

## HEMATITE



Figure 91: Hematite, stalactitic "grape ore" from Ironwood, Gogebic County, 8 x 13 cm, A. E. Seaman Mineral Museum No. CVW 6, Jeffrey Scovil photograph.

The most widely distributed iron oxide mineral and one of the most important and abundant iron ores. Formed under a wide variety of geological environments: 1) as an uncommon accessory mineral in a few igneous rocks, 2) as a constituent of some high-temperature, hydrothermal veins, 3) as a widespread and abundant sedimentary species in numerous rock types (ferruginous shales, sandstones, limestones, and sedimentary hematite ores), 4) as a major constituent of metamorphosed sedimentary iron formation (hematite schist, jasper, and jaspilite), and 5) as a weathering product of various iron-rich rocks (gossan). Like goethite, hematite appears in a variety of aggregate forms, the most important of which in Michigan are:

1. Earthy: Porous, may be mixed with limonite.
2. Specularite: Relatively coarse-grained micaceous plates with a metallic, mirrorlike luster.
3. Jasper: Red, microscopic platelets disseminated through very fine-grained quartz (chert).
4. Grape ore: Relatively small, clustered masses with smooth botryoidal surfaces or grouped rounded prominences.
5. Kidney ore: Reniform, relatively large masses bounded in part by smooth curving

botryoidal surfaces. The internal arrangement may be radiating or concentric or both.

6. Pencil ore: Elongate acicular pieces with well-defined, relatively flat sides separated by sharp edges.
7. Rainbow ore: Hematite that shows iridescent color coatings. May be specular or botryoidal.
8. Stalactitic: Radially fibrous aggregates shaped as an elongate, blunt-nosed cone.
9. Needle ore: Minute, sharp, and thin prismatic crystals.
10. Velvet ore: Fragile, fuzzy coatings consisting of exceedingly fine needles.
11. Slaty hematite or slate ore: Dense, very fine-grained, well-oriented specularite aggregates that show well-developed planar foliation.
12. Martite: Hematite pseudomorphous after grains or crystals of magnetite.

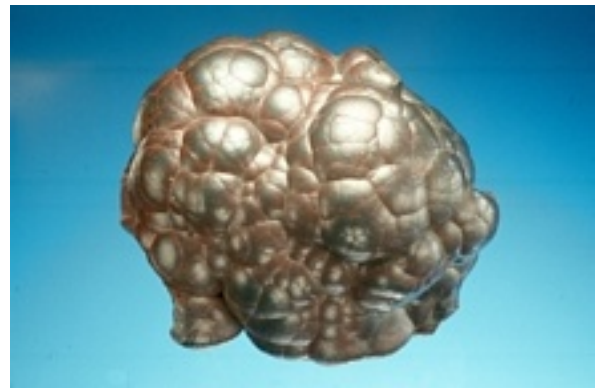


Figure 92: Hematite, botryoidal hematite ("kidney ore") from the Mather mine, Ishpeming, Marquette County, 8 x 9 cm, A. E. Seaman Mineral Museum specimen No. CVW 24, Jeffrey Scovil photograph.

Hematite ores are confined primarily to the iron ranges of the Northern Peninsula, which have produced world-class specimens. Minor amounts of hematite also are widespread in rocks, lodes, and veins of the native copper district (Butler and Burbank, 1929; Cornwall, 1951a). In the Southern Peninsula, it occurs as a minor constituent of a variety of sedimentary rocks.



figure 93: Hematite, “needle ore” probably from the Norrie mine, Ironwood, Gogebic County, 5 x 11.5 cm, A. E. Seaman Mineral Museum specimen No. JWVR 259, Jeffrey Scovil photograph.



Figure 95: Botryoidal hollandite from Wakefield, Gogebic County. 4 x 5 cm. A. E. Seaman Mineral Museum specimen No. CVW 9, Jeffrey Scovil photograph.



Figure 94: Hematite, specular hematite in quartz from the Cascade mine, near Marquette, Marquette County, 8 x 13 cm, A. E. Seaman Mineral Museum specimen No. DM 5926, Jeffrey Scovil photograph.

Because of the abundance of the mineral and its exceedingly numerous occurrences, only a few of the outstanding or unusual occurrences are listed.

**Baraga County:** Spurr mine: As “martite” replacing small octahedral crystals of magnetite in chlorite schist.

**Dickinson County:** 1. Loretto mine near Loretto: Iridescent specularite. 2. “Iron Mountain” mine: Specularite lining geodes in milky quartz (Brooks, 1873). 3. Menominee range generally: Most common iron ore mineral, usually as soft blue hematite but locally schistose and specular (Bayley et al., 1966). The Vulcan Iron Formation in this range carries earthy red hematite, specularite, martite, and magnetite (Carr and Dutton, 1959; James et al., 1961). Martite is common in the Brier Slate member of this formation (Bayley et al., 1966). Brecciated ores, present locally, consist of jasper fragments in a hematitic matrix or hematite fragments in a dolomitic matrix (Leith, 1904). Dutton and Zimmer (1968) describe the Vulcan Iron Formation in central Dickinson County as a typical oxide facies of moderately high metamorphic rank, being moderately coarse-grained, containing mainly hematite, magnetite, and quartz (including some jasper), and minor tremolite, cummingtonite, diopside, garnet, and calcite or dolomite. In southern Dickinson County, deposits formerly mined are secondary iron oxide ores. 4. Deerhunt Exploration, section 35, T43N, R29W: Fine-grained specularite, soft red hematite, interbedded

jasper, and martite (James et al., 1961). **5.** Groveland mine near Felch Mountain: Oolites of hematite in lower Vulcan Iron Formation. It also can be found as coarse specularite along joints (Cumberlidge and Stone, 1964). **6.** Felch: A road cut on highway 69 near the west end of the village exposes iron formation, some of which contains small cavities with quartz and hematite crystals (generally <2mm), though a few rare specimens of subparallel bladed crystal aggregates up to 4 cm have been found. Similar specimens have been collected from dumps at the old Metropolitan (?) mine, approximately a kilometer north of the village (M. Basal, personal communication, 1998). **7.** Vulcan mine: Pencil ore, jaspilite, and red earthy varieties.

**Gogebic County:** **1.** Gogebic range generally: Specular hematite is the most common iron mineral in unaltered iron formation associated with chert and magnetite. In altered iron formation, red hematite and limonite are most common (Hotchkiss, 1919; Carr and Dutton, 1959). Botryoidal hematite is also found. **2.** Eastern Gogebic range: Martite (Mann, 1953). **3.** *Geneva-Davis mine*, 30th to 31st level: A 30-kilogram kidney ore specimen (Eddy, 1948). **4.** *Norrie mine*, Ironwood: Fine specimens of needle ore and pencil ore to 35 cm. **5.** *Ashland mine*, Ironwood: Fine specimens similar to those from the Norrie mine. **6.** Also *Eureka*, *Mikado* and *Newport mines* for very good material. **7.** Sunday Lake mine, Wakefield: Specular crystals with quartz. **8.** Colby mine, Bessemer: Grape ore. **9.** Various other mines near Wakefield: Pencil and kidney ores (Hawke, 1976).

**Houghton County:** **1.** Isle Royale copper mine: Specularite in feeding fissures (Broderick, 1931). **2.** Kearsarge amygdaloid: Specularite in "short-circulating fissures" (Broderick, 1931).

**Iron County:** **1.** Iron River-Crystal Falls area (Menominee range) generally: Iron ore in this southern part of the county is of secondary origin and occurs in the Riverton Iron Formation. The ores consist of hematite and limonite (goethite) with cherty quartz, minor calcite, pyrite, gypsum, and some apatite (James and Dutton, 1951; Pettijohn, 1952; Carr and Dutton, 1959; Dutton and Zimmer, 1968). Much of the hematite is the red earthy variety. Specularite is locally present. **2.** Buck group of mines, southeast of Iron River: Earthy hematite, goethite, and minor specularite

occur. Also found are veinlets and vug fillings of minor specularite. Veinlets and vug fillings of minor chalcopyrite, pyrite, marcasite, barite, chlorite, calcite, quartz, and apatite commonly occur (James and Wier, 1948). **3.** Warner mine, sections 9 and 16, T44N, R33W: Amasa Iron Formation yielded over 6.5 million metric tons of direct-shipping, non-Bessemer hematite. Mine closed in 1957 (Wier, 1967). **4.** Delphic mine south of Alpha: Major producer in the late 1880s of red earthy hematite (Good and Pettijohn, 1949). **5.** *Sherwood mine*, Iron River: In fine, large stalactitic and botryoidal aggregates resembling specimens from west Cumbria, England (DeMark, 2000). Two large specimens in the A. E. Seaman Mineral Museum at Michigan Technological University measure over half a meter across (specimens DM 845, DM 846). **6.** *Bengal (Cannon) mine*, Stambaugh: Thin, tabular black rhombohedral crystals (Hawke, 1976). **7.** Northwestern Iron County: Soft earthy red hematite (red ochre). Once used for red paint. **8.** Other mines that have supplied interesting to excellent specimens include: *Bristol*, *Chicagon*, *Hiawatha*, and *Homer-Wauseca*.

**Keweenaw County:** **1.** Vicinity of Cliff copper mine: At the amygdaloidal top of the Greenstone flow, hematite occurs as a replacement of magnetite and ilmenite and as fracture fillings—both earthy and specular. It is also found in vugs as specularite intergrown with chalcocite. In addition, 21.6 meters below the top of the Greenstone flow, hematite dendrites occur associated with disseminated pyrite grains (Cornwall, 1951a). **2.** Cliff mine: Microscopic, flat, rhombohedral crystals of hematite occur on botryoidal prehnite and on native copper in prehnite-calcite veins (Moore and Beger, 1963). Occurs sparingly at the Avery shaft, Cliff mine, in small, microscopically transparent tablets showing forms  $\{0001\}$ ,  $\{10\bar{1}0\}$ , and  $\{10\bar{1}0\}$  (Williams, 1966). **3.** Ojibway Number 1 mine: Brilliant, black pseudohexagonal crystals on and in quartz crystals were collected from the the mine dump in the mid-1960s, when it was intact (T. Rosemeyer, personal communication, 1999). **4.** North side of Keweenaw Peninsula: The Copper Harbor Conglomerate, a red bed deposit, contains hematite in three forms: ultrafine pigment, microcrystalline hematite, and magnetite grains partially altered to martite (Elmore, 1981; Elmore and Van der Voo, 1981). **5.** Central mine: Specular hematite is an

uncommon accessory mineral filling voids in some quartz-prehnite-copper veins.

**Marquette County:** 1. Marquette district generally: Iron ore deposits occur in altered Negaunee Iron Formation. The unaltered formation, which averages about 26% Fe, has locally been enriched by combinations of diagenetic replacement, more intensive metamorphism, secondary oxidation, and leaching, to average about 31% Fe. Locally, in the Negaunee area, the enrichment achieves 35% Fe (Anderson, 1968). Soft ores are earthy, porous, friable mixtures of earthy hematite and martite (locally magnetite with minor goethite (q.v.), chert, mica, and chlorite). Hard ores are dense, firm aggregates of magnetite, martite, compact hematite, and specularite. Hematite also forms microscopic grains in ores as replacements of minnesotaite, stilpnomelane, grunerite, and chlorite (Mann, 1953). 2. *Athens mine*, Negaunee: Kidney ore, pencil ore, and velvet ore (Spiroff, 1940). 3. *Salisbury mine*, Ishpeming: Kidney ore. 4. *Champion mine*, Champion: Excellent specimens of specularite (Markert, 1960) and fine martite as octahedral crystals up to 1 cm in schistose specularite (Spiroff, 1940). 5. *Beacon mine*: Octahedral martite and specularite (Spiroff, 1940; Mandarino, 1950). 6. *Jackson mine*: Specularite as pockets of granular ore or irregular lenses of schistose "specular slaty ore." Additionally, martite, jasper, grape ore, red earthy hematite, and limonite are found (Rominger, 1881). 7. *Greenwood mine*: Excellent specimens of specularite. 8. *Stoneville mine*: Fine specularite (Markert, 1960). 9. *Platt mine*, near Palmer: Specularite, some iridescent. 10. *Charlotte mine*: Martite. 11. *Tracy mine*: Martite (Mann, 1953). 12. *Holmes mine*: Martite in hematite-kaolinite matrix (Schwartz, 1936). 13. *Cliffs shaft mine*: As magnetite crystals partially altered to martite in chlorite (Schwartz, 1936) and bands of blue-black martite alternating with red jasper (Brooks, 1873; Wienert, 1933). In addition, pencil ore and pseudomorphs of hematite after pyrite as much as 2.5 cm on an edge also have been found. 14. *Presque Isle*: Thin, flat rhombs of specularite in veins in an altered peridotite (Spiroff, 1940). 15. *Lake Angeline* south of Ishpeming in section 10, T47N, R27W: Specularite with quartz, feldspar, and chlorite in a vein in "diorite" (Brooks, 1873). 16. *Washington Street* south of Negaunee: Beautiful conglomerate hematite ore in Goodrich

Quartzite. Goodrich Conglomerate ore consists almost entirely of fragments derived from the Negaunee Iron Formation, including jasper, chert, and hematite ore. Secondary hematite and magnetite have infiltrated pore spaces between grains and have partly replaced jasper fragments. Such ore also occurs in the Saginaw Range and was mined at the Volunteer Mine. For a superb color representation of the ore see Van Hise and Bayley (1897, Plate XXVII). 17. *Cleveland mine*, Ishpeming: Martite in sharp octahedral crystals up to 5 mm in chlorite schist; also hematite pseudomorphs after cubic pyrite crystals up to 3 cm. 18. *Republic mine*: Excellent specularite and platy crystals to 10 cm. 19. *Humboldt*: Specularite (18, 19, Hawke, 1976). 20. *Michigamme mine*: Octahedral crystals of martite up to 5 mm in chlorite schist. 21. *Jasper Knob (Jasper Bluff)*, Ishpeming: Outstanding outcrops of highly contorted jaspilite. For a beautiful color representation of jaspilite from this location see Van Hise and Bayley (1897, Plates XXV and XXVI). 22. I.G.A. (Jubilee) grocery store construction site, Ishpeming: A portion of the Negaunee Iron Formation was excavated during the construction of the I.G.A. grocery store on Highway 41 in the village of Ishpeming. Good specimens of botryoidal and specular hematite have been collected from the rock pile adjacent to the store. 23. *Old Richmond mine*, Palmer: Lustrous, black, micaceous specular hematite. 24. *Lake Superior mine*, Ishpeming: As large botryoidal aggregates and lustrous, coarsely micaceous specularite. 25. *Mather mine*, Ishpeming: In fine botryoidal aggregates (kidney ore). 26. *Lucy (McComber) mine*, Negaunee: Hematite pseudomorphs after cubic pyrite crystals up to 3 cm, similar to those from the Cleveland mine. 27. *Washington mine*, Ishpeming: Thin, tabular to discoidal crystals up to 6 mm in vugs in limonite. Similar specimens but with smaller crystals occur at both the New York mine (Ishpeming) and Tracy mine (Negaunee). 28. Other mine localities: Blueberry, Cambria, Cascade, Empire, National, Odgen, Oliver, Palmer, Phoenix, and Tilden.

**Ontonagon County:** *Indiana mine*: As tabular, bladed crystals with epidote, actinolite(?), and calcite in brecciated basalt (Rosemeyer, 2003c).

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## UPDATE

**Dickinson County:** Rock Dam gold prospect near Pine Creek (SW  $\frac{1}{4}$  SE  $\frac{1}{4}$  section 31, T41N, R29W): As attractive dark brown-to-black botryoidal coatings on crystals of milky quartz (q.v.). (Carlson et al., 2007b).



*Black botryoidal hematite coating quartz crystals from the Rock Dam gold prospect, Dickinson County; 3 x 4 cm area. A. E. Seaman Mineral Museum specimen DM 25795, George Robinson photograph.*

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