ALMANDINE

$(Fe^{2+})_3Al_2(SiO_4)_3$

(see also garnet)

An iron aluminum garnet characteristic of medium-grade metamorphic micaceous schists and gneisses. It also occurs in some pegmatites and metamorphosed iron formations, as well as a heavy detrital mineral in sands and sandstone. Iron formation in the western part of the Marquette range, in the Felch area of central Dickinson County, and in northeastern Iron County contains almandine as a minor constituent of magnetite-quartz, magnetite-grunerite-quartz, and grunerite-quartz rocks (James, 1955). Retrograde metamorphism has transformed some almandines chiefly to chlorite. Analyses given by Penfield and Sperry (1886), when compared with the composition of the garnet that was replaced, shows that the chloritization was not an isochemical conversion.

Because of its widespread occurrence, only the more noteworthy localities for almandine are listed. Mainly Northern Peninsula.

Baraga County: *Spurr Mountain iron mine*: Dodecahedral garnet porphyroblasts up to 5 cm in diameter developed in the Bijiki Iron Formation have been partly replaced by chlorite with 5-50% garnet remaining in the pseudomorphs (Pumpelly, 1875). Van Hise and Leith (1911) state that the replacing material is a mixture of green amphibole, magnetite, and chlorite. Analysis of this garnet is given by Penfield and Sperry (1866).

Figure 32: Almandine crystals in quartz from the Champion mine, Champion, Marquette County. 6.5 x 7.5 cm. A. E. Seaman Mineral Museum specimen No. DM 16852, Jeffrey Scovil photograph.

Dickinson County: 1. Felch Mountain iron district: In fine-grained mica schists with accessory tourmaline (garnet, Part III). **2.** Pegmatite quarry, SE ¼ section 19, T42N, R29W, Randville area: Crystals of almandine-spessartine occur in pegmatite with black tourmaline, muscovite, and other minerals (James et al., 1961). **3.** Approximately a kilometer east of the Groveland iron mine: As small trapezohedral crystals of almandine-spessartine in pegmatite (Pratt, 1954). **4.** Groveland mine: As dodecahedral crystals to 2 cm partially altered to chlorite in chlorite-mica schist (M. P. Basal, personal communication, 1999).

Houghton and Keweenaw Counties: In the Jacobsville Sandstone as a heavy, detrital accessory mineral (Denning, 1949).

Marquette County: 1. *Beacon iron mine*: Similar pseudomorphs as described from Baraga County. Mandarino (1950) describes the chlorite as "aphrosiderite" (Spiroff, 1940; *Rocks and Minerals*, Vol. 30, p. 29, 1955). **2.** *Champion mine*, 32nd sublevel, about 180 meters east of Number 7 shaft: In a matrix of pyrrhotite, chalcopyrite, minor pyrite, and

quartz (Babcock, 1966a, b). **3.** Washington mine: Partly altered dodecahedra, generally less than 2 cm long, in chlorite schist. **4.** Republic Mountain: Similar occurrence (Brooks, 1873). **5.** *Edwards mine*: glassy, red dodecahedral crystals to 1.5 cm in mica schist (M. Basal, personal communication, 1999). Also southeast of Edwards iron mine: 2 to 5 mm crystals in chlorite-muscovite schist. The Edwards mine has today been incorporated by the Humboldt mine. **6.** Smith Mountain: In chlorite schist (Brooks, 1873). **7.** Republic area: In contact zones between iron formation and diorite (Snelgrove et al., 1944). At the Republic iron mine (Morris, 1983). **8.** *Michigamme mine*: Dodecahedral crystals up to 7.5 cm partially altered to chlorite in chlorite schist (DeMark, 2000). Excellent specimens have been found. **9.** At bridge on M-95 0.4 km south of Republic: Olive-colored fine-grained crystals in contorted bands with grunerite (K. Spiroff, personal communication).

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