) with up to 10 wt% Cr₂O₃. Cr-rich spinels vary from 0.70-0.85 molar Cr/(Cr+Al) and 0.40-0.60 molar Fe²⁺/(Mg+Fe²⁺), with generally high TiO₂ values up to 6 wt%. Iron oxidation ratios (Fe³⁺/Fe²⁺) suggest fO₂ conditions between WM to IW. Ilmenites have MgO values up to 10 wt% and Cr₂O₃ up to 3 wt%.

CANA VERDE

The Cana Verde intrusion is intruded into fine-grained well laminated slates and siltstones of the Upper Proterozoic Bambuí Group. The intrusion consists of fine-medium grained light-green colored micaceous tuffs and tuff-breccias. A large dark-green serpentized xenolith has also been observed. The exact surface dimensions are not known.

Bulk rock analysis of the tuff-breccia yield moderate values of SiO₂ (48-49 wt%), and Al₂O₃ (6.32-8.40 wt%), with low MgO (3.77-4.09 wt%) values suggestive of country rock contamination. However, high K₂O (5.54-10.72 wt%), and TiO₂ (8.44-10.05 wt%) values coupled with high Ba (874-2,571 ppm) and Sr (1,224 ppm) are suggestive of a lamproitic composition. Bulk rock analysis of the serpentized xenolith yielded high MgO (19.50 wt%) and Ni (730 ppm) values and together with the presence of Cr-diopside and garnet suggest that it is an altered garnet lherzolite.

DIM in the HMC include: relatively common red-purple Cr-pyrope; emerald-green Cr-diopside and a few Cr-rich spinels. Also present are: rare Mg-Cr-ilmenites, including some with coarse-grained spinel exsolution lamellae, and Cr-Nb-rutile intergrown with Mg-Cr-ilmenite. Other minerals include: almandine; rare sphene; and amorphous Ca-Nd-La-phosphates. No micro-diamonds were recovered, but insufficient material was processed to use this as a reliable assessment of diamond potential.

Cr-pyrope compositions are lherzolitic with up to 6 wt% Cr₂O₃. Cr-rich spinels vary from 0.65-0.95 molar Cr/(Cr+Al) and 0.35-0.80 molar Fe²⁺/(Mg+Fe²⁺), with generally high TiO₂ values up to 8 wt%. Iron oxidation ratios suggest fO₂ conditions between WM to IW. Ilmenites have MgO values up to 10 wt% and Cr₂O₃ up to 6 wt%.

CONCLUSIONS

Initial data suggest that the Boa Esperança pipe may be a kimberlite, while the Cana Verde pipe has bulk compositions more typical of lamproites. HMC chemistry shows that garnet peridotite was sampled, as represented by lherzolitic garnet, clinopyroxene and, Cr-rich spinel. Ti-metasomatism, is pervasive at both localities as indicated by the presence of Ti-rich chrome spinels, Mg-Cr ilmenites and, Cr-Nb-rutile-ilmenite intergrowths.

Although no micro-diamonds were recovered from either pipe, the land owners at Cana Verde report the recovery of macro-diamonds (Barbosa, 1983). DIM compositions do not indicate the presence of harzburgite which is regarded as the dominant source of peridotitic diamond (Gurney, 1984). However, diamond-bearing kimberlites containing only garnet lherzolite are described elsewhere (Scott-Smith et al., 1984). Thus the presence of garnet lherzolite DIM's supports deep mantle sampling, but indications of Ti-metasomatism may have decreased the diamond potential of the source rocks.

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