

REDETERMINATION AND REEVALUATION OF COMPOSITIONAL VARIATIONS IN METAMORPHOSED SEDIMENTS OF THE LITTLETON FORMATION, NEW HAMPSHIRE

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Abstract

In a study of metamorphosed pelites of the Devonian-aged Littleton Formation, New Hampshire, Shaw (1954) found little evidence for large scale compositional change other than devolatilization. Because his data are still used for such studies, we have re-analyzed his original samples using more precise methods and for additional elements to provide a more useful data set. Since Shaw's study, remapping in New Hampshire has shown that 21 samples from the original set of 67 appear to be from underlying Silurian formations. The new data for the remaining 46 Littleton samples show statistically unambiguous differences between sample sets in average concentration ratios to Al_2O_3 or TiO_2 for several elements (on a loss-on-ignition-free basis). The data do not, however, show systematic compositional differences as a function of metamorphic grade. Variations in element concentrations within sample sets of low, medium, and high metamorphic grade are as large or larger than differences in average concentrations between pairs of sample sets. This renders the method of comparing average compositions intrinsically insensitive even to substantial compositional change during metamorphism. We find no compelling evidence in support of metamorphic gain or loss of the elements we studied, but taken at face value, the statistical uncertainties would allow considerable gain or loss of most elements during metamorphism of Littleton pelites. Further detailed sampling would be required to determine whether the samples of each metamorphic grade are representative and to interpret the compositional variations and differences accurately in terms of metamorphic element mobility on the one hand and inheritance from the heterogeneous sedimentary protolith on the other.