

AUGITE



(see also *diopside*, *pigeonite*, and *pyroxene*)

Augite is a common and widespread rock-forming mineral, chiefly in ultramafic, mafic, and intermediate igneous rocks, both intrusive and extrusive. These include pyroxenites, gabbros, basalts, andesites, and diorites. Augites from the mafic lavas of the Portage Lake Series have compositions in the range $\text{Wo}_{45-38}\text{En}_{45-36}\text{Fs}_{19-17}$ (Scofield, 1976; Livnat, 1983). “Diallage” is a varietal name of augite extensively used in older petrographic descriptions of Precambrian gabbroic rocks of the Northern Peninsula (see, e.g., Bayley, 1904, page 137 ff). Augite also occurs in various high-grade metamorphic rocks (e.g., pyroxene gneisses and granulites), and as a detrital accessory mineral in some sedimentary rocks. Chiefly Northern Peninsula, and in some clastic sediments in the Southern Peninsula.

Dickinson County: 1. SW $\frac{1}{4}$ section 26, T39N, R29W on County Road 577. Large prismatic “diallage” in a dark blackish green massive serpentine matrix (Rominger, 1895). 2. Site 70 and 70B kimberlites near Norway: Dark, emerald green xenocrysts several centimeters across have been found in these hypabyssal kimberlites. This material has been reported as “chrome diopside,” but is probably chromian augite. 3. Site 69 kimberlite near Felch: Similar occurrence. (2, 3 S. M. Carlson, personal communication, 1995). 4. Booga kimberlite, located about 8 km north of Waucedah: Anhedral fragments of yellow-green chromian augite to 1 cm have been found in a bright green clay (highly weathered kimberlite) that outcrops along an old logging road (S. M. Carlson, personal communication, 1998).

Genesee County: Near Mount Morris, SW $\frac{1}{4}$ NW $\frac{1}{4}$ section 6, T8N, R7E: Titanian augite occurs with authigenic microcline and numerous other detrital species in a 8 meter water well in lacustrine sediments (Stewart, 1937).

Gratiot County: Near Ithaca, T10N, R2W in Michigan Basin Deep Drill Hole: In the altered lower basalt unit titanian augite occurs as corroded remnants in the assemblage albite-epidote-actinolite-chlorite. Analyses are given by

McCallister et al. (1978) and Heinrich and Pollack, (1978).

Houghton and Keweenaw Counties: 1. Jacobsville Sandstone: Detrital (Denning, 1949). 2. In rocks of the Keweenawan series: a. Ophitic basalt (along with small amounts of “hypersthene” and pigeonite). b. Pegmatoidal basalt. c. Amygdaloidal andesite. d. Silicic and chloritic aplite (Cornwall, 1951b). Lane (1911) also reports titanian augite in some Keweenawan flows. 3. Greenstone cliff: 5 cm crystals in pegmatoidal basalt. 4. Mount Bohemia: In gabbro with “labradorite” and olivine.

Iron County: Pyroxenes are widely distributed in the various inclusions of the Lake Ellen kimberlite, SW $\frac{1}{4}$ section 27, T44N, R31W (kimberlite). The clinopyroxenes are principally augites, although some are diopside (q.v.) (S. M. Carlson, personal communication, 1998). The orthopyroxenes are aluminian enstatites (q.v.). Augite occurs in the kimberlite both as xenocrysts and in a variety of xenoliths (McGee and Hearn, 1983). Analyses of many of these are provided by McGee and Hearn (1983) in tables 7a and 7b.

Marquette County: 1. Clinopyroxene, olivine (q.v.) enstatite (q.v.), and plagioclase are the essential minerals in a body of partly serpentinized lherzolite (also known as the Yellow Dog peridotite) which crops out in only two places in sections 11 and 12, T50N, R29W in northern Marquette County (Klasner et al., 1979). These clinopyroxenes are diopsidic augites of the component composition, $\text{En}_{41.53}\text{Wo}_{36.48}\text{Fs}_{11}$. 2. Larger augite crystals in a finer matrix of plagioclase-hornblende in metagabbro near Republic (Hawke, 1976). 3. Presque Isle (Morris, 1983).

Menominee County: 1. Site 73 kimberlite north of Hermansville: Olivine from this kimberlite contains inclusions of emerald green clinopyroxene, presumably chromian augite, but possibly chromian diopside (q.v.). 2. Till exposures along a railroad grade in section 10, T37N, R27W: Numerous dark green clinopyroxene fragments to 1 cm. Specimens from this locality have been sold as “chrome diopside,” but they are more likely chromian augite (1, 2 S. M. Carlson, personal communication, 1998).

Ontonagon County: 1. Thomaston quadrangle on Canyon Creek, section 8, T49N, R44W: Found in basaltic lavas of the Portage Lake Volcanics. A pegmatoid phase of the basalt contains phenocrysts of acicular augite as much as 4 cm long (J. T. Wilband, personal communication). **2.** Bond Falls Storage Basin area. Chromian augite (up to 1.12% Cr₂O₃) occurs as phenocrysts with chromite (q.v.) and altered olivine in basal pillow lavas of the Keweenaw Siemens Creek Formation. The composition is Wo₃₇En₅₁Fs₁₂ (Mattson et al., 1986).

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