

phism is less the augite is often uneffected as in the specimen described above. Still weaker phases are represented by the formation of prehnite and zeolites from the alteration of the feldspars, either as replacement of the feldspars or filling cracks and cavities in altered rocks.

The specimen containing the pumpellyite is possibly a unique variety of the intermediate phase of alteration in that no other occurrence of this mineral was found; nor was the particular amygdaloidal basalt containing this mineral found as a bedrock outcrop. It is possible however that a search in the vicinity of the upper part of the Limbé River would reveal outcrops of this rock, as the region was not explored during the reconnaissance.

AMMONIOJAROSITE, A NEW MINERAL OF THE JAROSITE GROUP FROM UTAH

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One of the most illustrative cases of isomorphism in systematic mineralogy is furnished by the jarosite division of the alunite-beudantite group. The original jarosite, known since 1838, is a hydrous sulphate of ferric iron and potassium. Sixty-four years later Hillebrand and Penfield described two new jarosites in one of which the potassium was replaced by sodium while the other contained, in place of the alkali metal, lead. The latter mineral has been found in a number of places since and in some localities is an important constituent of ores. Still more recently Schaller has called attention to a very interesting member of the group in which silver enters as an essential constituent. The purpose of the present short paper is to describe briefly a fifth jarosite in which the essential alkali is ammonium oxide. The present members of the jarosite group are as follows:

Jarosite	$K_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O.$
Natrojarosite	$Na_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O.$
Plumbojarosite	$PbO \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O.$
Argentojarosite	$Ag_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O.$
Ammoniojarosite	$(NH_4)_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O.$

The ammoniojarosite is from southern Utah. This is interesting, geographically, since all known members of the group have been

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found in this state. The new member was found in a shipment of minerals sent to the National Museum for identification by Mr. Frank Haycock of Panguitch, Utah. This shipment consisted principally of tschermigite, or ammonia alum, associated with a little of the jarosite in a black lignitic shale. In response to a request for more material Mr. Haycock forwarded additional specimens of the jarosite and tschermigite together with some associated minerals which included epsomite, palygorskite, and celestite as well as bentonitic material and a few imperfect fossils. All of these minerals will be described in detail in a paper which is being prepared for publication in the Proceedings of the U. S. National Museum.

The locality is not given more definitely than on the west side of the Kaibab fault in southern Utah. In the hand specimen the material is indistinguishable from the associated tschermigite and jarosite from Wamsutter, Wyoming, described by Erickson.² The two localities are, however, some 300 miles apart.

The ammoniojarosite forms small lumps and hard irregular flattened nodules up to 4 centimeters broad by 5 millimeters thick embedded in blackish-brown lignitic material. They frequently enclose small grains of the lignite and fibrous patches of tschermigite. On a fresh fracture the color is a light ochereous yellow while the lustre varies from dull and waxy to earthy.

One of the largest and purest lumps was selected and freed as far as possible from adhering lignite. This was ground finely and digested with frequent stirring in hot distilled water to remove all water soluble tschermigite and other salts. It was then filtered, washed thoroughly with hot water, dried in air, reground and allowed to stabilize its water content in air for several days. It was then analyzed by standard methods. Five grams were weighed out, dissolved in hot dilute hydrochloric acid and filtered. The insoluble material was dried for several days in air and then weighed after which it was ignited and weighed again. It consisted principally of lignite with some clayey material. This solution was diluted to 500 cc. and divided into 5 aliquot parts, each equivalent to a 1.0 gram sample. On these portions iron, alumina, lime, magnesia, soda, potash, and sulphuric acid were determined. Separate portions of the

² E. Theodore Erickson. Tschermigite (Ammonia alum) from Wyoming. *Jour. Wash Acad. Sci.*, vol. 12, pp. 49-54, Feb. 4, 1922.

same sample were used for the direct determination of $(\text{NH}_4)_2\text{O}$ and water. The analysis gave the following results and ratios:

ANALYSIS AND RATIOS OF AMMONIOJAROSITE FROM UTAH.
(Earl V. Shannon, analyst.)

CONSTITUENTS	PER CENT	RATIOS		
Insoluble	0.76			
TiO ₂	trace			
Al ₂ O ₃	0.02	.000	.309	.103×3
Fe ₂ O ₃	49.30	.309		
CaO	0.05	.001	.106	.106×1
MgO	0.13	.003		
Na ₂ O	0.22	.004		
K ₂ O	1.56	.017		
(NH ₄) ₂ O	4.23	.081		
PbO	trace			
Ag ₂ O	none			
SO ₃	34.49	.431		.108×4
H ₂ O	9.86	.547		.091×6
	100.62			

The above results agree very well with the formula: $(\text{NH}_4)_2\text{O} \cdot 3\text{Fe}_2\text{O}_3 \cdot 4\text{SO}_3 \cdot 6\text{H}_2\text{O}$. The existence of the ammonia member of the group is thus established. The theoretical composition to satisfy the above formula is: $(\text{NH}_4)_2\text{O}$ 5.43 per cent; Fe_2O_3 49.92; SO_3 33.38; and H_2O 11.27.

Under the microscope the analyzed sample was found to be composed of minute, transparent, pale-yellow, tabular grains a few of which showed hexagonal outlines. These were too small to yield an interference figures but those lying on the flat side are dark between crossed nicols so that the mineral is probably nearly uniaxial. Plates on edge show positive elongation so the mineral is perhaps optically negative. The refractive indices could not be measured exactly but they are approximately: $\omega = 1.800$, $\epsilon = 1.750$, both ± 0.005 .