CONTENT GUIDE FOR EOSC118

Ore Deposits of the Platinum-Group Elements

Mungall, J.E. and Naldrett, A.J. (2008). *Elements*, Vol. 4, pp 253-258.

This 6-page document discusses the general geological setting for platinum group element ore deposits. In particular, it describes the special magmatic conditions required to concentrate PGEs into a sulfide liquid that have been extracted from a silicate magma. It is this sulfide liquid the plays the key role in transporting the PGEs to their site of deposition. The language is quite technical in places, and the guide below has been divided into two sections: "Introduction" (pp 253-256) and "PGE Mineralization of the Bushveld Complex" (pp 257-258).

Use the discussion board on Connect to pose questions, since questions that you have are probably being thought by another one of your fellow students.

Use the following questions to help you through the article up to "Ore Deposit Models":

1. What is the average concentration of PGE on the surface of the Earth? 0.4 ppb
2. What is the average concentration of PGE in PGE ore deposits? 4ppm
3. In what 2 principal ways does sulfur geochemistry control the genesis of PGE deposits? limits PGE in it to magma, collection of immiscible sulfide in magma
4. What is an "immiscible sulfide liquid"? one mixed with magma, though of different composition
5. What are the two mechanism that provoke sulfide saturation? fractionation and assimilation
6. Why do the sulfide liquid drops end up on the base of the silicate melt? dissolved during ascension
7. The events leading to the formation of a PGE deposit are exceptional, and complex. The following is a brief outline of some of the key events:

   A. Proper production of an initial magma that has PGE and sulfide
   B. Proper saturation/distillation of sulfide melt to obtain a PGE –rich immiscible sulfide fluid through:
      i. fractionation of non-PGE minerals into a cumulous pile; OR
      ii. assimilation of crustal rocks that hasten sulfide saturation
   C. Proper trapping and settling of dense sulfide liquid droplets
   D. Recharging and upgrading of existing ore zones (Upper and Downers)

Investigating Figure 2 (p 255), the 'ore deposit' at the top of the page is developed through assimilation of crustal rock , B(ii) above, and no cumulous pile is developed. The 'ore deposit' in the lower part of the crust is developed through

the isolated fractional crystallization , B(i) above, within the magma chamber. Note the presence of the cumulus pile in this scenario from the fractional crystallization. The 'ore deposits' labeled with 'uppers' and 'downers' are examples where repeated influx of fluids cause an upgrading of the PGE ores after they have already been deposited..

Use the following questions to help you through the section on PGE Mineralization of the Bushveld Complex (pp 257-258): (Note: bypass the Ore Deposit Models section)

1. Where is the majority of the world's Rh, Pt, and Pd sourced?

Bushveld Igneous Complex

What are the three ore zones of the Bushveld complex?

Platreef, Merensky Reef, the Upper Group 2 (UG2)

What is the probability that another Bushveld-like complex will be discovered on the Earth?

unlikely