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Dufrenite in iron-formation on the Kangnas Farm, Aggeneys district, Bushmanland, South Africa: a comment

VAN DER WESTHUIZEN *et al.* (1990) have decribed a new occurrence of the relatively rare phosphate mineral, dufrenite. However, dufrenite is not as rare as they suggest. There have been many reports of the mineral over the last two decades from a number of localities world-wide (Strunz *et al.*, 1976; Cech *et al.*, 1981; Cassedanne and Cassedanne, 1982, Dietrich, 1982; von Knorring and Sahama, 1982; Angelelli *et al.*, 1983; Rewitzer *et al.*, 1984; Keller and von Knorring, 1989; Corbella, 1990; Corbella and Melgarejo, 1990).

Moreover Van der Westhuizen *et al.* (1990) concentrate on the uncommon chemical composition of dufrenite from the Kangnas Farm, and particularly on the replacement of Fe^{3+} by Al, and of Ca by Na. They do not compare their data with the related minerals burangaite, (Na,Ca)-$(Fe^{2+},Mg)Al_5(PO_4)_4(OH,O)_6.2H_2O$ (von Knorring *et al.*, 1977) and natrodufrenite, $Na(Fe^{3+},Fe^{2+})$-$(Fe^{3+},Al)_5(PO_4)_4(OH)_6.2H_2O$ (Fontan *et al.*, 1982); see also Fleischer (1987).

Van der Westhuizen *et al.* (1990) also claim that samples of dufrenite from Kangnas must be considered as aluminian dufrenite due to the presence of high Al_2O_3 contents and the concentration of Al_2O_3 they obtained are the highest ever recorded for this mineral. They do not mention the 'aluminium dufrenite' from Rochefort-en-Terre, France, with 4.50 wt.% Al_2O_3 (Frondel, 1949) and dufrenite from the upper basin in Ribeirao Laranjeiras, Minas Gerais, Brasil, containing 12.5 wt.% Al_2O_3(Cassedanne and Cassedanne, 1982), but they notice that 'the replacement of Fe^{3+} by Al is very low for samples from literature' and that 'only two dufrenite samples from literature contain in excess of 1 wt.% Al_2O_3'.

The chemical results published by Van der Westhuizen *et al.* (1990) also were not clearly discussed. We notice that the authors explained the calculation on the basis of 24(O,OH,F), whereas a basis of 22(O,OH,F) is given in Table 1. From Table 1 it clearly appears that the analyses 2 and 5 do not correspond to dufrenite, and that the results 10 and 14 are typical for natrodufrenite.

The problem of fluorine, reported in Table 1, is not envisaged by the authors, although it could be of some interest as this chemical element has never been reported for the twenty dufrenites described so far. However, it must be pointed out, that the determination of the fluorine contents of phosphate minerals with the electron microprobe is not easy, as pointed out by Potts and Tindle (1989), because the third-order P-$K\alpha$ line (λ = 18.460 Å) is near the first order F-$K\alpha$ line (λ = 18.320 Å). Now under the operating conditions given by the authors, i.e. 15 kV and 40 nA, the two lines cannot be discriminated. To analyse fluorine properly it is necessary to lower the beam current in order to hinder the excitation of the third-order P-$K\alpha$ line. The presence of fluorine should have been checked with another procedure.

Regarding the X-ray data, Van der Westhuizen *et al.* (1990) consider that their few *d*-values 'compare favourably with the data in literature'. Moreover Table 4 in their paper does not give the intensities. We do not accept their conclusion, because a dicussion of X-ray powder data requires the comparison of both the *d*-values and intensities. The absence of the intense peak *d* 200 at around 12 Å makes dubious the identification of dufrenite. It is one of the typical X-ray diffraction peak of dufrenite (Fransolet, 1975). A look at the JCPDS files is also convincing: dufrenite (8-155) d = 12.3 Å, I = 3; dufrenite (22-1143) d = 12.0 Å, I = 90; burangaite (29-1190) d = 11.7 Å, I = 100; natrodufrenite (35-270) d = 12.04 Å, I = 80. We are of the opinion that the calculation of unit-cell dimensions (without standard deviations) on the basis of 10 lines is not a valid means to properly identify a mineral. Additionally, the particular value of the b parameter, i.e. 4.88 Å, for a dufrenite is not discussed by Van der Westhuizen *et al.* (1990). Consequently another reasonable interpretation of the limited powder pattern (only 10 lines) given for the material from Kangnas could well be that the

material is a mixture of dufrenite, rockbridgeite, and some lipscombite and, possibly, some crandallite.

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