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Calibrations of modal space for metamorphism of mafic schist

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ABSTRACT

Three independent net-transfer reactions determine compositional and modal changes for greenschist-, blueschist-, and amphibolite-facies metamorphism of mafic rocks, as different paths are followed though pressure, temperature, and a_{H_2O} space. For natural terrains, only one a_{H_2O}–dependent reaction is chosen, whereas to interpret experimental studies, where H_2O is in excess, there is an advantage to choosing two dehydration reactions. Published experimental studies on the greenschist to amphibolite transition and thermodynamic calculation in simple systems and with pseudosections, show that reactions involving $Al_2Mg_{-1}Si_{-1}$ in amphibole and chlorite predominate, that $FeMg_{-1}$ exchange and $Al_2Mg_{-1}Si_{-1}$ are strongly coupled, and that all reactions and, in particular, the stability of chlorite are affected by Fe^{3+}/Fe_{total}. Modal spaces for mafic schist are constructed for different sets of independent reactions, and permit correlation of mineral mode with directions of change of pressure and temperature. These can be used to deduce field gradients in these variables in natural terrains, when only modal change data are available and when compositional and thermodynamic data are limited.