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COMANCHEITE, A NEW MERCURY OXYCHLORIDE – BROMIDE FROM TERLINGUA, TEXAS

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ABSTRACT

Comancheite is a new mercury oxychloride–bromide mineral from the Mariposa mine, Terlingua district, Texas. Associated minerals are calcite, goethite, hematite and quartz. Comancheite occurs as anhedral crystalline masses and as stellate groups of acicular crystals, elongate parallel to *c*, averaging 80 μm long and 3 to 4 μm wide. Masses are red with an orange-yellow streak and have a resinous lustre; crystals are orange-red to yellow, vitreous and translucent to transparent. Comancheite is brittle with fair cleavage parallel to {001} and {110}, has a Mohs hardness of 2 and does not fluoresce in ultraviolet light. Optically, comancheite exhibits parallel extinction and is length-fast with all indices of refraction between 1.78 and 1.79. The measured density is 7.7(4); calculated density is 8.0 Mg m^{-3}. Electron-microprobe analysis yielded the chemical formula $Hg_{13.00}(Cl_{4.51}Br_{3.50})_{\Sigma 8.01}O_{9.07}$, calculated on Hg = 13. The ideal formula is $Hg_{13}(Cl,Br)_8O_9$. Comancheite is orthorhombic, space group *Pnnm* or *Pnn*2, *a* 18.41(1), *b* 21.64(1), *c* 6.677(2) Å and *Z* = 4. The strongest seven reflections of the X-ray powder pattern (*d* Å, *I* on a ten-point scale) are: 5.68(7), 5.42(6), 2.878(8), 2.710(5), 2.669(10), 2.457(5) and 1.415(5).

Keywords: comancheite, mercury oxychloride–bromide, new mineral, Mariposa mine, Terlingua district, Texas.

SOMMAIRE

La comanchéite, nouvelle espèce minérale de la mine Mariposa, district de Terlingua (Texas), est un oxychlorure–bromure de mercure. En association avec calcite, goethite, hématite et quartz, elle se présente en amas xénomorphes et en groupes radiés de cristaux aciculaires allongés selon *c*, de dimensions 80 x 3-4 μm. Les échantillons massifs sont rouges, à rayure jaune orange et éclat résineux: les cristaux passent du rouge-orange au jaune, ils ont l'éclat vitreux et sont translucides à transparents. La comanchéite est fragile, avec clivage assez net suivant {001} et {110}; elle possède une dureté Mohs de 2 et ne montre aucune fluorescence en lumière ultraviolette. Extinction parallèle, allongement positif. Les indices de réfraction se situent entre 1.78 et 1.79. Densité mesurée 7.7(4), calculée 8.0. A la microsonde électronique, on trouve la formule $Hg_{13}(Cl_{4.51}Br_{3.50})_{\Sigma 8.01}O_{9.07}$, d'où la formule idéalisée $Hg_{13}(Cl,Br)_8O_9$. La comanchéite est orthorhombique, groupe spatial *Pnnm* ou *Pnn*2, *a* 18.41(1), *b* 21.64(1), *c* 6.677(2) Å, *Z* = 4. Les sept raies les plus intenses du cliché de poudre (*d* (Å), *I* sur échelle de 10) sont: 5.68(7), 5.42(6), 2.878(8), 2.710(5), 2.669(10), 2.457(5) et 1.415(5).

(Traduit par la Rédaction)

Mots-clés: comanchéite, oxychlorure–bromure de mercure, nouvelle espèce minérale, mine Mariposa, district de Terlingua, Texas.

INTRODUCTION

For nearly a century the Terlingua district of Texas has been worked for its mercury deposits; since the discovery of terlinguaite in 1899 (Sharpe 1980), it has become mineralogically well known for its secondary mercury minerals. The Terlingua area is the type locality for terlinguaite, montroydite, eglestonite (Moses 1903), kleinite (Hillebrand & Schaller 1909), mosesite (Canfield *et al.* 1910), pinchite (Sturman & Mandarino 1974) and gianellaite (Tunell *et al.* 1977). Other mercury minerals found here are cinnabar, calomel and mercury (Yates & Thompson 1959).

In 1977 one of the authors (ACR) was engaged in the routine X-ray identification of some mercury minerals in the National Mineral Collection housed at the Geological Survey of Canada. One specimen labeled *montroydite* from Terlingua, Texas (purchased in 1964 from Ward's Science Establishment, Inc., Rochester, New York) has some reddish masses and microscopic crystals that yield an X-ray-diffraction powder pattern matching no pattern listed in the JCPDS file for inorganic compounds. Electron-microprobe analysis and single-crystal

X-ray study show that the mineral is a new species. This mineral was later found in a nearly identical specimen, also labeled *montroydite,* in the David Wilson mineral collection now at the Smithsonian Institution. The locality given for the second specimen is the Mariposa mine, Terlingua, Texas. No montroydite was found on either specimen.

We take pleasure in naming the new mineral *comancheite* (KŌ-MAN'-CHĒ-ĪTE) in honor of the first miners in the Terlingua district, the Comanche Indians, who used cinnabar for warpaint. The mineral and mineral name have been approved by the Commission on New Minerals and Mineral Names, I.M.A. Type specimens are preserved in the National Mineral Collection, Geological Survey of Canada, Ottawa (GSC 14608) and the Smithsonian Institution collections, Washington (NMNH 150760).

Occurrence

Comancheite is a secondary mineral found at the Mariposa mine, Terlingua district, Brewster County, Texas, U.S.A. It occurs either as tiny crystalline masses or, more rarely, as stellate crystal groups perched on colorless skeletal calcite, on a matrix of colorless to banded yellow-brown calcite. Minor amounts of goethite, hematite and quartz are associated with the comancheite. Comancheite should be considered a rare species at the Mariposa mine; to date only two specimens are known, and together these contain less than one gram of the mineral. However, close examination of other supposed montroydites from the Terlingua district may lead to the discovery of more comancheite.

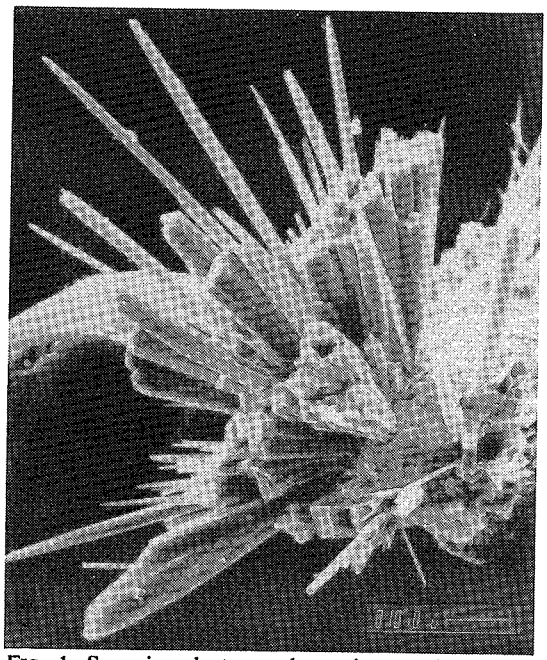

FIG. 1. Scanning-electron photomicrograph of acicular comancheite crystals.

Physical and Optical Properties

Comancheite occurs as anhedral red crystalline masses that have a resinous lustre and as translucent to transparent crystals that are orange-red to yellow with a vitreous lustre and an orange-yellow streak. Crystals are acicular, elongate parallel to *c,* and approximately 80 μm in average length with a width of 3 to 4 μm (Fig. 1). No indexable crystal faces could be distinguished. Comancheite is brittle and has fair cleavage parallel to {001} and {110}. It has a Mohs hardness of 2 and does not fluoresce in ultraviolet light. Comancheite is unaffected by cold concentrated HCl, H_2SO_4 or HNO_3, but slowly turns a dull orange-brown in 40% KOH solution. The measured density, determined with a Berman balance on 7.5 mg of hand-picked sample, is 7.7(4) Mg m^{-3}.

Optically, comancheite exhibits parallel extinction and is length-fast. All indices of refraction lie between 1.78 and 1.79. These are significantly lower than the range of indices of refraction predicted from the Gladstone–Dale relationship (approximately 2.1–2.3); the reason for the discrepancy is unknown. The strong absorption and small size of the crystals made further optical observations impossible.

Chemical Composition

A sample of comancheite in polished thin section was chemically analyzed at the Smithsonian Institution with an ARL–SEMQ electron microprobe utilizing an operating voltage of 15 kV and a beam current of 0.15 μA. Standards used for analysis were montroydite (Hg), scapolite (Cl) and synthetic KBr (Br). Oxygen was calculated assuming divalent Hg. A wavelength-dispersion microprobe scan did not reveal other elements with atomic number greater than 9. Comancheite was found to be homogeneous over 5 μm sample spots; the reported analytical results (Table 1) were obtained using a 20 μm beam spot in order to minimize evaporation of Cl and Br. Analytical data are accurate to 5% of the amount present.

TABLE 1. CHEMICAL COMPOSITION OF COMANCHEITE

	Wt.%	100%		atoms in unit cell, Hg=13.00			ideal formula Cl:Br=9:7	
HgO	89.7	88.21	0.4072	Hg	13.00		HgO	88.3
Cl	5.1	5.01	0.1413	Cl	4.51	8.01	Cl	5.0
Br	8.9	8.75	0.1095	Br	3.50		Br	8.8
	103.7	101.97						
less O=(Cl+Br)	2.0	1.97	0.1230	O	9.07			
total	101.7	100.00						

X-Ray Diffraction

Of the numerous comancheite crystals examined, only one needle-shaped crystal about 0.1 mm long proved satisfactory for detailed single-crystal precession- and Weissenberg-camera examination. X-ray exposures of one week or more were necessary to determine unit-cell parameters and systematic extinctions. Comancheite is orthorhombic, with space group extinction conditions as follows: (1) *hkl*: no conditions, (2) $0kl$: $k + l = 2n$, (3) $h0l$: $h + l = 2n$ and (4) $hk0$: no conditions. These are consistent with either space group *Pnnm* (58) or *Pnn*2 (34). Measured cell parameters from precession films are *a* 18.5, *b* 21.6 and *c* 6.67 Å.

The 114.6 mm Debye–Scherrer powder pattern of comancheite (Table 2) is exceedingly complex, with numerous weak to very weak reflections. The least-squares refined unit-cell parameters, based on 17 powder lines between 4.42 and 1.669 Å for which unambiguous indexing was possible, gave *a* 18.41(1), *b* 21.64(1), *c* 6.677(2) Å, $V = 2660.1$ Å^3 and $a:b:c = 0.851:1:0.309$. Zero- and upper-level single-crystal films (both precession and Weissenberg) were used to facilitate indexing of the powder pattern. With $Z = 4$, the calculated density, based on the analytical formula (Table 1), is 8.0 Mg m^{-3}, in reasonable agreement with the measured result.

The available crystals of comancheite are too small and diffract too weakly for any meaningful crystal-structure determination, especially considering the large size of the unit cell and the number of atoms contained therein (J.T. Szymański, pers. comm. 1980).

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TABLE 2. X-RAY POWDER DATA FOR COMANCHEITE

I obs.	*d*Å meas.	*d*Å calc.	*hkl*	I obs.	*d*Å meas.	*d*Å calc.	*hkl*	I obs.	*d*Å meas.	*d*Å calc.	*hkl*
5	9.33	9.33	120	80	2.878	2.878	232	3	1.945	1.948	911
3	6.31	6.28	101	30	2.805	2.805	071			1.944	851
5	6.04	6.03	111			2.804	550	3	1.913	1.912	482
70	5.68	5.68	230			2.715	242	20b	1.881	1.887	812
60	5.42	5.43	121	50	2.710	2.705	080			1.886	523
20	5.32	5.34	320			2.702	402	3	1.850	1.846	870
20	5.19	5.19	140	100	2.669	2.669	640	5b	1.816	1.825	582
		4.90	031	30	2.617	2.617	152			1.806	073
5	4.87	4.84	221	3	2.569	2.566	470	5b	1.782	1.782	951
10	4.71	4.73	131	3	2.531	2.531	432			1.782	2102
3	4.52	4.52	301	50	2.457	2.457	512	3	1.750	1.751	1021
40	4.42	4.42	311	30	2.414	2.418	442	20b	1.723	1.724	592
3	4.21	4.21	150			2.411	522	40	1.669	1.669	004
3	4.05	4.06	340	10	2.339	2.339	532			1.615	872
30	3.82	3.82	241			2.337	660	40	1.612	1.612	1002
1	3.73	3.73	411	3	2.294	2.288	810			1.605	1121
1	3.63	3.63	510	30	2.251	2.251	172	30	1.564	1.563	6102
5	3.59	3.61	060	3	2.203	2.202	481	30	1.546	1.545	1042
3	3.51	3.51	440			2.165	123	3	1.522	1.522	1060
30	3.34	3.34	002	5	2.158	2.164	0100	3	1.496	1.500	1230
3	3.25	3.25	112			2.149	1100			1.492	923
3	3.19	3.19	511	5	2.123	2.125	760	10b	1.466	1.466	604
20	3.129	3.127	161	20	2.083	2.083	831			1.464	544
40	3.097	3.109	360			2.083	313	3	1.439	1.442	1142
		3.090	521	10	2.055	2.056	712			1.434	554
20	3.040	3.043	540	20	2.034	2.035	472	50	1.415	1.415	644
		3.037	610	10	2.011	2.010	920				
30	2.988	2.990	132			2.009	243				
5	2.915	2.931	270	3	1.983	1.986	732				
		2.906	312								

- 114.6 mm Debye-Scherrer powder pattern, Cu radiation Ni filter (λCuKα = 1.54178Å)
- intensities estimated visually, b = broad line
- indexed with *a* 18.41, *b* 21.64 and *c* 6.677Å

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