



Alteration, very-low grade metamorphism and geochemical modification of basaltic rocks in the Quaraí amethyst district, Paraná volcanic province, Brazil

Sandro Duarte, Léo Hartmann, Juliana Pertille, and Karine Arena

Instituto de Geociências, Universidade Federal do Rio Grande do Sul Brazil, Porto Alegre, Brazil
(sandrokduarte@hotmail.com)

Alteration and very-low grade metamorphism of basaltic rocks in the southern Paraná volcanic province led to the generation of giant amethyst geodes and to significant modification in geochemical composition of some elements. The two main amethyst and agate mining districts are Ametista do Sul (Brazil) and Artigas (Uruguay), 600 ton/month. In the Quaraí amethyst district, the five lava flows present were submitted to intense hydrothermal processes that caused the chemical alteration of rocks. The five lavas (flows Mata Olho, Catalán, Cordillera, Muralha and Coxilha) were recognized in the field and positioned in correct stratigraphic succession. All rocks are low-Ti (< 2.0 wt % TiO₂) of the Gramado type and belong to the Serra Geral Formation.

Their SiO₂ contents are 51.0, 57.5, 52.5, 56.0 and 54.5 wt %. The first flow is basalt, followed by andesite and the other are basaltic andesites. The mineralized andesite and basaltic andesite (flows Catalán and Cordillera) were intensely altered at low temperature (30 – 150° C) to ~ 70 vol. % clay minerals (mostly smectites) and zeolites. These flows have a particular structure formed by two cores: type I and II. In the core type I the hydrothermal alteration is very large due to alteration caused by confined hydrothermal fluid. Core type II has columnar jointing which allowed the free flow of fluid through fractures without significant alteration of the rock. The hydrothermal events affected individually the lavas flows as evidenced by generation and placement of hydrothermal breccias at the top of the flow and at the base of core type II. The modification in content of SiO₂, K₂O and Rb is very large and the relationship is inversely proportional to loss on ignition (LOI). For example, the content of SiO₂ of flow Catalán is 57.5 wt.% at LOI=1.5 wt.%, but drops to 50.0 wt.% at LOI=7 wt.%; the rock would be incorrectly classified as basalt but it is actually an andesite. Titanium and phosphorous are among the least mobile elements and were not affected by hydrothermal processes. This allowed the discrimination and identification of the five lavas in the region by TiO₂ vs P₂O₅ plots because each has a characteristic composition. The correlation of rocks in the Quaraí region, Brasil with Los Catalanes gemologic district in Artigas, Uruguai was established through 82 rock samples analysed, indicating the possibility of deposits of amethyst geodes on the Brazilian side of the border with Uruguay.