ADDITIONAL OPTICAL AND CHEMICAL DATA ON THE STILPNOMELANE GROUP OF MINERALS

C. OSBORNE HUTTON, *Geological Survey, Wellington, New Zealand.*

SUMMARY

Since publication of a paper on the stilpnomelane group of minerals (Hutton, 1938), the author has succeeded in obtaining a member of this series with a composition considerably different from those previously analysed; in addition two analyses of stilpnomelanes have been published by other authors (Wager and Deer, 1939, p. 188; Ayres, 1940, p. 432), together with their optical constants. These analyses are discussed and the extent to which the provisional curves published earlier (Hutton, 1938, p. 187) require modification, is indicated.

OPTICAL DATA

The stilpnomelane newly analysed by Mr. F. T. Seelye for the writer was separated from an albite-epidote-stilpnomelane-chlorite schist containing minor amounts of quartz, titanite, muscovite, apatite, and calcite. The rock is coarsely crystalloblastic, strongly laminated, and schistose; it is a typical member of the green-schist facies as developed in the Chl. 4 subzone of the chlorite zone of western Otago (Hutton and Turner, 1936; Hutton, 1940). The stilpnomelane itself, in very coarsely crystalloblastic plates, and radiating or sheaf-like aggregates up to 5 mm. in length, is intimately interlaminated with plentiful chlorite from which it seems to be in the process of developing; it appears to lack any marked preferred orientation, and the sheaf-like aggregates in some cases lie transverse, in others parallel, to foliation and schistosity planes.

Optical properties of the associated chlorite are as follows:

$\alpha = 1.635 \pm 0.002$
$\beta = \gamma = 1.640$
$\gamma - \alpha = 0.005$
$2V = 0°$
Sign: negative
Elongation: positive
Pleochroism { α = very pale greenish yellow to colourless. / $\beta = \gamma$ = deep grass green.
Absorption $\gamma = \beta > \alpha$
Dispersion $r > v$ (not strong).

These data indicate a composition just inside the field of brunsvigite in the sense used by Winchell (1936, p. 649, Fig. 4) in his most recent study of the chlorite group. In an earlier investigation of the chlorites occurring in schists of the chlorite zone of western Otago, the β values of over thirty chlorites were found to be within the limits 1.607–1.639 (Hutton, 1940, p. 19). The chlorite just described is thus a relatively iron-rich type.

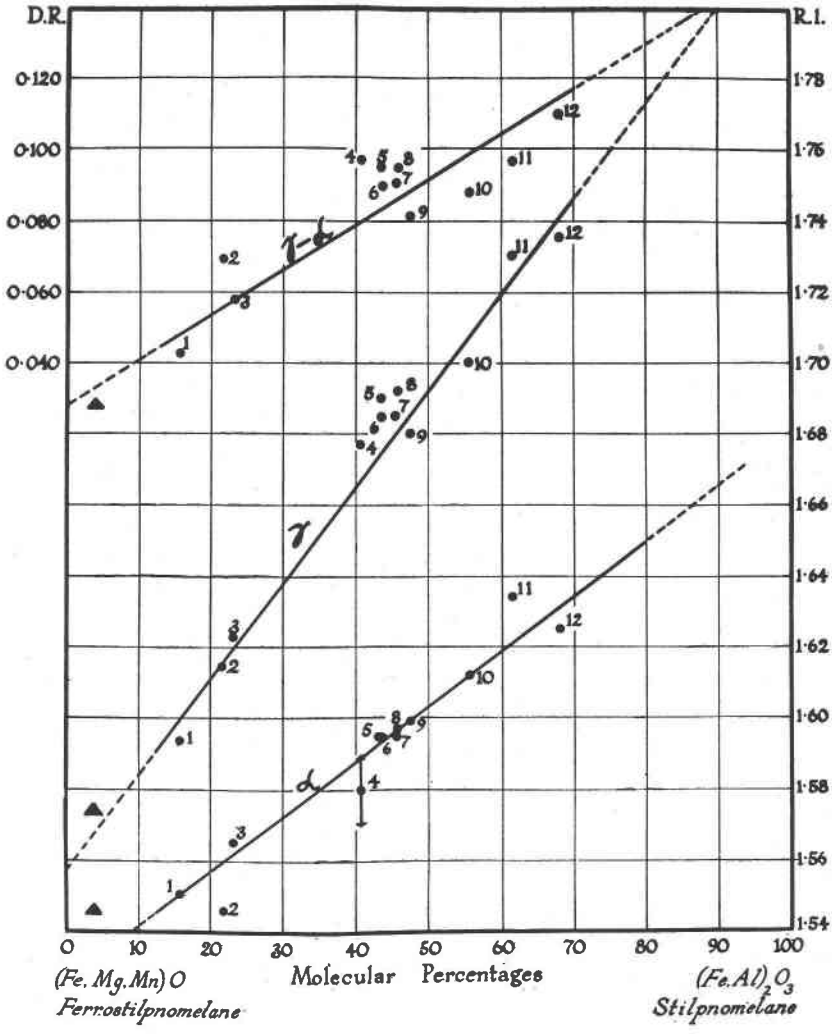
The stilpnomelane mineral was separated from the schist by careful crushing, screening, and centrifuging methods following the procedure recommended previously (Hutton, 1938, p. 183). The analysis undertaken by Mr. F. T. Seelye is set out in Table 1A.

When α and γ for the three newly analysed stilpnomelanes (Table 1, A, B, C) are plotted against the ratio (Fe, Mg, Mn) O/ (Fe, Al)$_2$O$_3$ on the original diagram (Hutton, 1938, p. 187), the values given for the Otago mineral and that described by Ayres and Park (analyses A and B) agree reasonably well with the existing curves. In the case of the Greenland stilpnomelane (analysis C), however, the values for α and γ certainly fall close to the extension of these curves, as stated by Wager and Deer (1939, p. 190), but only if the composition is not taken into account. However, in the case of the Greenland stilpnomelane, the values of α and γ quoted indicate a (Fe, Mg, Mn) O/ (Fe, Al)$_2$O$_3$ ratio (molecular) of about 30/70, whereas the ratio calculated from the corresponding analysis is approximately 52/48. This discrepancy is possibly due to difference in composition between the unanalysed material used for refractive index determinations, and that selected by Wager and Deer for analysis. Furthermore, the relatively high CaO content of the analysis (4.28 per cent—a figure much higher than that in any other analysis available to the writer) points to possible impurity of the analysed material.

The writer now suggests a slight modification of the previously published curves to take into account the new data given in Table 1, A and B. This has been done in Fig. 1. Points for γ of the refractive index ellipsoid tend to lie along a straight line with no one point far removed from it, whereas with the exception of Nos. 2 and 11, none of the α values are far removed from the line representing α of the refractive index ellipsoid. For stilpnomelane minerals either β or γ can be determined with reasonable accuracy so long as thin, fully transparent platelets are used. Greater difficulty attends the determination of α owing to the micaceous habit of the mineral, and considerable care is required in order to obtain the minimum value. For the stilpnomelane mineral represented by analysis No. 4, the value for α is given by Gruner (1937, p. 914) as 1.58 ± 0.01; this limit of accuracy is unusually wide, so that the possible range has be indicated in Fig. 1.

Chemical Data

No further information of the chemical properties of members of the stilpnomelane group is available. However, Ayres' (1940, p. 433) statement that stilpnomelane from Crystal Falls was "not at all attacked by sulphuric" acid is surprising in view of the results of earlier experiments by the present writer (Hutton, 1938, p. 190). The newly analysed Otago



KEY TO ANALYSES IN FIG. 1

Numbers in parentheses refer to the analyses plotted in Fig. 5 of Hutton (1938, p. 187).

1 (15). Western Otago. C. O. Hutton (1938, p. 184, anal. C, Table 3).
2 (1). Mesabi Range, Minnesota. F. F. Grout and G. A. Thiel (1924, p. 230, anal. No. 2).
3 (8). Theodor mine, Aumenau, Lahn. J. Holzner (1933, p. 216, anal. No. 4).
4 (12). Baern, Moravia. J. W. Gruner (1937, p. 913, anal. No. 4).
5. Western Otago. C. O. Hutton (1938, p. 184, anal. D, Table 3).
6 (4). Pen-y-rallt, Merionethshire. Hallimond (1924, p. 194, anal. No. 1).
7 (10). Zuckmantel, Austrian Silesia. C. O. Hutton (1938, p. 184, anal. E, Table 3).
8 (17). Anna Mine, Baern, Moravia. C. O. Hutton (1938, p. 184, anal. F, Table 3).

stilpnomelane (A in Table 1), when treated for 6 hours with 5N H_2SO_4 on the water-bath was completely decolourized, leaving colourless, isotropic plates of hydrated silica, with a refractive index of 1.438 after drying at 100°C. for 15 minutes.

TABLE 1. ANALYSES OF STILPNOMELANE

	A.	B.	C.
SiO_2	44.52	42.42	45.29
Al_2O_3	7.19	6.71	5.57
Fe_2O_3	27.32	33.24	23.95
FeO	3.31	0.85	8.99
TiO_2	0.10	—	0.02
MnO	0.42	2.27	1.14
MgO	5.63	5.20	3.30
CaO	0.23	—	4.28
Na_2O	0.32	—	nt.dt.
K_2O	1.77	—	nt.dt.
V_2O_3	nt.fd.	—	—
Cr_2O_3	nt.fd.	—	—
H_2O+	6.70	8.33	6.12
H_2O-	2.70	1.45	1.79
	100.21	100.47	100.45
$\alpha=$	1.612±0.002	1.634	1.626
$\beta=\gamma=$	1.700	1.730	1.745
$\gamma-\alpha=$	0.083	0.096	0.119
2V	0°	0°	0°
Pleochroism:			
$\alpha=$	Bright golden yellow	As for β but weaker	Golden yellow
$\beta=\gamma=$	Very deep reddish brown	Golden yellow to chestnut brown	Dark reddish brown
Absorption	$\gamma=\beta>\alpha$	$\gamma=\beta>\alpha$	$\gamma=\beta>\alpha$
Sp. Gr.	2.82	—	—
(Fe, Mg, Mn)O	44.47	38.70	51.88
$(Fe, Al)_2O_3$	55.53	61.30	48.12

A. Stilpnomelane from albite-epidote-stilpnomelane-chlorite schist, p. 2264. Cowcliff Hill, Kawarau S.D. Analyst: F. T. Seelye.

B. Stilpnomelane from ferruginous Upper Huronian slates, Crystal Falls, Michigan. Analysts: V. L. Ayres and B. Park. The following elements were found spectrographically: Na, Li, Co, Ni, V, Ba, Zn. (V. L. Ayres, 1940).

C. Stilpnomelane from spherical vesicles in granophyre inclusion. Mellemö, Kangerdlugssuaq, E. Greenland. (L. R. Wager and W. A. Deer, 1939, pp. 188–189).

---

9 (9). Western Otago. C. O. Hutton (1938, p. 184, anal. B, Table 3).

10. Western Otago. Anal. A, Table 1, this paper.

11. Crystal Falls, Michigan. V. L. Ayres (1940, p. 432); or anal. B, Table 1, this paper.

12 (16). Western Otago. C. O. Hutton (1938, p. 184, anal. G, Table 3).

The solid triangles represent the plot of typical parsettensite (J. Jakob, 1923).

References

Ayres, V. L. (1940), Mineral notes from the Michigan Iron Country: *Am. Mineral.*, **25,** No. 6, 432–434.

Grout, F. F., and Thiel, G. A. (1924), Notes on stilpnomelane: *Am. Mineral.*, **9,** 228–231.

Gruner, J. W. (1937), Composition and structure of stilpnomelane: *Am. Mineral.*, **22,** 912–925.

Hallimond, A. F. (1924), On stilpnomelane in north Wales: *Mineral. Mag.*, **20,** 193–197.

Holzner, J. (1933), Beitrage zur Kenntnis der varistischen Gesteins- und Mineralprovinz in Lahn-Dillgebeit. 2. Über den Stilpnomelan von Grube Theodor (Lahngebeit) und einen beim Trennen mit Clericilosung auftretenden Basenaustausch: *Neues Jahrb. Min.*, Abt. A., Beil-Bd. **66,** 213–225.

Hutton, C. O. (1938), The stilpnomelane group of minerals: *Mineral. Mag.*, **25,** No. 163, 172–206.

——— (1940), Metamorphism in the Lake Wakatipu region, western Otago, New Zealand: *D.S.I.R., Geol. Mem., No.* **5.**

Hutton, C. O., and Turner, F. J. (1936), Metamorphic zones in north-west Otago: *Trans. Roy. Soc. N.Z.*, **65,** 405–406.

Jakob, J. (1923), Vier Mangansilikate aus dem Val d'Err (Kt. Graubunden): *Schweiz. Min. Petr. Mitt*, **3,** 227–237.

Wager, L. R., and Deer, W. A. (1939), The petrology of the Skaergaard intrusion, Kangerdlugssuaq, East Greenland: *Meddel. om Grönland*, **105,** No. 4.

Winchell, A. N. (1936), A third study of chlorites: *Am. Mineral.*, **21,** No. 10, 642–651.