NOTES AND NEWS

AN UNIDENTIFIED MINERAL IN THE QUARTZ BASALT OF LASSEN VOLCANIC NATIONAL PARK, CALIFORNIA

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The occurrence of an unidentified mineral at Cinder Cone, Lassen Volcanic National Park, California, was pointed out to the senior author by Dr. W. I. Gardner. The former subsequently visited the locality and with the aid of Mr. Rondo Birch collected sufficient material for optical determinations and spectrographic analyses.

Occurrence

The geology of Cinder Cone has been well described by Finch and Anderson,[1] as well as by Williams.[2] They state that the volcanic history began with pyroclastic eruptions which built up a cone. A lava flow from the base of the cone was followed by another series of pyroclastic eruptions. Following a period of quiescence there were four or five eruptions of lava from the base of the cone, the last probably occurring about 1851. Small cinder cones indicate the presence of vents under the lava field. Opaline deposits locally cementing the pyroclastic material are accounted for as the work of steam vents.

Petrography

The cone and flows are composed entirely of quartz basalt. The lava is dense black or gray in color, mostly vesicular, but rarely massive. In places it exhibits "aa" or "pahoehoe" surfaces but the greatest part is of blocky character. The texture is microporphyritic with phenocrysts of plagioclase, olivine, and enstatite. Labradorite and augite microlites and pale-brown glass make up the groundmass. Quartz xenocrysts averaging 1–2 mm. in diameter are surrounded by coronas of diopsidic augite and glass. Inclusions range up to 15 cm. in length and are dacitic (quartz-oligoclase-sanidine-glass), with sanidine and quartz. It was suggested[1,2] that these inclusions were derived from a differentiated dacite magma, the quartz basalt thus being a hybrid rock.

Old fracture surfaces have a varnished appearance similar to that of desert varnish, areas adjacent to quartz xenocrysts being especially

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[1] Finch, R. H., and Anderson, C. A., The quartz basalt eruptions of Cinder Cone, Lassen Volcanic National Park, California: *Univ. Calif. Publ., Bull. Dept. Geol. Sci.*, **19**, 245–273 (1930).

[2] Williams, Howel, Geology of Lassen Volcanic National Park, California: *Univ. Calif. Publ., Bull. Dept. Geol. Sci.*, **21**, 195–385 (1932).

glassy. Microscopic examination reveals that the appearance is due to incipient fusion of minerals at the surface. Local oxidation has intensified the red color of the ferromagnesian minerals.

Glass exposed on the old fractured surfaces is commonly light-blue in color. Crusts of a bluish-green mineral have crystallized on many of these surfaces. Such areas appear as small (1–2 mm.), shiny, blue-green spots and consist of aggregates of plates and fibers lying more or less parallel to the surface. Crystallization has also occurred in cracks penetrating the glass and, in some instances, crystals appear to have developed entirely within the unfractured glass. The blue-green mineral is commonly associated with the blue glass but does occur with the colorless type.

Optical and Other Properties of Glass and Blue-Green Mineral

Optical and crystallographic properties were determined as far as possible on the material at hand and with the equipment available. Thin sections and immersion oils were used. The refractive index of the glass varies from 1.500 to 1.525. Apparently there is no relation between this property and color.

The blue-green mineral appears to be triclinic (nearly monoclinic with $Y=b$). Good cleavages are exhibited on planes that were taken to be (001), (100), and (010). The angle $001 \wedge 100$ is probably $68° \pm 5°$. Most grains, although crystalline, are irregular, roughly tabular or prismatic. Fibrous or platy aggregates are common. Indices of refraction determined in oils are: $\alpha=1.545$, $\beta=1.565$, $\gamma=1.575$; $\gamma-\alpha=.030$, all $\pm.002$. The negative 2V, roughly determined from interference figures, $=50°–60°$. Dispersion of the optic axes is $r>v$, strong. The optic axial plane is nearly normal to (010). In sections normal to Y the angle $Z \wedge c$ is 14° and the apparent angle $001 \wedge 100$ is 66°. Cleavage flakes lying on (010) usually show $Z \wedge c=18°$ and $001 \wedge 100$ is approximately 71°. No pleochroism is perceptible, the color being uniformly blue-green.

The specific gravity determined in bromoform is $2.60 \pm .02$. The hardness is approximately 3.

Chemical Composition

As yet sufficient material has not been concentrated for quantitative chemical analyses. However, the results of spectrographic examinations by Kennard (Table 1) show the qualitative, and approximate quantitative composition. It is probable that the iron and copper shown in group two are responsible for the color of the mineral and glass, and are essential to the formula of the mineral. The weight percentage of copper is probably between 1 and 5%, though possibly it exceeds 5%.

Table 1. Spectrographic Analysis of Blue Glass and Blue-Green Mineral from Cinder Cone

T. G. Kennard, *analyst*

	Blue Glass	Blue-Green Mineral
Large amount	Al	Al
	Si	Si
Small amount: X%	Ca	Ca
	Mg	Mg
	Fe	Fe
	Cu	Cu
Very small amount: 0.X%; possibly 0.0X%	Li	Li
	Na	Na
Traces: 0.0X to 0.00X%	B	B
	Ba	Ba
	Mn	Mn
	Pb	Pb
	Ti	Ti