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Updating of knowledge on the Calizzano Massif granitoids (Western Liguria)

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The crystalline basement of the Calizzano-Savona and Bagnaschino units (Maritime Alps) consists of polymetamorphic paragneisses and amphibolites (with eclogitic relics), associated to granitoid orthogneisses affected by a later or possibly penecontemporaneous Hercynian metamorphic phase (CORTESOGNO, 1984). DEL MORO et al. (1982) record the metamorphic re-equilibration of white micas and biotite in the range 327-297 ± 5 Ma thus dating the Hercynian event. As a result, the authors suggest a pre-Westphalian age for the metagranitoids (intrusion during Caledonian tectonomagmatic activity?).

In the Calizzano area metagranitoid rocks occur as large relatively homogeneous bodies (Fig. 1) of monzogranitic composition. Primary intrusive contacts rarely survive to the Prealpine and Alpine schistogeneous phases; the presence of andalusite in envelopping paragneisses close to the granitoids suggests emplacement at epi-mesocrustal levels.

The finding of foliated orthognessic dykes associated to granitoids bodies requires further consideration of petrochemical constraints in order to define the tectonomagmatic evolution of the Calizzano Massif.

The orthogneissic dykes (30-100 cm thick), ranging in composition from quartz-rich granodiorites to leucogranodiorites, outcrop interbedded with the paragneisses and are parallel to the main pre-Alpine schistosity.

In both granitic lithotypes parageneses and textures partially survive to the Prealpine and Alpine metamorphic events.

The monzogranitic orthogneisses are generally coarse-grained, with prevailing subhypidiomorphic texture; large (up to 10 cm) K-feldspar megacrysts locally occur (augen-orthogneisses). Primary muscovite rarely occurs as inclusions in the plagioclase and may be interpreted as a residuum or an early high-P crystallization phase; zircon, apatite and allanite are common accessory phases; garnet of possible primary origin is sometimes present (Spess 5-12, Py 11-13, Alm 63-76, Andr 1-10, Gross 0-6).

The granodioritic dykes show medium-sized equigranular texture and a recognizable hypidiomorphic sequence: bt + gt →

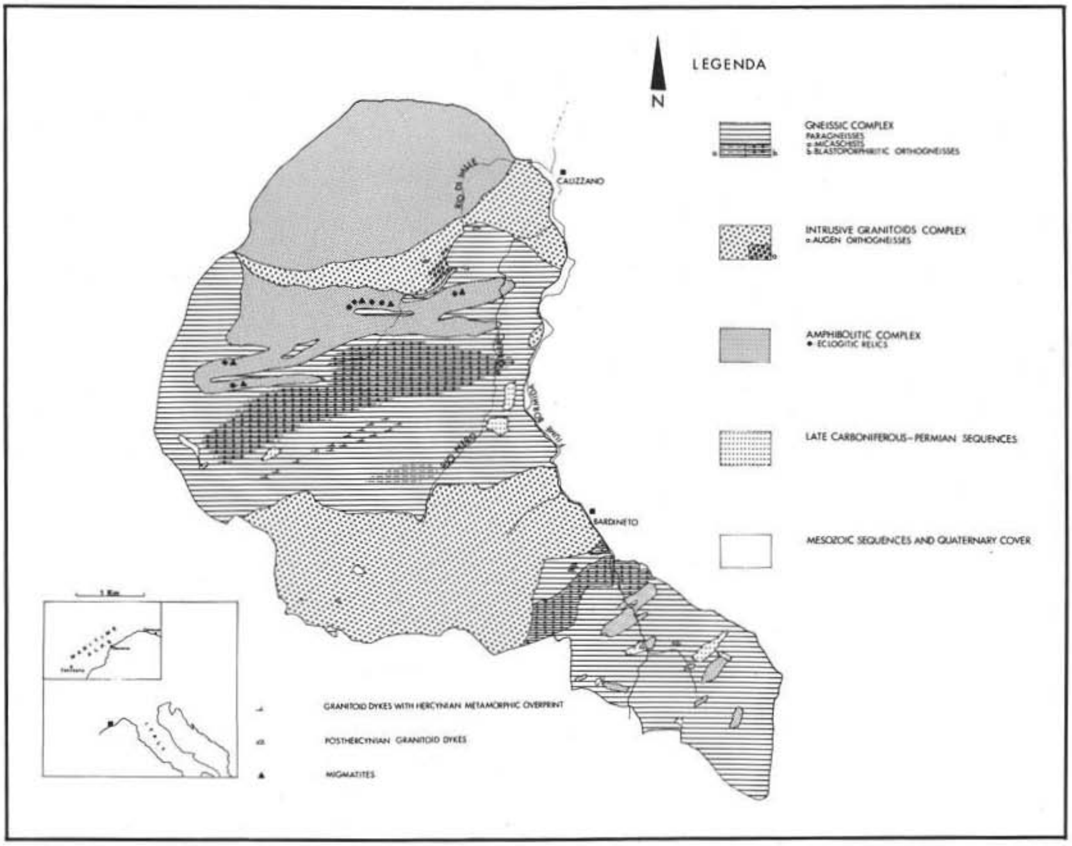

Fig. 1. — Geolithologic sketch map of Calizzano Massif.

bt + plg + qz → plg + qz + Kf. Zircon, mainly as inclusions in biotite, and apatite are relatively abundant.

Quartz/plagioclase/K-feldspar ratios from normative data and modal analyses are generally congruent; however, the normative An/Ab ratios are lower than those determined in relic plagioclases, thus suggesting some Ca loss.

The Ca loss and the high Si contents allow the dykes to be plotted in the granite field of the R1-R2 diagram (DE LA ROCHE et al., 1980).

Either monzogranitic and granodioritic orthogneisses show a peraluminous character (A/CNK always ≫ 1.1., normative corundum ≫ 1) and calc-alkaline geochemical affinity.

The representative points of the monzogranitic orthogneisses plot in the «mobilizates and related granitoids» field as defined by LAMEYRE & BOWDEN (1982) (Fig. 2); in Winkler's diagram (Fig. 3) they fall close to the qz + plg + alcalifeldspar cotectic surface.

The dykes show a low-K calc-alkaline affinity and correspond to higher T melts in

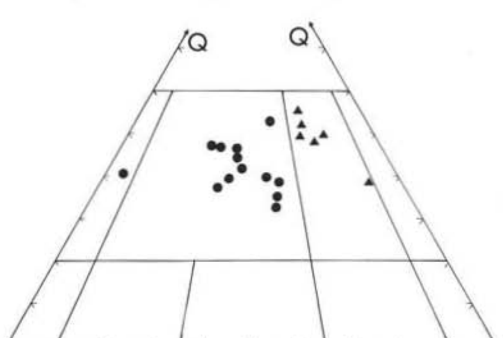

Fig. 2. — AQP diagram; solid triangles = granodioritic dykes; solid circles = monzogranitic orthogneisses.

Winkler's diagram.

Log covariation diagrams using high field strength elements indicate different petrogenetic processes for monzogranitic orthogneisses and granodioritic dykes.

In Fig. 4 the representative points of the former are rather scattered and only the Y vs. Zr covariation may be related to the primary petrogenetic history. Furthermore, the geotectonic interpretation by means of trace-element discrimination diagrams (PEARCE et al., 1984) is not univocal, most of the representative points plotting at the syn-COLG/VAG or VAG/WPG boundaries (Fig. 5).

On the contrary, the high field strength and large ion lithophile elements of the granodioritic dykes show straight regression lines (Fig. 4): this feature seems to be consistent with a crystal fractionation origin involving biotite and accessory phases.

The VAG affinity of dykes resulting from trace element discrimination (Fig. 5) may be interpreted as due to active continental margins.

Up-to-date petrochemical knowledge of the monzogranitic orthogneisses and granodioritic dykes suggests different petrogenetic processes: a prevailing crustal signature is supposed in the monzogranitic bodies (anatectic melts?), whereas the granodioritic dykes seem more consistent with a crystal fractionation origin from a more

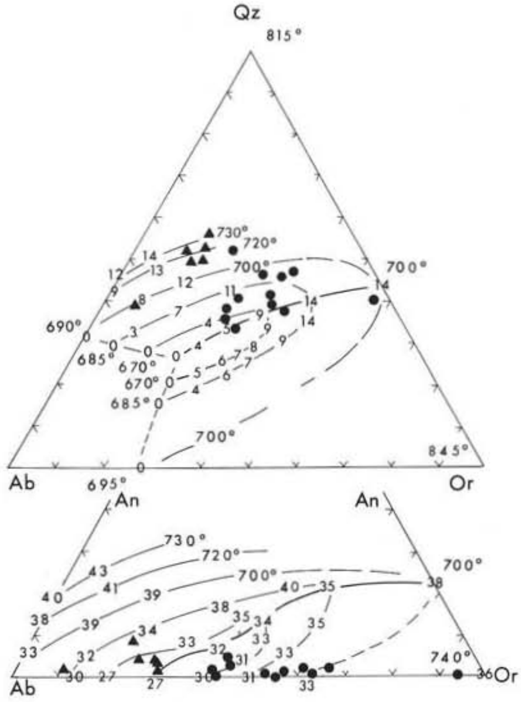

Fig. 3. — Projections of Qz-Ab-Or-An tetrahedron (WINKLER et al., 1975) for the analyzed rocks. Symbols as in Fig. 2.

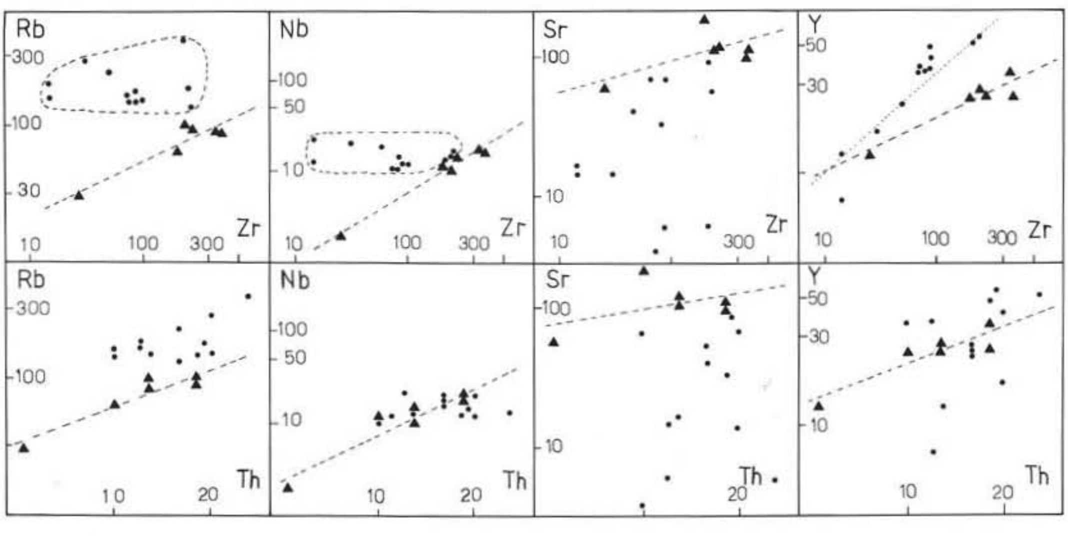

Fig. 4. — Selected trace elements plotted against Zr and Th (log scale). Symbols as in Fig. 2.

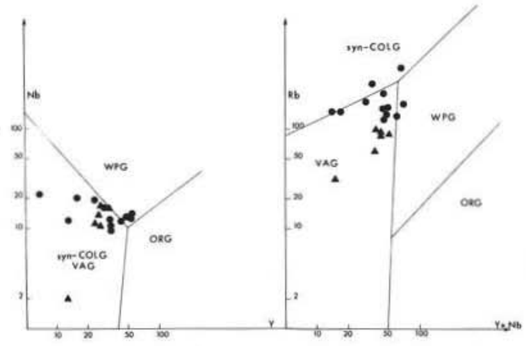

Fig. 5. — Trace element discrimination diagrams (from PEARCE et al., 1984). WPG = within plate granites; ORG = ocean ridge granites; syn-COLG = syn-collisional granite; VAG = volcanic arc granites. Symbols as in Fig. 2.

mafic (diorite?) primary magma.

At present the ages and tectonic significance of the different granitic lithotypes from the Calizzano Massif may only be hypothetically envisaged:

1) plutonic bodies and dykes represent magmas produced in different geodynamic environments; the former possibly intruded during pre-Hercynian (Caledonian?) events, the latter refer to early Hercynian activity;

2) plutonic bodies and dykes refer respectively to different magmatic events during early Hercynian stages (i.e. preceding the latest amphibolite facies metamorphic event).

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