Reaction microstructure in the Takahama metamorphic rocks, western Kyushu

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Two types of reaction rim are recognized in corundum- and kyanite-bearing metabasites in the Takahama metamorphic rocks, western Kyushu. Aggregates of margarite occur around corundum and spatially separate it from the matrix clinozoisite. Kyanite occurring in the same rock is also armoured by the aggregates of margarite. The formation of margarite at the expense of either corundum or kyanite requires the system to be open. Assuming Al as immobile, supply of Ca, Si and aqueous fluid destabilized corundum and produced margarite around it. Similarly, supply of Ca and aqueous fluid consumed kyanite to form margarite. Breakdown of clinozoisite in the matrix can be responsible to supply Ca and Si to corundom and kyanite. Therefore the overall reaction can be described as

$3\ Al_2O_3 + 2\ Al_2SiO_5 + 2\ Ca_2Al_3Si_3O_{12}(OH) + 3\ H_2O = 2\ Ca_2Al_8Si_4O_{20}(OH)_4$
corundum kyanite clinozoisite fluid margarite

This suggests that the formation of microstructures can be described in the closed system except for H_2O. Local association of corundum and clinozoisite as well as that of kyanite and clinozoisite is stable under conditions in which the right-hand side of the above reaction is stable. The chemical potential of components in the two associations is different from each other within a single rock, which triggered the reaction.