Abstracts

Volume 1 of 3

28th International Geological Congress

Washington, D.C. USA
July 9-19, 1989

he basalts and rocks of the differentiated complexes, according to 35 Ar determinations, erupted between 15 and 33 mybp, with a maximum ency from 25 to 28 mybp (Upper Oligocene) (5).

According to the Rb/Sr isochrone the potassic volcanics of Chacay erra are 19 mybp. (8).

Two K/Ar determinations of basanites and olivine nephelintes of the erra Queupuniyeu—showing a similar subsaturate dnature as many of he postplateau manifestations—reveal 19 to 21 mybp. (5).

The stress field at the time of the voluminous plateau basalts effusions eems to have been distensive. The regular radial design of the outcropping ikes in Siera Apas (3) evidences that the settlement of the differentiated ffusive centers occurred under a passive regime.

The geological moment of the eruptions and settlement of these volanics was not random but adjusts in tie with the orogenic events of the ontiguous folded belt.

The age of the "anorogenic" eruptive rocks of the Somuncura plateau orresponds to the distensive periods of the crust between the Inca orogeny compressive deformation phase ≈35 mybp.) and the Quechua I orogeny ≈10 mybp.) manifested in the Andean Cordillera (1,2,9). The uprise of hese lavas can be related to deep lithospheric fractures and continental rust tectonic readjustment after the Inca compressive orogenic phase.

REFERENCES

Charrier, R., 1973, Earth Planet Sci. Letters, 20:242-249.
—— and N. Malumian, 1975, Rev. Assoc. Geol. Argentina 30:193-207.
Corbella, H., 1979, 4th Latin American Geol. Congr. Trinidad & Tobago.
—— 1982, 5th Latin American Geol. Congr. Argentina II:197-211; II:225-238.
—— 1984, 9 Congr. Geol Argentino, I(10): 267-300.
—— 1985, 4 Congr. Geol Chileno, 4:89-107.
—— 1987, Internat. Symp. Andean Volcanism, 10 Congr. Geol. Argentino, in press.
—— M. Barbieri, 1987, Internat. Symp. Andean Volcanism, 10 Congr. Geol. Argentino, in press.
Fruto, J., 1981, Tectonophysics 72(1/2)T21-T32.
Vogt, P.R., 1974, Earth Planet. Sci. Lett. 21:235-252.

CORDANI, U. G., K. KAWASHITA, and K. SATO, Universidade de São Paulo, São Paulo, Brazil, S. S. IYER, Instituto de Pesquisas Energéticas e Nucleares, São Paulo, Brazil, and P. N. TAYLOR, Oxford University, Oxford, United Kingdom

Pb-Pb, Rb-Sr, and K-Ar Systematics of Rock Types in Lagoa Real Uranium Province, South Central Bahia, Brazil

Geochronological investigation using different isotopic systems (Pb-Pb, Rb-Sr, K-Ar) has been carried in the granite–orthogneiss complex of Lagoa Real, Bahia, one of the most important uranium provinces of Brazil (Angeiras et al., 1981).

Rb-Sr whole-rock data for eight migmatitic gneisses of the so- called "basement complex" yielded an isochron age of 2650 /pmn 100 Ma with an initial ratio of 0.712 /pmn 0.004, corresponding to the peak of Jequié orogenic cycle, an important tectonomagmatic period in eastern Brazil, when the regional crystal province was probably formed.

The lead-lead isotope data for five underformed granites (São Timóteo Granite) and seven gneisses (Lagoa Real orthogneisses) defined a well-fitted isochron with a calculated age of 1710 /pmn 100 Ma and a model μ_1 value of 8.38. This overlapping range of lead isotope composition for granites and gneisses lends support to the hypothesis of the deformed rocks being equivalent to the granites; in consequence, the common lead isotopic composition seems not to have been affected by the process of gneissification. The granite samples analyzed for Pb isotopes also yielded similar Rb-Sr isochron age (1710 /pmn 45 Ma); $(^{87}Sr/^{86}Sr)_i$ = 0.715, and the age values are in agreement with some already available U-Pb zircon dates (Turpin et al., 1988), indicating that 1700 Ma represents most probably the age of granite formation. The initial Sr isotopes ratio, as well as μ_1 value, suggests that the granites formed from the melting of crustal components.

In contrast to the Pb-Pb systematics, the Rb-Sr data for the orthogneiss showed that the Rb-Sr isotopic system has been highly disturbed as is evidenced by isochron diagrams with analytical points exhibiting some dispersion around best-fit lines with apparent ages of 1500 Ma, 1200 Ma, and 1000 Ma, which do not seem to have much geological significance. The disturbance of the Rb-Sr system appears to be the result of Rb gain and/or Sr loss, during one or more tectonothermal events in Mid-Late Proterozoic times. K-Ar data on minerals yield ages in the range of 500–570 Ma, which may be correlated with tectonic events associated to the Brasiliano orogenic cycle, representing the final regional cooling.

The present investigation complements the data already obtained by Turpin et al. (1988), which indicated ages of 1725 Ma, 1395 Ma, and 480 Ma, respectively, for granite formation, uranium mineralization, and tectonic rejuvenation. Altogether, the data do not provide an unequivocal age for the uranium mineralization, which could have occurred in several successive pulses.

REFERENCES

Angeiras, A. G., N. H. Waring, and A. V. F. Ferreira, 1981, Metasomatic uranium deposit of the Lagoa Real district, Brazil: AAPG Bulletin, Special Publication.

Turpin, L., P. Maruejol, and M. Cuney, 1988, U-Pb, Rb-Sr and Sm-Nd chronology of basement, hydrothermal albites and uranium mineralization (Lagoa Real, South Bahia, Brazil): Contributions to Mineralogy and Petrology, v. 98, n. 2, p. 139–147.

CORNELL, D. H., H. F. THEART, D. J. SCHEEPERS, University of Stellenbosch, South Africa, and H. C. HUMPHREYS, University of Cape Town, South Africa

Collision-Related P-T-time Path for Prieska Copper Mines, South Africa

Intensive petrographic and geochronological studies around the Prieska Copper Mines near the Eastern boundary of the Grenville age Namaqua Province of Southern Africa has led to the establishment of a well constrained P-T-time path for the region.

The country rocks, which form part of the Areachap Group, are the high grade metamorphic equivalents of dacite to basalt volcanic rocks and their immature sedimentary derivatives, the geochemistry of which suggests formation in a back arc tectonic setting close to 1300 Ma. The orebody comprises about 50 Mt of massive pyrite, with sphalerite and chalcopyrite. It was first interpreted as an almost unmetamorphosed Noranda-like volcanogenic deposit by Middleton (1975), then by Wagener (1980) as the product of precipitation from the waters of an evaporitic basin. Our work has shown that it is highly metamorphosed and can best be explained as a Besshi-like volcanogenic deposit related to basaltic magmatism in a back-arc basin.

Four phases of metamorphism M1 to M4 and three deformational events F1 to F3 are distinguished and their relationships determined using textural and mineralogical criteria in drill-core samples within 5 km of the mine. The metapelitic country rocks and peraluminous alteration zone show the clearest response to changes in metamorphic conditions, while basites generally retained amphibolite facies parageneses. The P-T conditions for each metamorphic phase determined using experimental reaction lines and geothermobaromtry are shown in Fig. 1.

M1 is characterized by the inferred former presence of staurolite (seen as hercynite sillimanite cordierite magnetite pseudomorphs) and fibrolite pseudomorphs after kyanite, which developed at 1210 Ma. These minerals gave way to higher temperature sillimanite, cordierite and garnet-bearing M2 assemblages, while hypersthene-bearing assemblages developed at a few localities. M2 parageneses are dominant in most samples.

M3 sillimanite phlogopite grain boundary coronas are evidence of a short pulse of fluid influx while high temperatures prevailed, and the intrusion of M3 pegmatites is dated at 1101 Ma. M4 minerals kyanite, staurolite, biotite, garnet, muscovite and chlorite formed in that order during a retrograde cooling history from 1070 to 965 Ma.

Sulphide minerals within the Prieska Orebody also show a complex history starting with F2-M2 "durchbewegung", through M3 oxidation reactions, and ending with dissemination in fractures during F3 and M4.

A model P-T-time path proposed for this region based on the P-T data given in Fig. 1, together with geochronological data from Pb/Pb, Rb/Sr, Ar/Ar and Sm/Nd studies, is shown in Fig. 2. It conforms to collision event models in which an early, rapid pressure increase is followed by a curved thermal relaxation and uplift path back to the surface. A thermal spike is superposed on this path to account for the M2 and M3 events, and this is ascribed to the short-lived thermal effects of ascending lower crustal melts, represented at Prieska Mine by an anorthosite body to the east. The implication that this "regional" metamorphism is actually a "contact" phenomenon is supported by the variations in M2 grade from lower amphibolite to two-pyroxene granulite found within a ten-kilometer belt centered at Prieska Mine.

The concept of a collision event in the Areachap Group is consistent with recent structural studies which related strain data to a "transpressional" stress field, and recognized major thrust faults in the Namaqua Front region. Geochemical evidence of subduction-related volcanic rocks in the belt also imply the existence of an ocean basin which would have closed by collision.

The development of this model is the result of many years work in the region. We had access to a large set of samples, of which only a few provided the crucial data which enabled us to work out the sequence of structural and metamorphic events. We suggest that if similar detailed work is carried out on other volcanogenic massive sulphide deposits, many of them may also be found to have participated in continental collision events.