IFS. Pub - 34

Proceedings of the 30th Technical Session of Geological Society of Sri Lanka
Published Online - 28th February 2014 *(http://www.gsslweb.org)*

GSSL-2014-02

P-T Evolution of Garnet-Sillimanite-Biotite-Graphite Gneiss from the Highland Complex, Sri Lanka

P.L. Dharmapriya[1], S.P.K. Malaviarachchi[1,*], N.D. Subasinghe[2] and C.B. Dissanayake[2]

[1]*Department of Geology, University of Peradeniya, Sri Lanka.*

[2]*Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka.*

[*]*E-mail: malavi@pdn.ac.lk*

We report here multiple mineral textures of quartz-inclusion present and quartz-inclusion deficient garnet (Grt) in a garnet–sillimanite-biotite-graphite gneiss collected from south west of Kandy of the Highland Complex (HC). Quartz-inclusions in garnet (Grt A_1) are found at the core and mantle area whereas isolated staurolite (St) inclusions are found at the mantle to rim area indicating the prograde dehydration reaction, *St+Qtz=Grt+Sil+ H_2O (1)*. Occurrence of corundum both as isolated inclusions and in association with kyanite psudomorphs within core to mantle areas of Grt A_2 indicates the prograde dehydration reaction, *St=Grt+Crn+Ky+ H_2O (2)*. Above evidences imply that the formation of Grt A_1 has started from sillimanite (Sil) stability field during early stage of the prograde path, and the Grt A_2 has subsequently started to grow in the kyanite stability field. Some of Grt A_2 contains tiny isolated prismatic sillimanite inclusions at the rim area, probably showing that the final stage of the garnet growth has taken place after the rock has re-entered into the sillimanite stability field from the kyanite stability field. This is further supported by the presence of abundant sillimantie in the matrix. Thus the rock has evolved through the kyanite to the sillimanite stability field via the prograde reaction, *Kyanite = Sillimanite (3)*. Further, existence of medium- to coarse-grained prismatic sillimanite with medium-grained spinels in the presence of rare tiny corundum inclusions in Grt A_2, imply the prograde metamorphic reaction, *Grt+Crn=Spl+Sil (4)*. Snowball garnets (Grt A_3) contain relict, partially broken down biotite co-existing with partially broken down sillimanite in the presence of tiny spinel indicating the prograde dehydration reaction, *Bt+Sil+Qtz=Grt+Kfs+Spl+ H_2O (5)*. The sillimanite-bearing tiny garnet (Grt A_4) of which the orientation of sillimanite inclusions is parallel to the major lineation. Formation of Grt A_4 may have taken place via consumption of matrix sillimanite by the reaction *Sil+Melt=Grt (6)*. Further, the formation of oriented rutile needles and ilmenite in Grt A_2 could have taken place during the isobaric cooling stage. This is inferred by comparison of numbers of laboratory and field studies worldwide which show that the TiO_2 can get dissolved into silicates like garnet at high temperatures and subsequently exsolving rutile and ilmenite as needle-like textures during the retrograde isobaric cooling. Since the oriented rutile and ilmenite needles are found in two well defined directions in Grt A_2, those may not represent early mineral lineation and could be a direct precipitation from the host garnet during the isobaric cooling followed by the peak metamorphism. Formation of thin film of cordierite (Crd) associated with Grt, Sil and Qtz indicate the decompression reaction *Grt+Sil+Qtz = Crd (7)* in Grt A_3. Local occurrence of Crd around Sil within the Grt A_2 could indicate the decompression reaction *Grt + Sil = Crd (8)*. Fine grained Sil+symplectitic-Spl at the boundary between Grt A_2 and corundum further evidence for isothermal decompression. Thus, prograde and retrograde textural evidence of the studied granulite reveals that this meta-sedimentary rock of the HC has passed through a metamorphic stage early in the sillimanite stability field and subsequently the rock has entered the kyanite stability field, indicating that the pressure has increased dramatically. Accordingly, the Grt-Ky-Crn assemblage is indicative of the peak pressure conditions of the rock. The rock has then re-entered in to the sillimanite stability field, followed by an event of isothermal decompression with increasing temperature up to the peak meatmorphism. Finally the rock has been subjected to a stage of isobaric cooling followed by an isothermal decompression event.

This research was financially supported by a National Research Council Grant, Sri Lanka (NRC-11-180).

Proceedings of the 30th Technical Session of Geological Society of Sri Lanka
Published Online - 28th February 2014 *(http://www.gsslweb.org)*

GSSL-2014-02

P-T Evolution of Garnet-Sillimanite-Biotite-Graphite Gneiss from the Highland Complex, Sri Lanka

P.L. Dharmapriya[1], S.P.K. Malaviarachchi[1,*], N.D. Subasinghe[2] and C.B. Dissanayake[2]
[1]*Department of Geology, University of Peradeniya, Sri Lanka.*
[2]*Institute of Fundamental Studies, Hantana Road, Kandy, Sri Lanka.*
[*]*E-mail: malavi@pdn.ac.lk*

We report here multiple mineral textures of quartz-inclusion present and quartz-inclusion deficient garnet (Grt) in a garnet–sillimanite-biotite-graphite gneiss collected from south west of Kandy of the Highland Complex (HC). Quartz-inclusions in garnet (Grt A_1) are found at the core and mantle area whereas isolated staurolite (St) inclusions are found at the mantle to rim area indicating the prograde dehydration reaction, *St+Qtz=Grt+Sil+ H_2O (1)*. Occurrence of corundum both as isolated inclusions and in association with kyanite psudomorphs within core to mantle areas of Grt A_2 indicates the prograde dehydration reaction, *St=Grt+Crn+Ky+ H_2O (2)*. Above evidences imply that the formation of Grt A_1 has started from sillimanite (Sil) stability field during early stage of the prograde path, and the Grt A_2 has subsequently started to grow in the kyanite stability field. Some of Grt A_2 contains tiny isolated prismatic sillimanite inclusions at the rim area, probably showing that the final stage of the garnet growth has taken place after the rock has re-entered into the sillimanite stability field from the kyanite stability field. This is further supported by the presence of abundant sillimantie in the matrix. Thus the rock has evolved through the kyanite to the sillimanite stability field via the prograde reaction, *Kyanite = Sillimanite (3)*. Further, existence of medium- to coarse-grained prismatic sillimanite with medium-grained spinels in the presence of rare tiny corundum inclusions in Grt A_2, imply the prograde metamorphic reaction, *Grt+Crn=Spl+Sil (4)*. Snowball garnets (Grt A_3) contain relict, partially broken down biotite co-existing with partially broken down sillimanite in the presence of tiny spinel indicating the prograde dehydration reaction, *Bt+Sil+Qtz=Grt+Kfs+Spl+ H_2O (5)*. The sillimanite-bearing tiny garnet (Grt A_4) of which the orientation of sillimanite inclusions is parallel to the major lineation. Formation of Grt A_4 may have taken place via consumption of matrix sillimanite by the reaction *Sil+Melt=Grt (6)*. Further, the formation of oriented rutile needles and ilmenite in Grt A_2 could have taken place during the isobaric cooling stage. This is inferred by comparison of numbers of laboratory and field studies worldwide which show that the TiO_2 can get dissolved into silicates like garnet at high temperatures and subsequently exsolving rutile and ilmenite as needle-like textures during the retrograde isobaric cooling. Since the oriented rutile and ilmenite needles are found in two well defined directions in Grt A_2, those may not represent early mineral lineation and could be a direct precipitation from the host garnet during the isobaric cooling followed by the peak metamorphism. Formation of thin film of cordierite (Crd) associated with Grt, Sil and Qtz indicate the decompression reaction *Grt+Sil+Qtz = Crd (7)* in Grt A_3. Local occurrence of Crd around Sil within the Grt A_2 could indicate the decompression reaction *Grt + Sil = Crd (8)*. Fine grained Sil+symplectitic-Spl at the boundary between Grt A_2 and corundum further evidence for isothermal decompression. Thus, prograde and retrograde textural evidence of the studied granulite reveals that this meta-sedimentary rock of the HC has passed through a metamorphic stage early in the sillimanite stability field and subsequently the rock has entered the kyanite stability field, indicating that the pressure has increased dramatically. Accordingly, the Grt-Ky-Crn assemblage is indicative of the peak pressure conditions of the