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8. *Segregation Vein in the Uwekahuna Laccolith, Kilauea Caldera, Hawaii.*

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Abstract

Dark, coarse-grained segregation veins cutting the Uwekahuna laccolith exposed on the caldera wall of Kilauea, Hawaii, consist of zoned plagioclase, clinopyroxene, ilmenite, magnetite, mesostasis, apatite, and silica minerals. Chemical composition of the segregation vein indicates a fairly advanced stage of iron enrichment.

Introduction

The Uwekahuna laccolith, first named and described by Daly [1911], is exposed on the wall of the Kilauea caldera, Hawaii, near the site of Volcano Observatory, U. S. Geological Survey. The mineralogy and chemistry of this differentiated gabbroic intrusive body have been recently described by Murata and Richter [1961]. The gravitational settling of olivine has taken place to form a layer enriched in olivine crystals. Another form of in-situ differentiation of this intrusive body is dark aphanitic dikelets as described by Murata and Richter [1961]. Still another type of segregation vein has been found by the writer, when he visited the laccolith in August, 1963. This report describes the petrography and chemistry of the vein in comparison with the results by Murata and Richter [1961] and Kuno et al [1957].

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Occurrence

The Uwekahuna laccolith is exposed on the vertical wall in a rather irregular horizontally-elongated outline about 230 m long [see Fig. 1 of Murata and Richter, 1961]. The bulk of the laccolith is a tholeiitic gabbro porphyry with a fairly large amount of olivine phenocrysts, set in a matrix of olivine, clinopyroxene, hypersthene, plagioclase, opaque oxides, apatite, silica minerals, and glass. According to Murata and Richter [1961] "dikelets of dark aphanitic material as much as 1/2 in. thick are fairly common as joint fillings in the north body" of the laccolith. The dikelets consist of "a dense, unoriented felty mass of feldspar, irregular interspaces filled with clear glass and cristobalite. Scattered through the dense groundmass are a few small highly corroded olivine crystals, some with hypersthene reaction rims, and ragged plagioclase and clinopyroxene crystals."

The segregation veins described here are found also fairly common throughout the portion of the laccolith easily accessible from the caldera floor. They are in general 1 to 5 cm wide, sometimes winding and branching irregularly, cutting obliquely the major joints. They are richer in vesicles and distinctly darker in color than the main part. Platelets of plagioclase and pyroxene needles are seen projecting into the vesicles and are often lined with white silica mineral.

Petrography

Specimens taken from the northern part of the southern body of the laccolith [see Murata and Richter, 1961] consist, under the

Table 1. Mode of the segregation vein in the Uwekahuna laccolith. No. SA 63072501 a. About 3000 point counts. Volume percent.

Plagioclase	42.1
Clinopyroxene	33.0
Opaque oxides	5.8
Mesostasis	17.4
SiO_2	1.5
Apatite	0.2
	100.0
Vesicles	27.0

microscope, of plagioclase, clinopyroxene, opaque oxides, apatite, partially crystalline mesostasis, cristobalite and other forms of SiO_2. The mode is given in Table 1.

The texture is subophitic with interlocking plates of plagioclase, clinopyroxene, and ilmenite. Plagioclase plates attain 1.5 mm in length, show strong normal zoning, and are andesine in approximate composition. Brownish clinopyroxene, up to 1.5 mm in length, also shows strong zoning: 2V ranging from about 30° in the core to about 45–50° in the margin. Rough estimation of the refractive indices indicates that the mode of zoning of the clinopyroxene is almost identical with that of the clinopyroxene described by Kuno et al [1957, p. 187], whose sample was derived from a segregation vein in a tholeiitic basalt flow exposed on the western wall of the Kilauea caldera. Kuno et al report that the zoned clinopyroxene is subcalcic augite in the core, a continuously changing composition through ferroaugite to ferropigeonite to the outer margin. Under reflecting microscope, ilmenite (in plates up to 2 mm long) is more abundant than the granular magnetite. Hematite and limonite(?) stain rim of opaque oxides and clinopyroxene. Apatite appears as needles up to 0.3 mm long. The mesostasis consists of brown

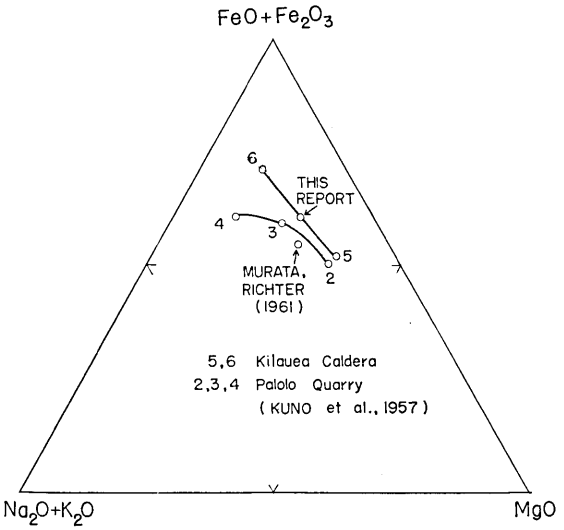

Fig. 1. Plotting of the ratio $MgO:Fe_2O_3+FeO:Na_2O+K_2O$. Nos. 2, 3, and 4 are the host basalt, dolerite pegmatite, and granophyre form Palolo quarry, Honolulu [Kuno et al, 1957]. Nos. 5 and 6 are the host basalt and segregation vein from the Kilauea caldera wall [Kuno et al, 1957.]

Table 2. Chemical composition and norm of segregation veins and host rocks of the Uwekahuna laccolith and basalt flow exposed on the western wall of the Kilauea caldera, Hawaii.

	1	2	3	4	5
SiO_2	48.37	52.04	51.68	52.36	50.88
TiO_2	1.88	4.16	4.26	2.95	2.59
Al_2O_3	11.19	13.20	11.53	12.34	13.75
Fe_2O_3	3.08	2.86	3.30	2.81	0.73
FeO	8.65	8.55	10.02	13.59	10.42
MnO	0.17	0.16	0.18	0.22	0.20
MgO	15.26	5.84	5.59	2.87	7.77
CaO	8.94	8.83	9.46	7.54	10.76
Na_2O	1.76	2.79	2.46	2.99	2.00
K_2O	0.28	0.83	0.70	0.80	0.52
$H_2O(+)$	0.10	0.33	0.35	0.77	0.51
$H_2O(-)$	0.03	0.08	0.05	0.12	0.19
P_2O_5	0.16	0.49	0.21	0.76	0.24
CO_2	0.02	0.01			
F	0.02	0.07			
S	0.00	0.00			
	99.91	100.24			
Less 0	0.01	0.03			
Total	99.90	100.21	99.79	100.12	100.56

Norms

Quartz	—	7.56	8.49	8.50	2.01
Orthoclase	1.65	4.90	4.14	4.73	3.07
Albite	14.89	23.60	20.81	25.29	16.91
Anorthite	21.81	21.05	18.35	17.89	27.01
Wollastonite	8.97	8.16	11.35	6.07	10.35
Enstatite	25.50	14.54	13.92	7.15	19.34
Ferrosilite	7.08	6.77	8.97	18.17	14.63
Forsterite	8.75	—	—	—	—
Fayalite	2.68	—	—	—	—
Magnetite	4.47	4.15	4.78	4.07	1.06
Ilmenite	3.57	7.90	8.09	5.60	4.92
Apatite	0.37	1.13	0.49	1.76	0.56
	*	*			

* Normative fluorite and calcite are not calculated.

1. Tholeiitic olivine gabbro, basal chill zone, south body of laccolith. Analyst V. C. Smith. Murata and Richter (1961, no. 1).
2. Black phanitic dikelets, 1/2 in. thick, in joints in north body of laccolith. Analyst, V. C. Smith. Murata and Richter (1961, no. 7).
3. Segregation vein about 3 cm thick, northern part of the south body of laccolith. No. SA 63072501 a. Analyst, H. Haramura.
4. Segregation vein in no. 5 of this table. Analyst, T. Katsura. Kuno et al (1957, no. 6).
5. Augite-olivine basalt, a pre-historic lava in western wall of the Kilauea caldera. Analyst, T. Katsura. Kuno et al (1957 no. 5).

Fig. 2. Photomicrographs of the segregation vein, Uwekahuna laccolith. Single polaroid.

cryptocrystalline material charged with opaque dusts, pyroxene needles, plagioclase hollow prisms and other unidentified microlites. Aggregates of cristobalite roof-tile are found filling the vesicles. Colorless transparent low-refringent materials often line the vesicles and are presumed to be very rich in SiO_2.

Chemical composition

Result of chemical analysis made by Mr. H. Haramura is given in Table 2. The chemical compositions of the chill zone of the Uwekahuna laccolith, aphanitic dikelet [Murata and Richter, 1961], augite-olivine basalt lava flow and its segregation vein [Kuno et al, 1957] are also shown for comparison. In Fig. 1, the ratio $MgO : Fe_2O_3+FeO : Na_2O+K_2O$ is plotted. From Table 2 it is apparent that the segregation vein described here and the dikelet described by Murata and Richter [1961] are very similar in chemical composition although they differ in crystallinity, grain size, and to some extent mineralogy. The segregation vein of this paper shows high CaO and TiO_2. It represents, as indicated in Fig. 1, a little more advanced stage of iron enrichment than the dikelet of Murata and Richter [1961] but still distinctly lower in iron than the segregation vein described by Kuno et al [1957].

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8. ハワイ，キラウエア・カルデラのウエカフナ・ラコリスの分化岩脈

地震研究所　荒　牧　重　雄

ウエカフナ・ラコリスはハワイ島，キラウエア・カルデラの北壁に露出しており，その岩石はかんらん石の斑晶を多くもつ，はんれい斑岩である．岩体中に見出される暗色脈状で粗粒の分化岩脈の一つは，斜長石，単斜輝石，チタン鉄鉱，磁鉄鉱，メソスタシス，燐灰石，珪酸鉱物から成っている．その化学成分は，MURATA and RICHTER [1961] の報告したものと似ているが，鉄の濃集度がやや大きい．