

C. Walsh gave permission to collect from his quarry at Stepaside.

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Rhenium sulphide from the Coldwell complex, northwestern Ontario, Canada

RHENIUM ranks as one of the most highly dispersed elements, and reports of *bona fide* rhenium-based minerals are few (Vlasov, 1966). This short communication presents the first conclusive evidence for the occurrence of a naturally occurring rhenium sulphide.

The Re mineral occurs in a copper–platinum

group element deposit hosted by a pegmatitic facies of the Two Duck Lake gabbro (Dahl *et al.*, 1986; Watkinson *et al.*, 1986). This gabbro intruded layered olivine gabbros that form the eastern margin of Center 1 of the Coldwell alkaline complex in northwestern Ontario (Mitchell and Platt, 1982).



Fig. 1. Back-scattered electron image of $(\text{Re},\text{Mo})_2\text{S}_3$ crystal hosted by pyrrhotite.

Examination of the portions of the deposit which are rich in platinum group minerals by back-scattered electron imagery and energy dispersive X-ray spectrometry revealed the presence of a single euhedral crystal, $7 \times 10 \mu\text{m}$, of a Re-rich phase (Fig. 1). The crystal is enclosed in pyrrhotite, which is intergrown with dominant chalcopyrite. Accessory minerals within the latter include hollingworthite (RhAsS), hessite (Ag_2Te), paolovite (Pd_2Sn), michenerite (PdBiTe) and clausenthalite (PbSe).

The composition of the Re-rich mineral was determined using wavelength dispersion and a JEOL-733 electron microprobe operated at 15 kV with a beam current of 20 nanoamperes, and with the following X-ray lines and standards: Re- $L\alpha$, Mo- $L\alpha$, Cu- $K\alpha$ (metals), Fe- $K\alpha$, S- $K\alpha$ (pyrite). Results given in Table 1 demonstrate that the mineral consists predominantly of Re, Mo, and S, with minor amounts of Cu and Fe. Recalculation of the composition into atomic proportions (Table 1) suggests the formula $(\text{Re},\text{Mo},\text{Fe},\text{Cu})_2\text{S}_3$ or $\text{Re}(\text{Mo},\text{Cu},\text{Fe})\text{S}_3$. Unfortunately, the small size of the crystal precluded our obtaining an X-ray diffraction pattern, necessary for more complete understanding of the stoichiometry of the phase and formal description as a new mineral.

Table 1. Composition of rhenium sulphide Coldwell Complex

	wt. %	Atom. Prop.	Atom %
Re	48.95	0.2629	18.82
Mo	14.15	0.1475	10.56
Cu	4.75	0.0747	
Fe	4.15	0.0743	
S	26.85	0.8374	59.95
	98.85		

In spite of the small grain size, we believe that the Fe and Cu concentrations reported are realistic because they are substantially more than can be expected from fluorescence from associated pyrrhotite or chalcopyrite (probably less than 0.25%).

Other rhenium sulphide minerals that have been reported but not adequately described include Re_2S_3 (Volborth *et al.*, 1986) and dzhezkazganite (CuReS_4 ?) (Poplavko *et al.*, 1962). Unfortunately, Volborth *et al.* (1986) did not report any compositional or optical data and it cannot be ascertained whether the Coldwell Re sulphide is similar to the Stillwater sulphide. The sulphur content of our material indicates that the mineral is unlikely to be ReS , or ReS_2 .

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Manganese oxides from the British Isles

RECENT lists of British minerals by Livingstone and Macpherson (1983), Bevins (1988) and Ryback *et al.* (1988) have added significantly to the original work of Greg and Lettsom (1858) and subsequent updates by Spencer (1898, 1931, 1958) and Embrey (1978). This note reports on the discovery of six manganese oxide minerals previously unrecorded in Britain, summarizes the difficulties involved in the accurate identification of this group of minerals and, in this context, discusses the reliability of the early identifications.

Manganese oxides are an often neglected and ill-defined group of minerals. They frequently occur as black, very fine-grained, often soft, coatings, cements and masses, and are commonly regarded as ubiquitous, amorphous weathering products of little mineralogical interest. However, while the bulk of the oxides may be (or appear to be) amorphous, close inspection under the binocular microscope can reveal crystalline grains which can be identified by X-ray diffraction (XRD). Studies of such occurrences, together with those on recognized manganese deposits, have confidently identified a total of sixteen manganese oxide minerals in Scotland alone (Nicholson, 1989). It is hoped that this work will encourage further studies on seemingly insignificant manganese oxide occurrences in Britain since, from the author's experience, it is likely that more manganese oxides await identification.

Early mineralogical works cite the presence of only four manganese oxides: manganite, psilomelane, pyrolusite and wad (Greg and Lettsom, 1858; Heddle, 1901). (Note that 'wad' is not now considered to be a valid species, and the term 'psilomelane' applied to a specific mineral has been replaced by 'romanechite'.) As a consequence of these entries, subsequent lists of British minerals have not included any new accounts or confirmation of these species. However, the early identifications are unreliable as they are based on the appearance of the mineral which, for the manganese oxides, is variable and not a dependable means of identification. In this respect, 'manganite' was applied to a grey-black crystalline mineral with a metallic lustre, while 'pyrolusite' referred to the blue-black equivalent. 'Psilomelane' described any hard, black, often botryoidal, mass with an earthy lustre, with 'wad' as the soft counterpart. As an example, minerals which Heddle (1901) described as pyrolusite, have been subsequently identified by the author as cryptomelane and hollandite. Mis-identifications such as these, and omissions in the oxide mineralogy from a locality, are understandable since it is difficult, usually impossible, to differentiate and identify different manganese oxides in hand-specimen. Identification by instrumental techniques and microscopy is not always a simple matter (Nicholson, 1989). Optimum results are obtained in XRD