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Metamorphic evolution of metabasites from Beth-Ghinivert (Schistes Lustrés Unit – Western Alps)

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The Schistes Lustrés of the Piedmont Zone (Pennidic domain) underwent a polyphasic metamorphic evolution under high-P/low-T to greenschists facies conditions. They consist of calcschists with scattered blocks of ophiolites metre up to kilometre-sized. A detailed structural study of the Beth-Ghinivert mines area (Chisone Valley, Western Alps) was done to determine the metamorphic evolution of these rocks by unravelling the superposed structures and related mineral assemblages. Here irregular bodies of metabasites (meta-gabbros, glaucophanites and prasinites), associated with pyrite-rich mineralizations, occur in the calcschist. Three deformation events are well recorded in the calcschists and associated metabasites:
- the oldest deformation event (D1) is characterized by isoclinal folding of pre-metamorphic surfaces and formation of a S1 axial-plane cleavage.
- the D2 deformation event produced closed to isoclinal folds and the associated S2 axial-plane foliation which is the main schistosity observable in the field.
- the D3 deformation event produced open to close folds, locally associated with a S3 axial-plane crenulation cleavage.
In metabasites, blueschists facies mineral relics can be recognized in both S1 and S2 foliations. S3 foliation is seldom observable and is associated with a greenschists facies paragenesis.
In the glaucophanites the syn-D1 mineral assemblage consists of blue amphibole, white mica, chlorite, epidote, albite, quartz, minor titanite and sulphides (pyrite and subordinate chalcopyrite). The syn-D2 paragenesis is similar to that described above with local enrichment in the calco-sodic molecule at crystal rims. Both generations of blue amphibole are patchy zoned with compositions ranging from Fe-glaucophane to crossite to glaucophane. In a mafic schist sample core-rim zoning was observed in blue amphiboles: D1 cores are Fe-glaucophanes whereas the corresponding syn-D2 rims are glaucophanes. Late chlorite, albite, epidote, white mica, ferro-actinolite and minor calcite, titanite and pyrite overprint the previous parageneses and are associated to S3 where it occurs.
Differences in the mineral composition and in the modal composition may be also related to local differences in the bulk rock compositions of glaucophanites.
Chlorite, albite, ferro-actinolite, white mica, epidote and minor calcite, titanite and pyrite represent the stable paragenesis in prasinites and metagabbros.
Preliminary PT determinations using THERMOCALC indicate epidote-blueschist facies conditions for D1 and D2 events, with D2 being associated with a pressure decrease. Re-equilibration under greenschists facies conditions is recorded in all metabasites.