Most metallic ore deposits form from the precipitation of metal-bearing minerals from a hydrothermal fluid.

Hydrothermal fluids are commonly acidic and reduced.

Most metals are quite insoluble on their own.

Metals are usually transported as complex ions (metal ion joined to another molecule or ion).

Metals join with two ions most commonly:
- $\text{Cl}^-$ (chloride)
- $\text{HS}^-$ (thiosulfide)

Chloride complexes will form when:
- Salinity is high
- Temperature is high (>350°C)

Chloride complexes will form with:
- $\text{Sn}^{4+}$, Mo, W, Ti
**Thiosulfide Complexes**

- Thiosulfide complexes will form when:
  - Salinity is low
  - Temperature is low (<350°C)
- Chloride complexes will form with:
  - Au, Ag, Hg, Cu*

**Either Complex**

- Some metals may be transported by either a chloride or thiosulfide complex. Such metals include:
  - Co, Ni, Cu²⁺, Pb, Sb, Sn²⁺, Zn

**Mineral Stability**

- Minerals will either go into solution or precipitate depending upon the physical and chemical conditions of the fluid
- If a mineral precipitates, the mineral that forms will be governed by the physical and chemical conditions of the fluid
- eH and pH are dominant controls in mineral formation from hydrothermal fluids

**Eh-pH Diagrams**

Eh-pH diagrams show the stability fields of minerals under different Eh and pH conditions.
Eh-pH Diagrams