not exceeding 115°C. All As_2O_3 is thus transferred to the condensing flask where it is determined by titration. The residue in the flask is reduced with filter paper, CuCl, and more conc. HCl, any As_2O_5 present thus being changed to As_2O_3, which is then determined by a repetition of the first process.

The mineral most nearly resembling this one in appearance and physical properties is dixenite, described by Flink from Långban, Sweden. To it has been assigned the almost equally complex formula: $21(Mn,Ca,Fe)O \cdot 4SiO_2 \cdot 4As_2O_3 \cdot 5H_2O$.

No attempt will here be made to transform either of these empirical formulae into a more intelligible form. Material is accumulating from the study of Franklin and Sterling Hill occurrences tending to show that these two minerals are part of a group together with friedelite, schallerite and some intermediate members. A full discussion of this relationship is reserved for a future paper when the material has been more fully elaborated.

The authors take much pleasure in naming this new mineral for J. J. McGovern, for many years the foremost of local collectors at Franklin, who died in 1915. From his place of duty at the picking-table at the shaft-head his keen eyes enabled him to save many a rare specimen from going to the crusher; and as he was always ready to place his discoveries in the hands of scientific mineralogists for study, he added largely to our knowledge of Franklin mineralogy.

OPTICAL NOTES ON SOME OF THE VARIABLE CONTACT MINERALS FROM EDENVILLE, NEW YORK

M. J. Buerger, *Massachusetts Institute of Technology.*

The writer has recently completed a brief study of the optical properties of some of the contact minerals from the limestone near Edenville, New York, and since the constants of several of these variable species differ from those recorded in standard reference books, it seems of interest to record the data obtained. The specimens were collected in August, 1925, by Dr. Joseph L. Gillson. Referring to the U. S. Geological Survey topographic sheet of the Goshen, N. Y., quadrangle, the specimens were taken from a stone fence near the road forks marked 451 (elevation), a little over a mile northwest of Edenville. Actual contact exposures are poor.

The geology of the locality has been described by Kemp and Hollick.[1] Briefly summarized, relatively small masses of granitic rock are intrusive into Cambrian limestone with the attendant development of characteristic contact minerals.

The minerals visible in hand specimens include: a black amphibole with conspicuous cleavage faces; rounded granules and cleavage flakes of golden-brown phlogopite; irregular areas of greenish-tinged scapolite; dolomite; quartz; serpentine; tourmaline; perthite; minute amounts of pyroxene; and the metallic minerals: graphite, pyrite, arsenopyrite, and pyrrhotite. Microscopic examination further reveals the presence of rounded grains of pleochroic titanite and shreads of muscovite, the latter as an alteration product of the scapolite. Heinrich Ries, in an appendix to Kemp and Hollick's paper,[2] lists a great number of other minerals found in this locality.

SCAPOLITE.—The scapolite examined checked with the data listed by Larsen[3] for wernerite, having indices:

$$e = 1.552 \pm .003$$
$$\omega = 1.581 \pm .003.$$

These correspond with the indices of mizzonite (marialite 60, meionite 40) on Winchell's graph.[4] However, fragments from portions of some hand specimens gave anomalous biaxial figures with small optic axial angles.

PHLOGOPITE.—Phlogopite is apparently of general occurrence in the area, being found both at the contact and in the crystalline limestone at some distance from the intrusives. The hand specimens show it to occur as numerous, well-rounded, dark granules with bronzy to golden-brown cleavage faces. The optical properties were determined as:

Biaxial negative			Pleochroism
$\alpha = 1.546 \pm .003$	$2V = 14°$	Optical orientation	X = Colorless
$\beta = 1.580 \pm .003$		X = c, Approximately	Y = Yellowish pink
$\gamma = 1.580 \pm .003$	$\rho < \nu$ Strong		Z = Yellow with brownish tinge

Absorption X < Y and Z

[1] Kemp, J. F. and Hollick, Arthur; The granite at Mounts Adam and Eve, Warwick, Orange Co., N. Y., and its contact phenomena. *Ann. N. Y. Acad. Sci.*, **7**, pp. 638–654 (1893).

[2] *Op. cit.*, pp. 651–654.

[3] Larsen, Esper S.; The microscopic determination of non-opaque minerals. *Bull.* **679**, *U. S. Geol. Survey*, p. 195 (1921).

[4] Winchell, A. N.; The properties of scapolite. *Am. Mineral.* **9**, fig. 1, p. 110 (1924).

Kemp and Hollick[5] give the optic axial angle of the phlogopite they examined as approximately 5°.

These data do not check with those given by Larsen[6] for phlogopite, the indices being much too low, the dispersion too strong, and the pleochroism different. The indices check much better with Larsen's cryophyllite[7] but the absorption is different, especially for the direction X. In the absence of an analysis, the mica can not be readily assigned to a definite variety, but its physical appearance suggests it to be a phlogopite.

SERPENTINE.—What appeared, in the hand specimen, to be chondrodite proved, on microscopic examination, to be a biaxial positive serpentine of very low birefringence and small optic axial angle. The β index was determined as about 1.545. The serpentine is doubtless the alteration product of chondrodite, for practically the same condition is mentioned by Kemp and Hollick,[8] who wrote, "The alteration [of chondrodite] yields an isotropic aggregate . . . . and the whole effect is very like altered olivine."

PYROXENE.—The pyroxene is a light greenish mineral, apparently the same as that mentioned by Kemp and Hollick. Little was done on its optical properties due to the scarcity of material; only one or two small grains were available. The data on hand are:

Biaxial positive.

$\alpha=1.685$[9] $\beta=1.690\pm.003$ $\gamma=1.705\pm.005$	2V = rather small $\rho>\nu$ moderate	Pleochroism not noticeable

AMPHIBOLES.—The Edenville amphiboles offer a very interesting mineral series. At least three varieties are recognized from this locality: edenite, pargasite, and hornblende (unqualified). In the suite studied only pargasite was represented but through the courtesy of Mr. Earl V. Shannon some fragments of type edenite were obtained for the purposes of optical study. The optical properties determined on edenite and pargasite were:

[5] *Op. cit.*, p. 644.
[6] *Op. cit.*, p. 255.
[7] *Op. cit.*, p. 251.
[8] *Op. cit.*, p. 647.
[9] The α index was estimated, but is probably not in error by more than .005.

EDENITE: Biaxial postive.[10]

$\alpha = 1.606 \pm .003$	2V = large	Optical orientation	Color of hand specimen: white, with greyish tinge
$\beta = 1.617 \pm .003$		$Y = b$	
$\gamma = 1.634 \pm .003$	$\rho > \nu$ distinct	$Z \wedge c = 31°$	

Pleochroism, none.

PARGASITE: Biaxial positive.

$\alpha = 1.638 \pm .003$	2V = 80° approx.	Optical orientation	Color of hand specimen: black, with brownish tinge
$\beta = 1.645 \pm .003$		$Y = b$	
$\gamma = 1.654 \pm .003$	$\rho > \nu$ quite distinct	$Z \wedge c = 31°$	

Pleochroism: X = pale greyish, almost colorless, Y = pale brownish; Z = pale greyish with a bluish cast

Absorption: X < Y and Z

No hornblende was examined, but the pleochroism of the pargasite is somewhat similar to that mentioned by Kemp and Hollick[11] for a greenish-brown hornblende occurring in the limestone between Mounts Adam and Eve, which had: X = very light yellow; Y = faint yellowish brown; Z = faint bluish green. The extinction angle is given by these authors as 20°.

Ford[12] gives as the optical properties of the Edenville hornblende:

Biaxial Negative

$\alpha = 1.6583$	2V = 81°42′	Pleochroism:
$\beta = 1.6701$		X and Y = light brownish-green;
$\gamma = 1.6789$	$Z \wedge c = 23°48'$	Z = dark green

Absorption: Z > Y = X

Fortunately the analyses of these minerals are available for comparison.

[10] This sign is uncertain, optic axis figures yield practically straight bars. If the sign is (−) the dispersion accordingly is $\rho < \nu$.

[11] *Op. cit.*, p. 645.

[12] Ford, W. E.; A contribution to the optical study of the amphiboles. *Am. Jour. Sci.*, (4) 37 p. 181 (1914).

	I Edenite from Edenville	II Pargasite from Edenville	III Hornblende from Edenville
SiO_2	51.67	42.50	41.99
TiO_2	.....	0.63	1.46
Al_2O_3	5.75	15.65	11.62
Fe_2O_3	2.86	5.65	2.67
FeO	.....	8.54	14.32
MnO	.....	trace	0.25
MgO	23.37	11.66	11.17
CaO	12.42	13.40	11.52
K_2O	0.84	not deter.	0.98
Na_2O	0.75	not deter.	2.49
H_2O total	0.46	1.01	0.69
F_2	.....	not deter.	0.80
	98.12	99.04	99.96

I Analysis No. 100 quoted in Dana's System, 6th Edition, p. 395.
II Analysis by Earl V. Shannon.
III Analysis No. 7 given by W. E. Ford, *Op. cit.*, p. 181.

Analysis II was made on about one-half gram of the pargasite appearing in the hand specimens collected by Dr. Gillson. While the weight of the sample was indeed small, it was very pure, having been hand picked under high power binoculars and found to be free from impurities by microscopic examination. The small amount of the sample sent for analysis precluded the determination of sodium, potassium and fluorine, but the total shows that these are probably not in excess of one per cent.

It will be noted that the usual increase of refractive indices and absorption accompanies an increase in iron content. However, the number of replacing atoms in the crystal series makes any exact linking of optical properties and chemical composition very complicated. The extinction angle is greatest for the intermediate pargasite and it is noteworthy that while hornblende is almost always optically negative, the pargasite examined is positive and the edenite is also positive, but with an optic axial angle of almost, if not quite, 90°.