SHORT COMMUNICATIONS

Preliminary note on a mboziite of metamorphic origin

IN 1964 Phillips and Layton introduced the name *sundiusite* for the theoretical amphibole end-member $NaNaCaMg_3Al_2Si_6Al_2O_{22}(OH)_2$; they knew of no minerals close to $Na_1^A(Na_1Ca_1)^X(R_3^{2+}R_2^{3+})^Y(Si_6Al_2)^ZO_{22}(OH)_2$. In a preceding article in the same number of *Mineralogical Magazine*, however, Brock, Gellatly, and von Knorring described two amphiboles close to the end-member $NaNaCaFe_3^{2+}Fe_2^{3+}Si_6Al_2O_{22}(OH)_2$ from Eastern African nepheline syenitic intrusives. These amphiboles are considered valid species and the end-member name *mboziite*, proposed by Brock *et al.*, was approved by the I.M.A. Commission on New Minerals and Mineral Names. Whittaker (1968) recorded a third amphibole that might be regarded as mboziitic. This amphibole—listed by Deer, Howie, and Zussman (1963) as a catophorite—was originally described as taramite by Morozevicz (1925 and 1930) and was found in a foyaite. This note is a first account of a mboziitic amphibole of metamorphic origin.

The amphibole was noted in a schistose albitiferous mica-quartzite by one of the authors (K. L.), while studying the alpine regional metamorphism in the Sierra de los Filabres (SE. Spain). The mineral attracted attention by its violet-grey colour in the β direction, which is distinct from those of the glaucophane–crossites and blue-green amphiboles found in adjacent schists and amphibolites. Electron-microprobe analyses by the other author (C. K.) indicate a slightly inhomogeneous alkali-calciferous amphibole with low silicon and high aluminium contents. The compositional data obtained from one point-analysis are presented in table I. As the method of analysis does not distinguish between Fe^{2+} and Fe^{3+} the $FeO:Fe_2O_3$ ratio has been adjusted to make $\Sigma\ Y = 5$, as required by the general amphibole formula $A_{0-1}X_2Y_5Z_8O_{22}(OH)_2$. The substitutions applied in the calculation of the atomic ratios are those discussed by Phillips (1963), and involve the assumptions that Ti occupies the same position as Mg and that oxy-amphibole molecules are absent. Comparison of the structural formula with that of the type mboziite (table I, 2) clearly demonstrates that the amphibole under consideration is a mboziite, admittedly a little more calciferous and showing notable $Fe^{2+} \leftrightharpoons Mg$ and $Fe^{3+} \leftrightharpoons Al^Y$ substitutions. Apart from the above-mentioned calculation the following reasoning also shows the mboziitic nature of the amphibole. From the formulae calculated on the basis of all iron FeO and Fe_2O_3, respectively, the limits of A, X, and Z occupancies follow directly: $(Na,K)^A = 0.71–0.53$, $Na^X = 0.73–0.81$ and $Al^Z = 1.76–2.11$. Substitution of these values into the condition $(Na,K)^A+(Fe^{3+},Al)^Y = Na^X+Al^Z$, which is implied by the replacements used in the calculations, leads to $(Fe^{3+},Al)^Y = 1.78–2.37$. With $(Na,K)^A$ and Na^X closer to 1 than to 0, and with $(Fe^{3+},Al)^Y$ and Al^Z closer to 2 than to 1 the amphibole

TABLE I. *Chemical composition and optical properties of a metamorphic mboziite; compared with the type mboziite*

	I		Ia		2	
SiO_2	40·1	Si	6·10 }8·00		6·20 }8·00	
Al_2O_3	15·8	Al^{iv}	1·90		1·80	
Fe_2O_3	[9·56]	Al^{vi}	0·93		0·15	
FeO	[12·95]	Fe^{3+}	1·09		1·59	
TiO_2	0·5	Fe^{2+}	1·65		2·52	
MnO	0·2	Ti	0·06 }5·00		0·11 }5·04	
MgO	5·2⁵	□	0·06		0·11	
CaO	7·6	Mn	0·02		0·26	
Na_2O	4·1	Mg	1·19		0·30	
K_2O	1·0	Ca	1·24 }2·00		1·00 }2·00	
H_2O	[2·0]*	Na^x	0·76		1·00	
Sum	99·0	Na^4	0·45 }0·64		0·47 }1·03	
		K	0·19		0·56	
α 1·684±0·002, colourless			OH		1·78 }1·97	
to light yellow			F		0·15	
β 1·700±0·002, violet-grey			Cl		0·04	
γ 1·703±0·002, blue			O		22·03	

1. Percentage composition (electron microprobe analysis by C. Kieft) and (1a) atomic ratios to $O_{22}(OH)_2$ of mboziite from Sierra de los Filabres, Spain. Total iron as FeO 21·5⁵ %; the $FeO:Fe_2O_3$ ratio has been adjusted to make $Y = 5·00$ (including the vacancies consequent on the substitution Ti+□ for 2 Mg).
2. Atomic ratios to 24(O,OH,F,Cl) of the type mboziite (Brock *et al.*, 1964).
* Calculated for $O_{22}(OH)_2$.

contains more than 50 % of the molecule $(Na,K)_1^A(Na_1Ca_1)^X(R_3^{2+}+R_2^{3+})^Y(Si_6Al_2)^Z O_{22}(OH)_2$; see also Whittaker's (1968) suggestions for amphibole classification.

The mboziite of present interest differs in two ways from the mboziites found in nepheline syenitic intrusives: it contains appreciably higher amounts of Mg and Al in the Y-site, and may therefore be referred to as *magnesian aluminian mboziite*; and it is of *regional metamorphic origin*. From the foregoing the suggestion emerges that the relation between Mg–Al-poor mboziites and Mg–Al-rich mboziites may be similar to the one existing between riebeckites and glaucophane–crossites.

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