MINERAGRAPHIC IDENTIFICATION OF PSILOMELANE AND MANGANITE[1]

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In the course of some recent mineragraphic work on the manganiferous iron ores of the Cuyuna Range, Minnesota, undertaken by the Mississippi Valley Experiment Station of the United States Bureau of Mines in cooperation with the Missouri School of Mines and Metallurgy, Rolla, Missouri, it was necessary to make quick identification of the various oxides of iron and manganese. Hematite and psilomelane were found to be the predominating minerals, although the occurrence of manganite and pyrolusite was important to the problem in hand. The mineragraphic characteristics of these four minerals are shown in Table 1.

Pyrolusite can be readily distinguished from the other minerals on the basis of its luster, color, surface characteristics and hardness. The pitted surface of the hematite and its creamy white color usually serve to make its identification positive. Psilomelane and manganite jointly can be distinguished from the hematite and pyrolusite, but difficulty was encountered in this investigation in visually distinguishing between the two. Psilomelane pseudomorphs after manganite were often confusing. Although the hardness and reactions with HNO_3 and HCl are apparently diagnostic, the results in practice were not distinctive enough to permit certain identification at all times. The action of other etchants was therefore studied. The results are shown in Table 2.

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TABLE I

MINERAGRAPHIC CHARACTERISTICS OF SEVERAL MINERALS

Characteristics		*Hematite*	*Psilomelane*	*Manganite*	*Pyrolusite*
Luster		Bright	Bright, but less than hematite	Bright, between hematite and psilomelane	Bright when well polished
Color		Creamy white	Gray	Gray	Brown when not well polished; gray with good polish
Surface		Much relief, considerable pitting	Smooth	Smooth	Rough; some specimens very difficult to polish
Hardness		5.5 to 6.5, brittle	5 to 6, brittle	4	2 to 2.5
Structure		Pitted, irregular grains	Varied	Radiating needles	Varied, some times banded
Etch Behavior	HNO_3	Negative	Tarnishes; rubs nearly clean	Negative	Negative
	HCl	Negative	Tarnishes; rubs faint brown	Negative	Tarnishes; rubs pale
	KCN	Negative	Negative	Negative	20 per cent solution — negative; dilute — rapid tarnish
	$FeCl_3$	Negative	Negative	Negative	Tarnishes dark brown; rubs pale

TABLE II

ETCHING OF HEMATITE, PSILOMELANE, MANGANITE AND PYROLSUITE

Reagent	*Effect of Reagent on*			
	Hematite	*Psilomelane*	*Manganite*	*Pyrolusite*
H_2SO_3(6–8 per cent SO_2)	Negative	Darkens, with sorbitic pattern	Darkens very slightly with long contact	Darkens rapidly; deeply etched
Equal volumes of HNO_3, H_2O_2, H_2O used cold	do	Similar to above but much more rapid	do	do
$FeSO_4 \cdot (NH_4)_2SO_4$ (0.3N) 10 per cent H_2SO_4 used hot	do	Darkens rapidly	do	do
HF	do	do	Accentuates cleavage cracks	do

Because of its moderate rate of attack and characteristic etch pattern on psilomelane, sulphurous acid is recommended as a distinguishing etching reagent to those desiring to differentiate rapidly between the manganese minerals.

Figs. 1 and 2 are photographs of the same field in a polished section of a briquet containing hematite, psilomelane, manganite, and pyrolusite. The specimen in Fig. 1 was unetched, but in Fig. 2 it was etched for 90 seconds in a solution of 8 per cent sulphurous acid.

Comparison between the two figures shows that the hematite and manganite are unattacked, the psilomelane is darkened with a spotted or sorbitic pattern, and the pyrolusite is blackened. The etch readily brings out the mineral components of the mixed grains. The true nature of the grain of psilomelane pseudomorphic after manganite [Ps(a)] is also shown.

Sulphurous acid is a very convenient etching reagent for differentiating between manganese minerals, especially in ores where pseudomorphism is encountered.

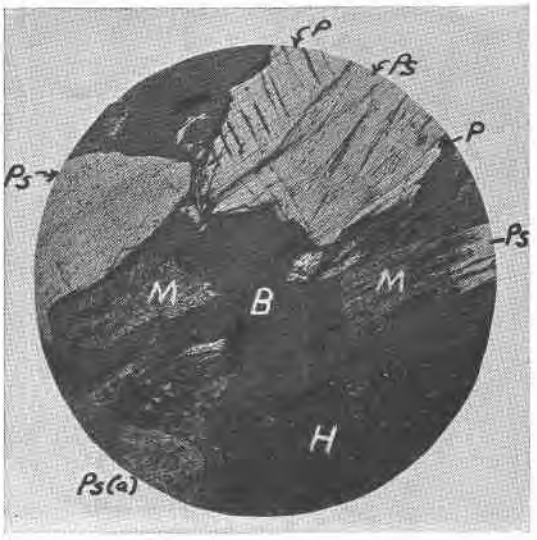

FIG. 1. Unetched. Magnification 50 x.

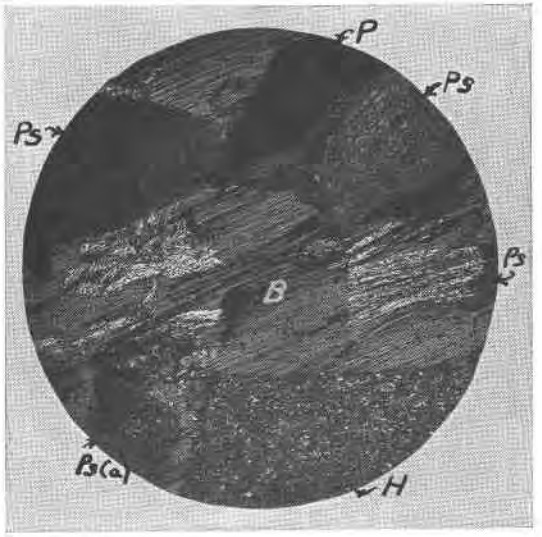

FIG. 2. Etched for 90 seconds in H_2SO_3.
Magnification 50 x.
Legend: B = bakelite matrix; P = pyrolusite;
Ps = psilomelane; M = manganite; H = hematite;
Ps(a) = psilomelane pseudomorphic after manganite