Wilson TEIXEIRA, Mike A. HAMILTON, Vicente A. V. GIRARDI, Frederico M. FALEIROS, 2016. Key Dolerite Dyke Swarms of Amazonia: U-Pb Constraints on Supercontinent Cycles and Geodynamic Connections with Global LIP Events Through Time. *Acta Geologica Sinica* (English Edition), 90(supp. 1): 84-85.

Key Dolerite Dyke Swarms of Amazonia: U-Pb Constraints on Supercontinent Cycles and Geodynamic Connections with Global LIP Events Through Time

Wilson TEIXEIRA[1*], Mike A. HAMILTON[2], Vicente A. V. GIRARDI[1], Frederico M. FALEIROS[1]

1 *University of São Paulo, Institute of Geosciences, São Paulo, SP, Brazil*
2 *Jack Satterly Geochronology Laboratory, Department of Earth Sciences, University of Toronto, Toronto, Canada*

High-resolution U–Pb (ID-TIMS, baddeleyite) ages are presented for mafic dykes from selected swarms in two important Amazonian regions: the Carajás Province in the east, and the Rio Apa block in the southwest – areas separated by over 1500km. The new ages reveal four significant episodes of intraplate magmatism (ca. 1880, ca. 1110, 535, and 200 Ma), and provide additional opportunities for assessing supercontinents cycles and correlating associated Large Igneous Province (LIP) events.

Recent U-Pb studies in Amazonia have documented two widespread magmatic episodes: the 1795Ma Avanavero and the 1110Ma Rincón del Tigre–Huanchaca LIP events. Both have "barcode" matches with global LIP events in the context of the Nuna and Rodinia reconstructions, respectively. Additionally, a third event, more clearly mantle plume-driven, has an important component preserved in Amazonia, linked with the 200 Ma Central Atlantic Magmatic Province (CAMP).

The Carajás Province (part of the Archean core of Amazonia) is bounded to the east by the Araguaia belt which records assembly of Amazonia and West Africa in Gondwana times. Dyke swarms intrude the Carajás country rocks, and subordinately the ca. 1.88 Ga Carajás anorogenic suite. Dyke subswarms mainly strike NW-SE and NE-SW, with the longest dykes (mafic and felsic) belonging to the prominent NW-trending Tucumã swarm. N-S trending dykes are subordinate. A representative NW-trending, basaltic dyke yields a U-Pb baddeleyite age of 1880 ± 2 Ma; a second sample, from a NE-trending, basaltic dyke gives a provisional, slightly older, age of ca. 1885 Ma. These two ages confirm previously published U-Pb SHRIMP zircon dates from rhyolitic members of the Tucumã bimodal swarm at 1881 ± 3 and 1882 ± 4 Ma (Silva, 2015). They are synchronous with the timing of the Carajás anorogenic suite, and with nearby, undeformed volcanics of the Iriri Group (1874 ± 8 Ma; Santos et al., 2002). All of these magmatic activities could be related to thermal perturbations in the upper mantle, which drove limited crustal extension and contemporaneous intraplate plutonism and volcanism. Potential barcode matches exist with dykes and sills in North China, Kaapvaal and Zimbabwe cratons, and Laurentia, Baltica, Australia and Siberia, suggesting global-scale connections within Nuna supercontinent at ca. 1.8Ga.

The Rio Apa block is bounded by the intervening Neoproterozoic Paraguay-Tucavaca belts. It comprises Paleoproterozoic metamorphic basement and granitoid intrusions partly covered by a supracrustal association (1.81 Ga). These rocks are intruded by EW- and NW-trending dykes and sills (andesitic basalts of tholeiitic affinity) of the Rio Perdido suite (Lacerda Filho et al., 2016 and references therein). A recent LA-ICPMS U-Pb study of zircon (Faleiros et al., 2015) from a N85°W-trending subvertical Rio Perdido dyke suggested an igneous crystallization age of 1589±44 Ma, although inheritance of older zircon was clearly present (at ~1800, 2200 and 2600 Ma). We subsequently recovered baddeleyite from this same microgabbronorite dyke sample (4220-FM-R-173), analysis of which has provided a robust conventional ID-TIMS U-Pb age of 1110Ma. Therefore the zircons previously analyzed from this dyke are xenocrystic in origin. The new age has a precise match with the 1110 Ma Rincon del Tigre-Huanchaca LIP event (Teixeira et al., 2013), occurring ca. 500-800 km to the northwest in the SW Amazonian craton, therefore significantly increasing the known regional expanse of this late Mesoproterozoic LIP. From a global perspective, the 1110 Ma LIP event defines mantle plume activity pre-dating Rodinia breakup, and has a rigorous, narrow age match with intraplate mafic magmatism in the Congo, Kalahari and Indian cratons, and the Keweenawan event of central Laurentia.

* Corresponding author. E-mail: wteixeir@usp.br

Carajás Province is also host to N-trending, high Ti dolerite dykes of the Paraupebas swarm. A sample of this swarm contains a population of fine-grained baddeleyite, and ID-TIMS U-Pb analysis of three multigrain fractions permits calculation of a Concordia age of 535.1 ± 0.9 Ma (2s; ± 1.1 Ma including decay constant errors), interpreted to represent the timing of emplacement and crystallization of these dykes. The N-trending dykes could be tectonically related to the giant NNE-trending Piranhas dyke swarm that occurs in the western Tapajós Province, though they appear slightly younger (tholeiitic gabbro, 507 ± 4 Ma; U-Pb baddeleyite, Santos et al., 2002). These ages are contemporaneous with A-type granite and gabbro magmatism from the outboard Araguaia belt, yielding U–Pb zircon ages of 533 and 526 Ma (Gorayeb et al., 2013) The 535Ma dykes in Carajás Province may reflect tectonic reactivation of older lithosphere, as a response to crustal extension/transtension active along the craton's margin. Moreover, ca. 535 Ma intraplate mafic magmatism in Amazonia correlates with Ediacaran and early Cambrian extensional igneous activity present in West Africa (e.g. Boho bimodal rift-related suite (534 Ma), and Ouarzazate Group felsic volcanics dated (U-Pb) in several Anti-Atlas Mountain inliers, Morocco: Sirwa (575 and 560 Ma), Tagragra de Tata (565 Ma) and Imiter (550 Ma).

Finally, we have analyzed a NW-trending, high-Ti doleritic dyke from Carajás Province. Analyses of baddeleyite from this sample (CJ-2) are strongly overlapping, concordant, and confirm primary crystallization at 199.3 ± 0.3 Ma (2s). This new U-Pb age improves on a 211 ± 7 Ma K-Ar age reported for the same sample, and aligns better with Ar-Ar plateau ages (192 ± 3, 189 ± 2 Ma) of large, N-S striking, diabase dykes (Periquito magmatism) located to west of Carajás area, as well as with most K-Ar ages of the giant NNW-trending Cassiporé swarm in Amapá and French Guyana, located farther north. The 199 Ma age fits extremely well into the narrow span of ages determined for CAMP LIP event, one of the Earth's largest continental igneous provinces around the present central and North Atlantic oceans. This event is also important for its linkages to the Triassic-Jurassic boundary extinction event.

References

Gorayeb et al., 2013. Journal of South American Earth Sciences 55: 278-292.

Lacerda Filho et al., 2016. Journal of South American Earth Sciences 65: 122-141.

Santos et al., 2002. Journal of South American Earth Sciences 15: 409–429.

Silva, F.F., 2015. Unpublished Masters Thesis. University Federal do Pará, Brazil. 59p.