Geodynamic Evolution of Basic Granulites of the Sonapahar from Shillong-Meghalaya-Gneissic–Complex (SMGC), NE India

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The area around Sonapahar (longitude 25^{o} $40^{'}$N and latitude $91^{o}01^{'}$E) belongs to the Shillong-Meghalaya-gneissic complex (SMGC) and consists essentially of rocks of upper amphibolite to granulite facies uncomfomably overlain by the Shillong Group of greenschist facies intra cratonic sandy and clayey rocks (Ahmed,1983,Nandy,2001). The basement rocks of the area around Sonapahar include (i) cordierite-bearing granulites, (ii) basic granulites (iii) quartz –sillimanite schist and (iv) granite gneisses. The Mineral assemblages suggest regional metamorphism in granulite facies condition and the rocks are affected by doubly plunging E-W trending folds (F_1) superposed by northerly striking later folds (F_2) formed during the D_1 and D_2 phases of deformation respectively. Time relations between the two phases of deformation and metamorphic crystallization, as revealed by S_i/S_e relationships of the porphyroblastic minerals, with the matrix foliation, indicates that the regional metamorphism which initiated with the D_1 and finally outlasted the D_2 deformation, represents a single events of metamorphism including both prograde and retrograde metamorphic sequences. These are dark colored rocks and contain orthopyroxene-clinopyroxene-hornblende and plagioclase as major constituents. The orthopyroxene plot lies between enstatite and fferrosilite join at En53-57 and contain up to 0.024 to 0.028 Ca per formula unit based on 6 oxygen. The Al^{VI} of the orthopyroxene varies between 0.01 to 0.031 p.f.u. while Al^{IV} varies between 0.008 and 0.023.The X_{Mg} ranges between 0.56 to 0.57 and corresponds to hyhersthene. The hypersthene from basic granulites of the Sonapahar contains 0.59 to 0.99 wt% Al_2O_3 which is significantly lower from the basic granulites of other terrains. The coexisting clinopyroxene plot lies in the field of salite. The X_{Mg} of clinopyroxene ranges between 0.72 and 0.75. The clinopyroxenes have higher X_{Mg} and Al-content in comparisons of orthopyroxene The analyses of hornblende shows the significant amount of Fe_2O_3 wt% which varies from 1.63 to 3.07Wt%.. The Al^{IV} and Al^{VI} content of hornblende varies from 1.374 to 1.493 and 0.01 to 0.031 per formula unit at 23 –oxygen basis respectively. The X_{Mg} of hornblende varies from 0.56 to 0.57 which does not show the significant change of the X_{Mg} values of the hornblende... The Ti content of the hornblende varies between 0.187 and 0.209 p.f.u and wt% of TiO_2 varies from 1.66 to 1.83wt%. The ca content of the hornblende varies from 1.828 to 1.893 p.f.u. and suggesting the presence of clacic amphibole. Textural relations between the two phases of deformation and metamorphic crystallization represent single events of metamorphism including both prograde and retrograde metamorphic sequences. The mineral chemistry of the pyroxene, hornblende and plagioclase and BSE image provide the evidence of occurrence of the two-pyroxene granulite and also show the variation of cations within the

granulite facies rocks. The average temperature, average pressure and average P-T conditions of metamorphism are 1021± 51^{0}C , 8.45 ± 1.52 kbar and 1029 ± 62^{0}C / 7.6 ± 1.**7** kbar respectively. The P-T condition indicate the thermal peak of the metamorphism of two-pyroxene granulite at 1029 ± 62^{0}C / 7.6 ± 1.**7** kbar which support the idea of ultrahigh-temperature of metamorphism . The seven stable intersections or invariant points have been observed in NCKFMAS system with phases involving di, hed, cats, en, fs, mgts, tr, fact, ts, parg, an ab and q, H_2O as excess phases at 780±249^{0}C /10.43±1.9 kbar, 917±239^{0}C /8.07±3.9 kbar, 1073±390^{0}C / 9..39 ±2.5 kbar, 1149±472^{0}C /5.13±6.2 kbar, 796±256^{0}C /6.57±5.6 kbar, 1005±415^{0}C /9.64±2.5 kbar and 923±245^{0}C /4.27±6.8 kbar.