of California. We acknowledge the valuable technical assistance of Evelyn Brown, Janet Frazer, and Tibor Batonay.

6. Tween 40 (Atlas Powder Co.) was included in the test media at 4 mg percent.
7. Media used previously in this laboratory have contained potassium at concentrations not less than 9.4 μmole/ml.
8. It is evident from the data of J. Folch-Pi [in *Biochemistry of the Developing Nervous System*, H. Waelch, Ed. (Academic Press, New York, 1955), pp. 124–125] that the appearance of cerebrosides parallels myelination in developing mouse brain and from the report of J. N. Cumings [*Brain* 76, 551 (1953); 78, 554 (1955)] that demyelination in multiple sclerosis is accompanied by a proportionate loss of cerebrosides.

8 March 1957

Autoradiography of Volcanic Rocks of Mount Lassen

Following the procedure of Guilbert and Adams (*1*), an autoradiographic study has been made of the volcanic rocks of Lassen Volcanic National Park, California. By this method, the sites of alpha-emitting elements (thorium and uranium series) may be located within 5 μ in thin sections. In each of the sections studied, approximately 100 alpha tracks were counted, and the mineral from which each one emanated was identified. These data, plus a modal analysis of the section, permitted calculation for each mineral of the following ratio: percentage of alpha tracks from mineral/percentage of mineral in the rock (*2*). Table 1 shows these ratios, plus the modal percentages, for the minerals in each section studied (*3*).

In Table 1, for each mineral in each sample, the upper (italic) figure in each pair is the ratio of percentage alpha tracks from mineral/percentage of mineral in the rock; and the lower figure (roman) is the modal percentage of the mineral. All samples had previously been used by Adams (*4*) in a study of the uranium geochemistry of the Mount Lassen lavas.

The volcanic rocks studied consisted of phenocrysts of plagioclase and one or more ferromagnesian minerals (and rarely quartz) in a groundmass of glass or aphanitic material. As shown by Table 1, the determined ratios (percentage alpha tracks from mineral/percentage of mineral in the rock) are close to 1 for most minerals, including glass, in each sample. Apparently no mineral is either enriched or impoverished in thorium and uranium, and the distribution of alpha-emitting elements seems to be uniform.

In addition to the minerals listed in Table 1, most samples contained small amounts of magnetite, and some samples contained a few tiny grains of apatite; no alpha tracks were definitely associated with the apatite, and we were not able to detect tracks in the emulsion above the opaque magnetite. The maximum number of alpha tracks from uncertain sources (for example, within 5 μ of the edges of grains) was 11 percent for all sections shown in Table 1. The possibility that thorium and uranium are concentrated in minerals so scarce that they do not appear in the sections studied is apparently eliminated by the fact that the total number of alpha tracks in the emulsion over each section accounts for roughly half of the radiometrically determined alpha activity for each sample.

In two samples not shown in Table 1, the constituents of the groundmass were sufficiently coarse so that alpha tracks could be identified from individual phases (glass, pyroxene, and plagioclase). Minerals in the groundmass apparently contained the same concentration of thorium and uranium as the corresponding phenocrysts, though the small grain size increased the uncertainty of location of the alpha tracks.

It must be concluded that the alpha-emitting elements are uniformly distributed among all the various constituents in the volcanic rocks of Mount Lassen. Apparently the rapid solidification of the lavas under volcanic conditions caused entrapment of the thorium and uranium in all the mineral phases and prevented concentration of these elements in any single mineral (*5*).

Table 1. Autoradiographic data and modal analyses of the volcanic rocks of Mount Lassen.

Sample No. (*3*)	Minerals. Phenocrysts, Plagioclase	Hornblende	Pyroxene	Biotite	Quartz	Altered ferromagnesian	Groundmass
5	*0.74*	*2.4*		*11.0*			*0.96**
5	19.5	4.3		0.2			76.0 *
8	*1.1*	*0.97*	*1.6*	*0.65*			*0.97**
8	25.3	0.9	3.4	2.6			67.0 *
11	*1.1*	*1.6*	*1.6*	*4.2*			*0.93†*
11	25.9	2.2	0.7	0.3			69.9 †
14	*0.48*	*2.5*	*1.5*	*6.9*			*1.2* †
14	27.9	1.3	2.8	0.1			67.6 †
15B	*1.0*		*1.2*				*0.94**
15B	60.4		11.0				28.6 *
16	*1.0*	*2.3*	*4.1*	*1.1*	*0.75*	*0.0*	*0.97†*
16	30.0	2.2	0.5	1.9	2.7	2.3	59.5 †
17	*0.95*	*3.0*	*1.0*				*1.2* †
17	77.5	0.7	10.9				10.2 †
18	*0.70*		*1.7*				*0.99‡*
18	5.6		3.4				90.9 ‡
21	*1.7*		*0.62*		*0.57*		*0.80†*
21	28.8		11.9		13.3		45.9 †
24	*0.95*	*1.1*	*1.0*				*1.0* †
24	17.3	1.0	7.0				74.8 †
25	*3.5*		*1.3*				*0.92†*
25	0.6		17.5				82.0 †
31	*1.0*		*0.85*				*2.4* *
31	65.9		29.2				4.9 *
36	*0.99*	*1.1*	*0.99*				*1.4* ‡
36	64.0	0.9	28.3				6.4 ‡
39	*0.86*		*0.0*			*1.4*	*1.05†*
39	19.0		1.8			1.0	77.9 †
41A	*0.92*	*1.5*	*0.98*	*2.8*			*0.99†*
41A	41.3	0.7	13.1	1.0			42.7 †

* Glass. † Glass (with plagioclase). ‡ Plagioclase, pyroxene, and glass.

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References and Notes

1. J. M. Guilbert and J. A. S. Adams, *Nucleonics* 13, No. 7, 43 (1955).
2. For both alpha counts and modal analyses, traverses were spaced so that the entire section was covered.
3. Sample numbers represent the following rocks: 5—Manzanita dacite; 8 and 11—Raker Peak dacite; 14—Chaos Crags dacite; 15B—Table Mountain basalt; 16—Chaos Jumbles dacite; 17—Flatiron andesite; 18—Pilot Mountain andesite; 21—quartz basalt bomb; 24—vesicular basalt, Cinder Cone; 25—andesite, Painted Dunes; 31—Eastern basalt; 36—Raker Peak pyroxene andesite; 39—altered Flatiron andesite; 14A—andesite.
4. J. A. S. Adams, *Geochim. et Cosmochim. Acta* 8, 74 (1955).
5. This work was supported by the Robert A. Welch Foundation, grant C-009. We express our thanks to F. W. Fessenden, J. A. Ragsdale, and J. P. Shannon for their help.

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