Inesite From Waihi Mine, North Island, New Zealand.

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RECENTLY Mr. F. T. Seelye (1937), of the Dominion Laboratory, has published a careful analysis of a specimen of the mineral inesite, a hydrated silicate of calcium and manganese, from Waihi Mine; this specimen (P. 5161) is now lodged in the collections of the New Zealand Geological Survey. A microscopic examination of crushed material has revealed data which do not wholly accord with those recently recorded for inesite by J. J. Glass and W. T. Schaller (1939).

According to Seelye (*op. cit.*, p. 199), " the mineral was found by Mr. W. Morrison, underground manager, in a vugh about 2 feet long and 2 inches wide at the centre of a 6 inch leader of crystalline quartz, where the leader joined the main north branch of the Martha Lode, about 30 feet above No. 4 level in the Hooper shrinkage block. The pink mineral lined the inside of the vugh for a thickness of about ½ inch." Further, Seelye stated that " a considerable quantity of the mineral associated with rich sulphides has recently been found."

In the hand specimen the mineral occurs in flesh-pink, radiating fibres up to ½ inch long, as vein-like masses, attached to walls of quartz, amethystine in parts, or propylitized andesite. Lenticles of amethystine quartz and altered andesine also occur within the vein-like mass of inesite itself. The mineral has a vitreous lustre, white streak, and an indication of two cleavages. The hardness is 5½–6 and the specific gravity at 18° C. is 3·003. Microscopically it is observed that the fibres of inesite are intergrown with quartz, and from Seelye's analysis of untreated material (Table 1, column 1) carbonate is also present.

In the writer's preparations of the crushed inesite mounted in Canada balsam the majority of the plates lie oriented in such a position that the α axis of the refractive index ellipsoid is inclined at only a few degrees ($< 25°$) to the plane of the glass slip. Now since Winchell (1933, p. 413) states that the α axis is nearly normal to 010, i.e., normal to the best cleavage, the majority of the plates of the Waihi inesite appear to lie with 010 at high angles to the glass slip; this must mean then that the plates are lying on the second best cleavage face (100). It should be noted here that this orientation differs from that prevalent in preparations used by Glass and Schaller (*op. cit.*, p. 27), who state that the elongated lath-like plates most commonly lie on the most perfect cleavage, *b* (010). Universal stage measurements on (100) plates of inesite from Waihi give extinction angles of 10°–13° to the elongation. This corresponds to the data given by Winchell [*op. cit.*: extinction on 100 ($\beta' \wedge 010$) = 10°–12°] and Glass and Schaller [*op. cit.*, p. 28: plates parallel to *a* (100) extinguished 13°–15° against the elongation]. On some

crystals the angle $\alpha \wedge c = 74°–78°$ was found†; hence the extinction angle, 10°–13° observed in those sections where α is nearly in the plane of the section. Further in plates parallel to (100), the writer finds that an optic axis is to be seen on the edge of the field; this is in agreement with the findings of Winchell, although Glass and Schaller state that such sections do not show interference figures.

TABLE I.

CHEMICAL AND OPTICAL DATA OF THE WAIHI INESITE.

	1.	2.	3.
SiO_2	52.08	45.30	46.27
MnO	29.78	35.80	36.57
CaO	6.69	8.04	8.21
MgO	1.73	0.52	—
FeO	0.68	0.82	—
Al_2O_3	0.46	0.56	—
Na_2O	0.11	0.13	—
K_2O	0.05	0.06	—
CO_2	1.14	—	—
$H_2O > 105°C.$	5.03	6.05	8.95
$H_2O < 105°C.$	2.26	2.72	
	100.28	100.00	100.00

1. Complete analysis of purest portion of specimen.
2. Analysis after elimination of quartz* and CO_2, the latter as $MgCO_3$.
3. Analysis after recalculation disregarding Al_2O_3, MgO, FeO, Na_2O, and K_2O.

$\alpha = 1.6185 \pm 0.0005$ (R.I. determinations in Na light).
$\beta = 1.6395$.
$\gamma = 1.6498$.
$\gamma - \alpha = 0.0313$.
$2V = 73° - 75°$ (many measurements).
Optic sign: negative.
Slight dispersion of optic axes, $\rho > v$.

A few crystals oriented with the α axis nearly perpendicular to the glass slip [i.e., lying on the (010) or best cleavage face] were noted in the writer's preparations. Universal stage measurements made on such plates gave as mean values:

$$\alpha \wedge c = 77°.$$
$$\beta \wedge c = 34°.$$
$$\alpha \wedge c = 58°.$$

A stereogram showing these measurements is given in Fig. 1. The values correspond approximately with the extinction angle $\gamma' \wedge c = 60°$ given by Winchell (*op. cit.*, p. 413), and by Larsen (in Glass and Schaller, 1939, p. 30, table 2, no. 4) for plates lying on (010), but cannot be reconciled with the angle $\gamma' \wedge c = 29°–33°$ recorded by Glass and Schaller (*op. cit.*, pp. 28 and 30). It is possible that β and γ may have been transposed in the data given by Glass and Schaller. The writer has rechecked his own determinations and obtained independent confirmation of his results.

† α, β and the longitudinal cleavage (010) are measured in crystals lying on the (100) cleavage and then plotted on a (100) projection. From this the extinction angles $\alpha \wedge c = 74°–78°$, and $\beta \wedge c = 30°–40°$ can be measured; c in this case is got by the intersection of the observed cleavage parallel to 010, and the plane of projection (100).

* Free quartz was determined chemically by Seelye.

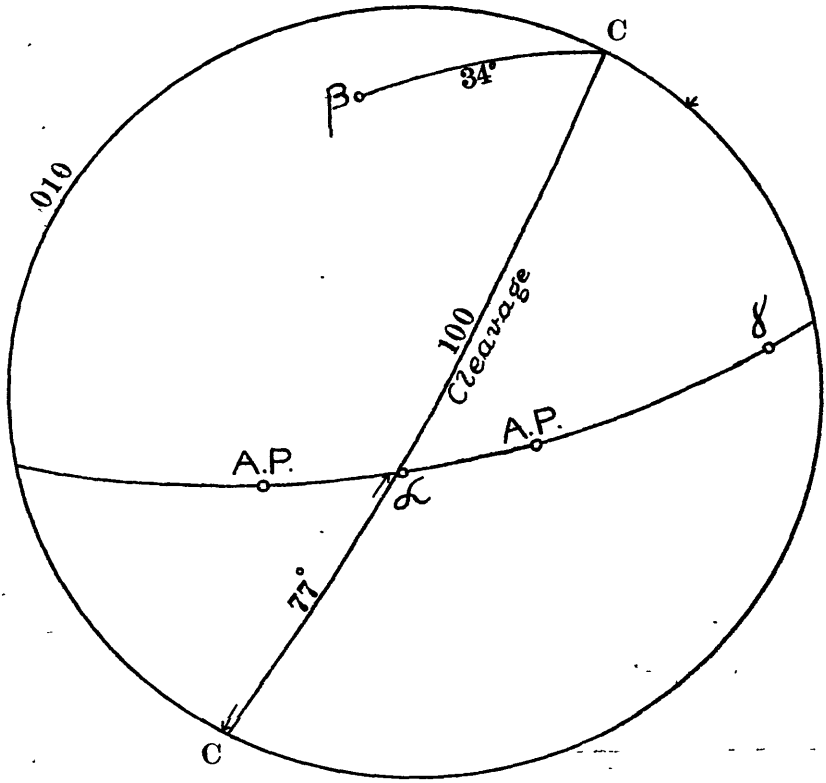

FIG. 1—Projection of section nearly parallel to 010. A.P. = optic axial points.

Chemical Composition.

The chemical composition of the New Zealand inesite closely resembles those analyses quoted by Glass and Schaller, and for convenience a comparison is made in Table II:

TABLE II.

RECALCULATED ANALYSES OF INESITE.

	1	2	3	4	5
	Germany, Bärwald.	Germany, Hampe.	Sweden, Flink.	Mexico, Farrington.	Sweden, Lundell.
SiO_2 ..	43.63	44.00	44.18	44.75	43.24
MnO ..	38.87	39.48	39.07	38.85	37.46
CaO ..	8.34	8.01	9.50	8.21	8.74
H_2O ..	9.16	8.51	7.25	8.18	10.56
	100.00	100.00	100.00	100.00	100.00

	6	7	8
	Japan, Tanaka.	Washington, Fairchild.	N.Z. Seelye.
SiO_2	44.65	45.14	46.27
MnO	38.88	37.08	36.57
CaO	7.88	9.22	8.21
H_2O	8.59	8.56	8.95
	100.00	100.00	100.00

Glass and Schaller, after a consideration of analyses Nos. 1–7, have come to the conclusion that the analyses of inesite appear to comply with the complex formula:

$$15\ SiO_2,\ CaO,\ 11\ MnO,\ 10\ H_2O.$$

This formula was arrived at by utilizing all the $H_2O < 105°C.$, part of which, it is the present writer's belief, may well be hygroscopic moisture. Nevertheless, there is a remarkable constancy in the quantity of total water present in the eight analyses of inesite quoted in Table II, but until X-ray and dehydration investigations are carried out, the part played by water will remain in doubt. The formula for inesite derived by Glass and Schaller requires the theoretical composition shown in Table III, column 1, and a comparison with the composition of the New Zealand inesite is made in column 2 of Table III.:

TABLE III.

	1	2	Difference.
SiO_2	44.42	46.27	+1.85
MnO	38.42	36.57	—1.85
CaO	8.29	8.21	—0.08
H_2O	8.87	8.95	+0.08
	100.00	100.00	

The discrepancies between the figures for SiO_2 and MnO, though not great, are slightly in excess of any listed by Glass and Schaller (see their Table 8, p. 37); the figures for CaO and H_2O, on the other hand, are remarkably close. That the molecular ratios $\frac{SiO_2}{MnO + CaO}$ and $\frac{SiO_2}{MnO + CaO + H_2O}$ are in excess of those determined in the case of other analyses quoted by Glass and Schaller, while the ratio $\frac{MnO}{CaO}$ lies within the limits found by them, points to the possibility that a little free quartz is represented in the figure 46·27% quoted for silica in the recalculated analysis of inesite from Waihi.

ACKNOWLEDGMENT.

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