

U-Pb (ZIRCON) AGES OF METABASIC ROCKS OF THE ÁGUA CLARA FORMATION IN THE ARAÇAIBA REGION – SÃO PAULO (BRAZIL): PRELIMINARY DATA

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INTRODUCTION

The bibliography related to the Precambrian units of eastern Paraná and southeastern São Paulo states is extensive, and encompasses more than a hundred published papers and reports. The resulting scenario is confusing and fragmented, characterized by an immense proliferation of terms, many of them informal and applicable only locally, thus contradicting stratigraphic norms. One of these units, object of this study, is the

Água Clara Formation defined by Marini et al. (1967), which is a pile of impure calcareous rocks outcropping northwest of Rio Branco do Sul - Paraná.

The main objective of this work is to present U-Pb isotopic data obtained from zircons of metabasic rocks and subordinate acid and associated rocks of the Água Clara Formation in the Araçaiba region, São Paulo (Fig. 1).

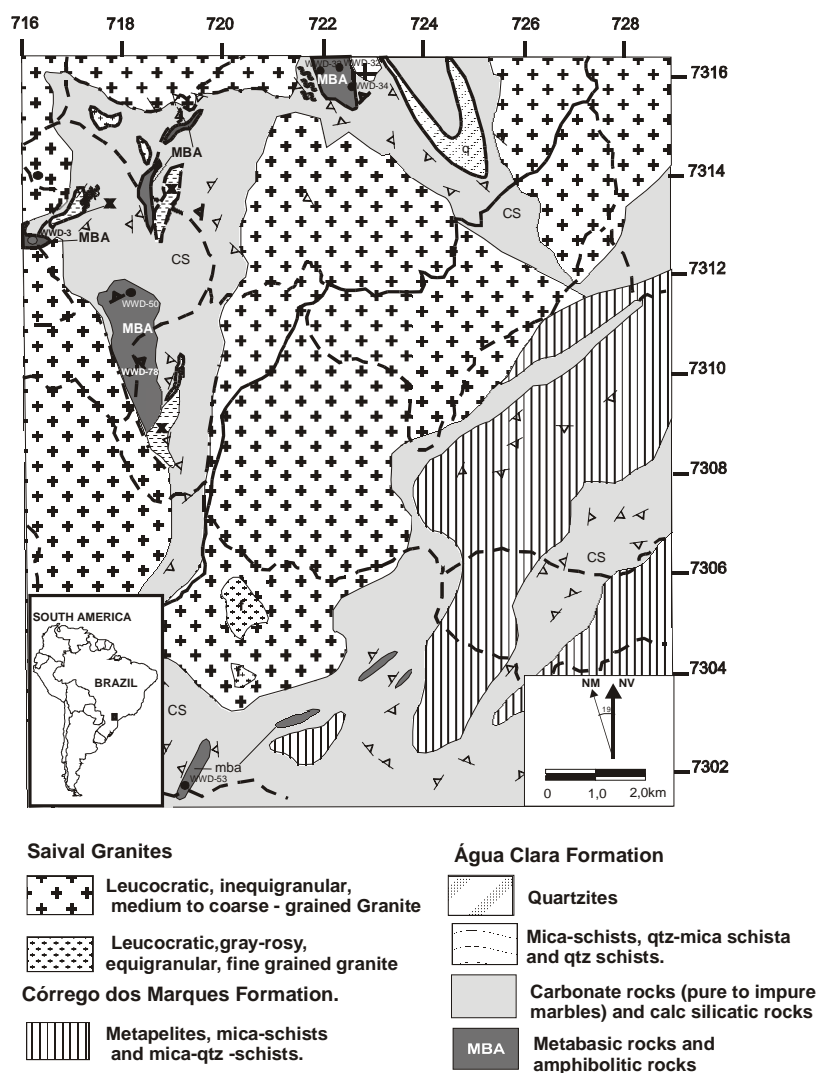


Figure 1 - Simplified geological map of Araçaiba Region

The Água Clara Formation is predominantly constituted by a sequence of carbonate rocks (pure to impure marbles), calc-silicate rocks, calcschists, micaschists, amphibole schists, quartzites, garnet-chlorite-biotite schists, metacherts, basic and intermediate metatuffs, metabasites, amphibolites and cornubianites.

The metabasic rocks have in general expressive dimensions reaching kilometers in length, and are hundreds of meters wide. They are greenish gray, fine- to medium-grained, and usually present nematoblastic texture. More isotropic terms also occur, showing granoblastic texture. They are composed of pyroxenes (diopside or augite), amphiboles (actinolite and hornblende), and plagioclases (andesine/oligoclase). The most common accessories are apatite, magnetite, epidote, titanite, and rare zircon.

In thin section, preserved ophitic and subophitic textures are observed, indicating a probable igneous origin.

The geochemical data suggest compositions similar to enriched midoceanic ridge basalts (E-MORB) tending to oceanic island basalts (OIB).

The subalkaline, tholeiitic characteristics, similar to E-MOR basalts tending to OI basalts, suggest distension or back-arc environments as the geotectonic settings for the basic magmatism.

GEOCHRONOLOGICAL DATA (U-Pb IN ZIRCONS)

Three analytic techniques (conventional, single-zircon filament evaporation and SHRIMP) were involved in the U-Pb isotopic study of zircons from metabasic rocks labeled WWD-03 in the field (vicinity of Araçuaíba). Firstly, the zircon populations were selected by splitting, using a FRANTZ electromagnetic separator, and secondly by hand picking under the stereoscope.

Each zircon population is characterized by a specific crystal form (relatively well formed, oval-shaped, or with diffuse terminations), transparency, and presence of fractures and inclusions.

SHRIMP analytical data (rims and nuclei) for five zircons yielded a straight line in the Tera-Wasserbourg diagram (Fig. 2), characterizing for the upper intercept ages of 1593 ± 70 Ma, and for the lower intercept, 586 ± 24 Ma. Two points fall in intermediate positions between these values.

Cathodoluminescence images reveal overgrowths in practically all the studied zircons. The closest point to the upper intercept (oldest age) corresponds to the analysis of a more internal crystal portion, whereas the other analyses correspond to the more external portions, characterized by overgrowths and oscillatory zoning. The data suggest the Mesoproterozoic (1593 ± 70 Ma) as the time of zircon crystallization. The Neoproterozoic (586 ± 24 Ma) values correspond to the overgrowth zones, probably coeval with metamorphic processes, or processes related to the emplacement of the Três Córregos granitic batholith.

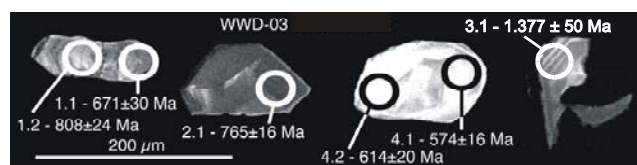
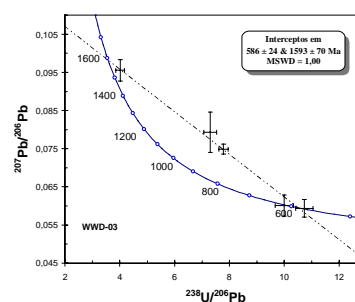


Figure 2. Tera-Wasserbourg diagram and cathodoluminescence from zircons of WWD-03 sample.

The isotopic data obtained using the conventional technique for four populations from sample WWD-03 are aligned along the discordia, intercepting the concordia curve at 1561 ± 18 Ma (upper intercept) and at 751 ± 15 Ma (lower intercept). The intermediate positions of three analytical points in the discordia (Fig. 3) indicate partial Pb losses, probably associated with the Neoproterozoic tectonics. The sole point plotting close to the lower intercept is located left of the concordia curve, revealing isotopic disequilibrium, possibly related to incomplete crystal digestion. Therefore the age of 751 ± 15 Ma obtained for this intercept must be dealt with care, once it may lack geological significance. Anyway, these zircons crystallized during the Mesoproterozoic at 1561 ± 18 Ma, with Pb losses associated with the Neoproterozoic tectonics imprinted in these lithotypes. Using the single-zircon filament evaporation technique, for a zircon of the same sample (WWD-03) a step corresponding to an age of $ca. 1461 \pm 51$ Ma is observed (Fig. 4), characterizing once more crystallization events related to the Mesoproterozoic. It is worth mentioning that in this case such technique is not effective regarding zircon rims, due to the amount of common Pb present and relatively fast ignition of the rims.

Another outcrop of metabasic rocks occurs in the vicinity of Taquari-Mirim (field number WWD-32). Four zircon fractions of sample WWD-32 were analyzed, using the conventional technique. Two fractions - 32a and 32d - are composed of translucent, badly shaped zircon crystals with weakly defined edges, free of inclusions and fractures. In the concordia diagram both fractions plot in the upper intercept. Other two fractions, 32b and 32c, are composed of transparent, colorless, relatively well-formed prismatic zircon crystals with defined edges, usually having inclusions and/or fractures. The size of the prisms differs in fractions 32b and 32c, being shorter in the former (2:1) than in the latter (~3:1). Both sets plot in the lower intercept, practically on the concordia curve.

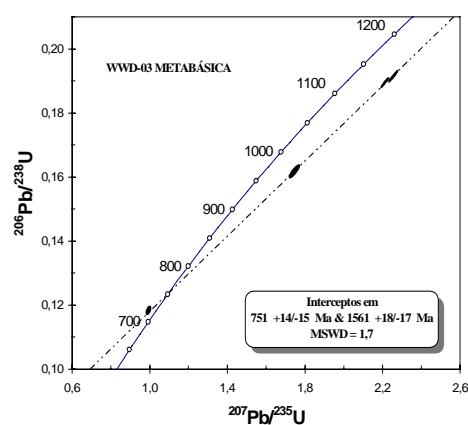


Figure 3. Concordia diagram using the conventional technique for four populations from sample WWD-03.

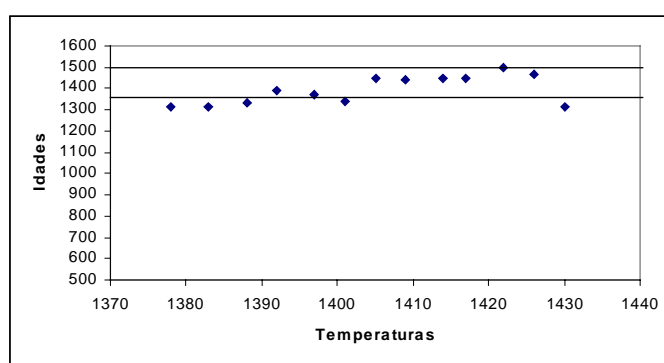


Figure 4. Single-zircon filament evaporation technique, for a zircon of the same sample (WWD-03) a step corresponding to an age of *ca.* 1461±51 Ma.

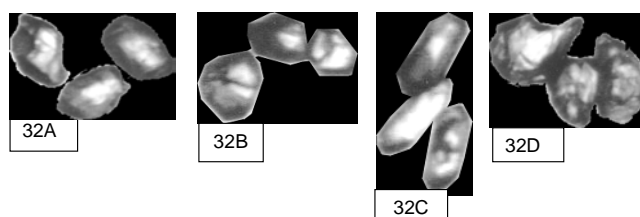
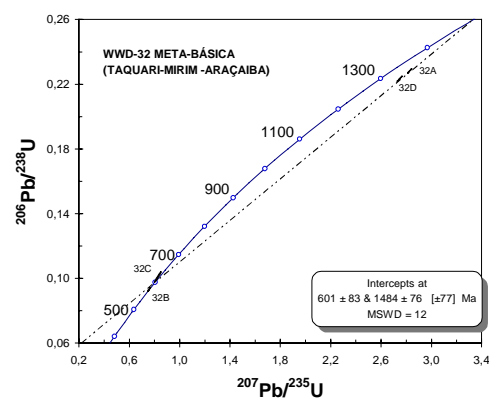


Figure 5. Concordia Diagram using the conventional technique for four populations from sample WWD-32.

The best-fitting discordia yielded the age of 1484 ± 76 Ma for the upper intercept and 601 ± 83 Ma for the lower intercept (figure 5).

FINAL CONSIDERATIONS

The geochemical characteristics (subalkaline tholeiitic basalts) indicate an extensional environment for the emplacement of the metabasic and amphibolitic lithotypes, suggesting a relationship with the opening of an oceanic basin.

The geochronologic and geochemical characteristics and structural patterns described for the Água Clara Formation metabasic lithotypes (probably sills and/or dikes) suggest volcanism periods with associated sedimentation related to the Mesoproterozoic, with ages close to 1500 Ma. Therefore such era represents an important mark in the evolution (sedimentation/volcanism) of the Apiaí Domain. The Neoproterozoic values obtained refer to zircon recrystallization and

neoformation processes (affecting metabasics/amphibolites), emplacement of rocks of granitic/acid volcanic nature and regional cooling of the Água Clara Formation.

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