UNRAVELLING IGNEOUS PETROGENESIS AND THE FERTILITY OF MAGMAS THROUGH GEOCHEMICAL MODELLING: EXAMPLE FROM THE TAPAJÓS MINERAL PROVINCE

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RESUMO: The tectonic and petrogenesis mechanisms changed significantly during Earth's geologic history. The Archean-Proterozoic transition is particularly interesting, as the processes evolved from stagnant-lid and/or intermittent subduction, to present-day style subduction zones at late-Proterozoic. Interestingly, the Paleoproterozoic Era, with its typical A-type AMCG rock association, remains poorly studied. At the context of the South-American Platform, the Amazonian craton, in special its southern portion, the Tapajós Mineral Province (TMP) consists on a good example of Paleoproterozoic terrain composed by calc-alkaline igneous suites, with ages between 1.99 and 1.89 Ga, that hosts many base and precious metals occurrences. Topics such as how these lithotypes evolved, their petrogenesis constraints and the tectonic setting of this part of the craton, however, still require additional effort for a better and detailed understanding. Hence, at this study we address these topics basically using whole-rock geochemistry, geochronology and geochemical modeling. The TMP is dominated by calc-alkaline and shoshonitic igneous suites that show geochemical evidence of a subduction-zone directly and indirectly controlling their petrogenesis at the 1.99 – 1.89 Ga interval. Hence, instead of successive juxtaposed magmatic-arcs as classically proposed, we understand the rock assemblage identified at the TMP as the result of a long-lived subduction process that accounts for continental-crust formation for roughly 100 Ma. The first stage of the magmatic-arc (at ca. 1.98 Ga) would be represented by at least two main petrologic trends, one with pyroxene as the main mafic phase and another where amphibole predominates. The subduction dynamics allows the coexistence of different batches of magmas due to the continuous input of primary mafic melts provided by the mantle wedge. Most porphyry deposits around the world are, in fact, genetically related with magmatic chambers that were constantly and continuously refilled, rather than genetically related with a single phase intrusion. Furthermore, the presence of amphibole and magnetite on the petrologic evolution of the first stage of the magmatic-arc should be emphasized, since it's compatible with oxidized and hydrous magmas, which confers them their metallogenetic potential. As the arc evolves the mantle wedge gets progressively metasomatized and hydrated, explaining the high-K to shoshonitic, metaluminous to mildly peraluminous characteristic of the granitoids of ca. 1.89 Ga. Geochemical modelling shows that amphibole and magnetite are compatible at these lithotypes as well. The younger 1.87 Ga granitoids are more strongly peraluminous, essentially shoshonitic and, comparatively, depleted in Ba, Sr and Eu, pointing to early fractionation of plagioclase, which is compatible with anhydrous magmas. Such characteristics suggest a change on the source of these magmas, from mantle hydrated wedge to metasomatized subcontinental-lithospheric-mantle, at an early-anorogenic setting. Geochemical modelling for the younger lithotypes confirms their relatively "dry" characteristics and, consequently, less favorability in terms of metallogenetic potential.

PALAVRAS CHAVE: Tapajós, magmatic-arc, metallogeny