

Acknowledgement. The kind donation of specimens by Dr. G. T. Faust, the curator of the U.S. National Museum, and Mr. C. D. Rushton is gratefully acknowledged.

*Dept. of Geology, Hebrew University
Jerusalem*

L. HELLER-KALLAI
SH. YARIV

*Geological Survey of Israel
Jerusalem*

S. GROSS

REFERENCES

- CRUZ (M.), JACOBS (H.), and FRIPIAT (J. J.), 1972. *International Clay Conference Madrid*, **1**, 59.
 FAUST (G. T.) and FAHEY (J. J.), 1962. *U.S. Geological Survey Prof. Paper* **384A**.
 GIESE (R. F., Jr.), 1973. *Clays and Clay Minerals*, **21**, 145.
 HISOTA (H. I.) and OINUMA (K.), 1967. *Amer. Min.* **52**, 1206.
 JAHANBAGLOO (I. C.) and ZOLTAI (T.), 1968. *Ibid.* **53**, 14.
 LUCE (R. W.), 1971. *U.S. Geol. Survey Prof. Paper*, **750B**, 199.
 TUDDENHAM (W. M.) and LYON (R. J. P.), 1959. *Anal. Chem.* **31**, 377.
 VENIALE (F.) and VAN DER MAREL (H. W.), 1963. *Beitr. Min. Petr.* **9**, 198.
 WILKINS (R. W. T.), 1967. *Min. Mag.* **36**, 325.
 YARIV (S.) and HELLER (L.), 1970. *Israel Journ. Chemistry*, **8**, 935.
 — and HELLER-KALLAI (L.), 1975. *Clays and Clay Minerals*, in press.

[*Manuscript received 13 May 1974, revised 15 July 1974.*]

© Copyright the Mineralogical Society.

MINERALOGICAL MAGAZINE, JUNE 1975, VOL. 40, PP. 200-2

A nickel-bearing aluminium serpentine (septechlorite) from Western Australia

PERCUSSION drill samples from Woodline Well, Western Australia, reported up to 3.9 wt % Ni, but with no visible sulphide. Woodline Well is situated approximately 8 km west of the Poseidon-Western Mining Corporation nickel mine at South Windarra. The sulphide nickel at South Windarra lies within an Archaean ultramafic complex at the south-west contact within a banded iron formation. It has an east-west strike, dips 45° south and forms the westernmost part of the limb of a regional anticline, terminated by a granite intrusion. The intersection at Woodline Well probably represents the xenolithic remnants of an ultramafic, that once extended west from South Windarra. The drill chip samples came from the oxidized zone above the water table.

X-ray diffractographic examination of the samples indicated major quartz, 'serpentine', hornblende, and talc with minor feldspar, chlorite, and magnetite. A mineralogical examination detected no sulphide or discrete nickel component.

After screening, the plus 200 mesh fraction was subjected to methylene iodide heavy medium and magnetic separations. Nickel enrichment occurred in the light,

non-magnetic fraction. A binocular stereomicroscope examination showed the predominant component to be a dark green, coarsely crystalline sheet mineral of 'chloritic' appearance.

Optical properties. The mineral is micaceous, biaxial negative with $2V = 0$ to 10° , having straight extinction, and a pronounced $\{001\}$ cleavage. Refractive indices are $\alpha 1.632 \pm 0.002$, yellow-green: β and $\gamma 1.672 \pm 0.002$, dark green.

TABLE I. *X-ray powder data for nickel-bearing aluminium serpentine (septechlorite) from Woodline Well. Estimated intensities*

<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>	<i>d</i>	<i>I</i>
7.120	100	2.579	30	1.886	10	1.510	40	1.275	10	1.006	10
4.750	90	2.548	30	1.823	10	1.470	20	1.227	10	0.993	10
4.605	10	2.393	80	1.747	10	1.417	30	1.185	10	0.940	10
3.556	90	2.265	20	1.670	20	1.333	20	1.135	10	0.914	10
2.834	10	2.027	50	1.568	10	1.323	20	1.100	10		
2.658	60	2.008	50	1.544	70	1.295	10	1.045	20		

TABLE II. *Electron microprobe analysis for nickel-bearing aluminium serpentine (septechlorite) from Woodline Well*

	1	2	3	4	5	6	Average		No. ions per 36 (O, OH)
SiO ₂	27.5	28.7	27.6	27.5	29.2	28.9	28.2	Si	6.12
TiO ₂	0.8	1.3	0.9	1.0	0.9	0.9	1.0	Ti	0.16
Al ₂ O ₃	11.9	12.2	11.0	11.2	10.4	10.7	11.2	Al	2.86
FeO*	20.3	20.7	20.3	19.9	19.9	20.1	20.2	Fe ³⁺	2.27†
								Fe ²⁺	1.40‡
NiO	14.1	14.1	14.6	15.2	14.6	15.2	14.6	Ni	2.55
MgO	12.4	11.5	12.2	14.9	14.2	11.5	12.8	Mg	4.14
H ₂ O†	13.0	11.5	13.4	10.3	10.8	12.7	12.0	OH	15.33

* Total iron as FeO. † By difference. ‡ Wet-chemical analysis.

X-ray diffraction data. Both camera and diffractometric techniques were employed to obtain X-ray data. A ball-mount preparation together with a silicon internal standard in a 114.6 mm diameter Gandolfi camera was used. An exposure of one hour using cobalt radiation rated at 30 kV and 40 mA proved sufficient. A silicon internal standard was also used for the diffractometric examination, and scanned at a speed of $\frac{1}{4}^\circ 2\theta$ per minute for both normal and oriented preparations. The corrected *d* values are listed in Table I. They are similar to the aluminium serpentine of Bailey and Tyler (1960) and the nickeloan amesite of Maksimovic (1972).¹

¹ Maksimovic proposed the name nimesite for this variety. Fleischer (1973), however, describes this name as 'unfortunate, being readily confused with the 14Å dimorph, nimite'.

Electron microprobe analysis. Chemical analyses were done on a Jeol JXA-3 instrument, with a beam diameter of about 10 μm , generated by an accelerating voltage of 20 kV and giving a specimen current of 0.1 μA . Two point analyses in each crystal flake for each element were averaged to give one result. The standards used were pure elements, periclase, and topaz, and the data corrected for atomic number, mass absorption, and secondary fluorescence effects. The results are listed in Table II, as well as the calculated formula based on 36 (O, OH). The $\text{Fe}^{2+}:\text{Fe}^{3+}$ ratio of 1:1.6 was determined by chemical analysis of a purified sample.

Conclusions. The nickel-bearing component at Woodline Well, Western Australia, is a nickel-bearing aluminium serpentine (septechlorite) containing 11.5 wt % Ni (14.6 wt % NiO). Little variation in composition occurs between grains, or across individual grains. The calculated formula (Table II) assumes the remaining component to be water.

Acknowledgements. The electron microprobe analysis was done at the Australian Mineral Development Laboratories, Adelaide, by P. K. Schultz, to whom the author expresses his thanks. This communication is published by permission of Carpentaria Exploration Company Pty. Ltd., and Mount Isa Mines Limited.

*Technical Services Department, Mount Isa Mines Limited,
Mount Isa, Queensland 4825, Australia.*

JOHN F. RILEY

REFERENCES

- BAILEY (S. W.) and TYLER (S. A.), 1960. *Econ. Geol.* **55**, 150.
 FLEISCHER (M.), 1973. *Amer. Min.* **58**, 1112.
 MAKSMOVIC (Z.), 1972. *Bull. Sci. Cons. Acad. Sci. Arts. R.S.F. Yugoslav, Sect.* **A17**, 224.

[Manuscript received 26 March 1974, revised 7 July 1974.]

© Copyright the Mineralogical Society.

MINERALOGICAL MAGAZINE, JUNE 1975, VOL. 40, PP. 202-5

Existence of 3T muscovite in low-grade metamorphic rocks of the Sanbagawa metamorphic belt, Japan

THE presence of muscovite with a wide range of $2V_{\alpha}$ has been reported from a few metamorphic terrains (Spry, 1963; Ansilevsky, 1966; Mimuro, 1971). It was found that muscovites in pelitic and basic schists of the Sanbagawa metamorphic belt in Japan also show various $2V_{\alpha}$ values in different grains in the same hand-specimen, or sometimes in different portions of single muscovite flakes (Mimuro, 1971). We have carefully examined a muscovite flake with $2V_{\alpha} \approx 2^{\circ}$ and concluded that it is a