3950 0107

124

(321)

ITEM 14

74. RHYOLITES IN THE EGAN RANGE SOUTH OF ELY, NEVADA

By DANIEL R. SHAWE, Denver, Colo.

Rhyolite of Tertiary age in the Egan range south of Ely, White Pine County, Nev., occurs as (a) intrusive bodies, including a volcanic neck a mile across and a small sill; and (b) extensive dissected layers of welded tuff (fig. 74.1). Whether the intrusive rhyolite bodies are comagmatic with and mark the vents for the welded tuff ash flows is the subject of this paper. This possibility is in part suggested by the crude tendency for the welded tuff layers to dip outward from the neck (fig. 74.1), and in part by the superficial similarity of the rhyolites.

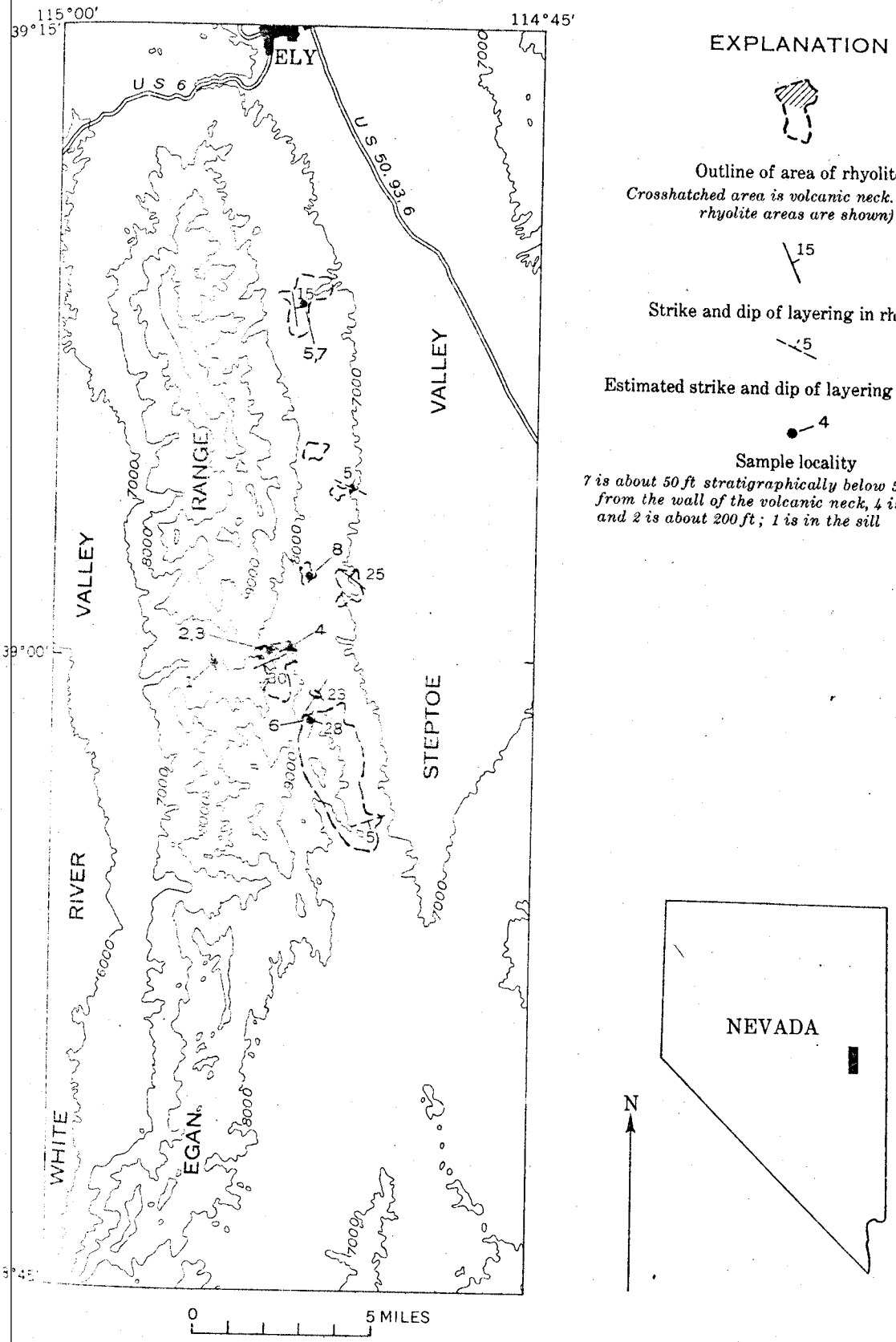
PETROLOGIC CHARACTER OF THE RHYOLITES

The intrusive rhyolite is generally a light- to dark-gray porphyritic rock composed of phenocrysts mostly about 1 to 2 mm across set in an aphanitic or glassy matrix that makes up about 75 to 80 percent of the rock. Glassy rhyolite forms a chilled border 100 to 200 feet wide around the volcanic neck. Flow structure is locally evident, generally as vertical banding in the volcanic neck and lineation in the sill. Much of the rhyolite in the neck is brecciated, and, as seen in thin section, flow lines are marked by strings of crushed crystals embedded in groundmass (fig. 74.2). Apparently deuteric or hydrothermal alteration affected large parts of the volcanic neck, as these parts are bleached light yellowish gray to almost white, and the rhyolite has become "porcelaneous." Another result of deuteric or hydrothermal action in the volcanic neck was the development of numerous small and imperfect "thunder-eggs"—cavities within dense, siliceous ellipsoidal shells lined with chalcedony and minor amounts of fluorite and manganese oxide. Oxidation occurred locally in the neck, as parts of the rhyolite are pinkish from "dusty" hematite. Small inclusions of chert or silicified limestone 1 mm to 1 cm in diameter are abundant.

Phenocrysts in intrusive rhyolite comprise subequal amounts of quartz, sanidine, and plagioclase (albite to oligoclase?), and about 1 percent of biotite; the size range is about 0.1 to 4 mm. Quartz occurs as euhedral to strongly corroded and embayed crystals; some is smoky. Sanidine forms subhedral to euhedral crystals; a few crystals contain intergrown quartz in graphic and myrmeckitic forms (fig. 74.3). Plagioclase forms subhedral to euhedral crystals, with slight oscillatory zoning and few albite and pericline twins. Biotite is dark brown to light yellowish brown and in places is charged with tiny specks of an iron oxide. Except for sparse iron ores, no accessory minerals were recognized.

The welded rhyolite tuff is similar in gross appearance to the intrusive rhyolite, except that almost everywhere it shows layering due to flattened pumice lapilli, and there is no obvious flow structure. Phenocrysts are mostly 1 to 2 mm across and are embedded in a glassy matrix constituting about 50 to 65 percent of the rock. In hand specimen, the tuffs appear no darker than the intrusive rhyolites, although crystals, especially mafic species, are more abundant in the welded tuffs. Inclusions of chert or silicified limestone in the welded rhyolite tuff appear to be more abundant than in the intrusive rhyolite, and they are not concentrated locally—as they are in the intrusive rock.

Phenocrysts in welded tuff comprise plagioclase (albite to andesine?), making up about 15 percent of the rock, lesser and subequal amounts of quartz, sanidine, and biotite, about 1 percent of pyroxene, iron ores, and pale hornblende, and traces of sphene, apatite, and zircon. The size range of all phenocrysts is about 0.1 to 4 mm. Plagioclase occurs as subhedral to euhedral crystals with slight to rather strong progressive zoning; a few crystals show ragged cores that are probably albite, rimmed with andesine(?) which is zoned outward progressively to albite. Albite and pericline twins are sharper and more abundant than in plagioclase of the intrusive rhyolite. Quartz is euhedral to strongly corroded and embayed (fig. 74.4); hand specimens show some smoky quartz like those of the intrusive rhyolite. Sanidine forms subhedral to euhedral crystals; a few of these have glass inclusions, in part zoned, but none contain graphic and myrmeckitic intergrowths of quartz. Biotite is strongly pleochroic, almost black to yellowish brown with a greenish cast, and commonly includes minute apatite crystals, and opaque iron minerals along cleavage traces. Accessory minerals aggregate less than 1 percent of the rock; they comprise iron ores, sphene (some diamond-shaped grains as much as 0.5 mm long), apatite, and zircon.



EXPLANATION

Outline of area of rhyolite
Crosshatched area is volcanic neck. (Not all rhyolite areas are shown)

15

Strike and dip of layering in rhyolite

5

Estimated strike and dip of layering in rhyolite

4

Sample locality
7 is about 50 ft stratigraphically below 5; 3 is a few ft from the wall of the volcanic neck, 4 is about 100 ft, and 2 is about 200 ft; 1 is in the sill

FIGURE 74.1.—Map showing areas of rhyolite and sample localities in the Egan range south of Ely, Nev.

TABLE 1.—*Chemical analyses and semiquantitative spectrographic analyses of eight rhyolites from the Egan range south of Ely, Nevada*

[Chemical analyses by Margaret Lemon; semiquantitative spectrographic analyses by Paul R. Barnett; d, detected; 0, looked for but not found (below limit of detectability)]

	Intrusive rhyolite				Arithmetic average of four intrusive rhyolites	"Comparison factor"	Arithmetic average of four extrusive rhyolites	Extrusive rhyolite			
	Sill	Volcanic neck						Welded tuff			
	Sample							Sample			
	1 (DRS–45–58)	2 (DRS–22–58)	3 (DRS–21–58)	4 (DRS–52–58)				5 (AB–23–58)	6 (DRS–5–59)	7 (AB–22–58)	8 (DRS–28–58)
Chemical analyses											
SiO_2	75.36	73.09	72.92	72.49	73.47	>	69.71	70.50	70.28	69.46	68.58
Al_2O_3	13.55	13.59	13.63	13.45	13.56	<	14.11	14.31	13.97	14.62	13.55
Fe_2O_3	.31	.44	.51	.55	.45	<2X	1.12	1.07	1.09	1.11	1.21
FeO	.43	.34	.27	.25	.32	<4X	1.41	1.41	1.63	1.44	1.16
MgO	.07	.07	.14	.08	.09	<9X	.81	.74	.76	.84	.88
CaO	.84	.90	.97	.88	.90	<3X	2.85	2.89	3.21	2.98	2.30
Na_2O	3.80	3.42	3.48	3.30	3.50	>	2.51	3.02	2.48	2.97	1.56
K_2O	4.61	5.11	4.83	5.00	4.89	>	3.84	3.48	3.70	3.54	4.64
H_2O+	.35	2.46	2.66	3.33	2.20	>	1.81	1.43	1.38	1.53	2.88
H_2O-	.19	.12	.29	.23	.21	<5X	1.00	.36	.50	.61	2.52
TiO_2	.05	.05	.05	.05	.05	<9X	.45	.46	.45	.47	.43
P_2O_5	.09	.01	.01	.00	.03	<3X	.10	.10	.09	.10	.09
MnO	.07	.08	.07	.08	.08	>	.05	.05	.04	.05	.04
CO_2	.01	.01	.01	.01	.01	<2X	.02	.01	.03	.03	.00
Cl	.01	.03	.03	.02	.02	=	.02	.04	.01	.04	.00
F	.11	.14	.11	.13	.12	>2X	.07	.08	.03	.09	.07
Sub-total	99.85	99.86	99.98	99.85	.....	.....	.....	99.95	99.65	99.88	99.91
Less O	.05	.07	.06	.05	.....	.....	.....	.04	.01	.05	.03
Total	99.80	99.79	99.92	99.80	.....	.....	.....	99.91	99.64	99.83	99.88
Semiquantitative spectrographic analyses [1]											
B	0	.0015	.0015	.0015	.0011	>	0	0	0	0	0
Ba	.003	.003	.003	.003	.003	<60X	.19	.15	.3	.15	.15
Be	.0003	.0003	.0003	.0003	.0003	>2X	.00015	.00015	.00015	.00015	.00015
Ce	0	0	0	0	0	<	.023	.015	.03	.03	.015
Co	0	0	0	0	0	<	.0003	.0003	.0003	.0003	.0003
Cr	d	d	.0003	d	<.0003	<	.0003	.00015	.0007	.0003	.00015
Cu	.0003	d	d	d	<.0003	<	.0003	.0003	.0003	.0003	.0003
Ga	.003	.003	.0015	.0015	.0023	>3X	.0009	.0007	.0007	.0015	.0007
La	0	0	0	0	0	<	.011	.007	.015	.015	.007
Nb	.003	.003	.003	.003	.003	>	.0019	.003	.0015	.0015	.0015
Nd	0	0	0	0	0	<	.009	.007	.015	.007	.007
Ni	0	0	0	0	0	<	<.0003	.0003	.0003	0	0
Pb	.003	.003	.003	.003	.003	>3X	.0009	.0007	.0007	.0015	.0007
Sc	.0003	.0003	.0003	.0003	.0003	<2X	.0007	.0007	.0007	.0007	.0007
Sn	.0007	.0007	.0007	.0007	.0007	>	0	0	0	0	0
Sr	.003	.003	.003	.003	.003	<20X	.06	.07	.07	.07	.03
V	0	0	0	0	0	<	.004	.003	.003	.007	.003
Y	.003	.003	.003	.003	.003	>	.0023	.003	.0015	.003	.0015
Yb	.0003	.0003	.0003	.0003	.0003	>	.00023	.0003	.00015	.0003	.00015
Zr	.007	.007	.003	.003	.005	<4X	.019	.015	.03	.015	.015

[1] Figures are reported to the nearest number in the series 7, 3, 1.5, 0.7, 0.3, 0.15, etc., in percent. These numbers represent midpoints of group data on a geometric scale. Comparisons of this type of semiquantitative results with data obtained by quantitative methods, either chemical or spectrographic, show that the assigned group includes the quantitative value about 60 percent of the time.

CHEMICAL CHARACTER OF THE RHYOLITES

The chemical character of four samples of intrusive rhyolite and four samples of welded rhyolite tuff is summarized in table 1. As shown in table 1, the four intrusive rhyolites form a group closely similar in composition, as do the four welded tuffs; the two groups are, however, chemically quite distinct. (See "Comparison factor" of the group averages, table 1.) For more valid comparison of the groups the analyses should probably be recalculated without H_2O, although this could not alter the basic differences between the two.

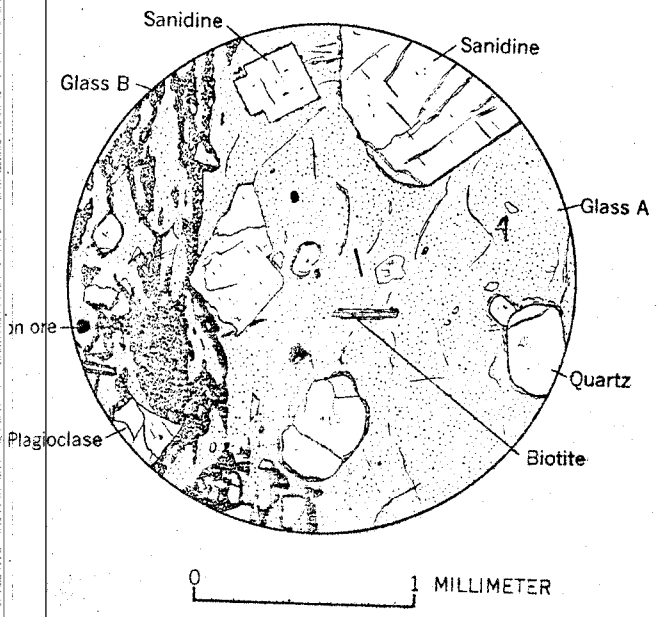


FIGURE 74.2.—Pen-and-ink drawing of rhyolite from volcanic neck. Glass *A* is clear; glass *B* is comminuted containing numerous small fragments of broken crystals (sample 3).

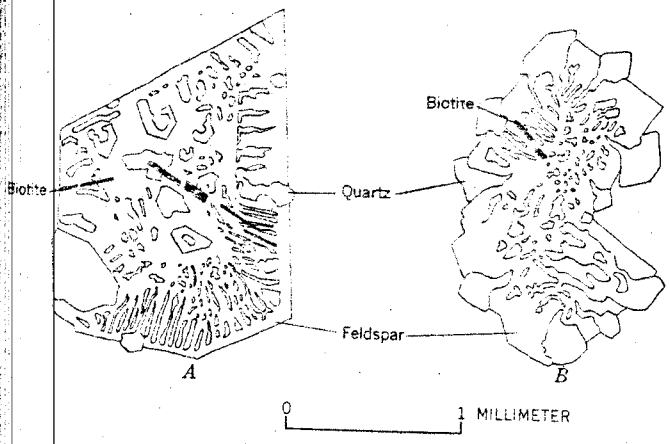


FIGURE 74.3.—Feldspar crystals with myrmeckitic and graphic intergrowths of quartz. Feldspar crystal *A* is sanidine from sill (sample 1). Feldspar crystal *B* is sanidine rimmed with plagioclase from volcanic neck (sample 4).

CONCLUSIONS

Both the petrologic and chemical data suggest that the intrusive and extrusive rhyolites were not closely related genetically. For example, the distinct differences between both plagioclase and sanidine phenocrysts in the two groups indicate that they probably were not derived from the same magma chamber, even at widely separated times. Further, the obvious chemical disparity between the intrusive rhyolite and the welded rhyolite tuff suggests that one is not related to the other through crystal fractionation.

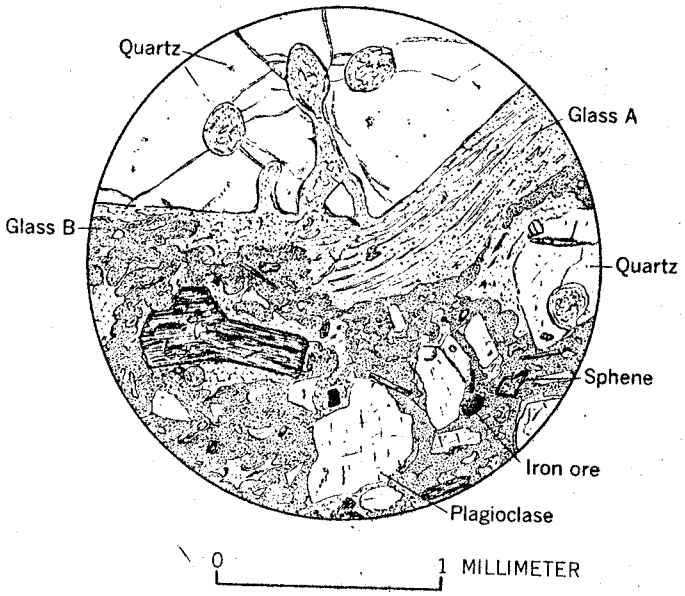


FIGURE 74.4.—Pen-and-ink drawing of welded rhyolite tuff. Glass *A* generally rims crystals, is vesiculated and fragmented; glass *B* forms matrix enclosing whole and broken crystals and particles of glass *A* (sample 8).