

URANINITE FROM PLACER DE GUADALUPE, CHIHUAHUA.*

ROGER C. WELLS, *U. S. Geological Survey.*

INTRODUCTION

The interest attached to pitchblende as a source of radium has recently been intensified by the study of the problem of the genetic relationships existing between its constituent elements, and analyses of material from new localities are especially desirable. The principal point to be determined is the ratio of the lead to the uranium, which gives the age of the pitchblende, but other matters, such as the presence of thorium, rare earths, and isotopes of uranium, may have some additional importance.

As analyses are accumulated, the general idea that the older pitchblendes—in terms of geologic time—have higher ratios of lead to uranium seems to be substantiated. Some qualifications of this idea with reference to the containing rocks have been given by Fersman,¹ such as the possibilities that (1) pegmatites in the same intrusive may have different ages, (2) minerals in the same pegmatite may have slightly different ages, (3) uraninite may have acquired lead at its formation,² and (4) there may have been alterations and replacements.³ Fersman cites a uraninite from Sinyaya Pala, Karelia, White Sea district, analyzed by Nenadkevich, having $Pb/U=0.296$ and the atomic weight of the lead=206.06; this is one of the oldest uraninites so far reported, if the theory can be applied without qualification.

The uraninite of which the analysis is reported in this paper has several interesting differences from most other uraninites. It occurs in a calcite vein and has a high specific gravity, a high UO_2 content, indicating relatively little alteration, and a lead-uranium ratio indicating that it is relatively young. It contains, however, between 5 and 6 per cent of rare earths.

* Published with the permission of the Director of the U. S. Geological Survey.

¹ E. A. Fersman, The age of uranium minerals of pegmatite veins. *Bull. Acad. Sci., U.S.S.R.*, 1926, 775-80.

² This possibility is partly ruled out if the lead is shown by its atomic weight to be uranium lead.

³ See also Hess and Wells, *Am. J. Sci.*, [5] 19, 18-26, 1930.

OCCURRENCE OF THE MINERAL

The specimen was collected by Dr. W. F. Foshag, of the United States National Museum, to whom the writer is indebted for the following information as to its occurrence. It came from the Virgen mine, at Placer de Guadalupe, a small town about 72 miles east of the city of Chihuahua, Mexico. The nearest railroad station is San Sostenes, 6 miles away.

In this district the chief rock formations are limestone, shale, and sandstone of Mesozoic age. The rocks in the immediate vicinity of the mine have been determined by Böse⁴ to be Upper Jurassic. Intruded into them are a few small porphyry dikes.

Pitchblende also occurs in another mine, the Puerta del Aire, about 2 miles from the Virgen mine. In the Virgen mine the pitchblende is found in a calcite vein about 2 feet thick that lies between a footwall of dark-purple porphyry and a hanging wall of black fissile shale. The calcite has been mined for gold, which occurs intimately associated with the pitchblende. Above the water level the pitchblende is leached out, and most of the cavities left are filled with reticulating wires of gold and show small quantities of uranophane and thin coatings of a dark-green undetermined uranium mineral. A little pyrite is scattered through the calcite.

The pitchblende ranges in size from small specks to nodular masses as large as walnuts. It has colored the calcite pink. The pitchblende is invariably accompanied by gold, although gold may be found without pitchblende.

The porphyry footwall is cut by numerous small veins of calcite, generally rich in gold, and is hydrothermally altered to sericite. The veins are later than the Jurassic sediments and later than the porphyry dikes. Intrusive masses similar to the one associated with these veins are found in many places in Mexico cutting an older andesite series, which is presumed to be of Middle Miocene age.

ANALYSIS

The material, already very clean, was hand picked and washed for a short time with dilute hydrochloric acid before drying and weighing. There was sufficient material for two analyses. For the first, 1.9985 grams was used; for the second, 2.0676 grams. The

⁴ Unpublished manuscript.

soluble silica found was less than 1 milligram and is not included in the weight taken.

The methods of analysis used followed in a general way schemes which have been published elsewhere.⁵ Some attention was paid to certain features suggested by Hillebrand⁶ and followed by C. W. Davis.⁷ The last two investigators converted the uranium to sulfate and added alcohol to the solution in dilute sulfuric acid. As they give no figures to show the results of this treatment it may be of interest to know the order of the correction found by the writer. In the second analysis the insoluble sulfates resulting from the treatment with alcohol were found to contain: rare earths 0.0007 gram; CaO 0.0021; and U_3O_8 0.0023.

Hillebrand and Davis further converted the uranium to nitrate and extracted it with ether, in which uranium nitrate is easily soluble. In this way the writer found 0.0020 gram of rare earths, of which 0.0004 was ThO_2 , in the residue insoluble in ether.

The R_2O_3 hydroxides were separated from calcium by one precipitation. Thus the results for calcium were finally:

Main CaO.....	0.0037	gram
Insoluble in $(NH_4)_2CO_3$.....	.0029	
Insoluble in alcohol.....	.0021	
	<hr/>	
	0.0087	

In the first analysis the uranium was purified by the cupferron method⁸ and weighed as U_3O_8 .

The water was calculated from the change in weight on ignition of the mineral—actually a gain, owing to the oxidation of UO_2 to U_3O_8 . There was not enough material available for a direct determination of the water.

Until the atomic weight of the lead is determined the lead may be assumed to be uranium lead. The age of 36 million years for the uraninite would then place it in late Oligocene time according to Barrell's time scale. Thus the age of the veins as computed from the lead-uranium ratio is a little greater than the supposed age

⁵ R. C. Wells, Samarskite from Petaca, New Mexico. *Am. J. Sci.*, [5], **19**, 17, 1930.

⁶ W. F. Hillebrand. *U. S. Geol. Survey, Bull.* **78**, 47, 1891.

⁷ C. W. Davis. *Am. J. Sci.*, [5], **11**, 201, 1926.

⁸ Holladay and Cunningham. *Am. Electrochem. Soc. Trans.*, **43**, 329, 1923.

RESULTS OF ANALYSES

	1	2	Mean	
UO ₂	70.17	70.00	70.09	} = 80.67 U
UO ₃	22.72	22.66	22.69	
ThO ₂	0.05	0.34	0.20	= .18 Th
CeO ₂	0.71	.....	0.71	
La ₂ O ₃ , etc.	1.02	.....	1.02	
Y ₂ O ₃ , etc.	3.20	3.62	3.41	
Fe ₂ O ₃	0.13	0.06	0.10	
As ₂ O ₃	0.06	.....	0.06	
PbO	0.41	0.38	0.40	= 0.37 Pb
CaO	0.17	0.42	0.30	
TiO ₂	0.06	.....	0.06	
Al ₂ O ₃ (?)	0.25	0.25	0.25	
H ₂ O	(0.41)	.....	(0.41)	
	<hr/>	<hr/>	<hr/>	
	99.36		99.70	

Sp. Gr. = 10.63

$$\frac{\text{Pb}}{\text{U}} = \frac{0.37}{80.67 + (0.38 \times 0.18)} = 0.0046$$

Age = 0.0046 × 7900 = 36 million years.

based on the geologic evidence, but considerably less than that of the Upper Jurassic rocks into which the porphyry dikes are intruded.

The specific gravity, 10.63, determined by the pycnometer, is the highest so far reported for uraninite. This gravity is presumably caused by the freshness and high UO₂ content of the mineral. Pure UO₂ is reported to have a density of 10.95, U₃O₈ 7.31, and UO₃ powder 5.2, but the density of the mineral calculated from these figures would be below 10, from which it appears that the figure given for the density of UO₃ is too low or does not correspond to the compact structure of the mineral.