

U-Pb Mantle Zircon Ages for Kimberlites from the Juína and Paranatinga Provinces, Brazil

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The Juína Kimberlitic Province has drawn considerable attention in the literature due to the discovery of diamond inclusions containing minerals assemblage that indicate equilibrium conditions typical of at least the mantle transitional zone at depths of 400-670 km (Widing et al. 1991; Harte and Harris, 1994; Harte et al. 1994; Harris et al. 1997). The Paranatinga Province is located between the two main centers of kimberlitic magmatism in Brazil (Alto Paranaíba and Juína). The age of kimberlite magmatism in both provinces is critical not only for a better understanding of the origin of kimberlite and related rocks in Brazil but also for the understanding of the temporal relationship between this kimberlite magmatism and tholeiitic magmatism associated with the Trindade or Valis Ridge mantle plume activity (Gibson et al. 1995; Bizzi et al. 1993).

The Juína Kimberlitic Province is located near the northern border of the Paleozoic Parecis Basin. The Paranatinga Province occurs in the middle portion of the Neoproterozoic Paraguai-Araguaia Fold Belt (Fig. 1). Both provinces are underlain by the Mesoproterozoic Rio Negro - Jurua Mobile Belt. These are roughly aligned in the AZ125 mega-lineament (extending 2500 km) which controls the main alkaline-ultramafic occurrences in Brazil, from the Atlantic oceanic crust to the Amazon region near Bolivia's border (Gonzaga and Tompkins 1991). The different geotectonic settings that host the major alkaline provinces in Brazil (kamafugites, carbonatites, leucitites, picrites, kimberlites and lamproites) along the AZ125 lineament can be characterized by: a) São Francisco cratonic edge (Bambuí Province); b) Neoproterozoic orogenic belts (Brasília and Paraguay) peripheral to the São Francisco and Guaporé Cratons (Alto Paranaíba, Iporá and Paranatinga Provinces) and c) Rio Negro - Jurua and Rondonia Mesoproterozoic collisional sialic mobile belts in the southwestern border of the Amazon Craton (Juína and Pimenta Bueno Provinces). The orogenic belts represent zones of lateral accretion of mainly juvenile Proterozoic crust (Pimentel and Fuck, 1992) while the ensialic belts may contain remelted portions of an older Transamazonian crust (e.g. Rondonien Mobile Belt; Tassinari 1984).

The kimberlite intrusions of the Juína Province were emplaced into Permo-Carboniferous fluvio-glacial sediments and Mesoproterozoic granite-gneiss. In Paranatinga they intrude a folded metasedimentary belt and unfolded sediments related to the cratonic cover. Both provinces are covered by Cretaceous/Tertiary sandstones of the Parecis Formation. The kimberlite structures of Juína and Paranatinga provinces represent a series of distinct explosions producing a complex assemblage of pyroclastic surge and fall deposits.

U-Pb Results

The U-Pb results presented here were determined on large (up to 1 cm) mantle zircon grains obtained from three samples from the Juína Province and one sample from the Paranatinga Province. Two of the zircon suites from the Juína Province were obtained from separate kimberlite intrusions

(one hosted by Paleozoic sediments and the other by Mesoproterozoic granites). Mantle zircon from a third sample, also located in the Juína province, was collected from the Chapadão diamondiferous sediments, which are the headwaters of the São Luis Creek. Mantle zircon grains from the Paranatinga Province were recovered from a kimberlite intrusive breccia.

The U-Pb results for 11 mantle zircon grains have been obtained from these four samples. The U-Pb ages indicate two distinct periods of mantle zircon formation at 1) 91.6-94.6 Ma and 2) 122.6-127.2 Ma which we interpret as two episodes of kimberlite magmatism. In general, the timing of Cretaceous kimberlite magmatism in the Juína and Paranatinga areas is quite distinct with dominantly Cenomanian (91.6-94.6 Ma) activity in the Juína area and somewhat older Barremian (122.6-126.3 Ma) activity in the Paranatinga area.

Discussion

The U-Pb mantle zircon ages of 123-126 Ma obtained here for kimberlites in the Paranatinga region are consistent with those presented by Crough et al. (1980). Based on these results, Crough et al. (1980) proposed that the Paranatinga kimberlite magmatism is contemporaneous with tholeiitic magmatism formed along the Trindade hot spot track. In addition, Crough et al. (1980) proposed that the South American plate migration progressed westward over the Trindade hot spot. If kimberlite magmatism in the Juína and Paranatinga areas is related to such a plume track then older kimberlite magmatism would be expected to predominate in the Juína area. The U-Pb mantle zircon ages obtained in this study however document the exact opposite of this prediction and indicate that kimberlite magmatism in this part of Brazil may be related to some other triggering mechanism that is not linked to Trindade mantle plume activity.

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Figure 1

