Identification and Occurrence of Uranium and Vanadium Minerals From the Colorado Plateaus

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CONTRIBUTION TO THE GEOLOGY OF URANIUM

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TYUYAMUNITE and METATYUYAMUNITE

$Ca(UO_2)_2(VO_4)_2 \cdot 7\text{–}10\frac{1}{2}H_2O$

Crystal system: Orthorhombic.

Habit: As scales and laths flattened {001} and elongated [100]; as radial aggregates. Commonly massive, compact to cryptocrystalline; also pulverulent.

Physical properties:

Color: Yellow, greenish yellow (turns green on exposure to sunlight).
Fluorescence: None.
Luster: Of crystals adamantine; pearly on {001}; massive material waxy
Cleavage: {001} perfect, micaceous; {010} and {100} distinct.
Hardness: About 2.
Specific gravity: 3.62 (fully hydrated material).
Strongest lines of X-ray powder pattern:[9] S 9.9, M 4.93, M 3.29, M 3.16

Optical properties:

ORIENTATION	n	PLEOCHROISM	
$X=c$	1.57 calcd.	Nearly colorless	Biaxial negative
$Y=b$	1.805 ± 0.002	Pale canary yellow	$2V$ 42° $r<v$
$Z=a$	1.851 ± 0.002	Canary yellow	

The indices increase on dehydration

Analysis: Chemical analysis, in percent, of material from Small Spot mine, Gateway district. Analyst, R. G. Milkey:

CaO	UO_3	V_2O_4	V_2O_5	H_2O	Total
6.03	57.08	0.55	20.31	16.03	100.00

Recalculated to 100 percent, after H_2O determination of fully hydrated sample.

Occurrence and associated minerals: Disseminated in sandstone. Coating joints and fractures, with metatyuyamunite, carnotite, rauvite, corvusite, and hewettite. At Mesa No. 1 mine, Shiprock district, with melanovanadite.

Identification: Tyuyamunite and carnotite can be distinguished from other yellow U minerals by the presence of vanadium; they will turn red-brown when a drop of concentrated HCl is touched to the mineral. X-ray powder pattern may be necessary to distinguish from carnotite and metatyuyamunite. When coarsely crystalline, may be distinguished optically. Fuses much more easily than carnotite.

Localities: Same as for carnotite. Abundant in Grants and Shiprock districts, with little carnotite.

Metatyuyamunite is a mineral with a formula like that of tyuyamunite, except for the number of water molecules, $Ca(UO_2)_2(VO_4)_2 \cdot 5\text{–}7 H_2O$. In general, its physical properties resemble very closely those

[9] Too vigorous grinding of tyuyamunite for a powder pattern destroys the structure.

of tyuyamunite. Its specific gravity is higher (3.81—3.93). Optically it is biaxial negative, but the indices of refraction are higher than tyuyamunite: $nX=1.67$ (calcd.), $nY=1.835$, $nZ=1.865$, $2V=44°$. The strongest lines of its X-ray powder pattern are S 8.4, M 4.21, M 3.24, M 3.04. These properties vary somewhat with minor changes in water content. Metatyuyamunite is found in the same districts as tyuyamunite, and is especially abundant near Haystack Mountain and Laguna, Grants district.

URANINITE (PITCHBLENDE)