The properties of cuprorivaite may be summarized as follows:
\[ \text{CaCuSi}_4\text{O}_10, \ a \ 7.30 \pm 0.01, \ c \ 15.12 \pm 0.02 \ \text{Å}, \ Z=4, \ P4/ncc: x-ray powder } \\
\text{diffraction pattern same as for artificial CaCuSi}_4\text{O}_10. \ \text{Cleavage } \{001\}, \ \text{perfect; brittle; hardness not surely determined, probably near 5; } \\
\text{density } 3.08 \pm 0.6 \ \text{(obs.), } 3.09 \ \text{(calc.). Color blue; vitreous. } \omega \ 1.633 \pm 0.003, \ \epsilon \ 1.590 \pm 0.003 \ \text{(artificial } 1.636 \ \text{and } 1.591 \pm 0.003 \ \text{respectively,} \\
\text{Minguzzi had considered cuprorivaite biaxial negative, } 2V = 13° \ 14', \ \text{indices } 1.589, 1.627 \ \text{and } 1.6275). \ \text{Pleochroism, O blue, E pale rose, nearly } \\
\text{colorless. Habit tabular } \{001\}, \ \text{rarely also } \{102\} \ \text{and possibly } \{110\}. \ \text{Insoluble in HCl.}

**References**

Bloss, F. Donald, (1961), An Introduction to the Methods of Optical Crystallography. \\


Garavelli, C. L. and F. Mazzi, (1957), Un metodo per l'esecuzione di diffrattogrammi \\
a raggi X su campioni dell'ordine del centigrammo. Atti. Fondazione G. Ronchi, 12, \\
3-13.

687 (in English).


through this list as is necessary to fill up the available spaces D. The remainder of the Al, etc., are then assigned to C, and this space is filled up by additions, in order, of Mg, Fe$^{2+}$, Mn, Ca. Reminders of these and the Na and K are assigned to position B until that is full, then any remaining Ca, Na, and K are assigned to position A. The F and Cl are assigned to position E, and the remaining space therein is filled by O+OH, or by OH+H$_2$O. A warning card is punched if there is too much H for that. Warning cards also are punched during the program if the summation reported in the input differs from the sum of the oxides reported, if there are insufficient numbers of atoms of (Si, Al, Fe$^{3+}$, Ti) for position D, and if there are insufficient atoms for position C. The sum of all atoms except H, F, Cl, and O, and the sum of 3000+cations in B and A, are reported; the latter sum may be compared directly with the last four digits of the former to check on the sufficiency, and on possible excess, of atoms for any of the positions.

Thirteen variables $w_i$, representing the numbers of atoms per 24000 (O+F+Cl), and a fourteenth $w$ representing the sum of the first ten of these, are reported out. Twenty-five variables $x_i$ represent the assignments of these 13 to various positions in the amphibole formula. Both sets $w_i$ and $x_i$ are in form suitable for use in the Furnival regression program.

Up to thirteen variables $y_i$, representing optical properties, specific gravity, and various lattice constants and functions thereof, may be included in the input, and after slight rearrangement these same numbers are reproduced in the output, together with two code digits representing certain combinations of (a) $n_x$, $n_y$, $n_z$, $Z/c$, and $G$, and (b) a, b, c, $\beta$, and functions depending on them. These code digits permit sorting the cards so that groups having the same assortments of variables can be prepared for the regression analysis. The variables $y_i$ are mostly in the form of 4-digit and 5-digit numbers appropriate to the best accuracy that is commonly available in these physical measurements.

Because the output includes the set of data $w_i$, the program can be useful for other minerals than hornblende, with or without a simple change that would cancel the remainder of the program after reporting $w_i$.

Two alternate programs are automatically introduced if the amount of Si per 24000 (O+F+Cl) is greater than 8000. The first of these reduces Si to 8000 by assuming that some free quartz impurity was present in the analyzed sample; the second assumes that some H$_2$O was missed in the analysis. Both alternative programs yield full sets of data-reports, but only $w_1$-data are reported from the main program, if the alternate programs are run.

Several other alternate programs could be incorporated if needed, as for example, ones to handle excess H, or excesses or shortages of any other
elements as signalized by a difference between the sum of the first 10 w's, and the sum of $13000 + A + B$. Shortages signalized by warning-cards can be made up by various assumptions, such as assumed errors in the H$_2$O-determination; excesses can be corrected in the same way, or by carrying over some atoms to a position of larger than normal size (as Mn, Fe$^{3+}$ with the normal Ca, Na, K in position A). In a set of some hundreds of published amphibole analyses, I have used about six alternative programs, performed manually because the number of instances did not seem sufficient to warrant writing them for automatic operation by the 650. The alternative programs are easy to compute by slide rule from the w$_1$-data resulting from the preliminary recast of the analyses.

This note is published on the assumption that there may be mineralogists interested in further correspondence and/or discussion of the topics noted,—either programming problems, or regression studies.