10IKC-224

MINERAL CHEMISTRY OF MANTLE XENOLITHS FROM KAMAFUGITE DIATREMES IN THE GOIAS ALKALINE PROVINCE, BRAZIL.

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INTRODUCTION

A cluster of diatremes is found in the southwest of Goiás state - Brazil intruding Devonian sedimentary rocks of the Parana Basin. They belong to an extensive kamafugite magmatism associated with the impact of the Trindade Mantle Plume during the Late-Cretaceus in Central Brazil. These and other related alkaline rock occurrences are grouped under the Goiás Alkaline Province - GAP. The diatremes are infilled by a variety of fragmental rocks, mainly as breccia facies. Small plugs of coherent magma, dykes and small lava ponds are also found associated to the diatremes. The fragments composing the breccias range in size from less than a millimetre to about two metres. They vary in composition from juvenile kamafugites to magma chamber cognates and an assortment of xenoliths. The xenoliths are represented by amphibolites, granites and gnaisses from the Precambrian basement, sandstones, siltstones and limestones from the Paraná Basin and peridotites either from the mantle or from deep-seated magma chambers. The diatreme breccias usually contain less than 0.1 vol.% of peridotites. This work focuses on peridotite xenoliths dominantly from the KAX diatreme, a small breccia body where the amount of these xenoliths is anomalously high and their compositional range is wider, compared with other known diatremes in the GAP.

GEOLOCIGAL SETTING

There is a marked change in the GAP, from north to south, in terms of the stratigraphic level at which the alkaline rocks are exposed, which enables some emplacement considerations (fig.1) (Junqueira-Brod *et al*. 2004). Plutonic bodies in the northern GAP intrude the contact between the Precambrian basement and the Phanerozoic Paraná sedimentary cover, usually in direct contact with granitic rocks and limited on the top by Devonian sedimentary rocks of the Furnas Formation (Assine, 2001). This distinctive discordance allowed enough space to accommodate relatively large amounts of magma. Magma chambers that fed the volcanic and subvolcanic bodies in the central and southern GAP maybe equivalent to these northern intrusions and located at the same interface at depth. The central GAP volcanic to subvolcanic rocks are emplaced into Carboniferous strata of the Aquidauana Formation (Camaço and Souza, 1986), whereas the Santo Antônio da Barra – SAB, lavas in the south cover the Jurassic–Early Cretaceous Botucatu and Serra Geral Formations (Rocha-Campos *et al*., 1988). These two stratigraphic units may have played an important role in the way the volcanism occurred at SAB, where effusive rocks dominate, in contrast with the Aguas Emendadas (AE) region, where diatremes are common. The thickness of the Paraná basin sedimentary pile in the central GAP is just greater than 500 m, whereas to the south it reaches 1500 m plus more than 100 m of the Serra Geral Formation basalts, mostly absent in the central GAP (Melfi *et al*., 1988).

Diamonds of controversial origin are found in the alluvial deposits of the Caiapó River in the central GAP. Tompkins (1987) argues that the lithosphere of the region is less than 150 km thick and considers the primary diamond source to be Precambrian. In contrast, Danni *et al*. (1990) suggest that the source is related to the Cretaceous GAP magmatism.

PETROGRAPHY

The studied xenoliths comprise lherzolites, olivine websterites and wehrlites, with spinel as the aluminium phase. All samples are medium- to coarse-grained, showing no signs of deformation (fig. 2).

The modal proportions of the essential constituents are olivine (35%), orthopyroxene (OPX, 30%) e clinopyroxene (CPX, 25%) with interstitial spinel (10%).

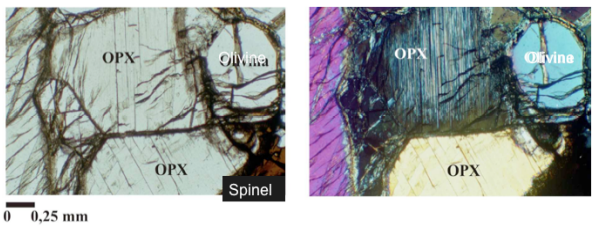

Fig.2 Cumulate aspects showing by olivine and OPX. Interstitial spinel.

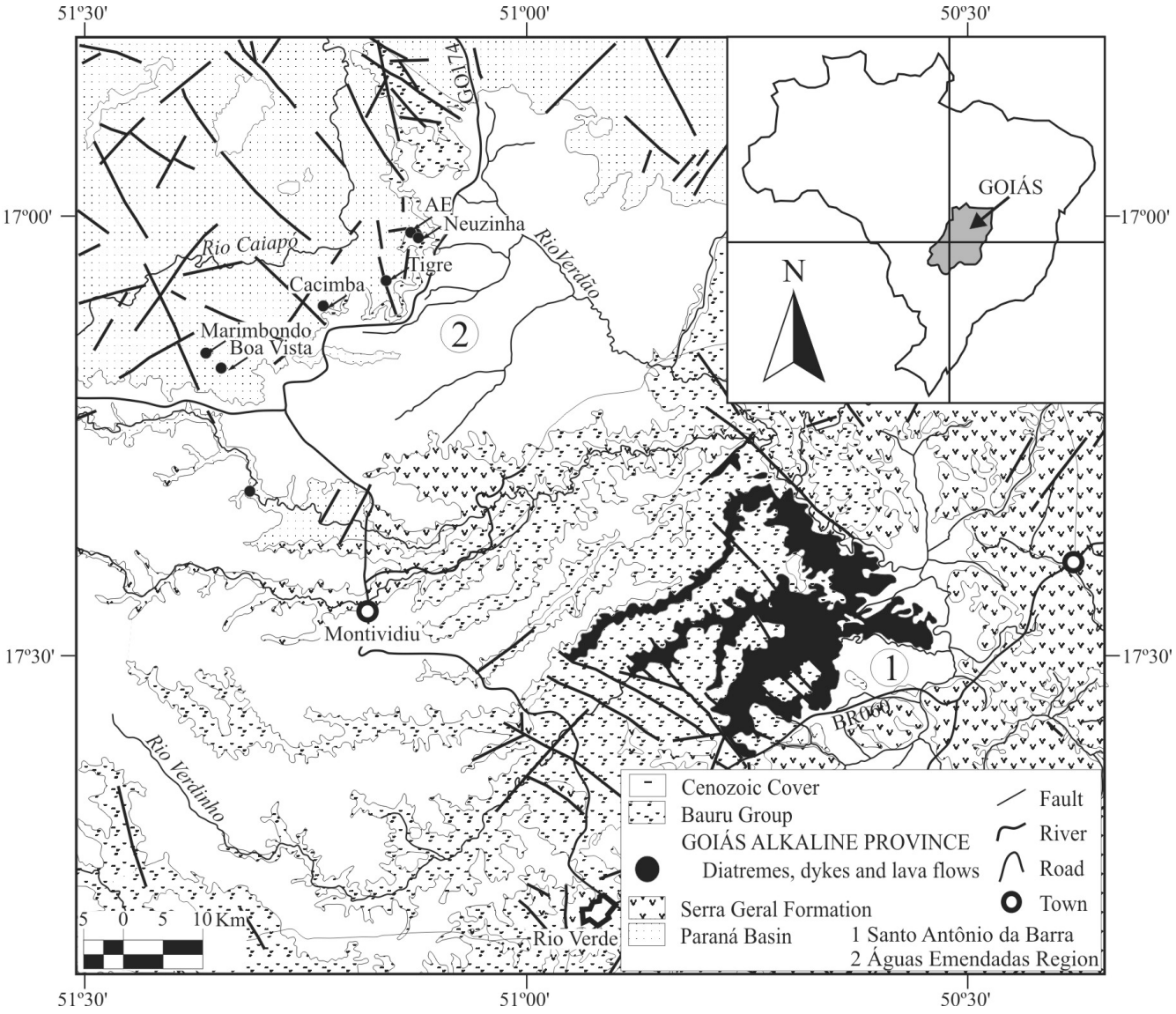

Fig. 1. Simplified geological map of the Goiás Alkaline Province. Modified from Lacerda Filho *et al.* (2000).

MINERAL CHEMISTRY

Mineral chemistry data were acquired with a CAMECA SX50 electron microprobe at the University of Brasília.

Olivine has a narrow composition range, varying from $Fo_{88,4}$ to $Fo_{89,5}$. Regardless of compositional overlap, it is clear that the olivines with the highest contents of the forsterite molecule ($Fo_{88,4\text{-}89,5}$) are from the lherzolites, followed by the olivines from wehrlites and websterites.

Enstatite ranges from $En_{87,8}$ to $En_{89,4}$. Both the enstatite from lherzolite and the rare enstatite from wehrlite have slightly higher $MgSiO_3$ than that from websterite.

Clinopyroxene belongs to the diopside-hedenbergite series, with about 9.5 mol.% of hedenbergite and relatively rare augite. It contains 4.7 to 7.6% of Al_2O_3 and 0.47 to 1.75% of Cr_2O_3.

Spinel is $MgAl_2O_4$, with limited solid solution towards chromite ($FeCr_2O_4$) through an increase in the ratios Cr/(Cr+Al), from 0.08 to 0.28 and $Fe^{2+}/(Mg + Fe^{2+})$, from 0.22 to 0.36.

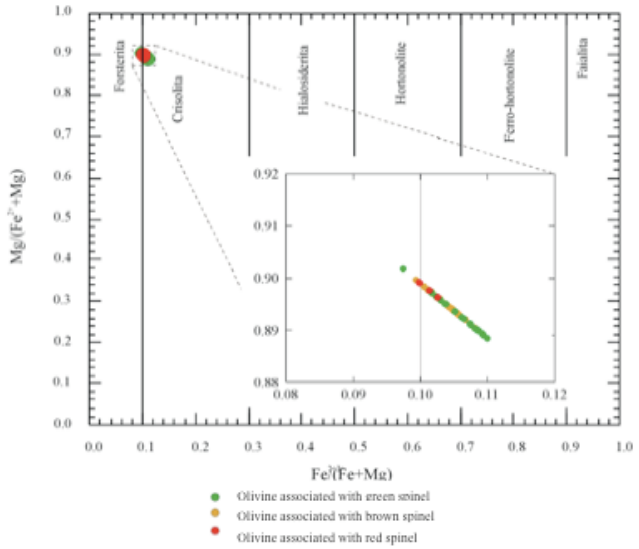

Fig. 3. Compositional variation of olivine.

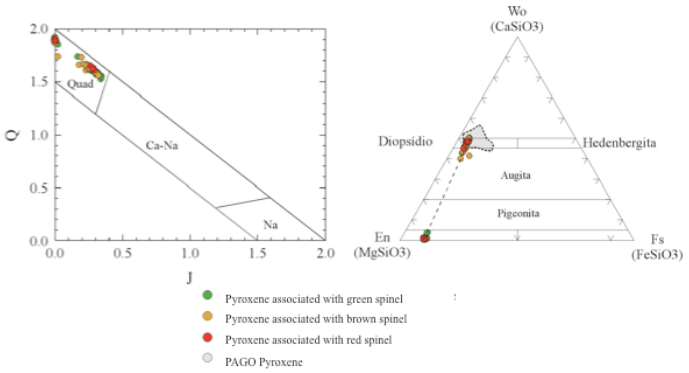

Fig. 4. Chemical composition of pyroxene.

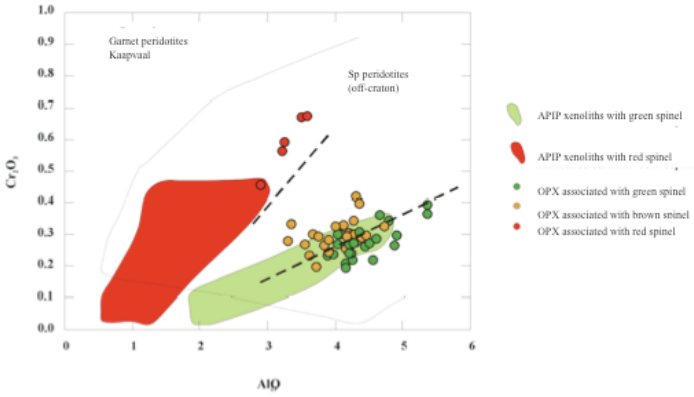

Fig. 5. Chemical composition showing the variation of orthopyroxene. OPX associated with red spinel has higher Cr, whereas OPX associated with green spinel has higher Al.

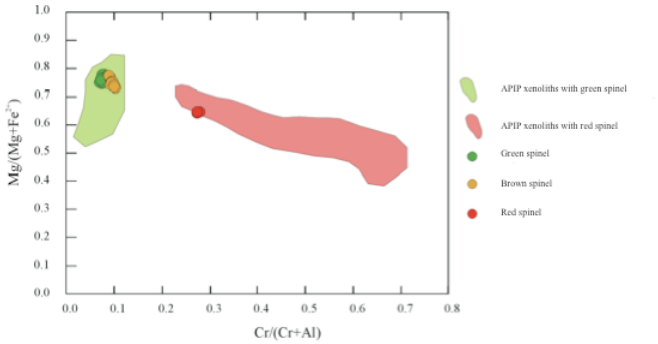

Fig. 6. Compositional variation of spinel. Green and brown spinel are compositionally corresponding to the APIP green spinel, while red spinel is compositionally corresponding to the APIP red spinel.

CONCLUSIONS

Spinels from lherzolite have a wide compositional spectrum whereas spinels from wehrlite and websterite always are very close to the ideal $MgAl_2O_4$ composition. The data obtained for the GAP xenoliths studied here suggest that spinel-lherzolite is the dominant type in the mantle source area, but the presence of wehrlite indicates the presence of metasomatised patches. Websterite xenoliths are interpreted as a cumulate facies.

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