

perature allochthonous (Socorro-Guaxupé nappe).

The hind portion of the Aiuruoca-Andrelândia nappe, south of Caxambú and Aiuruoca (MG), consists of a structural-metamorphic domain with extensional structures in normal shear zones and compressive structures exhibiting E-NE transport. Tourmaline leucogranites in stratiform bodies and diatexitic gneisses occur frequently. There is a metamorphic transition, north to south, from the kyanite zone (and metabasic rocks in eclogite facies) to kyanite and sillimanite coexistence, until kyanite broken and exclusive sillimanite presence.

The S_2 texture foliation on mineral assemblage, suggests a decompressive path, where metabasics *boudins* preserve paragenese eclogite facies (Omp-Pl-Grt-Rt-Qtz) with simplectite textures between Cpx-Pl-Qtz. Externally, corroded garnets wrapped by plagioclase coronas, in amphibole matrix, represent the amphibolite facies re-equilibration (MgHbl-Pl-Grt-Zo-Ilm-Ttn). Metapelites (Rt-Ky-Grt-Ms-Bt-Pl-Qtz) may show Sil-Pl-Qtz coronitic intergrowths around garnets.

The maximum temperatures for the distinguished metamorphic domains (14 samples), vary from $710 \pm 30^\circ\text{C}$ (Ky domain) to $730 \pm 50^\circ\text{C}$ (Sil domain). Although the pressure vary at 17 ± 0.5 to 6 ± 0.5 kbar. P-T conditions at $720 \pm 50^\circ\text{C}$ and 11.5 ± 2.5 kbar marks the kyanite assemblage re-equilibration (amphibole facies). P-T conditions $625 \pm 55^\circ\text{C}$ and 6.8 ± 2 kbar represent the cooling path (Ky-Sil fields).

The high pressure decompressive path suggests an extrusional process, immediately after buried at about 60 km deep. Fast exhumation, process controlled by convergent events, derived by the São Francisco plate subductions and tectonic erosion take these units, isothermally, to upper levels (20-33 km). Later, the metamorphic path shift toward a near-isobaric cooling though in a slower extrusional process.

P-T path continuity through three metamorphic domains suggests a sin-metamorphic process (S_2 foliation) as a continuous effect $S_1 \times S_2$, without diacronism or ensuing event superposition.

However, large amount of leucogranites denotes a regional thermal event, subsequent and superimposed, responsible for quartz static polygonization in schists/gneisses and for Ms breakdown with microcline crystallization ($730^\circ\text{C}/6$ kbar) in the vicinity of large granite plutons. — (*December 14, 2001*) .

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STUDY OF THE RADIOACTIVE DISEQUILIBRIUM OF THE VOLCANIC ROCKS FROM THE TRINDADE ISLAND (BRAZIL)

ROSANA N. SANTOS^{1,2} AND LEILA S. MARQUES¹

¹Instituto de Astronomia, Geofísica e Ciências Atmosféricas, Universidade de São Paulo, 01065-970, São Paulo, SP.

²Departamento de Física, Pontifícia Universidade Católica de São Paulo, 01303-050, São Paulo, SP.

Presented by ANTONIO C. ROCHA-CAMPOS

The radiochemical procedures employed for the determination of ^{238}U , ^{234}U and ^{230}Th activities in silicates by alpha spectrometry are presented. The best experimental conditions were defined using ^{233}U , ^{232}U and ^{229}Th radioactive tracers and simulating the usual conditions found in processing silicate samples. The adapted procedure consists of the following steps: radioactive tracer addition and sample dissolution by acid digestion, U and Th pre-concentration by co-precipitation, element separation and purification by ion exchange chromatography and electrodeposition in stainless steel disks. In order to evaluate its effectiveness, the procedure was applied to the Brazilian geological standards BB-1 (basalt) and GB-1 (granite). The chemical yields obtained for uranium and thorium are of about 60% and 70%, respectively, for both matrices. The described methodology provides activity measurements with less than 4% relative precision and accuracy of about 1%, that are essential for petrogenetic applications.

The ^{238}U and ^{232}Th series disequilibrium conditions were investigated by alpha spectrometry, together with neutron activation analysis and natural gamma-ray spectrometry. $^{234}\text{U}/^{238}\text{U}$, $^{238}\text{U}/^{232}\text{Th}$ and $^{230}\text{Th}/^{232}\text{Th}$ activity ratios were obtained, as well as the ^{234}Th , ^{214}Pb , ^{214}Bi , ^{235}U , ^{228}Ac , ^{212}Pb , ^{212}Bi and ^{208}Tl specific activities. These results were interpreted along with additional constraints given by major and minor element concentrations, determined by X-ray fluorescence.

The ^{232}Th series is in secular radioactive equilibrium in all analyzed samples. In the case of the ^{238}U series, the equilibrium condition was verified, as expected, in the oldest rocks from the Trindade Island (Trindade Complex and Desejado Sequence). On the other hand, the results show that, in the samples from the last three volcanic episodes of the island (Morro Vermelho Formation, Valado Formation and Vulcão do Paredão), the ^{230}Th and ^{238}U are not in secular equilibrium. Furthermore, three Morro Vermelho Formation samples analyzed by gamma

spectrometry showed disequilibrium between ^{226}Ra and ^{238}U .

The obtained ($^{238}\text{U}/^{232}\text{Th}$) and ($^{230}\text{Th}/^{232}\text{Th}$) activity ratios allowed to estimate a 140,000 y age for the Morro Vermelho Formation. — (*December 14, 2001*).

METAHALLOYSITE CLAYS OF POÇOS DE CALDAS ALKALINE COMPLEX, MG-BRAZIL

HANS D. SCHORSCHER AND RENATA A.R.N. DE-OLIVEIRA

Instituto de Geociências, USP, São Paulo, SP.

Presented by ANTONIO C. ROCHA-CAMPOS

Based on field work and mineralogical-petrographical optical, XRD and SEM methods, we compared a clay deposit (Mineração Varginha) located in the western part of the domain of 'potassic rock' hydrothermal alteration hosting the Osamu Utsumi uranium mine, SE-Poços de Caldas Complex (PAC), to the unweathered hydrothermalized protoliths. The deposit occurs in the swampy upper hillside of an S-to-N-draining open valley within an area of moderately hilly morphology with gentle slopes, open valleys and altitudes of 1280-1380m. Here, different generations of mutually intrusive leucito-hololeucocratic nepheline syenites and phonolites were transformed by potassic-pyritic alteration into hydrothermalites referred to as 'potassic rocks' (with K_2O of 12.5-13.8wt.-%), having low-grade U-Th-REE-Zr-F-Mo mineralization. Deep chemical weathering originated the clay deposit and exhumed this part of PAC to a subvolcanic level.

Studied deposit hosts two types of clays: one is grey with millimetric to centimetric white argillized pseudoleucite phenocrysts (ACP) representing a weakly porphyritic pseudoleucite phonolite of fine matrix weathered in situ to clay, with preserved magmatic structure; the other is a homogeneous white clay (ABM) formed from a fine hololeucocratic aphyric phonolite. Combined optical, XRD and SEM studies of ACP and ABM clays and of unweathered 'potassic rocks' (hydrothermalites of hololeucocratic aphyric and pseudoleucite phonolites), considered as analogous to the clay protoliths, always showed highly crystalline hydrothermal kaolinite with the same habit of fine idiomorphic plates and booklets ($\emptyset \leq 5\mu\text{m}$); equivalent idiomorphic hydrothermal illite is also omnipresent yet much coarser ($\emptyset \geq 15\text{-}50\mu\text{m}$), practically representing fine sericite/muscovite. Feldspar occurs only in the hydrothermalites, being a low-temperature pure K-feldspar of maximum triclinicity formed by hydrothermal

alkali-exchange reactions (K for Na) and structural readjustments from magmatic sanidine.

Kaolinite and illite of low crystallinity occur only in the clay samples; the former predominates by far over the kaolinite of high crystallinity and proved to be in fact tubular metahalloysite (SEM). XRD studies with heating techniques at 60°C showed the illite of low crystallinity to be in fact (hydrated) halloysite partially preserved from dehydration (to metahalloysite) due to water-saturation in the clay deposit. — (*December 14, 2001*).

LATE PALEOZOIC EXHUMED GLACIAL EROSION LANDSCAPE IN SALTO, SP*

JULIANA B. VIVIANI** AND ANTONIO C. ROCHA-CAMPOS

Instituto de Geociências, USP, São Paulo, SP.

Outcrops of the Itu granite (early Paleozoic) in the Tietê river valley, in Salto, SP, expose a variety of glacial erosional landforms of meso-scale extremely well preserved. Structures occur on land or eventually emerge above the water inside the river channel.

The most notable landforms correspond to streamlined bedrock (whalebacks) and stoss and lee features (roches moutonnées). The first category includes the classic roche moutonnée from Salto. Another reported occurrence of glacially abraded granite in the area could not be properly examined. Submerged depressions in the granite that separate landforms inside the river may correspond to rock basins.

Exposed dimensions of landforms vary from 1-15m of length to 1-1.5m of height. Their plan view shape is roughly elliptical. Micro-scale erosional features on the structures include striae, grooves, polishing and quarrying. Orientation of micro-features varies locally, but is in general SE-NW, parallel to elongation of landforms. They indicate a sense of movement of glacier towards NW.

Areal distribution of landforms over a distance of at least 1.2km in the Tietê river valley configures an extensive, exhumed, well preserved late Paleozoic landscape of glacial erosion.

The glacially eroded features of Salto indicate the action of a warm based glacier with subglacial meltwater. The ice mass probably flowed on an irregular, fractured granite floor, generating a complex pattern of effective ice pressure that resulted in different erosional landforms.

Itararé Subgroup rocks overlying the glacially eroded basement in the area vary from lodgement and meltout tillites, and lacustrine (?) rhythmites and sand-