SILVER

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Native silver occurs in a variety of vein and lode deposits of hydrothermal origin. In Michigan, it is found in the Keweenaw's native copper deposits and in certain hydrothermal gold-quartz and lead-zinc veins in Marquette County. Placer silver reportedly has been recovered from Lake Superior on the north side of Keweenaw Point, whereas placer copper is reported from both sides of the Point. The term "half-breed" has been used to describe an intergrowth of native silver and native copper.

Classic specimens of crystallized native silver have long been obtained and eagerly sought from the native copper deposits. The history of Michigan silver has been reviewed by Olson (1986). Many of the details presented below are abstracted from his account. Although silver was produced in relatively large amounts, it commonly was not recorded under company production records, as both miners and managers regarded it as their personal and private property whenever it came within their reach. By 1977 the recorded silver production for the district was 16,469,544 troy ounces, but the actual total may have been twice as much.

Figure 128: Native silver with copper from the Cliff mine, Keweenaw County, 9.5 x 10.5 cm, A. E. Seaman Mineral Museum specimen No. LLH 508, Jeffrey Scovil photograph.

Native silver and copper are intimately associated in the Lake Superior copper district, and small amounts of silver were probably found in nearly all lode and fissure deposits. Some may have formed at the same time as the copper, though most silver occurs in vugs and appears slightly later in the paragenetic sequence than the copper (Butler and Burbank, 1929). Very few specimens show the converse relationship. According to Olson (1986), most of the nugget-like "half breed" specimens seen in the marketplace are products of the stamp mills, which crushed fine crystals and "amal-gamated" the copper and silver. A very few of these intergrowths, however, may be natural, having been been formed by glacial smashing and subsequently found in alluvial gravels.

A few early mines were so rich in silver that they were initially regarded as silver rather than copper mines. Among these were the Isle Royale, Sheldon and Columbian, Huron, and Portland. The Lake Superior mine yielded so much silver from the first10 meters of its shaft that the management informed the shareholders that subsequently the mine was to be classed as a silver mine (Murdoch, 1943). With depth, however, the quantity of silver diminished. Silver was the ultimate "high graded"

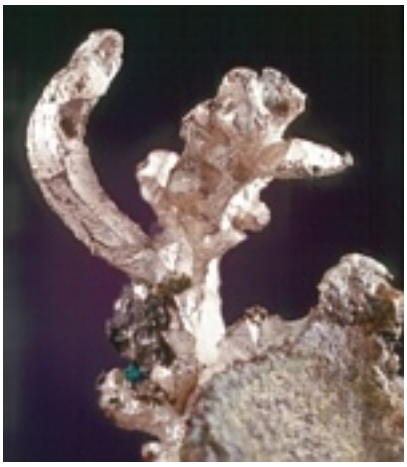

Figure 129: A curved, elongated crystal of native silver from the South Kearsarge mine, Kearsarge, Houghton County, 3.5 x 5 cm area, A. E. Seaman Mineral Museum specimen No. JTR 395, George Robinson photograph.

Figure 130: A 2 x 7.5 cm fern-like growth of crystals native silver from the Quincy mine, Hancock, Houghton County, A. E. Seaman Mineral Museum specimen No. DCG 665, Jeffrey Scovil photograph.

mineral. Mine managers ordered newly hired miners to "just set aside the white copper for me and I'll pick it up later." In many bars miners paid for their drinks in silver specimens. Others melted down the silver and sold it to jewelers. It is told that a Wolverine mine superintendent remarked that all the automobiles in Gay should have belonged to the Calumet and Hecla Company, inasmuch as they were paid for with high-graded silver.

Figure 131: A 2.5 cm crystal aggregate of native silver on prehnite with native copper and quartz from the Pewabic shaft, Quincy mine, Hancock, Houghton County, A. E. Seaman Mineral Museum specimen No. JTR 493, Jeffrey Scovil photograph.

Numerous fine specimens were found in the mines that exploited the Kearsarge and Pewabic amygdaloid lodes, especially the Kearsarge, Wolverine, and Quincy mines. Many other fine specimens have been obtained from the Copper Falls area, the Cliff mine, and other nearby fissure deposits. While wire silver is rare to absent, a wide variety of other habits has been recorded. Most crystals are at least somewhat distorted, with elongation along one axis, resulting in herringbone aggregates and "spikes." Many crystals are octahedral or dodecahedral or combinations of these forms. Some may be twinned. Rare cubic silver crystals have been found in a prospect pit near the Petherick vein at Copper Falls.

Figure 132: Dendritic silver crystals with domeykite in calcite from the White Pine mine, White Pine, Ontonagon County, approximately 3.5 cm area, Michael P. Basal collection, Jeffrey Scovil photograph.

Baraga County: Two "old silver pits" occur in section 23, T51N, R30W on Robarge Creek. Also shown on the county map is the "Old Silver Mine" on Silver River in section 6, T50N, R32W. No published reports on the geology and mineralogy of these localities are available.

Figure 133: Native silver crystals on native copper from the South Kearsarge mine, Kearsarge, Houghton County, 3.5 x 5 cm, A. E. Seaman Mineral Museum specimen No. JTR 435, Jeffrey Scovil photograph.

Dickinson County: Cuff mine, Iron Mountain: Rare. Thin sheets along joints in basalt (Lane, 1924).

Houghton County: **1.** *Isle Royale mine*: Production was recorded in 1902 and from 1909 to 1920 with a maximum of $94,000 in silver produced in 1919. Crystals, both as fine micromount specimens and sitting in jagged depressions in copper (Moore and Beger, 1963). **2.** *North and South Kearsarge mines*: The Kearsarge amygdaloid, mined largely by the Kearsarge and Wolverine mines, probably yielded more fine silver specimens that any other lode. Olson (1986) illustrates a number of fine specimens. **3.** *Wolverine mine*: Occurrence similar to the adjacent Kearsarge mines. Olson (1986, Figures 15, 17, 19, and 20) shows superb groups of silver crystals. **4.** Osceola mine: Produced silver from 1878 to 1892. **5.** *Quincy and Pewabic mines*: Fine silver crystals with rounded dodecahedral copper crystals (MacFall, 1983, Figure 131). Olson (1986, Figure 11) shows a globular aggregate of silver crystals 2.5 cm across on prehnite from the Pewabic shaft (later Quincy Number 6). Nearly a million dollars in silver is the recorded production from 1862 to 1925. **6.** *Franklin mine*: Fine specimens similar to those from the Quincy mine. **7.** LaSalle mine: Recorded production from 1914 to 1917. **8.** Superior mine: Produced from 1913 to 1917. **9.** Atlantic mine: A large calcite vein cutting amygdaloid contained nests and pockets of silver and copper (Rominger, 1895). **10.** *Baltic mine*: Fine crystalline aggregates on copper, up to 2.9 cm across (Olson, 1986, Figure 6). **11.** Calumet and Hecla mine: Crystals and "halfbreeds," including a slab about 12.5 cm long (Harvard Mineralogical Museum collection) (Olson, 1986). Recorded silver production was 1 million ounces for 1916 to 1919. **12.** *Lake Superior mine*: Silver crystals possibly in epitactic overgrowth on copper are shown by Olson (1986).

Iron County: **1.** Great Western mine, Crystal Falls. **2.** Chicagon mine, Iron River: Occurrences at both mines are rare, thin sheets along joints in basalt (Lane, 1924).

Keweenaw County: **1.** *Cliff mine*: The Cliff fissure had the distinction of being the most silver-rich fissure in the district. Silver occurred there as crystals with copper or prehnite and in amygdules in basalt. Some crystals show complex octahedral forms, while others occur perched on copper or

"halfbreed" wires. Many hung like little bells from copper wire arches (Moore and Beger, 1963). Production recorded from 1847 to 1852 and 1858 to 1871 was 60,000 ounces. The crystals are brilliant, sharp, and morphologically complex, occurring on prehnite and "delessite" (chamosite-clinochlore). One highly distorted crystal showed the following forms: {001}, {011}, {013}, {012}, {047} and {344}, with multi-lamellar twinning on {111} (Williams, 1966). Some crystals associated with chalcocite may be rimmed by small, twinned acanthite blades. **2.** *Eagle River*: Fine silver-copper specimens (Harvard University collections, number 632). **3.** Seneca mine: Found in part as coatings on epidote crystals (Moore and Beger, 1963). **4.** *Phoenix mine*: Fine crystals. Production from 1872 to 1878 and 1904. **5.** *Central mine*: Fine crystals. **6.** Mount Bohemia area: With calcite in a vein in a drill core. **7.** *Ahmeek mine*. **8.** Delaware mine. **9.** Iroquois mine. **10.** Medora mine: (7-10, Morris, 1983). **11.** *Copper Falls mine*: The Copper Falls mine yielded about 30,000 ounces of silver, most of which came from various fissure veins of which the Owl Creek fissure was the most productive (Olson, 1986). Some delicate and beautiful groups of silver crystals were found by Don Pearce of Calumet in 1982. **12.** *Prospect pit, Copper Falls*: Located just north of the Petherick vein, this small surface vein was found in 1980 by a prospector with a metal detector. This "vein" was in fact a mineralized basalt flow top comprising vuggy prehnite with minor analcime and chalky white datolite, and produced few, but superb, groups of cubic silver crystals up to 5 mm in size. Rare and unusual skeletal cubic crystal aggregates of silver on prehnite are depicted by Olson (1986). **13.** Copper Harbor: A most unusual occurrence of silver in agate is exposed on the west bank of a small creek that crosses highway 26 approximately 2.5 km west of Copper Harbor. A limited number of exceptional specimens have been found (S. M. Carlson, personal communication, 2000).

Livingston County: In the Winans Lake fulgurite (q.v.): As rare microscopic blebs with native gold, silicon, graphite, and iron silicides (q.v.) and phosphides, all enclosed in lechatelierite (q.v.) (Essene and Fisher, 1984; Essene, 1985).

Marquette County: **1.** Immediately north of Dead River Storage Basin: Old mines and prospects on quartz-carbonate-sulfide (lead-zinc) veins along small faults and shears have yielded a few tons of lead-silver ore (Segerstrom and Raymond, 1966). **2.** Presque Isle: A minor constituent in veins in altered peridotite (Spiroff, 1940). **3.** Ropes gold mine, NW ¼ section 29, T48N, R27W: Jopling (1897) reports that $50,000 in silver was recovered from 1881 to 1897, but does not mention its mineralogic source. Likewise, both Snelgrove et al. (1944) and Broderick (1945) state the ore assayed 0.9 oz. silver per ton, but do not identify the form of the silver. According to Bornhorst et al. (1999) silver is present as auriferous native silver, "electrum," argentiferous tetrahedrite, argentiferous galena, and rare dyscrasite. **4.** Holyoke mine: A lead-silver quartz vein deposit in the NE ¼ section 2, T48N, R27W, about 13 km north of Ishpeming. The workings, which also contained gold (Maguire, 1986), closed in 1866. **5.** Clark Creek region: An anomalous silver assay was obtained from an area of galena mineralization associated with a shear zone in meta-basalt in the Ishpeming greenstone belt (Baxter et al., 1987). See galena, arsenopyrite, pyrrhotite, pyrite, gold.

Ontonagon County: **1.** *White Pine mine*: Forms rims on disseminated native copper and films with native copper along the bedding planes and cross fractures in the Nonesuch Shale (Doane, 1956; Carpenter, 1963; Brown, 1966, 1968). Very minor occurrence in the Copper Harbor Conglomerate chloritic facies (Hamilton, 1967). Superb specimens of arborescent and herringbone crystal aggregates occurred in late-stage calcite veins in the Southwest orebody (Rosemeyer, 1999). **2.** *National mine*: Crystal groups. Production from 1860 to 1869. **3.** *Caledonia mine*: As well-formed crystals associated with native copper, and occasionally epitactic on copper crystals. In August, 1994, a number of very fine specimens of crystallized silver were recovered from the 850 Stope, 4th level, Knowlton lode by Red Metal Minerals. **4.** *Mass mine*: Production in 1903, 1908 to 1909, and 1916 to 1919. Renowned for fine specimens (Rominger, 1895). Known for its sharp silver microcrystals (Olson, 1986). **5.** Rockland mine: Production from 1859 to 1861. **6.** *Minesota mine*: Murdoch (1943, page 95) tells how, between 1848 and 1870, this mine was operated so loosely that at one time two kegs of silver nuggets were misplaced and their loss shrugged off. They were found 2 years later in an abandoned shed. Production recorded from 1856 to 1863. A

beautiful crystal group nearly 7 cm across is depicted in Figure 10 of Olson (1986). **7.** Little Iron River: A silver "vein," reportedly found by Austin Corser in 1855, was developed as the Scranton, Ontonagon, Superior, and Collins mines. In 1875, a bar of silver was poured weighing 523 ounces and worth $732.20 at that time (Murdoch, 1943, pages 100 - 104). R. W. Seasor (written communication, 1977) reports, "All of the old reports on the Iron River silver district in Ontonagon County refer to the discoveries as 'veins' of silver. Mapping and drilling show that the 'veins' are actually the basal portion of the Nonesuch Formation. The early miners misinterpreted the transitional beds between the Copper Harbor Conglomerate and the Nonesuch as veins. The silver discoveries were in an area where the Nonesuch is folded between cross faults, has a slightly higher than normal dip, and has been mineralized with silver to a much higher degree than is average for the rest of the White Pine deposit. The dramatic difference between the Copper Harbor Formation and the Domino bed, the first black shale in the Nonesuch sequence, gave rise to the early thoughts that the 1 to 2 feet of rock in between was a vein filling on a fault zone." **8.** Adventure mine, Greenland: Crude crystals up to 2 cm long have been obtained (Rominger, 1895; Morris, 1983; Olson, 1986). **9.** Ridge mine: Fine specimens (Rominger, 1895).

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UPDATE

Baraga County: Huron River uranium prospect, NW ¼ NW ¼ section 1, T51N, R30W: as hackly blebs and aggregates of dendritic microcrystals to 0.25 mm and sheets to 1 mm associated with bornite in a small dug-out area on the west side of the river. Electron microprobe analyses show this silver contains from 16.48% to 30.55% mercury, suggesting at least some of it may be eugenite (q.v.) (Carlson et al., 2007a).

Huron County: Lake Huron shoreline near Point aux Barques: An historically interesting account is given by Henry Schoolcraft (1855) of the discovery of a native silver specimen near Point aux Barques by a Native American in the early 1820s. The specimen was confirmed as native silver by wet-chemical analysis at the New York Lyceum of Natural History, and described as a "rolled mass" (probably a glacially-transported boulder) consisting of silver veinlets and flattened masses in a matrix composed of quartz, calcite, and "steatite" that appeared to have been "detached from a stratum of gneiss."

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