U-Pb (SHRIMP), Sm-Nd and Re-Os systematics of the Cana Brava, Niquelândia and Barro Alto layered intrusions in central Brazil, and constrains on the tectonic evolution

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The Barro Alto, Niquelândia and Cana Brava complexes belong to a 300 km long, discontinuous, north-trending belt of mafic-ultramafic massifs in the Goiás State, Central Brazil. Tectonically they occur inside the area defined as the Porangatu Block[1]. To the east, they overthrust metasedimentary rocks of the Serra da Mesa or Araxá Groups and to the west they come into contact with some volcano-sedimentary sequences.

The Niquelândia and Barro Alto mafic-ultramafic Complex have been dated in this study by use of the whole-rock Sm-Nd isochron and (SHRIMP) U-Pb zircon ages respectively.

The Sm-Nd method has been applied to ten mafic to ultramafic samples including chromitites, peridotites, gabbros and anorthosites from the main units of Niquelândia. The aim of this approach was to determine the timing of the last important metamorphic episode, which affected the complex. The ten analytical points define a poor linear correlation (MSWD= 68) when plotted on a Sm-Nd isochron diagram. The slope of this line corresponds to an age of 776 ± 25 Ma with an initial $^{143}Nd/^{144}Nd$ ratio of 0.51157 ± 0,00004 and ε_{Nd} value of -13. This age is in close agreement with the 800 Ma[2] Re-Os isochron age obtained on some of this samples, and with the lower concordia intercept for zircons of 778 ± 16 Ma[2]. These data are interpreted in terms of the last metamorphic episode, which affected the region, during the Neoproterozoic time. The strong negative ε_{Nd} value of -13 reinforces the interpretation that the age about 0.78 Ga is related to a metamorphic overprint on pre-existent rocks.

In order to improve the geochronological control of the Barro Alto Complex, SHRIMP U-Pb zircon ages were determined on different units associated with this complex. The data from the country gneiss of its east border display a large range of ages, from 2128 ± 15 Ma (upper intercept) to 700 Ma (lower intercept). Data from a granite intrusive in the central part of Barro Alto define an important zircon population located on the concordia and yielded a calculated age of 1235 ± 120 ma. These results are concordant with the SHRIMP geochronological pattern obtained for the Niquelândia Complex[2], consistent with the interpretation of a 2 Ga emplacement age for magmas parental to Niquelândia followed by episodic Pb loss as a result of multiple metamorphic events. For instance, metamorphism with Uruaçuano ages (ca. 1.3 Ga) are supported by previous Rb-Sr ages[3,4]. Zircons from one Barro Alto diorite display a lower intercept age of 796 ± 20 Ma, similar to the lower intercept achieved for Niquelândia.

Previous geochronological results available for the Cana Brava Complex, obtained by Rb-Sr[4,5], Sm-Nd[6] and Ar-Ar[7], are in close agreement with the radiometric results of the Barro Alto and Niquelândia Complexes, suggesting a polymetamorphic history for

these rocks, with a primary rock-formation episode around 2.0 Ga and two important superimposed metamorphic events, during the Mesoproterozoic (1.3 - 1.2 Ga) and the Neoproterozoic (0.8 - 0.7 Ga).

The observation that the three mafic-ultramafic layered complexes have very similar geological evolution seems to imply that the dated events occurred on a regional scale in the central part of Brazil, and the time-interval between 2.1 - 2.0 Ga represents a lithospheric extension episode associated with extensive production of basic magmas while the periods between 1.3 - 1.2 Ga and 0.8 - 0.7 Ga characterize metamorphic events related to shortening and thickening of the lithosphere during continental collision.

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