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Ex./M.Sc.II/G-2/IX/6/2019

MASTER OF SCIENCE EXAMINATION, 2019

(2nd Year, 1st Semester)

APPLIED GEOLOGY

Ore Deposits

Paper : - IX

Time : Two hours

Full Marks : 50

Use a separate answer script for each group.

GROUP - A (25 marks)

Answer any *five* questions. 5x5=25

- (e) Discuss the different mechanisms of uranium transportation in oxygenated hydrothermal solutions. Also, compare the relative solubility of U^{4+} as chloride and fluoride complexes in reduced hydrothermal solutions. 3+2
- (f) Discuss the commonalities and major differences between porphyry Cu-Au (PCD) and Iron oxide Cu-Au (IOCG) deposits. 'IOCG deposits are characterized by ubiquitous magnetite/haematite'— accept or reject the statement with reason.
- (g) "Compositions of parent rock that undergoes partial melting, initial water content and depth of emplacement of the melt, and mechanism of fluid boiling collectively control whether a magmatic hydrothermal process will generate porphyry Cu(Mo) or porphyry W (Mo)-type deposit" – Explain. 5
- (h) Why are beach placer deposits so important? Briefly discuss the major factors that control the formation of economically important beach placer deposits. Where does India stand in terms of global beach placer resources of different minerals? 1+3+1

— X —

1. Explain the chondrite normalized platinum-group element (PGE) patterns of sulfides that are commonly present in the mantle xenoliths. How does partial melting of the source mantle control the PGE content in ultramafic-mafic magma ?
2. "PGE-geochemistry of ultramafic-mafic rocks can be used to understand the sulfide saturation history of the parental magma" – Explain with necessary diagrams. What is the significance of PGE-sulfide and Os-Ir-Ru alloy inclusions in chromites of ophiolitic chromitites ?
3. Explain with necessary diagrams how the solubility of S changes in ultramafic-mafic melt due to change in T, fO_2 and activities of FeO and SiO_2 .

(Turn over)

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4. “Changes in chemical or physical conditions cause the ultramafic-mafic magma to become supersaturated in chromite, and remove other phases from the liquidus inducing chromite to crystallize” – what are these chemical and physical conditions and how do they control the Cr solubility in ultramafic-mafic melt?
5. Express the equilibrium partitioning relation of Ni among three co-existing phases (1) silicate liquid (sil), (2) olivine (ol), (3) immiscible $\text{Fe}_{1-x} - \text{Ni}_{1-x}$ monosulfide liquid (sulf) in a mafic silicate magma saturated with S and crystallizing Olivine as a liquidus phase.
6. How do you explain the shape and discordant orientation of chromitite pods in upper mantle of the oceanic lithosphere? Explain the occurrence of dunite rim around the pods and nodular textures in podiform chromitites.
7. What are the major types of ultramafic-mafic igneous bodies that are important for orthomagmatic ore deposits? Answer with examples.

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GROUP - B (25 marks)

8. Answer any *five* questions. 5x5=25
 - (a) What is supergene enrichment? What is the role of pyrite in supergene enrichment? Why do porphyry copper deposits often show extensive supergene enrichment? 1+2+2
 - (b) Describe the different mechanisms by which ore constituents are leached from crustal rocks by hydrothermal fluid. Which factors control the efficiency of such processes? 3+2
 - (c) “During hydrothermal mineralization Au is efficiently trapped from AuCl_2^- complexes through acid neutralization or reduction whereas it is efficiently trapped from AuHS_2^- complexes through acidification and oxidation” – Explain. Use necessary sketch for your explanation. Why are metal ions more efficiently adsorbed onto mineral surfaces in alkaline environment than in acidic environment? 4+1
 - (d) “The timing and changing style of major uranium deposit types through geological time can be explained by the evolution of lithosphere, atmosphere and biosphere” – accept or reject the statement with reasons. 5

(Turn over)