It is not the intention of this paper to maintain that vertical illumination has no value and should be discarded, but to attract the attention of students of mineragraphy to the advantages which may be derived from oblique illumination and to suggest that this type of illumination may be frequently used with profit to supplement observations made with vertical illumination.

NEW OPTICAL DATA FOR ANALYZED SUSSEXITE*

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On comparing the indices given for sussexite,[1] 2Mn(Mg)O_2 $B_2O_3H_2O$, with those of Camsellite,[2] $2MgO.B_2O_3.H_2O$, there is a marked discrepancy evident when one considers the specific refractivity of the constituent radicals. Manganese oxide has a higher specific refractivity than magnesium oxide and therefore, sussexite should have the higher indices, contrary to the published values as indicated below.

	α	β	γ	Elongation
Sussexite	1.541±0.003	1.545±0.003	1.554±0.003	+
Camsellite	1.575±0.005	———	1.649±0.005	−

Having recently obtained a good specimen of sussexite from Franklin Furnace, New Jersey, U. S. A., the original locality, we have determined the indices of refraction of this mineral on a sample of known chemical composition.

The specimen consists chiefly of willemite, franklinite and zincite with a coating of white, fibrous sussexite on what appears to be a slickensided surface. A sample 0.4 g. in weight was obtained by scratching the fibres with a steel point. Half of this was used for the general analysis and half for a direct water determination. Microscopic examination of the sample showed that only a few minute grains of the associated minerals were present.

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[1] Larsen: Microscopic Determination of the Non-opaque Minerals, *U. S. Geol. Survey, Bull.* **679.**

[2] Ellsworth and Poitevin: Camsellite, a New Borate Mineral from British Columbia, Canada. *Trans. Royal Soc. Canada,* **May,** 1921.

METHODS OF ANALYSIS.—After volatilizing B_2O_3 by means of methyl alcohol the silica was removed by two evaporations. Manganese was next separated by a modification of the Williams method, (HNO_3 $KClO_3$), dissolved, precipitated and weighed as pyrophosphate. Iron and alumina were precipitated twice by ammonia in ammonium chloride solution and after weighing, the minute amount of manganese present was determined by the persulfate colorimetric method. Calcium was precipitated as oxalate and magnesium as phosphate, the small amount of manganese present in the magnesium pyrophosphate being determined by the colorimeter method and the necessary corrections applied. On evaporating the strongly ammoniacal filtrate from the magnesium phosphate only about a third of the zinc was precipitated even by taking the solution to dryness. Adjustment of the solution for neutrality, acidity, or alkalinity, by means of a delicate universal indicator failed to produce any further precipitate. This seems to indicate that the phosphate precipitation cannot be trusted when only a few milligrams of zinc are concerned, though for large amounts it is a very good method. The zinc remaining in solution was brought down by H_2S in a slightly alkaline solution and weighed as oxide. The presence of large amounts of B_2O_3 was confirmed by the usual test.

The analysis gave the following results:

	ELLSWORTH	PENFIELD	BRUSH
MnO	37.58	38.08	40.10
MgO	16.29	15.92	17.03
ZnO	3.87	3.24	
Fe_2O_3	0.60		
CaO	0.10		
SiO_2	0.50		
H_2O 110−	0.10		
H_2O 110+	7.80	8.53	9.59
B_2O_3 (diff.)	33.16	33.31	31.89

On referring to the original work of Brush[3] and Penfield[4] it is seen that this analysis agrees well with that of Penfield. Brush precipitated manganese by means of bromine water and it was no doubt contaminated by zinc, magnesium and calcium.

PYROGNOSTICS.—It may be worth mentioning that while the fusibility of the mineral is low (F 2 as given by Brush and Penfield)

[3] Brush, Geo. J.; *Am. J. Sci.*, **46,** 240 (1868).

[4] Penfield, S. V.; *Am. J. Sci.*, **36,** 323 (1888).

when exposed in the open flame and oxidation of the manganese occurs, it appears to be much more difficultly fusible when heated in a closed tube, the dehydrated mineral remaining white and fusing to a nearly colorless glass.

Dr. W. F. Ferrier, one of the earliest collectors of sussexite from Franklin Furnace, recently told the writers that a large number of specimens sold or exchanged as sussexite years ago were really chrysotile serpentine. It seems that the specimen supposed to be sussexite from the University of California examined by Larsen must have been chrysotile. The two minerals are so much alike that in the absence of optical data they can only be identified by chemical tests.

Larsen's figures for chrysotile serpentine and sussexite are as follows:

	α	β	γ	Elongation
Sussexite[5]	1.541±0.003	1.545±0.003	1.554±0.003	+
Chrysotile serpentine[6]	1.542±0.005		1.552±0.005	+

leaving no doubt that the specimen examined by Larsen was really chrysotile.

The sussexite material analysed by Ellsworth was examined under the microscope and its optical properties are found to be in agreement with its chemical composition when compared with camsellite as follows:

	α	γ	Elongation
Camsellite	1.575±0.005	1.649±0.005	−
Sussexite	1.639±0.003	1.704±0.003	−

Thus camsellite and sussexite may be easily distinguished from chrysotile which has positive elongation.

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[5] *Idem.* p. 140.

[6] *Idem* p. 133.

AN IMPROVED WENTWORTH RECORDING MICROMETER

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In one of the more recent issues of the Journal of Geology[1] Professor Chester K. Wentworth described a very ingenious mechanical device in the nature of a recording micrometer for rock analysis. This instrument, when attached to the stage of a

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[1] *J. Geology*, **31**, 228-232 (1923).