# NOTES AND NEWS

## CADMIUM IN SMITHSONITE FROM NEW MEXICO*

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Two specimens of yellow smithsonite from the Kelly mine, Magdalena district, Socorro County, New Mexico, presented to G. F. Loughlin by the late C. T. Brown of Socorro, N. M., were studied to determine the quantity and distribution of any cadmium present.

A polished surface on one of the reniform banded specimens (Fig. 1, natural size) shows the variously colored, slightly wavy, concentric lay-

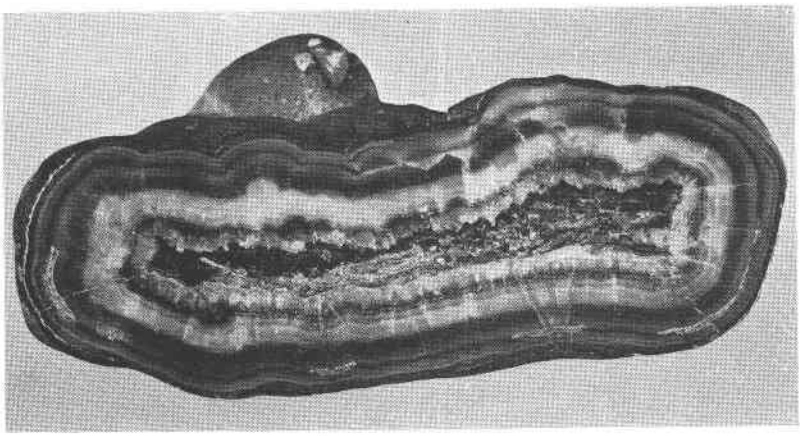

FIG. 1. Reniform, banded smithsonite from the Kelly mine, Magdalena district, Socorro County, New Mexico. Natural size.

Layer 1 is brownish amethystine, layer 2 is milky white, layer 3 is yellow (black in the reproduction), and layer 4 is white or nearly colorless, with fine bands of brown iron oxide.

ers, each from 2 to 4 millimeters wide, surrounding a central, somewhat cavernous mixture, about 5 to 9 millimeters thick, of dominantly brown iron oxide with green malachite and white smithsonite.

From the center outward, these layers are as follows:

First layer (analysis no. 1, brownish amethystine), about 4 millimeters wide, has a narrow non-continuous white zone adjacent to the central iron oxide, but most of it is of a brownish amethystine color, with narrow brownish bands of manganese oxide (?). This first layer grades imperceptibly into the second milky white layer.

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Second layer (analysis no. 2, milky white), about 2 millimeters wide, contains a few very thin bands of the first layer. In the reproduction (Fig. 1), this second layer appears wider than it really is as part of the first layer photographed the same color.

Third layer (analysis no. 3, yellow) about 4 millimeters wide, has a sharp contact with the second or milky white layer and, although yellow throughout, shows varying intensities of yellow in different places, better seen in thin section than on the polished specimen.

Fourth and outside layer (not analyzed) 2 to 4 millimeters wide, is white or nearly colorless with several thin brown bands of iron oxide.

A thin section across the variously colored layers shows no difference between them except that in the yellow area the stronger color is present in irregular blotches suggesting that cadmium sulphide is disseminated through the smithsonite in an extremely fine state of division. The different colors seen on the hand specimen are probably due to a very slight variation in the quantities of the chromatic compounds, which probably have a compensating effect in the white smithsonite.

Partial Analyses of Variously Colored Layers of Smithsonite from the Kelly Mine, Magdalena District, Socorro County, New Mexico

| | First specimen | | | Second specimen | |
|---|---|---|---|---|---|
| | 1 Brownish amethystine | 2 Milky white | 3 Yellow | 4 Milky white | 5 Yellow |
| Cadmium (Cd) | .40 | .44 | .56 | .39 | .57 |
| Manganese oxide (MnO) | .57 | .56 | .34 | .58 | .34 |
| Ferrous oxide (FeO) | 1.46 | 1.03 | 1.31 | (*a*) | 1.56 |
| Lead oxide (PbO) | (*b*) | .33 | Trace | (*b*) | Trace |
| Insoluble in HCl | .04 | .01 | .01 | .01 | .02 |

(*a*) Present but not determined.

(*b*) Present, more than a trace, but not determined.

Cadmium in no. 1 determined by Schaller; in no. 2 the average of 0.45 (Fairchild) and of 0.45 and 0.39 (Schaller); in no. 3 the average of 0.58 (Fairchild) and of 0.58 and 0.51 (Schaller); in no. 4 determined by Schaller; in no. 5 the average of 0.56 (Fairchild) and 0.58 (Schaller).

Ferrous oxide (total iron) and insoluble determined by Schaller, lead oxide by Fairchild, and manganese oxide by George Steiger.

Parts of both specimens were crushed and the fragments hand-sorted, on the basis of color, into brownish-amethystine, milky white, and yellow fractions from one specimen, and into milky white and yellow from the second specimen. The amethystine layer is present on the second specimen but fragments from this layer could not well be isolated. The fractions were partially analyzed with the above results. The milky white layers from the two specimens and the yellow layers from the two specimens gave very similar results.

Expressing the total content of cadmium as $CdCO_3$, the equivalents will be, on the average, 0.87 per cent for the yellow smithsonite and 0.63 per cent for the amethystine and white smithsonite.

The yellow layer (no. 3) contains more cadmium and less manganese and lead than the amethystine and white layers. The content of iron shows no regular variation.

Spectrographic tests for Ag, As, Be, Bi, Ga, Ge, In, Re, Sb, Sn, and Tl, made by George Steiger, gave no evidence of their presence in any of the five samples tested.

Qualitative tests for sulphide, as $H_2S$, evolved by treatment with hydrochloric acid and testing with moist lead acetate paper, which turns black if $H_2S$ is present, gave the following results.

Presence of Sulphide

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| Brownish amethystine | Milky white | Yellow | Milky white | Yellow |
| Trace | Trace | Strong | Weak | Strong |

As the two samples of yellow smithsonite (nos. 3 and 5) give a strong test for $H_2S$, it would seem that the cadmium is present as sulphide. But as samples nos. 1, 2, and 4, which are not yellow and give only a faint test for $H_2S$, nevertheless contain, on an average as much as 72 per cent of the cadmium content of the yellow smithsonite, it would seem that most of the cadmium in these differently colored varieties of smithsonite is present as carbonate and that only a minor quantity is present in the yellow smithsonite as sulphide.

That cadmium is present in two forms in yellow smithsonite is also suggested by the analysis of a bright yellow variety from Marion County, Arkansas. H. N. Stokes reports[1] in his analysis 0.63 per cent of CdO and 0.25 per cent of CdS, confirming the conclusion reached as a result of the determinations on the smithsonites from the Kelly mine, namely, that most of the cadmium present in yellow smithsonite is there as the carbonate. It also follows that the lack of a yellow color in any smithsonite is no indication of the absence of cadmium.

[1] Dana, E. S., *System of Mineralogy*, 6th ed., p. 279, 1892.

The quantities of cadmium in the brownish amethystine and milky white varieties are unexpectedly high. They suggest that cadmium may be more generally present in smithsonites than has been commonly realized. Apparently the presence of only a few tenths of a per cent of yellow cadmium sulphide is sufficient to color smithsonite yellow.

The special method used here for determining Cd has been published in the Chemist Analyst (published by J. T. Baker Chemical Co.), vol. **20,** p. 5, May 1931. For easy reference, a brief summary of the necessary procedure will be given.

Precipitation of CdS is made in a 200 ml. Erlenmeyer flask provided with inlet and outlet tubes. Besides zinc, only a small quantity of iron, manganese, and possibly lead, should be present as heavy metals. The first precipitation is made with $H_2S$ in an acidity of cold 0.3N $H_2SO_4$, and carries much ZnS. Filter after 1 hour, wash once with cold water and dissolve the precipitate in 1:1 HCl. Evaporate to dryness and dissolve the residue in 50 ml. 0.3N $H_2SO_4$. Repeat the precipitation with $H_2S$ twice. The third precipitation may be made in 0.6N $H_2SO_4$ with a liberal excess of $H_2S$.

If the second precipitate is dark colored, lead is probably present and should be separated as $PbSO_4$ before the final precipitation of CdS. Cadmium is then weighed as $CdSO_4$ by converting CdS to $CdCl_2$ which in turn is evaporated and ignited in a platinum crucible with a drop of 1:1 $H_2SO_4$.