The pleochroism of finely ground material from occurrence 1 is essentially identical with that shown by 2 and 4, namely: X deep blue, Y nearly colorless, Z colorless, pale olive green, or brownish. As in the first case the amount of ferric oxide is known to have increased from practically zero to nearly 5 per cent. it seems reasonable to conclude that the pleochroism is connected with this change in all cases, and that pure vivianite is an essentially non-pleochroic mineral.

With reference to the other optical properties, allowing for such variation as is likely to be shown from one specimen to another, coming from widely separated localities, and studied by different investigators, it seems clear that the oxidation of part of the iron is connected with a definite increase in the values of refractive indices β and γ, while α remains constant within the limits of accuracy of measurement. The relations in the case of the optic axial angles are less clear, for the data given appear to be inconsistent. Calculation of the angles for numbers 3 and 4 of table 1 by the usual formulas[6] gave 82°7′ and 81°46′ respectively, whereas the values observed are decidedly less than these.

The general conclusions are justified, however, that the change of color shown by vivianite on exposure or grinding is connected with partial oxidation of the iron to the ferric condition, and that marked changes in pleochroism and refractive indices are connected with this alteration.

NOTE ON IRON AS A CAUSE OF BLUE COLORS IN MINERALS.

EDGAR T. WHERRY. *Washington, D. C.*—Since ferrous iron usually colors minerals green, and ferric iron yellow or brown, it may seem rather remarkable that the presence of both together should give rise to a blue color, as in the case described in the above paper. It may be pointed out, however, that this is by no means a unique instance of such an effect. Even apart from the artificial substances, "Prussian" and "Turnbull's" blues, which are complex cyanides containing both ferric and ferrous iron, there are several blue minerals in which the color seems explainable only on this basis. The most noteworthy of these are: crocidolite and related amphiboles; iolite; and blue tourmaline or indicolite. Other instances may perhaps be discovered, should this subject ever be investigated as it deserves to be.

[6] See Johannsen, *Manual of petrographic methods*, p. 103, 1914.