

## THE LEPIDOLITE SYSTEM

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In previous studies<sup>1</sup> of the mica group it was concluded that the lepidolite system belongs to the heptaphyllite micas and differs from the muscovite system in the number of its oxygen atoms. Since the date of those studies, Mauguin<sup>2</sup> has shown by *x*-ray methods that all micas have very similar crystal structures and that all contain 24 atoms of O+F in their chemical formulas. A table of percentage number of non-oxygen (+H+F) atoms calculated from 26 analyses of lithia micas (selected as probably the most accurate now available) shows that K+Na varies from 12.9 to 14.9 per cent; this was taken to indicate that the formula contained fourteen non-oxygen atoms. It was shown that the best analyses have between 21 and 22 oxygen (+F) atoms for fourteen non-oxygen atoms. With the evidence discovered by Mauguin that the molecule contains 24 oxygen (+F) atoms, it follows that the number of non-oxygen atoms must be sixteen. The lepidolite system must therefore be classed with the octophyllite micas rather than with the heptaphyllite micas.

Another conclusion may be drawn from these data. The lithia micas contain more than two K+Na atoms among each sixteen non-oxygen atoms. This may mean that there is a variation in composition, some component molecules containing more than two K+Na atoms, but an alternative explanation (which seems preferable) is that the Na atoms do not proxy exclusively for K in the lithia micas, since K atoms alone never exceed 12.5 per cent of the non-oxygen atoms.

If the lepidolite system belongs with the octophyllite micas what are the formulas for its component molecules? An attempt to solve this problem has met with little success, but one lithia mica (protolithionite) approaches annite in composition. It is reasonable to suppose that the lithia mica system must contain *some* lithium in all its component molecules, and, assuming a minimum of one atom of Li to 24 oxygen atoms, the formula of protolithionite may be written as  $H_4K_2LiFe_4Al_3Si_6O_{24}$ . Certain good lepidolite analyses

<sup>1</sup> A. N. Winchell: *Am. Jour. Sci.*, **IX**, 1925, pp. 309 and 415, and *Am. Mineral.*, **XIII**, 1927, p. 267.

<sup>2</sup> C. Mauguin: *Comp. Rend.*, **186**, 1928, pp. 879 and 1131

approximate to  $H_3K_2Li_3Al_4Si_7O_{24}$ , but other good analyses vary considerably from this in their tenor of alumina and silica. The range of good analyses is represented approximately by assuming a variation from  $H_4K_2Li_3Al_5Si_6O_{24}$  to  $H_2K_2Li_3Al_3Si_8O_{24}$ . These formulas are not entirely satisfactory; they require too much lithia for some analyses and they do not require as much OH (and F) as shown by some analyses. The first difficulty can be remedied in part by using  $H_2K_2Li_2Al_6Si^6O_{24}$  in place of  $H_4K_2Li_3Al_5Si_6O_{24}$ , but that increases the second difficulty. With present data the writer is not now able to find a better solution of the problem.

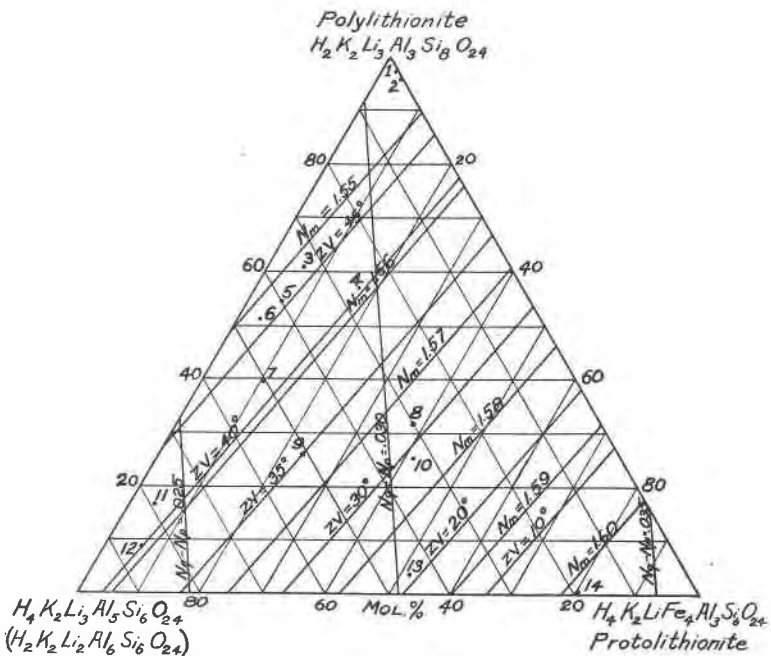


FIG. 1. Variations in composition and optic properties in the lepidolite system.

The relations between variations in composition and variations in optical properties are shown in Fig. 1. In this figure  $Fe_2O_3$  is considered equal to  $2FeO$ ;  $MnO$  (and even  $MgO$ ) is computed with  $FeO$ . The fluorine, abundant in lithia micas, is considered equal to hydroxyl. Some examples do not agree well with the diagram. In some cases this is probably due to the presence of more Al and

less Li than shown in the molecules of the diagram. In other cases a different explanation must be sought. Thus, Simpson's analyzed lepidolites should have an optic angle of about  $45^\circ$ ; they are essentially uniaxial. This may be due to fine twinning on (001). Also certain lithia micas are reported to be triclinic, while others (even in the same rock) seem to be monoclinic. Apparently these micas are dimorphous, and that condition would doubtless entail variations in optical properties, the extent and character of which are at present unknown.

## REFERENCES FOR FIGURE 1

1. Duparc, Wunder et Sabot: *Mem. Soc. Phys. Hist. Nat. Genève*, **XXXVI**, 1910, p. 367.  $N_m=1.5307$ ,  $N_o-N_p=.0314$ ,  $2V=45\frac{1}{2}^\circ$ .
2. Duparc, Wunder et Sabot: *op. cit.*:  $N_m=1.5522$ ,  $N_o-N_p=.0244$ ,  $2V=45^\circ 50'$ .
3. W. Kunitz: *N. Jahrb. Min., Bl. Bd.*, **L**, 1924, p. 365.  $N_m=1.5525$ ,  $N_o-N_p=.0268$ ,  $2V=46\frac{1}{2}^\circ$ .
4. W. Kunitz: *op. cit.*  $N_m=1.5626$ ,  $N_o-N_p=.0291$ ,  $2V=40^\circ 28'$ .
- 5, 6. E. S. Simpson: *Am. Jour. Sci.*, **IX**, 1925, p. 424.  $N_m=1.5550$ ,  $N_o-N_p=.0224$ ,  $2V=0^\circ$ .
7. W. Kunitz: *op. cit.*  $N_m=1.5574$ ,  $N_o-N_p=.0288$ ,  $2V=43^\circ 46'$ .
8. W. Kunitz: *op. cit.*  $N_m=1.5754$ ,  $N_o-N_p=.0307$ ,  $2V=31^\circ 16'$ .
9. W. T. Schaller: *Am. Jour. Sci.*, **XXIV**, 1907, p. 158.  $2E=57^\circ \therefore 2V=35^\circ \pm$ .
10. W. Kunitz: *op. cit.*  $N_m=1.5777$ ,  $N_o-N_p=.0301$ ,  $2V=29^\circ 36'$ .
11. J. Sekanina and J. Vyslouzil: *Min. Abst.*, **IV**, 1930, p. 379.  $N_m=1.558$ ,  $2E=63^\circ \therefore 2V=39^\circ$ .
12. C. H. Stockwell: *Ph.D. Thesis, Univ. Wis.*, **1931**.  $N_m=1.570$ ,  $N_o-N_p=.031$ ,  $2V=40^\circ$ .
13. W. Kunitz: *op. cit.*  $N_m=1.5850$ ,  $N_o-N_p=.0304$ ,  $2V=20^\circ 42'$ .
14. W. Kunitz: *op. cit.*  $N_m=1.6057$ ,  $N_o-N_p=.0333$ ,  $2V=0^\circ$ .