

SHORT-LIVED GRANITIC MAGMATISM ALONG SHEAR ZONES: EVIDENCE FROM U-Pb ZIRCON AND SPHENE AGES OF CARAÚBAS AND TOURÃO GRANITES

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INTRODUCTION

The Borborema Province, NE Brazil, was formed by a collage of different polideformed terranes during the Brasiliano orogeny (Van Schmus *et al.*, 1995). In this region deformation was partitioned along a continental-scale framework of EW- and NE-trending transcurrent shear zones that separate terranes with different evolution. These structures were intruded by a great amount of granitic bodies. Field relationships suggest that the plutons were emplaced at the peak of metamorphism along the shear zones. The southern boundary of one of these terranes, the Seridó Belt, coincides with the EW-trending Patos shear zone. ⁴⁰Ar/³⁹Ar dating on amphiboles and biotites of mylonitic belts from the eastern part of this shear zone suggests a slow cooling from 540 up to 500 Ma (Corsi *et al.*, 1998). Data from the Central Ceará, west of Seridó Belt, indicate a faster cooling for this area (Monié *et al.*, 1997). The age of metamorphism peak, however, is still disputable because of the scarcity of high-quality geochronological data in the syn-kinematic plutons.

In between the Seridó and Central Ceará areas a large volume of granitic rocks is well exposed over more than 3000 km² near to the NE-trending Portalegre shear zone (Galindo *et al.*, 1995). Among these, the Tourão and Caraúbas plutons are typical examples of the voluminous K-rich calc-alkalic monzogranites closely associated to the shear zones. These granites were subject of U-Pb zircon and sphene dating to better constrain the metamorphic

peak age of the transcurrent event.

RESULTS

Zircons were analyzed at the Isotope Geochemistry Lab, University of Kansas, Lawrence, KS, USA. The isotopic analyses of sphenes were carried out at the Center of Geochronology Research of the University of São Paulo, São Paulo, Brazil.

Zircons from Caraúbas granite are prismatic, clear and yellow to colorless. Four fractions (single grains) show variable Pb loss and plot on a discordia which yields an upper intercept U-Pb age of 576 +/- 24 Ma. One fraction of pale yellow sphenes (multigrains) falls along the same discordia defined by the zircon data. Regression of sphene and zircon data define an U-Pb age of 574 +/- 10 Ma, which is interpreted as the crystallization age of the granitic magma. Because the sphenes and zircons fall in the same discordia we suggest that cooling until ca. 650 °C was relatively fast.

Tourão granite yielded three different zircon populations. Analysis of a pale yellow, clear, stubby crystal yielded a concordant U-Pb age of 579.5 +/- 4 Ma. One fraction of pale yellow sphenes (multigrains) is concordant at 569 Ma. The zircon age is interpreted as the crystallization age of the Tourão granite. Because zircon and sphene plot at different points on the concordia diagram we suggest that the sphene crystallized ca. 10 Ma later, indicating that the cooling in the Tourão granite was slower than that observed for the Caraúbas pluton.

TECTONIC IMPLICATIONS

The Caraúbas pluton (~250 km²) is a typical sheeted complex, with an outstanding magmatic fabric progressively changing to a solid-state fabric, both parallel to the encircling NE-trending dextral shear zones. The Tourão pluton (~350 km²) is a N-trending ellipsoidal body also conditioned by the Portalegre shear zone but showing no imprints of solid-state deformation. Previous Rb-Sr (whole rock) dating yielded an isochron age of 654 \pm 24 Ma for the Caraúbas granite and 592 \pm 10 Ma for the Tourão granite, coherent with the structural contrast between these plutons. Additionally, a Rb-Sr isochron age of 545 \pm 7 Ma was obtained for the tardi-tectonic Umarizal charnockites, indicating a long-lived magmatism for this area (Galindo *et al.*, 1995). This interpretation can not be supported by the new U-Pb data, which indicate that granitic magmatism was short-lived. The differences between internal structure of Caraúbas and Tourão plutons could be explained by the rapid cooling of the former, related to its intrusion as a set of narrow sheets along the shear zone (Trindade *et al.*, 1998).

The U-Pb ages of the Caraúbas and Tourão granites are coincident with the few U-Pb ages for the Brasiliano granites in the Seridó Belt available in the literature. An age of 579 \pm 7 Ma was obtained from zircons of the Acari pluton (Leterrier *et al.*, 1994) and an age of 575 Ma from a concordant sphene was determined for the São Rafael pluton (Ketchum *et al.*, 1997). These results suggest that at high temperatures the transcurrent shear zones acted as an integrated system throughout a wide region in the Borborema Province, in spite of contrasting cooling patterns observed in different areas during the later low temperature deformation along these structures.

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