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Correlation between crystallization pressure and structural parameters of phengites

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Abstract

Linear correlations of ln$P$ vs. the thickness, t, of the TOT mica module and vs. the ditrigonal distortion, α, have been established by analyzing a population of 43 natural phengites for which estimates of the crystallization pressure P independent of the Si content are available. Synthetic phengites are not included because they behave as a separate population. The equations for the resultant regression lines are $\ln P = -0.35(3)\alpha + 5.0(3)$ ($R = 0.90$, 26 observations) and $\ln P = -29(2)t + 293(22)$ ($R = 0.90$, 43 observations). These linear correlations are evidence of the links involving P, chemical composition, structural parameter c (i.e., t), and α. In turn, there is a linear correlation between t and α: $t = 0.0110(9)\alpha + 9.859(7)$ ($R = 0.92$, 26 observations). The linear correlations of ln$P$, t, and α vs. Si content have equations: $\ln P = 4.2(4)Si - 12(1)$ ($R = 0.86$, 43 observations), $t = -0.13(1)Si + 10.37(4)$ ($R = 0.87$, 43 observations), and $\alpha = -12.7(9)Si + 50(3)$ ($R = 0.94$, 26 observations). The observed dispersion of the data are mainly due to the uncertainty in the pressures estimated from mineral assemblages. The possibility of calculating P from only a measurement of c neither overcomes this type of uncertainty nor pretends to be competitive with petrologic geobarometers, but is does open the possibility of estimating the crystallization pressure of nanoscale phengite relics (e.g., by transmission electron diffraction).

Keywords: Phengites, crystallization pressure, pressure-structure correlation, ditrigonal distortion, mica module thickness