

CHAPTER III

Classification of metalliferous deposits.

1. Magmatic Deposits

1.1 Formation Processes

Igneous ores are formed by the accumulation of minerals. They form ore deposits when present in relatively large quantities at economically viable concentrations.

Several types of magmatic processes contribute to the formation of these deposits:

- crystallization,
- segregation of an immiscible liquid,
- sedimentation of solid or liquid phases.

This process is related to two types of magmatic intrusions:

A. Intrusions of ultrabasic and basic rocks; examples:

- chromite and Pt ore in large layered intrusions (Bushveld, Muskox)
- chromite ore in ophiolites (Turkey)
- Cu-Ni-Fe sulfides in layered intrusions (Sudbury, Norilsk)
- Ni-Cu-Fe sulfides in komatiitic lavas (Kambalda)
- Diamonds in kimberlites

B. Acidic intrusions; examples:

- Cu ore in carbonatites (Phalabora)
- Rare Earth Elements (REE), P, Nb, Li, Be, etc., in pegmatites

2 - HYDROTHERMAL DEPOSITS

The hydrothermal process is linked to the circulation of deep fluids transporting metals within the Earth's crust.

The origin of these fluids can be magmatic or metamorphic, or come from meteoric or connate water waters (found deep within the Earth's crust).

When the fluids are typically drained and trapped in fractures of varying sizes and geometries, the minerals are deposited by precipitation.

Hydrothermal deposits are the world's primary source for the majority of metals (Pb, Zn, Mo, Ag, Cu, Au, U), precious stones, clay, and quartz.

There are different types of hydrothermal deposits depending on the geodynamic context (plate boundaries, granitic intrusions, ocean floor, sedimentary basins).

These deposits are characterized by the origin and temperature of the carrier fluids, which contain significant amounts of CO₂ and/or CH₄.

Note

Five types of hydrothermal deposits were selected to illustrate the different formation types:

1. Volcanogenic Massive Sulfide (VMS) deposits
2. Porphyry-associated deposits
3. Sedimentary exhalation deposits (SEDEX)
4. Mississippi Valley Type (MVT) deposits
5. Uranium deposits

3- Sedimentary Deposits

3.1 Formation Processes

3.1.1 Different possible formation processes:

- Accumulation of minerals transported by water in a trap after erosion of the parent rocks: "**detrital**" or "**placer**" deposits,
- Weathering of a pre-existing rock that has lost a significant portion of its constituents through dissolution and has thus become enriched in certain minerals: **residual deposits**.

The first category of these deposits, sedimentary, includes deposits formed by the accumulation of detrital grains or by biological and/or chemical precipitation in rivers, lakes, coastlines, or ocean environments.

The second category corresponds to deposits formed in weathering zones, just below the surface, most often in tropical environments.

Deposits formed by sedimentary and surface processes

- + Placer deposits
- + Sedimentary iron deposits
- + Other sedimentary deposits: Cu-Pb-Zn-Ag sulfides, sulfates (barite, evaporites, manganese), phosphates, nitrates, salts, sulfur
- + Deposits associated with laterites
- + Deposits associated with supergene weathering