

MINERAGRAPHIC IDENTIFICATION OF PSILO- MELANE AND MANGANITE¹

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In the course of some recent mineragraphic work on the man-
ganiferous 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. Hema-
tite and psilomelane were found to be the predominating minerals,
although the occurrence of manganite and pyrolusite was impor-
tant 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 hard-
ness. 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 py-
rolusite, but difficulty was encountered in this investigation in visu-
ally 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 identifi-
cation at all times. The action of other etchants was therefore
studied. The results are shown in Table 2.

¹ This paper has resulted from cooperative work between the U. S. Bureau of
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TABLE I
MINERAGRAPHIC CHARACTERISTICS OF SEVERAL MINERALS

<i>Characteristics</i>	<i>Hematite</i>	<i>Psilomelane</i>	<i>Manganite</i>	<i>Pyrolusite</i>	
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 PYROLUSITE

Reagent	Effect of Reagent on			
	Hematite	Psilomelane	Manganite	Pyrolusite
H ₂ SO 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 ₂ O ₂ , H ₂ O used cold	do	Similar to above but much more rapid	do	do
FeSO ₄ · (NH ₄) ₂ SO ₄ (0.3N) 10 per cent H ₂ SO 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.

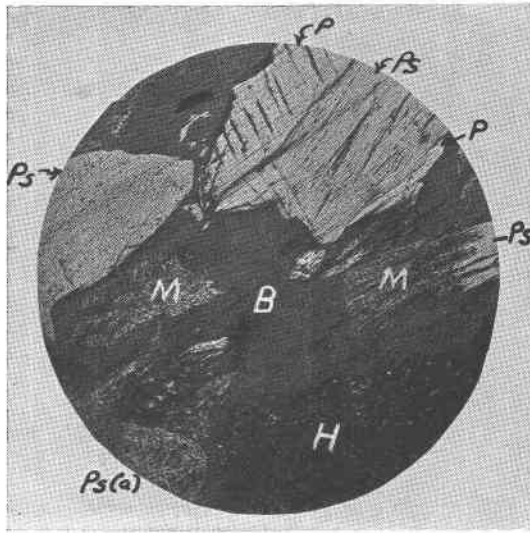


FIG. 1. Unetched. Magnification 50 x.

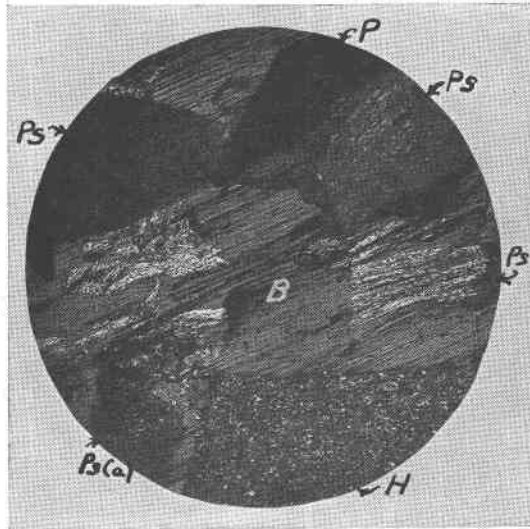


FIG. 2. Etched for 90 seconds in H_2SO_4 .
Magnification 50 x.

Legend: B = bakelite matrix; P = pyrolusite;
Ps = psilomelane; M = manganite; H = hematite;
Ps(a) = psilomelane pseudomorphic after manganite.