Ex./M.Sc-1/G-1/IV/3/2018

MASTER OF SCIENCE EXAMINATION, 2018

(1st Year, 1st Semester)

APPLIED GEOLOGY

Metamorphic Petrology

Paper - IV

Time : Two hours Full Marks : 50

Answer ***all*** questions
All questions carry equal marks.

1. (a) Discuss the factors that control P-T-t path of evolution of an orogenic belt ? What do you mean by 'Peclet Number (Pe)' of orogenesis ? What type of prograde metamorphic path and tectonic set up can be inferred for an orogenic belt that has Pe ~ 150 ? Answer with reasons.

   (b) What is symplectite ? What are the guiding factors of such texture ? Do you expect this to develop at peak granulite facies condition of metamorphism of a metapelite ? Answer with reasons.

   (c) Discuss the mineralogical criteria by which you can differentiate a 'medium pressure mafic granulite', a 'high-pressure mafic granulite' and a 'high-pressure eclogite'. $5+4+3^{1}/_{2}=12^{1}/_{2}$

(Turn over)

2. (a) 'Melting of crustal rocks at H_2O saturated solidus doesn't produce large granite batholiths' – Why ? Discuss and compare the important 'fluid absent' dehydration melting reactions normally encountered in metapelite and metagreywacke bulk at granulite facies condition.

   (b) 'Decompression melting and post tectonic mineral growth is a normal consequence of collisional tectonics'– discuss why ?

   (c) What is UHT metamorphism ? How such extreme metamorphic condition can be recorded and estimated from Mg-Al granulites ? $5+3^1/_2+4=12^1/_2$

OR

   (a) What is UHP metamorphism ? Discuss the common UHP minerals and the role of polymorphism in such extreme pressure condition of metamorphism. 'Pacific-type' tetonic set ups are not suitable for exhumation of UHP rocks to shallow crustal level' – Why ?

   (b) 'Presence of high density CO_2 fluid inclusion does not always indicative of granulite genesis through CO_2 streaming' – Why ?

   (c) What is the significance of isobaric cooling path (IBC) at mid-to shallow crustal level ? Discuss one texture from calc-silicate granulite indicative of IBC.

$5+3^1/_2+4=12^1/_2$

4. Derive an equation for Mineralogical Phase Rule for open system. Can the variance of a system be negative ? Justify your answer. Using Phase rule, how do you differentiate a peritectic point from a eutectic point. What is the difference between Gibbs Free Energy and Chemical potential ? $12^1/_2$

5. Define mineralogical geothermobarometers. What are the criteria for a reaction to be used as a good geothermometer ? What is Classeus-Clayperon slope of a reaction ? Why is the slope of a decarbonation/ dehydration reaction curved in P-T field ? $12^1/_2$

OR

Employing Rick's law derive a relation among diffusion coefficient, transport distance and time required for diffusive mass transport. Can a magma (at 1000°C) heat up a rock (at 100°C) to 700°C ? Justify your answer. $12^1/_2$

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