

Change of modal abundance of mafic minerals during formation of arrested charnockite in Sri Lanka

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Arrested charnockite occurs as a number of patches with lenticular to ovoidal shapes in hornblende-biotite gneiss in central Sri Lanka. Yamasaki et al. (2012) tentatively proposed the following reactions to produce orthopyroxene based on compositional difference of hornblende and biotite between charnockite and surrounding gneiss.

Ti-rich biotite + quartz = Ti-poor biotite + orthopyroxene + ilmenite + alkali feldspar + H₂O

Ti-rich hornblende + quartz = Ti-poor hornblende + orthopyroxene + ilmenite + anorthite + albite + alkali feldspar + H₂O.

These reactions suggest that orthopyroxene is produced under the condition of low-H₂O activity in the interstitial fluid. However, it is still unclear where the formation of charnockite began and how the reactions proceeded with time. Although gneissic structure in the surrounding gneiss becomes obscure at interior of charnockite, it can be traced into the near-boundary charnockite. Therefore information before charnockitization have been possibly preserved in charnockite. This study describes variation in modal abundance of hornblende, biotite and orthopyroxene in both rock-types.

Modal abundance of hornblende and biotite in gneiss decreases with decreasing the distance from charnockite. The modal abundance of hornblende and biotite at a point 12cm apart from charnockite is 7.9% and 6.9%, respectively, which decreases to 5.0% and 5.5%, respectively, at the boundary. This abundance decreases discontinuously to 1.7% and 4.1%, respectively, in the charnockite next to the boundary, and further decreases to 0.06% and 1.9% at the interior of the charnockite. The amount of orthopyroxene in charnockite is almost constant at 3.3%.

Biotite occurs both in leucocratic and melanocratic parts in gneiss, in contrast, biotite is absent in leucocratic part in charnockite. Orthopyroxene occurs in melanocratic part or its extension.

Provided that the small amount of hornblende and biotite in central part of charnockite were due to progress of orthopyroxene-forming reaction, the amount of orthopyroxene increases toward the center of charnockite. This prediction contradicts the observation. If the amount of hornblende and biotite before charnockitization tends to decrease toward the present center of charnockite, similar progress of the orthopyroxene-forming reaction in the charnockite would leave hornblende and biotite of which amount decreases toward the centre. This hypothesis is consistent with the fact. This indicates that the orthopyroxene-forming reaction initiated at the hornblende- and biotite-poor part, i.e., leucocratic part.

Keywords: Sri Lanka, arrested charnockite, hornblende-biotite gneiss