CREVOLA G.

Granite-Derived Micaschists (Orthomicaschists) Through Metasomatic Ductile Shear Deformation from the French Variscan Fold Belt.

28th International Geological Congress Washington D.C. (U.S.A.). Vol. 1, p. 339-340.

1989

CREVOLA, G., Universite de Bordeaux III, Talence, France

Granite-Derived Micaschists (Orthomicaschists) Through Metasomatic Ductile Shear Deformation from the French Variscan Fold Belt

In the French Variscan Fold Belt, intimate associations of metagranites and orthogneisses with micaschists, extending over areas up to several hundred square kilometers, are fairly common. These assemblages have been previously considered as metamorphic equivalents of: (1) granitic basement along with its pelitic cover; (2) granitic intrusions into pelitic country rocks; (3) volcano-detrital series (if the granitic origin of the gneisses has not been previously established). In recent years the study of some of these associations in several metamorphic regions of Southern France (especially in the Maures, Cevennes and Rouergue) has led to a new interpretation (Crevola, 1987). The assemblages are a series of granite-derived rocks through ductile shear deformation, involving progressive recrystallization and mass transfer. The micaschists, also called "orthomicaschists," are completely recrystallized and appear as the final product of this blastomylonitic process. This interpretation is based on field relations, petrographic and geochemical data. It is consistent with current understanding of the importance of fluids and mass transfer in tectonic processes (Etheridge et al, 1984; Fyfe, 1985). Moreover, this blastomylonitic evolution is, to some extent, similar to the classic mylonitic evolution which leads to the formation of ultramylonites and phyllonites (Bryant, 1966; Marquer et al, 1985; Sinha et al, 1986).

Field Occurrence. Orthomicaschists are observed in regions which have experienced intense ductile shear deformation (orthogneisses with generalized S-C tectonite fabric) during development of fold nappes or thrust nappes. The transformations can occur under a wide range of metamorphic conditions: low pressure to medium pressure metamorphism, from lower greenschist facies to amphibolite facies near anatexis.

The orthomicaschists can be observed in three types of occurrences: -within narrow anastomosed ductile shear zones (mm to m wide) cutting through orthogneissic country rocks; -in layers (cm to 10 m wide) intercalated with orthogneisses; -in large (10 m to 1 km wide) mappable formations alternating with orthogneissic formations.

In all the occurrences, gradational transitions exist between micaschists and orthogneisses. Localized micaschist shear zones or layers often occur within an orthogneissic formation near its boundary with a large micaschist formation. The petrographic convergence between ortho and paramicaschists however, may prohibit the identification of the actual extension of the granite-derived terms. In the well-documented Cezarenque association (Cevennes), albitic micaschists outcrop in alternating strips of several hundred meters width; here the granite-derived formations are clearly separated from the surrounding metasedimentary schists by a quartz-feldspathic formation.

Petrographic and geochemical features. Orthomicaschists are fine to medium-grained, conspicuously foliated and completely recrystallized rocks. They are distinguished from classic ultramylonites and phyllonites by their coarser-grained texture and by the lack of protolithic relict crystals.

The existence of complete petrographic and geochemical transitions between metagranites, orthogneisse and micaschists suggests that the micaschists can be derived from the previous granite by a loss of SiO_2, CaO and Na_2O, a correlative concentration of Al_2O_3, TiO_2, FeO and MgO and an input of H_2O. Syntectonic quartz veins may be a sink for some of the lost SiO_2. Mineralogically, the transformations consist primarily of a progressive removal of the feldspars and a correlative increase of the amount of phyllosilicates. The mineralogical and chemical transformations are identical to those typically ascribed to the genesis of phyllonites. In the case of orthomicaschists, however, these process are are initiated early in the granite evolution and they continue to completion, resulting in the total disappearance of the previous igneous paragenesis. The amount of available fluids may be determining factor in triggering such an evolution.

In most of the examples, at a given stage of the evolution, the rock has experienced a complete restructuring during recystallization. As a result, products such as micaschists or even micaceous gneisses no longer exhibit an S-C fabric and do not show extreme stretching of mineral aggregates, thus appearing as non-sheared rocks.

In some associations, orthogneisses can also show a pervasive mineralogical and chemical transformation. For instance, in the Cezarenque association, all the feldspars of the augen gneisses are already converted into albite and the rock shows a significant loss of CaO and a variable Na_2/K_2O ratio.

Conclusion. In areas of intense ductile shear, tectonometamorphic transformations of granites may be more intense and spatially extensive than previously thought. As a result, micaschists may be common and volumetrically important metamorphic products derived from granites. The granitic mylonite spectrum should be broadened to include blastomylonitic series which are formed by extensive recrystallizations. Metamorphic reaction and mass transfer are the major processes in this transformation.