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More porphyritic dikes in the Bergell Alps

by *H.-R. Wenk**

Abstract

Two more occurrences are added to the collection of porphyritic dikes in the higher Pennine nappes. The andesitic hypabyssal rocks of L'Ala near Maloja and La Margneta are very similar to those described by NIEVERGELT and DIETRICH (1977) from Piz Lizun and GAUTSCHI and MONTRASIO (1978) from Val Malenco. The new findings indicate that even though dikes are not common, they occurred over a large area. A brief description of several other dioritic dikes which may be unrelated to those in the Suretta and Margna nappes is included for comparison.

The description of porphyritic dikes in higher Pennine nappes surrounding the Bergell granite has been one of the significant advances in the geological exploration of the eastern region in the Central Alps. NIEVERGELT and DIETRICH (1977) discovered basaltic dikes at Piz Lizun, Bergell valley, in greenschists of the Suretta nappe (they may correspond to those units mapped by STAUB (1921) as «gabbro»). Independently GAUTSCHI and MONTRASIO (1978) found similar rocks in Malenco ultramafics and associated gabbros belonging to the Margna nappe (Fig. 1). In summer 1979, I have found some additional localities and a short note seems warranted, especially in view of the new emphasis in characterizing the metamorphic rocks of the Margna nappe (e. g., GAUTSCHI, 1980).

One occurrence (Sci. 1875) resembling in the field the dikes at Piz Lizun (Fig. 2a, for comparison) is 200 m S of *L'Ala*, right above the much frequented trail from Maloja (coord. 774.55, 140.45). Large amphibole phenocrysts occur in a groundmass with intersertal texture of amphibole and plagioclase laths in ophitic intergrowths (Fig. 2b). Microscopic analysis documents that the original igneous fabric has been subjected to secondary alteration. Amphiboles transformed to actinolite-pargasite assemblages like those described by WENK (1979) and GAUTSCHI (1980) in amphibolites of the Cavloccio zone. Secondary quartz fills interstices and has probably replaced glass. The porphyritic dike crosscuts muscovite schists belonging to the Margna nappe less than 100 m S of

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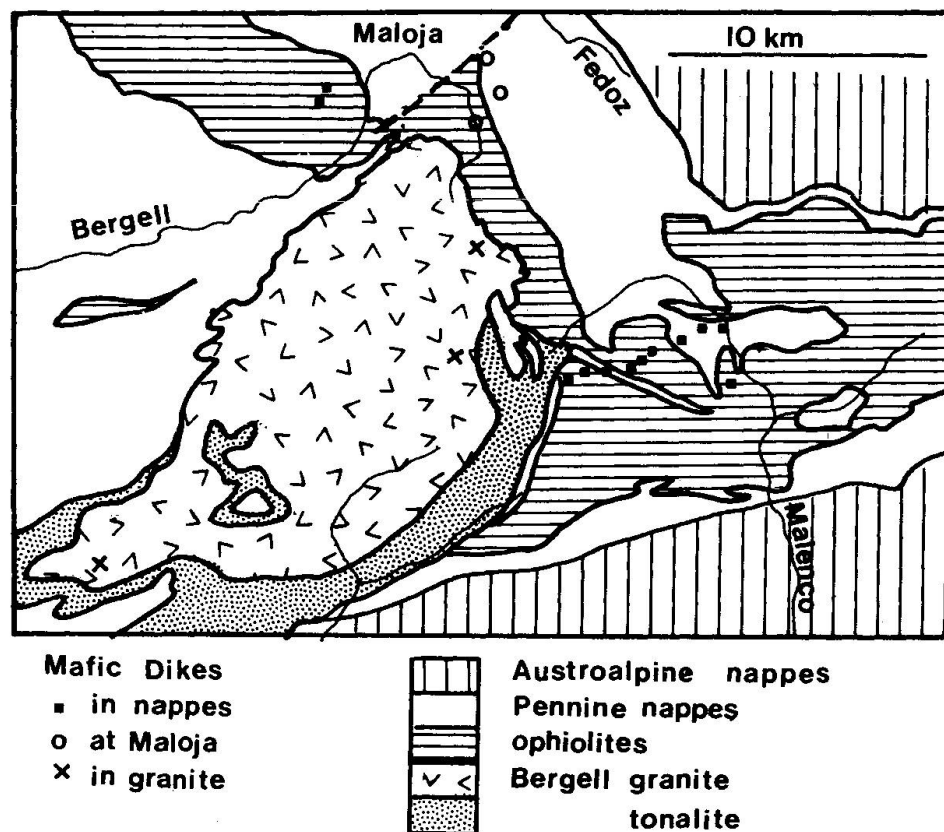


Fig. 1 Tectonic sketch of the Bergell Alps indicating localities of andesitic and gabbroic dikes.

the Engadine Line which has in this area a maximum of 3 km leftlateral displacement.

A second dike has been found about 1 km E of LA MARGNETA at 2400 m in mesocratic gneisses also of the Margna nappe (Sci. 1890, coord. 775.4, 140.2). It is less altered than that of L'Ala. Cores of igneous amphiboles are preserved. There is abundant biotite. But amphiboles show overgrowth of actinolite and there is significant epidote. Plagioclase phase relations are complex with secondary, more sodic compositions replacing the bladed original crystals. In contrast to the former occurrence, amphibole phenocrysts are lacking (Fig. 2b).

Dikes are not uncommon in the Orlegna Canyon at A. Cavloc crosscutting coarse porphyroblastic amphibolites of similar composition (e.g., Sci., 1929 at coord, 774.8, 139.35). These are entirely recrystallized to actinolite-chlorite-epidote amphibolites with small albite porphyroblasts depicting a foliated texture (Fig. 2c). Their association with the other dikes is not well established. They may represent diabase intrusions related to ophiolites with which they are associated.

The first two dikes show little deformation and are discordant in highly foliated rocks of the Margna nappe. They are therefore younger than the penetra-

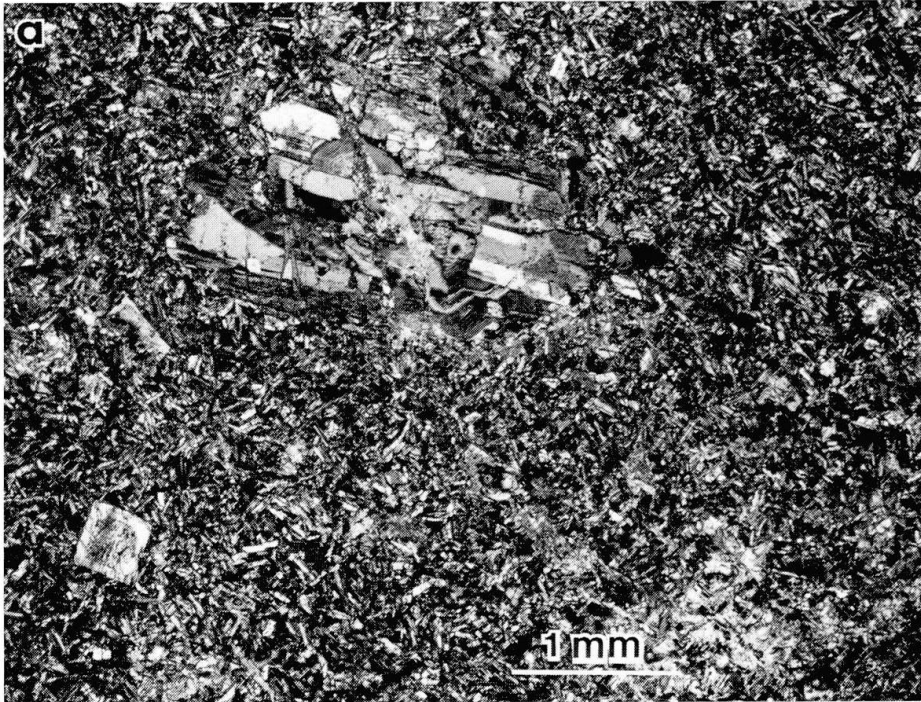


Fig. 2 Photomicrographs, crossed polarizers of andesitic-gabbroic dikes in the Bergell Alps. Same magnification for all micrographs.

a) Hastingsite - augite - plagioclase phenocrysts in a plagioclase-amphibole intersertal groundmass. Note oscillatory zoning of plagioclase. Piz Lizun, Bergell Valley (for comparison).

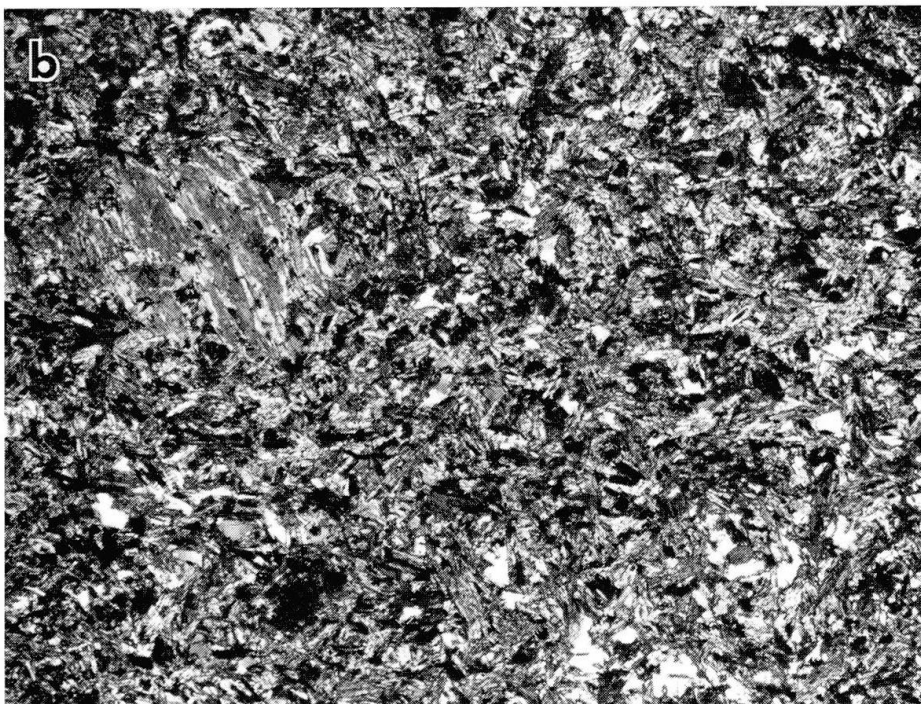


Fig. 2b) Diabase with ophitic intergrowth of plagioclase laths and amphibole. A large amphibole phenocryst is altered to actinolite-pargasite. L'Ala, SE of Maloja.

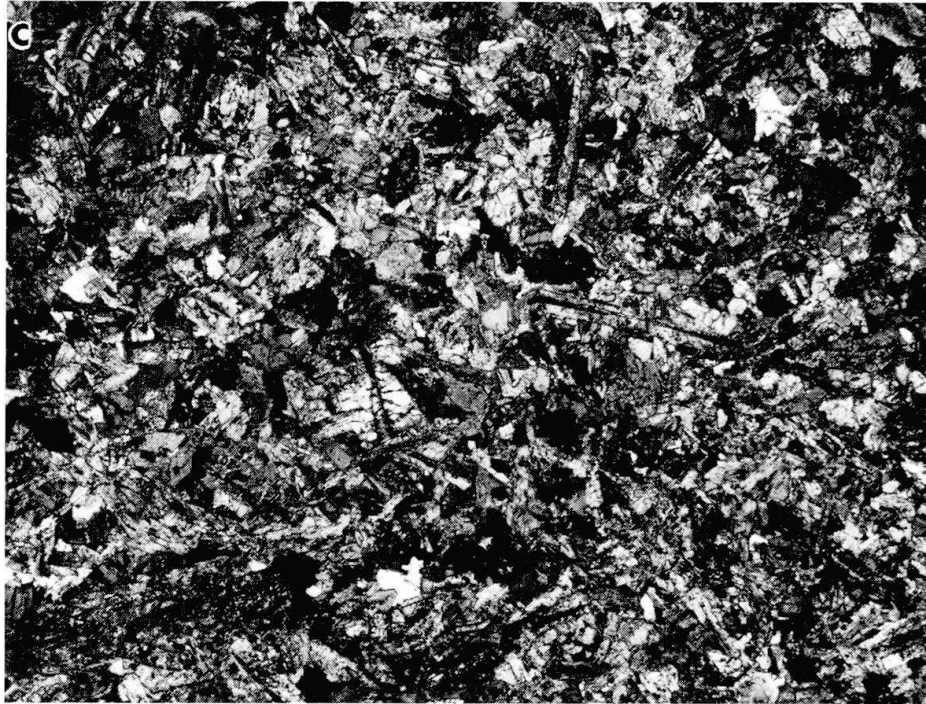


Fig. 2c) Biotite-amphibole-diabase. Note overgrowths on amphiboles. La Margneta, SE of Maloja.

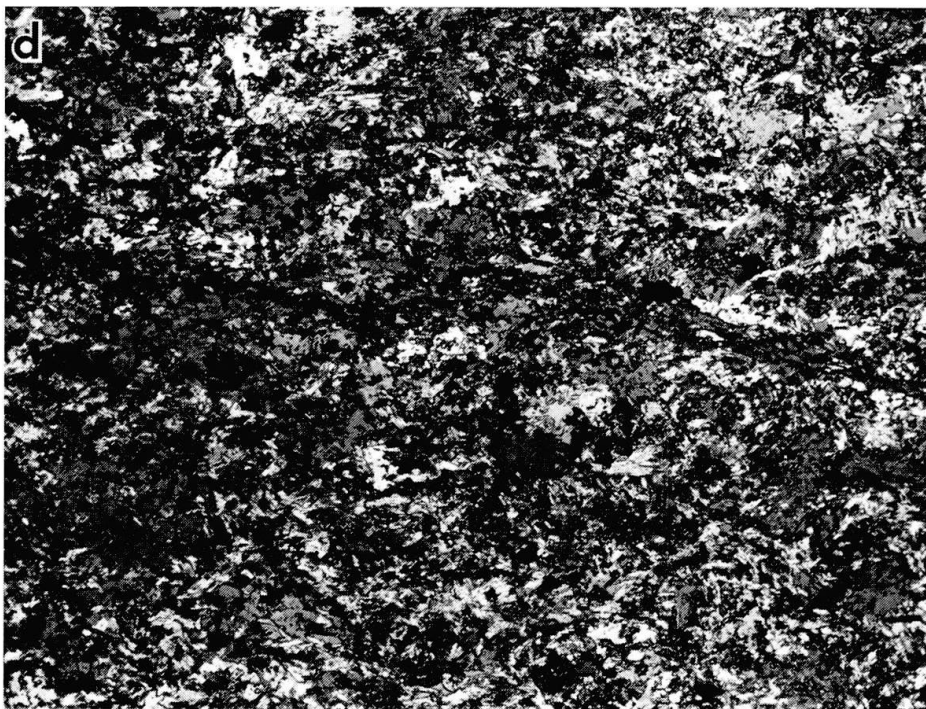


Fig. 2d) Andesitic dike recrystallized to chlorite-actinolite-epidote-albite schist with good foliation. Orlegna riverbed E of A. Cavloc.

tive deformation. Textures indicate that they are most likely also younger than the regional metamorphism which is of greenschist and amphibolite facies. On the other hand GAUTSCHI and MONTRASIO (1978) have documented recrystallization of the basaltic dikes in the vicinity of Bergell tonalite inferring that they are older than the Tertiary igneous activity in the Bergell. Contact metamorphism is probably responsible for the recrystallization of igneous amphiboles to actinolite-pargasite.

In this context it ought to be mentioned that gabbroic dikes have been described and mapped within the Bergell granitic rocks and in the immediate contact zone (MOTICKA, 1970, upper Valle dei Ratti and WENK and CORNELIUS, 1977, Sella del Forno, Torrone and Cma. di Vazzeda). The gabbroic dike at Sella del Forno (Sci., 1100, Fig. 2e) in granite is characterized by plagioclase with calcic cores (An 70-75) and overgrowth of An 25-35. Hornblende and plagioclase form locally very large (5cm) crystals. Alkalifeldspar (myrmekite), sphene, quartz and allanite are accessories. A dike at Cma. di Vazzeda passes through marbles and shows some similarity in texture and composition to that described by GAUTSCHI and MONTRASIO (1978) from P. Ventina (compare their sample P1 with Sci. 1477 in WENK et al., 1977) with lower SiO₂ and higher FeO and Na₂O than average tonalite. The Amphibole component is hornblende, plagioclase is strongly zoned An 46-72 and equidimensional (Fig. 2f), and biotite is abundant. While all dikes described in this note and also those at P. Lizun and in Val Malenco have a similar composition, those crosscutting granite are gabbroic with coarse granular texture. Extreme zoning, some of it oscillatory, and plagioclase overgrowths indicate a multistage history but they are likely related to the mobilization of Bergell tonalite. Those of Ala-Margneta are much coarser than those at Piz Lizun and more diabase-like with 1 mm plagioclase blades. The dikes at Lizun are rather porphyritic andesites with groundmass plagioclase rarely exceeding 0.2 mm. This suggests that Ala-Margneta dikes were closer to the source and emplaced at deeper levels with slower cooling rates.

A brief discussion of metamorphic episodes in this area seems in order. The Margna nappe between Orlegna and Val Fedoz contains dolomitic marbles which bear tremolite and also amphibolites with calcic plagioclase (WENK, 1979). These highgrade minerals are observed far to the east and therefore are thought not to have resulted from contact metamorphism of the Bergell granite. Carbonate rocks, because of their association with quartzites and gypsum beds, are assumed to represent Triassic sediments. Therefore, tremolite and calcic plagioclase are not due to some old, prealpine metamorphism. A regional amphibolite-facies event has been documented with isotopic ages of phengite and muscovite in Margna gneisses which give ages between 60 and 75 m.y. (JÄGER, 1973). This metamorphism *preceeded* igneous activity and emplacement of the Bergell granite as is documented by a metamorphic aureole superposed on the older metamorphic assemblages (TROMMSDORFF and EVANS, 1972; WENK, 1979;



Fig. 2e) Gabbroic dike in Bergell granite. Plagioclase with sodic overgrowths. Sella del Forno.

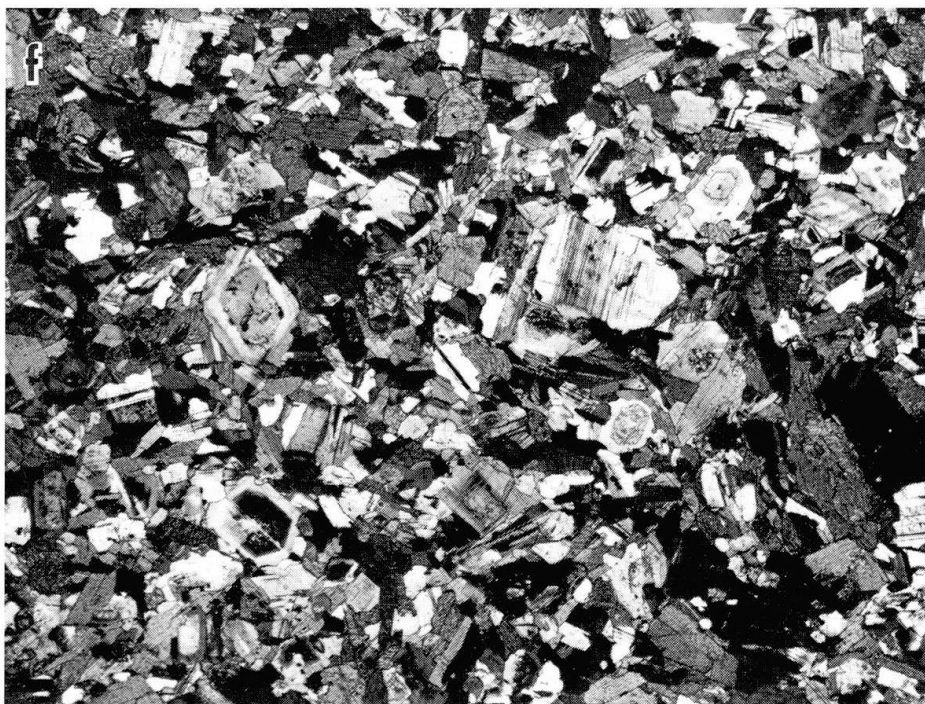


Fig. 2f) Gabbroic dike in Marbles near granite contact. Plagioclase is strongly zoned and equigranular. Cma. di Vazzeda.

GAUTSCHI, 1980). Anthophyllite, andalusite, anorthite-albite and pargasite-actinolite are products of contact metamorphism between V. Preda Rossa and Cma. di Murtaira. The basaltic-andesitic hypabyssal activity dates sometimes between the regional metamorphism (~70 m.y.) and the contact metamorphism (~30 m.y.). The relationship between the contact metamorphism in the Eastern Bergell and the thermal Lepontine metamorphism to the West in the Ticino (E. WENK, 1956) is still subject of some debate. Maps of isograds based on mineral assemblage (e.g., TROMMSDORFF, 1966; E. WENK, 1962; H.-R. WENK et al., 1974) all show high grade countours enveloping the eastern Ticino and the Bergell. There is no geological or textural evidence that minerals such as sillimanite (Sissone-Forno-Vöga-Gruf-Zone of Bellinzona), cordierite (Murtaira-Preda Rossa-Mera-Verzasca), and wollastonite (Sissone-Albigna-Val Codera-Claro) are not in their whole field of distribution the product of the same general thermal recrystallization.

Contrary to NIEVERGELT and DIETRICH (1977) who relate the basaltic dikes at Piz Lizun to tonalite in the Bergell, GAUTSCHI (1980) points out the similarity between those in the Bergell Alps and andesitic-basaltic magmatism in the Western Alps which have been dated at 29–33 m.y. (DAL PIAZ et al., 1979) and the Eastern Alps (BECCALUVA et al., 1979, Deutsch, 1980). On the basis of their chemical composition they have been compared with andesites of continental margins. It is interesting to note that all occurrences in the Bergell Alps, including the new ones are associated with a mafic-ultramafic belt. The above mentioned porphyritic dikes in the Eastern and Western Alps are at quite large distances from those in the Bergell. Closer occurrences of diabase dikes in the Silvretta (e.g. BEARTH, 1932a) and the Southern Alps (e.g. BEARTH, 1932b, REINHARD, 1964) are generally assumed to be of Permian age.

Addendum: I just received a note from Mr. R. Nievergelt informing me that he found independently the dike at L'Ala in summer 1980.

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