characteristic of sulphides (*e.g.*, B. J. Skinner *in* Roedder, 1965). Preservation of the above fabrics indicates little post-depositional change occurred. The ores of the Tilt Cove area have therefore suffered only mild metamorphism.

Studies (Bachinski) are continuing on the Tilt Cove and related deposits in the area. An attempt is being made to reconstruct the volcanic-sedimentary sequences and to place constraints on the time of mineralization. Further consideration of the textures described in this note is thus being deferred until completion of the project.

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SOME PROPERTIES OF RAMMELSBERGITE AND PARARAMMELSBERGITE

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A number of nickel diarsenide specimens were examined in the course of a larger investigation of transition metal arsenide minerals (Radcliffe 1966) using electron microprobe, density, and *x*-ray diffraction techniques.

Rammelsbergite has the space group *Pnnm* (58) (Peacock & Dadson, 1949). This was confirmed by Kaiman (1946) who showed that it has the marcasite structure (*C*18 type).

Pararammelsbergite has the space group *Pbca* (61) determined by Yund (1961) for synthetic material and by Berry & Thompson (1962) for the type mineral specimen. This space group was confirmed by Bennett & Heyding (1966).

Yund (1961) demonstrated that pararammelsbergite is a lower temperature polymorph of rammelsbergite with an inversion temperature of 590° C in equilibrium with niccolite (NiAs). He also pointed out that this inversion temperature is appreciably lowered by inclusion of small quantities of cobalt and sulphur in the lattice.

TABLE 1. CELL DIMENSIONS OF $NiAs_2$ POLYMORPHS

Author	a Å	b Å	c Å	Material
Rammelsbergite				
Peacock & Dadson (1940)	4.79	5.79	3.54	Natural
Heyding & Calvert (1960)	4.76	5.79	3.54	Synthetic
Swanson *et al.* (1960)	4.759	5.797	3.539	Synthetic
Yund (1961)	4.757	5.793	3.544	Synthetic
Roseboom (1963)	4.755	5.801	3.543	Synthetic
Radcliffe (1966-extrapolated)	4.77	5.80	3.53	Natural
Pararammelsbergite				
Peacock & Michener (1939)	5.75	5.82	11.43	Natural
Heyding & Calvert (1960)	5.75	5.82	11.43	Synthetic
Bennett & Heyding (1966)	5.770	5.838	11.419	Synthetic
Radcliffe (1966-impure)	5.749	5.788	11.418	Natural

The unit cell dimensions of $NiAs_2$ polymorphs are given in Table 1. Three rammelsbergite specimens were examined in this study and all contain less than 4 mole % metal impurities, but up to 10 mole % S replaced arsenic. Since sulphur is smaller and lighter than arsenic, an effect on the density, cell constants and molar volumes can be expected. This is shown in Fig. 1 where good linear agreement exists in all cases. The values of the cell constants, given in Table 1, have been obtained by extrapolation to 0 per cent S.

The stoichiometry of the two polymorphs has been determined by matching the density calculated for simple models (*e.g.* Frenkel and Schottky type defects) with the measured density. These details are given in Table 2.

Pararammelsbergite has vacant arsenic lattice positions which are occupied in part by excess metal atoms. No such vacancies were found in rammelsbergite and this difference in stoichiometry is probably related to crystal structure and stability temperature. The effect of impurities on $NiAs_2$ is not fully understood. However, in the case of rammelsbergite (Fig. 1) a significant change of stoichiometry can be recognized with increasing sulphur content, *i.e.* a Schottky type defect involving metal deficiencies is produced.

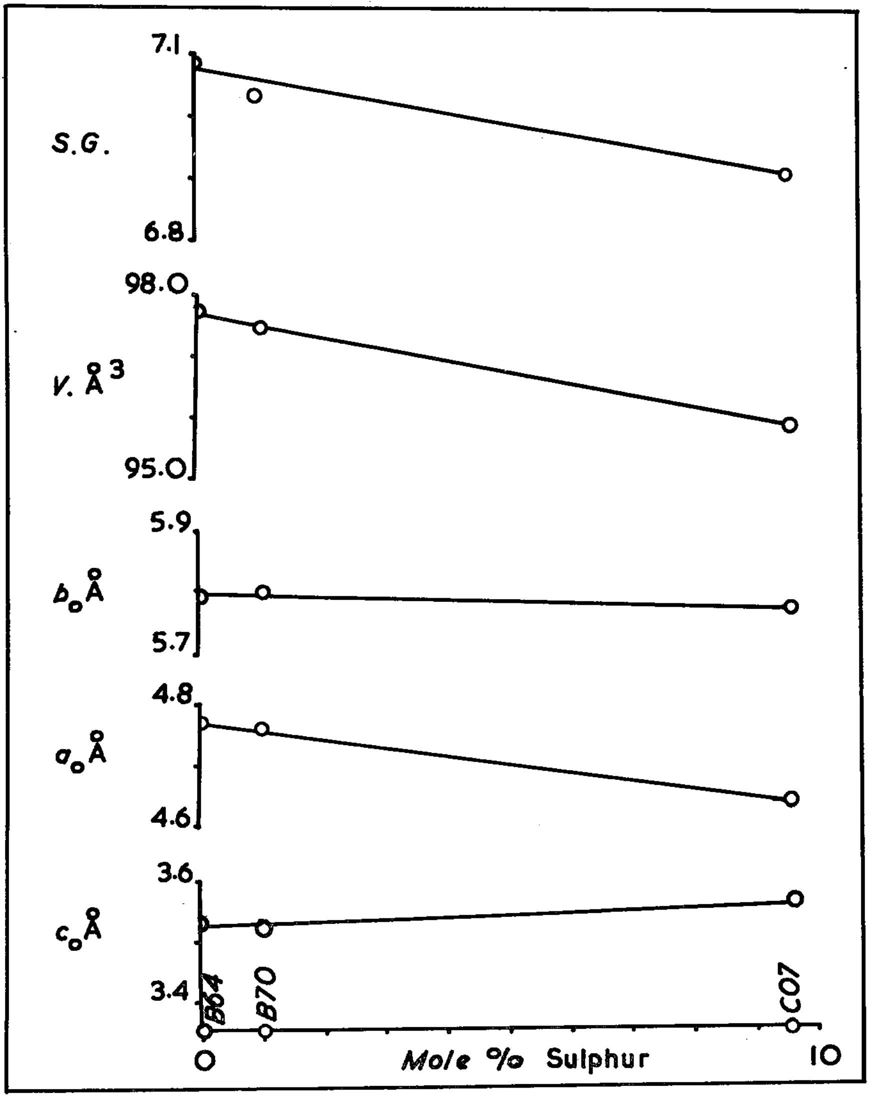

FIG. 1. Rammelsbergite. Sulphur *vs.* lattice parameters.

It thus appears that sulphur may control the stoichiometry in rammelsbergite at least. Since Yund (1961) found experimentally that the inversion temperature of rammelsbergite-pararammelsbergite was appreciably lowered by the presence of sulphur, it is probable that the stoichiometry is controlled by temperature also. In this regard the stoichiometry of $NiAs_2$ polymorphs may be of some use in geothermometry.

TABLE 2. STOICHIOMETRY OF $NiAs_2$ POLYMORPHS

Sample #	Mole % S	Mole % Co	Stoichiometry	D_m
Rammelsbergite				
1B64	0.0	3.32	$A_{1.00}B_{2.00}$	7.09
1B70	1.0	3.9	$A_{1.00}B_{1.99}$	7.03
1C07	9.6	0.7	$A_{.97}B_{2.00}$	6.89
Pararammelsbergite				
1B66	5.2	7.0	$A_{1.00}(A_{.03}B_{1.94})_{1.97}$	7.04
1B33	3.9	7.6	$A_{1.00}(A_{.02}B_{1.91})_{1.93}$	7.03

A = Ni, Co B = As, S D_m = measured density.

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