

NOTES AND NEWS

THE COMPOSITION OF MUSCOVITE (FURTHER DISCUSSION)

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The recent discussion by Mr. Hallimond¹ of the writer's theory of the composition of micas of the muscovite-phengite series seems to call for a restatement of certain points in order to avoid any misunderstanding.

The writer has stated before² that "no one has suggested that in muscovite proper the $K_2O:SiO_2$ ratio is not 1:6." He has suggested, however, that this ratio is 1:7 in phengite (at the other end of the series). It seems obvious, then, that data regarding pure muscovite have no bearing on the question at issue; furthermore, the differences between the requirements of Hallimond's theory and those of the writer for micas containing less than 30 or 40 per cent of the phengite molecule are so small that present analytical data can not be used successfully to discriminate between them; that is, for micas containing less than 30 or 40 per cent of the phengite molecule, the differences are clearly within the limits of error of the analyses (or else within the limits of actual and unexplained variations in the micas themselves). Therefore the writer disregarded such analyses entirely in his first discussion of the question,² and only included them in his second discussion³ in order to show the "progressive diminution in $K_2O:SiO_2$ as the magnesia increased," which Hallimond was unable to find. Now Hallimond¹ averages the results of such analyses in the series of Kunitz with the result of his analysis of a phengite and finds in this way a confirmation of his theory, since the "mean difference of the potash values" is only 1.1 units more than the requirements of his theory. The difficulty with this method of calculation is that in using the "mean difference" (rather than the average difference regardless of the sign) Hallimond is (undoubtedly unconsciously) assuming the correctness of his theory, and of course computations based on that assumption are not competent to test the correctness of the theory. The average difference (regardless of sign) between the results of Kunitz and the requirements of the theory of Hallimond is 4.3 units, which corresponds with about 0.5 per cent of potash. The average difference between the results of the analyses of Jakob⁴ (a series of ten analyses of micas of the muscovite-phengite series still more recent than the analyses of Kunitz) and the requirements of the theory of Hallimond is 8.6 units, which corresponds with about 1.0 per cent of potash. The average difference between the results of the analyses of Kunitz and of Jakob and the requirements of the writer's theory is 7.5 units, which corresponds with about 0.9 per cent of potash. Since Hallimond considers 0.7 per cent of potash too great a mean difference, these average differences seem important.

¹ *Am. Mineral.*, **XIII**, 1928, p. 451.

² *Am. Mineral.*, **XII**, 1927, p. 272.

³ *Am. Mineral.*, **XIII**, 1927, p. 52. In printing the first complete sentence on page 54 one line of the manuscript was inadvertently omitted producing a rather obvious error. This sentence should read as follows: "In the diagram the numbered points representing the analyses should lie along the horizontal line to confirm the theory of Hallimond; they should lie along the inclined line to confirm the theory of the writer." Also in the last line on page 55 the reference should be to footnote 9 instead of 8.

⁴ *Zeit. Krist.*, **LXII**, 1925, p. 443.

It seems evident to the writer that the only analyses which are really useful as a test of the theories concerned are those of phengitic micas, that is, those of micas of the muscovite system characterized chemically by the presence of considerable magnesia or ferrous iron and characterized physically by a small optic angle. The writer has already called attention to the fact that all analyses of such micas are in discord with the theory of Hallimond and that the three modern analyses of such micas (one by Penfield, one by Kunitz and one by Jakob) agree well with the theory of the writer. It was, of course, these analyses which the writer had especially in mind when he wrote that the "theory [of Hallimond] . . . is not in harmony with the modern analytical data on the composition of the micas of the muscovite series."

It is surprising to find that Hallimond¹ still thinks the writer's theory involves "the replacement RO/R_2O_3 "; also to find that Hallimond supposes the writer adopted Hallimond's "conclusion that in muscovite $RO+R_2O_3$ is constant." As a matter of fact the writer has urged that $MgSiO_3$ may proxy for $AlAlO_3$ in muscovite—an idea rejected by Hallimond.

Hallimond speaks of "Winchell's successive proposals to base formulæ on (1) equality in the total number of atoms, (2) equality in the number of oxygen atoms, and (3) equality of molecular volume." The writer regrets that he has so signally failed to make himself understood. A review of the writer's articles will show in them not three different proposals, but one theory, which was admittedly unsatisfactory in some respects, when first published, and was later modified so as to eliminate the unsatisfactory features; the first proposal was not based on "equality in the total number of atoms," but on equality in the number of non-oxygen atoms and approximate equality in the size of the non-oxygen atoms (in each case in which one may proxy for another), and was admittedly unsatisfactory because the oxygen atoms were not equal in number; the improvement in this proposal brought about equality in the number of oxygen atoms so as to secure thereby equality in the number of all the atoms and approximate equality in the size of each atom which may proxy for another; finally, far from basing any proposal on equality of molecular volume, the writer has not even mentioned such a conception, but on the contrary is inclined to question whether "molecules" (in the ordinary sense of groups of atoms held by chemical forces closer to each other than to atoms of other molecules) actually exist in crystals of the inorganic world.

The writer is pleased to learn that Hallimond now finds that there is "no difficulty in writing $RO \cdot SiO_2$ as a divalent group resembling 'basic' Al_2O_3 ," since this means that the proposal that $MgSiO_3$ may proxy for $AlAlO_3$ is not inconsistent with Hallimond's chemical theory even though it may be inconsistent with one of the corollaries drawn from that theory by Hallimond—that is, the idea of the fixed $K_2O:SiO_2$ ratio.

So far as the theoretical basis of the writer's explanation of the micas is concerned, evidence in support of it seems to be accumulating rapidly. The latest serious study of the relations between sizes of atoms and isomorphism known to the writer is described in an article by L. Royer.⁵ He investigated experimentally these relationships in the halides of all the monovalent metals (including NH_4) by determining which halides control the superimposed crystallization of others. He found that halides of the NaCl type of space lattice do not control the crystallization of

⁵ *Bull. Soc. Fr. Min.*, LI, 1928, pp. 7-159.

halides of the CsCl type of space lattice (and *vice versa*). He found also that any halide controls the crystallization of any other halide of the same type of space lattice only in case and in proportion as the space lattices concerned are (nearly) the same in dimensions. Since the dimensions of the space lattices depend upon the dimensions of the atoms, this conclusion can be stated in the form: any halide controls the crystallization of any other (of the same crystal type) only in case and in proportion as the atoms concerned are (nearly) the same in dimensions. The writer believes that the same law applies to isomorphous mix-crystals.

Attention is again called to the annual meeting of the Society to be held Dec. 27-29, 1928, in New York City. The December issue will contain a preliminary list of titles of papers to be presented before the Society at this meeting. Titles of papers should be sent to the Secretary *at once* to insure their appearance in the December number.

NEW MINERAL NAMES

CLASSIFICATION OF THE CALCITE GROUP

G. BILIBINE: On the isomorphous mixtures of the calcite group. *Mem. Soc. Russ. Mineral.*, 2nd series, 56, 3-36, 1927. (Russian with French summary). The isomorphous mixtures are classified as follows:

Binary mixtures:

Pistomesite	(Mg, Fe) CO ₃
Oligonite	(Fe, Mn) CO ₃
Roepperite	(Ca, Mn) CO ₃
Dolomite	Ca, Mg (CO ₃) ₂
Monheimite	(Zn, Fe) CO ₃
Baritocalcite	Ca, Ba (CO ₃) ₂

Ternary mixtures

Ankerite	Ca (Mg, Fe) (CO ₃) ₂
Cobaltsmithsonite	(Zn, Co, Mg) CO ₃

Quaternary mixtures

Kutnohorrite	(Ca, Mg, Fe, Mn) CO ₃
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The limiting values as Bilibine would give them are: For binary mixtures not less than 25 per cent of the second constituent; for ternary mixtures not less than 17 per cent of the third constituent.

W. F. F.

Alumohydrocalcite

G. BILIBINE: Alumohydrocalcite, a new species. *Mem. Soc. Russe Mineral.*, 55, 243-258.

NAME: From the chemical composition of the mineral, a hydrated carbonate of lime and alumina.

CHEMICAL PROPERTIES: A hydrous carbonate of lime and alumina. CaO.Al₂O₃. 2CO₂. 5H₂O. Analysis: SiO₂ 0.67, TiO₂ none, Al₂O₃ 28.60, Fe₂O₃ 0.45, FeO 0.35, MnO none, CaO 15.46, MgO tr., K₂O tr., Na₂O tr., P₂O₅ 0.74, CO₂ 25.20, H₂O—26.40, H₂O+ 2.48. Total 100.35. Easily soluble in acids with effervescence, par-