NOTES AND NEWS

AN OCCURRENCE OF GENTHELVITE IN THE YOUNGER GRANITE PROVINCE OF NORTHERN NIGERIA*

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INTRODUCTION

Genthelvite, the zinc member of the helvite group is an extremely rare mineral and has so far been recorded only from three localities in El Paso County, Colorado.§ The original specimen was discovered by F. A. Genth in the 1890's and subsequently two additional crystals were reported by Glass and Adams (1953) and by Scott (1957). A notable amount of genthelvite has, however, recently been found by one of us (P.D.), during a field investigation of one of the economically important columbite-bearing members of the Younger Granite suite in Northern Nigeria, and the occurrence is of particular importance:

1. In view of the extreme rarity of the mineral;
2. As the first recorded occurrence of a beryllium mineral associated with the Nigerian Younger Granites, although beryl is not rare in the Basement Complex of the territory;
3. If present in commercial quantities it could represent a potential ore of beryllium since, unlike beryl, its physical properties are such that it would be amenable to recovery by conventional mineral dressing methods.

LOCATION AND FIELD RELATIONS

The genthelvite is associated with the later members of the granitic suite that make up the Jos-Bukuru complex in Northern Nigeria. Studies of this and other complexes have been made recently by MacLeod (1954) and by Jacobson, MacLeod and Black (1958) and no further general details will be given here. The exact location of the occurrence is 9°50′ N. and 8°55′ E.

The country rock consists of albitized granite which is intensely decomposed by deep weathering and has been exploited as a source of columbite (Williams and others, 1956).

The genthelvite has been found in different associations at two adjacent localities which are only a hundred feet or so apart. The first occur-

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§ E. M. Eskova has recently described a manganese-rich genthelvite from alkaline pegmatites in Kola peninsula. (Doklady Acad. Sci. U.S.S.R., 1957, 116, 481–483).

rence is within a rather irregular vein of almost pure albite which intersects the later of two albite-biotite granites and runs close to and parallel with the contact. This vein contains irregular rounded masses or "knots" of genthelvite, usually about four inches in diameter, but locally as much as seven inches across. In a single instance the "knot" was embedded in the wallrock, but still in contact with the vein on one side. Occasionally the knots consist of pure genthelvite, but commonly the outer part, or the whole, is partially replaced by albite. A selvedge of mica, related to protolithionite-zinnwaldite from 0.5 to 2 cm. thick, with accessory thorite, invariably surrounds the nodules which, from their mode of occurrence, suggest that they have not crystallized in situ, but are xenoliths in the albitic magma in relatively early stages of digestion. They may, in fact, have been derived from a disrupted pegmatite, similar to that described below.

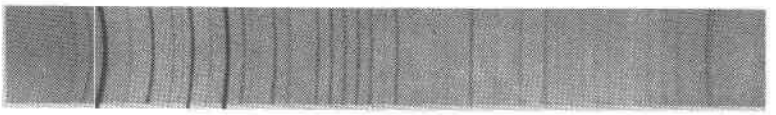

FIG. 1. X-ray powder photograph of genthelvite from Jos, Northern Nigeria. The three strongest lines are 3.33A, 2.174A and 1.918A. CuK radiation, Camera diameter 9 cm.

A hundred feet away from the albite vein in the pegmatitic contact zone between the two albite-biotite-granite phases is the second occurrence in coarse pegmatites containing green amazonite microcline. Most of the genthelvite is coated superficially and along cracks with an unusually bright red laterite. No crystal forms are visible in the masses which are generally not more than one or two inches across at most. They are far more irregular than those in the albite vein and appear to be interstitial in texture. The mica selvedge is generally, but not invariably, present and may be altered to a dull black material not further investigated. No genthelvite has been found in any of the other numerous albite veins or microcline pegmatites in the area.

MINERALOGY AND CHEMISTRY

The genthelvite in the knots is intimately intergrown with albite. It is granular (sugary) in appearance and resembles massive garnet as found in skarns or tactites. The individual grains are irregular in shape and are generally 1–3 mm., across, but larger masses of the mineral are also quite common. The color is purplish-pink, rather like that of almandine garnet. It is brittle and translucent with resinous luster and has a hardness of about 6. In thin section the irregular grains of genthelvite are greyish

TABLE 1. CHEMICAL COMPOSITION OF GENTHELVITE FROM JOS, N. NIGERIA COMPARED WITH GENTHELVITE FROM W. CHEYENNE CAÑON

	1	2
SiO_2	30.70	30.26
TiO_2	n.d.	—
Al_2O_3	0.18	0.51
BeO	12.39	12.70
FeO	11.73	6.81
MnO	1.72	1.22
ZnO	40.56	46.20
MgO	tr.	—
CaO	tr.	—
Na_2O	tr.	—
S	5.50	5.49
	102.78	103.19
Less O≡S	2.74	2.74
	100.04	100.45

1. Genthelvite from Jos, N. Nigeria. Analyst: O. von Knorring.
2. Genthelvite from W. Cheyenne Cañon. Analyst: F. A. Genth (Glass *et al.*, p. 180, 1944)

Atomic ratios to 13 (O+S), anal. 1, and excluding Al_2O_3 as albite impurities:

$$(Zn_{2.94}Fe_{0.96}Mn_{0.14})Be_{2.92}Si_{3.02}O_{11.99}S_{1.01}$$

or very nearly $Zn_3FeBe_3Si_3O_{12}S$.

TABLE 2. CHEMICAL COMPOSITION OF PROTOLITHIONITE ASSOCIATED WITH GENTHELVITE FROM JOS, N. NIGERIA

Analyst: E. Padget

SiO_2	41.11	Li_2O	1.85
TiO_2	0.30	H_2O^+	1.12
Al_2O_3	16.59	H_2O^-	0.29
Fe_2O_3	2.00	F	5.49
FeO	22.61	Cl	tr.
MnO	0.67		
MgO	0.13		102.24
CaO	n.d.	Less O≡F	2.31
Na_2O	0.16		
K_2O	9.92		99.93

Atomic ratios to 24 (O, OH, F):

$$(K_{1.94}Li_{1.06})(Fe_{2.90}^{2+}Mn_{0.09}Mg_{0.03}Na_{0.05}Li_{0.08}Al_{1.30}Fe_{0.23}^{3+}Ti_{0.03})$$
$$(Si_{6.30}Al_{1.70})O_{20.19}OH_{1.15}F_{2.66}$$

in color, isotropic and intersected by numerous cracks. Some aggregates, however, show triangular outlines which are emphasized by the enclosing albite laths. Inclusions of columbite, zircon and cassiterite are common, and in addition thorite (orangite) has been identified. The following properties were determined on genthelvite: specific gravity (Berman balance) $3.62 \pm .01$; $n = 1.745 \pm .002$. *X*-ray diffraction data are given in Table 3.

The dark-gray mica which envelops the genthelvite knots also contains albite, and, at times, narrow bands of albite and some micro-perthite rimmed with mica intersect the knots and replace the genthelvite.

TABLE 3. *X*-RAY DIFFRACTION DATA FOR GENTHELVITE FROM JOS, N. NIGERIA
Cu-Kα radiation, camera diameter, 9 cm.

d meas. Å	I estimated	d meas.	I estimated	d meas. Å	I estimated	d meas.	I estimated
4.07	m	1.778	w	1.258	s	.989	w
3.65	m	1.735	w	1.230	w	.973	w
3.33	vs	1.663	s	1.215	w	.961	w
2.875	m	1.596	m	1.200	w	.948	w
2.577	s	1.513	w	1.176	w	.936	w
2.351	m	1.489	s	1.152	w	.923	w
2.258	w	1.441	s	1.119	w	.911	w
2.174	vs	1.399	s	1.109	s	.900	w
2.036	m	1.359	s	1.072	w	.890	w
1.918	vs	1.322	s	1.035	m	.880	w
1.822	s	1.288	w	1.004	s	.860	vs

w = weak; m = medium; s = strong; vs = very strong. Calculated unit cell size $a_0 \simeq 8.12 \pm .01$ Å.

Under the microscope the mica appears to be uniaxial with distinct pleochroism: X = light yellow and Y = Z = pale green. Some grains contain inclusions of zircon surrounded by pleochroic haloes. The following physical properties were determined on the mica: Specific gravity $3.17 \pm .01$ (by suspension in Clerici solution) $\beta = \gamma = 1.612 \pm .002$. The chemical analysis of genthelvite is given in Table 1. In comparison with the analysis of the original genthelvite from W. Cheyenne Cañon, the present one is poorer in zinc, and richer in iron and to some extent in manganese. The analysis of the associated mica is given in Table 2. It is a lithium-iron mica, closely related to zinnwaldite and containing a large amount of the protolithionite component of the lepidolite series.

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AN OCCURRENCE OF PSEUDOMALACHITE AT SAFFORD, ARIZONA

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OCCURRENCE

Occurrences of the basic copper phosphate—pseudomalachite—have been recorded in only a few instances from United States localities, and some of the better known of these include the following: the Wheatley Mines, Chester Co., and the Ecton and Perkiomen Mines, Montgomery Co., Pennsylvania, Carbarrus Co., N. Carolina (Palache *et al.* 1951, p. 800); Black Pine Tungsten Project, Maxville, Montana (Kauffman *et al.* 1950, p. 19); the Empire-Nevada Mine, Yerrington, Nevada (Berry, 1950, p. 367). Other localities at which this mineral may have been recognized include the Calavada Mine, Nevada where Goudey (1945, p. 640) has described dihydrite, and the Silver Bell Mine, Lincoln, Nevada where Kauffman *et al.* (1950, p. 15) have noted the occurrence of a mineral described by them as tagilite. Dihydrite and tagilite are included here since most of the minerals so named and studied by Berry (1950) have been shown by him to have the properties of pseudomalachite.

Examination of the minor accessory minerals in some metasomatized latites, andesites and similarly altered volcanic rocks from Safford, Graham Co., Arizona, has led to the recognition of a number of interesting minerals, one of which is pseudomalachite. In view of the comparative rarity of this mineral in the United States it seems desirable that the occurrence be placed on record.

The copper phosphate is associated with the following minor constituents: malachite, brochantite, antlerite, carbonate-apatite, chrysocolla, jarosite, lepidocrocite, and a variety of other oxides of iron, covellite, chalcopyrite, pyrite, and a deep blue cupriferous mineral that has not been satisfactorily diagnosed so far.