ORTEGA L.A.*, GIL IBARGUCHI J.I.* - *REE distribution in late kinematic and post-kinematic granitoids from Galicia (Iberian Hercynian Folbelt, NW Spain)*

The late kinematic granitoids from Galicia are two-mica granites with or without Al-rich phases such as andalusite, sillimanite or cordierite, they appear mainly in Western Galicia. The post-kinematic granitoids are mainly biotite-rich granites and monzogranites appaering essentially in Western and Eastern Galicia and in restricted amounts in the central part of this region.

Computer model have been established for the origin and evolution of both granitic families. In most cases a two-stage model involving firstly a period of partial melting followed by one stage of crystal fractionation serves to account for the observed REE patterns. Continental crustal rocks such as greywackes, pelites and orthogneisses, analogous to those outcropping in the area studied, have been used as the source materials for the magma models. According to those models the main differences between these two types of granitoids are as follows.

The two-mica late kinematic granitoids show systematically an important Eu negative anomaly and higher La/Yb ratios than the biotite-rich granitoids. Their origin should be the partial melting of psamo-pelitic sequences followed by a mainly plagioclase controlled crystal fractionation process (F 0.7-1).

The biotite-rich post-kinematic granitoids show a much wide spectra pattern. In Western Galicia these granitoids should originate by partial melting of an ortho-derived rich protolith, undergoing subsequently a more or less important process of plagioclase and allanite fractionation (F 0.35-1) which led to the appearing in some cases of rather flat REE spectra. In Central and Eastern Galicia the protoliths should be more rich in pelitic component and the processes of crystal fractionation (F 0.3-0.95) were again controled mainly by the plagioclase.

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PAPINI M.*, RIVA B.* - *The thermal aureole of the Val Biandino pluton (Orobic Alps - Italy)*

The «Orobic Anticlyne» is an outstanding structural feature of the central sector of Southern Alps. It consists of a volcano-sedimentary sequence bearing at its core the crystalline basement and the late-Hercynian (about 290 Ma) intrusive bodies; the contact basement/cover is of tectonic nature.

The Val Biandino pluton is exposed over an area of about 8 km^2; it consists mainly of a quartz-bearing diorite with subordinate gabbrodiorite and cordierite-bearing microgranite. The pluton is compositionally and texturally very inhomogeneous, suggesting multiple intrusion as thikc vertical dykes of calcalkaline magma that was undergoing differentiation in a deep-seated reservoir during an extensional tectonic episode.

The country rock are paragneisses with plagioclase poikiloblasts (Gneiss di Morbegno) and thin amphibolite intercalations; the age of regional metamorphism in Hercynian whose climax can be evaluated, on the basis of the available radiometric data, around 320 Ma.

The intrusion induced a very intense thermal metamorphism that can be revealed in all the basement rocks despite the small size of the outcropping pluton, suggesting the presence of the intrusive rocks at a very shallow depth beneath the present topographic surface all over the exposed area.

Near the main quartzdiorite body the paragneisses underwent dehydration melting involving biotite and not muscovite, demonstrating that PH_2O was between 2 and 4 kb. Anatexis produced a cordierite-bearing granitic melt that in part was intruded in the fractures of the cooling pluton itself and in part remained in the country rocks giving rise to spectacular migmatites. It must be noted that the cordierite-bearing granite (which is not geochemically compatible with the differentiation trend of the pluton) was attributed by the previous authors to assimilation: the petrographic evidence does not confirm this view, since the leucocratic veins of the migmatites and the microgranitic dykes within the pluton show exactly the same composition.

In the thermal aureole it is possibile to recognize temperatures in the range 750° (presence of corundum) - 550 °C (cordierite is present even in the most distant samples).

P and T evidences from the thermal aureole and the late-Carboniferous radiometric age indicate that this calcalkaline pluton was intruded at the end of the Hercynian orogeny but before most of the upheaval and the erosion that preceded the Lower Permian volcano-plutonic cycle dominated an ex extensional horst and graben tectonics.

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PEARCE J.A.*, HARRIS N.B.W.**, ROGERS N.W.**, TINDLE A.J.** - *Trace element signatures of the petrogenesis and intrusive settings of granitic rocks*

XRF and INAA analyses of a range of granitic rocks from well-constrained tectonic environments have been used to identify geochemical characteristics which may be used to fingerprint the original intrusive environmental of granitic rocks of unknown affinities and which have a sound petrogenetic basis. These characteristics are most easily recognized on multielement patterns normalized to, for example, an ocean ridge granite (ORG) composition. Despite the complexities introduced by trace element fractionation processes such as fractional crystallization, crystal cumulation and volatile transport, it is possibile to make a first-order petrogenetic subdivision of most of these patterns into mantle (m), crust (c) and mantle-crust (mc) types and to make a second-order subdivision according to the nature of the mantle and/or crust involved;. further subdivisions according to the nature of the fractionation processes are also possible.

The mantle patterns are defined as those derived from a mantle-derived parent magma with no subsequent crustal involvement. Thus m_d and m_e patterns are found in granites whose parent magmas were derived respectively from incompatible element depleted (N-MORB-related) and enriched (plume-related) mantle sources while m_{ds} and m_{es} patterns result when the depleted or enriched mantle source had been modified by addition of a (LIL element rich) subduction component.

The crustal patterns are defined as having been solely derived from fusion of the continental crust. c_s and c_i patterns represent those derived from closed-system fusion of sedimentary and ingeous source region respectively and c_{vs} and c_{vi} patterns result from open-system fusion of these regions in which elements such as Rb have been selectively gained due to influx of a volatile phase. Effects of variable source composition and varying degrees of partial melting on pattern shape were otbained from analyses of partly assimilated xenoliths and autoliths, from analyses of leucosomes, palasomes and segregated granitic bodies in gneiss terranes and from granitic rocks derived from well-defined crustal sources. Mantle-crust patterns result from mixing of mantle-derived melts with crustal-derived melts and will vary according to the components involved and whether mixing precedes, accompanies and/or follows crystallization of the magma.

From our data base of granitic rocks from the main tectonic environments, ocean ridge granites (ORG) exhibit patterns of m_d to m_e type if from normal to anomalous ridge segments respectively and of m_{ds} type if from supra-subduction zone ridge segment. Within plate granites (WPG) intruded into attenuated lithosphere are predominantly of m_dc_s to m_ec_s type, although c_s patterns have been indetified in a few localities; WPG intruded into normal continental lithosphere yelds m_e to m_ec_s patterns; and WPG in oceanic island generally give m_e patterns, although m_{es} patterns can result if the mantle source had a major DUPÁL component. Volcanic arc granites (VAG) exhibit m_{ds} patterns if of oceanic origin and range from m_{es} to $m_{es}c$ at active continental margins.

Collision granites (COŁG) range from c_{vs} and c_{vi} to c_s and c_i in syn-collision environments. In post-collision environments, $m_{es}c_s$ patterns now dominate, although c_i and c_s patterns also exist and may have been more important in the Archaean.

Linear programming and pattern recognition techniques can be used to interpret trace elements patterns by providing quantitative measures of the proportions of crust and mantle components and the probabilities of tectonomagmatic assignments.

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PITCHER W.S. - *Andean batholiths: the generation of I-type granitoids at a plate margin*

The chain of great granitoid batholiths that cores the Western Cordilleras of the central and southern Andes provides a type example of silicic magmatism at an active plate edge of a continent. The magmas were generated in the upper mantle by processes initiated during crustal extension connected with Mesozoic subduction. Despite emplacement into the continental margin their composition had little to do with old crust, except where residence was prolonged locally. Overall the magmas made a major contribution to crustal growth.

Such batholith have been regarded as forming the roots of volcanic arcs developed above subduction zones. There is a close spatial relationship with evidence of a plutono-volcanic interface, but there is also a significant compositional and time hiatus as expressed in the cyclic nature of magma-tectonics events, viz. basinal volcanicity, compression, granitoid intrusion and finally uplift, which suggests that the nature of the source differed with time.

The Coastal Batholith of Peru illustrates well the nature of this type of silicic magmatism. A linear array of hundreds of plutons was stoped out of the axial zone of a precursor back-arc basin of Lower Cretacoeus age. The latter had been infilled with lavas, volcanosclasic deposits, feeder gabbros and basic dykes, and subjected to a non-deformative, episodic, burial metamorphims which was enhanced by the contact effects of granitoid intrusion.

Calc-alkaline, magnetite-bearing, I-type tonalites and granodiorites predominate, though the compositional spectrum is widened to include both K-rich diorites and evolved granites. All these rocks occur in well-defined, time-separated, consaguineous rock suites, each with its own identity as defined in terms of chronology, modal and chemical composition, textural characteristics, enclave population and dyke-swarm association. Overall the isotopic data are wholly in accord with a primary mantle source. Nevertheless the extraction processes seems to have required the early pillow lavas, gabbros and basic dykes. A mid-Cretaceous compressional phase triggered the equilibrium melting of this basic substrate with episodic production of hot, relatively dry magmas which fractionated on upwelling, the concentrates accreting on the walls of the conduits.

The Coastal Batholith represents a simple case of the generation of magma along a single megalineament, and over the long time interval of 112-32 Ma. An analogue is the event longer-lasting Patagonia Batholith, 155-10 Ma, with like dimensions, near identical compositions, a similiar history, and again with a close time and space relationship with the development of a back-arc bassin. Only the frame is different; a complex, accreted forearc terrane of Paleozoic age instead of the ancient gneisses of the craton as in Peru.

Such a Paleozoic understory persists into central and northern Chile carrying similar back-arc basial deposits of Mesozoic age. Here, however, both the volcanic belts and the linear batholiths show an easterly migration with time into the continental lip, with a correspondingly