

U–Pb SHRIMP age determinations for the Iporanga Formation, SE Brazil: implications for the tectonic evolution of the Ribeira Belt

G.A.C. Campanha¹, M.S. Basei¹, C.C. Tassinari¹, A.P. Nutman² and F.M. Faleiros³

¹ Instituto de Geociências da Universidade de São Paulo, Rua do Lago 562, São Paulo SP, Brazil. ginaldo@usp.br

² Research School of Earth Sciences, Australian National University, Canberra, Austrália.

³ PhD student, Instituto de Geociências da Universidade de São Paulo, Brazil.

Since its original definition, the stratigraphic position of Iporanga Formation has been a controversial question in the evolution of the Ribeira Belt in southwestern Brazil. It is characterized by the occurrence of levels and lenses of polymict meta-breccias and meta-conglomerates, with clasts of diverse sizes and rock types, set in a pelitic matrix, intercalated in rhythmic metapelites, with occurrences of meta-sandstones, meta-arkoses and meta-conglomerates of arkosic matrix. It has received diverse interpretations in terms of palaeo-environments: tillites, distal turbidites, molasses, wildflysh, and canalized debris-flow and turbidites. The metamorphic grade is low (chlorite zone), and the dominant deformation style is isoclinal folding with transposed bedding, NE-trending, steep axial-plane slaty cleavage or schistosity, usually dipping northwestwards.

The northwestern contact with the carbonatic platform of the Lajeado Subgroup is tectonic, against the Figueira inverse-to-oblique shear zone. To the SE, the contact with the Ribeira Subgroup is in part discordant, with the basal polymict breccia overlapping metapelites and metavolcanic rocks, and in part tectonic against the Agudos Grandes shear zone. The basal polymict breccia presents clasts of meta-claystones, meta-rhythmites, phyllites (some with a previous internal metamorphic cleavage), quartz, quartzites, micro-conglomeratic meta-sandstones, oligomict meta-sandstones, meta-conglomerates, amphibolites, metavolcanic rocks (which also occur below), gneisses and granitoids.

Despite its upper position in the Ribeira Subgroup, doubts remained about the time span between the deposition of the Iporanga Formation and the underlying units. The presence of metavolcanic rocks immediately below the basal polymict breccia of the Iporanga Formation, as well the occurrence of pebbles of granites and volcanic rocks in the breccia, led the present attempt to date deposition of the Iporanga Formation by U–Pb SHRIMP zircon geochronology.

Zircon separated from metavolcanic rock exposed below the Iporanga Formation, as well as from granite clasts from its basal polymict breccia, were analysed by U–Pb SHRIMP (Sensitive High Resolution Micro-Probe), at the Research School of Earth Sciences, Australian National University, Canberra, Australia. Twelve analyses of zircon from the metavolcanic rock, and six of zircon from two granite clasts were made in grain nuclei and borders. The location of the points was defined using cathodoluminescence images. The results were presented in Tera-Wasserburg diagrams, distributed in groups with distinct ages. The metavolcanic ages, from Archean to Cambrian, demonstrate the presence of xenocryst grains. However, a consistent group has Late Neoproterozoic ages, both in nuclei and in rims, with a weighted mean $^{206}\text{Pb}/^{238}\text{U}$ age of 573 ± 34 Ma, which is interpreted as the age of rock crystallization. The xenocryst grains have ages of 2660, 2200–1600, and 750–650 Ma, which point to different sources. Zircons from the granite pebbles also have a Neoproterozoic age, with a weighed mean $^{206}\text{Pb}/^{238}\text{U}$ age of 593 ± 15 Ma. These results are even younger than those of Lajeado subgroup intrusive rocks (Apiáí and Itaóca granites and Apiáí gabbro) which are in tectonic contact with the Iporanga Formation, and limit the maximum age for the sedimentation of the Iporanga Formation to the Ediacaran.

The presence of granite pebbles, phyllites and other metamorphic rocks, in the meta-conglomerates of the Iporanga Formation suggests that its deposition occurred after the intrusion of arc-related granites and after the initial deformational phases of Açungui Supergroup, but probably simultaneous with the wrench movements of the shear zones. Although continental source areas were very close, the environment was probably marine, perhaps with glaciation.

The radiometric results give a maximum age for the Iporanga Formation sedimentation at the end of the Neoproterozoic (Ediacaran), younger than 593 ± 15 Ma. Its deposition occurred after the first phases of deformation and metamorphism of the Ribeira and Lajeado subgroups, and after the intrusion of Itaóca Granite and Apiáí Gabbro, but still in an active tectonic environment.