Chemical reactions producing white mica during folding

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Chermak and Rimstidt (1990) used the following reaction to describe the formation of muscovite from clay: 1.5 kaolinite + K^+ = muscovite + H^+ + 1.5 H_2O at 250–307 °C. Wibberleg (1999) reported that under certain conditions, feldspar can break down to form muscovite and sericite as follows: 1.5 K-feldspar + HCl = 0.5 muscovite + 3 quartz + KCl. Both mechanisms can produce muscovite under low- to medium-temperature conditions during deformation, accompanied by sliding and grain dissolution in claystone, sandstone, limestone, and marble. During folding and with related fluid influx, both processes therefore enable muscovite/sericite mineral growth on flexural slip surfaces. The addition of a fluid containing K^+, Al^{3+}, and Si^{4+} to a rock of suitable siliceous composition, such as rocks with illite, smectite, or kaolinite, can lead to the formation of dioctahedral muscovite or sericite [$KAl_2AlSi_3O_{10}(OH)_2$].

Impure dolomite ($CaMg(CO_3)_2$) and limestone ($CaCO_3$) often contain traces of quartz (SiO_2), as do siliceous limestones and dolomites. Moreover, samples from this study contain traces of kaolinite and claystone, meaning that Si^{4+}, K^+, Al^{3+}, and Mg^{2+} cations were readily available to form authigenic muscovite, sericite and phlogopite. Smectite, kaolinite and illite are usually present in the original sedimentary sequence. In the present study, chemical compounds such as K_2O and Al_2O_3, which are constitutive of clay minerals, could have contributed to the crystallization of muscovite, sericite, phlogopite, quartz and Mg-rich chlorite.

Muscovite, sericite, and phlogopite are the most common K-bearing minerals in low-grade metamorphic rocks, particularly from the lower to middle greenschist facies (~400 °C). $^{40}Ar/^{39}Ar$ dating can be used to constrain the timing of muscovite and sericite growth at moderate to low temperatures (<400 °C) during folding, yielding well-defined plateau ages and thereby the age of deformation in the upper crust.