

mente alterado, em matriz com textura traquítica, com mais de 40% de feldspato, 10-20% de clinopiroxênio, e 10% de magnetita titanífera, 1-5% de anfíbólio e apatita como mineral acessório, imersos em base vítrea alterada (5-155°O).

Nessas rochas, a kaersutita ocorre como fenocristais subidiomórficos, com inclusões de apatita, junto a grãos reabsorvidos associados a magnetita titanífera. Os cristais ($mg\# = 0,580,62$) apresentam tanto zoneamento normal como inverso e, em alguns casos, possuem uma borda contínua de diopsídio titanífero ($mg\# = 1,0,68$). Os prismas de diopsídio titanífero fenocristalino ($mg\# = 0,67-0,78$) também mostram zoneamento variável: oscilatório, normal e inverso. Os plagioclásios fenocristalinos, escassos e tabulares, são pouco reabsorvidos e às vezes fraturados; são de labra-

dorita com fraco zoneamento ora normal ora inverso. Observam-se também alguns microfenocristais em seções retangulares até quadráticas com textura em peneira, que apenas conservam uma fina borda contínua de feldspato. Os feldspatos da matriz variam em rochas de corpos diferentes. Em alguns deles encontra-se andesina e anortoclásio (com até 2°15 de BaO), enquanto que outros possuem apenas sanidina.

Em geral todas as fases mineralógicas dos traquiandesitos basálticos registram desequilíbrio tanto textural como composicional que somente pode ser explicado em função de mistura de magmas, possivelmente de composição basáltica e traquiandesítica ou traquítica.

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GEOCHEMISTRY AND PETROLOGY OF CRETACEOUS SILICIC ROCKS FROM URUGUAY

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During early Cretaceous, a strong volcanic activity made up of basaltic (s.l.) and rhyolitic (s.l.) rocks occurred in southern Uruguay along the border of the Paraná Basin. Here major and trace element as well as Sr-Nd isotopic analyses for the silicic rocks are discussed. The mineral paragenesis of the silicic rocks is essentially anhydrous and is represented by plagioclase, alkali feldspar, quartz, iron oxides ± clinopyroxene, whereas that of basic samples consists of plagioclase ($An = 85-45\%$), clinopyroxene and, rarely, olivine. Alkali feldspars of the silicic rocks are sanidine, whose orthoclase content ranges from 60 to 30%. Clinopyroxenes are essentially augites ($Wo_{42}En_{45}Fs_{13}$ to $Wo_{38}En_{15}Fs_{47}$). The Uruguayan silicic rocks can be classified as: rhyodacite, alkali rhyolite and quartz latite; the rarer basic rocks are hawaiite and olivine tholeiite. With respect to the similar Paraná silicic lithologies they have a higher silica content. When plotted on a primitive mantle-normalized multielemental diagram, the silicic samples show negative anomalies at Eu, Sr, Nb, P, Ti and, sometimes, at Ba, which can be related to fractional crystallization. The olivine tholeiite (Mariscala area) shows negative anomalies at Th, K and Ti, positive anomaly at Ba and is enriched in LREE, the trace element concentration resembles a pattern similar to OIBs. The silicic rocks of different localities can be distinguished on the basis of interelemental ratios (e.g., LILE/HFSE) such as Ti/Zr, Nb/Y, K/Ti and Rb/Nb. The possibility of an origin from fractional crystallization process (in closed system) starting from a basaltic parental melt has been tested considering the Mariscala olivine tholeiite. For the major element the passage from basalt to rhyolite is possible after removal of about 86% of a gabbroic cumulate (pl + ol + cpx + mt + il). However, such a model cannot produce the trace element concentration of silicic rocks. In particular, the HFSE (Nb, P, Hf) content of rhyolites is lower than those of the calculated liquid, whereas Rb and K are higher. Better results are obtained proposing a two-stage model: a first step is fractionation with evolution from basalt to quartz latite and then from quartz latite to rhyo-

lite. However, also in this case, the LILE content is higher and the HFSE and HREE concentrations are lower in the rhyolites than in the calculated liquids. The hypothesis which takes into account the origin from partial melting from basaltic (or granulitic) lithologies has been tested considering the composition of experimental liquids obtained starting from basic (basaltic to granulitic) compositions. A comparison with experimental melts has shown that the Uruguayan rocks have K_2O and FeO too high and Al_2O_3 , CaO and Na_2O too low to be considered the product of anatexis of any basic source. As latter possibility an origin related to AFC processes has been tested. As parental liquids has been chosen the olivine tholeiite of Mariscala, whereas as crustal contaminant has been chosen a Proterozoic granite from Amazonas Craton. Trace element and isotopic evidences suggest that the combination of assimilation + fractional crystallization is the most viable process in order to explain the genesis of the volcanic rocks of the Arequita formation. The highest LILE and HFSE concentration in quartz latites compared to rhyolites speak for the absence of genetic relationships between these two rock groups. Open system processes are suggested also by the radiogenic Sr and unradiogenic Nd isotopic ratios of the Uruguayan rhyolites. Alkali rhyolites and quartz latites from Rio Salamanca and Arequita show the lowest $^{87}Sr/^{86}Sr$ (down to 0.70904) and the lowest $^{143}Nd/^{144}Nd$ (down to 0.511891) among the Uruguayan rocks. On the other hand, samples from Serra São Miguel and Lascano plot on a Sr-Nd isotopic space along a line in the enriched quadrant, with $^{87}Sr/^{86}Sr$ ranging from 0.71227 to 0.72391 and $^{143}Nd/^{144}Nd$ from 0.512287 to 0.511945. The olivine tholeiite from Mariscala show less radiogenic Sr and more radiogenic Nd. It is possible to propose a mechanism of fractional crystallization coupled with assimilation of crustal material which could be upper crust in the case of Serra São Miguel and Lascano (samples shifted towards more radiogenic Sr) and lower crust for Rio Salamanca and Arequita (samples with the lowest $^{87}Sr/^{86}Sr$).

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