GEIKIELITE, A NEW FIND FROM CALIFORNIA*

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ABSTRACT

Geikielite, $MgTiO_3$, from the Jensen quarry of the Riverside Cement Company, Riverside County, California, is the second known occurrence of this mineral and the only location where it is found in place. It is closer to the theoretical end member than the Ceylon material and has a lower specific gravity. The accompanying minerals are spinel, pyrite, pyrrhotite, diopside and forsterite.

INTRODUCTION

Geikielite, $MgTiO_3$, is an exceedingly rare mineral which has previously been recorded only from Ceylon, as pebbles from gem-bearing gravels. It is thus of particular interest to report a second occurrence, in California, especially as it has been found here in place, and its mineralogical relationships can be observed.

The Ceylon occurrence was reported by Fletcher (1), and the mineral described and analyzed by Dick (2). According to him the color is bluish or brownish black, thin splinters showing a peculiar purplish red by transmitted light. Sustschinsky (3) made another analysis, and measured cleavage fragments and poor crystals on the goniometer. He observed the base poorly developed, and on one crystal a narrow face with a ρ angle of about $72\frac{1}{2}°$. The unit rhombohedron he measured on cleavage surfaces. Crook and Jones (4) analyzed a number of specimens, and observed that the color and specific gravity appeared to vary with the composition. As FeO increased, the color darkened, and the specific gravity increased. All their analyses showed considerable amounts of Fe_2O_3. Table 1 gives various analyses of geikielite, including that from California.

OCCURRENCE

The new occurrence of geikielite is at the Jensen quarry of the Riverside Cement Company, in Riverside County, California. The quarry is in limestone which has been extensively altered by the intrusion of irregular tongues of igneous rock, with recrystallization of the calcite and development of abundant brucite. The brucite is in rounded grains and crudely octahedral crystals, and, probably as at nearby Crestmore, pseudomorphous after periclase. In addition, certain zones are particularly rich in minute grains of flesh-colored or pale-lavender spinel.

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Geikielite occurs very sparingly, as minute, ruby-red to nearly black, rounded or flattened grains in the spinel-rich layers. It is in places accompanied by minute grains of pyrite and pyrrhotite, and by colorless rounded grains of diopside and forsterite. Few of the grains are over 1 millimeter in diameter, and most are considerably less.

The geikielite appears to have been crystallized at essentially the same time as the accompanying minerals, as it is often intergrown with them, and all were developed in the crystalline limestone during the process of metamorphism. The spinel very commonly encloses microscopic grains of doubly refractive material, probably diopside or forsterite. Separation of even a few hundred milligrams of material involved dissolving a considerable volume of the rock in acid, and separation of the insoluble residue by heavy solutions. Even so, the specific gravities of spinel and geikielite are so close together that separation was poor, and final hand picking under the binocular was necessary.

TABLE 1. CHEMICAL ANALYSES OF GEIKIELITE

	I	II	III	IV	V	VI	VII
TiO_2	60.0	61.32	67.74	63.94	64.03	64.9	66.46
Al_2O_3	—	—	—	—	—	1.3	—
MgO	29.86	28.95	28.73	25.79	24.66	31.8	33.54
FeO	2.028	2.028	3.81	10.09	12.14	1.4	—
Fe_2O_3	6.90	7.75	–	.25	—	—	—
MnO	—	—	—	—	—	0.4	—
SiO_2	—	—	—	—	—	0.9	
	98.79	100.05	100.28	100.07	100.83	100.7	100.00
Sp. Gr.	3.976					3.79	

I, II Sustschinsky; III Dick; IV, V, Crook and Jones; VI Fahey; VII Mg TiO_3.

There appear to be several considerable differences in properties between the California geikielite and the Ceylon mineral. These are probably due to the variation in composition, as our material (see analysis VI) is extremely low in iron. The color is decidedly lighter, being distinctly ruby red except in the largest grains, and brownish red in transmitted light, rather than purplish as described. It is also decidedly pleochroic with ϵ pinkish, and ω brownish red. Specific gravity is lower than that of the material from Ceylon, and the calculated value in *Dana's* 7th Edition (6) from *x*-ray data by Posnjak and Barth (5).

CRYSTALLOGRAPHY

A number of the grains showed crystal faces, and in spite of their small size could be measured with considerable accuracy on the goniometer. Many of the thin tabular crystals showed one very good face, with traces of others, whereas some of the thicker ones yielded good measurements on a variety of forms. The base is always present and dominant, and practically always brilliantly smooth, so accurate setting of the crystals for measurement became simple. The next form in importance of occurrence and development is $r\{10\bar{1}1\}$, nearly always present as two or three faces on any crystal. It is accompanied in two instances by the negative form $\{01\bar{1}1\}$. Next in frequency, but seldom with good faces is $\zeta\{20\bar{2}5\}$. Its position is frequently fair, but the signal is usually rather poor. Another form $s\{02\bar{2}1\}$ is not common, but is of good quality and in good position. A flat rhombohedron $e\{01\bar{1}2\}$ was observed in excellent position in one crystal. In addition, three other forms have been included in the subjoined angle table; a number of doubtful forms are present which frequently were close to the calculated positions, but none of which gave really satisfactory signals.

TABLE 2. PARTIAL ANGLE TABLE

	$a:c=1:1.3806$		Measured Average		$p_0:q_0=1.592:1$ Calculated	
Forms		Quality	ϕ	ρ	ϕ	ρ
0001	8	A	—	0°00′	—	0°00′
$10\bar{1}1$	18	A	30°05′	57 54	30°00′	57 54
$01\bar{1}1$	2	B	−30 13	57 52	−30 00	57 54
$02\bar{2}1$	5	B	−30 15	72 24	−30 00	72 35
$20\bar{2}5$	13	D	30 40	33 20	30 00	32 31
$01\bar{1}2$	1	C	−30 39	38 32	−30 00	38 33½
$2\bar{3}12$	2	C	9 59	62 34	10 53½	64 38½
$8\bar{4}\bar{4}3$	1	C	61 41	72 54	60 00	74 48
$\bar{3}034$	2	D	−30 20	50 15	−30 00	50 05½
$\bar{8}719$	1	C	23 28	52 36	23 25	53 12½

Other doubtful forms, with poor signals but fairly good position $\{21\bar{3}0\}$, $\{50\bar{5}4\}$, $\{21\bar{3}1\}$, $\{21\bar{3}6\}$, $\{6173\}$, $\{71\bar{8}7\}$, $\{5.2.7.12\}$.

Measurement of an x-ray powder photograph gives the following spacings for prominent lines: 2.72, 2.22, 1.71, 1.46, 1.32.

CHEMICAL COMPOSITION

The chemical analysis (No. VI, Table 1) was made on the whole sample, weight 137 mg., recovered from the determination of the specific gravity. After dissolving the bisulfate fusion, the SiO_2 was filtered, weighed, and volatilized with HF; a double precipitation with NH_4OH

separated the titanium, iron, and aluminum from the magnesium and the manganese. The iron was determined colorimetrically with thiocyanate and computed to FeO. Titanium was measured by passing the solution through the Jone's Reductor, the delivery tube of which was below the surface of a solution of ferric sulfate, and titrating the equivalent ferrous iron with permanganate. The alumina was determined by difference in the usual manner. Magnesia was weighed as $Mg_2P_2O_7$ and the manganese contained therein measured colorimetrically.

The specific gravity (3.79 corrected to 4° C.) was determined on 147 mg., using a fused silica Adams-Johnston pycnometer of 5 ml. capacity.

A spectrographic analysis by K. J. Murata showed aluminum present in tenths of one per cent and calcium, zinc and magnesium in hundredths.

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