THE DEVELOPMENT OF FOLIATIONS IN LOW, MEDIUM AND HIGH GRADE METAMORPHIC TECTONITES

by

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ABSTRACT

Studies of foliation and associated microstructures are presented from a variety of rock types and localities in the metamorphic terraines of the northeastern United States.

At Islesboro, Maine cleavage is well developed in lower greenschist grade siltstones and interbedded pelites of lower Paleozoic age. Cleavage in the siltstone units consists of two types of discrete mica films: short film segments and lengthened mica film. Thick secondary mica-rich layers are also exhibited in some siltstones. The short film segments appear to be basic elements through which cleavage development progresses by a linkage process that is poorly understood. The linkage of these segments results in the production of lengthened mica films. Further development of the larger mica films may result in the production of the thicker mica-rich secondary layers. Detailed statistical and microstructural studies of these mica films suggests that fracturing, solution transfer, mica and opaque mineral accumulation, and mica crystallization are important mechanisms involved in mica film formation.

At New Paltz, New York, lower greenschist facies slates contain a number of soft-sediment clastic dikes. The author's work suggests that these clastic dikes are pre-cleavage structures which have been redistributed during folding. Folded clastic dikes contain a cleavage as an axial surface foliation, and this cleavage is continuous with the slaty cleavage in the

surrounding pelite. Bedding folds and dike folds have a common axial surface. Previous workers have suggested that clastic dikes might be made parallel to slaty cleavage by rotation during deformation instead of by injection during dewatering. The evidence presented here supports this view and countermands the hypothesis of tectonic dewatering as a mechanism for the production of slaty cleavage on a regional scale (Maxwell, 1962).

In the Ludlow, Vermont vicinity, abundant tabular garnets and biotite "cross-micas" occur in edidote-amphibolite grade metasediments. Evidence is presented here that conclusively demonstrates that shear displacement of originally equant grains parallel to schistosity is responsible for the tabular grain shape. An additional example of sheared garnets is presented from granulite facies gneisses of the Overlook, New York vicinity in the Adirondacks. The cross-micas in these rocks have incurred shear displacements along (001) surfaces and the overall shape changes due to deformation closely approximate a simple shear model operating on a grain scale. Shear strain in each cross-mica is determined and plotted on a map of the rock surface being investigated. The distribution illustrates that higher shear strains are found in cross-micas that are close to the translation surfaces along which garnet porphyroblasts have been sliced. The study illustrated here could be extended to other types of cross-mica and may prove to be a useful method for the investigation of strain in foliated rocks.

The final section of this thesis presents the authors

work concerning the problem of transposition in deformed metamorphic rocks. Much confusion presently exists in the application of the term transposition, primarily because of an erroneous translation of Sanders (1911) original description of this structure. In an attempt to clarify this situation a new translation of Sander is presented along with a number of examples from the Central Vermont metasedimentary sequence.