increasing influence of the old crust on the composition of the granitoid magmas.

In contrast, in the northern Andes, a Pacific island-arc terrane was accreted into the true continental margin, affording a sharp contrast between the voluminous, compositionally expanded, I-type granitoids of the liminal environment, and the small volume of compositionally restricted M-types of the oceanic arc.

Thus, overall, the evolution of the Andean batholiths provides a model for the origin of one type of granitic rocks at an active, continental plate margin. It is the thickness of the continental crust, combined with high heat flow, which provides the conditions for especially vigorous melting. During the extentional phase new crust was generated by extraction of a basic progenitor from the mantle. Then relatively mild phases of compression both triggered the remelting and generation of major batches of magma, and sufficiently sealed the thickned crustal carapace to provide the increased travel distances and times necessary to advance the differentiation process.

It is doubtful whether such a Pacific-type margin environment, with its voluminous production of K-poor, Ca-rich granitoids, ever formed an important element in the geological evolution of the European crust.

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PUPIN J.L.* - *Granites as indicators in paleogeodynamics*

The typologic study of zircon populations (PUPIN 1976; PUPIN and TURCO, 1972, 1981) is more and more employed to solve problems dealing with endogenous or exogenous petrology (i.e. plutonic and volcanic rock petrogenesis, origin of ortho and para-derived metamorphic rocks, origin of detritals in sedimentary rocks, metallogenesis associated with magmatism...). Among them, the use of granitic rocks as magmatic indicators in paleogeodynamics seems to be one of the most fruitful in the future.

Genetic classification of granites using the typologic diagram (PUPIN 1980, 1981a) is one of the most powerful concerning the discrimination of anatectic mobilisates, mantle derived granites (alkaline, tholeiitic) and hybrid granitic rocks (calc-alkaline s.l., K-calc-alkaline = magnesiopotassic and K-subalkaline = ferropotassic) where sialic crust and mantle materials ratio vary largely. The origin can be determined even on little, homogeneous and/or altered bodies in a very rapid and easy way.

The mean points distribution of zircon populations from granites sampled in the same area visualize very clearly the contrast previously mentioned by PITCHER (1979) for acidic magmas in «alpinotype», «andinotype» and «hercynotype» environments. Moreover, the comparison of the different typological characteristics (mean points $(\overline{A},\overline{T})$, typological evolutionary trends T.E.T.) lead to define magmatic zonings in ancient orogens (PUPIN 1981b, 1982, 1985). The nature and complexity of these zonings are depending upon numerous factors, i.e. duration of subduction, importance of the compressional and tensional tectonics, structural level of observation.

Several examples of magmatic zoning are proposed. They are characterized by the abundance or scarcity of granitic bodies and/or associated rhyolites, the importance of crustal anatexis, the temperature and water content of the melts — especially concerning calc-alkaline granites —.

— Cenozoïc period: Mexico, New Caledonia, Western Alps, Elba-Tuscany, Aegean Sea.
— Hercynian cycle: french Massif Central, Brittany, Corsica-Provence, Morocco.
— Caledonian cycle: Belgium.
— Brazilian cycle (late precambrian): Southern Brazil.

The complete zoning is generally characterized, with more or less overlapping, by the following succession towards internal zones:

1) Calc-alkaline granites derived from water rich magmas; tonalites.
2) Aluminous anatectic granites (linked with collision processes).
3) Calc-alkaline and K-calc-alkaline granites derived from «hotter and drier» magmas.
4) K subalkaline granites: (alkaline granites).

From the groups 1 to 4, an increase of $\overline{T}$ indices of populations is registred. The $\overline{T}$ values of calc-alkaline granites are higher for active margins with a long duration of the subduction process than for collision following limited subduction zone.

The use of such magmatic indicators is of interest notably for the study of very complex orogenic domains as i.e. the hercynian belt in western Europe, the patchwork distribution of the magmatism probably resulting of the working of several microplates. Thus, acid magmatism is likely to provide excellent criteria of polarity capable of solving the problems of paleogeodynamics.

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PUZIEWICZ J.* - *Origin of a gradual transition of the Koźmice granodiorite (Sudetes, SW Poland) into its wall rocks*

The Koźmice granodiorite forms a few-meters thick

sheet embedded in rocks composed of amphibole and/or pyroxene, feldspars, biotite and quartz. The country rocks originated through a high level thermal metamorphism of a clinopyroxene-plagioclase-biotite rock (vaugnerite) and their mineral assemblages indicate a decrease of temperature of this metamorphism outwards the granodiorite. At the contact the granodiorite gradually passes into its country rock through a few meters wide transitional zone. The granodiorite and the transitional zone exhibit well pronounced deformational structures (shear zones, foliation) generated at both magmatic and post-magmatic stages, whereas the rocks situated outside are not deformed.

The granodiorite was emplaced and crystallized during deformation of embedding series. The magma and the hot granodiorite soon after its crystallization were soft elements in an exposed in Koźmice rock assemblage, and the deformation was concentrated in them. The transitional zone between the granodiorite and its wall rocks is therefore indicative of processes taking place at the contact of magma and solid country rock during deformation. This zone might have been produced by magma contamination by grains coming from the disintegrated country rock and, further outside, by penetrative infiltration of magma into weakened and loosened country rock. The action of tectonic stress (shearing) seems to be a prerequisite for the formation of the transitional zone. Similar transitional zones occurring at contacts of magmatic intrusions with rocks lacking thermal markers (e.g. quartz-feldspathic ones) may be much more difficult to interpret.

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ROTTURA A.*, BARGOSSI G.*, CAIRONI V.**, D'AMICO C.*, MACCARRONE E.*** - *Petrology and geochemistry of late-Hercynian granites from the Western Central System, Iberian Massif*

A geological, petrographic and geochemical study involving mineral chemistry, zircon typology, whole-rock major, trace and rare earth element data, has been carried out on the granites occurring NNW of Bejar in the western zone of the Spanish Central System. These consist mainly of hydiomorphic and porphyritic-textured biotite monzogranites-granodiorites, with minor muscovite ± cordierite-bearing types, cleary intrusive at high-level into a thick sequence of greywackes and pelites metamorphosed at greenschist facies and cordierite ± K-feldspar-rich migmatites. Spatial distribution of the muscovite ± cordierite-bearing granites shows no correlation with proximity to the migmatite contact. Magmatic textured mafic microgranular enclaves commonly occur in the granites.

The textural and compositional evidence indicates a magmatic origin for plagioclase (well zoned up to An61; synneusis associations; etc.), biotite and partly for muscovite; cordierite may be primary and partly exogenic in origin.

The chemical data show the following: 1) moderately peraluminous typology for both granite types, more pronounced in the muscovite ± cordierite facies (A/CNK = 1.9 vs. 1.13; normative C = 2.36 vs. 1.99), which is also more acidic (SiO_2 = 70% vs. 68%); 2) different variation trends rather scattered in the muscovite ± cordierite granites, linear and in some instances compatible with a fractional crystallization process in the dominant biotite granites; 3) LREE-enriched patterns with moderate to pronounced negative Eu-anomaly (0.5 to 0.25), total REE decreasing with differentiation and higher HREE fractionation (Gd_N/Yb_N = 2.26 vs. 1.84) in the muscovite ± cordierite granites.

In the zircon typologic grid (after PUPIN, 1980) the biotite granites plot in the domain of the hybrid calc-alkaline granitoids and the muscovite ± cordierite types in that of the aluminous anatectic granites. Biotite granites enclosing xenocrystic cordierite do also occur.

The field, petrographic and chemical data rule out genetic processes involving a unique homogeneous source and suggest, in agreement with available initial Sr-isotopic composition (0.7094) for granites from the Eastern Central System, an origin via mantle-crust mixing processes. Further data, especially isotopic, are necessary to constrain the granite genesis in terms of source material and to choose between: (i) an intracrustal melting process triggered by the coeval ascent of mantle derived magmas (Appinitic suite of Spanish Authors) and involving an igneous-sedimentary composite source and, (ii) an interaction of differentiated mantle-derived magmas with crustal materials.

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ROTTURA A.*, BARGOSSI G.*, CAIRONI V.**, DEL MORO A.***, GRASSI G.*, MACCARRONE E.****, MACERA P.***, PAGLIONICO A.*****, PETRINI R.***, PICCARRETA G.******, POLI G.******* - *Petrology, geochemistry and petrogenesis of late Hercynian granitoids from the Southern Calabrian «Arc» (Southern Italy)*

The late Hercynian (295-270 Ma; Rb/Sr and U/Pb mineral ages) granitoids occurring in the Southern Calabrian «Arc» have been studied for phase chemistry, major and trace elements, REE, zircon typology and Sr and Nd isotopes.

Two distinct granitoid associations, both in time and space related and generally intruded at high level, have been distinguished: i) calcalkaline, compositionally-expanded (SiO_2 = 48-72%) and biotite-dominated; 75% of the plutonic rocks; ii) peraluminous,