GENERATING FERTILE MAGMAS THROUGH FRACTIONATION OF AMPHIBOLE AND MAGNETITE: AN EXAMPLE FROM THE TAPAJÓS MINERAL PROVINCE

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At the South American Platform, the Paleoproterozoic Era is the most expressive in terms of crust addition, with one event at ca. 2.3 –2.1 Ga and another at 2.1 –1.8 Ga. The latter is well represented at the Amazonian craton (AC) by AMCG intrusions and calc-alkaline intrusive and extrusive igneous suites. At the southern portion of the AC, a region known as Tapajós Mineral Province (TMP) shows a strategic relevance since it hosts many mineral occurrences that are genetically related with the Orosirian igneous suites. Despite the effort of many researchers over the past decades, the metallogenetic models for many of the mineral occurrences are rather controversial. Most recent papers point to magmatic–hydrothermal deposits such as porphyry and epithermal systems, however, topics such as how the lithotypes evolved and the precise tectonic setting at TMP still require additional effort. At this study we confront igneous petrogenesis, tectonic setting and the potential fertility of magmas through whole-rock geochemistry and modelling, in order to enlighten the debate on which sources and tectonic processes were actively playing a role for the formation of the lithotypes.

Our results show that within the 1.99 – 1.89 Ga age span, intrusive rocks compatible with the Creporizão (CRP) and Parauari (PAR) suites vary from metaluminous to peraluminous and belong to the high-K calc-alkaline or shoshonitic magmatic-series. The Maloquinha Intrusive Suite (MLQ) is metaluminous to more strongly peraluminous and shoshonitic. The older extrusive lithotypes (VLC-B) are essentially rhyolitic and shoshonitic, whereas the younger sequence, attributed to the Iriri Group of ca. 1.88 Ga (IRI), vary from andesites to rhyolite and belong to the high-K calc-alkaline or shoshonitic series. Trace-element patterns reveal the contrasting behavior of MLQ (ca. 1.87 Ga), clearly depleted in Eu, Ba and Sr. Within IRI, two trends are noticeable, one similar to CRP and PAR, and another that resembles the MLQ. Harker diagrams reveal different petrologic evolutions within CRP, particularly for the syenites and granites. Accordingly, our models show that the main differences are the proportion of K-feldspar partitioned to the cumulate and the presence of amphibole and magnetite on the granites. Modelling for IRI indicates that differentiation is not a continuous process from intermediate to acid compositions, and for MLQ, the results reveal a comparatively short and dry petrologic evolution, compatible with an alkali-gabbro cumulate.

The TMP is dominated by calc-alkaline and shoshonitic igneous suites genetically related with a subduction-zone controlling the petrogenesis at the ca. 1.99 – 1.89 Ga interval. The first stage of the magmatic-arc is represented by CRP, with metaluminous melts that differentiate to peraluminous compositions. The presence of amphibole and magnetite point to oxidized and hydrous magmas. As the arc evolves the mantle wedge gets progressively metasomatized and hydrated, explaining the high-K characteristic of PAR and intermediate IRI. For MLQ, the modelling results point to early fractionation of plagioclase, compatible with dry magmas. MLQ petrogenesis involves previously metasomatized lithospheric-mantle that generates shoshonitic metaluminous to peraluminous melts, at an early-anorogenic context. The first stage of the

magmatic-arc (hence CRP and PAR) is compatible with amphibole and magnetite fractionation and could be understood as more favorable for the formation of magmatic–hydrothermal deposits.

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