

Dr. Dinesh Pandit, (M. Sc. Semester-II: Ore Geology, Course No GLM-205, Theory)

Tin Ore Deposits

Ore Mineralogy: Cassiterite (SnO_2), Stannite ($\text{Cu}_2\text{FeSnS}_4$);

Tin Ore Deposits: Tin deposits occur mainly in veins, stockworks, disseminations, replacement and placers. Granites are the most common host rocks for both tin mineralization.

Mode of Occurrences:

1. Pegmatite type, 2. Quartz veins associated with granite, 3. Placers, alluvial and eluvial placers,

Origin of Tin Ores/ Genesis: Tin ore deposits are mostly formed under high temperature conditions derived by pneumatolytic action. Tin possibly transported from the magma chamber as gaseous tin fluoride or chloride complexes, which by reaction with water to form cassiterite. Some time high temperature hydrothermal processes are also responsible for the formation of tin ores.

Tin Ore Deposits of India:

North India: Tosham-Bhiwani (Haryana), Soniana mica belt-Bhilwara (Rajasthan),

Eastern India: Koraput (Odisha), Nurungo-Hazaribagh, Semritanr, Chappatnar and Pihra - Giridih (Jharkhand); Chakrabandha-Aurangabad (Bihar),

Central India: Tongpal-Leda-Kudripal in Bastar (Chattishgarh),

South India: Kadavur (Tamil Nadu),

Uses of Tin:

1. Tin is used in many forms (wrought and unwrought) and as alloy.
2. Tin plates (steel sheet covered with a thin coat of tin) and
3. Corrosion resistant alloys as bronze, brass, solder, etc.
4. Electrical industry uses tin to make tin foil for condensers, moisture proof packing material, and
5. Pottery; pigments, enamels and glazing.

Tungsten Ore Deposits

Ore Mineralogy: Wolframite $[(\text{Fe}, \text{Mn})\text{WO}_4]$, Scheelite (CaWO_4), Tungstite ($\text{WO}_3 \cdot \text{H}_2\text{O}$), Tungstenite (WS_2);

Mode of Occurrences: 1. Stockwork deposits associated with granitic rocks, 2. Skarn deposits associated with granitic rocks, 3. Placers deposits,

Origin of Tungsten Ores/Genesis: Tungsten mineralization is commonly associated with granitic rocks. Tungsten ore may have formed under conditions of medium to high temperature hydrothermal fluid. The deposit associated with fissure veins, replacement, contact metasomatic and pegmatitic.

Tungsten Ore Deposits of India:

North India: Balda, Dera-ka-Bera, Sewariya, Degana, Nagaur, Motiya, Pali (Rajasthan),

South India: Burugubanda (Andhra Pradesh),

Central India: Agargaon, Kuhi, Chapegarhi, Paladi, Kosamtonidi-Bagawan (Maharashtra),

Uses of Tungsten:

1. Steel industry is the bigger consumer of tungsten, mainly used for manufacturing of high grade tool steel and heat resistant alloys for high speed cutting tools, springs, gun barrels, pneumatic tool component, internal combustion engine valves, etc.
2. Numerous alloys with iron, nickel, cobalt and molybdenum.
3. Compounds of tungsten with carbon (carbides) and boron (borides) are extremely hard alloys used for manufacturing of drill rods and bits, cores of anti-tank shells, cutters, etc.
4. Tungsten filaments are used in bulbs, X-ray tubes, radio-valve components and electrodes for contact and atomic welding.
5. Chemical industry for paints and varnishes, fire and water proofing textiles.

Reference Books:

1. Asoke Mookherjee (1999) Ore Genesis: A Holistic Approach. Allied Publisher Ltd., Mumbai
2. Jense, M.L. and Bateman, A.M. (1981): Economic Mineral Deposits, John Wiley and Sons.
3. Stanton, R.L. (1972) Ore Petrology. McGraw Hill.
4. Mihir Deb and Sanjib Chandra Sarkar (2017) Minerals and Allied Natural Resources and their Sustainable Development: Principles, Perspectives with Emphasis on the Indian Scenario. Springer Geology

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Magnesite Deposits

Ore Mineralogy: Magnesite ($MgCO_3$), Dolomite ($CaCO_3 \cdot MgCO_3$), Olivine [$(MgFe)_2SiO_4$], Epsomite ($MgSO_4 \cdot 7H_2O$), Kieserite ($MgSO_4 \cdot H_2O$), Carnallite ($MgCl_2 \cdot HCl \cdot 6H_2O$), Spinel ($MgO \cdot Al_2O_3$), Periclase (MgO), Brucite ($MgO \cdot H_2O$);

Mode of Occurrences:

1. Magnesite occurs as veins, fracture fillings in serpentinite or ultra-basic rocks. It is also occurs as replacement of dolomite and limestone forming bedded deposits, lens or irregular in shape and size. Sedimentary bedded deposits in association with salt and gypsum of shales and limestone.
2. Dolomite occurs as sedimentary beds, replacing limestone and in the form of veins.
3. Epsomite occurs as solution in seawater and mineral water.
4. Spinel occurs in crystalline rocks such as limestone and schist,
5. Periclase occurs in associated with marble and crystalline dolomite.
6. Brucite occurs with marble and also in the form of veins traversing serpentinite.

Magnesium Metallogeny: Based on the metallogenic provinces, tin and tungsten metallogeny confined to wide range of geological time scale.

Origin of Magnesium Ores/ Genesis:

1. Magnesite formed due to the break down of serpentinite by hydrothermal carbonate solution accompanied by the release of silica. Progressive replacement of limestone or dolomite by magnesite through hydrothermal solution.
2. Dolomite may formed from sea water deposition of calcium and magnesium carbonate. Epigenetic replacement of limestone, calcite in limestone is replaced by dolomite. It may also formed due to action of hydrothermal solution enriched in $MgCO_3$.
3. Epsomite deposited from water of saline lakes due to chemical precipitation followed by subsequent dehydration.
4. Spinel may formed due to regional and contact metamorphism.
5. Periclase formed due to contact metamorphism of limestone.
6. Brucite originated from contact metamorphism of impure limestone and also formed due to secondary processes as a result of hydration of periclase.

Magnesium Ore Deposits of India:

Most important deposits of magnesite are in the states of Uttar Pradesh, Tamil Nadu, Karnataka, and Jammu and Kashmir. Some minor occurrences are in Himachal Pradesh, Kerala, and Rajasthan.

Uses of Magnesium:

1. Magnesite used in refractory bricks, furnace lining and crucibles; also used in cement, manufacturing of magnesium metal, salt, and carbon dioxide, paper, ceramic, glass and sugar industries, chemical accelerator in rubber.
2. Dolomite used as building material, cement, refractory, furnace lining, source of carbon dioxide.
3. Epsomite used in manufacturing of medicine, tanning,
4. Spinel used as gemstone,
5. Periclase used as source for extracting Mg-metal, refractory material, drying agent.
6. Brucite also used as source for extracting Mg-metal.

Reference Books:

1. Asoke Mookherjee (1999) Ore Genesis: A Holistic Approach. Allied Publisher Ltd., Mumbai
2. Jense, M.L. and Bateman, A.M. (1981): Economic Mineral Deposits, John Wiley and Sons.
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