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3T muscovite from a staurolite-zone south-alpine gneiss, Cermeledo, Italy

SYSTEMATIC studies of the white micas of the metamorphic rocks of the south-alpine complex of Valtellina, central Alps, Italy, showed in places occurrences of the 3T polymorph coexisting with the ubiquitous 2M form. The 3T mica has the chemical and X-ray characteristics of muscovite. It was found to be dominant in a specimen collected at Cermeledo, near Dazio, and this rock was therefore chosen for detailed examination. The rock is 'Morbegno Gneiss' (Bonsignore *et al.*, 1971) and was metamorphosed under amphibolite facies conditions (staurolite-almandine subfacies, B 2.1, Winkler, 1967). The main mineral constituents of the sample are K-feldspar, quartz, plagioclase, biotite, muscovite, and garnet. The chemical compositions, cell parameters, and optical properties of the white micas are given in Table I, where they are compared with the well-known 3T muscovite from Sultan Basin (Güven and Burnham, 1967) and with muscovite from the Sanbagawa metamorphic belt (Kihara *et al.*, 1975).

The trigonal symmetry determined from the powder pattern (Yoder and Eugster, 1955) was confirmed by single crystal methods. Weissenberg photographs were taken of one flake, which was picked by hand from the concentrate and was almost free of mechanical distortion. This gave a sensibly uniaxial interference figure and the c unit cell dimension was found to be $29.7 \pm 0.1 \text{ \AA}$. Rotation about the a axis confirmed the parameter obtained from the powder pattern ($a_1 = a_2 = 5.21 \text{ \AA} \pm 0.02 \text{ \AA}$). Of 200 measured flakes 67.7% gave uniaxial interference figures while for 20 flakes of the biaxial micas the $2V_\alpha$ ranged from 18 to 27.5° (with a mean of

TABLE I. *Chemical, X-ray, and optical data for 3T white micas*

	1	2	3	4	A	B	C		
SiO ₂	n.d.	47.73	48.75	46.75	a	5.210Å	5.1963	5.24	A: Cermeledo
Al ₂ O ₃	30.19	32.10	32.47	32.64	b	29.922Å	29.970	30.1	B: Sultan Basin
Fe ₂ O ₃	1.09	—	—	—	V	703.39Å ³	7.00.84	715.75	C: Sanbagawa
FeO	1.75	2.82*	2.97*	2.61*	a	1.568 [±] 0.004	—	—	
MgO	1.43	1.38	1.61	1.04	δ	1.597	1.592	1.599	all [±] 0.002
CaO	n.d.	nil	nil	nil	1. Wet-chemical analysis of the concentrate containing 3T and 2H polytypes (R. Bocchio).				
Na ₂ O	0.51	0.37	0.35	0.34	2. Microprobe analysis of the 3T polytype (average of 5 measurement on different flakes (W. L. Griffin).				
K ₂ O	9.96	10.53	10.61	10.45	3. Microprobe analysis of the 3T flake with the highest value of RM (W. L. Griffin).				
TiO ₂	0.73	0.70	0.82	0.77	4. Microprobe analysis of the 3T flake with the lowest value of RM (W. L. Griffin).				
H ₂ O †	4.48	—	—	—					
<u>Na</u>	0.07	0.05	0.05	0.05					
Na+K									
RM	0.07	0.07	0.08	0.06					

* Total iron as FeO † At 1000°C

Errata: Line 3, for b read c ; line 4, for 7.00.84 read 700.84; line 8, for 2H read 2M

23.54° and standard deviation of 2.65°) and $\alpha = 1.571 \pm 0.004$, $\beta = 1.597 \pm 0.002$ and $\gamma = 1.602 \pm 0.002$. Owing to the coexistence of the two micas the chemical analysis performed by wet chemistry cannot be considered to represent the true composition of the 3T white mica. Better results, as a whole compatible with the wet-chemical ones, were obtained using the microprobe and measuring only micas showing a uniaxial figure in thin section. A certain scatter in composition is evident.

These micas are low in the paragonitic component ($\text{Na}/(\text{Na}+\text{K}) \leq 0.07$) as well as in the phengitic one ($\text{RM} = 1/2\text{Fe}_2\text{O}_3 + \text{FeO} + \text{MgO}_{\text{mol. ratio}} \leq 0.07$). According to Cipriani *et al.*, (1971), the value $\text{RM} = 0.08$ should be taken as the boundary between muscovite and phengite, thus the $\text{RM} = 0.07$ determined for this sample clearly sets it in the muscovite field. With the exception of the 3T muscovite of Sultan Basin, which occurs in metasomatic veins, the Cermeledo 3T white mica is, so far, the 3T mica that shows the purest muscovitic composition, the Sanbagawa sample being just at the boundary between muscovite and phengite ($\text{RM} = 0.08$). It is significant, moreover, that such a mica occurs in high-grade metamorphic rocks, with a composition fully compatible with the 2M white micas of the same environment, whereas most 3T white mica are phengites occurring in low-grade high-pressure metamorphic rocks (Liborio and Mottana, 1975).

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Eskolaite, Cr₂O₃, from County Wicklow, Ireland

ALTHOUGH long known as a synthetic material, Cr₂O₃ was reported as a mineral only in 1958 following its discovery in 1949 at the Outokumpu copper mine, Finland (Kuovo and Vuorelainen, 1958; Tennyson, 1961). The Outokumpu eskolaite occurs in skarns, quartzites, pyrrhotine veins, and chlorite seams within chromium-rich metamorphic rocks surrounding the mine. A second occurrence in the then British Guiana has also been described (Milton and Chao, 1958; Milton and Narain, 1969). The Guyana eskolaite is the predominant species amongst a complex mixture of several chromium minerals termed 'merumite', which occurs as pebbles in placer gravels dispersed within the Merume river and its tributaries. A new find from County Wicklow is believed to be the third known occurrence of eskolaite.

On 20 September 1974 a small piece of greywacke with a marked green coloration was submitted to the Geological Survey of Ireland by Mr. T. H. Stevenson of Newcastle, Co. Wicklow; the material had been encountered in the form of tiny pebbles within clay being dug for foundations. Examination of a polished mount failed to reveal discrete green mineral grains although a green internal reflection was evident surrounding the quartz grains of the greywacke. The presence of Cr and Mn was indicated by XRF examination. A sample was sent to the Institute for Industrial Research and Standards, Dublin, for XRD analysis, and the presence of eskolaite within the rock was established. Further XRD and microprobe analysis was conducted at University College, Dublin, confirming both the identification and the concentration of the chromium around the quartz grains and dispersed within the matrix. As the eskolaite grains are virtually submicroscopic no physical description can be given.