LITHOLOGIC, AGE GROUP, MAGNETOPOLARITY, AND GEOCHEMICAL MAPS OF THE SPRINGERVILLE VOLCANIC FIELD, EAST-CENTRAL ARIZONA

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INTRODUCTION

SETTING AND GENERAL CHARACTERISTICS OF THE FIELD

The Springerville volcanic field is one of the many late Pliocene to Holocene, mostly basaltic, volcanic fields present near the Colorado Plateau margin (fig. 1)[1]. The field overlies the lithospheric transition zone between the Colorado Plateau and the Basin and Range Province (Condit and others, 1989b). Establishing relations in time, space, and composition of the rocks of these plateau-margin fields offers the possibility to integrate more fully into a regional synthesis the detailed geochemistry of these fields now being examined (for example, Perry and others, 1987; Fitton and others, 1988; Menzies and others, 1991). The work also provides baseline information for understanding mantle properties and processes at different depths and locations. Because the Springerville field is the southernmost of the plateau-margin fields, and because it contains both tholeiitic and alkalic rocks (tables 1 and 2), it is a particularly important location for establishing these patterns in time, space, and composition.

Our four thematic maps of the Springerville field were compiled by using digital mapping techniques so that associated petrologic and chemical data could be conveniently included in a geographic information system for one of the plateau-margin fields. Parts of these maps have been included in Condit (1995), a stand-alone Macintosh[2] computer program that takes advantage of their digital format.

In contrast to other plateau-margin volcanic fields, including the San Francisco, Mormon Mountain, Mount Baldy (White Mountains), and Mount Taylor fields (fig. 1; Moore and others, 1976; Lipman and Mehnert, 1979; Crumpler, 1980, 1982; Holm and others, 1989; Nealey, 1989), the Springerville field contains no coeval silicic centers or large composite volcanoes (Condit and others, 1989a); it consists dominantly of monogenetic cinder cones and their associated flows. The field within Arizona encompasses about 3,000 km^2 and has a volume of about 300 km^3; it contains approximately 400 cones (Condit and others, 1989b). An estimated 100 km^2 of the field extends eastward into New Mexico.

The geology of the field's 2,166 km^2 of volcanic outcrop in Arizona was mapped at 1:24,000 scale, compiled at 1:50,000 scale, and reduced to a scale of 1:100,000. The south-central part of the field (fig. 5, sheet 1) was not mapped because of access problems, and detailed mapping in the central part of the field extends as far north as about lat 34°27' N. Reconnaissance suggests that an additional 50 km^2 to the north is also covered by flows, a large part of which are diktytaxitic; sampling by Cooper and others (1990) shows that the northern end of this area (Volcanic Mountain, fig. 5, sheet 1) is composed of tholeiitic lavas; a sample from Volcanic Mountain has an age of 5.31 Ma (Cooper and others, 1990).

The mapped units of the Springerville field range in age from 2.1 to 0.3 Ma, with the exception of six older flows around the periphery of the field. The oldest two of these six flows, found on the southwest edge of the field and dated at 8.66 and 8.97 Ma (table 3), have a source on Mount Baldy (fig. 1; Condit, 1984). Two northern units have ages of 7.6 and about 6.6 Ma (two aliquots have ages of 6.52±0.12 and 6.66±0.12 Ma); the last two of the older flows, on the southeast margin of the field, are dated at 2.94 Ma and 3.1 Ma. Sources for these last four units are unidentified.

The lithologic types and chemical classes of the map area, as defined in this report, are summarized in table 1A. The areal data were obtained directly from digital map images. The most common rock is olivine phyric basalt (lithologic types b, c, and d); these lithologies make up about 46 percent of the volcanic outcrop area. Olivine phyric lithologies most commonly belong either to chemical class alkali olivine basalt (AOB, table 1A), or to a transitional (TRANS) chemical class between AOB and tholeiite (THOL). The next most abundant lithology is diktytaxitic basalt (types f and g, which together cover about 32 percent of the volcanic area); most flows of this lithology are tholeiitic. The only other lithologic type to cover more than 3 percent of the out-

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[1]All figures and tables are in pamphlet except as noted.

[2]Any use of trade, product, or firms names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

crop area is aphyric basalt (type h), which makes up about 11 percent of the volcanic area; most of these flows are hawaiitic.

Eighty-seven percent of the outcrop area (1,887 km^2) and 60 percent of the mapped units (267 of 449) are mildly alkalic to alkalic, largely basaltic rocks (table 1A); these rocks compose about 72 percent of the area described chemically. Of this alkalic group, about one-third (27 percent of the area described chemically) is hawaiite, mugearite, and benmoreite (evolved alkalic rocks, or EAR). Vents for most of these flows are cinder cones. The rest of the rocks (about 28 percent) are tholeiitic and emanate from 16 vents; where exposed, these vents appear to have been fissures initially but are now elongate spatter mounds.

The geochemical evolution of the field, as expressed in percent of outcrop area with chemistry, is summarized in table 1B, where rocks are subdivided first by chemical class and then by age group. Geochemical modeling by Condit (1984) and additional work involving isotopic considerations by Cooper (1986, 1991) and Cooper and others (written commun., 1992) suggest that the transitional (TRANS) rocks are chemically similar to the alkalic rocks; many apparently owe their transitional chemistry (low alkali content) to their olivine-rich character (for example, picrites of lithologic type b). For this reason, in table 1B these rocks have been included in the alkalic basalt (ALK) chemical group, which also includes basanite and alkali olivine basalt. A third geochemical group shown in this table consists of evolved alkalic rocks (EAR) listed above. Early volcanism (age group 1) is represented by six units (1.3 percent of the volcanic area) dominated by tholeiitic chemistry; if the flows of Volcanic Mountain were included, this bias would be even greater (about 4 percent). Tholeiitic basalts of this group differ from younger tholeiites of the field in that they plot in a distinct group having lower alkali content with respect to silica (Cooper, 1991; Cooper and others, written commun., 1992). Rocks of age groups 2 and 3 (about 20 percent of the volcanic field) are dominantly tholeiitic; only about 5 percent of the field is alkalic basalt of these age groups. Volcanism was greatest during the time of age group 4 formation (47 percent of the field emplaced); during this interval tholeiitic eruptions declined, alkalic basalt volcanism peaked (about 30 percent), and evolved alkalic rock eruptions started to increase in volume. The youngest period of volcanism, that of age group 5, produced about 19 percent of the field. This period marks the peak of evolved alkalic rock eruptions; alkalic basalt eruptions declined to levels about half that of evolved alkalic rock production, and tholeiitic volcanism is represented by a single small flow.

A vent-distribution map and a quantitative analysis of the geographic distribution of the 409 vents of the field (including those in the unmapped south-central part) have been made by Connor and others (1992). Their analyses show regional cinder cone alignments in an arcuate pattern subparallel to the Mogollon Rim (the Colorado Plateau/Transition Zone boundary in the map area, fig. 1). The additional coincidence of these alignments with aeromagnetic lineaments suggests that the vent alignments are a reflection of the structural margin of the Colorado Plateau. While the structures implied by these vent alignments are regional in extent, they appear to differ significantly from those in other plateau-margin fields in that they cannot clearly be related to major reactivated Precambrian structures, which are lacking around the Springerville field.

MAPPING CONVENTIONS

Our four thematic maps of the Springerville volcanic field differ from conventional geologic maps in that they portray separately the areal distribution of lithologic, chronologic, magnetopolarity, and geochemical data. The volcanic units are presented on the lithologic map (sheet 1) and in the correlation of map units (sheets 2, 3 and 4) in a format designed to facilitate interpretation of the magmatic evolution of the volcanic field. In a further effort toward that goal, an age-group map (sheet 1) shows the units classified into five age groups, a magnetopolarity map (sheet 5) displays the units by magnetic polarity, and a geochemical map (sheet 5) shows the units by characteristic geochemical type. The format of these maps follows closely those of the 1:50,000-scale maps of the western part of the Springerville volcanic field (Condit, 1991); however, new data presented in this compilation permit a more refined interpretation of ages, and the chemical classification of Coombs and Wilkinson (1969) used by Condit (1991) is here replaced by that of Le Bas and others (1986). For convenience, long 109°45' is considered the boundary between the western and eastern parts of the volcanic field.

An effort was made to map each lava flow as a discrete unit on the basis of lithology and age and to correlate each flow with the vent from which it was extruded (sheets 1 and 5). Where cinder cones could be identified as vents for a unit, the tephra of the cinder cones is outlined and its related flows identified by numbers. Isolated cinder cones and pyroclastic deposits that could not be related to a flow are mapped as separate units; where their lithology could not be easily determined, these units are classified simply as pyroclastic deposits. Because the basic map unit is an eruptive unit, contacts are drawn between flows that are interpreted to represent separate eruptions even if the ages and lithologies are similar. The distinction is important in understanding the petrogenesis of each flow and of the field as a whole. This type of mapping helps to establish a temporal correlation of units within polarity-stratigraphic sequences.

Twelve lithologic types of basalt are identified and mapped on the bases of type and abundance of phenocrysts larger than about 0.33 mm (fig. 2); pyroclastic deposits are also mapped. Chemically, the volcanic rocks are basanite, tholeiite, alkali olivine basalt, hawaiite, mugearite, and benmoreite, according to the classification of Le Bas and others (1986), slightly modified within their basalt field. As noted above, basalts are divided into three classes: alkali olivine basalt, tholeiite, and an intervening class, transitional basalt (see sheet 5). A comparison of each of the lithologic types with the Le Bas classification is shown in figure 3. Major-element analyses of volcanic rocks in the Springerville volcanic field are given in table 2.

The field is divided into 20 geographic areas that separate, as nearly as possible, discrete packages of flows within which the most complete stratigraphic sucession is established from field relations (fig. 4, sheet 1). In addition, the division into these geographic areas helps to identify flows that, because of proximity, may be seen to be related to common magma batches. Only composite flow unit QTsf transcends geographic area boundaries in the western part of the field; single outcrops of units Qeb_2, Qcg_3, Qih_1 and Qkc_4 cross the boundaries of their respective geographic areas.

Numbers are assigned to vents on the basis of their locations (see index map of township and range boundaries, sheet 1). The numbers uniquely identify the township, range, and section in which the vent is located. Flows traced to a source vent bear the vent number without the prefix "V." Three-digit numbers preceded by "V" designate samples, not vents. Sample locations in tables 2, 3, and 4 follow the same numbering scheme.

Four hundred and seven individual flow units are recognized in the Springerville volcanic field and are described in this pamphlet (table 5). In addition to lithologic criteria and flow morphology, units are further distinguished by the proportion of minerals and the size of phenocrysts. Each flow unit is interpreted as a single batch of magma extruded in a single eruption from a single vent. Where individual units could not be separated, they are mapped as parts of a composite flow unit. Fifty composite flow units are recognized, twelve of which contain more than one lithology; these units are designated on the lithologic map by the dominant lithologic type. Some mixed lithologies may represent a magma of varied phenocryst content emplaced during a single eruptive episode; where noted in mapping, this information is included in the Remarks column of the description of volcanic units (table 5), and the unit is designated by its dominant lithology.

After the maps were reduced to a scale of 1:100,000, the linework was digitized by scanning, and thematic maps were produced by using experimental computerized mapping techniques developed by Acosta and others (1989) and Condit and others (1989c). Early work using computerized techniques was based on the VAX; later work was carried out almost entirely on Macintosh computers.

Informal nomenclature for volcanic units

Map symbols for volcanic units are composed of three or four letters and in most cases a subscripted number (for example, Qlh_2). The upper-case letter(s) designates the geologic system to which the unit is assigned (Q, Quaternary; QT, Quaternary and (or) Tertiary; T, Tertiary). The first lower-case letter is the first letter in the name of the geographic area in which the unit is located (fig. 4 and maps), as follows:

a, Antelope Mountain	l, Lake Mountain
b, Blue Ridge Mountain	m, Morgan Mountain
c, Cerro Hueco	n, North Fork White River
d, Dead Horse Draw	o, Ortega Sink
e, Ecks Mountain	p, Pole Knoll
g, Greens Peak	r, Richville
h, Haystack Mountain	s, Show Low Creek
i, Iris Spring	u, Udall Range
j, Juan Garcia Mountain	v, Vernon
k, Knolls	w, White Lakes Basin

The final letter refers to one of the 12 lithologic types of volcanic rocks shown in figures 2 and 3 and in the explanation on the lithologic map (sheet 1); "p" refers to pyroclastic deposits of undetermined lithology, mostly cinder cones. A subscripted number is used where more than one unit of the same lithologic type and geologic age occur in the same geographic area; the stratigraphically oldest unit is numbered 1. The unit designated Qlh_2 is therefore the second oldest aphyric unit of Quaternary age in the Lake Mountain area.

AGE GROUPS

To portray the general chronologic evolution of the Springerville volcanic field, the flow units have been assigned to five polarity-chronologic age groups on the basis of K-Ar ages (table 3) and the polarity-chronostratigraphic positions of the units (Condit, 1984, 1991). Magnetopolarities were determined in core samples collected from flows and from oxidized agglutinate on cinder cones (table 4). The boundaries of the age groups were placed at magnetopolarity reversals in the polarity-chronologic sequence of Mankinen and Dalrymple (1979). Because each flow unit may have been emplaced over an extended period of time, each is located in the correlation diagram (sheets 2, 3, and 4) in the center of its estimated time of eruption. Some apparent mismatches between the magnetopolarity of a flow unit and its position in the polarity-chronologic sequence are due to insufficient data to assign the unit to a discrete period matching its polarity. Where little stratigraphic control is available, the ages of some cinder cones were estimated by their degree of degradation determined by observation and (or) their height/width ratio, according to the terminology of Wood (1980).

To show spatially the chronologic development of the Springerville field, the five age groups are shown by color on the age-group map (sheet 1).

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DESCRIPTION OF MAP UNITS

SURFICIAL DEPOSITS

[Volcanic units that appear on maps are described in table 5]

Qal **Alluvium (Holocene and Pleistocene)**—Cinders, silt, sand, gravel, and boulders. Cinders dominant over most of region except in stream valleys bounding volcanic areas

QTt **Travertine (Quaternary and upper Tertiary)**—Spring deposits; ranges from grayish-tan massive to yellowish-white banded. Commonly forms mounds with circular summit pits. Occurs mostly in alluvial areas along Little Colorado River

QTc **Colluvium (Quaternary and upper Tertiary)**—Boulders and blocks of basalt, primarily at base of basalt-capped mesas

QTl **Landslide and Toreva blocks (Quaternary and upper Tertiary)**—Dominantly slump blocks of basalt

QTg **Younger gravel (Quaternary and upper Tertiary)**—Boulder-size gravel and coarse sand; light-gray to pinkish-gray and grayish-red. Most clasts are rounded to subrounded fragments of quartzite, sandstone, limestone, and chert derived from Proterozoic and Paleozoic formations. Sand grains are feldspar, quartz, and chert. Locally cemented by calcite. Questionably identified deposits may be rim gravel (unit Tg). Younger gravel differs from rim gravel in that wherever it is in contact with basalt, it overlies basalt

QTs **Sand and sandstone (Quaternary and upper Tertiary?)**—Coarse sand with local deposits of bouldery gravel; light gray to white. Clasts are dominantly rounded to subrounded fragments of quartzite, sandstone, limestone, and chert. Locally cemented by calcite. Unit identified only in eastern and southeastern parts of field where it underlies all basalt outcrops. May be correlative with rim gravel (Tg), younger gravel (QTg), or possibly Eagar or Baca Formations of Sirrine (1956)

SEDIMENTARY UNITS

Tg **Rim gravel (Oligocene?)**—Coarse sand and local boulders; light greenish gray to white. Clasts are dominantly well-rounded quartzite, chert, and limestone fragments derived from Proterozoic and Paleozoic formations; clasts of diabase and granite in fresh exposures. Sand grains of feldspar, quartz, and chert. Locally well cemented by calcite. Surface commonly mantled by lag gravel. Underlies all flows where found in contact with them. Probably correlative with rim gravel of Price (1950)

Ku **Sedimentary rocks, undivided (Upper Cretaceous)**—Sandstone, pale-yellowish-gray to yellowish-brown and pale-red, fine- to coarse-grained, feldspathic, crossbedded. Limestone, olive-gray to green, silty, discontinuous; contains pelecypods

₮c **Chinle Formation (Upper Triassic)**—Mudstone and siltstone, brownish-gray and grayish-reddish-purple; interbedded with lenticular beds of conglomeratic sandstone

₮m **Moenkopi Formation (Middle? and Lower Triassic)**—Siltstone and sandstone, reddish-brown to pale-orange. Sandstone, poorly sorted, in lenticular and wedge-shaped beds showing medium-scale trough crossbedding

Pk **Kaibab Formation (Lower Permian)**—Limestone and sandstone. Limestone, light-gray to yellowish-gray and pale-olive-gray, commonly silty, dolomitic, and cherty; locally fossiliferous; beds 20 cm to 1 m thick. Sandstone, light-yellowish-gray to light-yellowish-brown, fine-grained to very fine grained; thin-bedded to massive, locally crossbedded

Pc **Coconino Sandstone (Lower Permian)**—Sandstone, light-yellowish-gray to pale-orange, fine- to medium-grained, well-sorted quartz; moderately well cemented by quartz and iron oxides. Commonly in crossbeds 3–15 m thick

VOLCANIC UNITS

All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column of table 5.

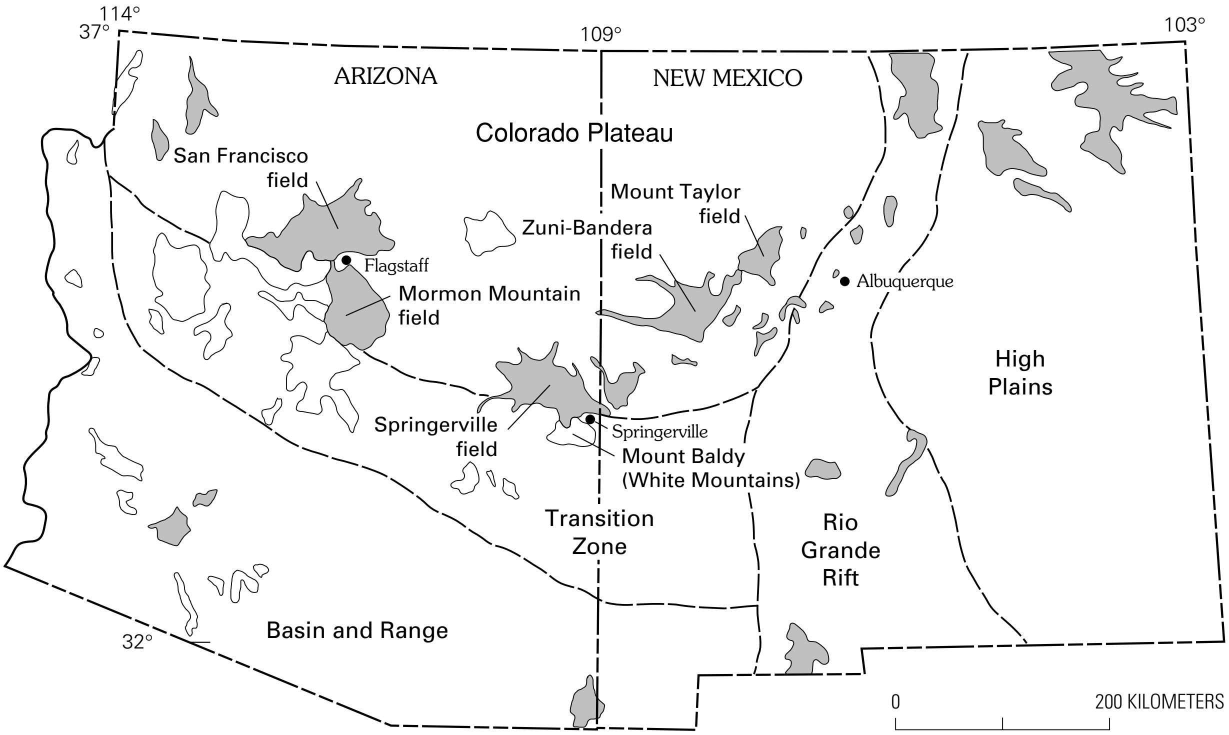

Figure 1. Physiographic provinces and distribution of late Cenozoic basaltic volcanic fields in Arizona and New Mexico (from Luedke and Smith, 1978). Stippled areas, volcanic rocks of Pliocene to Holocene age (<5 Ma); outlined areas, volcanic rocks of Miocene or older age.

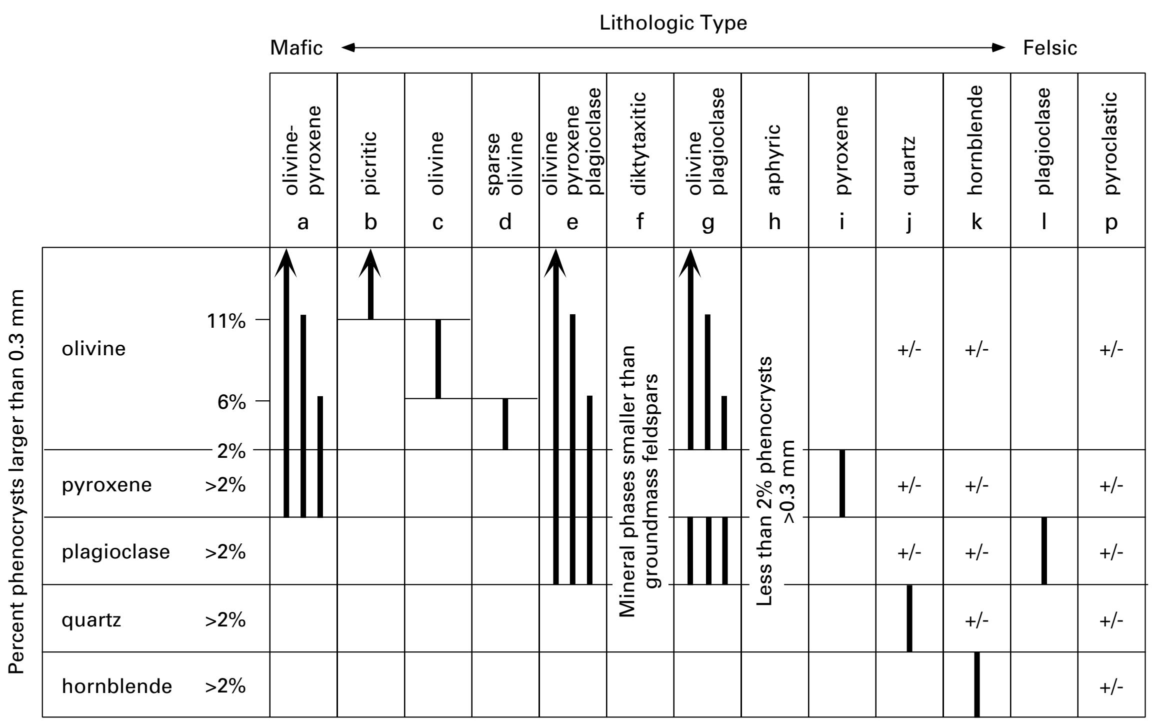

Figure 2. Volume-percent phenocrysts present in each lithologic type of basalt. Possible phenocrysts present in various percentages shown on left. Vertical bar in a column associated with a given lithologic type shows range of percentage(s) and combinations of phenocrysts in that type; ± indicates presence (in any amount) or absence of a mineral in lithologic type.

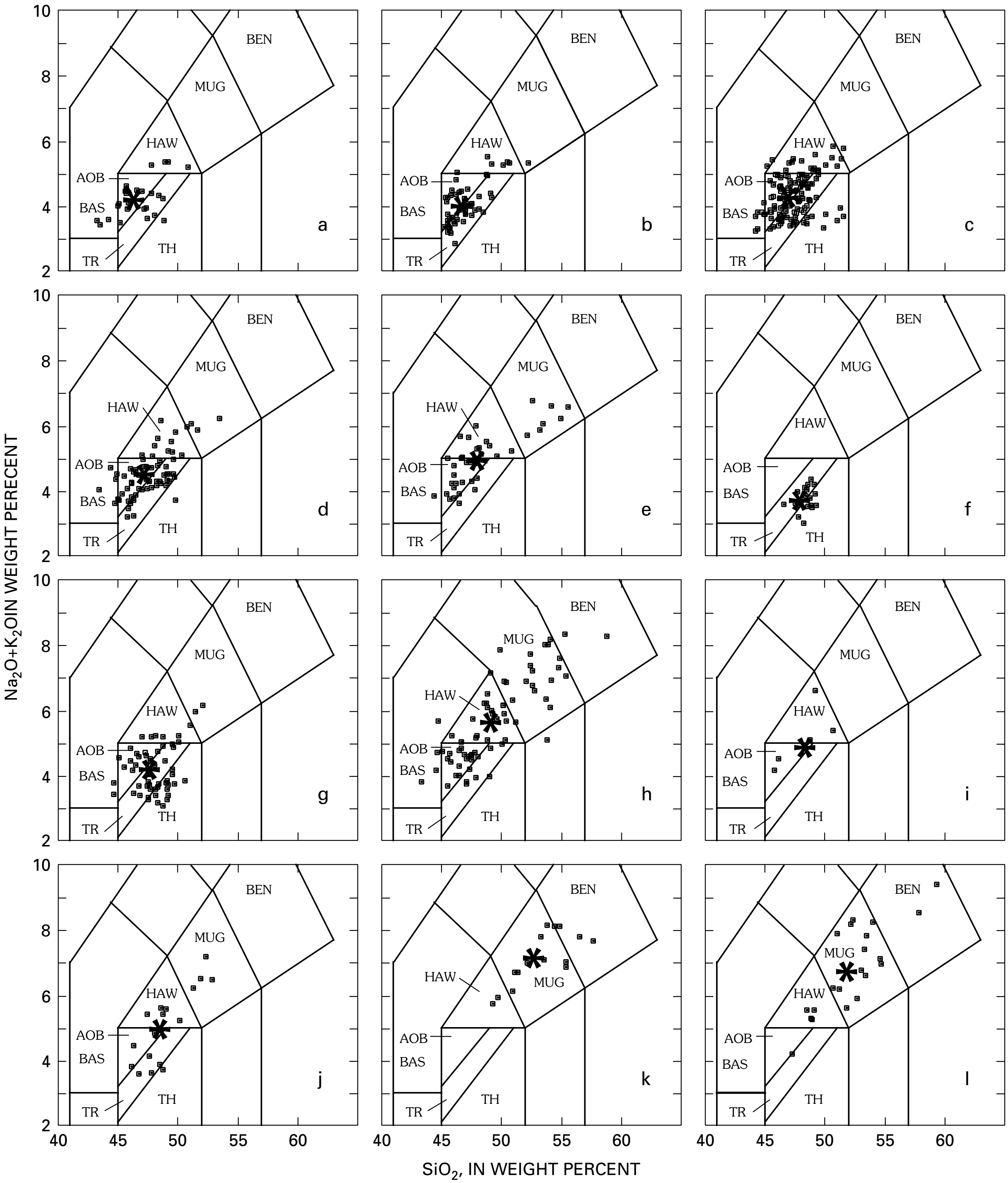

Figure 3. Chemical data for each lithologic type (a–l) in Springerville volcanic field, plotted on fields slightly modified from Le Bas and others (1986). (See sheet 4 and pamphlet text for explanation.) Asterisk shows mean value for each lithologic type. AOB, alkali olivine basalt; BAS, basanite; TR, transitional basalt; TH, tholeiite; HAW, hawaiite; MUG, mugearite; BEN, benmoreite.

Table 1A. *Area, areal percentage, and number of map units in map area as subdivided by lithologic type (left) and chemical class (right)*

[Chemical classes slightly modified from those of Le Bas and others (1986); for details see text, figure 2, and explanation on geochemical map (sheet 5). AOB, alkali olivine basalt; BAS, basanite; TRANS, transitional basalt; THOL, tholeiite; HAW, hawaiite; MUG, mugearite; BEN, benmoreite]

Litho-logic type	Area (square km)	Percentage of volcanic outcrop	Number of map units	Chemical class	Area (square km)	Percentage of area chemistry	Number of map with units
a	58.37	2.69	23	BAS	18.41	0.98	4
b	218.63	10.09	41	TRANS	476.30	25.24	78
c	519.59	23.99	111	AOB	357.25	18.93	74
d	263.14	12.15	77	HAW	318.45	16.88	51
e	62.00	2.86	20	MUG	155.67	8.25	36
f	356.21	16.44	5	BEN	39.59	2.10	8
g	337.99	15.60	42	THOL	521.34	27.63	16
h	233.34	10.77	63	Total	1887.01	100.00	267
i	8.52	0.39	3				
j	44.96	2.08	8				
k	28.60	1.32	6				
l	23.41	1.08	13				
p	11.55	0.53	37				
Total	2166.31	100.00	449				

Table 1*B*. *Area, percentage of area with chemistry, and number of map units in map area for each of five age groups (left) as subdivided by chemical class (right)*

[Chemical classes as in table 1*A*; chemical groups: ALK (alkalic basalts), BAS + TRANS + AOB; EAR (evolved alkalic rocks), HAW + MUG + BEN]

Group (Age)	Chemical class	Area (square km)	Percentage of area*	Number of map units	Chemical group	Percentage of area*	Number of map units
Group 5	BAS	0.54	0.03	1			
(0.97<0.3 Ma)	AOB	43.87	2.32	13			
	TRANS	51.15	2.71	13	ALK	5.06	27
	HAW	161.23	8.54	18			
	MUG	89.26	4.73	14			
	BEN	9.26	0.49	1	EAR	13.77	33
	THOL	11.09	0.59	1	THOL	0.59	1
	Unclassified	57.84		28			28
	Total	424.24		61			
Group 4	BAS	11.01	0.58	2			
(1.67<0.97 Ma)	AOB	307.40	16.29	47			
	TRANS	254.93	13.51	43	ALK	30.38	92
	HAW	154.10	8.17	29			
	MUG	59.61	3.16	18			
	BEN	28.60	1.52	6	EAR	12.84	53
	THOL	108.72	5.76	10	THOL	5.76	10
	Unclassified	143.69		122			122
	Total	1068.06		155			
Group 3	BAS	—	—	—			
(1.87<1.67 Ma)	AOB	43.71	2.32	10			
	TRANS	45.29	2.40	10	ALK	4.72	20
	HAW	2.40	0.13	2			
	MUG	1.40	0.07	1			
	BEN	1.73	0.09	1	EAR	0.29	4
	THOL	382.45	20.27	2	THOL	20.27	2
	Unclassified	34.89		21			21
	Total	511.87		26			
Group 2	BAS	—	—	—			
(2.14<1.87 Ma)	AOB	81.32	4.31	8			
	TRANS	5.88	0.31	8	ALK	4.62	16
	HAW	0.12	0.01	1			
	MUG	2.16	0.11	1			
	BEN	—	—	—	EAR	0.12	2
	THOL	1.10	0.06	1	THOL	0.06	1
	Unclassified	9.52		10			10
	Total	100.10		19			
Group 1	BAS	6.86	0.36	1			
(9.0<2.14 Ma)	AOB	—	—	—			
	TRANS	—	—	—	ALK	0.36	1
	HAW	0.60	0.03	1			
	MUG	3.24	0.17	2			
	BEN	—	—		EAR	0.20	3
	THOL	17.98	0.95	2	THOL	0.95	2
	Unclassified	33.36		1			1
	Total	62.04		6			
All age	Total Area	2166.31		449			
groups	Unclassified	279.30	12.89	182			
	Classified	1887.01	87.11	267			

*Percentage for entire field

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*

[For key to location of samples, see index map of township and range boundaries (sheet 1). All analyses are in weight percent. Unless noted, all analyses by U.S. Geological Survey, Denver, Colorado, using wavelength-dispersive X-ray fluorescence techniques. $FeTO_3$, total iron as Fe_2O_3; LOI, lost on ignition (900°C); NA, not avabilable]

Sample number	Unit symbol	Location	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
6T	Qsg$_1$	2136	48.93	1.84	16.54	12.78	0.18	6.77	9.57	3.62	0.82	0.32	NA	101.37
12SLN	QTsf	0112	47.51	1.64	16.09	13.26	0.19	7.81	9.62	3.01	0.60	0.23	NA	99.95
14SS	QTsf	1320	49.21	1.78	16.13	12.77	0.18	7.46	9.18	3.10	0.81	0.24	NA	100.86
16SS	QTsf	0211	48.82	2.26	17.12	13.27	0.17	5.31	9.52	3.40	0.94	0.36	NA	101.18
19SLS	QTsfu	9210	48.27	1.74	16.18	12.43	0.18	7.39	9.72	3.27	0.82	0.25	NA	100.24
24MR	Qwg$_3$	2431	48.30	1.49	15.50	12.70	0.18	8.89	9.59	2.61	0.54	0.21	0.06	100.02
25MR	Qwg$_3$	2429	49.73	1.51	16.39	11.91	0.18	7.67	9.60	3.07	0.65	0.23	NA	100.94
26MR	Qwg$_3$	2418	49.20	1.61	16.10	11.60	0.17	6.64	10.80	2.67	0.70	0.23	0.62	99.72
27MR	Qwg$_3$	2301	48.70	1.52	15.80	12.20	0.18	8.85	10.00	2.52	0.55	0.21	<0.01	100.53
31IP	Qbc$_1$	8321	48.28	2.21	16.42	12.08	0.20	6.93	9.44	3.50	1.37	0.49	NA	100.91
35OM	Qwg$_2$	1422	49.10	1.55	16.42	12.29	0.18	8.23	9.51	3.06	0.53	0.22	NA	101.10
37MR	Qwg$_3$	2425	49.20	1.41	15.33	12.75	0.18	8.87	8.98	3.09	0.62	0.21	NA	100.64
42SM	QTsf	0325	49.10	1.82	16.90	12.30	0.18	6.40	10.08	3.38	0.82	0.26	NA	101.25
48SM	Qec$_1$	9404	45.14	2.74	17.26	12.97	0.22	6.74	10.43	3.98	1.22	0.64	NA	101.34
50SM	Qld$_1$	9425	45.33	2.56	15.65	13.20	0.20	9.49	9.45	2.95	0.94	0.45	NA	100.22
55L	Qsc$_5$	9212	47.87	2.49	16.97	12.25	0.19	6.96	8.96	3.85	1.11	0.44	NA	101.10
56L	Qsb$_1$	9318	47.02	1.73	14.63	12.59	0.19	10.59	8.98	3.06	0.82	0.35	NA	99.95
59L	Qsc$_5$	9306	48.03	2.42	16.86	11.98	0.10	7.23	9.14	3.53	1.13	0.42	NA	100.84
62L	Qmg	9311	50.06	1.68	16.63	11.81	0.18	6.84	8.40	3.81	1.20	0.47	NA	101.08
69IP	Qnc	7303	48.60	2.13	16.04	11.84	0.19	7.67	9.09	3.40	1.14	0.39	NA	100.49
72MC	Thb$_2$	8422	50.53	1.85	15.56	10.82	0.17	7.87	8.07	3.74	1.59	0.39	NA	100.61
100IP	Qbc$_2$	8306	45.60	2.84	15.60	12.70	0.18	8.19	8.22	3.40	2.02	0.71	0.38	99.48
103L	Qsc$_5$	9202	46.40	2.31	15.59	12.00	0.17	9.09	10.20	2.60	0.90	0.40	<0.001	99.67
104L	Qsc$_5$	0235	46.30	2.31	15.60	11.90	0.16	8.94	10.10	2.50	0.93	0.40	<0.001	99.15
105L	Qsc$_2$	9307	45.50	2.26	15.10	12.10	0.17	10.10	9.92	2.20	1.42	0.58	0.12	99.34
107L	Qsg$_2$	0308	47.70	2.38	16.40	11.90	0.17	7.86	9.99	3.19	1.32	0.47	<0.01	101.38
108L	Qbb$_4$	9308	47.50	2.02	15.40	13.00	0.18	10.30	9.77	2.80	0.91	0.50	<0.001	102.38
111L	Qmc$_4$	9308	45.00	2.63	16.50	13.70	0.18	7.10	10.20	2.80	0.93	0.56	<0.001	99.58
112L	Qsd	9308	45.10	2.69	16.50	13.70	0.18	6.93	10.20	2.80	0.90	0.53	<0.001	99.56
113L	Qbb$_4$	9308	46.30	1.78	14.80	12.40	0.17	10.90	9.27	2.70	0.87	0.40	<0.001	99.60
114L	Qsb$_1$	9202	45.60	2.00	15.10	12.80	0.17	9.95	10.00	2.60	0.76	0.40	0.08	99.38
116LA	Qba	9217	45.05	2.18	16.60	11.70	0.19	7.27	11.20	2.93	1.13	0.65	0.88	98.90
118L	Qbb$_4$	9318	45.80	1.75	13.90	12.60	0.18	12.50	9.54	2.40	0.76	0.40	<0.001	99.84
119L	Qsa$_1$	0223	48.80	1.71	15.90	10.40	0.18	8.62	11.10	2.50	1.05	0.40	<0.001	100.67
120L	Qsc$_5$	9225	47.70	2.16	16.00	11.30	0.17	8.39	9.58	2.80	1.10	0.50	<0.001	99.70
122SS	Qsb$_2$	0222	45.70	2.70	16.20	12.80	0.19	6.51	9.74	3.20	1.46	0.70	0.14	99.20
124L	Qsc$_4$	0330	45.50	2.80	15.80	12.60	0.19	8.20	9.31	2.80	1.45	0.58	0.11	99.23
128L	Qbg	9318	46.70	1.98	15.40	12.20	0.17	8.04	9.64	2.60	1.07	0.40	0.56	98.21
129L	Qbh	9224	50.20	2.25	17.65	11.45	0.18	3.45	5.81	4.50	2.37	0.82	<0.001	98.69
130L	QTsf	9236	47.80	1.96	16.30	12.10	0.17	6.59	11.40	2.40	0.79	0.30	0.38	99.80
131L	Qbd$_2$	9331	49.01	2.09	16.60	11.20	0.15	5.43	9.58	2.80	1.34	0.40	0.65	98.60
132L	Qbc$_2$	9331	45.70	2.35	15.10	12.20	0.17	9.38	11.10	2.40	0.94	0.40	<0.001	99.74
173R	Qcb$_4$	1626	50.70	1.92	15.80	10.50	0.17	8.08	8.49	3.50	1.80	0.52	<0.01	101.49
174R	Qcb$_3$	1622	52.20	1.47	15.00	9.36	0.15	8.76	7.77	3.50	1.81	0.40	<0.01	100.43
193BB	Qel	9507	57.80	0.79	18.00	7.96	0.22	1.31	3.73	5.46	3.06	0.68	0.10	98.99
200L	Qbd$_2$	9319	49.80	1.68	16.20	11.60	0.17	6.93	10.10	2.90	0.79	0.30	0.14	100.47
201bL	Qbd$_2$	9319	49.70	1.89	16.30	11.50	0.16	5.50	9.55	3.30	1.12	0.31	<0.01	99.33
204L	Qbd$_2$	9328	49.00	2.06	16.90	11.20	0.16	4.91	9.95	3.39	1.34	0.40	0.12	99.31
205L	Qbd$_2$	9329	49.20	2.04	16.60	11.30	0.15	4.70	9.68	3.84	1.38	0.38	0.01	99.27
208L	Qbd$_2$	9332	49.60	1.99	16.10	11.60	0.16	6.78	9.53	3.25	1.25	0.38	0.34	100.64
210IP	QTsf	8304	48.80	2.01	16.00	12.30	0.17	6.95	11.10	2.73	0.81	0.25	<0.01	101.13
211IP	Qbc$_2$	8304	46.70	2.40	15.40	12.40	0.17	9.53	11.20	2.86	0.98	0.37	<0.01	102.01
212IP	Tbl	8304	51.00	2.22	16.70	10.30	0.18	2.45	5.97	4.04	3.83	1.49	1.51	98.18
213L	Qbc$_2$	9223	46.40	2.44	15.40	12.20	0.17	9.02	11.10	2.66	0.97	0.39	<0.01	100.76
214IP	Qbc$_2$	8305	47.60	2.09	16.30	11.80	0.19	8.14	10.20	3.26	1.20	0.58	<0.01	101.36
216L	Qbb$_2$	9335	46.10	1.56	11.80	13.10	0.17	17.60	7.99	2.16	0.67	0.26	<0.01	101.44
217SM	Tbc$_2$	9326	51.50	1.67	15.40	10.30	0.16	7.66	7.51	3.73	2.03	0.42	0.44	100.39
218SM	Qbb$_3$	9430	47.00	1.68	13.00	11.90	0.17	14.30	9.21	2.61	1.11	0.35	0.21	101.33
219SM	Qbb$_3$	9430	46.80	1.71	13.20	12.00	0.17	13.80	9.42	2.43	1.08	0.39	0.05	100.99
220SM	Qlh$_2$	9324	48.80	2.34	17.30	11.70	0.18	5.32	7.90	4.03	2.06	0.82	0.51	100.44

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*—Continued

Sample number	Unit symbol	Location	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
221SM	Qlc_3	9432	46.21	2.28	15.70	12.40	0.17	8.51	10.91	2.75	0.87	0.33	<0.01	100.12
222aS	Qlh_7	9434	48.70	2.34	17.30	11.70	0.18	5.45	7.98	4.15	2.05	0.80	<0.01	100.65
222bS	Qlh_7	9434	48.80	2.25	17.00	11.50	0.15	5.30	7.69	4.46	2.03	0.73	0.01	99.91
223SM	Qhc_2	9432	48.50	1.73	14.60	13.20	0.18	9.56	9.21	2.68	0.78	0.23	<0.01	100.67
225L	Qbe	9327	46.00	2.88	16.30	12.70	0.18	7.75	10.01	3.37	1.40	0.56	<0.01	101.15
226SM	Qme	9314	49.60	1.89	16.00	11.20	0.17	7.97	8.99	3.46	1.59	0.52	<0.01	101.39
229L	Qmb_4	0334	45.50	2.23	13.70	13.10	0.17	13.30	9.74	2.35	0.84	0.36	0.32	101.30
230SM	Qmh	0336	45.80	2.64	17.30	13.80	0.22	5.91	10.10	3.39	1.02	0.81	<0.01	100.99
231SM	Qmb_6	9201	45.69	2.19	13.60	13.00	0.17	12.40	9.51	2.45	0.87	0.35	0.11	100.23
232SM	Tme	9301	47.90	2.27	16.00	13.30	0.18	7.60	7.93	4.06	1.93	0.74	<0.01	101.92
234SS	QTsf	0320	48.59	1.87	15.80	12.50	0.18	8.09	10.30	2.67	0.85	0.26	0.05	101.11
235IP	Qbd_1	8318	48.30	2.03	16.70	11.40	0.19	7.16	9.71	3.47	1.29	0.64	<0.01	100.89
236FR	QTsfu	8215	49.30	1.80	14.50	13.40	0.19	9.23	9.22	2.74	0.81	0.22	0.19	101.43
237IP	Tbl	8332	52.30	2.15	17.20	10.10	0.18	2.43	5.64	4.40	3.90	1.48	0.60	99.79
238MC	Qnd	7406	49.60	2.06	16.50	12.20	0.18	6.83	8.49	3.55	1.41	0.48	<0.01	101.30
[1]238MC2	Qnd	7406	50.32	2.01	16.99	12.32	0.18	6.92	8.40	3.69	1.40	0.52	–0.42	102.31
239MC	Qhb_3	8324	47.80	1.87	15.50	10.80	0.16	9.74	10.30	2.72	1.14	0.42	0.04	100.46
240MC	Qhb_1	8407	47.10	2.14	14.90	12.00	0.18	11.00	9.10	2.88	1.19	0.45	<0.01	100.94
241MC	Qhb_1	8417	49.20	2.13	15.80	11.80	0.17	8.32	8.10	3.64	1.63	0.60	<0.01	101.40
242MC	Thc_2	8419	46.60	2.57	16.50	13.30	0.18	7.56	10.20	3.10	0.89	0.42	0.20	101.33
243SM	Qed_2	0432	44.40	3.06	16.80	13.50	0.21	7.03	11.00	3.57	1.14	0.70	0.04	101.41
246IP	Qbc_1	8322	47.09	2.20	16.10	12.10	0.19	7.29	9.32	3.27	1.36	0.53	0.21	99.46
247IP	Qbb_1	8321	45.20	1.77	13.50	12.50	0.18	13.80	8.99	2.52	0.83	0.35	<0.01	99.65
254IP	Tbc_1	8332	46.70	2.19	16.09	12.20	0.19	5.92	8.34	3.53	1.54	1.12	1.59	97.84
260L	QTsfu	9332	47.70	1.96	16.30	12.30	0.18	6.46	11.00	2.76	0.79	0.29	0.35	99.75
265IP	Tng	7312	48.30	1.40	15.60	11.60	0.17	8.59	9.51	2.77	0.86	0.28	0.36	99.09
268IP	Qng	7311	48.10	1.38	16.10	12.20	0.18	8.56	9.45	2.83	0.73	0.24	0.39	99.78
300IP	Tnb_3	7303	47.50	2.11	15.00	12.00	0.18	10.10	9.09	2.98	1.08	0.38	<0.01	100.42
301IP	Qnb_2	7303	48.10	1.55	15.30	11.30	0.17	9.89	9.38	2.91	0.98	0.36	<0.01	99.94
302MC	Tnc	7312	46.80	2.38	16.90	12.80	0.18	6.68	9.04	3.41	1.06	0.43	<0.01	99.68
303MC	Tnb_1	7312	45.90	2.21	15.30	11.60	0.18	9.90	9.54	3.13	1.35	0.50	<0.01	99.61
304IP	Thd	8336	46.26	2.35	14.90	12.60	0.18	8.37	11.10	2.69	1.00	0.41	0.26	99.88
305IP	Qhb_2	8335	48.51	1.52	15.30	11.40	0.17	9.62	9.09	2.77	1.04	0.35	<0.01	99.76
307IP	Thc_1	8335	46.20	2.75	16.00	13.10	0.17	6.38	9.66	3.10	1.11	0.51	0.71	98.97
309IP	Thg_1	8335	47.80	2.52	17.40	12.80	0.16	4.73	7.73	3.87	1.31	0.44	0.85	98.75
310MC	Qnb_1	8336	45.70	2.21	15.40	12.70	0.18	9.21	10.90	2.81	0.79	0.36	<0.01	100.26
311MC	QTnb	7406	45.80	2.20	15.20	11.60	0.18	10.20	9.35	2.94	1.37	0.49	0.24	99.33
312MC	QTnf	7406	48.70	1.37	15.80	11.70	0.17	8.65	9.50	2.87	0.89	0.26	<0.01	99.91
314MC	Qng	7301	49.00	1.41	15.40	11.50	0.17	9.03	9.43	2.87	0.90	0.27	<0.01	99.98
315MC	Thb_1	8429	45.70	2.25	15.40	12.70	0.18	9.11	10.90	2.50	0.77	0.37	0.39	99.87
318MC	QTsf	8429	48.40	1.79	16.00	13.00	0.17	7.34	9.52	3.10	0.72	0.22	0.06	100.25
319MC	Thc_3	8422	47.50	2.01	15.60	11.90	0.18	8.45	9.26	3.32	1.38	0.55	<0.01	100.15
321MR	Twj	2416	46.30	2.65	14.20	11.9	0.16	8.24	8.06	2.79	1.64	0.53	2.91	96.49
324MC	Qhe	8435	45.90	2.00	15.10	11.60	0.17	11.00	9.15	3.02	1.21	0.47	<0.01	99.63
325MC	Qhe	8436	46.00	2.38	17.70	11.90	0.20	5.93	10.20	3.31	1.16	0.67	0.29	99.44
326MC	Tha_1	8436	45.20	2.13	15.20	11.90	0.17	11.00	9.91	2.44	1.04	0.43	0.57	99.44
401MC	Qhd	8531	46.51	2.20	15.80	12.50	0.18	8.47	10.90	2.95	0.92	0.49	<0.01	100.92
402MC	Qhe	8531	46.20	2.02	15.00	11.80	0.17	11.40	9.30	3.00	1.22	0.44	<0.01	100.54
403MC	Qhe	7401	46.70	2.02	14.90	11.60	0.17	11.20	9.19	3.00	1.26	0.47	<0.01	100.50
407MC	Qhh_2	8425	48.80	2.13	16.90	12.40	0.19	6.32	7.88	3.57	1.52	0.54	0.23	100.25
409MC	Qha_2	8424	45.90	2.35	15.60	11.70	0.17	9.63	10.40	2.83	1.25	0.46	0.04	100.29
[1]409MC1	Qha_2	8424	46.52	2.33	15.51	11.62	0.17	9.72	10.17	3.18	1.30	0.41	–0.34	100.60
[1]414#1	Qla_3	8506	43.20	2.51	16.31	12.74	0.20	8.91	12.43	2.70	0.83	0.69	0.26	100.25
414MC	Qla_3	8506	43.50	2.56	16.07	12.80	0.20	8.96	12.40	2.58	0.82	0.64	<0.01	100.51
422MC	Qhc_2	8407	46.20	2.40	16.10	12.70	0.18	8.14	10.60	2.78	0.95	0.38	0.30	100.45
424SM	Qlg_1	9435	47.00	2.39	16.80	11.90	0.18	6.69	9.00	3.45	1.73	0.69	0.34	99.83
425SM	Qla2	9434	45.80	2.12	15.60	11.90	0.18	8.91	11.60	2.81	1.08	0.47	<0.01	100.48
426SM	Qlh5	9434	47.60	2.32	17.20	11.70	0.18	5.78	8.26	3.78	1.95	0.75	0.45	99.52
430SM	Qlh_3	9422	47.10	2.26	16.30	12.10	0.18	7.39	10.00	3.23	1.26	0.52	<0.01	100.34
431SM	Qmb_6	9420	45.50	2.16	14.10	12.90	0.18	12.20	9.45	2.78	0.94	0.38	<0.01	100.58
434SM	Qej	9412	49.00	2.06	15.70	10.50	0.16	8.25	8.47	3.62	1.96	0.56	<0.01	100.27
435AV	Qek	9412	55.40	1.23	18.01	8.47	0.17	2.22	6.03	4.40	2.46	0.67	0.43	99.06
436SM	Qej	9411	52.30	1.68	17.80	9.95	0.17	3.68	6.19	4.56	2.62	0.79	0.05	99.75

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*—Continued

Sample number	Unit symbol	Location	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
437SM	Qlh$_3$	9409	45.50	2.50	15.00	13.00	0.18	9.26	10.20	2.73	0.93	0.41	0.09	99.71
439SM	Qei	9404	50.70	1.75	17.70	10.30	0.18	5.03	8.23	3.65	1.72	0.63	<0.01	99.90
444SM	Qeg	9433	46.00	2.87	16.80	13.00	0.19	6.39	9.15	3.50	1.33	0.49	0.25	99.72
445SM	Qed$_4$	0427	47.20	2.06	18.50	11.70	0.19	6.03	9.09	3.69	1.03	0.65	<0.01	100.14
450SS	QTsf	1326	48.90	1.63	16.30	11.80	0.17	7.51	10.20	2.79	0.69	0.23	<0.01	100.22
453SS	QTsf	1235	47.70	2.41	16.10	13.10	0.18	6.15	10.20	3.01	0.94	0.38	0.15	100.16
454SS	Qsa$_2$	1226	45.80	2.54	15.39	12.40	0.17	9.18	9.22	3.07	1.38	0.53	0.06	99.70
457MN	QTsf	1303	48.20	1.32	14.89	11.90	0.17	9.02	10.10	2.43	0.56	0.22	0.87	98.81
460OM	Qwc$_3$	1432	47.50	1.77	14.50	12.40	0.18	9.48	9.39	2.80	0.85	0.32	0.76	99.20
[1]460OM#2	Qwc$_3$	1432	48.64	1.71	15.33	12.28	0.18	9.68	9.11	3.26	0.91	0.40	–0.28	101.21
461OM	Qwh$_1$	1430	46.60	2.48	17.20	12.90	0.22	5.03	9.24	3.51	1.33	0.83	<0.01	99.32
479MR	Qwg$_3$	2429	49.10	1.55	15.60	11.90	0.17	8.11	10.00	2.56	0.69	0.23	0.16	99.92
481OM	Qwg$_2$	1427	48.40	1.85	16.90	11.70	0.17	6.10	10.60	2.90	0.84	0.30	0.06	99.75
488OM	QTwc	1435	44.20	2.46	15.80	12.60	0.20	8.86	10.50	2.11	1.10	0.73	0.96	98.56
500L	Qlh$_2$	9322	48.60	2.28	17.30	11.50	0.18	4.88	7.53	4.09	2.12	0.82	0.16	99.30
501SM	Qlh$_3$	9420	46.50	2.34	16.10	12.30	0.18	7.05	10.20	2.72	1.27	0.54	0.48	99.18
502SM	Qej	9415	51.30	1.82	16.40	9.68	0.16	5.55	7.29	3.88	2.34	0.61	0.13	99.01
504SM	Qec5	9410	46.89	2.73	16.00	12.70	0.18	6.55	9.22	3.26	1.29	0.51	0.14	99.33
505SM	Qlc$_6$	9423	46.30	2.40	16.20	12.10	0.18	7.78	9.88	2.80	1.12	0.51	0.54	99.26
[2]606	Que$_1$	0735	52.57	1.90	15.94	9.23	0.15	5.13	7.32	4.32	2.43	0.59	0.43	99.58
[1]700IP	Qbd$_1$	8318	47.91	1.98	16.47	11.28	0.19	7.16	9.52	3.76	1.29	0.51	–0.44	99.62
[1]701IP	Qnc	7303	47.97	2.14	15.48	11.81	0.18	8.42	9.20	3.46	1.10	0.42	–0.52	99.81
[1]702MC	Qhb$_3$	8324	47.56	1.82	15.30	10.73	0.17	9.58	10.07	2.92	1.15	0.37	–0.11	99.55
[1]703IP	Tbl	8305	52.17	2.24	17.77	10.53	0.17	1.99	4.84	4.35	3.83	1.41	1.31	99.30
[1]704IP	Tbc$_1$	8332	47.25	2.15	16.05	12.11	0.19	5.44	8.24	3.78	1.57	1.10	1.23	99.11
[1]705MC	Qhe	8436	46.04	1.95	14.71	11.33	0.16	11.12	9.07	2.93	1.15	0.46	0.28	99.21
[1]706GP	Qph$_2$	8730	45.09	2.41	17.64	13.20	0.21	5.37	9.74	3.60	1.13	0.83	0.38	99.60
[1]707GP	Qgh$_3$	8624	52.39	1.57	17.93	9.41	0.17	2.90	5.89	5.10	2.62	0.85	0.05	98.83
[1]708WK	Qgh$_7$	9627	49.21	2.03	18.37	11.06	0.17	4.79	7.35	4.23	1.74	0.79	–0.03	99.69
[1]709WK	Qgb$_1$	9615	45.49	1.93	15.22	11.76	0.18	10.36	10.08	3.19	1.05	0.65	0.32	99.59
[1]710WK	Qgj$_2$	9627	50.13	1.57	15.37	9.93	0.15	8.20	7.89	3.67	1.55	0.41	–0.18	98.70
[1]711GP	Qpk	8732	56.51	0.96	18.30	6.54	0.18	1.18	4.64	5.25	2.53	0.71	0.46	96.80
[1]712GP	Qpc$_8$	8728	47.88	1.71	15.72	11.20	0.17	8.20	9.96	3.18	0.97	0.43	–0.39	99.03
[1]713SN	Qkc$_4$	9735	48.03	1.87	16.71	11.29	0.16	7.05	8.47	4.02	1.36	0.52	0.38	99.09
[1]714SL	QTsfu	0228	47.68	1.70	15.21	13.13	0.21	8.66	8.50	2.76	0.88	0.32	1.59	100.64
[1]715#2	QTsfl	0221	46.58	1.90	14.82	12.45	0.18	9.59	9.63	2.55	1.01	0.45	0.13	99.29
[1]716SM	Qmb$_6$	9424	45.49	2.11	13.67	12.55	0.18	12.49	9.62	2.61	0.93	0.34	–0.18	99.81
[1]717MR	Qwg$_3$	2429	48.16	1.58	16.12	12.36	0.17	8.31	9.77	2.83	0.56	0.30	0.01	100.14
[1]718OM	Twg	1313	46.24	2.29	16.11	12.34	0.18	8.78	10.53	3.17	0.97	0.37	–0.27	100.70
[1]719V	Qvc$_4$	1515	46.39	1.77	15.82	11.42	0.17	7.77	10.51	2.72	0.88	0.44	0.29	98.18
[1]720S	Qab	0823	48.74	1.82	14.80	10.99	0.17	9.45	9.00	3.47	1.48	0.43	–0.37	99.98
[1]721GP	Qpc$_2$	8636	46.53	1.68	14.93	11.73	0.16	9.02	9.80	2.89	0.80	0.50	0.31	98.36
[1]722SN	Quh$_4$	0735	55.28	1.12	17.47	8.48	0.17	1.66	4.44	5.62	2.72	0.90	0.90	97.86
[1]723SS	Qmb$_1$	1225	46.67	2.03	14.87	11.62	0.17	9.35	8.70	3.08	1.37	0.43	0.60	98.89
[1]724CH	Qdc$_4$	0705	50.07	1.80	15.19	10.73	0.15	8.21	8.49	3.78	1.45	0.38	0.05	100.25
[1]725LL	Qdh$_1$	0704	44.52	2.87	13.75	12.65	0.16	8.07	9.48	2.75	1.39	0.60	1.75	97.99
[1]726LS	Qdh$_1$	0704	44.59	2.95	14.01	13.08	0.17	8.22	9.49	3.26	1.45	0.60	1.20	99.02
[1]727SN	Qdb	0733	49.12	2.15	14.44	11.20	0.16	8.91	9.78	3.18	1.19	0.42	–0.18	100.36
[1]728SN	Qde$_3$	0722	46.55	2.17	15.81	10.86	0.17	7.75	8.70	3.80	1.86	0.64	–0.18	98.12
[1]729SN	Qde$_3$	0727	47.29	2.05	15.67	10.65	0.16	8.07	8.26	3.60	2.03	0.69	1.10	99.58
[1]730LS	Qdj$_1$	0715	46.09	1.61	13.82	11.60	0.17	11.92	9.90	2.89	0.90	0.43	0.06	99.04
[1]731LS	Qrd$_2$	0714	45.85	2.21	15.29	12.88	0.18	8.70	9.96	2.70	0.73	0.34	0.02	98.86
[2]732#1	Qph$_6$	8723	47.43	2.26	15.23	12.35*	0.17	8.52	9.35	3.47	1.13	0.44	0.67	99.90
[1]732SN	Qkb$_2$	0828	46.76	2.17	15.04	12.24	0.17	10.16	9.81	3.00	0.99	0.41	–0.69	100.07
[1]733SN	Qug	9806	46.73	1.94	14.92	11.42	0.16	10.94	9.66	3.27	1.31	0.51	–0.36	100.50
[1]734SN	Quc$_5$	9806	49.21	1.89	15.67	11.03	0.16	9.05	8.53	3.99	1.58	0.51	–0.22	101.62
[1]735G	Qah$_1$	8714	46.63	2.36	15.99	11.50	0.17	8.27	9.22	3.48	1.54	0.56	0.10	99.83
[1]736G	Tab	8711	48.13	2.23	16.28	12.04	0.17	6.87	10.12	3.23	1.05	0.46	0.00	100.59
[1]737GP	Qpg$_1$	7708	46.59	2.96	16.96	12.97	0.17	6.27	9.56	3.55	1.13	0.62	–0.31	100.48
[1]738GP	Qpa	7709	48.71	1.80	15.98	11.60	0.17	8.19	9.68	3.15	1.06	0.52	–0.48	100.37
[1]739GP	Qig	8612	51.41	1.90	17.47	10.02	0.16	5.07	7.16	4.11	1.85	0.65	0.15	99.80
[1]740GP	Qgg$_4$	8612	47.29	2.14	14.62	12.08	0.17	10.86	8.71	3.32	1.37	0.58	–0.55	101.59
[1]741S	Qka$_2$	9815	44.96	2.38	16.46	12.81	0.18	7.97	11.12	3.03	0.96	0.38	–0.14	100.14

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*—Continued

Sample number	Unit symbol	Loca-tion	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
[1]742S	Qad	9823	46.11	1.96	15.38	12.91	0.18	9.55	9.49	3.25	0.98	0.51	–0.65	99.69
[1]743WK	Qgj_2	9613	48.01	1.99	15.12	10.82	0.16	9.94	8.92	3.26	1.56	0.56	0.01	100.34
[1]1744WK	Qgc_2	9613	48.02	2.17	16.03	13.03	0.18	8.63	7.73	3.64	1.32	0.58	–0.60	101.91
[1]745CH	Qck_1	0616	51.40	1.91	17.51	10.54	0.18	4.48	7.26	4.52	2.16	0.70	–0.36	100.66
[1]746V	Qcc_6	0618	48.06	2.20	15.67	12.70	0.18	9.99	9.50	3.27	1.10	0.50	–0.27	102.89
[1]747CH	Qce_1	1631	47.94	2.23	16.75	11.88	0.17	7.69	9.23	3.86	1.43	0.60	–0.36	101.43
[1]749OM	QTwc	1435	44.41	2.24	15.80	12.21	0.20	8.42	11.10	2.27	1.01	0.53	1.15	99.35
[1]750BB	Qja_2	9630	47.77	2.42	17.54	11.94	0.18	6.19	8.69	3.87	1.39	0.58	0.34	100.91
[1]751BB	Qjh_5	9529	49.05	2.11	17.75	10.45	0.17	5.11	7.37	4.61	2.53	0.76	–0.04	99.87
[1]752BB	Qjl_2	9524	54.59	1.21	19.25	8.74	0.17	2.46	6.23	4.98	2.12	0.83	–0.21	100.58
[1]753BB	Qjh_6	9525	54.82	1.24	19.22	9.06	0.18	2.63	6.55	5.46	2.12	0.70	–0.29	101.98
[1]754BB	Qji_1	9515	48.74	1.99	18.03	11.23	0.17	5.70	8.86	3.76	1.31	0.57	–0.24	100.13
[1]755BB	Qjg_4	9509	50.08	1.08	16.18	11.21	0.17	6.62	8.47	3.90	1.31	0.41	–0.44	99.43
[1]756BB	Qjg_5	9507	48.29	2.00	16.31	11.98	0.18	6.92	9.41	3.69	1.05	0.42	0.08	100.33
[1]757BB	Qel	9506	59.30	0.81	17.81	8.22	0.21	1.43	3.77	6.28	3.11	0.61	–0.06	101.55
[1]758BB	Qel	9412	54.01	1.41	18.59	9.66	0.18	2.32	4.86	5.35	2.87	0.90	0.05	100.15
[1]759BB	Qje	9519	46.48	2.26	15.83	12.80	0.18	8.91	10.93	2.96	0.92	0.31	–0.46	101.12
[1]760BB	Qlh_3	9425	45.52	2.34	16.60	13.83	0.22	7.75	10.95	3.41	1.09	1.32	–0.22	102.82
[1]761SM	Qlh_7	9434	47.91	2.19	16.36	12.15	0.17	7.55	9.78	3.03	0.89	0.36	0.67	101.08
[1]762SM	Qla_1	9433	45.71	2.40	16.48	12.44	0.19	7.93	10.36	3.22	1.17	0.56	0.16	100.61
[1]763SM	Qbb_3	9430	46.46	1.62	12.92	11.90	0.17	14.28	8.94	2.78	1.09	0.33	–0.21	100.29
[1]765SM	Tbc_2	9326	50.66	1.65	15.47	10.49	0.16	7.55	7.25	3.85	1.97	0.40	0.16	99.60
[1]766#1	Qbb_2	9335	46.94	1.82	15.24	12.57	0.18	10.33	9.08	3.30	0.93	0.39	0.57	101.71
[1]767SM	Qme	9314	48.96	1.82	16.06	11.13	0.17	7.76	8.66	3.75	1.62	0.53	–0.49	99.98
[1]768OM	Qwh_4	1421	50.08	1.67	15.85	10.70	0.16	7.91	8.51	3.51	1.44	0.35	0.09	100.27
[1]770SS	Qsa_2	1235	48.06	1.73	15.50	13.20	0.18	8.37	8.88	3.00	0.71	0.28	–0.14	99.77
[1]801C#1	Tof	2623	51.27	1.67	15.21	11.72	0.15	7.26	8.76	3.07	0.86	0.22	–0.04	100.14
[1]804MC1	Qng	7312	50.61	1.40	16.02	11.98	0.17	9.93	9.48	2.95	0.87	0.31	–0.17	102.56
[2]6663	Qkc_6	1816	47.47	2.03	15.24	13.46*	0.19	8.18	10.16	3.06	0.75	0.28	0.53	100.28
[1]6666	Trc_2	1816	48.20	1.73	15.30	12.60	0.18	9.33	10.14	2.90	0.91	0.33	–0.48	101.14
BB110	Qjl_1	0536	49.10	2.78	17.70	12.80	0.19	4.50	8.04	4.20	1.35	0.69	<0.01	101.37
BB112	Qjl_4	9507	53.50	1.84	18.50	10.10	0.17	3.00	5.21	5.10	2.71	0.82	0.22	100.96
BB113	Qja_2	9618	47.00	2.50	16.10	13.00	0.18	7.79	10.10	3.40	1.03	0.40	<0.01	101.51
BB114	Qjh_6	9515	49.90	2.18	17.90	10.80	0.18	4.20	6.61	5.00	2.86	0.87	NA	100.51
BB115	Qjl_3	9524	48.80	2.18	16.50	10.80	0.16	7.57	8.61	3.40	1.87	0.53	NA	100.43
BB116	Qjl_2	9515	48.90	2.45	17.50	12.30	0.19	4.90	8.78	3.70	1.53	0.69	<0.01	100.95
BB117	Qjc_3	9514	46.30	2.40	16.50	13.21	0.18	7.94	10.60	2.80	0.73	0.40	NA	101.07
BB123	Qjh_3	0535	55.40	1.23	18.80	8.78	0.17	2.60	6.47	4.90	2.16	0.88	NA	101.40
BB124	Qjl_1	9501	48.50	2.85	17.70	13.00	0.19	4.60	8.14	4.20	1.33	0.69	NA	101.22
BB143	Qgb_2	8606	50.10	1.99	15.70	11.00	0.16	8.68	8.08	3.60	1.65	0.40	0.10	101.37
BB146	Qji2	9523	49.20	2.39	16.90	12.20	0.18	4.70	6.68	4.40	2.20	0.82	0.29	99.68
BB155	Qja_1	9527	45.60	2.77	16.30	13.31	0.20	7.56	10.20	3.40	1.04	0.65	<0.01	101.04
BB157	Qji_1	9522	45.80	2.55	16.20	12.80	0.19	8.02	10.30	3.00	1.16	0.57	0.26	100.60
BB160	Qjh_1	9528	47.80	2.52	17.50	12.20	0.19	6.14	9.48	3.40	1.29	0.51	<0.01	101.04
BB161	Qjd_2	9528	51.10	1.99	16.70	10.80	0.17	5.52	8.11	4.10	1.94	0.50	<0.01	100.94
BB162	Qjg_5	9529	48.70	2.30	16.70	11.50	0.17	6.62	8.93	3.70	1.48	0.50	<0.01	100.61
BB163	Qgd_1	0524	51.60	1.80	16.60	10.10	0.16	6.03	7.78	4.10	1.74	0.53	0.21	100.45
BB164	Qgb_1	0524	46.80	2.07	14.70	12.70	0.18	10.90	9.75	3.00	0.92	0.40	NA	101.44
BB165	Qjg_3	0528	48.10	1.99	15.90	11.60	0.17	8.54	8.74	3.70	1.50	0.59	0.16	100.84
BB167	Qjh_5	9502	53.60	1.82	18.40	10.20	0.16	2.90	5.33	5.30	2.71	0.82	NA	101.25
BB169	Qjc_3	9511	48.90	2.07	16.30	11.80	0.17	7.16	9.27	3.50	1.18	0.40	0.00	100.76
BB170	Qji_1	9510	46.10	2.53	16.50	12.70	0.19	7.83	10.10	3.40	1.12	0.58	NA	101.06
BB171	Qjg_4	9509	49.60	1.75	15.80	11.10	0.18	7.41	8.88	3.60	1.26	0.40	0.11	99.99
BB182	Qld_2	9436	53.50	1.73	16.50	8.56	0.16	4.85	7.87	3.93	2.27	0.56	0.01	99.95
BB185	Qlh_3	9424	43.30	2.36	16.10	13.62	0.23	7.34	11.00	2.83	0.96	1.36	0.44	99.11
BB186	Qjc_2	9517	49.40	1.88	16.90	11.51	0.17	6.11	8.55	3.68	1.29	0.51	<0.01	100.01
BB187	Qje	9518	45.70	2.27	15.60	12.80	0.18	8.89	11.10	2.84	0.90	0.34	<0.01	100.63
BB192	Qel	9506	51.20	1.91	17.80	11.40	0.21	3.27	6.98	4.42	1.76	1.18	<0.01	100.14
BB198	Qjh_4	9508	49.30	1.89	18.10	11.40	0.20	3.72	8.35	4.28	1.61	1.28	<0.01	100.14
BB199	Qjg_4	9504	44.60	2.17	14.20	12.20	0.17	12.60	9.56	2.30	1.11	0.50	0.91	99.42
BB201	Qje	0532	44.40	2.67	16.20	13.40	0.20	7.90	10.30	2.82	1.00	0.65	NA	99.55
BB246	Qec_6	0530	47.10	2.07	16.80	11.60	0.18	7.10	9.68	2.99	1.01	0.50	0.28	99.05
BB250	Qvc_5	0521	45.80	2.24	15.40	12.40	0.18	9.51	9.92	2.89	0.99	0.43	<0.01	99.78

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*—Continued

Sample number	Unit symbol	Location	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
[2]BK1	Qcl_2	0512	53.41	1.73	18.40	10.28*	0.16	2.58	6.18	4.76	1.82	0.76	1.43	100.08
[2]BK3	Qcl_2	0512	54.71	1.57	17.87	*9.62	0.16	2.64	5.78	4.91	2.05	0.70	0.91	100.01
[2]BM3	Que_1	9715	47.98	1.92	15.31	11.65*	0.17	8.24	9.30	3.32	1.06	0.47	0.80	99.54
[2]C1	Qag	0824	47.62	1.84	15.70	12.78*	0.18	8.26	10.37	3.03	0.66	0.27	0.78	100.38
C258	Qok	1605	50.90	1.88	17.80	10.40	0.20	3.65	7.18	4.23	1.89	0.83	<0.01	98.97
C265	Tof	1602	49.90	1.60	14.80	12.50	0.16	7.89	8.82	2.66	0.67	0.20	<0.01	99.21
C266	Qog	1602	44.60	2.60	15.40	12.80	0.18	8.60	10.30	2.73	1.04	0.59	0.47	98.86
C268	Qoa_2	2621	47.80	2.05	15.10	11.80	0.17	9.80	8.35	3.10	1.28	0.46	<0.01	99.93
C269	Qoh	2615	47.50	2.27	16.50	11.80	0.16	6.67	8.90	3.12	1.34	0.52	0.37	98.79
C270	Tof	2623	51.00	1.69	14.70	11.90	0.16	7.49	8.84	2.73	0.80	0.25	NA	99.58
[2]CH1	Qcd_7	1635	48.57	2.16	16.60	11.24	0.17	6.13	8.49	4.33	1.80	0.70	0.62	99.97
[2]CH7	Qcg_3	1625	49.12	1.56	14.80	12.33*	0.17	8.96	9.16	3.15	0.67	0.20	0.99	100.35
CH100	Qce_2	0622	47.80	2.21	16.70	11.20	0.17	5.81	9.07	3.20	1.62	0.70	NA	98.49
CH108	Qck_1	0616	51.10	1.89	18.10	11.00	0.23	2.30	7.44	4.90	1.79	1.30	0.59	100.06
CH175	Qde_2	0613	47.10	2.69	17.20	12.51	0.18	6.78	9.80	3.50	1.37	0.58	<0.01	101.71
CH177	Qde_2	0613	46.70	2.74	17.20	12.60	0.18	6.62	9.54	3.70	1.33	0.58	NA	101.20
CH178	Qdc_3	0718	46.90	2.62	16.80	12.30	0.18	6.89	10.10	3.60	1.28	0.55	NA	101.23
CH206	Qdd_1	0708	46.00	2.68	17.10	12.60	0.19	6.47	9.55	3.42	1.26	0.57	NA	99.85
CH208	Qcd_8	0706	49.10	1.87	15.60	11.90	0.17	8.83	8.90	3.21	1.09	0.39	NA	101.08
CH209	Qdc_5	0707	46.30	2.57	17.10	12.40	0.19	6.17	9.30	3.43	1.42	0.67	<0.01	99.57
CH210	Qcc_9	0601	48.10	1.80	15.70	11.80	0.17	9.01	9.05	3.14	1.08	0.39	<0.01	100.26
CH211	Qcd_7	1732	48.50	1.92	15.10	11.50	0.16	8.87	8.93	3.08	1.20	0.37	<0.01	99.64
CH212	Qdc_3	1732	48.50	1.74	16.10	12.00	0.18	7.20	10.60	2.78	0.86	0.32	<0.01	100.29
CH213	Qce_2	0614	48.30	2.18	16.70	11.30	0.19	6.43	9.36	3.57	1.55	0.66	<0.01	100.26
CH214	Qca	0611	45.70	2.31	15.60	11.90	0.18	8.97	10.30	3.10	1.40	0.55	<0.01	100.02
CH215	Qck_2	1634	54.40	1.44	18.30	8.84	0.16	2.34	4.88	5.22	2.89	0.72	<0.01	99.21
CH216	Qcd_2	0635	44.80	3.01	13.90	13.30	0.18	9.39	9.47	2.95	1.40	0.58	0.82	99.00
CH217	Qcd_7	1635	48.30	2.21	17.10	11.10	0.17	6.12	8.77	3.84	1.76	0.70	NA	100.08
CH218	Qck_2	1634	53.30	1.69	18.00	9.22	0.16	2.54	5.31	4.95	2.83	0.70	NA	98.72
CH219	Qcd_7	1731	49.80	1.85	17.10	10.20	0.17	5.54	8.11	3.87	1.92	0.71	<0.01	99.28
CH220	Qcg_1	1625	45.10	2.42	15.10	12.90	0.18	9.82	9.42	3.21	1.32	0.62	<0.01	100.11
CH222	Qcb_1	1633	46.50	1.98	14.70	11.60	0.17	11.50	9.11	3.15	1.26	0.45	<0.01	100.43
CH224	Qce_1	1632	48.10	2.23	17.10	11.30	0.17	6.39	8.82	3.71	1.59	0.54	<0.01	99.97
CH225	Qck_2	1627	54.90	1.45	18.20	8.90	0.16	2.29	4.81	5.21	2.91	0.73	NA	99.57
CH228	Qch_2	0605	52.10	1.57	17.90	10.00	0.23	2.28	6.38	4.97	1.91	1.16	0.45	98.51
CH229	Qck_1	0607	49.70	2.09	17.20	11.00	0.20	4.98	8.18	4.03	1.90	0.74	NA	100.04
CH230	Qck_1	0609	49.30	2.14	17.10	11.20	0.19	5.22	8.37	3.89	1.83	0.73	NA	99.99
CH231	Qcc_3	1624	45.90	2.54	16.90	12.50	0.20	6.41	9.79	3.61	1.34	0.70	0.01	99.90
CH232	Qcc_5	1719	51.50	1.74	15.00	11.90	0.16	7.40	8.91	2.84	0.83	0.23	0.11	100.52
CH233	Qcc_7	1613	49.40	1.97	16.90	10.70	0.16	6.07	8.51	3.60	1.49	0.63	0.29	99.44
CH234	Qcg_2	1613	51.00	1.61	15.80	9.18	0.15	7.04	8.37	3.53	2.00	0.54	0.20	99.24
CH236	Qch_3	0617	49.10	1.61	17.50	11.00	0.17	5.88	9.08	3.57	1.25	0.61	<0.01	99.78
CH238	Qce_1	1628	47.80	2.22	16.60	11.20	0.17	6.96	9.20	3.40	1.59	0.56	NA	99.72
CH243	Qod_4	1707	49.50	1.91	16.60	10.60	0.16	6.34	8.26	3.59	1.59	0.60	NA	99.17
CH244	Qod_4	1612	49.30	1.77	15.40	10.80	0.16	8.08	9.08	3.04	1.24	0.40	0.16	99.29
CH257	Qce_1	1608	48.70	2.66	17.20	11.20	0.17	5.25	8.25	3.77	1.73	0.63	NA	99.57
CH263	Qcd_4	1616	47.10	2.33	15.50	12.20	0.17	8.24	8.47	3.34	1.61	0.59	0.02	99.57
CH264	Qcd_9	1609	47.00	2.19	16.00	11.80	0.18	8.00	8.87	3.42	1.65	0.61	<0.01	99.73
CL260	Qvc_4	1501	49.30	1.63	16.40	10.30	0.15	6.83	9.31	3.08	1.16	0.43	0.49	98.61
[2]CP1–2	Qdd_2	0625	46.49	2.40	16.17	12.19	0.18	7.10	9.95	3.38	1.24	0.48	NA	99.58
[2]CP2	Tac_3	8813	45.44	2.39	15.51	12.20*	0.17	8.13	10.34	3.47	1.28	0.48	1.09	99.65
[2]CX2	Qkb_1	0827	45.45	1.90	14.28	11.47	0.16	11.07	9.76	2.82	1.29	0.45	NA	98.65
E34	Qag	8803	47.10	1.80	15.00	12.70	0.18	10.50	10.00	2.90	0.83	0.30	0.09	101.33
E76	Tac_1	8905	44.20	2.24	15.10	12.40	0.18	9.11	12.40	2.63	1.03	0.39	NA	99.70
E77	Qag	8802	46.30	1.79	14.80	12.70	0.18	10.30	10.00	2.64	0.81	0.35	<0.01	99.88
E78	Tac_1	8811	44.40	2.44	15.70	12.70	0.18	8.23	11.80	2.74	1.07	0.43	<0.01	99.70
E79	Tag	8906	47.50	1.80	15.80	12.50	0.18	7.44	10.80	2.61	0.70	0.32	0.18	99.67
[1]FM1–2	Qcb_3	1622	49.16	1.67	14.72	10.65	0.16	10.46	8.86	3.12	1.14	0.45	0.06	100.73
[2]FP2	Qkc_2	8715	46.54	2.23	15.32	12.35*	0.17	8.56	9.48	3.19	1.09	0.42	0.88	99.28
G35	Qpe	8716	46.60	3.10	15.90	13.00	0.18	6.30	9.37	3.60	1.39	1.10	0.12	100.55
G36	Qpc_8	8716	48.10	2.25	15.90	12.20	0.17	8.47	8.78	3.40	1.29	0.51	0.20	101.09
G37	Qpd_3	8714	47.40	2.41	16.80	12.00	0.17	6.06	10.50	3.00	1.06	0.50	0.80	99.92
G38	Tad_4	8713	48.50	2.00	16.30	11.90	0.18	6.89	8.23	3.30	1.61	0.54	0.58	99.47

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*—Continued

Sample number	Unit symbol	Location	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
G39	Qpc_8	8714	47.50	2.34	16.00	12.40	0.17	8.34	9.48	3.30	1.15	0.55	NA	101.24
G40	Tad_2	8807	46.30	2.52	16.30	12.60	0.17	7.58	10.60	3.30	1.28	0.50	0.05	101.16
G41	QTac	8809	45.70	2.87	16.80	14.20	0.20	6.77	9.55	3.60	1.03	0.72	<0.01	101.46
G42	QTac	8805	46.40	2.45	15.80	13.20	0.19	8.02	9.26	3.40	1.12	0.58	<0.01	100.44
G43	Tag	8805	47.70	2.08	16.20	12.80	0.18	7.35	11.00	2.90	0.69	0.30	NA	101.22
G45	Qkc_4	8701	48.10	2.06	16.60	11.90	0.17	7.39	9.34	3.70	1.24	0.50	NA	101.01
G46	Qac	8807	44.90	2.41	15.80	12.60	0.17	8.50	12.30	3.00	1.08	0.40	<0.01	101.18
G47	Qah_1	8711	50.10	2.15	17.40	11.30	0.18	5.43	7.67	4.20	1.93	0.68	NA	101.06
G48	Qkc_2	8710	48.70	2.14	15.70	11.90	0.17	9.01	8.63	3.30	1.36	0.50	<0.01	101.42
G49	Qph_6	8733	46.60	2.83	16.50	13.30	0.22	5.60	9.51	3.60	1.42	0.91	<0.01	100.50
G50	Qpc_8	8722	48.50	1.82	15.90	11.80	0.18	8.38	10.30	3.00	0.99	0.40	NA	101.28
G58	Tad_4	8314	47.80	2.13	16.10	12.30	0.19	7.89	9.01	3.37	1.33	0.53	NA	100.66
G59	Tab	8711	47.40	2.23	16.20	12.20	0.17	7.39	10.40	2.99	1.00	0.39	NA	100.39
G60	Tag	8711	47.50	2.44	17.20	12.20	0.17	5.74	10.40	3.03	1.04	0.47	0.30	100.20
G80	Qac	8810	45.70	2.49	15.90	12.60	0.18	7.64	10.60	3.05	1.22	0.50	NA	99.89
[2]GP1	Qgh_3	8611	47.92	2.11	16.81	13.73*	0.17	5.87	8.74	3.76	1.46	0.71	0.73	101.29
GP118	Qgg_4	8601	47.70	2.17	15.10	12.00	0.17	10.30	8.87	3.00	1.43	0.66	NA	101.42
GP121	Qgg_4	8708	45.50	2.21	15.40	12.40	0.16	9.38	8.74	3.10	1.16	0.50	0.10	98.57
GP125	Qgl_2	8718	52.70	1.51	18.40	9.80	0.21	2.50	7.73	4.10	1.80	0.87	0.60	99.63
GP126	Qpc_1	8719	48.70	1.71	16.20	11.20	0.17	7.87	9.97	3.10	1.05	0.40	0.01	100.39
GP127	Qpc_5	8720	48.20	2.17	16.00	12.30	0.18	8.00	9.00	3.40	1.30	0.51	0.01	101.08
GP128	Qpc_2	8625	48.20	1.83	15.20	12.20	0.18	9.55	10.60	2.70	0.79	0.40	<0.01	101.66
GP129	Qgh_3	8717	52.60	1.68	17.80	9.83	0.16	3.70	6.30	4.40	2.37	0.67	0.29	99.52
GP130	Qph_2	8730	46.90	2.50	17.80	13.61	0.22	4.70	9.94	3.50	1.14	0.86	0.49	101.19
GP131	Qph_2	8729	45.70	2.64	16.70	13.70	0.21	7.02	9.77	3.60	1.07	0.71	<0.01	101.13
GP132	Qpd_4	8728	47.30	2.29	16.30	13.00	0.20	7.95	9.18	3.50	1.22	0.80	<0.01	101.76
GP133	Qpg_2	8624	49.50	2.07	16.80	11.90	0.16	6.35	10.20	3.30	0.90	0.30	0.35	101.49
GP135	Qgh_4	8623	52.40	1.73	18.60	10.20	0.16	2.90	6.33	5.10	2.25	1.00	0.12	100.69
GP137	Qgh_6	8615	48.00	2.28	16.20	11.60	0.17	7.43	10.50	3.20	1.36	0.40	0.02	101.16
GP138	Qgh_4	8623	52.60	1.58	18.90	9.86	0.16	2.40	5.47	4.90	2.31	1.00	0.96	99.20
GP139	Qge_3	8613	47.90	2.14	15.30	11.41	0.17	9.68	9.09	3.30	1.59	0.58	0.11	101.17
GP140	Qge_3	8614	50.80	2.04	16.30	10.50	0.16	6.86	9.41	3.50	1.71	0.50	<0.01	101.79
GP145	Qjh_2	9526	54.20	1.35	18.70	9.03	0.17	2.90	6.54	4.80	2.13	0.87	<0.01	100.70
GP147	Qge_2	8602	47.40	2.62	17.50	12.30	0.18	4.30	9.89	3.50	1.36	0.51	0.91	99.57
GP148	Qgd_4	8610	47.00	2.67	15.70	12.60	0.18	7.65	9.00	2.90	1.57	0.65	0.69	99.94
GP149	Qpc_8	8732	48.30	1.80	15.90	11.70	0.17	8.60	10.50	3.00	0.92	0.40	NA	101.31
GP150	Qph_3	7706	45.90	2.91	16.80	13.80	0.20	6.31	9.30	3.80	1.41	0.85	<0.01	101.30
GP151	Qpc_7	7705	46.00	2.24	15.30	11.80	0.17	10.40	9.24	3.30	1.61	0.62	0.01	100.70
GP153	Qpg_1	7708	46.00	3.00	16.60	13.00	0.17	6.11	9.99	3.30	1.14	0.72	0.30	100.04
GP154	Qpj	8625	51.90	1.94	16.90	10.10	0.16	5.00	7.76	4.20	2.31	0.63	0.09	100.92
GP158	Qph_4	7601	54.10	1.41	18.60	9.69	0.16	1.90	4.86	5.40	2.77	0.97	0.62	99.87
GP237	Qpk	8733	57.70	0.97	18.60	6.82	0.19	1.23	4.78	5.08	2.59	0.68	NA	98.66
HC144	Qgc_4	8607	46.30	2.28	16.40	12.87	0.19	7.81	10.30	3.40	1.03	0.52	NA	101.12
[1]JC11	Qca	0611	44.16	2.41	14.80	11.88	0.17	10.14	11.06	2.54	1.03	0.34	0.44	98.98
[1]JC734	Tac_1	8905	44.69	2.24	15.25	12.70	0.18	9.20	12.34	2.83	0.98	0.39	–0.10	100.71
[1]JCAP3	Tad_4	8714	48.25	2.22	16.21	12.52	0.17	7.49	10.12	3.24	1.03	0.42	–0.19	101.51
[1]JCMM3	QTac	8805	45.43	2.07	14.40	11.95	0.19	9.26	9.81	2.86	0.95	0.44	0.77	98.14
L4	Qae_2	0812	55.52	1.28	16.04	8.44	0.16	5.98	7.22	4.47	2.10	0.35	NA	101.58
[2]LC1	Qkc_6	0833	47.06	2.09	15.90	11.96	0.17	8.96	9.50	3.46	1.30	0.52	0.22	100.07
[2]LH3	Qdh_2	0735	46.46	2.33	15.90	12.79	0.18	7.76	9.88	3.27	1.01	0.50	0.91	100.04
LL81	Qkd_1	0810	45.00	2.40	15.90	12.80	0.18	8.17	11.30	2.83	0.91	0.39	<0.01	99.89
LLS61	Qde_3	0715	46.50	1.64	14.10	11.90	0.18	12.00	10.00	2.73	0.88	0.36	0.04	100.31
LLS62	Qdh_1	0704	44.70	3.54	15.40	14.01	0.17	5.49	8.76	3.73	1.93	0.80	1.51	98.54
LLS63	Qdh_1	0704	47.30	2.27	14.20	12.50	0.17	9.15	10.00	3.03	1.15	0.46	0.08	100.24
LLS64	Qdc_3	0704	48.90	1.74	15.90	11.90	0.18	7.24	10.70	2.82	0.84	0.32	<0.01	100.55
LLS65	Qrd_2	0714	46.30	2.27	14.60	13.50	0.18	9.47	10.10	2.52	0.70	0.30	0.21	99.96
LLS67	Qdj_1	0715	46.70	1.66	14.20	12.00	0.18	11.90	9.86	2.66	0.90	0.37	NA	100.45
LLS68	Qdc_7	0715	45.40	2.47	16.60	13.20	0.18	7.91	10.50	3.05	0.81	0.39	NA	100.52
LLS69	Qde_3	0715	45.40	2.46	16.60	13.20	0.18	7.75	10.50	3.08	0.82	0.39	<0.01	100.40
LLS70	Qdc_7	0715	46.80	1.66	14.10	11.90	0.18	11.70	9.79	2.73	0.90	0.36	<0.01	100.13
LLS71	Qdj_1	0715	47.80	1.73	15.00	11.90	0.18	8.80	11.10	2.73	0.89	0.36	NA	100.50
LLS72	Qdj_1	0715	48.70	1.69	15.20	11.60	0.17	8.25	10.60	2.79	0.92	0.34	0.08	100.27
LLS82	Qrc	0813	46.70	2.51	15.80	11.70	0.17	8.43	8.90	3.32	1.61	0.56	<0.01	99.72

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*—Continued

Sample number	Unit symbol	Loca-tion	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
LLS83	Qrd$_1$	0809	44.90	2.62	15.40	12.00	0.17	8.90	10.30	3.07	1.43	0.54	NA	99.34
LLS84	Qrd$_1$	0805	45.50	2.62	15.80	11.90	0.17	8.24	9.86	2.96	1.49	0.56	0.49	99.11
LLS85	Trc$_2$	1818	46.10	1.66	14.90	12.50	0.17	8.68	10.30	2.54	0.83	0.30	NA	98.00
LLS86	Trc$_2$	1710	47.30	1.71	15.00	12.90	0.19	9.04	9.73	2.56	0.85	0.30	NA	99.59
LLS87	Trc$_2$	1723	47.10	1.70	15.10	12.70	0.18	8.43	10.10	2.55	0.83	0.30	0.55	99.00
LLS88	Qdc$_3$	1726	47.00	1.91	15.40	11.50	0.17	8.48	10.50	2.97	1.16	0.50	<0.01	99.60
LLS89	Qcd$_7$	1728	47.30	1.84	15.30	10.69	0.16	6.99	10.70	3.03	1.33	0.50	1.21	97.85
LLS90	Qdb	0711	46.00	1.62	13.90	11.90	0.18	12.00	9.95	2.61	0.89	0.36	<0.01	99.43
LLS91	Qod$_1$	1716	46.70	2.40	15.80	12.70	0.17	7.57	10.00	3.08	0.97	0.44	<0.01	99.84
LLS98	Qrd$_1$	1823	46.10	2.53	15.50	13.39	0.18	7.87	10.20	2.93	0.86	0.41	NA	99.99
LLS99	Qkc$_6$	0816	46.60	2.22	15.60	12.99	0.17	8.85	9.51	2.97	1.20	0.45	0.02	99.57
LS5	Qrd$_2$	0806	46.69	2.52	16.28	13.44	0.18	7.07	9.93	3.55	0.92	0.41	NA	101.00
[1]PD2	Qod$_4$	1612	49.41	1.95	16.71	10.75	0.16	6.20	8.26	3.92	1.58	0.65	0.11	99.70
[2]PD5	Qoa$_1$	2634	45.65	2.58	15.19	13.23*	0.19	9.13	9.79	3.48	1.11	0.54	0.58	100.39
[2]PK4	Qpc$_8$	8728	47.64	1.74	15.17	11.71*	0.17	8.73	9.87	2.79	0.97	0.41	1.17	99.54
R11	Qga	9601	48.41	1.60	16.53	11.11	0.18	8.73	10.01	3.31	0.99	0.37	NA	101.25
R15	Qwg$_2$	1424	49.55	1.71	17.16	11.35	0.18	6.04	10.54	3.21	0.83	0.26	NA	100.85
R17	Qgb$_1$	9621	46.20	1.94	15.89	11.82	0.17	9.61	9.92	3.30	1.06	0.59	NA	100.53
R21	Qgb$_1$	0632	47.17	1.89	15.28	11.95	0.20	10.99	9.32	3.34	1.15	0.59	NA	101.89
R28	Qdh$_4$	0730	50.43	1.70	18.86	10.27	0.20	3.05	8.23	4.23	1.44	0.90	NA	99.32
R29	Qcd$_7$	1730	50.74	1.83	16.79	10.20	0.17	6.41	8.65	4.03	1.93	0.58	NA	101.35
R32	Qca	0602	50.82	1.86	16.18	10.88	0.16	7.36	8.44	3.84	1.34	0.37	NA	101.27
R34	Qgh$_7$	9628	50.23	1.92	18.17	10.30	0.15	4.23	7.46	4.08	1.80	0.74	NA	99.09
[2]RT4	Qcd$_8$	0610	49.11	1.75	15.12	10.61*	0.17	8.88	8.13	3.31	1.20	0.37	0.96	99.93
[2]RT5	Qcc$_9$	0615	50.59	1.77	15.67	10.93	0.16	7.53	8.10	4.00	1.48	0.39	0.83	100.82
S6	Qkc$_6$	0827	47.74	2.08	16.74	11.56	0.19	8.80	8.87	3.52	1.29	0.41	NA	101.22
[1]S14–7	Qek	8705	53.52	1.23	19.01	8.86	0.21	2.16	5.96	4.92	2.17	0.89	0.95	98.94
[1]S15–7	Qlc$_6$	9423	46.03	2.49	16.39	12.57	0.17	6.98	9.39	3.61	1.33	0.66	–0.02	99.60
[1]S21–7	Qdh$_4$	0729	49.64	1.70	18.30	10.82	0.19	3.24	8.39	4.25	1.49	1.21	–0.02	99.21
[1]S26–7	Qjh$_3$	9511	53.91	1.70	18.50	9.87	0.16	2.84	5.22	5.36	2.66	0.79	–0.43	101.01
[1]S29–7	Qok	9629	52.16	1.76	17.85	10.15	0.20	3.59	7.24	5.03	1.96	0.62	–0.17	100.56
[1]S30–7	Qsc$_5$	9306	48.06	1.48	15.61	10.02	0.15	9.00	11.30	2.89	0.96	0.49	–0.27	99.69
[1]S34–7	Qwb$_3$	0301	48.86	1.92	16.35	11.78	0.18	8.19	8.25	3.92	1.58	0.66	–0.43	101.26
[1]S35–7	Twj	2409	52.88	2.37	14.82	12.25	0.17	3.65	7.18	4.06	2.39	0.80	NA	100.58
[1]S36–7	Twj	2415	47.47	2.54	14.44	12.17	0.15	7.89	9.00	3.74	1.67	0.80	NA	99.88
[1]S38–7	Qae$_2$	0918	53.49	1.32	15.46	8.59	0.14	5.99	7.52	4.08	1.98	0.63	0.00	99.20
[1]S39–7	Qae$_2$	0919	52.11	1.42	14.92	9.06	0.14	6.80	8.03	3.83	1.88	0.72	0.04	98.92
[1]S40–7	Qae$_2$	0919	54.93	1.29	15.32	8.44	0.14	6.13	7.21	4.11	2.11	0.57	0.10	100.25
[1]S41–7	Qae$_1$	0919	53.19	1.26	15.01	8.56	0.14	6.46	8.02	3.98	1.88	0.46	0.15	98.97
S92	Qad	9823	45.90	1.97	15.00	13.11	0.19	9.91	9.67	2.79	0.89	0.42	<0.01	99.86
S93	Tag	9823	46.80	2.06	15.10	12.80	0.18	8.69	10.80	2.67	0.72	0.35	<0.01	100.19
S94	Qag	9824	47.50	1.91	16.10	12.40	0.18	7.59	10.90	2.61	0.65	0.31	<0.01	100.17
S97	Qkd$_3$	9803	48.80	1.91	16.80	11.59	0.19	5.78	9.28	3.31	1.17	0.53	<0.01	99.37
[2]SF1–2	Qcc$_8$	1635	49.24	1.81	15.37	11.69*	0.17	8.47	8.45	3.53	1.30	0.42	0.75	100.26
[2]SF2–2	Qck$_2$	1634	53.81	1.72	17.74	9.69*	0.16	2.58	5.33	5.30	2.85	0.72	0.88	99.91
[1]SK3	Qvh$_1$	1525	47.26	2.16	16.71	12.91	0.18	7.17	9.02	3.43	1.13	0.50	–0.32	100.15
[2]SM2	Qdg	9716	47.33	2.27	16.05	12.43*	0.18	7.40	9.14	3.37	1.24	0.54	1.15	100.16
SN7	Qdb	9704	48.81	1.92	15.42	10.95	0.16	9.02	8.71	3.44	1.47	0.47	NA	100.39
SN8	Qkc$_4$	9804	49.33	1.69	15.84	11.33	0.16	8.65	8.17	3.87	1.23	0.43	NA	100.71
SN9	Quh$_3$	9808	50.97	2.11	17.60	11.31	0.19	4.06	7.06	4.91	1.41	0.49	NA	100.12
SN10	Quc$_3$	9807	46.10	1.80	14.70	12.10	0.17	10.50	9.89	2.60	0.99	0.40	<0.01	99.26
SN11	Quh$_4$	9701	52.80	1.91	16.30	9.11	0.14	3.90	6.88	3.90	2.71	0.69	0.58	98.36
SN12	Quj	9714	48.70	2.13	16.20	11.30	0.17	6.52	8.14	3.40	2.02	0.73	NA	99.32
SN13	Quh$_1$	9727	53.80	1.86	15.40	9.47	0.13	5.87	6.86	3.30	1.77	0.30	0.18	98.78
SN14	Quc$_4$	9715	45.50	2.34	15.50	12.00	0.17	8.99	10.60	2.70	1.11	0.50	<0.01	99.42
SN15	Quc$_2$	9722	46.30	1.83	15.00	12.10	0.17	10.10	9.95	2.70	0.97	0.40	0.11	99.54
SN16	Que$_1$	9710	47.80	1.96	15.60	12.10	0.17	8.11	9.42	2.90	1.13	0.50	0.14	99.71
SN17	Qud$_2$	9711	47.60	1.92	15.60	12.20	0.17	7.64	9.33	3.10	1.18	0.50	<0.01	99.25
SN18	Quj	9714	49.00	1.77	15.80	11.20	0.16	7.20	9.15	2.80	1.17	0.40	0.42	98.67
SN19	Qdg	9716	48.00	2.20	16.10	12.00	0.17	7.04	9.14	3.00	1.31	0.50	<0.01	99.48
SN20	Quh$_1$	9715	53.70	1.48	18.10	9.45	0.16	2.50	5.80	4.20	2.14	0.77	<0.01	98.32
SN21	Quh$_1$	9722	47.10	1.95	14.20	10.80	0.16	9.21	8.88	2.50	1.30	0.50	2.02	96.61
SN22	Qih$_1$	9721	50.40	1.74	17.30	12.40	0.21	3.00	5.47	4.40	2.44	1.30	0.18	98.68

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*—Continued

Sample number	Unit symbol	Loca-tion	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
SN22B	Qid$_2$	9726	45.80	2.46	15.90	13.00	0.18	8.22	10.70	2.40	0.80	0.40	0.21	99.87
SN23	Quc$_1$	9703	46.20	3.33	15.80	12.90	0.16	6.47	7.90	3.20	1.37	0.55	0.89	97.89
SN24	Quh$_4$	9702	54.80	1.21	18.00	9.45	0.19	1.80	4.86	4.80	2.50	0.89	<0.01	98.51
SN25	Que$_2$	9702	46.00	1.88	14.40	11.30	0.16	11.50	9.42	2.50	1.27	0.40	0.19	98.84
SN26	Qug	9701	46.50	2.18	15.20	11.70	0.16	9.53	9.72	2.90	1.40	0.50	<0.01	99.81
SN27	Quc$_5$	9806	48.60	1.89	15.90	10.90	0.16	8.16	8.56	3.10	1.46	0.50	0.09	99.24
SN28	Qkb$_2$	0832	46.10	2.15	14.80	12.30	0.17	10.60	9.99	2.50	0.94	0.40	<0.01	99.96
SN29	Qkc$_3$	0828	47.80	1.78	15.20	10.60	0.15	9.59	9.28	2.70	1.42	0.40	0.41	98.93
SN30	Qdh$_2$	0735	46.20	2.35	16.30	12.60	0.17	6.99	9.47	2.90	1.10	0.55	0.41	98.64
SN31	Qdd$_4$	0726	44.70	2.29	16.00	12.80	0.19	8.35	10.70	2.70	0.92	0.60	0.21	99.26
SN32	Qde$_3$	0727	46.30	2.30	15.80	11.10	0.16	8.02	9.43	2.90	1.71	0.64	0.36	98.37
SN33	Quj	9807	48.60	2.14	17.00	11.10	0.16	5.67	7.85	3.60	2.01	0.64	0.14	98.78
SN51	Qkc$_4$	9829	48.80	1.95	16.80	11.60	0.17	7.31	8.78	3.80	1.34	0.52	NA	101.08
SN52	Qkc$_4$	9736	49.00	1.96	16.90	11.60	0.16	7.11	8.85	3.70	1.36	0.53	NA	101.19
SN54	Qkc$_4$	9726	49.10	1.90	16.70	11.50	0.16	7.25	8.66	3.80	1.36	0.52	0.08	100.96
SN55	Qid$_2$	9726	46.00	2.43	15.90	12.90	0.17	8.47	10.60	2.80	0.82	0.40	0.26	100.51
SN56	QTac	9831	48.50	2.01	15.50	11.90	0.18	8.72	8.51	3.40	1.52	0.55	0.09	100.81
SN57	Qka$_2$	9821	49.20	2.14	16.80	11.50	0.17	5.99	8.74	3.70	1.64	0.58	0.35	100.47
SN73	Qih$_3$	9733	58.80	0.88	18.80	6.65	0.15	1.40	4.43	5.53	2.72	0.56	<0.01	99.94
SN74	Qdc$_6$	0724	47.00	2.54	16.30	11.80	0.17	8.30	8.94	3.65	1.65	0.58	<0.01	100.94
SN75	Qde$_3$	0723	45.50	2.40	16.30	12.50	0.19	6.76	9.45	3.53	1.46	0.83	NA	98.93
SN95	Qka$_2$	9809	48.90	2.09	16.40	11.30	0.17	6.19	8.60	3.75	1.59	0.55	NA	99.56
SN96	QTac	9833	47.20	2.04	15.80	12.30	0.17	7.39	10.80	2.76	0.81	0.36	NA	99.65
[1]SR188	Qsg$_1$	1101	47.55	1.84	16.33	12.20	0.17	6.55	9.72	3.20	0.81	0.32	0.07	98.74
[1]SS6–2	Quh$_3$	9818	50.12	2.17	18.35	11.58	0.18	9.91	7.19	4.76	1.40	0.68	0.16	100.49
[1]TH1	Qud$_3$	9711	45.74	2.46	16.89	13.31	0.18	7.90	10.46	3.26	0.81	0.37	0.55	100.84
[1]TP4	Qga	9602	47.33	1.72	15.98	11.57	0.17	9.33	9.96	2.97	0.96	0.40	1.53	101.04
[2]TP6	Qgl$_4$	9602	47.26	1.75	15.88	11.05*	0.17	9.02	9.96	3.24	0.94	0.41	0.80	99.87
[2]UP2	Qgh$_6$	8615	47.53	2.20	15.60	11.68*	0.17	7.57	10.05	3.19	1.43	0.42	1.14	99.99
V172R	Qcl$_2$	0512	53.00	1.69	18.30	9.85	0.16	2.90	6.13	4.80	1.97	0.74	0.16	99.55
V241	Qvh$_1$	1526	47.90	2.71	17.20	12.70	0.19	4.92	7.68	3.82	1.34	0.59	0.55	99.06
V248	Qjg$_1$	0520	47.40	2.08	16.30	12.50	0.18	6.06	10.50	2.89	0.77	0.38	0.41	99.07
V249	Qcc$_2$	0606	47.00	1.90	15.20	11.80	0.17	8.65	9.59	2.92	1.19	0.49	0.48	98.92
V251	Qcd$_1$	1535	46.10	2.44	15.90	12.50	0.18	7.89	9.71	3.02	1.22	0.54	<0.01	99.52
V252	Qvc$_4$	1527	47.60	1.67	16.00	11.70	0.17	8.18	10.50	2.65	0.84	0.36	<0.01	99.68
V253	Qvd$_5$	0504	48.60	1.91	15.10	11.70	0.17	8.13	9.11	2.94	1.28	0.40	0.06	99.35
V254	Qvh$_3$	1533	46.50	2.54	16.70	12.70	0.18	6.34	9.03	3.59	1.18	0.57	0.10	99.34
V255	Qwd$_1$	1531	43.40	3.40	14.10	12.80	0.18	8.17	9.98	3.37	0.67	0.78	2.41	96.86
WK23	Qgg$_3$	0627	49.50	1.95	15.50	10.10	0.15	8.25	8.52	3.00	1.97	0.50	0.41	99.45
WK27	Qgb$_1$	9604	45.90	1.97	14.60	12.20	0.18	11.20	9.62	2.60	1.05	0.61	NA	99.94
WK31	Qgk	9604	55.40	1.51	18.10	8.71	0.14	2.50	5.15	4.40	2.60	0.60	<0.01	99.12
WK33	Qgg$_3$	0633	48.70	2.00	15.40	10.40	0.16	8.65	8.77	3.40	1.48	0.54	NA	99.52
WK41	Qdd$_1$	0731	48.00	2.32	16.80	11.80	0.17	6.01	8.45	3.60	1.77	0.63	<0.01	99.56
WK42	Qdd$_2$	0624	47.00	2.48	16.40	12.10	0.18	7.07	10.10	2.80	1.23	0.51	NA	99.89
WK45	Qgg$_2$	9602	52.10	2.33	17.20	11.30	0.18	3.80	6.20	4.00	2.15	0.60	<0.01	99.87
WK47	Qgc$_1$	9611	47.40	1.94	15.40	12.20	0.18	8.73	10.70	2.60	0.91	0.40	<0.01	100.47
WK53	Qgl$_1$	9614	50.70	1.76	17.10	11.10	0.18	4.80	6.39	3.90	2.30	0.83	<0.01	99.07
WK57	Qgh$_2$	9609	54.10	1.41	18.10	9.47	0.19	2.80	6.34	4.10	1.97	0.73	0.01	99.22
WK58	Qgb$_1$	9609	45.50	1.97	14.00	12.50	0.18	12.40	9.38	2.50	0.96	0.56	NA	99.97
WK60	Qgh$_7$	9609	51.20	1.84	18.00	10.70	0.18	4.20	7.44	3.80	1.82	0.88	0.09	100.07
WK64	Qgc$_2$	9613	47.70	2.04	14.80	10.80	0.15	9.98	9.21	2.70	1.52	0.53	<0.01	99.44
WK68	Qdl	9706	53.30	1.79	17.60	9.96	0.17	2.70	5.14	4.60	2.79	0.90	<0.01	98.96
WK74	Qgj$_2$	9624	48.50	1.73	15.20	11.30	0.16	9.77	9.27	2.70	1.15	0.40	<0.01	100.20
WK75	Qdd$_5$	9718	48.20	1.93	15.20	11.00	0.16	9.73	9.31	2.80	1.34	0.50	<0.01	100.18
WK77	Qgg$_2$	0626	47.50	1.92	16.60	12.00	0.18	7.67	9.81	2.80	1.01	0.40	<0.01	99.90
WK79	Qpe	8721	54.20	1.25	18.70	8.77	0.21	1.90	6.05	4.60	2.00	0.90	<0.01	98.59
WK83	Qga	9612	47.40	1.91	16.30	11.30	0.17	9.10	9.84	2.60	1.00	0.40	<0.01	100.03
WK84	Qgd$_5$	9629	49.30	1.91	15.40	11.30	0.16	9.28	8.12	3.00	1.50	0.40	<0.01	100.38
WK85	Qgc$_5$	9633	51.40	1.84	17.80	10.90	0.20	3.70	7.57	3.60	1.84	0.79	0.54	99.65
WK89	Qic$_1$	9625	51.00	2.03	16.60	12.70	0.19	7.96	7.62	3.50	1.70	0.65	0.14	103.96
WK92	Qid$_1$	9729	47.80	2.25	17.70	12.00	0.17	5.62	9.29	2.90	1.18	0.65	0.19	99.57
WK93	Qic$_2$	9729	45.40	2.23	16.30	13.10	0.19	8.76	11.00	2.50	0.80	0.52	<0.01	100.81
WK95	Qcl$_1$	0628	51.80	2.10	17.70	10.70	0.18	3.40	7.08	3.90	1.71	0.75	<0.01	99.34

Table 2. *Representative major-element whole-rock analyses of volcanic rocks from the Springerville volcanic field*—Continued

Sample number	Unit symbol	Location	SiO_2	TiO_2	Al_2O_3	$FeTO_3$	MnO	MgO	CaO	Na_2O	K_2O	P_2O_5	LOI	Total
WK97	Qcc_6	0621	47.30	3.05	17.50	12.70	0.17	5.10	7.56	3.90	1.55	0.57	<0.01	99.41
WK103	Qgj_2	9604	47.60	1.98	14.70	11.10	0.16	10.30	9.28	2.70	1.43	0.53	0.05	99.79
WK104	Qdc_2	9705	48.40	1.97	15.00	10.40	0.16	9.48	8.91	3.00	1.63	0.50	<0.01	99.47
WK105	Qdh_4	0729	50.30	1.74	18.50	10.50	0.21	3.00	8.35	3.70	1.39	1.00	<0.01	98.70
WK166	Qie	9636	47.50	2.78	15.60	13.20	0.17	7.23	9.14	3.10	1.18	0.53	0.46	100.44

[1]Analysis by direct current argon-plasma spectrometry (DCP), Miami University, Oxford, Ohio (Cooper, 1991).
[2]Analysis by wavelength-dispersive X-ray fluorecence techniques, Miami University, Oxford, Ohio (Cooper, 1986);
* $FeTO_3$ recalculated from FeO and Fe_2O_3 by titration.

Table 3. *K-Ar ages for samples from the Springerville volcanic field and vicinity*

[For location of samples see index map of township and range boundaries (sheet 1). Source of age: 1, Cooper and others (1990); 2, R.J. Miller, oral commun., 1991; 3, Laughlin and others (1979); 4, Laughlin and others (1980); 5, Peirce and others (1979); 6, Condit and Shafiqullah (1985); 7, Aubele and others (1986). Leaders (—) indicate no information; do., ditto]

Sample number	Unit symbol	Location	K-Ar age (Ma)	Source of age	Comments
705MC	Qhe	8435	0.50±0.03	1	—
706GP	Qph_2	8730	1.27±0.07	1	Underlies unit Qpc8 (sample 712GP, 1.30±0.04 Ma); suggests age >1.26 Ma.
708WK	Qgh_7	8627	0.76±0.02	1	Normal magnetic polarity of flow (two sites) suggests age <0.73 Ma.
709WK	Qgb_1	9615	0.91±0.02	1	—
712GP	Qpc_8	8728	1.30±0.04	1	—
713SN	Qkc_4	9735	0.61±0.01	1	—
716SM	Qmb_6	9420	1.01±0.02	1	—
717MR	Qwg_3	2429	1.56±0.03	1	—
719V	Qvc_4	1514	1.00±0.02	1	Normal magnetic polarity of flow and age of sample UAKA 82-191 (1.30 ± 0.05 Ma) cannot be reconciled with this age.
801C	Tof	2623	6.52±0.12	1	Aliquot of sample below.
801C	Tof	2623	6.66±0.12	1	Aliquot of sample above.
2316-2	Twj	2409	7.6±0.4	2	Sample collected by Clay Conway and analyzed by R.J. Miller, both U.S. Geological Survey.
AWL-40-74	(Trg)	—	2.94±0.14	3	Sample site 6.8 km east of Springerville along U.S. 60, outside map area.
AWL-41-74	(Qrg)	—	0.82±0.04	3	—do.—
AWL-42-74	Tac_1	8906	3.06±0.08	3	—
AWL4-77	Qdh_4	0729	0.84±0.07	4	Normal polarity suggests age > 0.90 Ma.
AWL5-77	Qag	0826	1.67±0.09	4	—
AWL6-77	Qkc_6	0823	0.75±0.13	4	Normal polarity; overlies Qkc_4 (sample 713SN, 0.61±.01 Ma), suggesting age of 0.62 Ma, at young limit of one-sigma error on age of this sample.
UAKA 73-80	QTsf	—	1.62±0.08	5	Sample from flow tongue near Carrizo, 37 km southwest of Show Low, outside map area.
UAKA 73-137	QTsf	—	1.63±0.08	5	—do.—
UAKA 74-136	QTsf	—	1.90±0.06	5	—do.—
UAKA 75-52a	QTsf	—	1.76±0.15	5	—do.—
UAKA 80-131	Qsc_5	9212	1.53±0.21	6	—
UAKA 80-132	Qsg_2	9308	1.74±0.15	6	Stratigraphic and paleomagnetic constraints suggest age of 1.60 Ma.
UAKA 80-133	QTsf	8321	1.78±0.22	6	—
UAKA 80-134	Tbc_3	8318	1.83±0.21	6	—
UAKA 80-135	Tbl	8329	8.66±0.19	6	Probable source was Mount Baldy shield complex 20 km southeast of sample site (Condit, 1984.)
UAKA 80-136	Tbc_1	8332	8.97±0.19	6	Oldest dated volcanic unit in Springerville field; probable source was Mount Baldy shield complex 20 km southeast of sample site (Condit, 1984.)
UAKA 82-95	Tnc	7406	2.05±0.10	6	—
UAKA 82-96	Qnd	7301	1.47±0.06	6	—
UAKA 82-183	Qbb_2	9334	1.65±0.09	6	Normal polarity suggests age >1.67 Ma.
UAKA 82-184	Qme	9313	0.49±0.03	6	—
UAKA 82-185	QTsf	1207	2.00±0.11	6	—
UAKA 82-190	Qek	9507	1.56±0.05	7	—
UAKA 82-191	Qvc_4	1511	1.30±0.05	7	Normal magnetic polarity from co-located site and age of sample 719V (1.00 ±0.02 Ma) cannot be reconciled with this age.
UAKA 82-192	Qcb_1	0605	1.19±0.04	7	—
UAKA 82-193	Qde_3	0727	1.05±0.04	7	—
UAKA 82-194	Trc_2	1808	1.98±0.6	7	—
UAKA 82-195	Qkb_2	0832	0.31±0.07	7	—
UAKA 82-196	Quh_4	0735	1.04±0.05	7	—
UAKA 82-197	Qgj_2	8627	0.67±0.02	7	—

Table 4. *Paleomagnetic data from the Springerville volcanic field, by site*

[For location of samples, see index map of township and range boundaries (sheet 1); location numbers are followed by + where site is in given unit south of mapped area (see Condit, 1984, 1991 for these locations). Polarity is magnetic polarity: NM, normal; R, reversed; T, transitional. Two-part number indicates number of samples used in calculations/number collected; three-part number indicates number of samples from direct observation/ number from remagnetization circles/ number collected. Demag I, magnetic inclination after demagnetization; Demag D, magnetic declination after demagnetization. α-95, circle of confidence around mean direction at 95 percent level. k, precision parameter of Fisher (1953). Where Demag I data (both direct observations and remagnetization circles) were mixed, α-95 and k calculated using equations of McFadden and McElhinny (1988). *, data determined from remagnetization circles; Fisher statistics not calculated]

Site	Map symbol	Location	Polarity	Number	Demag I (degrees)	Demag D (degrees)	α-95 (degrees)	k
1	Qsc_5	0222	NM	6/7	61.9	339.8	7.6	79
2	Qsa_1	0330	NM	5/7	41.0	357.0	*	*
3	Qsc_5	0221	NM	2/3/7	57.0	323.5	11.0	63
4	QTsf	0221	R	6/8	–42.7	202.4	8.3	66
5	QTsf	0221	R	3/1/6	–59.6	157.6	12.6	61
6	Qbc_2	9223	NM	6/1/7	38.5	18.3	8.9	48
7	QTsf	9214	R	4/1/7	–38.7	188.1	4.6	295
8	Qsb_1	9213	NM	7/7	14.6	72.1	13.3	22
9	Qbg	9213	NM	7/7	59.4	348.8	7.9	59
10	Qsc_5	9312	NM	6/6	56.5	332.3	9.2	54
11	Qsb_1	9318	NM	7/7	79.7	42.4	3.1	377
12	Qbg	9318	NM	8/8	64.0	19.8	9.5	35
13	Qsd	9317	R	3/4/7	–49.8	161.7	11.7	39
15	Qbc_2	9332	NM	6/6	42.3	12.5	4.8	195
16	QTsf	9332	R	6/7	–37.2	179.7	5.8	134
17	Qbd_2	9332	NM	6/6	78.3	343.2	6.5	107
18	QTsf	9334	R	5/6	–33.0	184.4	7.7	100
19	QTsf	8304	R	4/2/6	–43.6	165.4	10.4	46
20	Qbd_2	9333	NM	7/7	65.2	356.5	4.1	216
21	Qbc_3	9326	NM	4/1/5	75.1	336.3	9.4	71
22	QTsf	9336	R	7/7	–38.0	179.5	9.0	46
23	Tbc_2	9335	R	6/1/7	–33.8	191.8	3.8	255
24	Qbc_2	8303	NM	4/1/6	31.5	22.7	10.3	59
25	Qbc_2	8304	NM	3/2/6	36.4	17.2	9.0	85
26	QTsf	8305	R	6/6	–32.4	181.6	12.2	31
27	QTsf	8304	R	1/4/5	–39.7	181.4	13.0	55
29	Qbc_2	8305	NM	6/7	47.4	349.4	10.7	40
30	Qbc_2	8309	NM	3/1/7	32.6	10.5	19.0	27
31	Qbc_2	8315	NM	4/2/6	49.4	342.2	7.8	82
32	Qbc_1	8321	R	7/7	–46.2	182.4	2.8	466
33	QTsf	8321	R	4/3/7	–31.7	186.4	10.4	38
34	QTsf	8321	R	4/2/7	–44.9	169.5	10.8	43
35	Qbb_1	8321	R	3/3/6	–54.9	172.2	7.0	105
36	Tbc_3	8320	NM	6/6	61.8	355.9	5.5	151
37	Tbc_3	8318	NM	6/6	56.8	356.6	3.0	514
39	Tbc_1	8332	NM	5/6	61.8	340.2	8.3	87
40	Qnc	7303	R	6/6	–47.7	203.3	7.4	83
41	Qnc	7323+	R	5/6	–41.6	175.9	10.7	52
43	Tnf_2	7323+	NM	7/7	40.7	351.2	2.2	766
44	Tnb_2	7323+	NM	5/6	31.7	359.9	7.7	100
45	Tng	7323+	NM	6/6	42.2	348.6	1.2	3000
46	Tng	7323+	NM	5/6	44.1	350.7	5.6	185
47	Tnf_1	7314+	NM	7/7	40.7	346.4	5.3	129
48	Tnf_1	7324+	NM	6/6	40.5	350.3	7.2	88
49	Tnf_2	7323+	NM	6/6	45.0	356.8	8.3	66
51	Tnb_1	7335	NM	6/6	40.4	353.2	11.3	36
52	Qbd_2	9225	NM	5/6	77.6	340.7	5.8	173
53	Tnb_1	7312	NM	6/6	42.7	7.1	6.8	99
54	Tnb_1	7312	NM	6/6	42.9	1.4	3.2	452
55	Tnc	7312	NM	6/6	38.3	14.8	6.7	101
56	Qng	7312	NM	7/7	41.1	355.8	3.7	263
57	Tnc	7312	NM	6/6	43.3	25.0	18.0	15
58	Qnd	7301	NM	6/6	32.8	34.7	7.2	88
59	QTnb	7301	NM	4/7	43.9	44.6	8.5	118
60	QTnb	8431	NM	6/6	61.6	340.9	5.4	154

Table 4. *Paleomagnetic data from the Springerville volcanic field, by site*—Continued

Site	Map symbol	Location	Polarity	Number	Demag I (degrees)	Demag D (degrees)	α-95 (degrees)	k
64	Qng	7302	NM	6/6	31.1	345.1	6.3	114
65	Qnd	8428	NM	4/6	29.7	42.0	12.7	54
66	Qng	7303	NM	7/7	43.2	347.8	5.8	108
67	Qbd$_2$	8224	NM	7/7	18.6	323.2	8.2	55
68	Tnc	8431	NM	8/8	45.4	329.1	6.2	81
69	QTnf	7406	NM	5/6	44.4	353.9	3.0	655
70	QTnf	7406	NM	6/6	31.4	345.9	4.3	239
71	Tnc	7301	NM	7/7	57.0	329.1	6.1	99
72	Qnd	8431	NM	6/6	50.0	25.6	6.2	116
73	Qnd	8431	NM	5/6	41.7	34.4	9.6	64
74	Qmg	9302	R	5/7	–38.5	183.7	*	*
75	Qmc$_4$	9303	R	6/7	–43.4	184.2	12.6	29
76	Qmb$_6$	0335	R	3/6	–22.0	142.3	29.1	19
77	Qmg	0335	R	6/6	–15.6	252.8	5.7	140
78	Qmg	0326	R	5/6	–39.7	170.2	12.8	37
79	Qmb$_4$	0317	R	4/1/6	–54.1	172.3	9.3	73
80	QTsf	0318	R	2/4/6	–55.8	149.4	8.6	77
81	Qmb$_4$	1330	R	3/6	–39.8	279.6	41.6	10
82	Qmb$_4$	0311	R	5/6	–20.8	173.5	20.6	15
83	Qeg	0301	NM	3/3/6	39.0	354.0	11.7	39
84	Qmg	9310	R	5/7	–54.8	166.7	8.2	84
85	Qmc$_4$	9215	R	5/7	–27.8	167.4	9.7	64
86	Qmb$_5$	9315	R	4/2/7	–50.5	171.1	10.3	46
87	Qlh$_2$	9322	R	4/1/7	–60.2	111.9	24.9	11
88	Qmb$_5$	9214	R	3/1/6	–45.3	205.9	13.1	57
89	Qme	9314	NM	4/2/7	44.0	22.3	12.7	31
90	Qmc$_4$	9314	R	7/7	–42.3	199.6	5.5	121
91	Qmb$_6$	9301	R	3/7	–70.6	244.4	24.1	27
92	QTsf	9301	R	4/2/6	–58.0	162.6	3.2	467
93	Tme	9301	T	3/4/7	–23.6	59.5	14.2	22
94	Qmb$_6$	9407	R	5/8	–39.7	173.9	33.9	6
95	Qme	9418	NM	4/1/7	58.1	28.3	4.6	293
96	Qme	9418	NM	4/2/6	59.2	347.2	9.9	50
98	Qmb$_6$	9420	R	9/9	–41.1	173.7	35.2	5
99	Qmb$_6$	9416	R	7/7	–9.4	182.9	40.9	3
101	Qec$_5$	9404	NM	6/2/8	40.9	347.0	9.9	33
102	Qmd$_5$	9405	R	3/3/6	–41.2	142.7	12.5	34
103	Qeg	0433	NM	6/7	40.1	1.1	6.9	94
104	Qed$_2$	0430	T	6/7	–35.7	42.8	6.6	104
105	Qeg	0421	NM	7/7	31.0	348.0	*	*
106	Qed$_4$	0427	NM	5/1/6	6.0	21.4	7.2	92
107	Qed$_3$	9402	R	5/6	–71.3	165.4	9.4	67
108	Qlh$_3$	9420	T	1/4/6	–42.6	244.9	13.7	49
109	Qec$_5$	9410	NM	7/7	36.6	356.0	5.2	137
110	Qej	9415	NM	7/7	68.0	326.0	*	*
111	Qej	9413	R	6/6	–49.1	163.3	9.4	52
112	Qej	9414	NM	1/4/6	75.0	346.5	7.9	148
113	Qlc$_6$	9423	NM	5/5	58.0	319.0	*	*
114	Qlh$_3$	9422	T	7/7	–51.6	246.3	6.1	99
115	Qld$_5$	9427	NM	4/6	78.9	314.4	15.3	37
116	Qlh$_7$	9434	R	5/2/7	–66.1	138.2	9.7	50
117	Qhb$_3$	8324	NM	7/7	52.6	1.4	6.2	95
118	Thc$_2$	8430	R	7/7	–47.1	154.2	8.6	51
119	QTsf	8430	R	7/7	–44.5	172.4	9.5	41
120	Thb$_1$	8430	R	6/6	–47.3	186.5	11.8	33
121	Thb$_2$	8420	R	6/6	–51.4	149.8	5.6	145
122	Thc$_3$	8422	R	3/2/7	–41.1	146.8	17.9	22
123	Qhc$_1$	8427	NM	5/3/8	52.8	356.2	7.0	67
124	Qlc$_5$	8411	R	4/7	–62.7	185.5	14.9	39
125	Qld$_8$	8411	NM	4/3/7	78.0	338.4	8.2	59
126	Qlc$_5$	8414	R	4/6	–69.2	160.2	10.9	14
127	Qld$_7$	8414	NM	7/7	46.8	20.6	10.7	33
128	Qlh$_1$	8414	R	5/1/7	–47.5	159.9	12.1	33

Table 4. *Paleomagnetic data from the Springerville volcanic field, by site*—Continued

Site	Map symbol	Location	Polarity	Number	Demag I (degrees)	Demag D (degrees)	α-95 (degrees)	k
129	Qhg	8423	NM	4/1/7	50.0	302.1	16.1	25
130	QTsf	1207	R	8/8	–62.1	167.3	7.6	54
131	Qbb_2	9334	NM	4/2/6	50.0	12.4	7.9	79
132	QTsf	5934+	R	3/6	–35.1	144.2	3.9	999
133	Qsb_2	0221	NM	4/2/9	62.6	358.2	10.9	42
134	Qsc_5	9212	NM	6/1/9	62.5	336.6	8.5	53
135	Qbh	9225	R	3/3/8	–48.5	170.3	17.7	17
136	Qek	9507	R	9/10	–68.0	180.1	3.5	221
137	Qek	9507	R	9/9	–54.5	181.7	8.0	42
138	Qlc_6	9426	NM	7/8	40.3	346.6	6.8	81
139	Qvc_4	1515	NM	6/8	44.2	330.1	8.9	57
142	$QTrc_2$	1818	NM	4/1/7	42.1	15.0	7.9	100
143	Qrd_1	0804	NM	7/8	56.1	304.2	15.9	15
144	Qkc_6	0803	NM	6/6	47.6	13.1	6.0	127
145	Qkc_6	0823	NM	9/9	44.7	9.8	6.1	73
146	Qag	0823	R	6/1/7	–26.4	187.1	9.8	40
148	Qag	9907	R	2/3/9	–33.8	187.6	12.9	46
149	Qcc_6	0617	R	4/4/8	–43.8	175.5	7.3	63
151	Qdh_4	0728	NM	5/2/7	51.1	342.9	6.7	86
152	Quh_4	0735	R	8/8	–30.8	170.2	10.2	31
153	Que_1	0735	R	3/4/8	–27.4	153.6	22.0	9
154	Qkb_2	0832	NM	11/11	47.5	3.9	4.9	88
155	Quc_5	0806	R	6/8	–26.2	170.2	10.6	41
156	Qgj_2	9612	NM	8/8	47.4	355.8	7.0	64
157	Qgj_2	9627	NM	5/2/8	44.3	357.8	5.8	115
158	Qjh_3	9511	NM	6/2/8	49.7	357.8	7.7	55
159	Qjh_5	9511	NM	8/8	32.7	352.1	7.2	60
160	Qpc_3	8636	R	1/5/8	–30.4	148.3	9.5	71
162	Qpc_6	8723	R	4/2/7	–61.0	159.6	6.1	132
164	Qph_6	8723	R	8/8	–54.5	163.6	3.8	211
165	Qpc_8	8727	R	4/4/8	–65.8	138.1	6.9	72
166	Qph_6	8727	R	3/3/6	–54.1	165.2	8.8	68
167	Qac	8811	NM	5/7	63.0	319.0	*	*
168	Qja_2	9630	R	7/7	–66.7	195.7	5.5	121
169	Qjh_5	9624	NM	6/1/7	46.3	6.0	4.7	171
170	Qgh_7	9608	NM	3/2/8	48.4	2.0	15.0	31
171	Qga	9601	R	6/8	–62.4	164.8	11.7	34
172	Qgh_3	8611	NM	3/2/6	44.3	4.7	12.0	48
173	Qpk	8732	R	7/7	–53.0	172.2	10.9	32
174	Qpc_8	8728	R	4/2/7	–68.6	151.8	10.3	47
180	Qwg_3	2432	R	4/7	–66.8	174.0	18.5	26
181	Qjg_5	9507	NM	3/2/7	60.6	10.4	11.0	57
182	Qgb_1	0513	NM	1/4/7	52.8	5.3	26.0	14
183	Qcc_6	0617	R	4/1/7	–50.3	175.8	5.7	190
184	Qcc_9	0615	R	8/8	–66.0	193.0	7.1	61
185	Qcd_8	0610	R	8/8	–61.2	188.2	7.6	54
186	Qce_2	0614	R	3/2/6	–42.8	162.9	14.4	34
187	Qcd_7	1731	NM	4/6	54.6	350.0	6.3	216
188	Qdc_3	0624	R	5/2/8	–64.2	169.1	6.3	96
189	Qdc_8	0729	R	2/3/7	–54.3	169.6	13.3	43
190	Qdh_4	0729	NM	1/5/7	58.4	346.4	11.5	49
191	Qgh_7	8610	NM	3/2/5	43.1	16.0	15.5	29
192	Qgh_3	8719	NM	4/1/6	41.7	10.0	12.6	40
801	Tof	2623	NM	4/4	45.0	313.8	6.8	185

Table 5. *Description of volcanic units*

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
IN OR NEAR ALL AREAS WEST OF LONG 109°45′								
Diktytaxitic basalt								
QTsf—Composite flow of Show Low Creek—Probable sources are vents 1235A, 9336A, and 9336B. Except in the Show Low Creek area, unit mapped is interpreted to be lower part, mostly pre-Quaternary.	Smooth; alluvial cover; edge 2–10 m thick. Probable vents composed of spatter and locally welded cinders.	0.5–1.5	714SL 715#2 12SLN 14SS 16SS 19SLS 42SM 130L 210IP 234SS 450SS 236FR 260 453SS 457MN	See remarks	See remarks	1.62±0.08 to 2.00±0.11 (mostly >1.87)	TH TR	Composed of at least 2 flow sheets separated by soil one. Diktytaxitic groundmass; local plagioclase phenocrysts. Underlies all volcanic units except units Tbc_2, Twg, and Twh(?); overlies all sedimentary units. Flow fronts separating an upper and lower flow sheet found 1 km southeast of Show Low and south of V9335. K-Ar ages on upper and lower sheets (within map area: UAKA 80-133, 82-185, Condit and Shafiqullah, 1985; outside map area: UAKA 73-80, 73-137, 75-52a, 74-136, Peirce and others, 1979). Polarity: R. The following paleomagnetic sites from both sheets have reversed polarity: 4, 5, 7, 16, 18, 19, 22, 26, 27, 33, 34, 80, 92, 119, 130, 132.
ANTELOPE MOUNTAIN AREA								
Picritic basalt								
Qab—Flow and cinders of vent 0823.	Irregular; alluvial cover	1.0–6.0	720S	Qkc_5 Qae_1	Qkd_1 Qag	0.90–1.20	HAW	Phenocryst size varied, averages 2 mm.
Tab—Flow of vent 8711 (Antelope Mountain, east).	Smooth; alluvial cover	>1.5	736G G59	Qke Qkc_4 Qah_1 Tag	—	1.89–2.05	TR	Stratigraphically lowest flow (of four) from Antelope Mountain vent complex.
Olivine basalt								
Qac—Flow and cinders of vent 8818A.	Irregular; thickness 3 m.	0.3–1.0	G46 G80	—	Qpc_8 Qag Tag Tad_2 Tac_1	1.05–1.30	BAS	Phenocryst size varied; most between 0.3–1.5 mm with sparse plagioclase to 1 cm. Polarity: NM, site 167.
QTac—Flow and cinders of vent 8804.	Irregular; partly covered by alluvium; thickness 1–4 m.	0.3–1.0	G41 G42 SN56 SN96 JCMM3	Qkc_4 Qag	Tag Ku	1.58–2.03	AOB	Phenocryst size and abundance varied, increase with distance from vent.
Tac_3—Minor flow and cinders of vent 8818B.	Irregular; appears to be late eruptive product.	1.0–1.5	CP2	Tad_4	—	1.68–1.95	AOB	—
Tac_2—Pyroclastic materials of vent(?) 8806B.	Highly degraded cinder cone (?); pyroclastic materials possibly rafted remnants from vent 8711.	0.5–1.0	—	—	—	1.78–1.98	—	—
Tac_1—Flow 2 km west of Springerville.	Smooth; alluvial cover; thickness 4–8 m.	0.5–1.5	JC734 E76 E78	Qac Qag Tag	—	3.06±0.08	BAS	"Airport Mesa" flow. Source may be south of Little Colorado River where Toreva blocks and colluvial cover obscure boundary of field, or to west where unit is now covered by younger basalt flows. K-Ar sample AWL-42-74 (Laughlin and others, 1979).
Sparse olivine basalt								
Qad—Flow and cinders of vent 9823.	Smooth; alluvial cover; thickness ≈2 m.	0.3	742S S92	Qag	Tag	1.60–1.89	AOB	—

Tad$_4$—Flow and cinders of vent 8711 (Antelope Mountain, east).	Smooth; edges <1 m thick.	0.3	G38 G58 JCAP3	Qpc$_8$	Tac$_3$ Tag Tad$_2$ Tad$_1$ Tab	1.62–1.98	TR	Sparse phenocrysts.
Tad$_3$—Minor flow north of vent 8818B.	Smooth; thickness 2–3 m.	1.0–1.5	—	—	—	1.50–2.23	—	—
Tad$_2$—Flow 2 km southwest of vent 8804.	Smooth; alluvial cover; thickness approximately 2 m.	0.3	G40	Tag Qac	—	1.79–2.05	AOB	Rare plagioclase phenocrysts to 3.0 mm.
Tad$_1$—Cinders of vent 8806A and minor flows south of vent 9830.	Dissected.	0.5–1.5	—	Tag	—	1.83–2.11	—	Phenocrysts highly weathered. Unconformably overlies unit Ku.
				Olivine-pyroxene-plagioclase basalt				
Qae$_2$—Flow and cinders of vent 0919B (Scraper Knoll).	Rough; thickness 10–30 m.	1.0–1.5	S38-7 S39-7 S40-7 L4	—	Qae$_1$ Qag QTg	0.75–1.00	MUG	Abundance of pyroxene increases with distance from vent.
Qae$_1$—Flow and cinders of vent 0919A.	Moderately rough; thin alluvial cover; thickness 5–10 m.	1.0–1.5	S41-7	Qae$_2$	Qab Qag	0.78–1.09	MUG	—
				Olivine-plagioclase basalt				
Qag—Composite flow and cinders of vent 8803.	Hummocky; alluvial cover; thickness 7–10 m.	0.5–1.5	E77 S94 C1 E34	Qkc$_5$ Qae$_2$ Qae$_1$ Qab Qac Qap$_2$ Qah$_2$	Qad QTac Tag Trg Tac$_1$ Ku	1.67±0.09	TR	Granular matrix of plagioclase and moderately abundant olivine with rare plagioclase glomerocrysts; local diktytaxitic texture. Possible vent in sec 24, T. 9 N., R. 28 E. K-Ar sample AWL-5-77 (Laughlin and other, 1980). Polarity: R, sites 146, 148.
Tag—Flow and cinders of vent 8711(?).	Rough; local alluvial cover, with red weathered surface; thickness varied, >2 m.	0.1–1.5	G43 G60 E79 S93	Qkc$_5$ Qkc$_4$ Qac Qpc$_8$ Qkd$_3$ Qag Qap$_1$ Qad Qah$_1$ QTac Tad$_4$ Tad$_1$	Qkd$_2$ Tap Tkg Tah Tad$_2$ Tab Tac$_1$ QTg Ku	1.78–1.97	TR	Appears to be early eruptive product of vent 8711. Olivine abundance increases with distance from vent.
				Aphyric basalt				
Qah$_2$—Minor flow of vent 8803.	Moderately smooth.	—	—	—	Qag	1.58–1.76	—	Probably late-stage eruption on vent flank.
Qah$_1$—Flow and cinders of vent 8714 (Antelope Mountain, west).	Moderately smooth; partly alluvium covered; thickness about 6 m.	—	735G G47	Qke	Qkc$_2$ Tag	1.67–1.89	HAW	Moderately granular matrix of lath-shaped plagioclase and rare olivine, both <0.3 mm.
Tah—Cinders of vent 9832.	Degraded cinder cone.	—	—	Tag	—	1.81–2.09	—	—
				Pyroclastic deposits				
Qap$_2$—Pyroclastic material southeast of vent 0919B.	Pyroclastic materials of unknown origin.	—	—	—	Qag(?)	1.57–1.76	—	—
Qap$_1$—Pyroclastic material 2 km south of vent 8701A.	—do.—	—	—	—	Tag(?)	1.40–1.97	—	—
Tap—Pyroclastic material 3 km northeast of vent 8803.	—do.—	—	—	Tag	—	1.87–2.08	—	Possibly rafted from vent 8803; alternatively, a rootless vent.
				BLUE RIDGE MOUNTAIN AREA				
				Olivine-pyroxene basalt				
Qba—Flow and cinders of vent 9308.	Smooth; dissected; thickness 1–3 m.	0.3–0.5	116LA	—	Qbb$_4$	1.42–1.80	AOB	Varied pyroxene content.
				Picritic basalt				
Qbb$_4$—Flow northeast of Blue Ridge Mountain.	Smooth to irregular; locally dissected; thickness 2–4 m.	0.5–1.0	118L 108L 113L	Qbe Qmc$_4$ Qlh$_2$ Qmb$_5$ Qbd$_2$	Qsd	1.47–1.82	TR	Local columnar jointing exhumed by Morgan Wash.
Qbb$_3$—Composite flow and cinders of vents 9430A and 9430B.	Moderately smooth; alluvial cover.	1.0–2.0	219SM 218SM 763SM	—	QTsf	1.56–1.74	TR	Overlies lower flow sheet of unit QTsf. Cinder cones contain welded spatter.

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
			Picritic basalt—Continued					
Qbb_2—Flow and cinders of vent 9335.	—do.—	1.0–2.0	216L 766#1	—	QTsf	1.65±0.09 1.67–1.74	TR AOB	Overlies lower flow sheet of unit QTsf. Contains as much as 27 modal percent olivine. Age constrained by stratigraphic and paleomagnetic data. K-Ar age sample UAKA 80-183 (Condit and Shafiqullah, 1985). Polarity: NM, site 131.
Qbb_1—Flow and cinders of vent 8321.	Smooth; alluvial cover; edge 1–2 m thick	1.0–2.0	247IP	Qbc1	QTsf	1.50–2.00	TR	Contains as much as 28 modal percent olivine. Polarity: R, site 35.
			Olivine basalt					
Qbc_3—Flow and cinders of vent 9326 (Pat Mullen Mountain).	Smooth; alluvial cover; partly dissected	0.5–1.0	—	Qlh_2(?)	QTsf	0.90–1.75	—	Overlies lower flow sheet of unit QTsf. Polarity: NM, site 21. May represent Gilsa or some other unrecognized normal polarity subchron.
Qbc_2—Composite flow and cinders of vents 8311 and 8308.	Smooth; alluvial cover; partly dissected; thickness 1–4 m.	0.5–1.0	214IP 100IP 132L 211IP 213L	—	Qbc_1 Qbb_1 QTsf Tbl	0.90–1.87	AOB TR	Vent material locally contains welded spatter. Polarity: NM, sites 6, 15, 24, 25, 29, 31. May represent Gilsa or some other unrecognized normal polarity subchron.
Qbc_1—Flow of Cooley Lake.	Smooth; alluvial cover; edge 1–3 m thick	0.3–0.5	31IP 246IP	Qhb_3 Qhb_2 Qbc_2	QTsf Tbc_3	1.30–2.00	AOB	Distal flow edge forms dam for Cooley Lake. Polarity: R, site 32.
Tbc_3—Flow of Bootleg Lake.	Smooth; alluvial cover; partly dissected	0.5–3.0	—	Qbc_1 Qbd_1	Ku	1.83±0.21	—	Flow locally exhumed. K-Ar age sample UAKA 80-134 (Condit and Shafiqullah, 1985). Polarity: NM, sites 36, 37.
Tbc_2—Flow of Whitcomb Spring and cinders of vent 9325.	Smooth; alluvial cover.	0.3–0.5	765SM 217SM	QTsf	—	1.87–2.12	MUG	Polarity: R, site 23.
Tbc_1—Basal flow of Amos Mountain.	Thickness 2–5 m.	0.3–0.5	704IP 254IP	Tbl	Tg	8.97±0.19	MUG	Oldest dated flow in area; probable source is Mount Baldy shield complex 20 km southeast. K-Ar age sample UAKA 80-136 (Condit and Shafiqullah, 1985). Polarity: NM, site 39.
			Sparse olivine basalt					
Qbd_2—Composite flow of Blue Ridge Mountain (vent 9326B).	Irregular; local alluvial cover.	0.5–1.0	131L 208L 205L 200L 201bL 204L	Qbe Qbh	Qbb_4 Qbg QTsf	1.32–1.87	TH TR HAW	Varied lithology, phyric to aphyric. Locally glomeroporphyritic. Series of flows forms shield volcano. Polarity: NM, sites 14, 17, 20, 30, 52, 67.
Qbd_1—Flow and cinders of vent 8318.	Smooth to irregular.	0.5–1.0	235IP 700IP	—	Tbc_3	1.67–1.83	AOB	Sparse crystals of clinopyroxene as long as 1 cm.
			Olivine-pyroxene-plagioclase basalt					
Qbe—Flow and spatter of vent 9328.	Irregular.	0.5–1.0	225L	—	Qbd_2 Qbb_4	0.30–1.32	AOB	Flow on east flank of Blue Ridge Mountain.
			Olivine-plagioclase basalt					
Qbg—Composite flow and cinders of vents 9317 and 9318.	Irregular; local alluvial cover	0.5–1.0	128L	Qbh Qbd_2 Qsb_1	QTsf	1.58–1.87	TR	Phenocrysts give distinctive salt-and-pepper appearance. Polarity: NM, sites 9, 12.
			Aphyric basalt					
Qbh—Flow and cinders of vent 9330 (Springer Mountain).	Moderately smooth; alluvial cover; edge 1–2 m thick.	—	129L	—	Qbd_2 Qbg	0.73–1.60	MUG	Evolved hawaiite. Local plagioclase crystals as long as 1 cm. Polarity: R, site 135.

			Plagioclase basalt					
Tbl—Upper flow of Amos Mountain.	Smooth; alluvial cover; thickness 2–15 m.	1.0–20	703IP 212IP 237IP	Qbc_2	Tbc_1 Tg	8.66±0.19	MUG	Caps mesa 0.1 km south of Pinetop, Amos Mountain, and mesa 1 km south of Amos Mountain. Probable source, Mount Baldy shield complex 20 km to southeast. Includes ubiquitous plagioclase megacrysts as long as 2 cm. K-Ar sample UAKA 80-135 (Condit and Shafiqullah,1985).
			CERRO HUECO AREA					
			Olivine-pyroxene basalt					
Qca— Composite flow(s) and cinders of vents 0610A and 0611.	Irregular; local alluvial cover; vents dissected.	1.0–4.0	CH214 JC11 R32	Qcd_8 Qcd_7 Qcc_9 Qcc_8	QTg	1.15–1.59	AOB	Facies of vent 6011 include pyroxene megacrysts as much as 1 cm in diameter.
			Picritic basalt					
Qcb_5—Pyroclastic material and ash of vent 1626B (Cerro Hueco).	Ash from phreatic eruption; includes blocks in rim deposits.	—	—	—	Qcb_4 Qcg_3 Qcd_7	0.30–0.74	—	Overlies vent 1615A; blocks in rim deposits ejected from units Qcb_4, Qcg_3, Qcd_7, all of which are exposed in crater walls.
Qcb_4—Flow and cinders of vent 1626A (Cerro Hueco, west).	Irregular; forms constructional topography; vent material partly truncated by maar crater of unit Qcb_5 (vent 1626B).	2.0–4.0	173R	Qcb_5	Qcb_3 Qcg_3 Qcd_7 Qcg_2 Qck_2 Qcc_7 Qcc_3 Qcc_2	0.30–0.79	HAW	Vent partially covered by ash of unit Qcb_5 (of vent 1626B); flow surface rough and one of youngest in field (estimated age ≈0.5 Ma).
Qcb_3—Flow and cinders of vent 1622.	Irregular; forms constructional topography.	2.0–4.0	174R FM1-2	Qcb_4	Qcd_9 Qcg_3 Qoc_5 Qcb_1 Qce_1 Qck_2 Qoa_1 Qcd_4 QTg	0.31–1.09	MUG	Collapse (“sag”) feature in center of flow, spindle-shaped bombs near vent; one of youngest flows in central part of field.
Qcb_2—Flow of vent 0601.	Smooth; alluvial cover; thickness 1–2 m.	1.0–2.0	—	—	Qcd_8 Qcd_7 Qdc_5 Qcc_9 Qdc_3 Qcd_6 Qcc_4 Qcp_1 Qcc_1	0.70–0.97	—	Flow surface tilted 3° northwest on flank of local domed upwarp; fissure vent strikes N. 80° E.
Qcb_1—Flow and cinders of vent 1633.	Smooth to rough; alluvial cover; locally distorted by regional flexures; thickness 1–5 m.	0.3–4.0	CH222	Qcb_3	Qce_1 Qck_2 Qcc_9 Qvh_1 Qch_2 Qcc_2 Qcd_4	1.19±0.04	AOB	Central collapse (“sag”) feature similar to those in units Qck_2, Qcb_3, Quh_4, and Qgk; pyroxenite nodule analysis 227. K-Ar sample UAKA 82-192 (Aubele and others, 1986).
			Olivine basalt					
Qcc_9—Composite flow and cinders of vent 0615B.	Smooth to moderately rough; vent material degraded.	0.5–1.2	RT5 CH210	Qce_2 Qcb_2 Qcd_8 Qcl_1 Qcb_1	Qcc_8 Qca Qch_2 Qch_1	1.15–1.40	HAW	Polarity: R, site 184.
Qcc_8—Flow and cinders of vent 0603.	Smooth; alluvial cover.	0.5–1.2	SF1-2	Qck_2 Qcc_9	Qca QTg	1.15–1.55	TR	—
Qcc_7—Cinders of vent 1612B.	Degraded and breached symmetrical cinder cone.	—	CH233	Qcb_4 Qcg_3	—	0.90–1.70	TR	—
Qcc_6—Composite flow and cinders of vents 0621B and 0621C.	Smooth; alluvial cover; vent material ash covered and partially degraded.	0.5–-1.0	746V WK97	Qgh_7 Qce_2 Qcl_2	Qch_3 Qcd_5 Qcd_3	1.23–1.56	AOB	Polarity: R, sites 149, 183.

Table 5. *Description of volcanic units*—Continued

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Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
		Olivine basalt—Continued						
				Qgb$_1$ Qcl$_1$ Qck$_1$				
Qcc$_5$—Flow and cinders of vents 1624B and 1719.	Smooth; alluvial cover; thickness 2–3 m. Vent material degraded and irregular and may be faulted.	0.5–1.0	CH232	Qcg$_3$	Qod$_4$	0.95–1.72	TH	—
Qcc$_4$—Minor flow 2 km northeast of fissure vent 0601.	Alluvial cover.	0.3–1.0	—	Qcb$_2$	—	0.73–1.80	—	May be distal part of unit Qcd$_8$; possible source vent 0706.
Qcc$_3$—Flow and cinders of vent 1624A.	Smooth; alluvial cover; faulted; dissection of vent material exposes agglomerate ledges at summit.	0.3–0.5	CH231	Qcb$_4$ Qcg$_3$	Qcd$_4$ Qod$_4$	1.00–1.84	HAW	—
Qcc$_2$—Flow and cinders of vent 0606.	Smooth; alluvial cover; vent material degraded.	0.3–0.5	V249	Qcl$_2$ Qcb$_1$ Qce$_1$ Qvh$_1$ Qck$_1$ Qch$_2$	Qcd$_1$	1.15–1.75	TR	Additional window of flow exposed 3 km southeast of Little Ortega Lake.
Qcc$_1$—Minor flow southeast of vent 1730.	Smooth; alluvial cover.	0.3–0.5	—	Qcb$_2$ Qcd$_7$	—	1.20–1.86	—	—
		Sparse olivine basalt						
Qcd$_9$—Cinders of vent 1609.	Moderately well preserved cinder cone.	—	CH264	Qcb$_3$	—	0.50–1.15	HAW	Includes unbreached crater 30 m deep. Polarity: NM.
Qcd$_8$—Flow and cinders of vent 0615A.	Smooth; dissected; vent facies degraded.	0.3–0.5	CH208 RT4	Qce$_2$ Qcb$_2$	Qdc$_5$ Qdd$_3$ Qcc$_9$ Qde$_2$ Qca	0.73–1.02	TR	Vent facies includes abundant spatter and sandstone blocks. Polarity: R, site 185.
Qcd$_7$—Composite flow and cinders of vent 1730.	Rough and dissected; vesicular blocks and alluvium; thickness 20–30 m.	0.5	CH219 CH211 CH217 CH1 R29 LLS89	Qcb$_5$ Qcb$_4$ Qcb$_2$ Qcg$_3$	Qdc$_3$ Qcd$_6$ Qca Qcg$_1$ Qcd$_4$ Qcc$_1$ Qod$_1$ Trc$_2$ QTg	0.90–0.97	HAW	Predates eruption of unit Qcb$_5$ from vent 1626B. Vent surrounded by nonpyroclastic domed accumulation of reddish-brown basaltic flows and rubble. Polarity: NM, site 187.
Qcd$_6$—Minor flow 1 km northwest of vent 0705.	Smooth; dissected.	<0.5	—	Qcb$_2$ Qcd$_7$	—	1.00–1.64	HAW	May be correlative with unit Qdc$_3$.
Qcd$_5$—Minor flow 1 km southwest of vent 0617.	Dissected minor outcrop.	<1.0	—	Qgb$_1$ Qcc$_6$	—	1.15–1.80	—	—
Qcd$_4$—Flow 1 km south of vent 1609 and 1 km west of vent 1624A.	Smooth; alluvial cover; faulted; thickness 1–2 m.	0.3–0.5	CH263	Qcb$_4$ Qcb$_3$ Qcg$_3$ Qcd$_7$ Qcb$_1$ Qcc$_3$	QTg	1.15–1.78	HAW	—
Qcd$_3$—Flow northwest of vent 0617.	Smooth; alluvial cover.	0.5	—	Qcc$_6$ Qch$_3$	—	1.23–.70	—	—
Qcd$_2$—Cinders of vent 1635.	Degraded cinder cone; consists of agglomerate, cinders, and fine red ash.	—	CH216	—	—	1.14–1.90	AOB	—
Qcd$_1$—Flow 2 km south of vent 1526.	Smooth; alluvial cover.	—	V251	Qvc$_5$ Qvh$_1$ Qcc$_2$	—	1.15–1.85	AOB	—

Olivine-pyroxene-plagioclase basalt								
Qce_2—Flow, cinders, and ash of vent 0621A (Cerro Montoso).	Irregular; locally dissected; thickness 2–3 m.	2.0–3.0	CH100 CH213	—	Qcd_8 Qcl_1 Qck_2 Qcc_9 Qck_1 Qcc_6 Qch_2	0.73–0.90	TR	Vent is unbreached crater with steep block- and cinder-covered slope; north flank dissected. Includes late layer of ash used as construction material in local paleo-Indian sites. Polarity: R, site 186.
Qce_1—Composite flow and cinders of vent 1627.	Smooth; alluvial cover; thickness ≈3 m.	2.0–4.0	747CH CH257 CH238 CH224	Qcb_3 Qok	Qck_2 Qcb_1 Qvh_1 Qcc_2	1.15–1.50	HAW	Pyroxene xenocrysts and nodules as much as 2 cm in diameter in cinders of south-southwest distal vent flanks; sparse specular hematite coating on cinders near breach in crater.
Olivine-plagioclase basalt								
Qcg_3—Composite flow and cinders of vent 1625 (Cerro Hueco, east).	Smooth, alluvial cover; thickness 1–3 m.	<3.0	CH7	Qcb_5 Qcb_4 Qcb_3	Qog Qcd_7 Qcc_7 Qcc_5 Qcc_3 Qcg_1 Qod_4 Qcd_4 Tof	0.73–0.97	TH	Vent material partially truncated by later phreatic(?) eruption of vent 1625B.
Qcg_2—Cinders of vent 1613.	Degraded cinder cone; smooth; local alluvial cover.	—	CH234	Qcb_4	—	0.70–1.60	—	—
Qcg_1—Flow 1 km south and 2 km east of vent 1719.	Smooth, locally blocky; alluvial cover; dissected; thickness 2–3 m.	0.5–2.0	CH220	Qcg_3 Qcd_7	—	1.00–1.75	AOB	—
Aphyric basalt								
Qch_3—Flow and cinders of vent 0617.	Smooth; alluvial cover; degraded.		CH236	Qcl_2 Qck1 Qcc_6	Qcd_3	1.22–1.52	TR	Vent material dissected, consists of subrounded cinders 2–3 cm in diameter and sandstone and granite fragments.
Qch_2—Flow and cinders of vent 0609.	Smooth; alluvial cover; locally dissected; vent material dissected and partly buried by unit Qck_1.		CH228	Qce_2 Qcb_1 Qcc_9 Qck_1	Qcc_2	1.15–1.66	MUG	—
Qch_1—Minor flow north of fissure vent 0601.	Smooth; alluvial cover; edges dissected.		—	Qcc_9	—	1.18–1.74	—	—
Hornblende basalt								
Qck_2—Flow and cinders of vent 1634 .	Smooth; alluvial cover; thickness 4–30 m.	<3.0	CH215 CH218 CH225 SF2-2	Qcb_4 Qcb_3 Qcb_1 Qce_1	Qcc_8	1.15–1.35	BEN	Flow near vent is massive with central collapse; flow surface dips ≈3° W. at right angles to flow direction.
Qck_1—Flow and cinders of vent 0616.	Smooth; degraded; thickness 1–2 m.	1.0–2.0	745CH CH108 CH229 CH230	Qce_2 Qcl_2	Qcc_6 Qch_3 Qch_2 Qcc_2	0.95–1.69	MUG	Varied phenocryst content; includes olivine and pyroxene.
Plagioclase basalt								
Qcl_2—Flow and cinders of vent 0512 (Burnt Knoll).	Locally rough but alluvium covered and undissected; thickness 3–4 m.	1.0–3.0	V172R BK1 BK3	—	Qck_1 Qch_3 Qcc_6 Qcc_2 Qcd_1	0.55–1.10	MUG	—
Qcl_1—Flow and cinders of vents 0628 and 0621D.	Dissected; thickness 2–10 m.	<5.0	WK95	Qce_2 Qgk Qgg_3	Qcc_9 Qcc_6 Qdd_2	0.95–1.29	MUG	—
Pyroclastic deposits								
Qcp_2—Cinders of vent 0610B.	Degraded vent material of undetermined lithology.	—	—	Qcc_9	—	1.15-1.62	—	
Qcp_1—Cinders of vent 0706.	—do.—	—	—	Qcb_2	—	1.00–1.88	—	—

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
DEAD HORSE DRAW AREA								
Picritic basalt								
Qdb—Composite flow east of vent 9705.	Smooth; dissected; thickness 2–3 m.	1.0–4.0	727SN SN7 LLS90	Qdh$_4$ Qrd$_2$ Qdc$_9$ Qdg Qde$_3$ Qdc$_8$ Qdc$_7$ Qdc$_3$ Qdc$_2$	Qdp$_2$ Qdc$_1$ Qdd$_1$ Qrd$_1$	1.01–1.59	TR	—
Olivine basalt								
Qdc$_9$—Flow northwest of vent 9717A.	Smooth; dissected.	0.5–1.0	—	Qgj$_2$ Qdd$_5$	Qdc$_8$ Qdb Qdp$_2$ Qde$_1$	0.84–1.21	—	—
Qdc$_8$—Flow east of vent 9601.	Irregular; locally dissected.	0.5–1.0	—	Qgj$_2$ Qdh$_4$ Qdc$_9$	Qdp$_4$ Qgp$_1$ Qdc$_7$ Qdl Qga Qdj$_2$ Qdc$_3$ Qdb Qde$_1$ Qdd$_1$	0.98–1.25	—	Possible sources include vents 9613 and 9624; if so, unit correlates with unit Qgc$_2$. Polarity: R, site 189.
Qdc$_7$—Composite(?) flow and cinders of vent 0721.	Smooth; alluvial cover.	0.3–0.5	LLS66 LLS70	Qdh$_4$ Qde$_3$ Qdc$_8$	Qdc$_3$ Qdb Qdj$_1$ Qdp$_1$ Qdd$_1$	1.00–1.27	AOB	—
Qdc$_6$—Flow and cinders of vent 0724A.	Rough but alluvium covered; thickness 2–3 m.	0.3	SN74	Qdd$_4$ Qdp$_3$	Qrc	0.86–1.60	HAW	Phenocrysts are rare plagioclase (to 7.0 mm in diameter) and sparse pyroxene (1.0–1.5 mm in diameter).
Qdc$_5$—Flow 2 km southeast of fissure vent 0601.	Smooth; locally dissected; structurally domed.	0.5	CH209	Qcb$_2$ Qcd$_8$ Qdd$_3$	Qdc$_3$ Qde$_2$	0.79–1.17	AOB	—
Qdc$_4$—Minor flow and cinders of vent 0705.	Degraded cinder cone.	—	724CH	—	Qdh$_1$	0.90–1.63	HAW	—
Qdc$_3$—Composite flow south of vent 0718.	Smooth; alluvium covered; dissected.	0.5–1.0	CH212 CH178 LLS64 LLS88	Qcb$_2$ Qgg$_2$ Qcd$_7$ Qdc$_5$ Qdc$_8$ Qdc$_7$ Qdc$_2$	Qdb Qde$_2$ Qdh$_1$ Qdd$_2$ Qdd$_1$ Qrd$_1$ Trc$_2$ Ku	1.03–1.53	TH	Polarity: R, site 188.
Qdc$_2$—Cinders and spatter of vent 9705.	Degraded vent material.	—	WK104	—	—	0.87–1.76	TR	Partially buried by unit Qdb.
Qdc$_1$—Flow west of vent 0711.	Moderately smooth; forms eroded hill.	0.3–1.5	—	Qdb	Qdp$_1$	1.11–1.74	—	—
Sparse olivine basalt								
Qdd$_5$—Flow and cinders of vent 9718A.	Flow and vent surfaces smooth and dissected.	0.3–0.5	WK75	Qgj$_2$	Qdc$_9$ Qdh$_3$	1.13–1.39	TR	—

Qdd_4—Flow and cinders of vent 0726.	Moderately rough; local alluvial cover.	1.0–1.5	SN31	Qrd_2 Qde_3	Qdc_6 Qdp_3 Qdh_2 Qdd_1 Ku	0.85–1.56	AOB	Sparse to moderately abundant olivine and rare quartz crystals (to 1.5 mm in diameter).
Qdd_3—Flow north of vent 0718.	Smooth; alluvial cover; thickness 2 m; vent material moderately degraded.	0.3–0.5	—	Qcd_8	Qdc_5 Qde_2 Qdd_1	0.99–1.43	—	Surface partially dissected to depth of 0.5–1.0 m; vent appears to have produced unit Qde_2 later.
Qdd_2—Flow and cinders of vent 0625.	Smooth; alluvial cover; vent material degraded.	0.3–0.5	WK42 CP1-2	Qgk Qgg_2 Qcl_1 Qdc_3 Qde_2	Qdd_1	1.19–1.92	TR	—
Qdd_1—Composite(?) flow and cinders of vent 0731.	Smooth; alluvial cover; dissected; forms eroded escarpment.	0.3–0.5	WK41 CH206	Qdh_4 Qgg_2 Qde_3 Qdc_8 Qdc_7 Qdd_3 Qdc_3 Qdb Qde_2 Qdh_2 Qdd_2	—	1.32–2.00	HAW	Flow appears to have been faulted or folded in sec. 23, T. 10 N., R. 27 E.
Olivine-pyroxene-plagioclase basalt								
Qde_3—Flow and cinders of vent 0727.	Moderately irregular; thickness 1–5 m; structurally deformed.	0.3–1.5	728SN 729SN LLS61 LLS69 SN75 SN32	—	Qdc_7 Qdb Qdh_2 Qdd_1	1.05±0.04	HAW	Phenocrysts are parse plagioclase (to 1.5 mm in diameter) and pyroxene and olivine (0.3–1.0 mm); K-Ar sample UAKA 82-193 (Aubele and others, 1986).
Qde_2—Flow and cinders of vent 0718.		0.5	CH177 CH175	Qcd_8 Qdd_3 Qdc_3	Qdd_2 Qdd_1	1.13–1.53	HAW	Pluglike flow (from breached lava lake?) in center of cinder-cone crater; vent appears to have previously produced unit Qdd_3.
Qde_1—Flow and cinders of vent 9718B.	Smooth; alluvial cover; degraded.	1.0–3.0	—	Qgj_2 Qdc_9 Qdc_8	—	1.17–1.73	—	—
Olivine-plagioclase basalt								
Qdg—Flow and cinders of vent 9716.	Smooth; alluvium covered.	0.5–1.5	SM2 SN19	Qgj_2	Qdh_3(?) Que_1 Qdb Qih_1 Qua_1 Qdp_2 Qdh_2 Quc_2 Quc_1 Quh_1	0.79–1.29	AOB	—
Aphyric basalt								
Qdh_4—Composite flow and cinders of vent 0732.	Rough; margins intact; locally alluvium covered; edge 3–6 m thick.	—	S21-7 R28 WK105	—	Qdc_8 Qdc_7 Qdb Qdd_1	0.84±0.07	HAW	Cinder cone surface smooth, covered with fine cinder; summit dissected exposing crater. K-Ar sample AWL-4-77 (Laughlin and others, 1980). Polarity: NM, sites 151, 190, which suggests age of 0.90–0.91Ma.
Qdh_3—Minor flow, cinders, and spatter of vent 9717A.	Smooth and degraded.	—	—	Qdd_5	Qdg(?)	0.75–1.25	—	—
Qdh_2—Flow and cinders of vent 0734.	Moderately rough; oxidized spatter at surface; thickness 1–3 m.	—	SN30 LH3	Qdg Qde_3 Qdd_4	Ku	1.05–1.71	TR	—
Qdh_1—Flow 1 km southeast of vent 0705.	Moderately smooth; overlain by veneer of gravel of sandstone and chert.	—	LLS63 LLS62 725LL 726LL	Qdc_4 Qdc_3	Ku	1.20–1.93	TR	Rare phenocrysts are plagioclase (to 1 mm in diameter) and olivine (to 0.3 mm); flow structurally deformed.

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
			Quartz basalt					
Qdj_2—Minor flow 1 km east of vent 0731.	Dissected; exposed on steep slope.	—	—	Qdc_8	—	0.98–1.51	—	—
Qdj_1—Cinders and agglomeratic basalt of vents 0715A and 0715B.	Degraded vent material.	0.3–1.5	730LS LLS71 LLS67 LLS72	Qdc_7	—	1.01–1.63	TR	Phenocrysts are quartz (1–1.5 mm in diameter) and sparse olivine (to 0.3 mm).
			Plagioclase basalt					
Qdl—Flow and cinders of vent 9601.	Smooth; alluvial cover; vent area partially dissected.	<3.0	WK68	Qgj_2 Qdc_8	Qga	0.84–1.44	MUG	Feldspar phenocrysts in banded spatter.
			Pyroclastic deposits					
Qdp_4—Cinders of vent 9707A.	Degraded vent material of undetermined lithology.	—	—	Qdc_8	—	0.75–1.49	—	
Qdp_3—Cinders of vent 0724B.	—do.—	—	—	Qdd_4	—	0.87–1.58	—	—
Qdp_2—Cinders of vent 9717B.	—do.—	—	—	Qdc_9 Qdg Qdb	—	1.10–1.66	—	—
Qdp_1—Pyroclastic materials east of vent 0711.	—do.—	—	—	Qdc_7 Qdc_1	—	1.06–1.85	—	—
			ECKS MOUNTAIN AREA					
			Olivine-pyroxene basalt					
Qea_2—Cinders and minor flow of vent 0413.	Cinder cone moderately degraded	—	—	—	—	0.70–1.50	—	—
Qea_1—Composite flow and cinders of vent 0434 (Doyle Mountain).	Smooth; alluvial cover; locally dissected; thickness 2–4 m.	0.3–0.5	—	Qed_4 Qed_3 Qeg Qec_2	Qed_1(?)	1.70–1.80	—	Lithology varies from olivine-pyroxene to olivine basalt.
			Picritic basalt					
Qeb_2—Cinders and ash of vent 0424 (Lake Hole).	Maar crater moderately degraded	—	—	Qjd_2 Qvc_5	—	0.80–1.60	—	—
Qeb_1—Cinders and minor flow of vent 9402A.	Cinder cone moderately degraded	—	—	—	—	1.00–1.60	—	Olivine phenocrysts as large as 3 mm in diameter.
			Olivine basalt					
Qec_6—Flow of vent 0519 (Timber Knoll).	Smooth; covered by thin alluvium; edge 4–10 m thick; partly dissected.	—	BB246	Qjd_2 Qed_4(?)	—	0.70–1.00	TR	—
Qec_5—Minor flow west of Antelope Hills.	Partly dissected	0.5–1.0	504SM	Qej Qlh_3	Qeg(?)	0.90–1.80	AOB	Brown Creek dissects flow to depths of as much as 5 m. Polarity: NM, sites 101, 109.
Qec_4—Minor flow and cinders of vent 9403.	Cinder cone moderately degraded	—	—	Qei(?)	Qeg	1.05–1.65	—	Varied lithology to sparse olivine basalt.
Qec_3—Cinders of vent 0429 (Ziegler Mountain).	—do.—	—	—	—	—	1.20–1.80	—	—
Qec_2—Flow and cinders of vent 0433.	Smooth; alluvial cover; locally dissected; thickness 2–3 m.	0.3–0.5	—	Qeg	Qeh_1 Qea_1	1.40–1.80	—	East flow edge 3 m thick.
Qec_1—Cinders and minor flow of vent 9404A.	Cinder cone degraded	0.3–0.5	48SM	—	—	1.55–1.90	AOB	—
			Sparse olivine basalt					
Qed_4—Flow and cinders of vent 0435 (Ecks Mountain).	Mantled by cinders and thin alluvium; edge 3–30 m thick.	0.5–1.0	445SM	—	Qec_6(?) Qed_3 Qea_1	0.70–0.97	AOB	Well-preserved morphology. Polarity: NM, site 106.
Qed_3—Composite flow and cinders of vents 9401 and 9402B(?).	Smooth; alluvium and cinder covered; partly dissected.	0.3–0.5	—	Qed_4	Qea_1	0.73–1.50	—	Varied lithology with local occurrences of quartz phenocrysts. Polarity: R, site 107.
Qed_2—Flow and cinders of vent 0432B.	Smooth; alluvial cover; partly dissected.	0.3–0.5	243SM	—	QTsf	0.80–1.80	BAS	Polarity: T, site 104.

Qed_1—Minor flow 4 km north-northeast of vent 0429 (Ziegler Mountain).	Partly dissected by Brown Creek.	—	—	Qeg Qea_1(?)	—	1.67–1.87	—	Flow exhumed by Brown Creek.
				Olivine-plagioclase basalt				
Qeg—Flow of Brown Creek.	Smooth; alluvial cover; locally dissected; thickness 1–4 m.	0.3–0.5	444SM	Qej Qmd_5 Qec_5(?) Qec_4	Qec_2 Qeh_1 Qea_1 Qed_1 QTsf	0.90–1.87	AOB	Local columnar joints in Brown Creek. Polarity: NM, sites 83, 103, 105. May represent Gilsa or other unrecognized normal-polarity subchron.
				Aphyric basalt				
Qeh_2—Cinders and minor flow of vent 0432A.	Cinder cone moderately degraded.	—	—	—	Qeg	1.00–1.60	—	—
Qeh_1—Minor flow east of vent 0429 (Ziegler Mountain).	Exhumed and partly dissected by Brown Creek.	—	—	Qeg Qec_2	—	1.45–1.85	—	—
				Pyroxene basalt				
Qei—Flow and cinders of vent 9404B.	Smooth; alluvial cover; thickness 4 m.	0.5–1.0	439SM	—	Qec_4(?)	0.85–1.15	HAW	Cinder cone contains dikes.
				Quartz basalt				
Qej—Composite flow, cinders, and dikes of vents 9411A, 9411B, 9412, 9413, 9414A, and 9414B (Antelope Hills).	Smooth, with alluvial cover to locally rough with squeeze-ups.	0.5–1.0	436SM 434SM 502SM	Qjg_5	Qed_3 Qjc_2 Qec_5 Qeg Qel(?)	0.55–1.55	MUG HAW	Aphyric to olivine basalt. Polarity: Nm, R, site 110 (NM), 111 (R), 112 (NM).
				Hornblende basalt				
Qek—Flow of vent 9507 (Wolf Mountain).		1.0–5.0	435AV S14-7	Qej	Qel(?)	1.56±0.05	BEN	Forms endogenous dome, light-brown to brown. K-Ar age sample UAKA 82-190 (Aubele and others, 1986). Polarity: R, sites 136, 137.
				Plagioclase basalt				
Qel—Minor flow and cinders of vent 9506 (northern part of Wolf Mountain).	Cinder cone moderately degraded.	0.5–1.5	757BB 758BB BB192 193BB	—	Qej(?) Qek(?)	1.56–1.80	BEN	Flow intrudes northwest side of cinder cone.
				GREENS PEAK AREA				
				Olivine-pyroxene basalt				
Qga—Flow and cinders of vent 9623.	Smooth; alluvial cover; edges and vent material partly dissected; thickness 3 m.	< 4.0	WK83 R11 TP4	Qgj_2 Qgg_2 Qgl_3 Qdl(?)	Qgl_1 Qgp_1 Qgc_1	0.97–1.40	TR	Locally warped and faulted by laccolithlike injection of unit Qgl4 (vent 9602) about 2.5 km N. 15° E. from vent 9610 (Cerro Trigo); flow probably overlies cinder-rich muds and silts. Polarity: R, site 171.
				Picritic basalt				
Qgb_2—Flow and cinders of vent 8604.	Irregular; locally dissected; thickness 3–4 m; vent material slightly dissected.	1.5–2.5	BB143	—	Qgc_5 Qgd_5 Qgh_7 Qgp_8 Qgh_5 Qja_2 Qgh_1 Qgc_4	0.37–0.90	HAW	One of youngest flows in the field. Common translucent olivine.
Qgb_1—Flow and cinders of vents 9621 and 9622 (Whiting Knoll).	Smooth; dissected; vent material dissected.	1.0–2.5	709WK R17 R21 WK27 WK58 BB164	Qgj_2 Qgh_7 Qgk Qgg_3 Qgh_2	Qgj_1 Qgp_3 Qgd_1 Qgg_1 Qgp_2 Qcc_6 Qcd_5	0.91±0.02	AOB	Ultramafic xenoliths on west shore of Lake Boynton (west of Kitchen Spring). K-Ar sample 709WK (Cooper and others, 1990). Polarity: NM, site 182, which suggests age of 0.89 Ma.
				Olivine basalt				
Qgc_5—Flow and cinders of vent 9633.	Smooth; alluvial cover; thickness 3–6 m.	0.3–0.8	WK85	Qgb_2	Qgd_5 Qgh_7 Qja_2 Qgl_4	0.51–0.90	MUG	Basal springs around perimeter of flow are common.

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
Olivine basalt—Continued								
Qgc_4—Cinders of vent 8607.	Degraded cinder cone; moderately dissected.	—	CH144	Qgb_2	—	0.90–1.66	AOB	—
Qgc_3—Minor flow 2 km northeast of vent 9602.	Isolated flow in alluvium-filled valley.	0.5–1.0	—	—	—	1.05–1.70	—	—
Qgc_2—Flow and cinders of vents 9613 and 9624.	Smooth; alluvial cover; cone smooth with agglomerate on summit.	0.5–1.5	744WK WK64	Qgj_2	—	0.90–1.70	HAW	May be correlative with unit Qdc_8. Granulite inclusions.
Qgc_1—Flow and cinders of vent 9612.	Smooth; dissected; vent material degraded; agglomerate on cone summit.	0.5–1.0	WK47	Qgj_2 Qgg_2 Qga	—	1.02–1.66	TR	—
Sparse olivine basalt								
Qgd_5—Flow and cinders of vent 9631.	Smooth; alluvial cover; thickness 1–3 m; vent material dissected.	<2.0	WK84	Qgb_2 Qgc_5	Qja_2 Qgh_1	0.56–0.90	TR	—
Qgd_4—Cinders of vent 8609D.	Moderately well preserved cinder cone.	—	GP148	Qgh_7	—	0.70–1.10	AOB	—
Qgd_3—Cinders of vent 8613B.	Degraded cinder cone; alluvium-covered slopes.	—	—	Qgh_2	—	0.90–1.20	—	—
Qgd_2—Flow and cinders of vents 8718B and 8707.	Smooth; dissected; thickness 2–4 m.	0.3–0.5	—	Qgg_4 Qgh_3		0.90–1.20	—	—
Qgd_1—Flow and cinders of vent 0632A.	Smooth; dissected; 2 m thick.	0.5	BB163	Qgg_3 Qgb_1	Qcc_6(?)	0.90–1.25	MUG	—
Olivine-pyroxene-plagioclase basalt								
Qge_3—Cinders of vent 8614B.	Degraded cinder cone.	1.0–2.0	GP140 GP139	—	Qgh_3	0.71–0.97	HAW	Pyroxene and feldspar present in spatter and bombs.
Qge_2—Cinders of vent 8602.	—do.—	1.0–2.0	GP147	Qgh_7 Qgg_4	—	0.77–0.97	AOB	Cinders are fragmented.
Qge_1—Minor flow on north flank of vent 0634.	Degraded; forms small ridge.	1.0–2.0	—	Qgk	—	0.74–1.35	—	Unit may be an outlyer of (and correlative with) unit Qga.
Olivine-plagioclase basalt								
Qgg_4—Flow and cinders of vents 8614A and 8611B.	Smooth to locally irregular; alluvial cover; thickness 1–3 m; vent material degraded.	2.0–5.0	740GP GP118 GP121	Qgj_2 Qgh_7	Qgh_3 Qgd_2 Qig Qic_3 Qge_2 Qgp_5 Qpp_4 Qih_1 Qid_2	0.73–0.97	AOB	—
Qgg_3—Flow and cinders of vent 0633.	Blocky and irregular; locally alluvium covered; vent material slightly degraded.	2.0–3.0	WK33 WK23	Qgk	Qgb_1 Qgd_1 Qgg_1 Qcl_1 Qcc_6	0.73–0.93	TR	—
Qgg_2—Flow and cinders of vent 9610 (Cerro Trigo).	Smooth; alluvial cover; dissected; thickness 2–3 m; vent material moderately degraded.	1.0–4.0	WK45 WK77	Qgj_2 Qgk	Qgl_3 Qga Qdc_3 Qgc_1 Qdd_2 Qdd_1	0.74–1.10	MUG	—
Qgg_1—Flow and cinders of vent 9605 (Negro Knoll).	Smooth; dissected; vent material moderately degraded.	1.0–2.0	—	Qgh_7 Qgg_3 Qgb_1 Qgd_1(?)	Qgp_2	0.98–1.25	—	Spatter on cinder cone summit.

Aphyric basalt								
Qgh_7—Composite flow and cinders of vent 8611A.	Smooth; alluvial cover; locally dissected; thickness 1–3 m.	—	708WK R34 WK60	Qjl_4 Qgb_2 Qgj_2 Qgh_6	Qgp_7 Qgc_5 Qgk Qjd_2 Qgg_4 Qja_2 Qgd_4 Qgh_2 Qgb_1 Qgh_3 Qgj_1 Qgp_3 Qge_2 Qgg_1 Qjg_3 Qie(?) Qjc_3 Qjl_1 Qic_1(?) Qcc_6 Qjp_1 Ku	0.76±0.02	HAW	Locally moderately coarse grained. Lava tube at Harris Cave, (SE1/4NE1/4, sec. 18, T. 9 N., R. 26 E. K-Ar sample 708WK (Cooper and others, 1990). Polarity: NM, sites 170, 191, suggests age of <0.73 Ma.
Qgh_6—Flows and cinders of vent 8615.	Smooth; locally alluvium covered and dissected; thickness 1–3 m; vent moderately degraded.	—	GP137 UP2	Qgh_7	Qgh_5 Qgh_4 Qge_3	0.72–0.97	AOB	—
Qgh_5—Composite flow and cinders of vents 8609A, 8609B, and 8609C.	Smooth; alluvial cover; vent material degraded.	—	—	Qgb_2 Qgh_6	—	0.70–0.96	—	—
Qgh_4—Flow and cinders of vent 8623.	Irregular surface but locally alluvium covered.	—	GP135 GP138	Qgh_6	Qgp_6(?) Qgh_3 Qpj Qph_4(?) Qpc_2	0.73–0.97	MUG	—
Qgh_3—Flow and cinders of vent 8613A.	Rough but locally alluvium covered.	—	707GP GP129 GP1	Qgh_7 Qgg_4 Qgh_4 Qge_3	Qgd_3 Qgd_2 Qgp_5 Qgp_4 Qpp_4 Qpg_2 Qpc_5 Qkd_4 Qpc_2 Qpb Qph_2 Qpc_1 Qid_2	0.90–0.97	MUG	Overflows escarpment along east lobe. Locally coarse grained (to 1.0 mm). Polarity: NM, sites 172, 192.
Qgh_2—Cinders of vent 9609.	Degraded cinder cone.	—	WK57	Qgh_7	Qgb_1	0.73–1.15	MUG	—
Qgh_1—Flow and cinders of vent 8606.	Smooth; alluvium covered; thickness 2–3 m.	—	—	Qgb_2 Qgd_5 Qjh_2	—	0.90–1.43	—	—
Quartz basalt								
Qgj_2—Composite flow and cinders of vent 9626 (Saint Peter's Dome).	Irregular and undissected; locally alluvium covered; thickness 3–10 m; vent material undissected.	0.5–1.2	710WK 743WK WK74 WK103 743WK	—	Qgh_7 Qgk Qgg_4 Qgg_2 Qgh_2 Qgb_1 Qdc_{91} Qdg Qic_2 Qdc_8 Qdl Qga Qie Qgl_1 Qic_1 Qdd_5	0.67±0.022	HAW	Quartz phenocrysts, probably of accidental origin, and cognate olivine. K-Ar sample UAKA 82-197 (Aubele and others, 1986). Polarity: NM, sites 156, 157.

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
			Quartz basalt—Continued					
					Qih_1 Qgc_2 Qgc_1 Qid_2 Quc_2 Qde_1 Qdd_1			
Qgj_1—Minor flow 1 km southwest of vent 9609.	Moderately smooth.	<0.5	—	Qgh_7 Qgb_1	—	0.67–1.20	—	Sparse quartz phenocrysts a groundmass similar to that of units Qgh_7 and Qgh_4; could be outlier of unit Qgj_2 if in fact younger than unit Qgb_1, although has coarser grained groundmass.
			Hornblende basalt					
Qgk—Flow and cinders of vents 0634 and 9603.	Irregular and blocky; locally alluvium covered; thickness 3 m; vent material undissected.	<4 cm	WK31	Qgj_2 Qgh_7	Qgg_3 Qgg_2 Qgb_1 Qge_1 Qcl_1 Qdc_3 Qdd_2	0.73–0.93	BEN	Hornblende phenocrysts average 4 mm in diameter; feldspar phenocrysts are 2–4 mm.
			Plagioclase basalt					
Qgl_4—Cinders and spatter of vent 9629.	Degraded cinder cone.	—	—	Qgc_5	—	0.53–1.35	—	—
Qgl_3—Flow and agglomerate of vent 9602.	Smooth; alluvial cover.	1.0–3.0	TP6	Qgg_2	Qga	0.74–1.20	TR	Flow erupted from small vent on east flank near summit of laccolithlike hill that warped flows of unit Qga into dome.
Qgl_2—Cinders of vent 8718A.	Degraded cinder cone.		GP125	—	—	0.65–1.45	MUG	—
Qgl_1—Cinders and spatter of vent 9615.	Vent material very degraded, may be faulted; forms anomalous cinder ridge; banded spatter outcrops.	2.0–4.0	WK53	Qgj_2 Qga	—	0.99–1.45	MUG	—
			Pyroclastic deposits					
Qgp_8—Cinders of vent 8605.	Degraded vent material of undetermined lithology.	—	—	Qgb_2	—	0.50–1.05	—	—
Qgp_7—Cinders of vent 8603.	—do.—	—	—	Qgh_7	—	0.70–0.94	—	—
Qgp_6—Cinders of vent 8627.	—do.—	—	—	Qgh_4	—	0.73–1.10	—	—
Qgp_5—Cinders of vent 8708.	—do.—	—	—	Qgg_4 Qgh_3	—	0.90–1.35	—	—
Qgp_4—Cinders of vent 8704.	—do.—	—	—	Qgh_3 Qid_2	—	0.90–1.40	—	—
Qgp_3—Cinders of vent 9608.	—do.—	—	—	Qgh_7 Qgb_1	—	0.89–1.30	—	—
Qgp_2—Cinders of vent 0632B.	—do.—	—	—	Qgb_1 Qgg_1	—	1.03–1.47	—	—
Qgp_1—Cinders of vent 9707B.	—do.—	—	—	Qdc_8 Qga	—	1.14–1.53	—	—
			HAYSTACK MOUNTAIN AREA					
			Olivine-pyroxene basalt					
Qha_2—Flow of vent 8519 (Penrod Mountain).	Smooth; alluvial cover.	0.5–1.0	409MC 409MC2	Qld_7 Qhh_2 Qhg	—	0.35–1.57	AOB	A few pyroxene megacrysts as long as 1 cm.

Qha_1—Flow and cinders of vent 8313 (Largo Mountain).	Smooth; alluvium covered; edge 1–3 m thick.	—	—	—	Qhc_2 Qhb_1 Tha_2	0.65–1.67	—	Local welded spatter on cinder cone.
Tha_2—Flow northeast of vent 8313 (Largo Mountain).	—do.—	0.3–0.5	—	Qha_1 Qhb_1	—	1.75–2.01	—	—
Tha_1—Basal flow of Bog Creek.	Partly dissected.	0.5–1.0	326MC	Thg_2	—	1.75–2.12	TR	Basal flow at Mogollon Escarpment.
				Picritic basalt				
Qhb_3—Flow and cinders of vent 8324 (Kinney Mountain).	Slightly irregular; alluvial cover; edge 3–6 m thick.	0.5–1.0	239MC 702MC	—	Qbc_1 Thc_2	0.30–1.60	TR	Locally welded spatter on cinder cone. Polarity: NM, site 117.
Qhb_2—Flow and cinders of vent 8326.	Smooth; alluvial cover.	0.5–1.0	305IP	Qng	Qbc_1 QTsf	1.49–1.78	TH	Mottled texture at surface.
Qhb_1—Flow and cinders of vent 8407.	Smooth; alluvial cover; edge 2–5 m thick.	0.5–1.0	240MC 241MC	Qhh_1 Qhc_2	Tha_2	1.65–1.85	TR	Rare black pyroxene phenocrysts as large as 5 mm.
Thb_2—Composite flow and cinders of vent 8416 (Haystack Mountain).	Slightly irregular; alluvial cover; thickness 2–7 m.	0.5–1.0	72MC	Qhh_1 Qhg Thc_3(?)	Thc_2 Thb_1	1.87–1.97	TR	Flow on plateau edge. Polarity: R, site 121.
Thb_1—Composite flow on plateau edge southeast of McNary.	Thickness 4–10 m.	0.3–0.5	315MC	Thc_3 Thb_2 Thc_2	QTsf	1.87–2.12	TR	Composed of two flow sheets along plateau edge. Polarity: R, sites 51, 120.
				Olivine basalt				
Qhc_5—Flow 1/2 km northeast of vent 7401.	Smooth; alluvial cover; edge 2–4 m thick.	—	—	—	Qhe	1.00–2.05	—	Dissected by North Fork White River.
Qhc_4—Cinders and minor flow of vent 8424.	Cinder cone degraded.	—	—	—	—	1.00–1.80	—	Rare black pyroxene crystals as large as 1 mm.
Qhc_3—Minor flow and cinders of vent 7401.	Smooth; alluvial cover.	—	—	Qhe	Tg	1.40–2.00	—	Flow on plateau edge.
Qhc_2—Composite flow and cinders of vent 9432.	Smooth; alluvial cover; edge 2–4 m thick.	—	422MC 223MC	Qld_6 Qld_4 Qha_1	Qhb_1 Tha_2 QTsf	1.64–1.84	TR	Ranges from picrite to olivine and sparse olivine basalt.
Qhc_1—Flow 1/2 km southeast of vent 8422 (Blue Mountain).	Smooth; alluvial cover; edge 2–5 m thick.	0.5–1.0	—	Qhg	Thc_3	1.67–1.87	—	Polarity: NM, site 123.
Thc_3—Flow and cinders of vent 8422 (Blue Mountain).	Smooth; alluvial cover; thickness 2–7 m.	0.5–1.0	319MC	Qhg Qhc_1	Thb_1 Thb_2(?)	1.87–1.95	AOB	Flow on plateau edge. Polarity: R, site 122.
Thc_2—Flow on plateau edge south of McNary.	Smooth; alluvial cover; thickness 3–10 m.	0.3–0.5	242MC	Qhb_3 Thb_2	QTsf Thb_1 Thg_1 Tg	1.87–2.00	AOB	Groundmass appears mottled. Polarity: R, site 118.
Thc_1—Basal flow on plateau edge 1 km southeast of vent 8326.	Thickness 3–10 m.	0.3–0.5	307IP	Thd	Tg	1.90–2.10	AOB	—
				Sparse olivine basalt				
Qhd—Flow 1/2 km northeast of vent 7401.		0.5–1.0	401MC	—	Qhe Tg	1.00–1.60	TR	Channel-fill flow(?) in North Fork White River.
Thd—Flow east of vent 8326.	Slightly irregular surface; thickness 4–8 m.	0.3–0.5	304IP	—	Thc_1 Thg_1 Tg	1.90–2.00	TR	Rare green pyroxene megacrysts as large as 15 mm.
				Olivine-pyroxene-plagioclase basalt				
Qhe—Composite flow and cinders of vent 8435.		—	324MC 705MC 325MC 402MC 403MC	Qhg Qhd Qhc_5	Thg_2 Tg	1.35–1.97	AOB TR	Ranges from aphyric to sparse olivine basalt. Contains rare megacrysts of pyroxene as long as 15 mm. Flow on edge of plateau. K-Ar age sample 705MC (Cooper and others, 1990).
				Olivine-plagioclase basalt				
Qhg—Flow of Boyce Spring.	Smooth; alluvial cover; edge 2–4 m thick.	0.3–0.5	—	—	Qha_2 Qhe Qhc_1 Thg_2 Thb_2 Thc_3	0.80–1.87	—	Flow on edge of plateau. Polarity: NM, site 129.
Thg_2—Flow south of vent 8435.	Dissected; thickness 2–6 m.	0.3–05	—	Qhe Qhg	Tha_1	1.60–2.12	—	Basal flow at plateau edge except at Bog Creek.
Thg_1—Basal flow on plateau edge east of vent 8326.	Thickness 3–10 m.	0.3–0.5	309IP	Thd Thc_2	Tg	1.90–2.10	HAW	—
				Aphyric basalt				
Qhh_2—Flow southeast of vent 8424.	Smooth; alluvial cover; edge 1–2 m thick.	—	407MC	—	Qhg Qha_2	0.55–1.35	HAW	Rare black pyroxene.

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
				Quartz basalt—Continued				
Qhh_1—Flow and cinders of vent 8408 (Little Haystack Mountain).	Smooth; alluvial cover; edge 1–3 m thick.	—	—	—	Qhb_1 Thb_2	0.65–1.87	—	—
				IRIS SPRING AREA				
				Olivine basalt				
Qic_3—Cinders of vent 9635A.	Degraded cinder cone.	—	—	Qgg_4	—	0.73–1.27	—	—
Qic_2—Flow and cinders of vent 9731.	Smooth; dissected; thickness 2–3 m; vent material dissected.	0.5–1.0	WK93	Qgj_2	Qid_3 Qip_1 Qih_2 Qid_2 Quc_2	0.70–1.30	TR	—
Qic_1—Flow and cinders of vent 9625.	Irregular surface; locally alluvium covered; dissected margins; vent material smooth and dissected.	1.0–1.5	WK89	Qgj_2	—	0.67–1.83	HAW	—
				Sparse olivine basalt				
Qid_3—Cinders of vent 9730.	Degraded cinder cone.	—	—	Qic_2	Qid_2(?)	0.70–1.30	—	—
Qid_2—Flow and cinders of vent 8706.	Smooth; dissected edges; vent material dissected.	0.5	SN22B SN55	Qkc_4 Qgj_2 Qgg_4 Qgh_3 Qig Qic_2 Qid_3(?)	Qgp_4 Qih_3 Qip_1 Qih_2 Qie Qid_1 Quh_3 Qkc_2 Ku	0.90–1.38	TR	—
Qid_1—Cinder and spatter of vent 9729A.	Degraded vent material with summit spatter and agglomerate outcrops.	—	WK92	Qid_2	—	0.91–1.56	TR	—
				Olivine-pyroxene-plagioclase basalt				
Qie—Flow east of vent 9636.	Smooth; dissected.	2.0–4.0	WK166	Qig Qid_2	Qih_1	0.75–1.61	TR	—
				Olivine-plagioclase basalt				
Qig—Flow and cinders of vent 8601.	Smooth; alluvium covered; dissected; vent material highly degraded.	<2.0	739GP	Qgg_4	Qie Qih_1 Qid_2	0.73–1.21	MUG	—
				Aphyric basalt				
Qih_3—Flow and cinders of vent 9733.	Smooth; thickness to 20 m.	—	SN73	Qkc_4 Qid_2	—	0.75–1.56	BEN	Rare phenocrysts are olivine (to 0.3 mm in diameter) and plagioclase (to 0.4 mm).
Qih_2—Minor flow 1 km southeast and 2 km north-northeast of vent 9731.	Dissected; alluvial cover; locally coarse grained.	—	—	Qic_2 Qip_1 Qid_2	—	0.90–1.42	—	Flowed over pre-existing escarpment; may be correlative with unit Qih_1.
Qih_1—Flow and cinders of vents 9636 and 9635B.	Smooth; alluvial cover; margins dissected; vent material highly degraded.	—	SN22	Qgj_2 Qgh_7 Qgg_4 Qig Qdg Qie	Ku	0.90–1.38	MUG	May be correlative with units Qih_2 and Tah (to east).

				Pyroclastic deposits				
Qip_2—Cinders of vent 9729B.	Degraded vent material of undetermined lithology.	—	—	—	—	0.73–1.59	—	—
Qip_1—Cinders of vent 9732.	—do.—	—	—	Qic_2 Qid_2	Qih_2	0.90–1.41	—	—
				JUAN GARCIA AREA				
				Olivine-pyroxene basalt				
Qja_2—Flow and cinders of vent 9630 (Harris Lake crater) and vent 9525B(?).	Smooth; dissected.	3.0–5.0	750BB BB113	Qjl_4 Qgb_2 Qgc_5 Qgd_5 Qgh_7	Qjh_6 Qjh_5 Qjh_2	0.73–0.90	HAW	Unbreached crater (Harris Lake) consists of early cinder cone and subsequent phreatic explosion crater. Phreatic ash on crater's southwest rim. Common centimeter -size xenoliths in flow. Polarity: R, site 168.
Qja_1—Flow and cinders of vents 9527A and 9527B and dike of vent 9522.	Minor dissection of flows; vent material degraded.	0.5–1.5	BB155	Qjh_2 Qjc_2	Qji_1 Qjp_3	0.90–1.76	AOB	Dike, 1–2 m wide, 1 km long, on northwest flank of vent 9522.
				Olivine basalt				
Qjc_4—Flow 3 km southeast of vent 0528.	Smooth; dissected.	1.0–1.5	—	Qjg_4	Qjc_3	0.70–1.44	—	—
Qjc_3—Flow and cinders of vents 9514A, 9514C, and 9523.	—do.—	0.8–1.3	BB169 BB117	Qvc_5 Qjh_3 Qjg_3 Qjc_4 Qjh_2 Qjl_2(?)	Qvp_3 Qvd_2 Qji_1	0.91–1.51	TR	—
Qjc_2—Flow and cinders of vent 9528A.	Smooth; alluvial cover; vent material degraded.	0.3–0.5	BB186 BB187	Qjg_5 Qjd_2 Qjg_4 Qjh_4 Qej	Qja_1 Qje Qjh_1	0.90–1.64	HAW	—
Qjc_1—Minor flow and cinders of vent 9530 (Wishbone Mountain).	Smooth; alluvial cover.	1.0–2.0	—	Qje	—	0.96–1.80	—	—
				Sparse olivine basalt				
Qjd_2—Flow and cinders of vent 9528B(?).	Smooth; locally dissected.	1.0--1.5	BB161	Qjg_5	Qec_6 Qvc_5 Qvh_2 Qed_3 Qjh_2 Qeb_2 Qjg_1 Qjc_2 Qjd_1 Qji_1 Qje	0.55–1.20	MUG	—
Qjd_1—Cinders of vent 9520.	Degraded cinder cone; dissected.	1.0–2.0	—	Qjg_5 Qjd_2	—	0.85–1.75	—	—
				Olivine-pyroxene-plagioclase basalt				
Qje—Flow and cinders of vent 9532.	Smooth; dissected; thickness 2–5 m.	0.5–1.5	759BB BB187 BB201	Qjg_5 Qjd_2 Qjg_4 Qjh_4 Qjc_2	Qjc_1(?)	0.95–1.75	AOB	—
				Olivine-plagioclase basalt				
Qjg_5—Flow and cinders of vent 9529.	Smooth to blocky; alluvial cover; thickness 1–2 m.	2.0–3.0	756BB BB162	—	Qjd_2 Qjg_4 Qjh_4 Qej Qjc_2 Qjd_1 Qje	0.35–0.97	TR	Contains minor gabbroic clots. Polarity: NM, site 181.
Qjg_4—Flow and cinders of vent 9517 (Butler Mountain, west).	Smooth; moderately dissected; thickness 4–20 m; vent material partially dissected.	2.0–4.0	BB171 755BB BB199 755BB	Qjg_5	Qjh_4 Qvc_5 Qjc_4 Qjg_2	0.65–1.30	AOB	—

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
			Olivine-plagioclase basalt—Continued					
Qjg_3—Flow 2 km south of vent 0523.	Smooth; alluvial cover.	1.0–3.0	BB165	Qgh_7	Qjc_2 Qje Qjc_3 Qjh_3	0.90–1.22	HAW	—
Qjg_2—Flow and cinders of vent 9616C (Butler Mountain, east).	Smooth; alluvial cover; moderately dissected; thickness 4–20 m; vent material partially dissected.	2.0–4.0	—	Qjg_4	Qji_1	0.80–1.62	—	—
Qjg_1—Cinder and spatter of vent 0520.	Composite outcrop of vesicular reddish-brown agglomerate and dark basalt.	<3.0	V248	Qjd_2	—	0.85–1.61	TH	—
			Aphyric basalt					
Qjh_6—Flow of vent 9525A(?) (Juan Garcia Mountain).	Irregular; partially dissected; thickness 3–20 m.	—	753BB BB114	Qjl_4 Qja_2	Qjh_5 Qjh_3	0.74–0.97	MUG	—
Qjh_5—Flow of vent 9525A(?) (Juan Garcia Mountain).	Irregular; includes local ridges of mantling; constructional origin; brownish-tan ash thickness 8–10 m.	—	751BB BB167	Qja_2 Qjh_6	Qjh_3	0.90–0.97	MUG	Polarity: NM, sites 159, 169.
Qjh_4—Flow and cinders of vent 9505.	Smooth; dissected; thickness 10–20 m.	—	BB198	Qjg_5 Qjd_2 Qjg_4 Qjc_2	Qvc_5 Qje	0.65–1.33	HAW	—
Qjh_3—Flow of vent 9525A(?) (Juan Garcia Mountain).	Smooth; dissected on margins; edges 10 m thick.	—	BB123 S26-7	Qjl_4 Qjh_6 Qjh_5	Qjg_3 Qji_2 Qjh_2 Qjl_2 Qjc_3 Qjl_1	0.90–1.18	MUG	Internal flow foliation near margins suggests moderately high viscosity. Polarity: NM, site 158.
Qjh_2—Flow and cinders of vents 9535 and 9536.	Smooth and dissected; thickness 2–3 m.	—	GP145	Qjl_3 Qja_2 Qjh_3 Qji_2	Qgh_1 Qja_1	0.91–1.39	MUG	—
Qjh_1—Minor flow north of vent 9528A.	Low hill of foliated basalt.	—	BB160	Qjc_2	—	1.00–1.80	AOB	Probably old erosional remnant.
			Pyroxene basalt					
Qji_2—Flow and cinders of vent 9526.	Smooth; dissected; thickness 3 m.	3.0–4.0	BB146	—	Qjh_2	0.79–1.38	MUG	—
Qji_1—Flow and cinders of vents 9521, 9522, 9516A.	Smooth; dissected; thickness 3–4 m.	2.0–4.0	754BB BB170 BB157	Qjd_2 Qjc_3 Qjg_2 Qja_1	—	0.90–1.77	HAW	—
			Plagioclase basalt					
Qjl_4—Flow and cinders of vent 9512A (Coon Mountain).	Irregular; undissected; near vent consists of reddish-brown vesicular blocks and soil; thickness 3–6 m.	<5.0	BB112	—	Qgh_7 Qja_2 Qjh_6 Qjh_3 Qjl_1	0.49–0.73	MUG	—
Qjl_3—Cinders and agglomerate of vent 9525A (Juan Garcia Mountain).	Summit crater unbreached; flanks undissected.	2.0–8.0	BB115	Qjh_6(?) Qjh_5(?) Qjh_3(?)	Qjh_2	0.73–0.93	HAW	Possibly late-stage eruption of vent that was initially responsible for flows Qjh_6, Qjh_5, and Qjh_3.
Qjl_2—Cinders of vent 9514B.	Degraded cinder cone.	<3.0	752BB BB116	Qjh_3	Qjc_3(?)	0.90–1.49	MUG	—
Qjl_1—Flow and cinders of vent 9501 (Garris Knoll).	Smooth; dissected.	<4.0	BB124 BB110	Qjl_4 Qjh_3 Qgh_7	—	0.90–1.54	HAW	Cinders consist of agglomerate and spatter, including spindle-shaped bombs.

				Pyroclastic deposits				
Qjp_3—Cinders of vent 9534A.	Degraded vent material of undetermined lithology.	—	—	Qja_1	Qjp_2(?)	1.02–1.79	—	—
Qjp_2—Cinders of vent 9533A.	—do.—	—	—	Qjp_3(?)	—	1.00–1.80	—	—
Qjp_1—Cinders of vent 9512B.	—do.—	—	—	Qgh_7	—	1.05–1.90	—	—
				KNOLLS AREA				
				Olivine-pyroxene basalt				
Qka_2—Flow and cinders of vent 9821.	Hummocky; moderately dissected and alluvium covered; thickness 2–4 m.	0.3–2.0	741S SN57 SN95	Qkc_4	Qkd_3 Tag Tkg	0.63–1.32	AOB	Flow surface includes rafted cinder cone fragment. Phenocrysts are moderately abundant to abundant pyroxene (0.3–2.0 mm in diameter); sparse to rare plagioclase (0.3–1.5 mm).
Qka_1—Cinders of vent 8701B.	Degraded cinder cone.	—	—	Qkc_4	—	1.14–1.68	—	—
				Picritic basalt				
Qkb_2—Late-stage flow of vent 0833 (Twin Knolls).	Very rough and blocky; thickness 3–4 m.	0.3–1.5	732SN SN28	—	Qkc_6 Qkc_5 Qkc_3 Quh_4	0.308±0.070	TR	May be fissure eruption; youngest dated flow of field: K-Ar sample UAKA 82-195 (Aubele and others, 1986). Rare pyroxene phenocrysts to 0.3 mm. Polarity: NM, site 154.
Qkb_1—Cinders, ash and spatter of vent 0827.	Degraded cinder cone.	1.5	CX2	Qkc_6	—	0.61–1.25	AOB	Contains xenoliths.
				Olivine basalt				
Qkc_6—Flow and cinders of vent 0833 (Twin Knolls, south).	Rough and hummocky; some alluvial cover; thickness from 3–7 m.	0.3–1.5	S6 SN100 LLS99 6663 LC1	Qkb_2	Qkc_5 Qkc_4 Qkp_3(?) Qkb_1 Qab Qkd_1 Qrd_1 Tag QTg Ku	0.75±0.13	AOB	Stratigraphic relations and magnetic polarity suggest age of 0.61 Ma. K-Ar sample AWL-5-77 (Laughlin and others, 1980). Polarity: NM, sites 144, 145.
Qkc_5—Flow and cinders of vent 0828 (Twin Knolls, north).	Rough and hummocky with some alluvial cover; thickness varied from 3–7 m.	0.5–1.5	—	Qkb_2 Qkc_6	Qkc_3 Qrc Qkd_1 QTg Ku	0.60–0.61	—	Appears to be early eruptive phase of vent 0833 that produced unit Qkc_6.
Qkc_4—Composite(?) early flow of vents 8702 and 8701B.	Moderately rough; locally alluvium covered; thickness 2–3 m.	1.0–3.0	713SN SN8 G45 SN51 SN52 SN54	Qke(?) Qkc_6	Qkp_2(?) Qka_2 Quh_4 Qih_3 Qrc Qud_1 Qud_1 Qkd_3 Qkd_2 Qka_1 Qid_2 Quh_3 Qkh_2 Qkc_2 Qkc_1 QTac Tag Ku	0.61±0.01	HAW	Increased concentrations of plagioclase and pyroxene phenocrysts near vent. K-Ar sample 713SN (Cooper and others, 1990).
Qkc_3—Flow and cinders of vent 0829.	Rough; partly alluvium covered; thickness 1–3 m.	1.0–1.5	SN29	Qkb_2 Qkc_5	Quh_4	0.62–1.04	TR	Includes sparse plagioclase phenocrysts 1.0–1.5 mm in diameter.
Qkc_2—Flow and cinders of vents 8715A and 8715B.	Moderately smooth; alluvial cover; thickness 1–10 m.	1.0–2.0	G48 FP2	Qkc_4 Qkd_4 Qid_2 Qah_1	Qkh_1	1.35–2.21	TR	—
Qkc_1—Minor flow and cinders of vent 9830.	Moderately degraded cinder cone.	0.3–1.0	—	Qkc4	Ku	1.50–2.08	—	—
				Sparse olivine basalt				
Qkd_4—Flow and cinders north of vent 8715B.	Moderately smooth; thickness 2 m.	0.3	—	Qgh_3	Qkc_2	0.97–1.63	——	May be a continuation of unit Qpd_4 (to west).
Qkd_3—Flow 4 km south-southeast of vent 0833.	Smooth; dissected and alluvium covered.	0.3–2.0	S97	Qkc_4 Qka_2	Tkg	0.91–1.72	TR	—

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
				Sparse olivine basalt—Continued				
Qkd_2—Minor flow 2 km south of vent 9821.	Moderately smooth; thickness 10 m.	0.3	—	Qkc_4	—	0.90–1.79	—	May correlate with units Qkd_3 or Qid_2.
Qkd_1—Flow 2 km north of vent 0827.	Smooth; alluvial cover; thickness 20 m.	0.5	LL81	Qkc_6 Qab	—	1.00–1.72	AOB	—
				Olivine-pyroxene-plagioclase basalt				
Qke—Flow and agglomerate of vents 8702 and 8701A.	Slightly degraded cinder cone having breached crater.	3.0–7.0	—	—	Qkc_4(?) Qah_1 Tag	0.58–0.61	—	Interior crater wall contains phenocryst-rich spatter. May be late eruptive product associated with unit Qkc_4.
				Olivine-plagioclase basalt				
Tkg—Minor flow 3.5 km southeast of vent 0833.	Smooth; dissected.	1.0–1.5	—	Qka_2 Qkd_3 Tag	—	1.78–2.10	—	May be lower flow sheet of unit Tag.
				Aphyric basalt				
Qkh_2—Minor flow and cinders of vent 9820.	Moderately smooth.	—	—	Qkc_4	—	1.20–1.99	—	—
Qkh_1—Cinders of vent 8703.	Moderately degraded cinder cone.	—	—	Qkc_2	—	1.50–2.08	—	—
				Pyroclastic deposits				
Qkp_4—Ash deposit north of vent 0827.	Black ash.	—	—	—	—	0.10–0.59	—	—
Qkp_3—Pyroclastic deposit 1 km east of vent 0833.	Black basaltic ash deposit.	—	—	Qkc_6(?)	—	0.45–0.83	—	Covers large area northeast of vent 0833 and north of vent 0827.
Qkp_2—Pyroclastic deposit 3 km northeast of vent 8701B.	Basaltic spatter.	—	—	—	—	0.30–0.93	—	—
Qkp_1—Pyroclastic deposit northeast of vent 9821.	Cinders and ash.	—	—	—	—	0.63–1.32	—	Probably rafted deposit of vent 9821 on top of unit Qka_2.
				LAKE MOUNTAIN AREA				
				Olivine-pyroxene basalt				
Qla_3—Flow and cinders of vent 8506.	Slightly irregular; alluvium covered; edge 2–5 m thick.	1.0–2.0	414MC 414#2	—	Qld_7(?)	0.30–1.00	BAS	Dark-green pyroxene phenocrysts as large as 5 mm.
Qla_2—Flow and cinders of vent 9435A.	Smooth; alluvium covered; edge 1–3 m thick.	0.5–1.0	425SM	—	Qlh_5 Qld_3	0.30–1.00	AOB	Possible polygenetic cinder cone; may have erupted unit Qlh_5.
Qla_1—Minor flow and cinders of vent 9434A.	Cinder cone moderately degraded.	—	762SM	—	Qlh_7 Qlh_6	0.30–1.10	AOB	—
				Olivine basalt				
Qlc_6—Cinders, dikes, and spatter of vent 9423 (Lake Mountain).	Cinder cone slightly degraded.	—	505SM S15-7	Qlh_3	—	0.40–0.97	TR HAW	Several occurrences of welded spatter; cinders locally red. Polarity: NM, sites 113, 138.
Qlc_5—Flow south of Reservation Flat.	Slightly irregular; alluvium covered; edge 2–3 m thick.	0.5–1.0	—	Qld_9 Qld_8	Qlh_1(?)	0.73–0.90	—	Polarity: R, sites 124, 126.
Qlc_4—Cinders of vent 9435B.	Cinder cone moderately degraded.	—	—	—	—	0.80–1.70	—	—
Qlc_3—Flow of Telephone Tank.	Slightly irregular; partly dissected.	0.3–0.5	221SM	Qld_6 Qld_4	Qlc_2	1.30–1.55	TR	—
Qlc_2—Flow west of Telephone Spring.	—do.—	0.3–0.5	—	Qlc_3 Qlh_2	—	1.10–1.90	—	Locally fissile to platy.
Qlc_1—Minor flow and cinders of vent 9435C.	Cinder cone highly degraded.	—	—	—	—	1.25–1.85	—	
				Sparse olivine basalt				
Qld_9—Flow and cinders of vent 8402.	Irregular; alluvium covered; edge 1–4 m thick.	0.3–0.5	—	—	Qlc_5 Qld_4	0.30–1.10	—	Local occurrences of dark-green pyroxene crystals as large as 4 mm.

Qld_8—Composite flow and cinders of vents 8401A and 8412(?).	Slightly irregular; alluvium covered; 8 m thick.	0.3–0.5	—	—	Qlc_5	0.73–0.90	—	Variable lithology from sparse olivine to aphyric. Polarity: NM, site 125.
Qld_7—Flow north of vent 8424.	Slightly irregular; alluvium covered; edge 2–4 m thick.	0.5–1.0	—	Qlh_8 Qlg_2 Qla_3(?)	Qlh_1 Qha_2	0.90–0.97	—	Polarity: NM, site 127.
Qld_6—Composite(?) flow and cinders of vent 8404 (Brushy Mountain).	Smooth; alluvium covered; edge 2–4 m thick	0.3–0.5	—	—	Qld_4 Qlc_3 Qhc_2	0.77–1.17	—	Varied lithology (sparse olivine to picritic).
Qld_5—Flow north of vent 9434B.	Slightly irregular; edge 2–4 m thick	0.3–0.5	—	Qlh_7	Qlh_4 Qlh_3	0.90–0.97	—	Fissile to platy flow surface. Polarity: NM, site 115.
Qld_4—Composite(?) flow east of vent 8404 (Brushy Mountain) and vent 8410.	Smooth; alluvium covered; edge 2–4 m thick	0.5–1.0	—	Qld_6	Qlc_3 Qhc_2	0.80–1.20	—	Varied lithology (sparse olivine to olivine basalt).
Qld_3—Flow and cinders of vent 9434C(?).	Smooth; alluvium covered; edge 1–3 m thick	0.3–0.5	—	Qlh_5 Qla_2	—	0.70–1.50	—	Varied lithology (sparse olivine to aphyric).
Qld_2—Flow of vent 9531A and 9436.	Smooth; alluvium covered; edge 2–4 m thick	—	BB182	—	Qld_1	1.35–1.75	MUG	—
Qld_1—Minor flow and cinders of vent 9425A.	Smooth; alluvium covered; edge 1–2 m thick	1.0–2.0	50SM	Qld_2	—	1.57–1.75	AOB	Flow locally dissected to 3 m.
			Olivine-plagioclase basalt					
Qlg_2—Flow from vent 8518.	Smooth; alluvium covered; 3 m thick	—	—	Qlh_8	Qld_7	0.50–1.17	—	—
Qlg_1—Flow and cinders of vent 9425B.	Smooth; alluvium covered; thickness exceeds 30 m.	0.5–1.0	424SM	—	—	0.70–1.50	HAW	Flow has massive, steep flow edges.
			Aphyric basalt					
Qlh_9—Flow and cinders of vent 8401B.	Smooth; alluvium covered; edge 1–3 m thick	—	—	—	—	0.30–1.10	—	—
Qlh_8—Flow 3 km northeast of vent 8424.	Slightly irregular; thin alluvium cover; thickness 3 m.	—	—	—	Qlg_2 Qld_7	0.40–0.97	—	—
Qlh_7—Flow and cinders of vent 9434B.	Slightly irregular; alluvial cover.	—	222aS 222bS 761SM	Qla_1	Qlh_6 Qld_5 Qlh_4	0.73–0.90	HAW	Contains rare quartz. Polarity: R, site 116.
Qlh_6—Flow east of Telephone Spring.	Slightly irregular; alluvium cover; edge 1–4 m thick.	—	—	Qlh_7 Qlh_2 Qlh_3 Qlh_2	Qlh_4(?) Qla_1	0.73–1.10	—	Felty groundmass.
Qlh_5—Flow south of vent 9435A.	Smooth; alluvial cover.	—	426SM	Qla_2	Qld_3	0.65–1.25	HAW	Possible early flow from vent 9435A.
Qlh_4—Minor flow 2 km northwest of vent 9434B.	Slightly irregular; alluvial cover; edge 2–3 m thick.	—	—	Qlh_7 Qlh_6(?) Qld_5	Qlh_3	0.73–1.47	—	—
Qlh_3—Composite flow of Danstone Springs and cinders of vents 9427B, 9422B, 9422A, and 9424(?).	Smooth; alluvial cover; edge 2–5 m thick.	—	430SM 437SM 760SM 501BB BB185	Qlh_4 Qld_5 Qmb_6	Qec_5 Qmd_4 Qmb_2	1.01–1.67	AOB TR BAS	Felty groundmass has granular appearance. Composite flow; easternmost part (BAS, sample 760SM) probably from vent 9424. Polarity: T, sites 108, 114.
Qlh_2—Flow of Tenny Flat.	Smooth; thickness 7 m.	—	220SM 500L	Qlh_6	Qbc_3 Qlc_2 Qbb_4 $QTsf$	1.00–1.67	HAW	Contains rare quartz and dark-green pyroxene crystals. Polarity: R, site 87.
Qlh_1—Flow east of Haystack Cienega.	Smooth; alluvial cover.	—	—	Qlc_5 Qld_7	—	1.20–1.60	—	Polarity: R, site 128.
			Pyroclastic deposits					
Qlp_2—Cinders of vent 9419A	Degraded vent of undetermined lithology.	—	—	—	—	1.0–2.0	—	—
Qlp_1—Cinders of vent 9419B.	—do.—	—	—	—	—	1.0–2.0	—	—
			MORGAN MOUNTAIN AREA					
			Picritic basalt					
Qmb_6—Composite flow of Hog Spring and cinders of vents 9416A, 9416B, 9417A, and 9417B.	Smooth to irregular; alluvial cover; edge 1–4 m thick.	0.5–1.0	716SM 231SM 431SM	Qme	Qmh Qlh_3 Qmg Qmb_2 Qmb_4 $QTsf$ Tme	1.01±0.02	TR	Cinder cones contain welded spatter. Flow has multiple fronts. K-Ar age sample 716SM (Cooper and others, 1990). Polarity: R, sites 76, 91, 94, 98, 99.
Qmb_5—Flow of Elk Springs Draw.	Smooth to slightly irregular; edge 1–6 m thick.	—	—	Qmc_4 Qlh_2	Qbb_4	1.00–1.67	—	Polarity: R, sites 86, 88.
Qmb_4—Flow of Bourdon Windmill.	Smooth to irregular; alluvial cover; edge 1–4 m thick.	0.5–2.0	229L	Qmb_6 Qmh Qmg	Qmd_3 Qmd_2 Qmd_1 $QTsf$	1.30–1.80	TR	Varied lithology; local olivine phenocrysts as large as 5 mm. Polarity: R, sites 79, 81, 82.

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
			Picritic basalt—Continued					
Qmb_3—Cinders and spatter of vent 9325 (Sponseller Mountain).	Degraded.	—	—	—	—	1.40–1.80	—	Cinder cone contains welded spatter.
Qmb_2—Composite minor flow and cinders of vents 9408B, 9408C, 9417C, and 9409C.	Cinder cones moderately degraded.	—	—	Qmb_6 Qlh_3	—	1.40–1.80	—	Cinder cones contain local occurrences of welded spatter.
Qmb_1—Cinders and spatter of vent 1225 (Cooley Knoll).	Cinder cone degraded.	—	723SS	—	—	1.20–2.00	TR	Cinder cone contains welded spatter.
			Olivine basalt					
Qmc_4—Flow of Morgan Flat and cinders of vent 9313.	Smooth; alluvium covered; edge 1–3 m thick.	0.3–0.5	111L	Qme	Qbb_4 Qmb_5 QTsf	0.73–1.67	AOB	Lithology varies from olivine basalt to sparse olivine basalt. Polarity: R, sites 75, 85, 90.
Qmc_3—Cinders of vent 9301A.	Cone degraded.	—	—	—	—	1.40–1.80	—	—
Qmc_2—Cinders and minor flow of vent 9303.	Cinder cone moderately degraded.	—	—	—	—	1.20–2.00	—	—
Qmc_1—Cinders and spatter of vent 0327 (Jaques Mountain).	Cinder cone degraded.	—	—	—	—	1.40–1.80	—	Cinder cone contains welded spatter.
			Sparse olivine basalt					
Qmd_5—Flow of Marshall Flat Tank and cinders of vent 9408A.	Smooth; alluvial cover; dissected; thickness 4 m.	0.5–1.0	—	—	Qeg	0.73–1.67	—	Local occurrences of olivine crystals as large as 3 mm. Polarity: R, site 102.
Qmd_4—Composite minor flow and cinders of vents 9409A and 9409B.	Cinder cones moderately degraded.	—	—	Qlh_3	—	1.20–1.60	—	Cinder cones contain local occurrences of welded spatter.
Qmd_3—Flow 3 km southwest of vent 1336 (Ortega Mountain).	Moderately irregular; alluvium covered.	—	—	Qmb_4	QTsf	1.40–1.80	—	—
Qmd_2—Flow of Bell, 3 km southeast of V1225.	Smooth; alluvium covered; edge 1–3 m thick.	—	—	Qmb_4	QTsf	1.50–1.90	—	—
Qmd_1—Minor flow east and north of vent 0329 (Sponseller Mountain).	Smooth; alluvium covered.	—	—	Qmb_4	QTsf(?)	1.50–1.90	—	—
			Olivine-pyroxene-plagioclase basalt					
Qme—Flow and cinders of vent 9418 (Turkey Mountain).	Smooth to slightly irregular; edge 1–4 m thick; alluvium covered.	0.3–0.5	767SM 226SM	—	Qmb_6 Qmb_5 Qmc_4	0.49±0.03	HAW	Youngest dated flow in western part of Springerville volcanic field. K-Ar age sample UAKA 82-136 (Condit and Shafiqullah, 1985). Polarity: NM, sites 89, 95, 96.
Tme—Cinders and minor flow of vent 9301B.	Cinder cone degraded.	0.3–0.5	232SM	Qmb_6	QTsf(?)	1.61–2.10	HAW	Oldest olivine-pyroxene-plagioclase flow in western part of Springerville volcanic field. Polarity: T, site 93.
			Olivine-plagioclase basalt					
Qmg—Flow and cinders of vent 9311 (Morgan Mountain).	Smooth; alluvium covered; edge 1–3 m thick.	0.3–0.5	62L	Qmb_6	Qmb_4	1.01–1.49	HAW	Varied lithology with local occurrences of pyroxene phenocrysts. Polarity: R, sites 74, 77, 78, 84.
			Aphyric basalt					
Qmh—Composite flow of Marshall Mountain and cinders of vents 9406, 0431A, and 0431B.	Smooth to irregular; locally dissected; thickness 1–4 m.	—	230SM	Qmb_6	Qmb_4	1.01–1.50	AOB	Rare black pyroxene crystals as long as 1 cm.
			NORTH FORK WHITE RIVER AREA					
			Picritic basalt					
Qnb_2—Flow and cinders of vent 7303B.	Slightly irregular; alluvium covered; edge 1–3 m thick.	0.5–1.0	301IP	—	Qnc	0.73–1.67	TR	Southernmost vent in western part of Springerville volcanic field.
Qnb_1—Flow 4 km south-southwest of McNary		0.5–1.0	310MC	—	—	1.12–1.80	TR	Isolated outcrop surrounded by colluvium.

QTnb—Flow of Gomez and Gooseberry Creeks and North Fork White River.	Dissected; thickness 3–15 m	0.5–1.0	311MC	Qnd QTnf	Tnc Tg Pc	1.46–2.14	AOB	Channel-fill flow. Polarity: NM, sites 59, 60.
Tnb_3—Flow and cinders of vent 7303A.	Partly dissected.	0.5–1.0	300IP	Qnc	Tg	1.67–2.12	TR	Flow exhumed by tributary to Bull Cienega Creek.
Tnb_2—Flow west of Roberts Ranch.	Smooth; alluvial cover; dissected; thickness 5–10 m.	0.5–1.0	—	Qnc	Pc	1.67–2.14	AOB	Unit south of this map; for location see Condit (1991). Exhumed by Cottonwood Creek. Polarity: NM, site 44.
Tnb_1—Flow east and northeast of Wheat Field Cienega on west edge of the North Fork of the White River.	Smooth; alluvial cover; thickness 4–10 m.	0.3–1.5	303IP	Tnc	Tnf_1 Tng	2.00–2.12	AOB	Polarity: NM, sites 51, 53.
Olivine basalt								
Qnc—Flow and cinders of vent 8327 (Cooley Mountain).	Irregular; alluvium covered; edge 1–10 m thick.	—	69IP 701IP	Qnb_2	Qng Qbc_1(?) QTsf Tnb_2 Tnb_3 Tg	0.73–2.00	TR	Ranges from sparse olivine basalt to picrite. Locally includes flow rubble. Polarity: R, sites 40, 41.
Tnc—Basal flow of area of Gomez and Gooseberry Creeks.	Dissected; thickness 4–8 m.	0.3–6.5	302MC	Qnd Qng QTnb QTnf	Tnb_1 Tng Tg Ku Pc	2.05±0.10	TH	Oldest dated flow in western part of Springerville volcanic field. K-Ar sample UAKA 82-95 (Condit and Shafiqullah, 1985). Polarity: NM, NM, sites 55, 57, 68, 71
Sparse olivine basalt								
Qnd—Uppermost flow of area of Gomez and Gooseberry Creeks.	Smooth; alluvial cover; thickness 2–10 m.	0.5–1.0	238MC 238#2	—	Qng QTnf QTnb Tnc Tg	1.47±0.06	TR HAW	May represent previously unrecognized normal paleomagnetic subchron in Matuyama Reversed Chron; K-Ar sample UAKA 82-96 (Condit and Shafiqullah, 1985). Polarity: NM, sites 58, 65, 72, 73.
Diktytaxitic basalt								
QTnf—Minor channel-fill flow at confluence of Gomez and Gooseberry Creeks.	Thickness 5–10 m.	0.5–1.0	312	Qnd	QTnb Tnc	1.44–2.14	AOB	Polarity: NM, site 70.
Tnf_2—Middle flow of Cottonwood Canyon.	Smooth; alluvium covered; dissected; thickness 3–10 m.	0.5–1.0	—	Tnb_2	Tng Pc	2.02–2.12	—	Dissected by North Fork White River. Unit located south of map area; see Condit (1991). Polarity: NM, sites 43, 49.
Tnf_1—Flow south of Wheat Field Cienega.	Smooth; alluvial cover; thickness 4–10 m.	0.5-1.0	—	Qnc Tnb_1	Tg Ku Pc	2.02–2.14	—	Dissected by North Fork White River. Extends south of map area; see Condit (1991). Polarity: NM, sites 47, 48; also south of map area.
Olivine-plagioclase basalt								
Qng—Flow and cinders of vents 8335B and 8335A(?).	Slightly irregular; alluvium covered; edge 2–5 m thick.	0.5–1.0	314MC 268IP 804MC1	Qnc Qnd	Qhb_2 QTsf Tnc Tg Ku	1.44–1.68	TH	Contains boulders, cinders and welded spatter. Polarity: NM, sites 56, 64, 66.
Tng—Basal flow of Cottonwood Canyon, North Fork White River, and rim of North Fork White River east of Wheatfield Cienega.	Partly dissected; thickness exceeds 5 m.	0.5–1.0	—	Tnc	Pc	2.02–2.14	AOB	Southern part of unit south of map area; see Condit (1991). Polarity: NM, sites 45, 46 (south of map area), site 54.
ORTEGA SINK AREA								
Olivine-pyroxene basalt								
Qoa_2—Flow and cinders of vents 2621A and 2621B .	Irregular; locally dissected; edges 3 m thick; cinder cone degraded.	2.0–5.0	C268	—	Qoh Qoc_4 Qod_2 Tof	0.64–1.45	TR	Flow faulted and deformed by local warping;vents surrounded by low spatter mounds possibly elongated along fissure paralleling local axis of flexure and faulting that strikes N. 25° W.
Qoa_1—Minor flow and cinders of vent 1603.	Degraded flow and vent material; thickness 1–2 m.	1.0–3.0	PD5	Qcb_3	— Qoc_5	0.69–1.82	AOB	—
Olivine basalt								
Qoc_5—Flow west of vent 1603.	Smooth; partially dissected; thickness 4–8 m.	1.5–2.0	—	Qcb_3	Qok Qoa_1 Qod_2 Tof(?)	0.84–1.30	—	Vent 1610 is possible source.

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
				Olivine basalt—Continued				
Qoc_4—Flow west of vent 2621A.	Smooth to rough; dissected; thickness 3–4 m.	1.5–2	—	Qoa_2	Qod_2	0.80–1.47	—	—
Qoc_3—Minor flow 3 km west of vent 1603.	Degraded and deflated.	0.5–0.8	—	Qok	—	0.90–1.37	—	—
Qoc_2—Flow 2 km east of vent 1613.	Smooth; alluvial cover.	0.5–1.0	—	Qcg_3 Qod_4	Qod_1	1.05–1.96	—	May be correlative with unit Qcc_5.
Qoc_1—Cinders of vent 1610.	Degraded vent material.	—	—	Qoc_5(?)		1.05–2.09	—	May be rootless spatter mound.
				Sparse olivine basalt				
Qod_4—Composite flow and cinders of vents 1612A, 1612B and 1707.	Rough; dissected; southern portion faulted; edges 3–10 m thick; cinder cones partially dissected.	0.3–0.5	PD2 CH244 CH243	Qcg_3 Qcc_5 Qcc_3	Qod_3 Qoc_2 Qod_1 QTg Tof	1.00–1.90	HAW	—
Qod_3—Flow 2 km northeast of vent 1602.	Smooth; dissected; thickness 3-4 m.	0.3–0.5	—	Qod_4	—	1.02–1.99	—	May be lower flow sheet of unit Qod_4.
Qod_2—Flow east of vent 2629.	Smooth; alluvial cover; dissected.	0.3–0.5		Qoc_5 Qoa_2 Qok Qoc_4	—	1.11–2.06	—	—
Qod_1—Flow 3 km east of vent 1713.	Smooth; alluvium covered; dissected.	0.5–0.8	LLS91	Qcd_7 Qod_4 Qoc_2 QTg	—	1.10–2.08	TR	—
				Diktytaxitic basalt				
Tof—Flow east of vent 2615.	Alluvium covered; dissected; faulted; thickness 2–3 m.	0.5–1.0	801C#1 C265 C270	Qcg_3 Qoa_2 Qod_4 QTg	—	6.40–6.78	TH	Most hypersthene-normative tholeiitic unit in field. K-Ar ages 6.52±0.12; 6.66±0.12, aliquots of sample 801C (Cooper and others, 1990). Polarity: NM, site 801.
				Olivine-plagioclase basalt				
Qog—Cinders of vent 1602.	Moderately degraded cinder cone.	1.0–2.0	C266	Qcg_3	—	0.65–1.11	AOB	May also compose outcrop immediately to west, mapped as unit Qcg_3.
				Aphyric basalt				
Qoh— Cinders of vent 2615.	Dissected vent material of spatter, agglomerate, cinder, and ash.	—	C269	Qoa_2	—	0.78–1.43	TR	Fills local graben.
				Hornblende basalt				
Qok—Flow and cinders of vent 2629 (Concho Springs Knoll).	Irregular; partially dissected; edge 20–30 m thick.	2.0–5.0	C258 S29-7	Qoc_5	Qoc_3 Qvc_4 Qce_1 Qod_2	0.90–1.30	MUG	Flow is one-third to one-fourth height of cinder cone and may have been extruded after cone was constructed, possibly from separate vent.
				POLE KNOLL AREA				
				Olivine-pyroxene basalt				
Qpa—Flow east of vent 7705.	Blocky; flow margin dissected.	2.0–3.0	738GP	Qpc_8 Qpc_7 Qpp_3 Qpc_6	—	1.26–1.70	TR	Blocky surface may be periglacial feature.

Picritic basalt								
Qpb—Flow and cinders of vent 8625B.	Smooth; alluvium covered; dissected; vent material degraded; spatter at summit.	1.0–1.5	—	Qgh_3 Qpg_2 Qpd_4 Qpc_2	Qph_2	1.26–1.34	—	—
Olivine basalt								
Qpc_8—Composite flow and cinders of vent 8732A (Pole Knoll).	Rough; locally alluvium covered; thickness 1–2 m; vent material degraded.	0.5–1.0	GP149 712GP G36 G39 G50 PK4	Qac	Qpc_7 Qph_6 Qpd_4 Qpc_6 Qph_2 Qpd_3 Qpk Qpa Qph_1 Qpd_1 Tad_4 Tag	1.30±0.04	TR	K-Ar sample 712GP (Cooper and others, 1990). Polarity: R , sites 165, 174. Stratigraphic relations suggest that unit Qph_2 (K-Ar age 1.27±0.07 Ma) overlies this unit and that two units were emplaced between the two; age on correlation chart shown at youngest extreme of error interval.
Qpc_7—Flow and cinders of vent 7705.	Smooth; alluvium covered; vent material degraded.	0.5–1.2	GP151	Qpc_8	Qpp_3 Qpc_6 Qpc_3 Qpa	1.26–1.56	AOB	—
Qpc_6—Flow and cinders of vents 7709A and 7709B.	Smooth; alluvial cover; vent material degraded and smooth.	1.0–1.5	—	Qpc_8 Qpc_7 Qph_6 Qpp_3	Qpd_2 Qpa	1.26–1.54	—	Polarity: R, site 162.
Qpc_5—Flow and cinders of vent 8717.	Smooth; local periglacial(?) block rings; thickness 2 m; vent material degraded.	0.5–1.5	GP127	Qgh_3	Qpc_1 Qpe	0.97–1.62	AOB	—
Qpc_4—Flow and cinders of vent 7706.	Smooth; alluvium covered; thickness 2–3 m; vent material highly degraded.	0.5–1.5	—	—	Qpc_3	1.05–1.34	—	—
Qpc_3—Flow northeast of vent 7607.	Smooth; dissected.	0.5–1.0	—	Qph_4 Qpc_4	Qpc_2	1.01–1.34	—	Polarity: R, site 160.
Qpc_2—Minor flow and cinders of vent 8624.	Smooth; alluvial cover; vent material degraded.	0.5–1.0	721GP GP128	Qgh_4 Qgh_3(?) Qpg_2 Qpj Qpc_3	Qpb Qph_2	0.97–1.34	TR	—
Qpc_1—Flow and cinders of vent 8719.	Smooth; alluvium covered; vent material highly degraded.	0.3–0.5	GP126	Qgh_3 Qpp_4 Qpc_5	—	0.97–1.63	TR	—
Sparse olivine basalt								
Qpd_4—Flow surrounding vent 8720.	Smooth; dissected.	0.3–0.5	GP132	Qpp_4 Qpc_8	Qpb Qph_2 Qph_1	1.26-1.34	AOB	—
Qpd_3—Minor flow south of vent 8711.	Smooth hill; highly weathered.	1.0–1.5	G37	Qpc_8	—	1.26–1.67	TR	Contains ultramafic xenoliths.
Qpd_2—Cinders of vent 8723.	Degraded cinder cone.	—	—	Qpc_6	—	1.26–1.70	—	—
Qpd_1—Flow 1 km south of vent 8730.	Flow edges dissected.	0.3–0.5	—	Qpc_8 Qph_2(?)	—	1.26-1.73	—	—
Olivine-pyroxene-plagioclase basalt								
Qpe—Minor flow and agglomerate of vent 8716.	Degraded cinder cone.	1.0–3.0	WK79 G35	Qpc_5	—	1.23–1.77	MUG	—
Olivine-plagioclase basalt								
Qpg_2—Minor flow, spatter, and cinders of vent 8625A.	Moderately well preserved cinder cone.	2.0–3.0	GP133	Qgh_3 Qpb Qpc_2	Qpj	0.97–1.34	TH	—
Qpg_1—Flow and cinders of vent 7708A.	Smooth; dissected.	<2.0	737GP GP153	—	—	1.07–1.65	AOB	—
Aphyric basalt								
Qph_6—Flow and cinders of vent 8733 (Pole Knoll, east flank).	Smooth; alluvium covered; dissected; vent material degraded.	—	G49 732#1	Qpc_8	Qpc_6 Qph_5	1.26–1.52	HAW	Polarity: R, sites 164, 166.
Qph_5—Cinders of vent 8722.	Moderately well preserved cinder cone.	—		Qph_6	Tg	1.26–1.56	—	—

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
Aphyric basalt—Continued								
Qph_4—Flow and cinders of vents 8635A, 8635B and 7607 (Big Cienega Mountain).	Smooth; alluvial cover; vent material degraded.	—	GP158	—	Qpc_3	1.05–1.34	BEN	—
Qph_3—Cinders and spatter of vent 7707.	Dark, dense spatter and cinders; degraded vent material.	—	GP150	Qpc_7	—	1.26–1.56	HAW	—
Qph_2—Flow and cinders of vent 8730.	Smooth; degraded; thickness 1–2 m.	—	706GP GP130 GP131	Qgh_3 Qpc_8 Qpd_4 Qpc_2 Qpb	Qph_1 Qpd_1	1.27±0.07	AOB	K-Ar age sample 706GP (Cooper and others, 1990). Stratigraphic relations suggest that unit Qpc_8 (K-Ar age 1.34±0.04 Ma) overlies this unit and that two units were emplaced between the two; age on correlation chart shown at oldest extreme of error interval.
Qph_1—Minor flow 1/2 km southwest of vent 8720.	Smooth; degraded.	—		Qpc_8 Qpd_4 Qph_2	—	1.26–1.70	—	May be correlative with units Qpd_4, Qpc_1, or both.
Quartz basalt								
Qpj—Flow and cinders of vent 8625C.	Smooth; alluvium covered.	1.0–3.0	GP154	Qgh_4 Qpg_2	Qpc_2	0.97–1.34	MUG	Quartz crystals probably accidental; olivine phenocrysts <2.0 mm. Shallow vent area is bowl-shaped depression 30–50 m in diameter.
Hornblende basalt								
Qpk—Flow of vent 8732B (north flank of Pole Knoll).	Forms thick domed plug.	2.0–4.0	711GP GP237	Qpc_8	—	1.26–1.63	BEN	Similar in appearance to Wolf Mountain dome (vent 9506). Polarity: R, site 173.
Pyroclastic deposits								
Qpp_4—Phreatic ash of vent 8729 (Norton Reservoir maar).	Ash and nonjuvenile volcanic fragments forming circular crater rim 6–20 m high.	—	—	Qgh_3	Qpd_4 Qpb Qpc_1	0.97–1.26	—	—
Qpp_3—Cinders of vent 7708B.	Degraded cinder cone of undetermined lithology.	—	—	Qpc_7	Qpc_6 Qpa	1.26–1.56	—	—
Qpp_2—Cinders of vent 7718.	—do.—	—	—		—	1.15–1.82	—	—
Qpp_1—Cinders of vent 8720.	—do.—	—	—	—	—	1.15–1.84	—	—
RICHVILLE AREA								
Olivine basalt								
Qrc—Flow 1 km east of vent 0724A.	Moderately irregular; dissected and structurally deformed; thickness 1–2 m.	<1.5	LLS82	Qkc_5 Qrd_2 Quh_4 Qdc_6	Quh_4 Qdp_3 Ku	0.93–1.53	HAW	—
Trc_3—Minor flow 3 km south of Lyman Lake.	Smooth; dissected; highly weathered; minimum thickness 4 m.	1.0–2.0	—	QTg	Tc	1.40–2.50	—	Valley-fill flow; stratigraphic relations with other volcanic units not apparent.
Trc_2—Composite flow of vent 1711 and unknown source.	Smooth; alluvium covered; dissected; thickness 2–3 m.	1.0	6666 LLS85 LLS86 LLS87	Qcd_7 Qdc_3 Qrd_1	QTg	1.98±0.6	TR	K-Ar age sample UAKA 82-194 (Aubele and others, 1986). Polarity: NM, site 142.
Trc_1—Composite(?) flow 3 km east of Lyman Lake.	Smooth; alluvial cover; faulted; thickness 1–5 m.	0.5–1.5	—	Trg QTg	—	2.80–4.00	—	May have followed channel of ancestral Little Colorado River.
Sparse olivine basalt								
Qrd_2—Flow and cinders of vent 0714.	Moderately rough but covered by alluvium.	1.0	731LS LLS65 LS5	Qt	Qdd_4 Qrc Qdb Qrd_1	0.70–1.28	TR	—

Qrd$_1$—Flow 5 km southwest of Lyman Lake.	Smooth; locally alluvium covered; structurally deformed into broad folds.	0.5	LLS84 LLS83 LLS98	Qkc$_5$ Qrd$_2$ Qdc$_3$ Qdb Qt	Trc$_2$ QTg	1.67–1.87	AOB	Polarity: NM, site 143.
			Olivine-plagioclase basalt					
Qrg—Composite flow 3.5 km north of Springerville.	Rough; thickness 3 m.	0.5	—	—	Trg	0.82±0.04	—	Upper flows of Coyote Hills shield volcano. Multiple flow lobes; upper lobes decrease in length and increase in plagioclase content. K-Ar sample AWL-41-74, (Laughlin and others, 1979); sample location east of map area.
QTrg—Minor flow 3 km south of Lyman Lake.	Smooth; dissected; highly weathered; minimum thickness 4 m.	1.0–2.0	—	QTg	Tc	1.0–2.6	—	Valley-fill flow; stratigraphic relations with other volcanic units not apparent.
Trg—Flow 2 km north of Springerville.	Smooth; alluvium covered; minimum thickness 3 m.	1.0–1.5	See remarks	Qrg Qag QTg	Trc$_1$	2.94±0.14	TH	Lower flows of Coyote Hills shield volcano. Unit appears to be composed of several flows that represent early shield volcano eruption. Sparse to moderately abundant olivine phenocrysts (0.5–1.0 mm in diameter). Chemical analysis of K-Ar sample AWL-40-74 (Laughlin and others, 1979) indicates tholeiitic composition; sample location southeast of map area.
			SHOW LOW CREEK AREA					
			Olivine-pyroxene basalt					
Qsa$_2$—Flow and cinders of vent 1235B.	Moderately smooth; alluvial cover; partly dissected.	0.3–0.5	454 SS 770SS	—	QTsf	1.30–1.60	AOB	Black pyroxene crystals rarely as large as 20 mm.
Qsa$_1$—Flow and cinders of vent 0331.	Alluvium covered; edge 2–4 m thick.	0.5–1.0	119L	—	Qsc$_5$ Qsb$_2$ QTsf	1.32–1.74	TH	Green pyroxene phenocrysts. Polarity: NM, site 2.
			Picritic basalt					
Qsb$_2$—Composite(?) flow and cinders of vent 0224 (First Knoll).	Smooth to moderately rough; alluvium covered; partly dissected; edge 1–10 m thick.	0.3–0.5	122SS Qsc5	Qsa$_1$	QTsf	1.53–1.60	AOB	Varied lithology. Cinder cone contains local accumulations of spatter. Polarity: NM, site 133.
Qsb$_1$—Flow of Scott Reservoir.	Smooth; thick alluvial cover; locally dissected; edge 1–6 m thick.	0.5–1.0	56L 114L	Qsd	Qbg	1.60–1.80	TR	Local columnar joints about 30 cm in diameter where dissected. Polarity: NM, sites 8, 11.
			Olivine basalt					
Qsc$_5$—Flow of Timber Mesa and cinders of vent 9306 (Porter Mountain).	Smooth; alluvium covered; edge 3–30 m thick; cinders black to locally red.	0.3–1.0	55L 103L 59L 104L 120L S30-7	Qsa$_1$	Qsc$_4$ Qsb$_2$ Qsb$_1$ Qsc$_2$ QTsf	1.53±0.21	AOB TR	Flow ranges from microporphyritic to phyric. Magneto-stratigraphic relations suggest that it may belong to an unrecognized subchron. K-Ar age sample UAKA 80-131 (Condit and Shafiqullah, 1985). Polarity: NM, sites 1, 3, 10, 134.
Qsc$_4$—Composite flow and cinders of vents 9304B and 9304A (Twin Knolls) and vent 0333.	Smooth; alluvial cover; edge 1–3 m thick; locally dissected.	0.3–0.5	124L	Qsa$_1$ Qsc$_5$	QTsf	1.34–1.74	AOB	Cinder cone contains local accumulations of spatter.
Qsc$_3$—Cinders of vent 0321 (Woolhouse Mountain).	Cone moderately degraded.	—	—	—	—	1.40–1.80	—	—
Qsc$_2$—Cinders of vent 9307 (Flume Mountain).	—do.—	—	105L	Qsc$_5$	—	1.57–1.93	TR	Summit crater contains local accumulations of spatter.
Qsc$_1$—Minor flow of Frost Tank.	Moderately rough; edge 1–2 m thick.	—	—	Qsc$_5$	—	1.65–1.85	—	—
QTsc—Cinders of vent 0319 (Second Knoll).	Cone degraded; local spatter.	—	—	—	—	1.60–2.00	—	Cinder pit dissects north side of cone.
			Sparse olivine basalt					
Qsd—Flow of Jacques Spring.	Moderately smooth; thin alluvial cover; edge 0.5–4 m thick.	0.3–0.5	112L	Qsg$_2$ Qbb$_4$	Qsb$_1$	1.63–167	AOB	Pahoehoe lava toes preserved at distal end of flow. Polarity: R, site 13.
			Olivine-plagioclase basalt					
Qsg$_2$—Flow and cinders of vent 9305.	Slightly rough; thin alluvial cover; edge 1–3 m thick.	0.5–1.0	107L	—	Qsd	1.74±0.15 1.60	AOB	Black clinopyroxene crystals. Age suggested by stratigraphic and paleomagnetic data. K-Ar age sample UAKA 80-132 (Condit and Shafiqullah, 1985).
Qsg$_1$—Flow and spatter of vent 2136 (Shumway Butte).	Smooth; alluvium covered; edge 2–4 m thick.	0.5–1.0	6T SR188	—	QTsf	1.50–1.90	TR	Diktytaxitic groundmass. Vent material has local accumulations of spatter and minor cinders.
QTsg—Flow northeast of Schoens Crossing.	Smooth; alluvium cover; edge 2–6 m thick.	0.5–1.0	—	—	Trc	1.60–2.00	—	Diktytaxitic groundmass. Caps mesa; locally flow is columnar jointed.

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
			UDALL RANGE AREA					
			Olivine-pyroxene basalt					
Qua_2—Flow west of vent 9702.	Rough; thickness <1.0 m.	>1.0	—	—	Que_1 Qud_3	0.65–1.15	—	Appears to be early flow of vent 9702.
Qua_1—Flow south of vent 9703.	Smooth; alluvium covered; thickness 1–2 m	>1.0	—	Qdg Que_1 Qud_3	Quc_1 Qup_1	0.99–1.61	—	—
			Olivine basalt					
Quc_5—Flow and cinders of vent 9806.	Moderately rough.	0.5–1.5	734SN SN27	—	Quh_4	0.80–1.09	HAW	Vent 9806 appears to align with fissure vents of unit Qug. Polarity: R, site 155.
Quc_4—Flow and cinders of vent 9715.	Rough; thickness 3 m.	0.5–2.0	SN14	—	Quc_3 Quc_2 Quj Quh_1	0.76–1.44	AOB	Rare plagioclase phenocrysts averaging 2.0 mm in length.
Quc_3—Flow east of vent 9714A.	Blocky.	1.0–3.0	SN10	Qud_2 Quh_4 Quc_4	Quh_2 Quj	0.99–1.41	TR	—
Quc_2—Composite(?) flow and cinders of vent 9722.	Smooth; alluvial cover; edge 1 m thick.	0.5–3.0	SN15	Qic_2 Quc_4	Quh_1	1.05–1.82	TR	—
Quc_1—Flow and cinders of vent 9703.	Smooth; alluvial cover; thickness ≈2 m.	0.3–1.0	SN23	Qdg Qud_3 Qua_1	—	1.04–1.91	TR	Abundance of phenocrysts varied.
			Sparse olivine basalt					
Qud_3—Minor flow and cinders of vent 9710A	Smooth; thickness 1 m; cinder cone degraded.	0.3	TH1	Qua_2 Quh_4 Que_1	Qua_1	0.99–1.29	AOB	—
Qud_2—Flow and cinders of vent 9714A.	Moderately rough.	0.3–0.5	SN17	Quh_4 Que_1	Quc_3	0.99–1.38	TR	Rare phenocrysts of plagioclase to 1.5 mm and of pyroxene to 0.5 mm.
Qud_1—Minor flow 5 km south-southwest of vent 0833.	Smooth; alluvium covered.	1.5	—	Qkc_4 Quh_4	—	0.99–1.59	—	—
			Olivine-pyroxene-plagioclase basalt					
Que_2—Flow and cinders of vent 9702.	Moderately rough; thickness 3 m.	1.0–5.0	SN25	—	Quh_4	0.71–1.09	TR	Flow appears to be second of two from vent (first flow formed unit Qua_2).
Que_1—Flow and cinders of vent 9710B.	Locally rough but alluvium covered; thickness 1 m.	0.3–10.0	SN16 BM3 606	Qua_2 Qdg Quh_4	Qud_3 Qud_2 Qua_1 Quh_1	0.99–1.24	TR	Phenocrysts of olivine (0.3–0.5 mm); of pyroxene (to 0.3 mm); of plagioclase) to 10 mm). Polarity: R, site 153.
			Olivine-plagioclase basalt					
Qug—Composite flow and cinders of fissure vents 9701A, 9701B and 9701C.	Rough; locally alluvium covered; thickness 1–3 m.	0.5–5.0	733SN SN26	—	Quh_4	0.60–1.09	AOB	Aligned fissure vents erupted through unit Quh_4; fissure strikes N. 75° E.
			Aphyric basalt					
Quh_4—Flow and cinders of vent 9711.	Moderately rough except where alluvium covered; hummocky near central collapse depression in flow; thickness 1–10 m.	—	722SN SN11 SN24	Qkb_2 Qkc_5 Qug Que_2 Quc_5 Quc_3 Qrc	Qkc_3 Qkc_3(?) Que_1 Qud_3 Qud_2 Quc_3 Qud_1	1.04±0.05	BEN	Near flow edges are local concentrations of large (>1.0 mm) olivine, plagioclase and pyroxene phenocrysts; central sag may result from draining of breached flow-margin levee. K-Ar sample UAKA 82-196 (Aubele and others, 1986). Polarity: R, site 152.

Quh$_3$—Flow and cinders of vent 9818.	Smooth to hummocky; degraded vent material; thickness uncertain, possibly as great as 6 m.	—	SS6-2 SN9	Qkc$_4$ Qid$_2$	Quj	1.05–1.85	HAW	Flow surface interupted by ledge or bench that possibly represents second eruptive pulse.
Quh$_2$—Cinders of vent 9713.	Degraded vent material.	—	—	Quc$_3$	—	1.16–1.90	—	—
Quh$_1$—Minor composite(?) flow 1 km north, south, and east of vent 9722.	Smooth; alluvium covered; dissected; locally dips 35° W.	—	SN20 SN13 SN21	Qdg Que$_1$ Quc$_4$ Quc$_2$	—	1.53–2.05	MUG	Rare occurrences of small olivine and plagioclase phenocrysts. Forms mesas or ridges, probably remnants of an early flow.
			Quartz basalt					
Quj—Composite(?) flow and cinders of vent 9723.	Smooth; alluvium covered; dissected.	0.3–1.0	SN33 SN12 SN18	Quc$_4$ Quc$_3$ Quh$_3$	—	1.25–1.95	HAW	Sparse to moderately abundant olivine and quartz glomerocrysts.
			Pyroclastic deposits					
Qup$_2$—Cinders of vent 9714B.	Degraded vent material of undetermined lithology.	—	—	—	—	0.77–1.46	—	—
Qup$_1$—Volcanic conglomerate southwest of vent 9703.	Red mudstone with volcanic ash and lithic fragments of scoria, basalt, and minor sandstone.	—	—	Qua$_1$	—	1.30–2.17	—	Contains reworked fragments of Cretaceous rocks.
			VERNON AREA					
			Olivine basalt					
Qvc$_5$—Flow and cinders of vent 0528 (Serviceberry Hill).	Smooth; partially dissected; edge 3–6 m thick; cone undissected.	0.5–1.0	BB250	Qjd$_2$ Qjg$_4$ Qjh$_4$ Qjg$_1$	Qvh$_2$ Qvd$_5$ Qvc$_4$ Qeb$_2$ Qjc$_3$ Qvc$_2$ Qvd$_2$ Qvh$_1$ Qcd$_1$	0.85–1.15	AOB	—
Qvc$_4$—Composite flow of Little Ortega Lake.	Surface irregular and locally dissected.	0.5–1.2	719V V252 CL260	Qvc$_5$ Qvd$_5$ Qvd$_4$ Qvd$_3$ QTg	Qvp$_2$(?) Qvc$_2$ Qvh$_1$ Qvd$_1$(?) Qwg$_3$ Ku Trc	0.98–1.35	TR	North of vent 1526 (Smooth Knoll) flow upwarped by regional flexure. K-Ar age 1.30±0.05, UAKA 82-191 (Aubele and others, 1986); 1.00±0.02, 719V (Cooper and others, 1990). Polarity: NM, site 139. Sample for K-Ar ages collected from vesicular flow tops approximately 200 m apart, magnetic polarity site 139 co-located with sample UAKA 82-191. The one sigma error bars of neither age overlap period of normal magnetic polarity; unit is placed at 1.15 Ma on correlation chart.
Qvc$_3$—Flow 2 km south of vent 1601.	Smooth; alluvial cover; degraded.	0.3–0.5	—	—	Qvd$_1$	0.97–1.47	—	May be correlative with unit Qcc$_2$.
Qvc$_2$—Flow 2 km northwest of vent 1526.	Smooth; alluvium covered; dissected.	0.5–1	—	Qvc$_5$ Qvc$_4$	—	0.97–1.62	—	—
Qvc$_1$—Minor flow 2 km northeast of Laguna Salada .	Smooth; largely mantled by eolian silt from Laguna Salada.	0.5–1.0	—	Qvd$_4$ Qvd$_3$	—	0.95–1.77	—	—
			Sparse olivine basalt					
Qvd$_5$—Flow and cinders of vents 0504A, 0504B, and 1529.		0.3	V253	Qvc$_5$ Qvh$_3$	Qvd$_3$ Qvc$_4$ Qvc$_1$	0.77–1.27	TR	—
Qvd$_4$—Flow 2 km west of Little Ortega Lake.	Smooth; moderately dissected; thickness 7–8 m.	0.5–0.8	—	—	Qvc$_4$ Qvc$_1$ Trc	0.85–1.35	—	Vent not apparent; unit appears to be down-faulted into Laguna Salada; may be correlative with unit Qwd$_1$.
Qvd$_3$—Flow 2 km northeast of vent 1529.	Smooth; alluvium covered; degraded; thickness <5 m.	0.3	—	Qvd$_5$	Qvc$_4$ Qvc$_1$	0.90–1.35	—	—
Qvd$_2$—Flow and cinders of vent 0523.	Smooth; dissected; possibly faulted; thickness 3 m.	0.5	—	Qgh$_7$ Qvc$_5$ Qjc$_3$ Qvp$_3$	Ku	0.90–1.70	—	—
Qvd$_1$—Minor flow southeast of vent 1601.	Smooth; dissected.	0.3–0.5	—	Qvc$_4$(?) Qvc$_3$	—	1.15–1.85	—	—

Table 5. *Description of volcanic units*—Continued

[All units are massive, light to dark gray, and have fine-grained groundmass unless noted in Remarks column. Volcanic units are distinguished largely by phenocryst type (shown in second-order spanners) and size and by field characteristics. For each unit, chemical sample listed first is representative of that unit's overall chemical type, which is listed in the column Chemical Class. For composite units, a second (sometimes a third) chemical class, correlated by row with the appropriate chemical sample, is included. In all other cases, additional chemical samples from a given unit are listed in the same order as in Table 2, which gives the composition as analyzed in weight percent of the sample. Chemical classes (except TR) are those of International Union of Geological Sciences (Le Bas and others, 1986): AOB, alkali olivine basalt; H, hawaiite; B, benmoreite; T, tholeiite; TR, type transitional between tholeiite and alkali olivine basalt. Sample number for K-Ar age-dated unit given after age in reference following sample number. Polarity: NM, normal; R, reversed; T, transitional (see Remarks). Assignment of cinder-cone degradation follows usage of Wood (1980). Leaders (—) indicate no information, no overlying unit, or underlying unit unknown; do., ditto]

Unit symbol and identification	Characteristics (flow surface texture, cover, degree of dissection, thickness) or degradation state of cinder cone	Phenocryst size (mm)	Sample number	Overlying unit(s)	Underlying unit(s)	Range in age or K-Ar age (Ma)	Chemical class	Remarks
			Aphyric basalt					
Qvh_3—Flow and cinders of vents 0507B and 0506(?).	Smooth; alluvial cover; moderately dissected; thickness 2–5 m.	—	V254	—	Qwh_5(?) Qvh_2 Qvd_5 Ku	0.75–1.25	AOB	—
Qvh_2—Flow and cinders of vent 0507A.	Smooth; ash mantled; dissected flow top; thickness 4 m; vent material slightly degraded.	—	—	Qvc_5 Qvh_3	—	0.85–1.17	—	—
Qvh_1—Flow and cinders of vent 1526 (Smooth Knoll).	Smooth; ash mantled; locally faulted.	—	V241 SK3	Qvc_5 Qvc_4 Qcd_1 Qce_1(?)	Qcc_2 Qcb_1	1.15–1.45	HAW	—
			Pyroclastic deposits					
Qvp_3—Maar deposits of vent 0522.	Dominantly nonjuvenile basalt fragments and gravel.	—	—	Qjc_3	Qvd_2	0.91–1.53	—	Forms semi-circular breached crater rim 30 m high; center of vent is in alluvium west of ridge.
Qvp_2—Cinders of vent 1601.	Degraded vent material of undetermined lithology	—	—	Qvc_4(?)	—	1.00–1.44	—	—
Qvp_1—Cinders of vent 0506.	—do.—	—	——	—	—	0.95–1.81	—	—
			WHITE LAKES BASIN AREA					
			Picritic basalt					
Qwb_3—Cinders and minor flow of vent 1336 (Ortega Mountain).	Cone moderately degraded.	—	S34-7	—	—	1.30–1.70	HAW	Local welded spatter on cinder cones.
Qwb_2—Cinders of vent 1327.	—do.—	—	—	—	—	1.30–1.70	—	—do.—
Qwb_1—Cinders of vent 1302.	—do.—	—	—	—	—	1.30–1.70	—	—do.—
			Olivine basalt					
Qwc_4—Cinders of vents 0410A and 0410B (Dobbins Knoll).	Cones moderately degraded.	—	—	—	—	1.00–1.80	—	Local spatter, some welded, on cinder cone.
Qwc_3—Flow and cinders of vent 1428.	Slightly rough; alluvium covered.	0.5–1.0	460OM 460#2	—	Qwg_2	1.30–1.70	TH TR	Local occurrences of spatter.
Qwc_2—Flow and cinders of vent 0414.	Moderately rough; partly dissected.	0.3–0.5	—	—	—	1.30–1.90	—	Local occurrences of spatter and welded cinders.
Qwc_1—Cinders of vent 0408.	Cone degraded.	—	—	—	—	1.45–2.05	—	—
QTwc—Cinders of vent 0402.	Cone moderately degraded.	—	488OM 749OM 488OM#2	—	—	1.60–2.00	TR	Cinder pit on north side contains cumulate xenoliths. Local occurrences of welded spatter.
			Sparse olivine basalt					
Qwd_2—Cinders of vent 1301.	Cone moderately degraded.	—	—	—	—	1.30–2.10	—	—
Qwd_1—Flow and cinders capping Dutch Mountain.	Dissected basalt flow and cinders.	0.3–0.5	V255	—	—	1.50–2.00	AOB	—
			Olivine-plagioclase basalt					
Qwg_4—Minor flow west of vent 0410B (Dobbins Knoll).	Moderately rough.	0.5–1.0	—	—	—	0.50–1.50	—	—
Qwg_3—Flow of Point of the Mountain and cinders of vent 1414 (Sides Knoll).	Smooth; alluvium covered; edge 1–5 m thick.	0.5–1.0	25MR 24MR 26MR 27MR 37MR 479MR 717MR	—	Qwg_2 QTsf(?) Ku	1.56±0.03	TH	Diktytaxitic groundmass. Local columnar joints. Mesa-capping flow displays topographic reversal. K-Ar age sample 717MR (Cooper and others, 1990). Polarity: R, site 180.

Qwg_2—Composite flow of Sides Lake and cinders of vents 1420, 1422, and 1427.	Smooth; alluvial cover.	0.5–1.0	35OM 481OM R15	Qwh_4 Qwc_3 Qwg_3	Qwh_1(?) QTsf(?) Ku	1.40–1.95	TH	Locally glomeroporphyritic in diktytaxitic groundmass. Vent material composed of welded spatter and flow.
Qwg_1—Composite(?) flow and cinders of vent 0405.	Smooth; alluvium covered.	0.3–0.5	—	—	QTsf(?)	1.54–1.94	—	Vent material contains local occurrences of welded spatter.
Twg—Flow and cinders of vent 1312.	Smooth; partly dissected.	0.3–0.5	718OM	QTsf	—	1.70–2.12	AOB	—
			Aphyric basalt					
Qwh_5—Flow southeast of vent 0402.	Smooth; alluvium covered.	—	—	—	QTg	0.80–1.40	—	—
Qwh_4—Flow and cinders of vent 1421.	—do.—	—	768OM	—	Qwg_2	1.00–1.60	HAW	Local occurrences of welded spatter on cinder cone.
Qwh_3—Minor flow east of vent 0402.		—	—	—	QTg	1.35–1.85	—	Caps mesa.
Qwh_2—Minor flow east of vent 0402.		—	—	—	QTg	1.35–1.85	—	Underlying unit may be rim gravel (unit Tg). Caps mesa.
Qwh_1—Flow and cinders of vent 1429.	Moderately smooth; alluvium covered; partly dissected.	—	461OM	Qwg_2(?)	—	1.60–1.90	AOB	Local occurrences of welded spatter on cinder cone.
Twh—Flow southwest of Martinez Lake.	Smooth; alluvium covered; edge 1–4 m thick.	—	—	QTsf(?)	—	1.80–2.10	—	—
			Quartz basalt					
Twj—Flow of Mesa Redonda.	Partly covered by younger gravel (unit QTg).	0.3–0.5	321MR S35-7 S36-7	QTg	Ku	7.6±0.4	HAW MUG	Caps Mesa Redonda. Contains local accumulations of spatter and cinders. Columnar joints at places. K-Ar age sample 2316-2 collected by Clay Conway, U.S. Geological Survey, Flagstaff, analyzed by R.J. Miller, U.S. Geological Survey, Menlo Park, oral commun., 1991).