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Development of Multiple Foliations Defined by Different Sillimanite and Gahnite Crystal Habits in the Cannington Deposit, Northeast Australia

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A succession of foliations defined by different sillimanite-bearing structural fabrics suggests that the macroscopic, isoclinal synform that dominates the geometry of the Cannington Ag-Pb-Zn deposit, northwest Queensland, Australia formed during D2. The five foliations in this succession, S1 to S5, are defined by aligned sillimanite with habits ranging from individual crystals in S1 through S4 to clusters of fibrolite in S5 in both the matrix and as inclusion trails within garnet and gahnite(Zn-rich spinel) porphyroblasts. S1, S3 and S5 formed as sub-horizontal foliations, whereas S1a, S2 and S4 formed sub-vertically. Foliation intersection/inflexion axes(FIAs) within garnet and gahnite porphyroblasts preserve a succession of trends that shifts from W-E to N-S. This succession indicates that this region experienced N-S followed by W-E bulk crustal shortening. N-S shortening occurred during D1 and D1a, and W-E shortening occurred from D2 to D5. Prismatic and rhombic sillimanite produced during D1-D4 accompanied prograde metamorphism to ca.634±62 C and 4.8±1.3 kbar. The coexistence of fibrous, prismatic and rhombic sillimanite resulted from post peak metamorphic reactivation of the early foliations during D5. The synformal D2 fold was intensified during D4 by W-E bulk shortening. Local partial melting occurred after D1 in the appropriate bulk rock compositions, based on calculation of P-T pseudosections in the chemical systems KFMASH, KFMASHTO, NCKFMASH and MnNCKFMASH. Zn mineralization related to gahnite growth occurred during D3 through D4, and was redistributed by partial melting into structural and rheological sites during D4 and D5 shearing.