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On the formation of diffusion-controlled multilayer corona textures in mafic granulites from Sandmata Complex, Aravalli Craton (northwestern India)

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Mafic granulites in the Sandmata Complex (Aravalli Craton, NW India) are characterized by multilayered corona-symplectite textures at the interface between plagioclase and orthopyroxene, indicating signatures of incomplete mineral reactions and persistent chemical potential gradients. The inner to outer layers of the coronae are characterized by clinopyroxene + quartz|garnet + clinopyroxene|garnet + quartz|K-feldspar. The mineralogical assemblage and compositional zonation in such multilayered coronae textures are often governed by variations in *P*–*T*, a_{H2O}, effective bulk composition and relative elemental diffusion rates. The samples investigated in this study preserved magmatic relicts of orthopyroxene with exsolved clinopyroxene and yielded minimum crystallization conditions of ~8.4 kbar at ~1050 ºC for a gabbronorite protolith. The P-T estimates on various corona layers indicate that the inner clinopyroxene + quartz and garnet + clinopyroxene corona layers were developed at ~9 kbar/850–800 ºC and ~8 kbar/700–600 ºC, respectively. Discontinuous growth of the garnet-clinopyroxene-quartz layers, forming multiple corona and symplectite micro-domains, appears as the product of chemical potential relationships and elemental diffusion across orthopyroxene and plagioclase interfaces. The application of single-value decomposition models suggests that the sequential diffusion of Mg, Fe and Ca resulted in the development of multilayered corona-symplectite textures between plagioclase and orthopyroxene. The chemical potential gradients (μ^{CaO}–μ^{FeO} and μ^{CaO}–μ^{MgO}) and local equilibrium modelling in the CFMAS system reveal that the garnet stabilized in corona layers at ~6.7 kbar/840 ºC. In comparison to Fe and Mg, the slower diffusion of Ca and Al favors the optically continuous but chemically heterogeneous growth of multilayered and multi-mineral corona-symplectite textures across the plagioclase and orthopyroxene interface. In addition, the combination of P-T conditions obtained for hydrous and anhydrous corona (~9 kbar/850–800 ºC) constrains a near-isobaric cooling path. It supports the magmatic underplating hypothesis for the evolution of high-grade rocks in the Sandmata Complex. We further emphasize that the growth of multilayered corona textures is largely controlled by elemental diffusion and chemical potential gradients rather than variation in *P-T* conditions.

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