CREEDITE FROM NEVADA

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The mineral creedite was first found by Esper S. Larsen in the fluorite mines of Wagon Wheel Gap, Creede Quadrangle, Colorado, and described by Larsen[2] and Wells as a new mineral species of the composition $CaSO_4 \cdot 2CaF_2 \cdot 2Al(F,OH)_3 \cdot 2H_2O$. Later, better material was obtained and the mineral further investigated by the present writer[3] confirming the composition as found by Wells and determining the crystal symmetry and elements. The mineral was found to be monoclinic. Several crystal habits were found, all prismatic but differing somewhat in the relative sizes of the terminal faces. The mineral is associated with fluorite or embedded in a white halloysite clay.

During geological field work for the U. S. Geological Survey in the Tonopah Quadrangle, Nevada, Mr. Stanley H. Cathcart visited the small gold camp of Granite (now abandoned), northwest of Tonopah in the northwestern corner of the Tonopah quadrangle and collected some specimens of the high grade ore found in the small veins of the district. These specimens showed scattered bunches of a colorless prismatic mineral which were determined by Dr. Clarence S. Ross, from their optical properties, to be creedite. The specimens were then turned over to the present writer for further study and are now in the collections of the U. S. National Museum (No. 96489).

The two specimens suggest that the gold bearing deposits of Granite are fluorite-quartz veins with free gold. The specimens are from the oxidized zone and are discolored by a clayey manganese wad. Visible flakes of gold are embedded both in the wad and in the fluorite. The fluorite is pale green in color where fresh surfaces are exposed. There are also small seams of a white to discolored gray halloysitic clay.

The creedite is in the form of small needles, usually less than 2 millimeters in length. On one specimen it forms a crust of reticulated needles; on the other, found lining cavities, as drusy wart-like

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[2] Esper S. Larsen and Roger C. Wells: *Jour. Wash. Acad. Sci.*, vol. **2**, pp. 360–365, 1916.

[3] W. F. Foshag: *Proc. U. S. Nat. Museum*, **59**, pp. 419–424, 1921.

masses, as radiated aggregates resembling wavellite in structure or as needles embedded in clay. The crystals are colorless or stained a pale buff to pink color, are glassy in luster and some crystals show a faint opalescence similar to many of the crystals from Creede.

The crystals were well formed but examination on the goniometer show the faces to be somewhat curved so that crystal measurements were not entirely satisfactory. Eight forms were noted, two of them not found on the Creede material and are therefore new for this mineral. The measurements are given in the following table.

MEASUREMENT OF CREEDITE FROM NEVADA

Face	Found		Calculated	
	ϕ	ρ	ϕ	ρ
$m(110)$	31°40′	90°00′	31°45′	90°00′
$a(100)$	90 00	90 00	90 00	90 00
$c(001)$	90 00	5 38	90 00	4 30
$p(111)$	35 11	54 49	34 30	54 36
$n(\bar{1}11)$	29 26	−53 1	28 52	−52 56
$d(101)$	90 00	38 43	90 00	38 33
$i(\bar{1}01)$	90 00	−32 32	90 00	−32 35
$v(331)$	37 38	31 30	38 4	30 33

The new orthodome $d(101)$ was noted as a small modifying face on crystals with a prominent base. The new pyramid $v(331)$ is likewise a narrow modifying face between the unit pyramid and the prominent base. Both forms were noted several times and

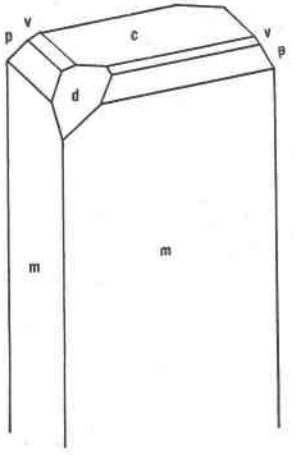

FIG. 1. Crystal of Creedite from Granite, Nevada, showing the new forms $d(101)$ and $v(331)$.

while the reflections were not good, they were sufficiently distinct to determine the form. They are shown in fig. 1.

The habits of the creedite are quite variable and are entirely similar to those found on the Creede mineral. The simplest combination is that of the prism and equally developed front and rear unit pyramid, giving the crystal an orthorhombic aspect. In another type the front pyramid is the predominant terminal form. the rear unit prism being reduced to small modifying faces. In a third type the basal pinacoid is the predominant end face, the front and rear unit pyramid and the front and rear unit domes being reduced to narrow and small modifying faces.

The mineral is biaxial negative with a medium large optic axial angle. Crystals lying on the orthopinacoidal face show the emergence on an optic axis nearly centered in the field. The dispersion is strong with ρ greater than v. The plane of the optic axis is in the plane of symmetry and the maximum extinction angle $Z \wedge c = 42°$. The indices of refraction are as follows: $\alpha = 1.462$, $\beta = 1.478$, $\gamma = 1.483$.

The amount of material available did not suffice for a chemical analysis but the crystallographical measurements and the optical properties definitely place this mineral as creedite.

The creedite needles are plainly a secondary product, their genesis is related to the formation of the clay and wad. The association of the mineral at both Creede and Granite with fluorite and halloysite suggests that it results by the action of aluminum bearing solutions upon fluorite. The gold of the veins is primarily inclosed in the fluorite but some crystals of creedite were found with inclosed plates of gold, suggesting that the material of the fluorite was removed and its place taken by creedite. Whether this is a surface alteration or the results of late hydrothermal change cannot be determined from the material at hand.

The occurrence at Granite is the second reported locality for creedite but the deposits are of small importance and are now completely abandoned, so it is doubful if many specimens are still obtainable.