

with the decomposed rocks of the solfatara. At Jerome, the hanging wall of the mineralized area is diorite, but the voltaite is not formed by direct contact with the diorite as shown by its occurrence in brecciated quartz, but it might well have formed by a concentration of the sulphur vapors in the ground waters above, which would probably contain iron, magnesia, and potash as a result of decomposition of the diorite. This would be more or less comparable to the conditions in the solfatara where the voltaite was first found.

Some altered pyrite from Shasta County, California, was sent to the University of California and examined by the writer. A large amount of this is melanterite, but minute black octahedrons are scattered throughout the mass. Microscopic study with oils showed that these octahedrons were isotropic, $n = 1.596 \pm .003$. The color under the microscope is a pale oil green; the fracture is conchoidal. The crystals were too minute for goniometric or blowpipe study, but the association with melanterite, the same association found in Kremnitz, Hungary and Concepcion Mine, Spain, plus the optical properties which correspond with those of voltaite, suggest very strongly that we have the mineral voltaite in California, making two known occurrences in North America.

AN OCCURRENCE OF PITTICITE IN NEVADA

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The iron arsenate-sulphate, pitticite, was first found by one of us (H. G. C.) in 1923 on the 400 foot level of the White Caps Mine at Manhattan, Nevada, as a secondary formation in the old workings.

The White Caps ore body represents a replacement and impregnation of limestone of Cambrian age, in this district called the "White Caps Limestone." The ore minerals are the sulphides of arsenic, realgar and orpiment, the sulphide of antimony, stibnite, and minor amounts of pyrite. The ore values are entirely its gold content. The gangue minerals are calcite, in part recrystallized into large rhombs, quartz and adularia feldspar

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replacing the limestone, and small amounts of sericite. Other minerals in small amounts in the deposits are fluorite, barite and cinnabar. Secondary minerals are the arsenates, haidingerite and pharmacolite, the oxides of antimony, stibiconite, valentinite and senarmontite (?), the oxysulphide kermesite, calcite, gypsum, sulphur, limonite and manganese oxides.

The pitticite forms crusts upon the limestone walls and floor of a drift, thin seams in melanterite or small globular forms upon melanterite stalactites. Its color varies from brownish red to almost black, with deep red reflections from the cracks in the mineral. The color of the small grains is kaiser brown (Ridgeway's color standard) while that of the powdered mineral is ocher brown. In appearance the mineral is typically a colloid. The surface of the crusts, when unbroken, is botryoidal and the mineral shows a perfect conchoidal fracture. It is very brittle; small fragments can easily be broken off with the finger nail. The lustre on the fracture is decidedly glassy.

Under the microscope the pitticite is light yellowish brown in color, transparent and completely isotropic. The index of refraction is only slightly variable in the specimen examined and analyzed, ranging from 1.615 to 1.617.

The pitticite is easily soluble in acids without leaving an appreciable residue. The solution gives the usual reactions for iron, sulphur and arsenic. The material selected for analysis consisted of clear grains with glassy lustre and fine conchoidal fracture. An analysis of this sample (No. 95426, U. S. National Museum Coll.) gave the following results:

ANALYSIS OF PITTICITE FROM MANHATTAN, NEVADA
(WILLIAM F. FOSHAG, ANALYST)

	Per cent	Molecular ratios
Insol.	0.41	
H ₂ O	29.64	1.6466
Al ₂ O ₃	3.11	.0304
Fe ₂ O ₃	34.01	.2129
FeO	0.72	
CaO	trace	
MgO	trace	
SO ₃	17.97	.2246
As ₂ O ₅	14.54	.0632
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	100.40	

As one might expect from material of this character the constituents are not present in definite proportions. In the molecular ratios given above, the sulphate is considerably in excess of the arsenate and both combined are somewhat in excess of the bases. This relation is perhaps due to the presence of some occluded free sulphuric acid. The mineral may be considered as a colloidal mixture of normal arsenate of iron with colloidal sulphate of iron.

The source of the constituents of the pitticite is a thin bedded pyritiferous limestone that is somewhat darker in color than the usual White Caps limestone. The pitticite oozes out of joints, cracks and bedding planes and incrusts the surface of the limestone to a thickness of $1/8$ to $1/2$ inch. At one spot the pitticite bearing solutions drip from the roof forming small stalactites and form a thick crust on the floor. Between two areas of pitticite is a patch of the iron sulphate, melanterite, forming in some places long, slender, green stalactites on the roof and thick stubby stalagmites on the floor. Some stalactites are cut by thin seams of pitticite and a few were collected with small pea-shaped globules of pitticite attached to their outer surface. Below both the pitticite and the melanterite is a growth of snow white epsomite crystals, one to two inches long.

The pitticite is a recent formation having been produced since the opening of the drift. It may be well to note here that haidingerite and pharmacolite are also recent formations, being best developed on the broken rock of a small stope of low grade ore on the 900 foot level. The pitticite may be the result of the oxidation of pyrite in the limestone, the iron sulphate so generated reacting with the realgar so abundantly present in this portion of the mine. Or it may be the result of the direct oxidation of arsenopyrite, a mineral believed to be sparingly, although widely distributed in the mine.

The writers are indebted to the White Caps Company and to Mr. Walter Fancher, superintendent of the mine, for the courtesy of allowing several examinations of the mineral occurrences.