JAROSITE IN TUFF FROM POTOSI, BOLIVIA*

CHARLES MILTON, *U. S. Geological Survey.*

INTRODUCTION

In the course of a petrographic examination of South American specimens in the Johns Hopkins University collection the writer found a specimen of tuff, which on account of its origin and associations, as well as the presence of a notable percentage of jarosite, seems to warrant a brief description. The tuff came from a lake bed and contains many well preserved fossil leaves, which explains its collection, but only the associated minerals will be described here. Jarosite has been described from Potosi as occurring in a specimen of oxidized ore by Lindgren and Creveling.[1]

OCCURRENCE AND FIELD RELATIONS.[2]

The tuff was collected by Berry and Singewald in 1919 on the George Huntington Williams Memorial Expedition on the west side of Potosi Mountain, Bolivia, which has an elevation of about 16,000 feet, rising 3,000 feet above the town of that name which lies at the foot of the north slope. The mountain is a rhyolite porphyry intrusion in steeply dipping early Paleozoic slates. On the west side of the mountain, near the Carrasco mine, is a saddle which separates the main mountain from a northerly sloping ridge called Huakachi. In this vicinity the Paleozoic slates are unconformably overlain by flatter-dipping plant-bearing stratified tuffs of Pliocene age. Collections from these tuffs were first described in 1887 by H. Englehardt. In 1915 Miller and Singewald made further collections which were described in 1917 by E. W. Berry; and in 1919 Berry and Singewald again collected specimens at this locality. It was in a tuff from their collection that the jarosite was found.

PETROGRAPHY OF THE TUFF

The tuff is very fine-grained, siliceous, light in color, with slightly brownish fracture planes. The bedding is a prominent feature,

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[1] Lindgren, Waldemar, and Creveling, J. G., The ores of Potosi, Bolivia: *Econ. Geol.*, vol. **23**, p. 253, 1923.

[2] For the information contained in this paragraph, I am indebted to Dr. J. T. Singewald, Jr.

there being scores of well defined bedding planes to the inch of thickness. Microscopically, it is seen to consist of exceedingly comminuted lava, or volcanic glass, still partly isotropic. Extremely small angular particles of quartz, and a few equally small prismatic pale colored tourmalines, are also present. The fossil leaves show up under the microscope as patches of black opaque carbonaceous matter. Along the bedding planes brownish-yellow areas can be seen with the naked eye; these consist essentially of jarosite.

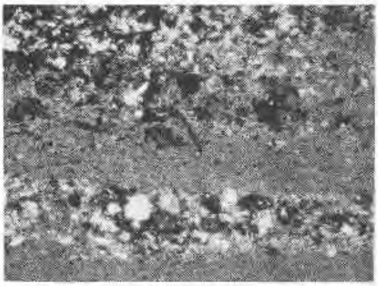

FIG. 1. Jarosite tuff showing stratification, ×70 ordinary light.

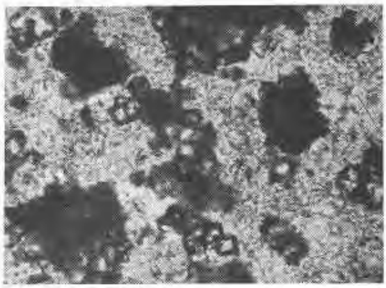

FIG. 2. Jarosite tuff showing jarosite rhombs and aggregates, ×167 ordinary light.

Microscopically, the jarosite is seen to be disseminated throughout the entire rock, even where none is visible to the eye. Besides being abundantly present in the coarser of the various bedding laminae, it is also concentrated in microscopic veinlets at right angles to the bedding. Where much jarosite is present there is also some quartz, some of it showing euhedral prismatic development. The relations seem to indicate essentially simultaneous formation of this quartz and the jarosite. The jarosite is golden yellow in color, not perceptibly pleochroic, and occurs in aggregates of poorly developed crystals and in single perfectly defined rhombohedra. Interference figures are secured with difficulty, owing to the minute size of the grains; they are uniaxial, negative. The crystals extinguish sharply parallel to the diagonals of the rhombs. A few grains become practically invisible when immersed in an oil of index 1.72; and all grains become so, at one extinction position, in an oil of index 1.82; hence $\omega = 1.82$, $\epsilon = 1.72$, approximately. The smaller crystals appear to be homogeneous, with apparent twinning or intergrowths, but many of the larger crystals appear to be hollow skeletal forms, the outer shell of jarosite enclosing what appears to be quartz, having the shape of a negative crystal of jarosite.

A sample of the tuff was prepared for analysis by crushing to 100 mesh, which gave the following results on treating with hydrochloric acid.

Soluble in HCl (jarosite)	14.49
Insoluble (dried at 110°C.)	84.20
Water (by difference)	1.31
	100.00

The soluble portion yielded the following constituents:

		Ratios
Fe_2O_3	7.00	3.00
SO_3	4.72	4.00
K_2O	1.42	1.03
Na_2O	0.16	
Al_2O_3	0.85	
TiO_2	0.13	
SiO_2	0.21	
CaO	Trace	
MgO	Trace	
P_2O_5	Trace	
CuS	None	
PbS	None	
	14.49	

A small quantity of tuffaceous material other than jarosite was dissolved by the acid, but the Fe_2O_3:SO_3:K_2O ratio agrees well with the 3:4:1 ratio of jarosite. It is assumed, for the purpose of calculation, that all the K_2O is in the jarosite, and all the Na_2O is in the tuff; this is probably not true, but such an assumption does not substantially affect the accuracy of the formula as calculated, or the conclusion that the rock contains some 16 per cent of jarosite.