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# AUSTINITE FROM GOLD HILL, UTAH

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The first complete description of austinite, $CaZn(AsO_4)(OH)$, (Staples, 1935) was based on material from the Western Utah mine at Gold Hill. Richmond (1940) reoriented austinite (Staples to Richmond: 001/010 /100) after study by the Weissenberg method. Strunz (1957) later reoriented austinite and the adelite group to Staples' original setting. In Dana's System of Mineralogy (Palache *et al*, 1951) the angle table is based on Staples' axial ratio in the Richmond orientation but the crystals are drawn in the Staples orientation.

Recent underground collecting at the Western Utah mine produced a large variety of complex but well-defined austinite crystals associated with adamite. These crystals are invariably elongated on Staples' [001], and his orientation is retained here. The following forms were found on six crystals: *b* [010], *h* [160], *e* [130], *m* [110], *n* [310], *z* [011], *d* [101], *p* [111], *r* [121], *f* [132], *s* [131], *g* [532], and *t* [431]. These forms are listed as they might appear on a right-handed crystal. Left-handed equivalents of all [*hhl*] and [*hkl*] forms also occur. The presence of [111] or $[1\bar{1}1]$ was used to distinguish right and left-handed crystals respectively. In no case were complementary forms found on any single crystal.

The crystals are dominated by [010] and either [111] and $[1\bar{3}1]$ or $[1\bar{1}1]$ and [131]. A typical crystal is shown in Figure 1. The form labelled $x$ in the figure is vicinal (approximately [4.27.1]. Many crystals show vicinal faces with $h=k\gg l$ or $k\gg h=l$. Another common distortion is

TABLE 1

$a:b:c=.6585:1:.8312 \quad p_0:q_0:r_0=1.2623:.8312:1 \quad q_1:r_1:p_1=.6585:.7922:1$
$r_2:p_2:q_2=1.2030:1.5186:1$

| form | | $\phi$ | $\rho$ | $\phi_1$ | $\rho_1=A$ | $\phi_2$ | $\rho_2=B$ |
|---|---|---|---|---|---|---|---|
| *b* | 010 | 0°00′ | 90°00′ | 90°00′ | 90°00′ | — | 0°00′ |
| *e* | 130 | 26 51 | 90 00 | 90 00 | 63 09 | 0°00′ | 26 51 |
| *m* | 110 | 56 38 | 90 00 | 90 00 | 33 22 | 0 00 | 56 38 |
| *n* | 310 | 77 37 | 90 00 | 90 00 | 12 23 | 0 00 | 77 37 |
| *z* | 011 | 0 00 | 39 44 | 39 44 | 90 00 | 90 00 | 50 16 |
| *d* | 101 | 90 00 | 51 37 | 0 00 | 38 23 | 38 23 | 90 00 |
| *p* | 111 | 56 38 | 56 31 | 39 44 | 45 50 | 38 23 | 62 35 |
| *r* | 121 | 37 13 | 64 24 | 58 58 | 56 57 | 38 23 | 44 06 |
| *s* | $1\bar{3}1$ | 153 09 | 70 19 | −68 09 | 64 50 | 38 23 | 122 51 |

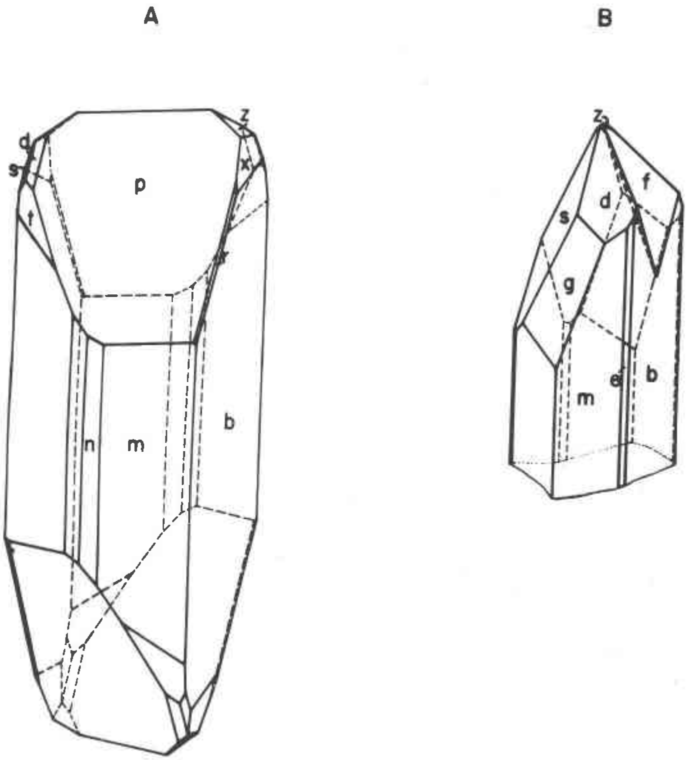

FIG. 1. (A) Right-handed austinite crystal and (B) twinned crystal.

tapering of the crystals so that $\rho$ for ($hk0$) and (010) varies in innumerable discrete steps from 90° to about 88°. Some crystals are highly perfect, however, and were used for the data presented in Table 1.

A number of twins were found as shown in Figure 1. These consist of a right- and a left-handed individual joined on {100} with {010} and {001} coincident.

Etch tests employing KOH, $NH_4OH$, 1:7 $HNO_3$, 1% $HNO_3$, $FeCl_3$ and 1:6 HCl were tried on {010}, {111}, {1$\bar{3}$1}, {110}, and {011} with inconclusive and conflicting results. The convention adopted here (and by Staples) for distinguishing right- and left-handed crystals is supported by optical study. This revealed rotary polarization on the optic axes which is clockwise in right-handed crystals when viewed against the light. The specific rotation is 15° at 640 m$\mu$ and 23° at 499 m$\mu$, a close fit to Biot's inverse square law.

Dr. John W. Anthony kindly reviewed the manuscript.

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# ON LEUCOPHOENICITES

## I. A NOTE ON FORM DEVELOPMENTS

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### INTRODUCTION

Leucophoenicite, $3Mn_2SiO_4 \cdot Mn(OH)_2$, is generally regarded as a member of the manganese humite group. However, unlike the monoclinic members alleghanyite, $2Mn_2SiO_4 \cdot Mn(OH)_2$, and sonolite, $4Mn_2SiO_4 \cdot Mn(OH)_2$, which seem to be normal members of the manganese humite series, being isotypic with chondrodite and clinohumite respectively, leucophoenicite does not appear to have the orthorhombic symmetry expected for the manganese analogue of humite. The detailed studies on leucophoenicite morphology by Palache (1928) led him to conclude that "No interpretation of the highly peculiar assemblage of forms offered the slightest resemblance to the form series of any member of the humite group to which leucophoenicite is related chemically" (p. 316).

Leucophoenicite is one of the more conspicuous and abundant of the accessory minerals from Franklin, New Jersey[1] occurring as raspberry-red to pink masses usually associated with green willemite and coarse granular franklinite. In most specimens it appears as a replacement mineral and Palache considered it a pneumatolytic product, somehow connected with the pegmatite lenses which intruded certain portions of the ore body. Crystals of leucophoenicite, however, appear to be confined to open hydrothermal veins and display a wide variety of developments and a range of colors from pink to red to brown.

No structure-cell studies on leucophoenicite have been done to my knowledge, and this effort was undertaken to elucidate the species as a

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[1] I have discovered that many of the 'hydrotephroites' from Pajsbreg, Sweden are leucophoenicites, which adds interest to the species.