

Lotharmeyerite

a new mineral from Mapimí, Durango, Mexico

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ABSTRACT

Lotharmeyerite, $\text{CaZnMn}^{+3}(\text{AsO}_4)_2(\text{OH})\cdot 2\text{H}_2\text{O}$, is a new species from the Ojuela mine, Mapimi, Durango, Mexico. It occurs as dark reddish orange druses coating violet adamite and the accompanying matrix. Lotharmeyerite is vitreous, forms equant crystals, has a Mohs hardness of approximately 3, density of 4.2 g/cm^3 , and indices of refraction above 1.80. Chemical analysis yielded CaO: 11.3, ZnO: 18.3, Mn_2O_3 : 13.4, Fe_2O_3 : 2.7, As_2O_5 : 45.7, H_2O by difference 8.6, sum = 100.0 percent. The strongest reflections in the X-ray powder diffraction pattern are: 2.557(100), 3.414(90), 3.175(90), 2.912(90), 2.710(80), 2.822(80) and 4.94(80). Lotharmeyerite may be locally abundant. The name is for Julius Lothar Meyer (1830–1895), in recognition of his contributions to chemistry.

INTRODUCTION

In early 1982, Curt Segeler of Brooklyn, New York, brought to the author's attention a dark reddish orange encrustation which coated the matrix of some recently discovered light-violet adamite specimens from the Ojuela mine, Mapimi, Durango, Mexico. (For

more information on this adamite see Wilson, 1982.) Preliminary examination, later confirmed, suggested that this material might be a new mineral species. The new species is named *lotharmeyerite* in honor of Julius Lothar Meyer (1830–1895) in recognition of his contributions to chemistry. Lothar Meyer, a German chemist and physician, developed many of the ideas which led to the *Periodic Table of the Elements*; the Periodic Table was used to predict the existence of then-undiscovered elements and demonstrate the relationships among those already known. His work was done at the same time as that of Mendeleev and they made many parallel observations, with different perspectives, while working independently in 1869. For further information, the reader is referred to the work of Weeks (1960). The new mineral and the name were approved by the Commission on New Minerals and Mineral Names, IMA, prior to publication. Type material is preserved at the Smithsonian Institution under catalog # NMNH 149482.

CHEMICAL COMPOSITION

Lotharmeyerite was chemically analyzed using an ARL-SEMQ electron microprobe utilizing an operating voltage of 15 kV and a sample current, standardized on brass, of $0.025 \mu\text{A}$. The standards used were synthetic ZnO (for Zn), hornblende (Ca,Fe), manganite (Mn), and synthetic olivenite (As). A wavelength-dispersive microprobe scan indicated the absence of any elements with atomic number greater than 8, except those reported herein. The data were corrected with a modified version of the MAGIC-4 program. Water could not be directly determined due to extreme paucity of material; it was calculated by difference. The analysis is presented in Table 1. The oxidation state of iron was assigned to $+3$ on the basis of microchemical tests which gave a strong reaction for Fe^{+3} and none for Fe^{+2} . The assignment of the oxidation state of manganese to Mn^{+3} is based on a number of factors: the ferric iron suggests a possible site for a $+3$ cation; the dark red color is consistent with the absorption of Mn^{+3} in the visible range; and the presence of associated cryptomelane indicates that conditions in the geochemical environment of lotharmeyerite were consistent with Mn in higher oxidation states. Calculation of a chemical formula, on the basis of $\Sigma (+2 \text{ and } +3 \text{ cations}) = 3$, yields: $\text{Ca}_{0.96}\text{Zn}_{1.07}(\text{Mn}^{+3}_{0.81}\text{Fe}^{+3}_{0.16})(\text{AsO}_4)_{1.89}(\text{OH})_{1.30}\cdot 1.63\text{H}_2\text{O}$ for analysis #2 in Table 1. This is in reasonable agreement with the theoretical formula of lotharmeyerite, $\text{CaZnMn}^{+3}(\text{AsO}_4)_2(\text{OH})\cdot 2\text{H}_2\text{O}$. The amount of water, calculated here by difference, is subject to error; the formula likely contains 1–2 H_2O . The chemical, physical and X-ray data do not suggest any apparent relationship to known

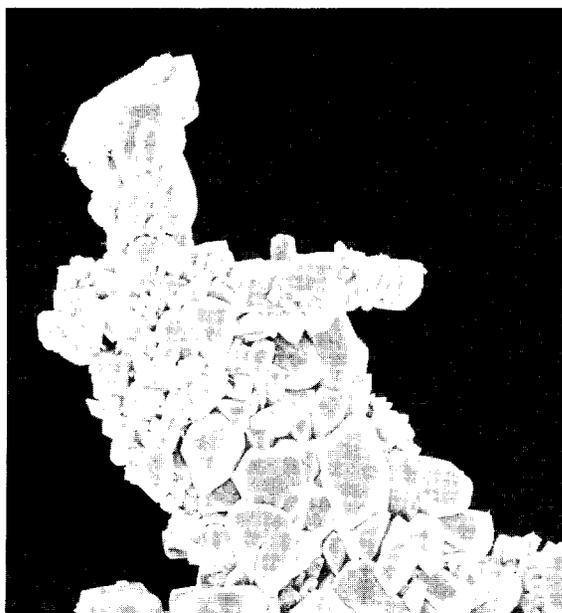


Figure 1. Scanning electron photomicrograph of a druse of lotharmeyerite crystals from Mapimi, Durango, Mexico. The largest crystal visible here is approximately 33 microns.

Table 1. Microprobe analyses of lotharmeyerite.

| | CaZnMn ³⁺ (AsO ₄) ₂ (OH)·2H ₂ O | |
|-----------------------------------|---|--------|
| | #1 | #2 |
| CaO | 11.9 | 11.3 |
| ZnO | 17.5 | 18.3 |
| Mn ₂ O ₃ ** | 16.3 | 13.4 |
| Fe ₂ O ₃ * | 1.1 | 2.7 |
| As ₂ O ₅ | 45.8 | 45.7 |
| H ₂ O | 7.4*** | 8.6*** |
| Sum | 100.0 | 100.0 |

Accuracy of data: ± 4 percent of the amount present.

* Total Fe calculated as Fe₂O₃ on the basis of microchemical test.

** Total Mn calculated as Mn₂O₃ per discussion in text.

*** Water by difference.

species; Lotharmeyerite is the first natural CaZnMn arsenate known.

DESCRIPTION

Lotharmeyerite occurs only as a druse of evenly-colored, reddish orange, equant microcrystals. No single crystal could be found and thus a unit cell was not determined. The X-ray powder diffraction data, obtained with nickel-filtered Cu K α X-radiation and a 114.6-mm-diameter Gandolfi camera, are presented in Table 2. Lotharmeyerite has a Mohs hardness of approximately 3 and a light orange streak. No cleavage was observed, but the exceedingly small crystal size hindered this observation. The density, determined using heavy liquid techniques, is approximately 4.2 g/cm³ for a granular aggregate which might have had interstitial spaces. Hence, this value might be slightly low. Lotharmeyerite has a vitreous luster, on both crystal faces and fracture surfaces. Optically, lotharmeyerite is anisotropic with indices of refraction above 1.80. Precise measurements were impeded due to dissolution of the mineral in index of refraction media. Pleochroism is strong with pleochroic colors dark reddish orange and light pinkish orange. The very small crystal size precluded the measurement of the optic axial angle. Lotharmeyerite crystals are equant; a representative crystal aggregate is shown in Figure 1.

OCCURRENCE

Lotharmeyerite occurs with pale violet adamite which has been reportedly found at the Ojuela mine, Mapimi, Durango, Mexico. The sample studied by the author is only 2 cm in diameter and thus limits the interpretation. The author has no direct knowledge of the occurrence and has not seen additional specimens. The esthetic nature of the associated adamite will probably guarantee other specimens being preserved in systematic collections.

On the holotype specimen, the matrix is composed of massive

Table 2. X-ray powder diffraction data for lotharmeyerite.

| d _{obs.} | I/I ₀ | d _{obs.} | I/I ₀ |
|-------------------|------------------|-------------------|------------------|
| 6.66 Å | 10 | 1.994 Å | 2 |
| 4.94 | 80 | 1.929 | 2 |
| 4.587 | 50 | 1.872 | 2 |
| 4.473 | 10 | 1.833 | 20 |
| 3.513 | 20 | 1.817 | 20 |
| 3.414 | 90 | 1.763 | 10 |
| 3.175 | 90 | 1.752 | 10 |
| 3.116 | 20 | 1.713 | 70 |
| 2.912 | 90 | 1.687 | 80 |
| 2.822 | 80 | 1.663 | 10 |
| 2.710 | 80 | 1.649 | 10 |
| 2.557 | 100 | 1.589 | 60 |
| 2.468 | 50 | 1.562 | 70 |
| 2.455 | 50 | 1.513 | 40 |
| 2.307 | 20 | 1.485 | 5 |
| 2.267 | 20 | 1.465 | 20 |
| 2.227 | 5 | 1.457 | 20 |
| 2.204 | 5 | 1.420 | 10 |
| 2.129 | 50 | 1.412 | 10 |
| 2.056 | 2 | 1.377 | 20 |
| 2.023 | 2 | 1.360* | 20 |

* - plus approximately 20 lines to 1.00 Å.

Intensities estimated visually.

Cu K α X-radiation

manganese oxides which are cryptomelane, K(Mn⁴⁺, Mn²⁺)₈O₁₆, in part, and which have a druse of fibrous cryptomelane on vug surfaces. The massive manganese oxides are intergrown with goethite and pale yellow to colorless adamite. The surface of the specimen consists of cryptomelane in a druse aggregate, associated with euhedral pale violet adamite. Lotharmeyerite occurs as a druse of very small reddish orange crystals which coat both of these minerals. Lotharmeyerite is thus the last phase to form.

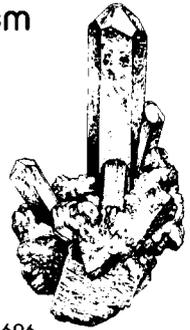
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ACKNOWLEDGMENTS

The author is indebted to Louis Perloff for originally noting this phase, and to Curt Segeler for calling it to his attention. I thank Abraham Rosenzweig and Richard Erd for constructive suggestions. ☒

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