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Kehoeite and viséite reviewed; comments on dahllite and francolite

'In addition to these synthetic materials, the minerals kehoeite (McConnell and Foreman, 1974) and viséite (McConnell, 1952) have been alleged to be, respectively, aluminophosphate and aluminosilicophosphate isotypes of analcime. However, the former is classed as a doubtful species by Fleischer (1987) and the latter is so fine-grained that little can be said with certainty about its structural affinities (Dunn and Appleman, 1977).'

This quotation is from Rouse *et al.* (1989) and is very misleading, if not erroneous. The part about kehoeite (Fleischer, 1987) is unsupported speculation inasmuch as Fleischer's only reference (McConnel) and Foreman, 1974) reaches entirely different conclusions: 'Kehoeite appears to be an isotype of analcime, is isometric or nearly so, and has a cell edge of approximately 13.45Å.' Thus Headden's (1893) mineral is temporarily, at least, rescued from oblivion as an alumino-tectophosphate of zinc and calcium.

Viséite comprises a more complex case because of the phraseology: '... is so fine-grained that little can be said with certainty about its structural affinities (Dunn and Appleman, 1977).' Perhaps it would be enlightening to examine what they said: 'Type viséite from Visé, Belgium (NMNH no. 106364) was re-examined in the present study and the sample agrees with Mélon's [1942] description.'

'The sodium, reported by Mélon in only one of his four analyses (Table III), is obviously in error. Four separate analyses for sodium, in the present study, indicate that it is present only as traces and thus plays no part in the structure. We also find significantly less calcium. Mélon proposed, on the basis of his analyses, the formula $3SiO_2.3P_2O_5.5Al_2O_3.5CaO.nH_2O(30 > n > 25)$. This formula was rewritten by McConnell (1952) as $(Na_2Ca_{10})(AlO_2)_{20}(SiO_2)_6(PO_2)_{10}(H_3O_2)_{12}.16H_2O$ to show a proposed relationship of the structure to that of analcime.

The new analyses of type viséite in this study indicate a much lower calcium content, a lower silicon content, and the absence of sodium. Based on these analyses, the approximate formula for the type viséite is: $5CaO.6Al_2O_3.3SiO_2.3.5P_2O_5.1.5F.36H_2O$. Due to the oolitic nature of the aggregate, the resultant lack of single crystals, and the extreme diffuse powder pattern, this viséite formula cannot be confirmed by single crystal methods and an accurate density determination.'

Using their criteria, there could be no such mineral as montmorillonite, and yet, they state regarding the 16 diffraction maxima tabulated by me: 'The results are in substantial agreement with those of McConnell (1952) [concerning spacings and intensities].'

I made several theoretical assumptions that were related to the number of oxygens in the structure, the density, etc. (McConnell, 1966 and 1967) most of which are justified by my work on montmorillonite: McConnell (1950); Foreman (1968); and Brindley and Fancher (1970). My summary (1952) states (in part): 'Viséite has a highly defective structure which is essentially pseudocubic.' The fact that the analysis for sodium was found to be erroneous does not disprove the analogy with analcime, and therefore the statement by Rouse *et al.* (1989) is misleading, if not incorrect.

The coloration of the 'blue viseite' of Dunn and Appleman (1977) is probably caused by organic matter, which was found to be present also in the type material and was discussed previously by McConnell (1952).

Concerning dahllite and francolite, Fleischer's (1987) entries are:

Dahllite = Carbonate-apatite

Francolite = Carbonate-fluorapatite

Carbonate-fluorapatite (Francolite) hex. Apatite group.

Carbonate-hydroxylapatite (Dahlite [sic]) $Ca_5(PO_4,CO_3)_3(OH)$ hex. Apatite group.

Not only are neither hexagonal (McConnell, 1973); they probably are monoclinic or triclinic as proved by their optical properties. Furthermore, carbonate-fluorapatite is a compositional-structural name; the mineral name is francolite (Sandell *et al.*, 1939). The formulation is peculiar; it is not in electrostatic balance for any ratio of

C to P except when C is zero. Dahllite, named after the Dahll brothers, is occasionally misspelled.

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