ACKNOWLEDGMENTS

The authors are indebted to several of their colleagues of the C.N.E.A.: Dr. E. Linares provided the computer program; Dr. J. Litvak assisted with the program and granted time on the computer; Mr. C. B. Amaya was responsible for the spectrographic determination and Mr. J. Orecchia obtained the infrared spectrum.

Thanks are also due to Y.P.F. for facilities in the use of the Bull G.E. 625 computer; to the L.E.M.I.T. laboratories for the D.T.A. curve, to the I.N.T.I. institute for the thermogravimetric chart, and to Dr. F. Roellig, of the Instituto Nacional de Geología y Minería, for supplying the specimen for study.

REFERENCES

ADLER, H. H. AND P. F. KERR (1965) Variations in infrared spectra, molecular symmetry and site symmetry of sulfate minerals. *Amer. Mineral.*, **50**, 132–147.

ANGELELLI, V. AND S. G. GORDON (1941) Sarmientite, a new mineral from Argentine. *Acad. Sci. Phil., Not. Nat.* **92.**

WEBER, K. (1959) Eine Kristallographische Untersuchung des Angelellits. *Neues Jahrb. Mineral., Monatsh.*, **7**, 152–58.

THE AMERICAN MINERALOGIST, VOL. 53, NOVEMBER–DECEMBER, 1968

JOHACHIDOLITE, A REVISED CHEMICAL FORMULA

W. O. DAVIES AND M. P. MACHIN,
Portsmouth College of Technology, Portsmouth, England.

Iwase and Saito (1942) described a new mineral which was discovered in nepheline veins in limestone at Johachido, Kankyohokudo, Korea, which they named after the locality. The impossible formula given, $H_6Na_2Ca_3Al_4F_5B_6O_{20}$, has appeared in several books dealing with mineralogy or the chemistry of boron compounds. Only the analysis appears in Dana (1951). A balanced formula, $Na_2Ca_3Al_4B_6O_{14}(OH)_5F_5$, is given in Hey (1962), and Strunz (1957) offers the formula $Ca_3Na_2Al_4H_4[(F,OH)BO_3]_6$, but neither represent the analysis well. A new calculation seemed necessary.

Since impurities due to nepheline, $NaAlSiO_4$, and apatite, $Ca_5(PO_4)_3F$, probably make some contribution[1], column 2 presents the amended analysis. The atomic proportions were calculated on a basis of total anions = 45 (column 3), this being the smallest number whereby an approximately integral number of cations in each group could be ac-

[1] Private communication from M. H. Hey.

TABLE 1. CALCULATION OF NEW FORMULA FOR JOHACHIDOLITE (WEIGHT-PERCENT)

Component	1	2	Component	3	4	5
Na_2O	8.27	8.18	Na	3.760	8.19	8.34
CaO	24.77	24.98	Ca	6.343	24.70	22.64
Al_2O_3	28.34	28.33	Al	7.914	28.74	27.44
B_2O_3	24.21	24.46	B	10.005	24.54	28.12
H_2O^+	6.52	6.59	H	10.419	6.66	6.06
H_2O^-	0.07	—	—	—	—	—
F	12.21	12.33	F	9.241	12.38	12.78
MnO	0.23	0.23	Mn	0.046	—	—
SiO_2	0.34	—	—	—	—	—
Fe_2O_3	0.09	0.09	Fe	0.016	—	—
P_2O_5	0.03	—	—	—	—	—
—	—	—	O	35.759	—	—
	105.08	105.19			105.21	105.38
$-O=F$	5.14	5.19			5.21	5.38
Total	99.94	100.00			100.00	100.00

1. Chemical analysis, (Iwase and Saito (1942)).
2. Recalculated chemical analysis after deduction of nepheline and apatite.
3. Atomic proportions based on total anions = 45.
4. Theoretical analysis for the composition $(Na_{3.75}Ca_{0.25})Ca_6Al_8B_{10}O_{25}((OH)_{10.50}F_{9.25}O_{0.25})$.
5. Theoretical analysis for the composition $Na_2Ca_3Al_4B_6O_{14}(OH)_5F_5$.

commodated. Basing the structure on five B_2O_5 units and rearranging into groups according to ionic size, we have,

$$Na_{3.76}Ca_{6.34}(Al_{7.91}Mn_{0.05}\overset{3+}{Fe}_{0.02})B_{10.00}O_{25}[F_{9.24}(OH)_{10.42}O_{0.34}]$$

or simply $(Ca, Na)_{10}Al_8B_{10}O_{25}(OH, F, O)_{20}$. The ratio of Ca:Na is much closer to 5:3 than 3:2 so the formula would be more correctly written as $(Na, Ca)_4Ca_6Al_8B_{10}O_{25}(OH, F, O)_{20}$. Replacement of Na by Ca causes a replacement of (OH, F) by oxygen in order to maintain neutrality. More simply this is $Na_4Ca_6Al_8B_{10}O_{25}(OH, F)_{20}$ when the minor substituent of Ca for Na is neglected.

A comparison is made in the table of the amended analysis (column 2) with a somewhat idealized composition in which Ca:Na = 5:3 (column

4) and the theoretical composition of the first balanced formula as it appeared in Chemical Index of Minerals (column 5).

REFERENCES

Palache, C., H. Berman, and C. Frondel (1951) *System of Mineralogy . . ., 7th Ed. Vol.* 2. John Wiley and Sons, New York.

Hey, M. H. (1962) *Chemical Index of Minerals, 2nd Ed.* British Museum, London.

Iwase, E. and Saito, N. (1942) Johachidolite: a new mineral, a hydrous fluoborate of sodium, calcium and aluminum. *Sci. Pap. Inst. Phys. Chem. Res. (Tokyo)*, **39**, 300–4.

Strunz, H. (1957) *Mineralogische Tabellen, 3rd ed.* Akademische Verlagsgesellschaft Geest and Portig K.-G., Leipzig.

THE AMERICAN MINERALOGIST, VOL. 53, NOVEMBER–DECEMBER, 1968

STRONTIOHILGARDITE-1Tc and TYRETSKITE, A STRUCTURAL PAIR

W. O. Davies and M. P. Machin,
Portsmouth College of Technology, Portsmouth, England.

A new formula for tyretskite, $[Ca_2[B_5O_8(OH)_2]OH]$, is deduced which is shown to correspond closely to that of strontiohilgardite-1Tc. (Although the mineral name strontiohilgardite-1Tc (Braitsch, 1959) was disapproved of by the IMA Commission on New Minerals and New Mineral Names in 1959, no alternative name has been proposed for what is certainly a valid new mineral in the hilgardite-heidornite group.) A comparison of the unit-cell dimensions of strontiohilgardite-1Tc (Braitsch, 1959) and tyretskite (Kondrat'eva, 1964) [setting changed to follow the standard convention] (Table 1) reveals a similarity which favors an analogy between them. The unit-cell content of strontiohilgardite-1Tc is $[(Ca,Sr)_2B_5O_8(OH)_2Cl]$, and the Ca:Sr ratio in analyzed

TABLE 1. CELL DIMENSIONS

Strontiohilgardite-1Tc (Braitsch, 1959)	Tyretskite (Kondrat'eva, 1964)
(triclinic, $Z=1$)	(triclinic, $Z=1$)
$a=6.48$ Å	$a=6.44$ Å
$b=6.608$ Å	$b=6.45$ Å
$c=6.38$ Å	$c=6.41$ Å
$\alpha=61°\ 12'$	$\alpha=61°\ 46'$
$\beta=60°\ 30'$	$\beta=60°\ 15'$
$\gamma=75°\ 24'$	$\gamma=73°\ 30'$