synthesized at 140°C and annealed for 1 month showed no twins. The possible effects of substitution solid solution, directed stress on twin formation, and the "erasure" of twinning by prolonged heating of argentite at low temperatures have not been investigated to date.

The present observations throw serious doubt on the interpretation of twinning in Ag_2S as evidence for initial formation of argentite (i.e., above 177°C) at least until such a time that inversion twinning can be readily distinguished from "premonitory" twinning. Twinning takes place as low as 152°C; therefore, the twinned low-temperature form may occur, with anhedral morphology, but need never have possessed the high-temperature crystal structure.

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TWIN LAWS AND COMPOSITION OF PLAGIOCLASE FELDSPAR IN TUFFS

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Abstract

Universal stage measurements of 105 plagioclase crystals from seven tuffs in the western United States show that twin laws with the (010) composition plane constitute 94.3 percent. The composition range of the plagioclase is from An_{10} to An_{37} with 54 percent in the An_{24-28} interval. Most of the plagioclase has high-optics: a few crystals display transitional optics.

Introduction

As part of a study on the use of plagioclase feldspar for provenance studies (Pittman, 1962), a literature survey was made of the characteris-

tics of plagioclase feldspar in various types of rocks. This survey revealed a paucity of reliable (*i.e.*, determined on the Universal Stage) data on tuffs. Therefore, data were collected on the twin laws, composition, and structural state of plagioclase feldspar by making 105 Universal Stage determinations in seven tuffs selected from the thin-section collection at the University of California, Los Angeles.

All measurements were made with a Zeiss microscope and four-axis Universal Stage. Glass hemispheres with an index of refraction of 1.555 were used; thus, the correction for the difference in index between crystal and hemisphere was negligible.

Slemmons' (1962) curves were used to determine the optical properties of the plagioclase.

Results

A total of seven twin laws were observed in the tuffs (Table 1). Albite and albite-Carlsbad A were the most abundant twin laws with Carlsbad A and albite-Ala B also important and Manebach, Baveno, and pericline insignificant. The later three constitute only 5.7 percent of the total twin laws recorded. Twin laws with the (010) composition plane were predominant (94.3 percent).

The bar diagram of Figure 1 shows the frequency of occurrence of plagioclase composition in the seven tuffs studied. Fifty-four percent of the plagioclase crystals were in the An_{24-28} interval. The range in composition was from An_{10} to An_{37}.

Most of the plagioclase crystals displayed high-optics although a few crystals in samples T-16 and PT-2 were of a transitional nature.

Twin law data for tuffs can be compared with data, compiled from published literature, on twin law distribution in igneous and metamorphic rocks (Pittman, 1962). Albite twins are abundant and ubiquitous in tuffs, igneous, and metamorphic rocks. Albite-Carlsbad A, Carlsbad A,

Table 1. Distribution of Twin Laws in Tuffs

Sample Number	Locality	Albite	Pericline	Carlsbad A	Manebach	Baveno	Albite-Carlsbad A	Albite-Ala-B	Total	Composition Range (An%)
T-14	San Bernardino Co., California	5	—	3	1	—	5	1	15	28–37
T-16	Unknown	4	1	4	—	—	4	2	15	25–33
T-21	Hueneme, Calif.	4	—	3	1	—	5	2	15	21–28
T-25	Bishop, Calif.	6	—	2	1	—	4	2	15	18–29
67-12	Elko Co., Nevada	7	—	1	—	1	5	1	15	24–31
PT-1	Clark Co., Nevada	5	—	3	1	—	4	2	15	10–23
PT-2	Kern Co., Calif.	4	—	4	—	—	4	3	15	14–26
Total		35	1	20	4	1	31	13	105	10–37

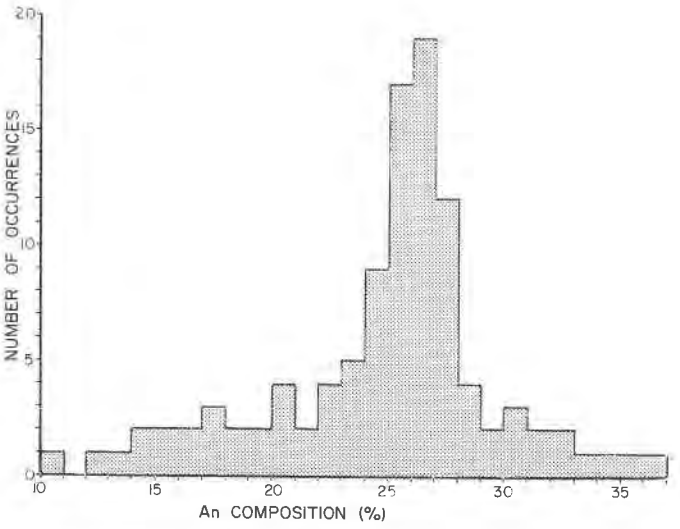

FIG. 1. Frequency of occurrence of plagioclase composition in tuffs based on 105 universal stage determinations.

and albite-Ala B are frequent twin laws in plagioclase of tuffs and igneous rocks of all types. Albite-Ala B commonly occurs in regional metamorphic rocks, also.

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