

Metal	Mineral ores	Family	Properties	Uses	Processes
Iron Fe	Magnetite 72,4%Fe Hematite 70%Fe	Fe _x O _y →oxides	Fe ²⁺ soluble forms magnetite(ferrous) Fe ³⁺ insoluble forms Hematite(Ferric) 1-Highly corrosive 2-Conducts heat 3-Conducts electricity	Production of steel: 1-iron + nickel (metal) 2-iron + molybdenum (metal) 2- iron + carbon (non-metal) steel is tougher, less brittle and more resistant to wear than iron	<u>Igneous deposits:</u> 1-accumulation in large mafic (ferro-magnesium), mined for Vanadium used <i>in armor plates</i> not for iron. 2-contact metamorphism: when emitted iron bearing fluid react with adjacent rocks like limestone a mixture of coarse grained iron oxides is formed. 3-Sea-floor volcanism: Algoma-type deposits form due to precipitation of hot springs rich in iron and silica: too small to be recovered. <u>Residual Deposits:</u> Brown ores: forms due to weathering where the more soluble minerals are transported and iron oxides and hydroxides are left: uneconomic in terms of large-scale mining. Laterites: red rich iron oxides that deposit due to weathering: are considered as future resources of iron but may cause massive environmental problems. <u>Sedimentary deposits: (formed through sedimentary processes)</u> 1-Bog iron deposits: first iron deposits to be exploited. Nowadays, not mined as they are local in extent and highly variable in their grade. 2- Ironstones: these deposits were mined-out, not considered any more for further iron exploitation (exhausted) Banded Iron Formations BIF Largest concentrations of iron oxide deposits and world's major source of iron. known as Lake Superior-Type Ores. date back to Pre-Cambrian Age (about 1.8-2 Billion years). Usually the deposits are 30-700 meters in thickness and extend over 100's to 1000's of kilometers. contain magnetite or hematite in a matrix of quartz, iron silicates and iron carbonates, and free of sedimentary debris. Mineral deposits typically have 20-40% iron and at times about 50% and exhibit banding. Formed from many processes: weathering, submarine hydrothermal systems and leaching of marine sediments. Mined in open-pits operation. First richest iron ores(50%) then Taconites (30% iron)

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Manganese	pyrolusite (MnO ₂)	Oxide	<i>0.09% by weight of the Earth's crust.</i> Mn ²⁺ soluble Mn ⁴⁺ insoluble Manganese is brittle	1-Production of iron steel, where 90% is consumed. 2-Used in iron smelting to remove impurities (7Kg used for each ton). Used in chemical industry: 1-use of potassium permanganate for the treatment of water. 2-use of manganese dioxide in cell batteries industry	It is concentrated by chemical sedimentary processes. Resources lie in sedimentary rocks.
	rhodonite (MnSiO ₃)	silicate			
	rhodochrosite (MnCO ₃)	carbonate			
Aluminum	Bauxite . Al(OH) ₃ Most important	Hydroxide	<i>Second most abundant in Earth's crust (8.2%) after silicon.</i> 1-light in weight 2-malleable 3-ductile 4-excellent conductor of electricity 5-valued gemstones as ruby and sapphires are recognized as oxides of this metal. 6-high melting point.	1-transportation 2-packing 3-containers 4-building products 5-refrigerating 6-cans manufacturing	Frequently in subtropical zone, During chemical weathering , and where there exist aluminous parent rocks, soluble ions like Na, K, Mg and Ca are removed in solution leaving a residue rich in hydroxides, <i>clay</i> and <i>kaolinite</i> (AlSi-hydroxide). percolating water tend at a later stage to dissolve the clays and remove the silica. The resulting rock is an aluminum rich <i>laterite</i> (or highly leached soil) called bauxite. Other forms of bauxite develop as a terra rosa type.
	Feldspars	Oxide			
	mica	silicate			
	Clay	hydroxide			

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Titanium	Rutile (TiO ₂) ilmenite (FeTiO ₃)impure	oxide	<i>The least common of the abundant metals (0.56%).</i> 1-high strength to weight ratio 2-high melting point 3-great resistance to corrosion 4-resistany to weathering	Its alloy with Al: 1-aircraft industry (engines and frames) 2-electricity generating plants.	Widely dispersed in igneous and metamorphic rocks. In igneous: large concentration of iron and titanium(ilmenite) Weathered igneous and metamorphic rocks and eroded products lead to the formation of placer deposits that contain ilmenite (48% to 65%) and rutile(93-96%).
Magnesium	magnesia (MgO)	oxide	<i>The eighth most abundant element (1.87) and the lightest one.</i>	Refractories and metal industries 1-magnesium and aluminum to produce lightweight metal used in beverage cans, automobiles and machinery. 2-used for fertilizers 3-cement manufacturing	Extracted from Brines of deep wells and from seawater. Brine: water with high concentration of salt and minerals trapped between evaporates.
	forsterite (Mg ₂ SiO ₄)	silicate			
Silicon	Silanes SiH ₄ Quartz Quartzite rock pegmatite	silicate	Pure silicon is: 1-light-weighted silvery substance 2-has a lustrous (shiny) appearance 3-very brittle.	1-ferroalloys (iron and silicon)used in steel industry. 2-silicon chips used in computers or photo/solar cells 3-Silanes are used in manufacturing rubber.	

