stract of the present findings appeared (Frondel, 1957). The 1H polytype also appears to have been observed by Bannister (1938) on material from Wheal Jane, Cornwall. At all of the localities mentioned in Table 1 the mineral occurs as a low-temperature hydrothermal product associated with siderite, pyrite, sphalerite and quartz in sulfide veins.

Stacking disorder, already noted by Hendricks (1939) in his 3R material, is particularly marked in the 9R polytype from Cornwall. It appears as diffuse scattering in zones with constant h and k indices, variable l, and h not a multiple of 3, due to random displacements of $na/3$. Steadman and Youell also mention a disordered 1H polytype. All of the polytypes have marked pseudo-cells with $a=3.19$ Å and $c=7.09$ Å (1H), 14.19 Å (2H), 21.29 Å (3R) or 21.28 Å (9R). The true and pseudo-cells are related by a 90° rotation around the c-axis in the 1H, 2H and 3R polytypes and are parallelly oriented in the 9R polytype.

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THE AMERICAN MINERALOGIST, VOL. 47, MAY–JUNE, 1962

FERROAN ANTIGORITE (JENKINSITE)[1]

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The ill-defined mineral jenkinsite, here shown to be a ferroan variety of antigorite, was named by C. U. Shepard (1852) in 1852. Two chemical analyses were reported by J. L. Smith and G. J. Brush in 1853. The mineral was later placed by E. S. Dana (1892) together with hydrophite among various ill-defined substances allied to serpentine. Jenkinsite was found as greenish coatings on fissures lined with magnetite crystals at O'Neil's mine near Monroe, Orange County, New York. This mine is one of a number of small magnetite deposits found in the Precambrian Grenville formation of the Highlands of New York and northern New Jersey.

Authentic specimens of jenkinsite are preserved in the Harvard, U. S. National Museum and American Museum of Natural History collec-

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[1] Mineralogical Contribution No. 406, Harvard University.

TABLE 1. ANALYSES OF JENKINSITE

	1.			2.	3.	4.
MgO	25.00	Mg	1.939	22.87	22.75	21.08
FeO	21.03	Fe	.916	19.30	20.60	22.73
MnO	2.53	Mn	.112	4.36	4.05	1.17
Al_2O_3	0.48	Al	.029	0.53	0.98	2.90
SiO_2	37.84	Si	1.971	38.97	37.42	36.19
H_2O	13.29	H	4.614	13.36	13.48	16.08
		O	9.259			
Total	100.7			99.39	99.28	100.26

1. Jenkinsite, Monroe, N. Y. Analysis by Jun Ito, 1955. Sample treated by heavy liquid and magnetic techniques. Formula calculated on the assumption that (Si, Al) = 2, with sufficient (OH) assigned to provide valence compensation; the remaining H_2O is regarded as nonessential. Some Fe^{3+} probably is present.

2, 3. Jenkinsite. Monroe, N. Y. Original analyses of Smith and Brush (1853), made on different specimens.

4. Hydrophite. Taberg, Sweden, Svanberg (1839). Total includes V_2O_5 0.11.

tions. The *x*-ray powder diffraction pattern is identical with that of antigorite from the Val Antigorio, Italy. The basal spacings, uncorrected for film shrinkage, are: (002) 7.230, (004) 3.615, (006) 2.415, (008) 1.816, (0.0.10) 1.453 Å. There is no apparent change in the pattern when the material is heated in air at 300° with complete oxidation of the Fe^{2+} to Fe^{3+}. A new chemical analysis (Table 1) shows a small excess of water over the requirements of the antigorite formula:

$$(Mg_{1.94}Fe^{2+}_{.92}Mn^{2+}_{.11})_{2.97}(Si_{1.97}Al_{.03})_2(O_{4.91}OH_{.09})_5(OH)_4 + 0.26H_2O.$$

The two old analyses show (Si, Al):(Mg, Fe, Mn) = 2:2.83 and 2:2.72.

Under the microscope, the mineral appears as a subparallel aggregate of laths. There is a perfect cleavage parallel to the flattening (with α perpendicular thereto), an imperfect cleavage with its trace on the laths parallel to the elongation (with γ parallel thereto), and a poor cleavage with its trace perpendicular to the elongation. The bulk of the material has indices of refraction within 0.002 of the values cited in Table 2, with the rest ranging from about 1.600 to slightly over 1.61. Other specimens, slightly different in color and mode of aggregation, showed γ ranging down to 1.592. Weakly pleochroic in greenish yellow, with absorption $X < Y = Z$. Material heated at 300° had more intense pleochroism in yellow-brown with γ increased to about 1.62.

A few other minerals also appear to be highly ferroan varieties of antigorite. Hydrophite, a little-known serpentine-like mineral described

TABLE 2. OPTICAL PROPERTIES OF JENKINSITE AND ANTIGORITE

	α	β	γ	2V	FeO	MnO	Fe_2O_3	Ref.
Jenkinsite	~1.595	1.603	1.604	small (−)	21.03	2.53		
Antigorite	1.5615	1.5660	1.5670	47½° (−)	0.81	0.04	0.90	Hess *et al.*, 1952
Antigorite	1.560	1.563	1.564	55° (−)	0.69	nil	0.88	Zussman, 1954

(Svanberg, 1839) in 1839 from Taberg, Sweden, is fairly close in composition to jenkinsite (Table 1). It has (Fe, Mn):Mg = 1:1.57. A non-type but probably authentic specimen gave the *x*-ray pattern of antigorite. This material was very fine-grained and virtually isotropic, olive green in color, with a mean index of refraction of 1.600. An unanalyzed yellowish brown mineral found as an alteration product of fayalite at Brynäs, Sweden, has been called ferroantigorite by von Eckermann (1925). It has $\gamma = 1.630$. Greenalite, which has the crystal structure of antigorite (Gruner, 1936; Orcel *et al.*, 1949), may represent the more or less oxidized iron end-member of a series extending from antigorite by substitution of Fe^{2+} (and Fe^{3+}) for Mg. The chemical composition, based on relatively poor analyses, is given (Leith, 1903; Gruner, 1936) as

$$\overset{2+}{Fe_9}\overset{3+}{Fe_2}Si_8O_{22}(OH)_{12}\cdot 2H_2O.$$

This is near

$$(\overset{2+}{Fe}_{2.46}\overset{3+}{Fe}_{0.54})_3Si_2O_5(OH_{3.46}O_{0.54})_4.$$

The mean index of refraction of very fine-grained Mesabi greenalite has been given (Jolliffe, 1935) as 1.675, and a specimen here examined had a mean index of 1.690. The names jenkinsite and hydrophite (if the identity of the latter material with antigorite is confirmed) may well be abandoned in favor of the term ferroan antigorite.

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