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Conversion of muscovite at high pressures and temperatures

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INTRODUCTION

Previous communications (Markov et al., 1966; Markov et al., 1968) established that certain trioctahedral micas (phologopite, biotite, and lepidomelane) are unstable at high pressures and decompose.

A characteristic feature of these potassium-containing minerals is that although the mean density of the mineral associations formed during decomposition is greater than that of the initial micas, the potassium in these associations is incorporated in minerals of relatively low density (not more than 3 g/cm^3).

This characteristic of potassium-containing minerals enabled us to draw certain inferences regarding their behavior at depth and the causes of removal of potassium into the outer layers (Markov et al., 1968).

This paper continues our work on the behavior of potassium-containing minerals at high pressures and temperatures. The investigations were performed on muscovite – one of the dioctahedral micas.

The conversions of muscovite were studied at a pressure of 66 kbar in the range 900-2000°C.

INITIAL MATERIAL

As the initial material we took pure, inclusion-free transparent crystals of muscovite (4 x 4 cm) from one of the Mamsk deposits. Table 1 gives the chemical composition of the initial muscovite. The refractive indices, measured in a refractometer, were as follows: Ng = 1.602, Nm = 1.599, Np = 1.566 (all ±0.001). The density was measured by the immersion method: 2.81 ± 0.02 g/cm^3. Table 2 gives the interplanar spacings.

TABLE 1. Chemical composition of initial muscovite.

SiO_2	43.35
TiO_2	0.22
Al_2O_3	35.45
Fe_2O_3	0.91
FeO	1.06
MnO	traces
MgO	3.29
CaO	0.75
H_2O^+	4.75
H_2O^-	0.30
Na_2O	0.57
K_2O	6.92
F	0.15
	99.72
F=0	−0.06
Total	=99.66

Analyst M.G. Zamurueva, Institute of Geology, USSR Academy of Sciences.

TABLE 2. Interplanar spacings of initial muscovite.

d*	J	d*	J
4.741	w	1.436	v.w.
4.311	s	1.404	w
3.741	avg.	1.340	s
3.391	avg.	1.325	avg.
3.231	s	1.311	avg.
3.121	v.w.	1.288	s
2.931	avg.	1.264	avg.
2.801	avg.	1.238	s
2.731	avg.	1.213	w
2.521	v.s.	1.196	w
2.431	w	1.149	w
2.341	avg.	1.123	avg.
2.161	w	1.110	avg.
2.091	avg.	1.096	w
1.971	s	1.080	v.w.
1.847	w	1.071	v.w.
1.792	w	1.060	w
1.712	w	1.053	w
1.633	v.s.	1.045	w
1.584	avg.	1.035	w
1.542	avg.	1.009	avg.
1.509	w	0.997	avg.
1.490	v.s.	0.989	avg.

*The X-ray photographs were corrected relative to NaCl.

SPECIMENS AND EXPERIMENTAL PROCEDURE

To create high temperatures in the pressure chamber we used internal heating. A stack of muscovite plates, cut from a crystal, was placed

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