Suggested Answers to Week 8 Assignment 1

Q1. What are the basic principles of gravity and magnetic methods of mineral exploration?

Ans. These methods are based on the measurement of density and magnetic susceptibility contrast between anomaly producing body and the surrounding country rock. The gravity and magnetic data presented in the form of anomaly map. Contouring them on surface in 2-dimensional or 3-dimensional view helps in identifying the presence of ore body by virtue of its difference in properties.

Q2. Give an account of the transmission spectra of the atmosphere in relation to remote sensing.

Ans. Each type of molecule has its own set of absorption bands in various parts of the electromagnetic spectrum. As a result, only the wavelength regions outside the main absorption bands of the atmospheric gases can be used for remote sensing. These regions are known as the Atmospheric Transmission Windows. The wavelength bands used in remote sensing systems are usually designed to fall within these windows to minimize the atmospheric absorption effects. These windows are found in the visible, near-infrared, certain bands in thermal infrared and the microwave regions.

Q3. Discuss briefly about the relationship between spectral characteristics of vegetation and sedimentary rock.

Ans. The spectral characteristics of vegetation is mainly in the edge of the visible to IR transition, that is the increase in intensity of reflection of the electromagnetic wave at the end of the visible and beginning of the IR rage. This edge is called the red edge and its position shifts to shorter wave length (blue shift) or longer wavelength (red shift) in response to high levels of metal concentration in the soil they grow. Various sedimentary lithounits such as sandstone, shale and limestone show difference in their reflectance characteristics which can be discriminated from spectral characteristics in different bands.

Q4. What are Red edge, red shift, and blue shift? Add a note on the reflectance characteristics of vegetation depending upon mineral enrichment of the area.
Ans. Spectral band of vegetation lies just on the edge of visible range of electromagnetic spectrum, so called as **Red edge**.

Red edge can be shifted to a shorter wavelength which is called as **blue shift**.

Red edge can be shifted to a longer wavelength which is called as **red shift**.

Spectral reflectance of plant species (Balsam Fir) is higher in copper enriched soil whereas in case of Red Spruce it shows the opposite characteristic.

**Q5.** Write down step by step process that is followed to select a target for diamond exploration.

**Ans.**

- Global, regional and local tectonics.
- Lithospheric structure and composition.
- Diamond formation and preservation
- Known host rock petrogenesis and emplacement.
- Country rock and source rock geochronology.
- Local tectonic control.

**Q6.** What are indicator minerals? Give example of one indicator mineral for diamond exploration, giving its chemical characteristics.

**Ans.** Indicator minerals are mineral species that, when appearing as transported grains in clastic sediments, indicate the presence in bedrock of a specific type of mineralization, hydrothermal alteration or lithology. Subcalcic Cr-pyrope common referred to as G10 pyrpe (garnet-bearing harzburgite/dunite source rock).

**Q7.** Based on the accepted genetic model of VMS deposit, discuss the strategy of exploration of these deposits beginning from larger geodynamic environment to individual deposit environment.

**Ans.** Taking example of Cyprus-type VMS, we know that they occur mainly in the oceanic rift settings. Therefore, an exploration program for such deposits would be targeted towards identification of paleo-rift settings in a regional scale. General geological attributes could be helped by regional scale geophysical anomalies and lineaments (from remote sensing). The district scale processes are controlled by presence of sub-volcanic magmatic unit (that provided heat and also some fluid component) should be looked for in a district scale. The
deposit scale processes result in feeder dyke with stockwork mineralization and the surrounding alteration halo which will be the elements that should be targeted in a more intense and local scale exploration.

Q8. What are primary and secondary dispersion? Discuss by citing some examples.

Ans.

• **Primary dispersion** – The movement of elements below the Earth's surface by metamorphic, magmatic, or hydrothermal processes resulting in the formation of igneous and metamorphic rocks.
  
  • Fractionation of elements during successive differentiation from the solar nebula.
  
  • Element fractionation during melting/crystallization of rocks.

• **Secondary dispersion** – The movement of elements at or just below the Earth's surface, which results from weathering, erosion, and deposition.
  
  • Mobility during solid state recrystallization.
  
  • Mobility in fluid medium.
  
  • Mechanical dispersion.
  
  • Absorption – desorption vis-a-vis surfacial process including microbial transportation of elements.

Q9. Give a brief account of stream sediment survey in combination with indicator minerals as an effective exploration method for diamondiferous kimberlite.

Ans. Areas containing kimberlite pipes are likely be hidden under soil cover and dissected by drainage network. In such areas, the location of the kimberlite pipes could be done by systematic study of the streambed sediments moving from the higher order to lower order streams. In these process, what is sampled is basically the stream sediments which could be subjected to routine processing by various physical methods (based on size ranges, specific gravity) to recover the heavy minerals such as mainly garnet and spinel. After they are recovered and the location of the kimberlite body ascertained, the minerals (garnets) could be analysed to see if they are G9 or G10 garnets and further follow up work could be carried out for final discovery of the kimberlite and its diamond potentials could be evaluated.

Q10. What is the difference between insitu and transported overburden? State their importance in mineral exploration.
**Ans.** Insitu overburden - Formed insitu. Product of degradation of material present beneath the profile. Inherit the characteristics of the material from which it is derived.

Transported overburden – It is transported from a different place by the action of gravity or other transporting agents. Not derived from the material which lies beneath it. Not reflect the characteristics of the terrain where it lies.

Overburden material reflects the characteristics of the material from which it is derived. Studying the metal content of that material leads us to find its source deposit.

**Q11. Discuss the importance of understanding the soil profile in geochemical exploration and discuss the intricacies involved in interpretation of geochemical anomaly in actual delineation of subsurface ore bodies.**

**Ans.** Soil profile differs from one geographical location to another. Soil immediate layer (c-layer) which derived from the weathering of bedrock, they do preserve the texture of bedrock from which they derived. The soil profile is usually layered, and in a geochemical soil survey the horizon giving the sharpest contrast between background and anomaly is chosen for analysis. Soil of temperate climatic region has maximum layers followed by semi-arid, arid. Sample must be taken from A2 or B horizons.

**Q12. Discuss briefly about the Orientation survey. Add a note on needs and types of orientation survey.**

**Ans.** In geochemical prospection, a geochemical survey normally consisting of a series of preliminary experiments aimed at determining the existence and characteristics of anomalies associated with mineralization. This information is then used in selecting adequate prospecting techniques and in determining the factors and criteria that have a bearing on interpretation of the geochemical data.

Types –

1. Public data review
   a) Case history
2. Expert opinion consultants
3. Traditional – field & laboratory
4. Combination approach