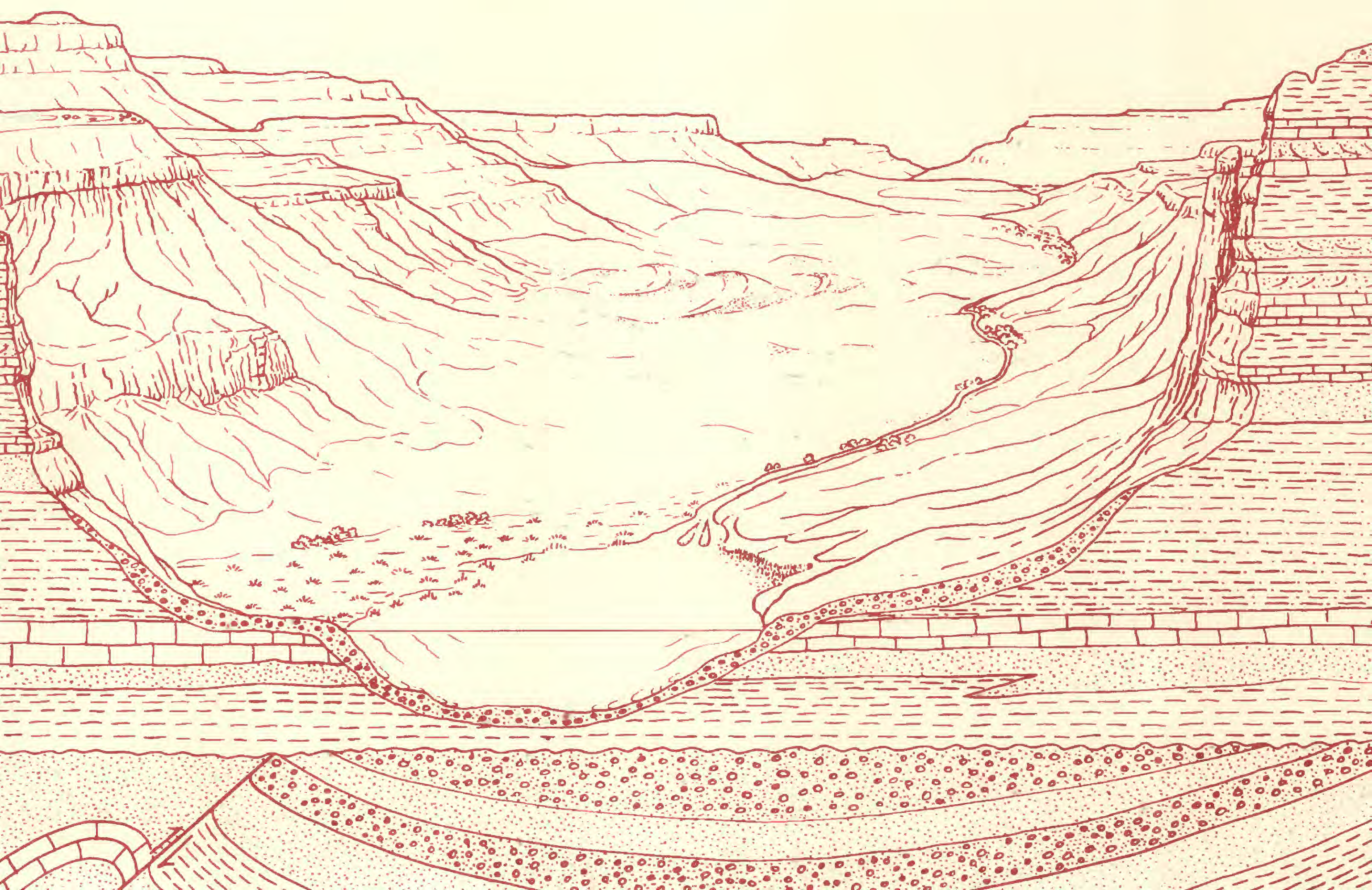
Summary of Chemical Analyses and $^{40}Ar/^{39}Ar$ Age-Spectra Data for Eocene Volcanic Rocks from the Central Part of the Northeast Nevada Volcanic Field

U.S. GEOLOGICAL SURVEY BULLETIN 1988–K



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By William E. Brooks, Charles H. Thorman, Lawrence W. Snee, Constance J. Nutt, Christopher J. Potter, *and* Russell F. Dubiel

EVOLUTION OF SEDIMENTARY BASINS—EASTERN GREAT BASIN
Harry E. Cook and Christopher J. Potter, Project Coordinators

U.S. GEOLOGICAL SURVEY BULLETIN 1988–K

A multidisciplinary approach to research studies of sedimentary rocks and their constituents and the evolution of sedimentary basins, both ancient and modern

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CONTENTS

FIGURES

TABLES

Summary of Chemical Analyses and $^{40}Ar/^{39}Ar$ Age-Spectra Data for Eocene Volcanic Rocks from the Central Part of the Northeast Nevada Volcanic Field

By William E. Brooks, Charles H. Thorman, Lawrence W. Snee, Constance J. Nutt, Christopher J. Potter, *and* Russell F. Dubiel

ABSTRACT

Widespread rhyolitic to andesitic calc-alkaline volcanic rocks in northeast Nevada and northwest Utah are part of a distinct Eocene eruptive sequence that is older than previously believed. Parts of this volcanic terrane, the central part of the Northeast Nevada volcanic field, are exposed over a large area that extends in an east-west direction from the Silver Island Mountains, Utah, to Elko, Nevada, and in a north-south direction from an area a few miles north of Wells, Nevada, to the Deep Creek Range, Utah.

The type area for the Northeast Nevada volcanic field is at Nanny Creek, in the northern Pequop Mountains, where the base of the volcanic sequence, unconformable on Eocene lacustrine deposits, includes rhyolitic ash-flow tuffs that are overlain by a monotonous series of dacitic to andesitic flows and flow breccias that were locally erupted. The similarities in age, chemistry, and mode of occurrence of these volcanic rocks throughout the field indicate that they are part of the same widespread Eocene volcanic sequence.

INTRODUCTION

Middle to late Eocene calc-alkalic volcanism that formed the Northeast Nevada volcanic field marks the onset of Tertiary volcanism in the northern Basin and Range. The central part of this large field, in northeast Nevada and adjacent Utah, is defined by (1) 12 numbered localities (fig. 1*A*) from which 23 $^{40}Ar/^{39}Ar$ ages, ranging from 42.6 to 39.0 Ma, were obtained, (2) more than 90 chemical analyses, (3) stratigraphic position of the volcanic rocks above a regional Eocene unconformity, and (4) lithology. The type area is at Nanny Creek in the northern Pequop Mountains, Nevada (Brooks and others, 1992, 1995a, b; Thorman and others, 1993) (fig. 1). Prior to our studies, dated middle Eocene volcanic rocks were known at a only few widespread sites in northeast Nevada and adjacent Utah (fig. 1*A*, lettered localities; table 1). Integration of ages (K-Ar method) from these localities into a regional volcanic framework was difficult because (1) the localities are geographically scattered and (2) only a few chemical analyses of these dated volcanic rocks are available.

On the basis of the previously sampled localities having middle Eocene ages listed in table 1, the Northeast Nevada volcanic field was defined as extending east to the Cottonwood Canyon area in the Wasatch Range, Utah, north to the Nevada-Idaho State line, south to the Roberts Mountains in central Nevada and west to the Snowstorm Mountains in north-central Nevada. Sparse chemical analyses and no $^{40}Ar/^{39}Ar$ dates are available for Eocene volcanic rocks at localities listed in table 1. As part of an ongoing regional study, samples of the volcanic rocks from those localities in table 1 were recollected for chemical and geochronological ($^{40}Ar/^{39}Ar$ method) analysis in order to help delineate the regional extent of the Northeast Nevada volcanic field.

REGIONAL EOCENE SETTING

The Northeast Nevada volcanic field consists of the coalesced products of intermediate to rhyolitic, calk-alkalic volcanism in northeast Nevada and adjacent Utah that were erupted from 42.6 to 39 Ma, during Eocene time. The central part of the Northeast Nevada volcanic field (Brooks and others, 1995) was defined by mapping and stratigraphy at 12 localities (fig. 1*A*), by 92 major oxide chemical analyses of

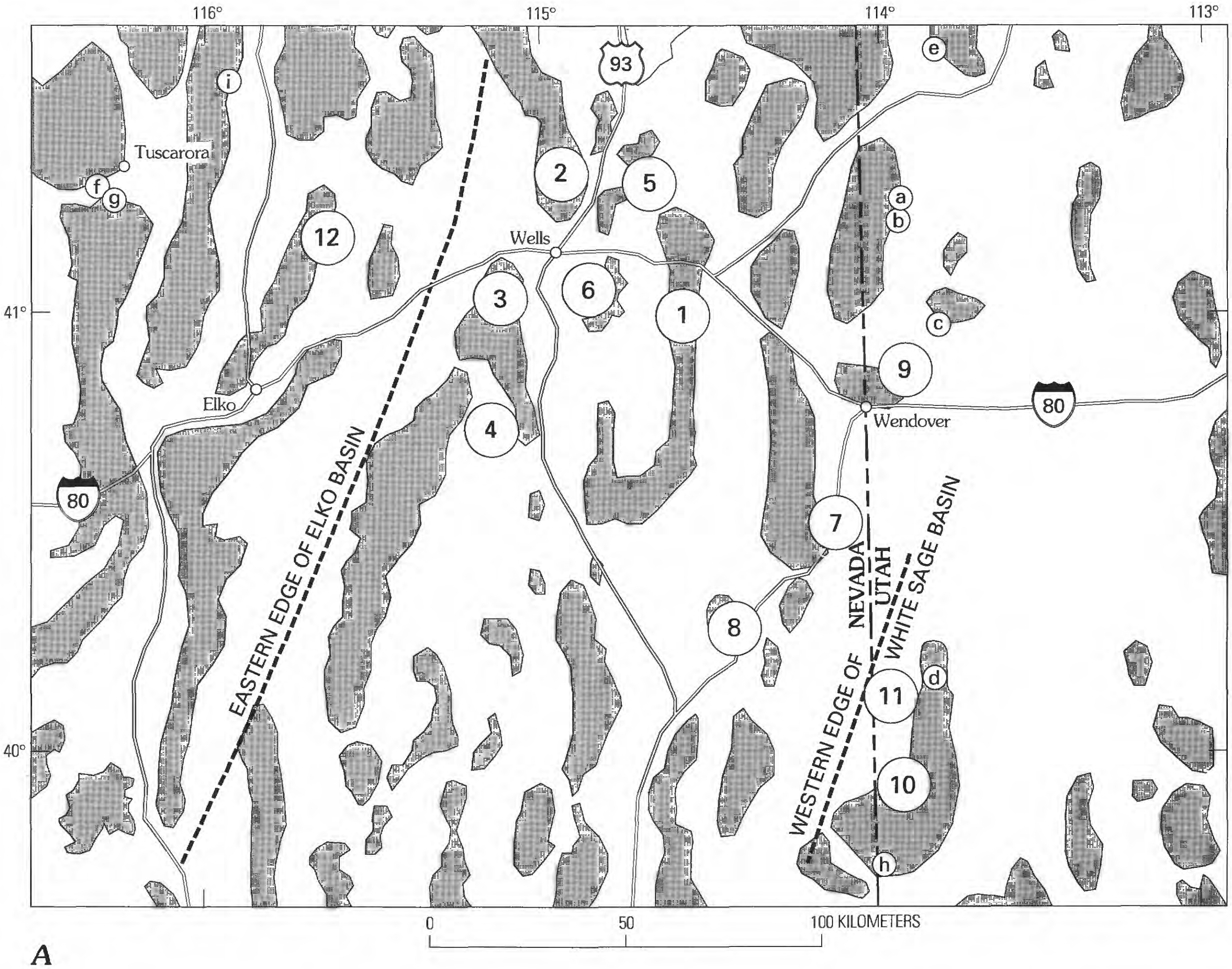
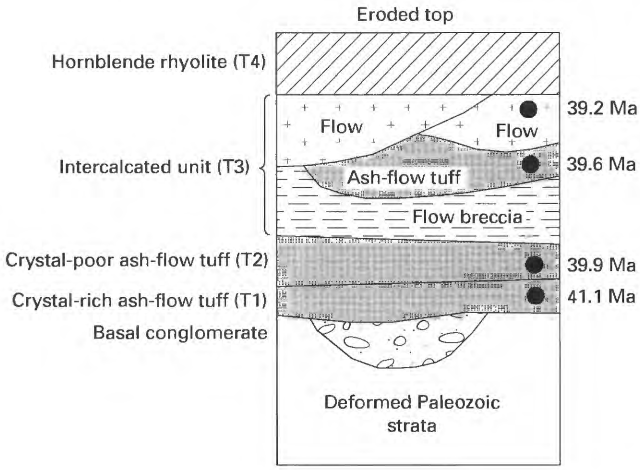
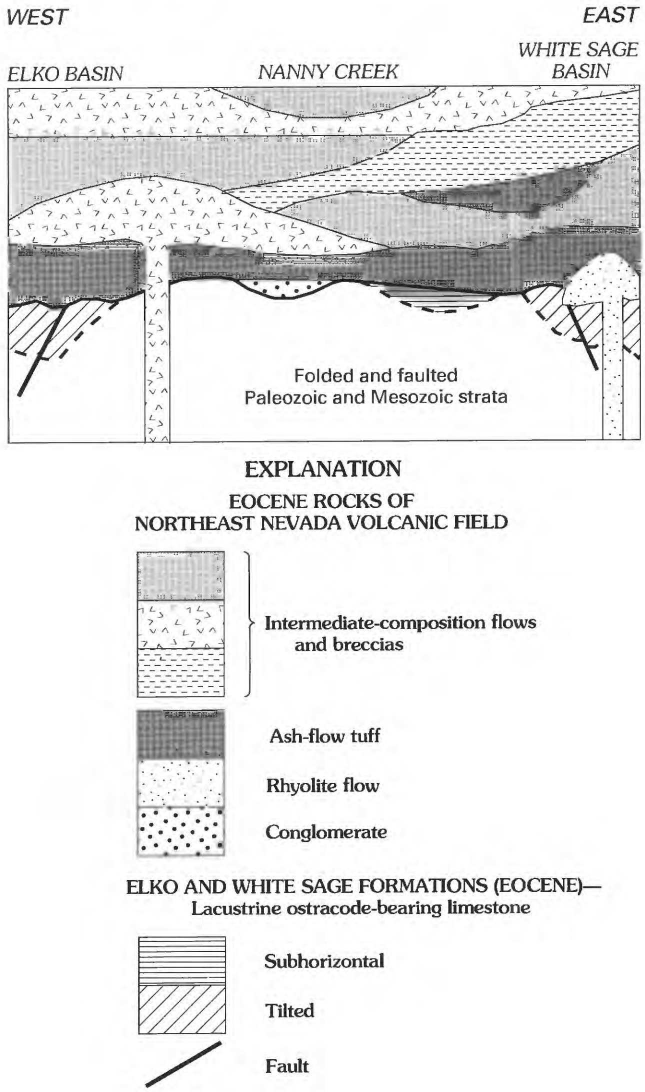


Figure 1 (above and facing page). Map showing central part of Northeast Nevada volcanic field, northeast Nevada and adjacent Utah, composite stratigraphic column for Nanny Creek type area, and schematic west-east cross section of central part of Northeast Nevada volcanic field. *A*, Map showing localities (solid circles) from which Eocene volcanic rocks were dated and analyzed. Shaded areas indicate ranges. Samples from numbered localities were collected as part of this study: 1, Nanny Creek, northern Pequop Mountains; 2, southern Snake Mountains; 3, northern East Humboldt Range; 4, southern East Humboldt Range; 5, Deadman Creek area, Windermere Hills (Mueller, 1992); 6, Wood Hills; 7, Ferguson Mountain (J. Welsh, U.S. Geological Survey, unpub. mapping, 1992); 8, Dolly Varden Mountains (Zamudio, 1992); 9, Silver Island Mountains; 10, Sanford Springs, southern Deep Creek Mountains; 11, Gold Hill area, northern Deep Creek Mountains (Dubiel and others, 1993); 12, Coal Mine Canyon, northern Adobe Range, east side of Elko Basin (K. Ketner, U.S. Geological Survey, written commun., 1993). Letters indicate localities of Eocene volcanic rocks previously studied: a, central Pilot Range, Utah, K-Ar (biotite), 37.1 Ma, tuff and sedimentary rock, (Miller, 1984); b, central Pilot Range, Utah, K-Ar (biotite), 36.9 Ma, tuff, (Miller, 1984); c, Silver Island Mountains, Utah, K-Ar (biotite), 40.9 Ma, andesite (Moore and McKee, 1983); d, Gold Hill, Utah, K-Ar (biotite), 39.2 Ma, latite (Moore and McKee, 1983); e, Grouse Creek Mountains, Utah, K-Ar (biotite), 36.4 Ma, tuff (Compton, 1983); f, Tuscarora (Big Cottonwood Canyon caldera), Nevada, K-Ar (biotite), 40.5 Ma, tuff (B.R. Berger, U.S. Geological Survey, written commun., 1993); g, Tuscarora, Nevada, K-Ar (biotite), 41.9 Ma, basal ash-flow tuff (Boden and others, 1993); h, Tippett Canyon, southern Deep Creek Mountains, Nevada, $^{40}Ar/^{39}Ar$ (biotite), 39.5 Ma, tuff (Gans and others, 1989); i, Independence Range, Nevada, $^{40}Ar/^{39}Ar$ (biotite), 41.6 Ma, tuff (A.H. Hofstra, U.S. Geological Survey, written commun., 1994). *B*, Composite stratigraphic column, Nanny Creek type area. Ages were determined by $^{40}Ar/^{39}Ar$ method; solid circles indicates dated units. Map units T1, T2, T3, and T4 are shown in figure 3. *C*, Schematic west-east cross section of the central part of the Northeast Nevada volcanic field. Intertonguing relationship of lava flows and pre-Eocene and early to middle Eocene unconformities (heavy dashed and solid lines, respectively) are generalized. Lines in sedimentary units in the Elko Basin and the White Sage Basin indicate tilted, bedded units, not true dip. No vertical scale implied.





volcanic rocks and 1 analysis of a coeval pyroxene diorite (tables 2, 3), and by 23 $^{40}Ar/^{39}Ar$ ages (table 4) from 12 localities. Age-spectrum diagrams and abbreviated data tables for samples from the 12 numbered localities shown in figure 1*A* are presented in figure 2 and table 5, respectively. Production ratios are presented in table 6. Comparable volcanic setting, lithology, and stratigraphic position of the volcanic rocks above a regional middle Eocene unconformity (Thorman and Brooks, 1991) that is recognized in the Elko Basin (Wingate, 1983; Ketner and Ross, 1990) to the west and in the White Sage Basin to the east (Potter and others, 1995) (figs. 1*A*, *C*) are also significant in the regional reconstruction of this Eocene volcanic terrane.

The Northeast Nevada volcanic field coincides in time and space with the Tuscarora magmatic belt of Christiansen and Yeats (1992), which was broadly defined using only a few K-Ar ages and no rock chemistry. The type area for the Northeast Nevada volcanic field is at Nanny Creek (fig. 1*B*, loc. 1, fig. 3) in the northern Pequop Mountains, where the section is 1,200 m thick. Here, rhyolite ash-flow tuffs (units T1, T2) are overlain by a thick section of intercalated andesitic to dacitic flows and flow breccias (unit T3x) and rhyolite ash-flow tuffs (unit T3a). These rocks, which are dated, are overlain by an undated hornblende rhyolite, and regional relationships of the flows, flow breccias, tuffs, and underlying Paleozoic strata are shown schematically in figure 1*C*. A widespread basal sedimentary unit is included in the stratigraphic section because of the tectonic implications of included Eocene volcanic material (Brooks and others, 1995). Typically, the volcanic outcrops of the field are widely scattered, have limited areal extent, and are discontinuous between ranges.

Intermediate-composition volcanic rocks, including hornblende andesite, two-pyroxene andesite, and biotite (±hornblende) dacite, probably were locally derived from numerous vents throughout the field, whereas calderas for the biotite (±hornblende, quartz, lithic) rhyolite ash-flow tuffs are, for the most part, unknown. For example, in the southern East Humboldt Range (fig. 1*A*, loc. 4) several volcanic centers in andesitic to dacitic rocks are characterized by flows, scoriaceous agglomerate, spatter, and near-source, oxidized, angular block and breccia (2–3 m) flows, all of which are features present in low hills with shieldlike morphology. A hypabyssal center in the southern East Humboldt Range was identified on the basis of an Eocene (U-Th-Pb ages of 39.5±0.4 Ma and 37.8±0.3 Ma on two sphene fractions; R.E. Zartman, USGS, written commun., 1994) pyroxene diorite (table 3, sample 91T22; table 7) that intruded and contact metamorphosed the Permian and Triassic strata. This fine-grained holocrystalline rock weathers much the same as its nearby extrusive equivalents and can be easily mistaken for andesite. In the southern Deep Creek Range, near Sanford Springs, a dissected block-and-cinder cone 40 m high is exposed through dacitic to andesitic flows and flow breccias (Nutt and Brooks, 1994).

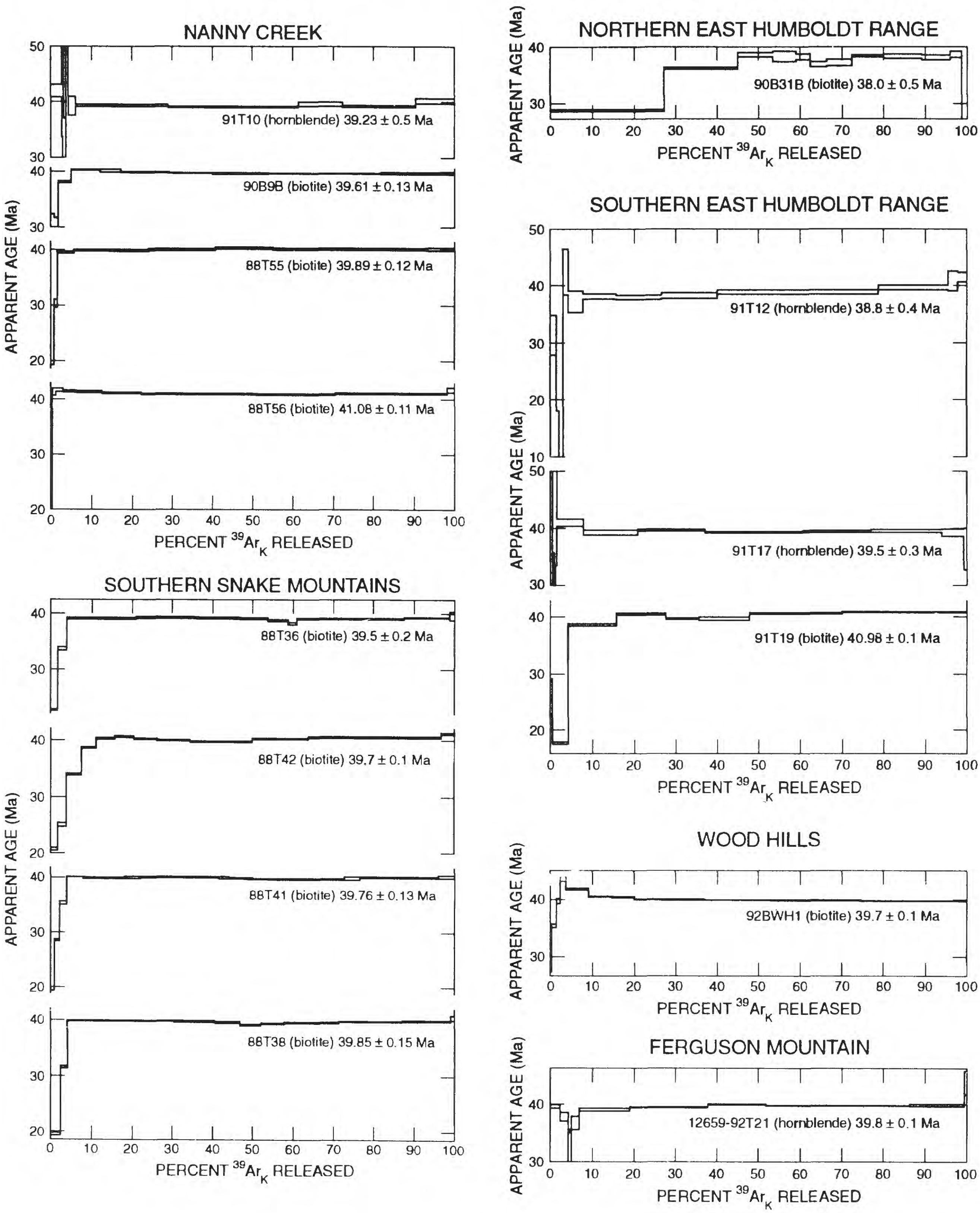
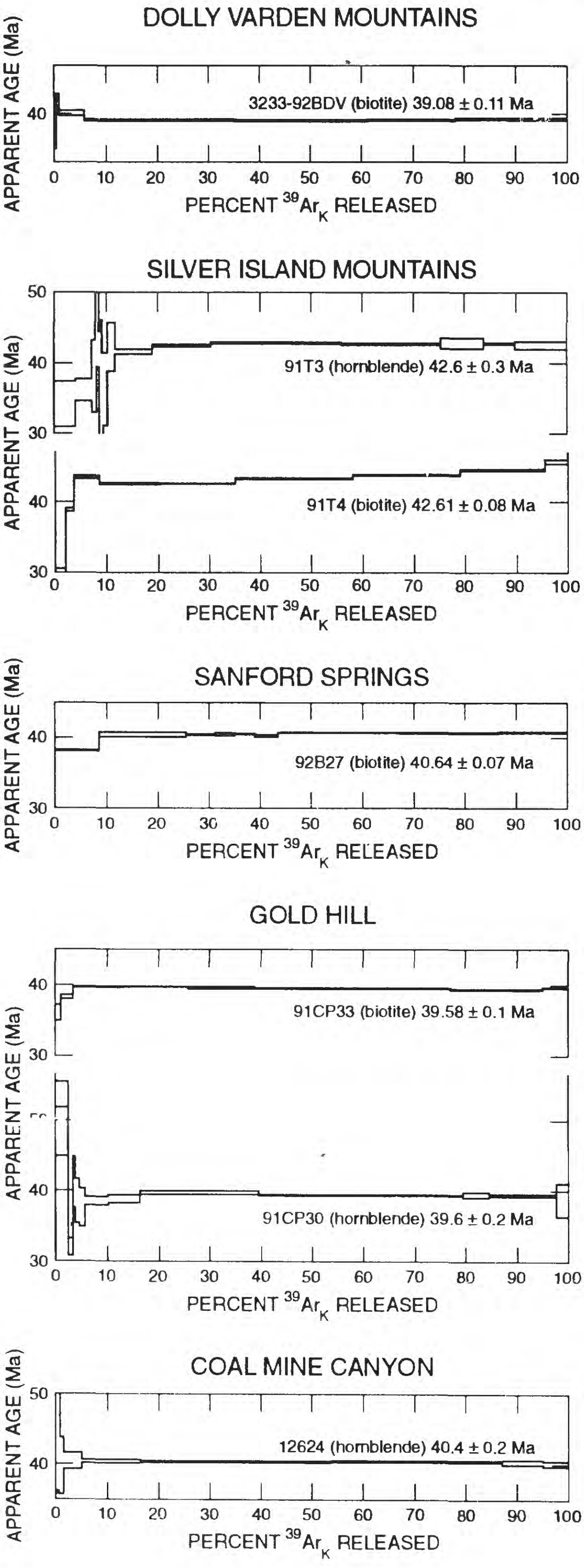


Figure 2 (above and facing page). Age-spectrum diagrams for volcanic rocks from the central part of the Northeast Nevada volcanic field. Sample localities are shown in figure 1*A*. Age-spectrum diagrams for Deadman Creek are given in Mueller (1992).

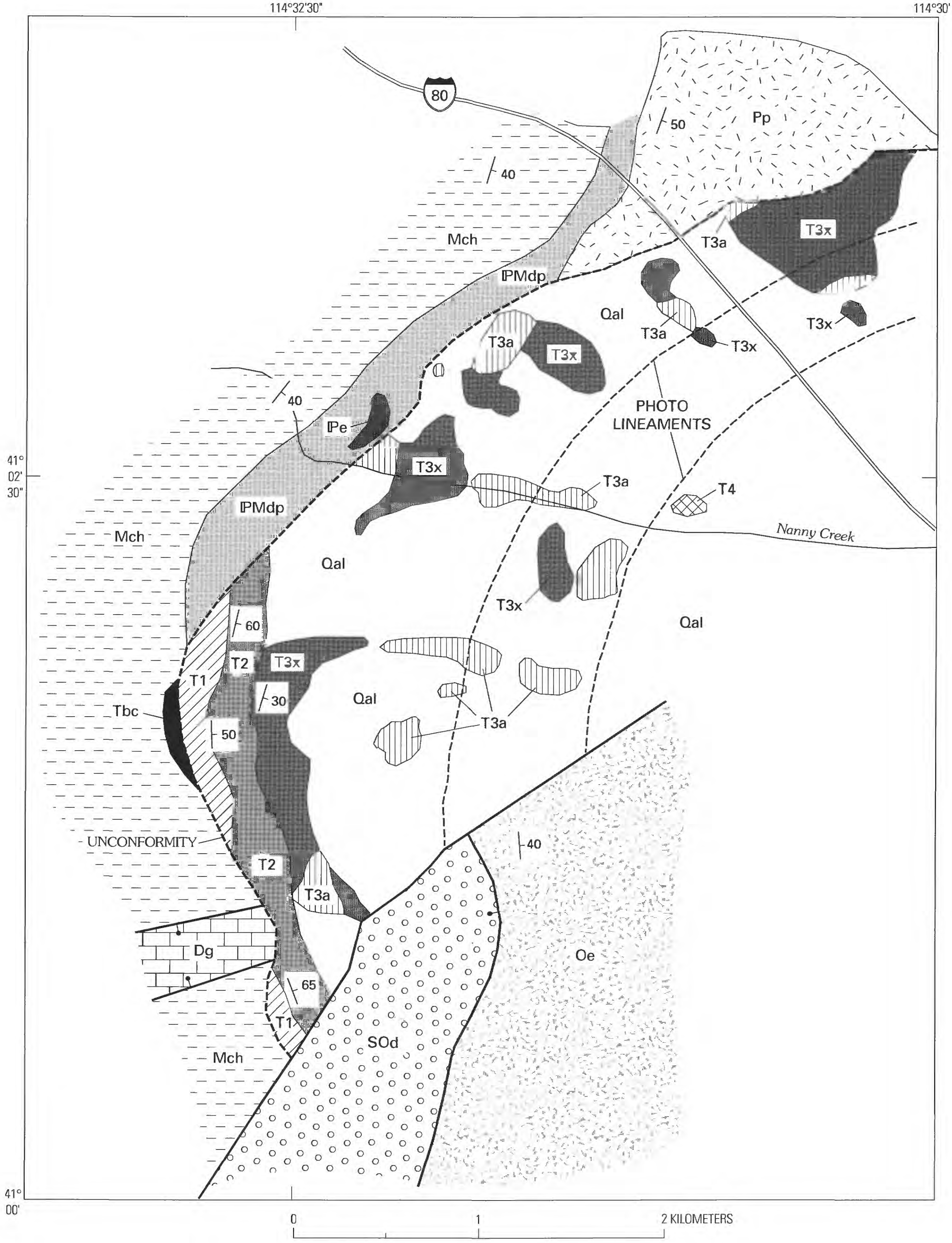


A possible source for some of the rhyolite ash-flow tuffs is an Eocene caldera complex near Tuscarora, northwest of Elko (McKee and Coats, 1975; Berger and others, 1991; Boden and others, 1993). A K-Ar age of 40.5 Ma was obtained from vitrophyre at the Big Cottonwood Canyon caldera (B.R. Berger, written commun., 1993) in the complex.

DATA TABLES AND PLOTS OF ANALYSES

Samples of the volcanic units from the numbered localities shown in figure 1*A* were collected in order to define regional and local chemical affinity and refine field nomenclature. Although most samples are devitrified and some are altered, samples were collected and analyzed in order to provide analytical data for each locality. Potassium-metasomatized volcanic rocks, which have been considered absent or sparse in the northern Basin and Range (Glazner and Bartley, 1990), are present in the Grant Range (Scott, 1965; Brooks and others, 1994), at Round Mountain (Shawe and Leprey, 1985), and, by this study, in the southern Snake Mountains (table 3, samples 88T36, 88T38, 88T41, and 88T42), southern East Humboldt Range (table 3, sample 92B46), and Deadman Creek area (table 3, sample 90–14). This type of alteration, which is usually not obvious in hand sample, is indicated by analytical results including minimal amounts of Na_2O (<1.0 weight percent) and excessive amounts of K_2O (as much as 12–13 weight percent) that yield K_2O:Na_2O ratios greater than 2 (Brooks, 1986). Neither leucite, analcite, nor nepheline, possible host phases for the excess potassium in some high-potassium volcanic rocks, is present.

Armstrong (1970) recognized problems in dating potassium-metasomatized rocks and indicated that dates from these altered rocks may indicate the age of metasomatism, not the age of the volcanic rock. Biotite from metasomatized volcanic rock from the southern Snake Mountains was dated by $^{40}Ar/^{39}Ar$ methods, and those ages (table 4) are considered reliable, based on work by Brooks and others (1994) on biotite from similarly potassium-metasomatized volcanic rocks in the Grant Range, Nevada. Despite their anomalously high potassium content these altered rocks are referred to as andesite or dacite because their SiO_2 content, a key oxide in chemical rock nomenclature, and other major-element contents were little changed during metasomatism (Sawyer and others, 1989; Brooks and others, 1994). Because of their excessive K_2O content, however, analyses from these potassium-metasomatized rocks commonly plot in the trachyandesite or trachydacite field on a total alkali-silica (TAS) diagram.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Pp
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2 KILOMETERS

EXPLANATION

- Qal — Alluvium (Quaternary)
- T4 — Hornblende rhyolite (middle Eocene)
- T3a — Rhyolite ash-flow tuff (middle Eocene)
- T3x — Andesite ash-flow breccia (middle Eocene)
- T2 — Crystal-poor rhyolite ash-flow tuff (middle Eocene)
- T1 — Crystal-rich rhyolite ash-flow tuff (middle Eocene)
- Tbc — Conglomerate (middle Eocene)
- Pp — Pequop Formation of Steele (1960) (Permian)
- IPe — Ely Limestone (Pennsylvanian)
- IPMdp — Diamond Peak Formation (Pennsylvanian and Mississippian)
- Mch — Chainman Formation (Mississippian)
- Dg — Guilmette Formation (Devonian)
- SOd — Dolomite (Silurian and Ordovician)
- Oe — Eureka Quartzite (Ordovician)
- Contact
- Fault—Bar and ball on downthrown side
- Lineament interpreted from aerial photographs
- Early to middle Eocene unconformity

Figure 3 (above and facing page). Geologic map of the Nanny Creek area, northern Pequop Mountains, Nevada.

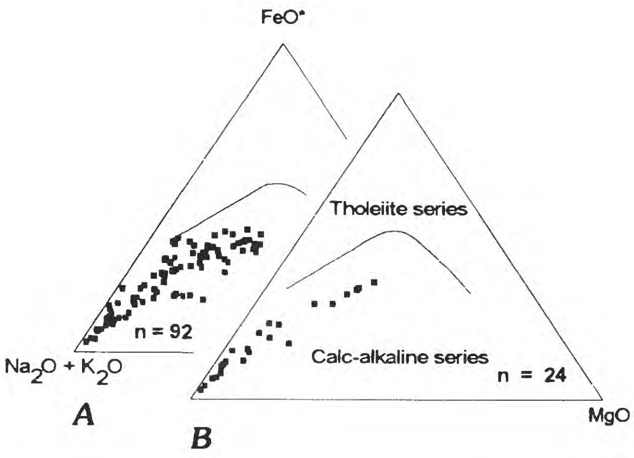


Figure 4. AFM ([Na_2O+K_2O]-total iron as FeO-MgO) diagrams using recalculated major oxide analyses for samples from the central part of the middle Eocene Northeast Nevada volcanic field. Recalculated using method of Sidder (1994); calc-alkaline trend from Irvine and Baragar (1971). *A*, All analyses from numbered localities shown in figure 1*A* within the central part of the Northeast Nevada volcanic field. *B*, Analyses from Nanny Creek type area.

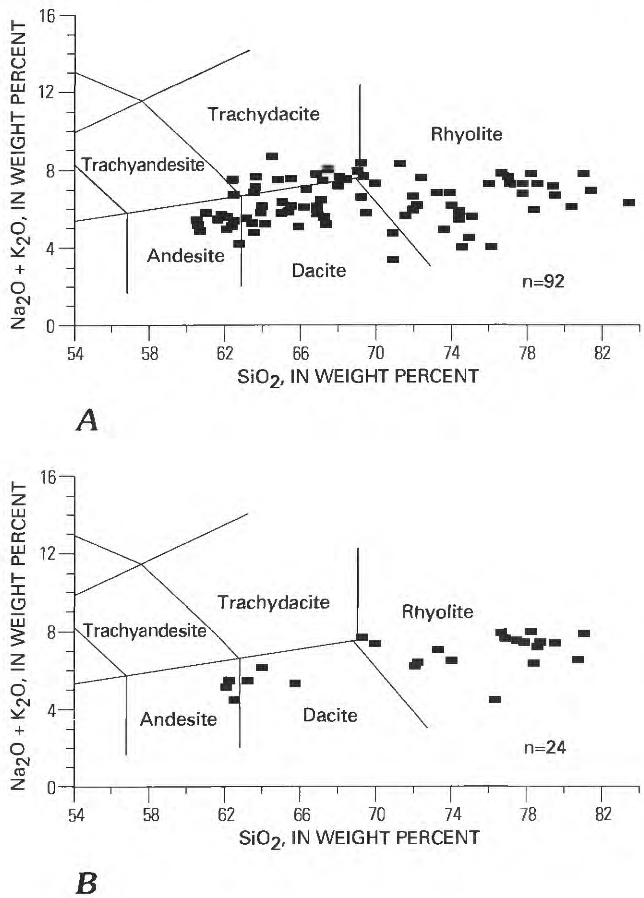


Figure 5. Total-alkali (Na_2O+K_2O)-(SiO_2) diagrams using recalculated major oxide analyses for samples from the central part of the middle Eocene Northeast Nevada volcanic field. Recalculated using method of Sidder (1994); rock classification grid from Le Bas and Streckeisen (1991). *A*, All analyses from numbered localities shown in figure 1*A* within the central part of the Northeast Nevada volcanic field. *B*, Analyses from Nanny Creek type area.

Propylitic alteration has affected andesite and dacite in the northern East Humboldt Range (table 3, sample 90B31B) and elsewhere in the study area. These rocks are commonly green, typically yield more than 2.0 weight percent volatiles (loss on ignition or LOI), and have total alkali-silica compositions in or near the trachytic field. Silicified ash-flow tuffs may also be green; however, they have conchoidal fracture and porcellaneous matrix. They typically contain more than 76 weight percent SiO_2 but still plot in the rhyolitic field of the total alkali-silica diagram.

Major oxide analyses presented in tables 2 and 3 are uncorrected for loss of volatiles and were obtained by X-ray fluorescence techniques in analytical laboratories of the U.S. Geological Survey, Denver, Colorado; analytical methods, accuracy, and precision are as described by Taggart and others (1987). Trace element contents (tables 2, 3) were determined by energy-dispersive X-ray fluorescence

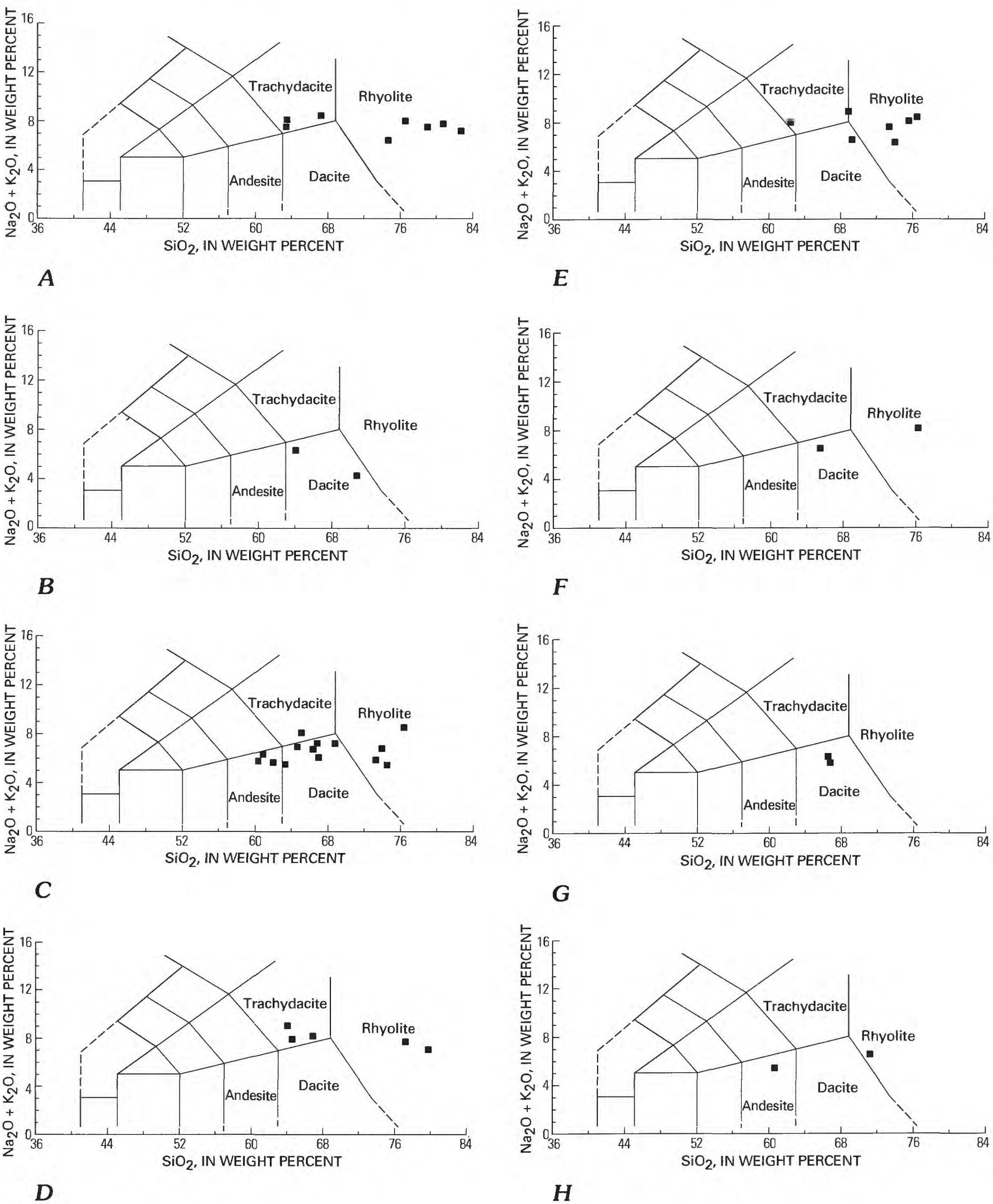
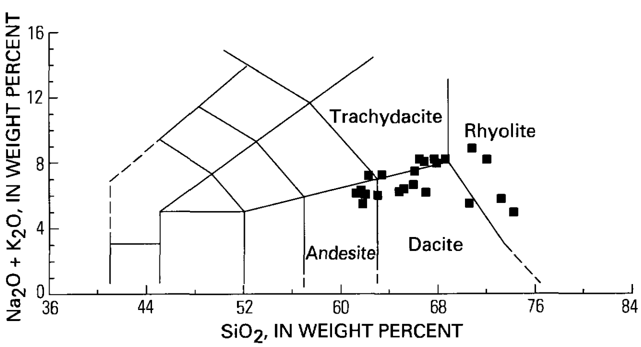


Figure 6 (above and facing page). Total-alkali (Na_2O+K_2O) -(SiO_2) diagrams using recalculated major oxide analyses for samples from the central part of the middle Eocene Northeast Nevada volcanic field. Recalculated using method of Sidder (1994); rock classification grid from Le Bas and Streckeisen (1991). Localities are shown in figure 1*A*. *A*, Southern Snake Mountains. *B*, Northern East Humboldt Range. *C*, Southern East Humboldt Range. *D*, Deadman Creek. *E*, Deadman Creek (samples received from K. Mueller, University of Wyoming). *F*, Wood Hills. *G*, Ferguson Mountain and Dolly Varden Mountains. *H*, Silver Island Mountains, Utah. *I*, Sanford Springs. *J*, Gold Hills area. *K*, Coal Mine Canyon, northern Adobe Range.

Table 1. Regional summary of localities at which Eocene volcanic rocks have been dated, northeast Nevada and adjacent Utah.
[Leaders (--) indicate not described]

Date (Ma)	Method	Rock type	Locality
37.3	K-Ar, biotite	--	Cottonwood area, Wasatch Range, Utah (Crittenden and others, 1973).
37.5	K-Ar, --	Tuff	Roberts Mountains, Nevada (Maher and others, 1990).
38.4	K-Ar, biotite	Dacite	Snowstorm Mountains, Nevada (Wallace, 1993).
38.8	K-Ar, biotite	Andesite	Bingham, Utah (James and others, 1961).
38–43	K-Ar, --	--	Tuscarora area–Bull Run Mountains, Nevada (McKee and others, 1976).
39.6	K-Ar, biotite	Rhyolite	Owyhee, Nevada (Coats, 1971).
39.9	K-Ar, biotite	Tuff	Jarbridge, Nevada (Coats, 1964).
41.8	Fission track, zircon	Rhyodacite	Drum Mountains, Utah (Lindsey, 1982).
42.5	K-Ar, biotite	--	Bull Run Mountains, Nevada (Axelrod, 1966).



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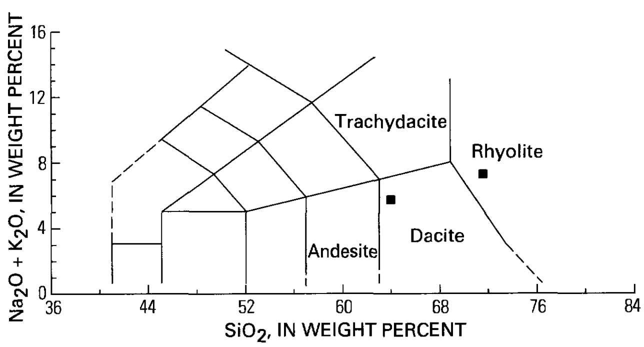

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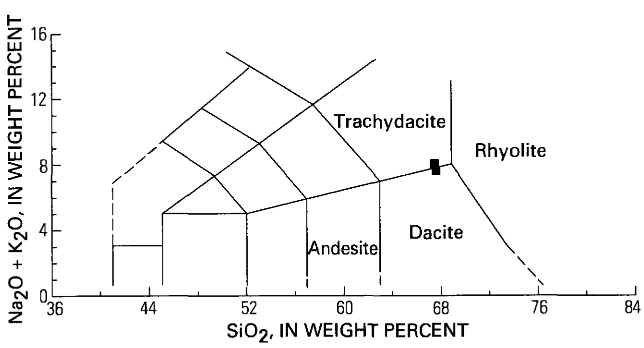

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spectroscopy (Elsass and duBray, 1982) using ^{109}Cd and ^{241}Am sources; accuracy and precision of these analyses are as described by Sawyer and Sargent (1989). Chemical data are for crushed bulk-rock samples from which xenocrystic fragments were hand picked from the ash-flow tuff samples.

Major oxide analyses shown in tables 2 and 3 were corrected for volatiles and plotted on AFM ($[Na_2O+K_2O]$-total iron as FeO-MgO] and total alkali (Na_2O+K_2O)-silica (SiO_2) diagrams using a petrologic recalculation program (Sidder, 1994). The AFM plots show the regional, calc-alkalic, subduction-related character of the central part of the Northeast Nevada volcanic field (fig. 4*A*). Analyses from the Nanny Creek type area show a similar trend (fig. 4*B*). The andesitic-dacitic-rhyolitic composition of the volcanic rocks from the central part of the Northeast Nevada volcanic field and the Nanny Creek type area is shown in the total alkali-silica diagrams (figs. 5*A*, *B*). Classification of the volcanic rocks at each numbered locality is shown in a series of total alkali-silica diagrams (fig. 6). The analysis of the Eocene pyroxene diorite from the southern East Humboldt locality (loc. 4, fig. 1*A*) was not plotted.

Table 2. Chemical analyses of Eocene volcanic rocks from the Nanny Creek type area, Northeast Nevada volcanic field.

[Location of areas shown in figure 1*A*. Major oxides (weight percent, uncorrected) determined by X-ray spectroscopy; analysts D.F. Siems and J.E. Taggart; $FeTO_3$ indicates total iron reported as Fe_2O_3. LOI (weight percent), loss on ignition at 925°C. Rb, Sr, Y, Zr, Nb, and Ba (parts per million) determined by energy-dispersive analysis, ^{109}Cd and ^{241}Am sources; analyst E.J. LaRock; error is 10 percent of value listed or ±6 (Rb), ±5 (Sr), ±4 (Y), ±3 (Zr), ±3 (Nb), and ±10 (Ba), whichever is greater. Asterisk (*) indicates dated sample (table 4). Map unit designations as in figure 3]

Map unit---------	T1	T1	T1	T2	T2	T2	T2	T2
Lab No.----------	D–323634	D–365204	D–365205	D–323633	D–365206	D–365207	D–365208	D–365209
Field No.---------	88T 56*	90B6	90B11	88T 55*	90B3	90B7A	90B7B	90B12
Latitude----------	41°01′30″ N.	41°01′38″ N.	41°00′34″ N.	41°01′29″ N.	41°00′42″ N.	41°01′38″ N.	41°01′38″ N.	41°00′57″ N.
Longitude--------	114°32′47″ W.	114°32′54″ W.	114°32′05″ W.	114°32′41″ W.	114°32′27″ W.	114°32′45″ W.	114°32′45″ W.	114°32′30″ W.
Major-oxide composition								
SiO_2	71.4	67.6	67.3	78.0	75.0	76.5	75.2	77.7
Al_2O_3	14.2	16.6	15.6	11.6	12.8	11.6	11.4	10.5
$FeTO_3$	1.78	1.80	2.57	0.45	0.93	0.74	1.74	1.03
MgO	0.53	0.66	0.60	0.12	0.29	0.24	0.21	0.18
CaO	2.29	2.75	2.54	0.76	0.88	0.87	0.78	0.85
Na_2O	3.18	3.81	3.46	2.46	3.08	2.52	2.39	2.21
K_2O	4.14	4.13	4.09	5.36	5.12	5.29	5.40	4.48
TiO_2	0.37	0.45	0.39	0.1	0.10	0.09	0.09	0.11
P_2O_5	0.11	0.14	0.14	0.05	0.05	0.07	0.05	0.05
MnO	0.02	0.02	0.02	0.02	0.04	0.02	0.02	0.02
LOI	0.96	1.48	2.41	0.67	1.25	1.01	1.65	1.96
Total	99.98	99.44	99.12	99.59	99.54	98.95	98.93	99.09
Trace element composition								
Rb	114	144	157	152	201	203	251	154
Sr	408	598	573	109	163	154	130	138
Y	21	20	24	18	22	25	23	21
Zr	212	276	252	99	141	120	114	112
Nb	8	15	12	12	15	14	11	12
Ba	1,974	2,110	2,550	605	1,043	915	711	967

Table 2. Chemical analyses of Eocene volcanic rocks from the Nanny Creek type area, Northeast Nevada volcanic field—Continued

Map Unit	T2	T3x	T3x	T3x	T3x	T3x	T3x	T3a
Lab No.	D–365210	D–365219	D–365220	D–365221	D–357055	D–357056	D–503359	D–365211
Field No.	90B13	90B5	90B19A	90B19B	90B24A	90B24B	91T10*	90B9A
Latitude	41°01′55″ N.	41°01′07″ N.	41°01′23″ N.	41°01′23″ N.	41°01′28″ N.	41°01′28″ N.	41°03′02″ N.	41°01′34″ N.
Longitude	114°32′39″ W.	114°32′25″ W.	114°31′40″ W.	114°31′40″ W.	114°32′30″ W.	114°32′30″ W.	114°30′10″ W.	114°32′36″ W.
Major-oxide composition								
SiO_2	75.2	61.3	60.3	64.6	60.3	60.8	61.7	68.5
Al_2O_3	12.4	16.3	16.0	16.5	16.8	16.4	16.4	12.6
$FeTO_3$	1.15	4.89	5.51	3.68	5.37	5.45	4.46	1.39
MgO	0.19	2.54	3.14	1.45	2.86	2.93	2.28	0.96
CaO	0.89	5.59	6.08	5.80	5.70	5.73	4.74	2.30
Na_2O	3.04	3.52	2.91	3.50	3.20	3.20	3.37	2.12
K_2O	4.85	2.09	1.71	2.09	2.13	2.42	2.88	2.34
TiO_2	0.10	0.59	0.64	0.64	0.66	0.66	.56	0.16
P_2O_5	0.05	0.19	0.17	0.18	0.21	0.23	0.23	0.05
MnO	0.02	0.07	0.08	0.04	0.10	0.09	0.08	0.02
LOI	1.55	2.66	3.69	1.10	2.71	2.27	2.22	9.17
Total	99.44	99.74	100.23	99.58	100.04	100.18	98.92	99.61
Trace element composition								
Rb	208	62	54	65	81	95	73	104
Sr	157	525	544	509	574	552	526	535
Y	20	18	22	24	21	18	20	16
Zr	126	168	154	147	181	171	124	146
Nb	14	7	12	8	9	7	10	13
Ba	952	1,348	1,136	1,462	1,240	1,243	2,910	1,336

Table 2. Chemical analyses of Eocene volcanic rocks from the Nanny Creek type area, Northeast Nevada volcanic field—Continued

Map Unit	T3a	T3a	T3a	T3a	T3a	T3a	T4	T4
Lab No.	D–357054	D–365212	D–365213	D–365214	D–365215	D–365218	D–365216	D–365217
Field No.	90B9B*	90B10	90B17	90B20	90B25	90B27	90B26A	90B26B
Latitude	41°01′34″ N.	41°01′36″ N.	41°01′56″ N.	41°01′33″ N.	41°03′03″ N.	41°02′10″ N.	41°02′04″ N.	41°02′04″ N.
Longitude	114°32′36″ W.	114°32′08″ W.	114°32′25″ W.	114°31′44″ W.	114°31′43″ W.	114°31′17″ W.	114°30′52″ W.	114°30′52″ W.
Major-oxide composition								
SiO_2	74.8	73.8	76.0	79.0	75.7	68.4	70.2	70.5
Al_2O_3	12.5	11.3	11.8	10.2	11.1	13.3	14.3	14.3
$FeTO_3$	1.35	1.16	0.67	0.34	1.12	2.07	2.71	2.69
MgO	0.23	0.51	0.17	0.10	0.22	0.79	0.89	0.61
CaO	0.89	1.38	0.96	0.12	0.74	1.80	3.00	3.05
Na_2O	2.86	1.44	2.62	1.21	1.64	2.26	3.46	3.48
K_2O	5.16	4.93	5.02	7.12	6.55	4.05	2.99	3.07
TiO_2	0.10	0.15	0.11	0.08	0.13	0.10	0.30	0.32
P_2O_5	0.05	0.06	0.05	0.05	0.14	0.08	0.13	0.16
MnO	0.02	0.02	0.02	0.02	0.02	0.04	0.03	0.03
LOI	1.65	4.69	1.69	1.27	1.74	6.90	1.35	0.99
Total	99.61	99.44	99.11	99.51	99.10	99.79	99.36	99.20
Trace element composition								
Rb	205	115	177	183	200	146	110	111
Sr	143	480	176	79	153	246	450	441
Y	22	18	18	14	21	16	17	13
Zr	128	149	143	121	146	110	133	136
Nb	12	14	17	11	11	13	9	9
Ba	773	1,941	1,146	895	1,499	1,658	1,468	1,535

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field.

[Location of areas shown in figure 1*A*. Major oxides (weight percent, uncorrected) determined by X-ray spectroscopy; analysts D.F. Siems, J.S. Mee, and J.E. Taggart; $FeTO_3$ indicates total iron reported as Fe_2O_3. LOI (weight percent), loss on ignition at 925°C. Rb, Sr, Y, Zr, and Nb (parts per million) determined by energy-dispersive analysis, ^{109}Cd and ^{241}Am sources; analysts E.J. LaRock and K. Woodburne; error is 10 percent of value listed or ±6 (Rb), ±5 (Sr), ±4 (Y), ±3 (Zr), and ±3 (Nb), whichever is greater. Asterisk (*) indicates dated sample (table 4); § indicates pyroxene diorite (table 7); † indicates sample received from K. Mueller, University of Wyoming; †† indicates sample received from P. Camilleri, Univiversity of Wyoming]

Locality	Southern Snake Mountains							
Field No.	88T 11	88T 36*	88T 37	88T 38*	88T 39	88T 40	88T 41*	88T 42*
Lab No.	D–323620	D–323621	D–323622	D–323623	D–323624	D–323625	D–323626	D–323627
Latitude	41°07′35″ N.	41°09′57″ N.	41°10′02″ N.	41°10′06″ N.	41°12′03″ N.	41°12′04″ N.	41°12′04″ N.	41°12′02″ N.
Longitude	114°59′08″ W.	114°57′06″ W.	114°57′02″ W.	114°56′59″ W.	114°54′04″ W.	114°54′21″ W.	114°54′36″ W.	114°54′43″ W.
Major-oxide composition								
SiO_2	68.0	81.7	61.9	77.1	75.6	62.1	79.3	64.4
Al_2O_3	11.6	8.63	16.4	11.2	12.1	17.6	9.83	14.6
$FeTO_3$	3.01	0.66	5.67	1.39	1.61	5.06	0.43	5.41
MgO	0.76	0.11	1.57	0.11	<0.10	0.67	0.21	0.86
CaO	1.59	0.30	3.66	0.23	1.07	4.19	0.40	1.86
Na_2O	1.09	0.83	3.89	0.53	2.81	3.93	0.93	1.86
K_2O	4.65	6.25	3.91	6.77	5.03	3.41	6.69	6.16
TiO_2	0.41	0.08	0.55	0.11	0.34	0.77	0.11	0.61
P_2O_5	<0.05	0.06	0.16	0.13	0.07	0.31	0.18	0.24
MnO	<0.02	<0.02	<0.02	0.04	<0.02	0.03	<0.02	0.03
LOI	8.45	0.69	2.24	1.72	0.48	1.57	1.21	3.35
Total	100.43	99.33	99.97	99.33	99.23	99.64	99.31	99.38
Trace element composition								
Rb	221	131	89	117	134	94	168	172
Sr	170	54	303	40	139	450	60	262
Y	52	8	11	13	34	19	23	26
Zr	464	82	121	114	408	157	91	130
Nb	37	9	6	13	20	9	6	7
Ba	1,288	836	860	837	1,975	1,216	876	1,537

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Locality	Northern East Humboldt Range		Southern East Humboldt Range					
Field No.	90B31A	90B31B*	91T11	91T12*	91T13	91T14	91T15	91T17*
Lab No.	D–357057	D–357058	D–503360	D–503361	D–503362	D–503363	D–503364	D–503365
Latitude	41°02′50″ N.	41°02′50″ N.	40°42′09″ N.	40°42′11″ N.	40°41′10″ N.	40°40′10″ N.	40°39′34″ N.	40°40′04″ N.
Longitude	115°04′10″ W.	115°04′10″ W.	115°04′20″ W.	115°04′22″ W.	115°03′47″ W.	115°02′40″ W.	115°06′09″ W.	115°06′22″ W.
Major-oxide composition								
SiO_2	62.0	65.4	61.7	61.1	60.6	59.0	66.1	63.8
Al_2O_3	16.5	14.2	16.0	16.3	16.4	16.7	15.9	15.5
$FeTO_3$	5.52	3.85	4.92	5.12	5.59	5.68	2.96	3.77
MgO	1.80	1.37	1.77	2.77	3.11	3.53	0.85	1.72
CaO	4.48	3.49	3.74	5.19	5.66	6.06	2.79	4.12
Na_2O	4.45	1.53	3.46	3.90	3.58	3.50	3.47	3.06
K_2O	1.64	2.32	2.94	1.26	1.84	2.10	3.36	3.29
TiO_2	0.69	0.39	0.61	0.62	0.70	0.83	0.40	0.47
P_2O_5	0.19	0.15	0.17	0.17	0.19	0.24	0.16	0.14
MnO	0.08	0.02	0.06	0.10	0.12	0.11	0.04	0.05
LOI	2.62	6.67	3.45	2.77	1.59	1.45	3.28	3.09
Total	99.97	99.39	98.82	99.3	99.38	99.2	99.31	99.01
Trace element composition								
Rb	43	114	77	70	80	84	95	80
Sr	481	2,965	341	404	402	653	320	359
Y	16	12	18	11	17	18	12	16
Zr	158	194	140	139	122	133	160	112
Nb	5	10	12	11	15	8	12	10
Ba	1,083	2,239	1,286	1,235	1,168	1,544	1,527	1,317

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Locality	Southern East Humboldt Range							
Field No.	91T19*	91T20	91T22§	91T23	92B42	92B45	92B46	92B49
Lab No.	D–503366	D–503367	D–503368	D–503369	D–522594	D–522595	D–522596	D–522598
Latitude	40°41'48" N.	40°41'22" N.	40°38'33" N.	40°38'29" N.	40°41'33" N.	40°41'39" N.	40°41'23" N.	40°40'04" N.
Longitude	115°04'44" W.	115°05'22" W.	115°05'28" W.	115°05'25" W.	115°04'33" W.	115°03'50" W.	115°05'15" W.	115°05'11" W.
Major-oxide composition								
SiO_2	71.4	67.5	53.2	58.4	67.3	62.8	72.8	64.3
Al_2O_3	12.4	13.8	17.0	17.0	12.6	15.7	11.1	15.9
$FcTO_3$	2.00	1.44	5.32	5.91	1.55	4.29	0.97	3.75
MgO	0.88	0.72	3.34	2.48	1.05	2.20	0.41	1.60
CaO	2.85	3.06	13.3	5.30	2.66	2.88	1.65	4.02
Na_2O	2.25	2.20	3.73	3.56	0.67	2.54	0.75	3.24
K_2O	4.10	3.00	1.38	2.32	4.09	5.07	7.17	2.43
TiO_2	0.39	0.13	0.45	0.81	0.19	0.68	0.11	0.46
P_2O_5	0.14	0.08	0.27	0.24	0.11	0.19	0.15	0.18
MnO	0.05	0.02	0.08	0.07	0.02	0.04	0.04	0.07
LOI	2.25	6.81	0.76	3.18	8.80	3.09	4.06	3.25
Total	98.71	98.76	98.83	99.27	99.04	99.48	99.21	99.2
Trace element composition								
Rb	89	57	35	50	126	106	138	46
Sr	509	1,101	1,948	554	763	277	137	932
Y	13	10	11	19	18	12	18	15
Zr	160	74	84	120	129	94	63	129
Nb	11	10	4	10	9	6	12	8
Ba	1,941	1,474	696	1,505	1,261	1,112	1,175	1,303

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Locality	Southern East Humboldt Range	Deadman Creek area						
Field No.	92B57	H1	H2	H3	H4	H6	WC–1*†	HOL–2†
Lab No.	D–522599	D–365192	D–365193	D–365194	D–365195	D–365196	D–365197	D–365198
Latitude	40°38′27″ N.	41°15′ N.	41°15′ N.	41°15′ N.	41°15′ N.	41°15′ N.	41°18′52″ N.	41°14′36″ N.
Longitude	115°10′00″ W.	114°37′30″ W.	114°37′30″ W.	114°37′30″ W.	114°37′30″ W.	114°37′30″ W.	114°38′30″ W.	114°37′55″ W.
Major-oxide composition								
SiO_2	65.2	62.4	74.9	63.9	78.1	62.5	71.7	60.6
Al_2O_3	15.7	16.8	12.4	14.6	11.1	17.9	13.6	17.2
$FeTO_3$	3.76	5.67	1.11	4.15	0.84	4.46	1.94	5.07
MgO	1.58	1.29	0.43	0.78	0.24	1.62	0.56	2.30
CaO	3.79	2.11	0.71	3.59	0.55	1.39	2.11	3.63
Na_2O	3.22	5.07	2.32	3.27	2.96	8.17	3.32	4.85
K_2O	3.61	2.51	5.00	4.47	3.77	0.49	3.93	2.80
TiO_2	0.54	0.65	0.11	0.60	0.09	0.59	0.37	0.74
P_2O_5	0.16	0.21	0.06	0.21	<0.05	0.19	0.14	0.27
MnO	0.06	0.05	<0.02	0.10	<0.02	0.18	0.02	0.05
LOI	1.97	2.50	2.22	3.70	1.61	1.85	0.86	2.02
Total	99.59	99.26	99.28	99.37	99.33	99.34	98.55	99.53
Trace element composition								
Rb	106	75	167	137	118	17	138	72
Sr	298	494	266	343	226	296	482	499
Y	22	21	23	21	27	14	23	22
Zr	139	190	141	197	118	105	253	195
Nb	15	11	15	12	16	15	9	12
Ba	988	1,754	1,611	1,721	1,115	650	1,873	1,485

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Locality	Deadman Creek area					Wood Hills		Ferguson Mountain
Field No.	HOL–5†	90–14†	90–22†	90–67†	90–78†	92BWH1*††	92BWH2††	92T21*
Lab No.	D–365199	D–365200	D–365201	D–365202	D–365203	D–522590	D–522591	D–522586
Latitude	41°14′48″ N.	41°16′28″ N.	41°17′18″ N.	41°18′58″ N.	41°18′44″ N.	41°04′53″ N.	41°04′53″ N.	40°26′15″ N.
Longitude	114°37′27″ W.	114°40′ W.	114°39′59″ W.	114°39′55″ W.	114°38′32″ W.	114°52′55″ W.	114°52′55″ W.	114°08′54″ W.
Major-oxide composition								
SiO_2	74.8	70.7	67.5	72.7	67.6	75.2	63.5	64.9
Al_2O_3	12.7	12.1	13.7	11.8	15.7	12.6	16.8	15.4
$FeTO_3$	1.13	1.16	4.10	2.97	2.74	1.44	4.75	4.36
MgO	0.38	0.58	1.33	1.04	0.60	0.19	0.68	1.76
CaO	0.57	1.40	3.95	2.95	2.32	0.91	4.37	4.21
Na_2O	2.26	0.85	2.80	2.27	3.65	3.15	3.80	2.81
K_2O	5.78	6.53	3.43	3.81	4.92	4.86	2.64	3.40
TiO_2	0.10	0.12	0.58	0.51	0.40	0.15	0.62	0.57
P_2O_5	0.05	0.05	0.22	0.19	0.18	0.05	0.19	0.18
MnO	0.02	0.02	0.02	0.02	0.05	0.04	0.04	0.08
LOI	1.86	5.71	1.58	1.14	1.04	0.93	1.71	1.99
Total	99.65	99.22	99.21	99.4	99.2	99.52	99.1	99.66
Trace element composition								
Rb	176	191	133	143	165	140	70	110
Sr	217	809	634	490	519	125	384	259
Y	21	17	23	21	28	14	16	26
Zr	139	146	157	162	278	113	136	199
Nb	18	12	13	10	15	13	8	16
Ba	1,596	1,195	1,810	1,394	2,096	1,274	1,043	1,096

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Locality	Dolly Varden Mountains	Silver Island Mountains		Sanford Springs area, southern Deep Creek Mountains				
Field No.	92BDV*	91T3*	91T4*	91T30	91T32	91T33	92B13	92B14
Lab No.	D–522589	D–503357	D–503358	D–503370	D–503371	D–503372	D–516488	D–516489
Latitude	40°19′20″ N.	40°49′59″ N.	40°49′56″ N.	39°48′26″ N.	39°48′23″ N.	39°48′35″ N.	39°55′27″ N.	39°54′24″ N.
Longitude	114°31′09″ W.	113°56′49″ W.	113°57′24″ W.	114°08′15″ W.	114°08′15″ W.	114°08′25″ W.	114°10′47″ W.	114°11′06″ W.
Major-oxide composition								
SiO_2	64.1	59.2	68.0	60.8	59.8	60.0	66.0	60.6
Al_2O_3	15.2	17.6	14.9	15.9	16.0	16.0	15.9	16.1
$FeTO_3$	4.46	6.06	2.31	5.56	5.31	5.44	4.28	5.41
MgO	2.04	2.79	0.88	3.71	3.80	3.61	1.05	2.18
CaO	3.74	6.04	2.99	5.73	5.76	5.84	3.13	5.25
Na_2O	2.84	3.14	3.15	3.38	3.03	2.76	3.34	2.97
K_2O	3.03	2.09	2.84	2.55	2.75	2.47	4.71	3.99
TiO_2	0.55	0.62	0.21	0.78	0.76	0.75	0.50	0.60
P_2O_5	0.15	0.19	0.11	0.20	0.21	0.19	0.21	0.28
MnO	0.06	0.11	0.07	0.08	0.08	0.09	0.09	0.12
LOI	3.16	1.30	3.53	0.81	1.41	2.22	<0.01	1.69
Total	99.33	99.14	98.99	99.5	98.91	99.37	99.22	99.19
Trace element composition								
Rb	109	67	84	83	94	75	189	168
Sr	230	368	275	490	513	463	331	383
Y	24	19	9	30	21	24	32	21
Zr	182	132	122	194	190	174	234	202
Nb	19	10	15	15	13	5	18	11
Ba	977	1,047	1,045	1,143	1,195	979	1,163	1,234

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Locality	Sanford Springs area, southern Deep Creek Mountains							
Field No.	92B15	92B16	92B19	92B21	92B24	92B26	92B27*	92B28
Lab No.	D–516490	D–516484	D–516485	D–516491	D–516486	D–516487	D–516498	D–516495
Latitude	39°54′16″ N.	39°57′13″ N.	39°57′43″ N.	39°58′13″ N.	39°59′59″ N.	39°59′23″ N.	39°48′39″ N.	39°48′24″ N.
Longitude	114°11′02″ W.	114°07′07″ W.	114°06′42″ W.	114°07′56″ W.	114°07′53″ W.	114°04′50″ W.	114°07′55″ W.	114°08′14″ W.
Major-oxide composition								
SiO_2	66.4	67.0	64.0	61.3	65.4	69.0	69.2	60.9
Al_2O_3	14.8	14.8	15.1	14.6	14.8	13.8	13.7	15.7
$FeTO_3$	4.28	3.53	4.43	5.33	3.63	2.55	1.79	5.55
MgO	0.80	0.94	2.03	2.13	1.26	0.11	1.54	3.78
CaO	2.95	2.63	3.64	5.59	2.94	3.07	2.57	5.74
Na_2O	2.93	3.05	2.77	2.85	2.99	3.28	2.51	3.28
K_2O	4.82	4.91	3.03	4.11	4.73	5.22	2.84	2.54
TiO_2	0.52	0.45	0.55	0.64	0.45	0.20	0.24	0.77
P_2O_5	0.19	0.18	0.15	0.29	0.18	0.10	0.12	0.20
MnO	0.08	0.06	0.06	0.1	0.07	0.08	0.04	0.09
LOI	1.26	1.51	3.55	1.81	2.56	1.48	4.46	0.80
Total	99.03	99.06	99.31	98.75	99.01	98.89	99.01	99.35
Trace element composition								
Rb	198	206	194	167	206	241	78	77
Sr	269	281	255	350	276	157	373	474
Y	27	23	26	21	25	22	14	20
Zr	205	210	197	201	218	192	114	186
Nb	21	21	18	16	20	22	8	13
Ba	1,245	1,239	1,208	1,576	1,141	981	1,343	1,126

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Locality----------	Sanford Springs area, southern Deep Creek Mountains							
Field No.---------	92B33	92B34	92B38	92B60	92B62	92B69	92B70	92B71
Lab No. ----------	D–516497	D–516496	D–516499	D–516492	D–516493	D–516494	D–516482	D–516483
Latitude----------	39°48′09″ N.	39°48′16″ N.	39°49′29″ N.	39°59′20″ N.	39°52′30″ N.	39°51′39″ N.	39°51′40″ N.	39°51′10″ N.
Longitude--------	114°07′50″ W.	114°07′44″ W.	114°07′31″ W.	114°08′04″ W.	114°10′37″ W.	114°09′49″ W.	114°09′53″ W.	114°08′01″ W.
Major-oxide composition								
SiO_2	62.8	60.7	67.4	64.5	65.0	65.0	70.8	62.5
Al_2O_3	15.9	16.1	11.1	14.3	14.6	14.9	13.9	15.5
$FeTO_3$	4.11	4.86	1.42	5.05	4.45	4.51	2.07	4.28
MgO	2.66	3.01	1.12	1.93	1.06	2.65	0.53	2.69
CaO	4.63	5.37	5.00	3.88	3.72	4.14	2.34	4.92
Na_2O	3.16	2.81	1.35	2.80	2.93	3.02	3.07	2.95
K_2O	2.86	2.83	3.06	4.46	4.82	3.43	4.90	3.14
TiO_2	0.61	0.72	0.20	0.55	0.51	0.73	0.37	0.64
P_2O_5	0.19	0.20	0.11	0.23	0.18	0.19	0.25	0.20
MnO	0.07	0.08	0.02	0.09	0.09	0.07	0.05	0.07
LOI	2.38	2.96	8.48	1.36	1.49	0.55	0.79	2.23
Total	99.37	99.64	99.26	99.15	98.85	99.19	99.07	99.12
Trace element composition								
Rb	91	76	60	195	191	136	194	92
Sr	513	475	637	226	284	383	224	481
Y	15	24	13	26	31	23	24	17
Zr	182	165	93	198	210	225	213	198
Nb	16	10	12	24	16	15	21	14
Ba	1,288	827	1,761	1,138	1,277	1,162	423	1,271

Table 3. Chemical analyses of other Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Locality	Sanford Springs area	Gold Hill area		Coal Mine Canyon	
Field No.---------	92B67	91CP30*	91CP33*	12247	12624*
Lab No. ----------	D–516500	D–522592	D–522593	D–559062	D–559063
Latitude ----------	39°48′15″ N.	40°11′23″ N.	40°12′18″ N.	41°07′ N.	41°06′52″ N.
Longitude--------	114°11′32″ W.	114°58′15″ W.	114°58′15″ W.	115°37′57″ W.	115°37′46″ W.
Major-oxide composition					
SiO_2	65.6	62.2	68.5	65.7	65.6
Al_2O_3	12.6	15.8	15.0	15.4	15.2
$FeTO_3$	1.62	5.16	1.68	3.46	3.54
MgO	1.81	2.68	0.72	1.04	1.17
CaO	5.88	5.19	2.47	2.92	3.11
Na_2O	2.58	2.82	2.87	2.61	2.58
K_2O	2.44	2.73	3.95	5.16	4.85
TiO_2	0.22	0.63	0.33	0.67	0.65
P_2O_5	0.12	0.15	0.12	0.23	0.23
MnO	0.03	0.1	0.05	0.04	0.08
LOI	6.23	2.06	2.93	1.79	2.39
Total	99.13	99.52	98.62	99.02	99.4
Trace element composition					
Rb	85	115	115	130	138
Sr	412	279	206	366	372
Y	17	29	36	16	20
Zr	111	191	209	157	164
Nb	9	15	16	16	15
Ba	1,373	931	980	2,252	1,527

Table 4. Summary of $^{40}Ar/^{39}Ar$ age-spectrum data for middle Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field.

[Location of areas shown in figure 1*A*. Ferguson Mountain sampled by J. Welsh for $^{40}Ar/^{39}Ar$ date, (12659), resampled by C. Thorman for rock chemistry (92T21). Dolly Varden Mountains sampled by J. Zamudio for $^{40}Ar/^{39}Ar$ date (3233), resampled by Brooks for rock chemistry (92BDV). All analyses performed by the U.S. Geological Survey, Denver]

Area	Sample no.	Rock type	Mineral	Apparent age (Ma) and error (1σ)	Character of spectrum
Nanny Creek	91T10	Dacite	Hornblende	39.23±0.5	Plateau date; 87 percent of total $^{39}Ar_K$
Nanny Creek	90B9B	Ash-flow tuff	Biotite	39.61±0.13	Plateau date; 60 percent of total $^{39}Ar_K$
Nanny Creek	88T55	Ash-flow tuff	Biotite	39.89±0.12	Plateau date; 94 percent of total $^{39}Ar_K$
Nanny Creek	88T56	Ash-flow tuff	Biotite	41.08±0.11	Plateau date; 86 percent of total $^{39}Ar_K$
Southern Snake Mountains	88T36	Ash-flow tuff	Biotite	39.5±0.2	Plateau date; 95 percent of total $^{39}Ar_K$
Southern Snake Mountains	88T42	Dacite	Biotite	39.7±0.1	Preferred date for disturbed spectrum; 60 percent of total $^{39}Ar_K$
Southern Snake Mountains	88T41	Ash-flow tuff	Biotite	39.76±0.13	Plateau date; 63 percent of total $^{39}Ar_K$
Southern Snake Mountains	88T38	Ash-flow tuff	Biotite	39.85±0.15	Preferred date for disturbed spectrum; 80 percent of total $^{39}Ar_K$
Northern East Humboldt Range	90B31B	Ash-flow tuff	Biotite	38.0±0.5	Preferred date for disturbed spectrum; 54 percent of total $^{39}Ar_K$; probably a minimum
Southern East Humboldt Range	91T12	Dacite	Hornblende	38.8±0.4	Plateau date; 71 percent of total $^{39}Ar_K$
Southern East Humboldt Range	91T17	Dacite	Hornblende	39.5±0.3	Plateau date; 92 percent of total $^{39}Ar_K$
Southern East Humboldt Range	91T19	Dacite[1]	Biotite	40.98±0.1	Plateau date; 52 percent of total $^{39}Ar_K$
Deadman Creek Area, Windermere Hills[2]	WC–6	Dacite	Hornblende	39.87±0.1	Plateau date; 77 percent of total $^{39}Ar_K$
Deadman Creek Area, Windermere Hills[2]	WC–1	Ash-flow tuff	Biotite	40.38±0.1	Plateau date; 64 percent of total $^{39}Ar_K$
Wood Hills	92BWH1	Ash-flow tuff	Biotite	39.7±0.1	Preferred date for disturbed spectrum; excess argon, maximum estimate
Ferguson Mountain	12659–92T21	Dacite	Hornblende	39.80±0.1	Plateau date; 62 percent of total $^{39}Ar_K$
Dolly Varden Mountains	3233–92BDV	Dacite	Biotite	39.08±0.11	Plateau date; 94 percent of total $^{39}Ar_K$
Silver Island Mountains	91T3	Andesite	Hornblende	42.6±0.3	Plateau date; 81 percent of total $^{39}Ar_K$
Silver Island Mountains	91T4	Rhyolite	Biotite	42.61±0.8	Preferred date for disturbed spectrum
Sanford Springs	92B27	Ash-flow tuff	Biotite	40.64±0.07	Plateau date; 92 percent of total $^{39}Ar_K$
Gold Hill	91CP33	Rhyolite	Biotite	39.58±0.10	Plateau date; 74 percent of total $^{39}Ar_K$
Gold Hill	93CP30	Dacite	Hornblende	39.6±0.2	Plateau date; 63 percent of total $^{39}Ar_K$ (recalculated)
Coal Mine Canyon	12624	Ash-flow tuff	Hornblende	40.4±0.2	Plateau date; 93 percent of total $^{39}Ar_K$

[1]Dacite clast in basal conglomerate.
[2]Mueller, (1992).

Table 5. Abbreviated $^{40}Ar/^{39}Ar$ age-spectrum data for middle Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field.

[Location of areas shown in figure 1*A*; reactor package (table 6) is given following sample number. Age-spectrum data for Deadman Creek are given in Mueller (1992). $^{40}Ar_R$, radiogenic ^{40}Ar; $^{39}Ar_K$, potassium-derived ^{39}Ar; F, $^{40}Ar_R$ divided by $^{39}Ar_K$; Ma error to 1σ. Leaders (--) indicate unmeasurable; asterisk (*) indicates step used in plateau-date or preferred-date calculation]

Temperature (°C)	$^{40}Ar_R$	$^{39}Ar_K$	F	$^{39}Ar/^{37}Ar$	$^{40}Ar_R$ (percent)	$^{39}Ar_K$ (percent)	Apparent age and error (Ma)
				NANNY CREEK			
Sample 91T10/66/DD37; dacite; 289.2 mg hornblende; measured $^{40}Ar/^{36}Ar$=296; plateau date=39.23±0.5 Ma; J-value=0.007781±0.1 percent (1σ); lat 41°1'28" N., long 114°30'10" W.							
800	0.12980	0.04291	3.025	2.5	23.2	2.3	42±1
900	0.02139	0.00710	3.01	1.10	20.9	0.4	42±8
1,000	0.01992	0.00949	2.10	0.41	27.4	0.5	29±7
1,050	0.03779	0.00977	3.87	0.34	61.8	0.5	54±5
*1,100	0.11208	0.03966	2.82	0.20	65.2	2.1	39±2
*1,150	1.2323	0.43526	2.831	0.15	85.8	22.9	39.3±0.2
*1,175	1.7275	0.61377	2.815	0.15	93.2	32.4	39.08±0.11
*1,200	0.59157	0.20750	2.851	0.15	88.2	10.9	39.6±0.4
*1,250	0.97129	0.34404	2.823	0.15	92.8	18.1	39.2±0.2
1,350	0.54260	0.18741	2.895	0.15	93.6	9.9	40.2±0.5
Total gas			2.839				39.4±0.3
Sample 90B9B/32/DD28; ash-flow tuff; 58 mg biotite; measured $^{40}Ar/^{36}Ar$=296.6; plateau date=39.61±0.13 Ma; J-value=0.007317±0.1 percent (1σ); lat 41°1'23" N., long 114°31'40" W.							
650	0.01982	0.02023	0.98	--	9.0	0.5	13±2
750	0.06042	0.03948	1.530	--	27.6	1.0	20±2
850	0.37870	0.12920	2.931	--	47.6	3.3	38.28±0.15
900	0.85369	0.27621	3.091	--	76.6	7.0	40.34±0.08
950	0.63085	0.20521	3.074	--	86.7	5.2	40.1±0.3
1,000	1.4416	0.47145	3.058	--	94.2	12.0	39.92±0.09
1,050	1.3049	0.42834	3.046	--	92.2	10.9	39.77±0.06
*1,100	1.6431	0.54138	3.035	--	90.8	13.7	39.62±0.13
*1,150	3.3623	1.1085	3.033	--	90.9	28.1	39.60±0.07
*1,300	2.1992	0.72483	3.034	--	92.2	18.4	39.6±0.2
Total gas			3.015				39.4±0.2
Sample 88T55/21/DD9; ash-flow tuff; 89.8 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; plateau date=39.89±0.12 Ma; J-value=0.007447±0.25 percent (1σ); lat 41°1'29" N., long 114°32'41" W.							
500	0.15838	0.10844	1.470	26	5.0	0.8	19.6±0.3
600	0.23313	0.10217	2.282	64	8.6	0.8	30.4±0.8
700	1.6435	0.55134	2.981	201	32.1	4.1	39.61±0.12
*750	3.6428	1.2111	3.008	417	58.0	9.1	39.96±0.11
*800	3.7730	1.2561	3.004	483	61.7	9.4	39.91±0.15
*850	3.0798	1.0239	3.008	542	58.0	7.7	39.96±0.11
*900	3.5829	1.1930	3.003	433	61.3	9.0	39.90±0.11
*950	5.7707	1.9131	3.016	253	67.5	14.4	40.08±0.13
*1,000	9.8746	3.2973	2.995	176	73.1	24.8	39.79±0.11
*1,050	5.8823	1.9644	2.994	101	76.3	14.8	39.79±0.11
*1,150	1.9717	0.65648	3.003	27	78.6	4.9	39.90±0.13
1,300	0.04820	0.01555	3.10	8.1	10.9	0.1	41±6
Total gas			2.984				39.65±0.13

Table 5. Abbreviated $^{40}Ar/^{39}Ar$ age-spectrum data for middle Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Temperature (°C)	$^{40}Ar_R$	$^{39}Ar_K$	F	$^{39}Ar/^{37}Ar$	$^{40}Ar_R$ (percent)	$^{39}Ar_K$ (percent)	Apparent age and error (Ma)
NANNY CREEK—Continued							
Sample 88T56/16/DD12; ash-flow tuff; 79.3 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; plateau date=41.08±0.11 Ma; J-value=0.007342±0.25 percent (1σ); lat 41°1'30" N., long 114°32'47" W.							
500	0.05826	0.03447	1.69	20	12.9	0.3	22±2
600	0.07291	0.02416	3.02	40	36.6	0.2	40±2
700	0.38815	0.12254	3.168	66	40.6	1.0	41.5±0.6
750	0.64068	0.20074	3.192	118	79.0	1.7	41.8±0.3
800	1.2601	0.39691	3.175	162	84.6	3.4	41.57±0.15
850	2.4142	0.76145	3.169	227	91.0	6.5	41.50±0.13
*900	3.6391	1.1572	3.145	277	93.0	9.9	41.18±0.12
*950	4.6752	1.4903	3.137	272	92.9	12.7	41.08±0.11
*1,000	6.0889	1.9407	3.138	163	89.9	16.5	41.09±0.11
*1,050	7.3773	2.3564	3.131	88	85.3	20.1	41.00±0.11
*1,150	9.7167	3.0952	3.139	50	87.7	26.4	41.11±0.11
1,300	0.50310	0.15804	3.183	28	54.4	1.3	41.7±0.4
Total gas			3.138				41.09±0.13
SOUTHERN SNAKE MOUNTAINS							
Sample 88T36/18/DD12; ash-flow tuff; 87 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; no plateau; preferred date=39.5±0.2 Ma; J-value=0.007163±0.25 percent (1σ); lat 41°9'57" N., long 114°57'6" W.							
500	0.30420	0.17163	1.772	30	27.8	1.4	22.76±0.07
600	0.77060	0.29229	2.667	13	63.5	2.4	34.1±0.2
700	6.6119	2.1322	3.101	72	85.9	17.3	39.63±0.11
750	5.7352	1.8427	3.112	230	94.0	14.9	39.78±0.11
800	4.1256	1.3290	3.104	210	94.1	10.8	39.68±0.11
850	2.6844	0.86756	3.094	161	91.9	7.0	39.55±0.15
900	1.8721	0.61022	3.068	98	87.0	4.9	39.21±0.15
950	0.79985	0.26451	3.024	85	83.5	2.1	38.7±0.3
*1,000	4.5589	1.4774	3.086	65	85.4	12.0	39.44±0.14
*1,050	5.6361	1.8242	3.090	25	90.7	14.8	39.49±0.11
*1,150	4.3953	1.4164	3.103	9.9	93.2	11.5	39.66±0.11
*1,300	0.33488	0.10708	3.127	9.2	76.6	0.9	40.0±0.7
Total gas			3.067				39.21±0.12
Sample 88T42/20/DD12; dacite; 102.3 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; minor excess ^{40}Ar; preferred date=39.7±0.1 Ma; J-value=0.007268±0.25 percent (1σ); lat 41°12'2" N., long 114°54'43" W.							
500	0.37846	0.23817	1.589	21	17.8	1.7	20.7±0.2
600	0.61035	0.31737	1.923	16	38.3	2.2	25.0±0.3
700	1.5013	0.57354	2.618	27	52.0	4.0	34.00±0.13
750	1.6668	0.55909	2.981	48	72.6	3.9	38.67±0.14
800	2.0437	0.65713	3.110	72	83.7	4.6	40.32±0.13
850	2.2285	0.71080	3.135	91	88.3	5.0	40.65±0.12
900	2.6020	0.83967	3.099	106	88.5	5.9	40.18±0.12
950	3.7744	1.2271	3.076	111	87.3	8.7	39.89±0.11
1,000	6.8916	2.2531	3.059	114	83.8	15.9	39.66±0.11
1,050	5.9272	1.9190	3.089	116	88.7	13.5	40.05±0.11
1,150	13.640	4.3898	3.107	78	92.3	31.0	40.29±0.11
1,300	1.5217	0.48327	3.149	47	86.4	3.4	40.8±0.2
Total gas			3.020				39.17±0.12

Table 5. Abbreviated $^{40}Ar/^{39}Ar$ age-spectrum data for middle Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Temperature (°C)	$^{40}Ar_R$	$^{39}Ar_K$	F	$^{39}Ar/^{37}Ar$	$^{40}Ar_R$ (percent)	$^{39}Ar_K$ (percent)	Apparent age and error (Ma)
SOUTHERN SNAKE MOUNTAINS—Continued							
Sample 88T41/14/DD12; ash-flow tuff; 101.6 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; plateau date=39.76±0.13 Ma; J-value=0.007208±0.25 percent (1σ); lat 41°12'4" N., long 114°54'36" W.							
500	0.17167	0.11099	1.547	58	22.1	0.7	20.0±0.6
600	0.39633	0.17888	2.216	66	42.2	1.2	28.6±0.2
650	0.67225	0.24434	2.751	80	58.2	1.6	35.4±0.3
700	2.1099	0.67874	3.108	101	74.1	4.5	40.0±0.2
750	4.6088	1.4847	3.104	125	91.9	9.9	39.92±0.11
800	5.3092	1.7032	3.117	157	94.5	11.4	40.08±0.11
850	3.7568	1.2060	3.115	164	92.1	8.1	40.06±0.13
*900	2.9802	0.96075	3.102	156	93.8	6.4	39.89±0.12
*950	2.6491	0.85635	3.093	120	91.7	5.7	39.78±0.13
*1,000	3.8378	1.2472	3.077	120	91.0	8.3	39.57±0.12
*1,050	6.6500	2.1593	3.080	158	91.7	14.4	39.61±0.11
*1,150	10.867	3.5066	3.099	105	92.2	23.4	39.85±0.11
*1,300	1.9346	0.62283	3.106	119	79.0	4.2	39.9±0.2
Total gas			3.071				39.50±0.12
Sample 88T38/11/DD12; ash-flow tuff; 97.7 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; no plateau; preferred date=39.85±0.15 Ma; J-value=0.007100±0.25 percent (1σ); lat 41°10'6" N., long 114°56'59" W.							
500	0.46200	0.29833	1.549	27	23.6	2.2	19.73±0.15
600	0.65700	0.26223	2.505	31	47.1	1.9	31.8±0.2
*700	5.0628	1.6003	3.164	45	75.5	11.6	40.07±0.11
*750	6.3761	2.0151	3.164	62	89.4	14.6	40.08±0.11
*800	4.1359	1.3108	3.155	67	90.9	9.5	39.97±0.11
*850	2.8251	0.8996	3.140	61	88.9	6.5	39.8±0.2
*900	2.2411	0.72269	3.101	46	82.7	5.2	39.29±0.15
*950	2.6114	0.83810	3.116	45	79.1	6.1	39.47±0.11
*1,000	5.9991	1.9146	3.133	56	82.6	13.9	39.69±0.11
*1,050	7.0790	2.2519	3.144	50	86.1	16.3	39.82±0.11
*1,150	4.9505	1.5710	3.151	35	88.5	11.4	39.92±0.11
*1,300	0.42176	0.13207	3.194	27	75.4	1.0	40.4±0.4
Total gas			3.099				39.27±0.12
NORTHERN EAST HUMBOLDT RANGE							
Sample 90B31B/42/DD28; ash-flow tuff; 62.3 mg biotite; measured $^{40}Ar/^{36}Ar$=296.6; no plateau; minimum date=38.0±0.5 Ma; J-value=0.007318±0.1 percent (1σ); lat 41°2'50" N., long 115°4'10" W.							
600	1.0729	0.48607	2.207	--	29.3	27.0	28.91±0.14
700	0.90034	0.32507	2.770	--	32.2	18.0	36.20±0.16
*750	0.45053	0.15259	2.953	--	34.4	8.5	38.6±0.4
*800	0.29564	0.10106	2.925	--	35.4	5.6	38.2±0.9
*850	0.17968	0.06158	2.918	--	38.4	3.4	38.1±0.5
*900	0.20100	0.07135	2.817	--	36.8	4.0	36.8±0.5
*950	0.30674	0.10802	2.840	--	35.8	6.0	37.1±0.6
*1,000	0.40961	0.13985	2.929	--	36.9	7.8	38.26±0.16
*1,050	0.48513	0.16587	2.925	--	39.3	9.2	38.2±0.4
*1,100	0.35793	0.12307	2.908	--	41.7	6.8	38.0±0.4
*1,150	0.14697	0.04986	2.948	--	47.0	2.8	38.5±0.5
1,300	0.03581	0.01901	1.88	--	27.4	1.1	25±3
Total gas			2.685				35.1±0.3

Table 5. Abbreviated $^{40}Ar/^{39}Ar$ age-spectrum data for middle Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Temperature (°C)	$^{40}Ar_R$	$^{39}Ar_K$	F	$^{39}Ar/^{37}Ar$	$^{40}Ar_R$ (percent)	$^{39}Ar_K$ (percent)	Apparent age and error (Ma)
SOUTHERN EAST HUMBOLDT RANGE							
Sample 91T12/67/DD33; dacite; 190.3 mg hornblende; measured $^{40}Ar/^{36}Ar$=296.6; plateau date=38.8±0.4 Ma; J-value=0.007750±0.1 percent (1σ); lat 40°42'11" N., long 115°4'22" W.							
800	0.0241	0.0107	2.26	0.39	5.4	1.2	31±3
900	0.0081	0.0058	1.41	0.51	25.3	0.6	20±2
950	0.0089	0.0085	1.05	0.30	31.0	0.9	15±8
1,000	0.0430	0.0139	3.09	0.15	70.6	1.5	43±4
1,025	0.0892	0.0329	2.71	0.12	73.1	3.6	37±2
*1,050	0.20204	0.07275	2.777	0.12	82.2	7.9	38.4±0.4
*1,075	0.27813	0.10068	2.762	0.12	86.9	10.9	38.2±0.4
*1,100	0.34620	0.12429	2.785	0.12	90.1	13.5	38.5±0.5
*1,125	0.59076	0.20926	2.823	0.12	92.8	22.7	39.0±0.3
*1,150	0.41827	0.14800	2.826	0.12	92.0	16.1	39.1±0.3
1,200	0.43733	0.15202	2.877	0.12	94.5	16.5	39.8±0.4
1,250	0.06277	0.02121	2.96	0.12	88.3	2.3	41±2
1,350	0.06355	0.02110	3.011	0.12	78.3	2.3	41.6±0.8
Total gas			2.793				38.6±0.8
Sample 91T17/59/DD37; dacite; 268.3 mg hornblende; measured $^{40}Ar/^{36}Ar$=296.6; plateau date=39.5±0.3 Ma; J-value=0.007482±0.1 percent (1σ); lat 40°40'4" N., long 115°6'22" W.							
800	0.0133	0.0071	1.87	0.73	2.5	0.5	25±5
900	0.0167	0.0052	3.22	0.58	15.9	0.3	43±7
950	0.0038	0.0015	2.4	0.28	14.3	0.1	33±24
1,000	0.0062	0.0016	3.7	0.19	25.1	0.1	50±35
1,050	0.0150	0.0046	3.25	0.15	41.7	0.3	43±10
1,100	0.27736	0.09039	3.068	0.14	86.8	5.9	41.0±0.6
*1,125	0.59974	0.20398	2.940	0.14	89.3	13.4	39.2±0.4
*1,150	0.72717	0.24471	2.972	0.14	93.4	16.1	39.67±0.14
*1,175	1.0586	0.35924	2.947	0.14	95.0	23.6	39.34±0.11
*1,200	0.73829	0.24966	2.957	0.13	93.5	16.4	39.5±0.2
*1,250	0.77600	0.26172	2.965	0.13	95.6	17.2	39.6±0.3
*1,350	0.23507	0.07968	2.950	0.13	90.0	5.2	39.4±0.6
1,450	0.0397	0.0145	2.73	0.15	44.2	1.0	37±4
Total gas			2.957				39.5±0.4
Sample 91T19/68/DD37; dacite clast in conglomerate; 54.5 mg biotite; plateau date=40.98±0.10 Ma; measured $^{40}Ar/^{36}Ar$=296.6; J-value=0.007818±0.1 percent (1σ); lat 40°41'48" N., long 115°4'44" W.							
600	0.03695	0.01958	1.89	13	18.5	0.5	26±3
800	0.18778	0.14897	1.260	19	20.7	4.1	17.69±0.15
900	1.1766	0.42345	2.778	98	71.5	11.5	38.8±0.2
1,000	1.2428	0.42579	2.919	87	84.3	11.6	40.70±0.10
1,050	0.82265	0.28726	2.864	57	80.0	7.8	39.94±0.13
1,100	1.2821	0.44795	2.862	56	81.9	12.2	39.9±0.3
*1,150	2.2633	0.77111	2.935	63	91.9	21.0	40.93±0.11
*1,350	3.3878	1.1517	2.942	31	95.2	31.3	41.02±0.09
Total gas			2.829				39.47±0.16

Table 5. Abbreviated $^{40}Ar/^{39}Ar$ age-spectrum data for middle Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Temperature (°C)	$^{40}Ar_R$	$^{39}Ar_K$	F	$^{39}Ar/^{37}Ar$	$^{40}Ar_R$ (percent)	$^{39}Ar_K$ (percent)	Apparent age and error (Ma)
WOOD HILLS							
Sample 92BWH1/8/DD49; ash-flow tuff; 54.6 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; no plateau; preferred date=39.7±0.1 Ma; J-value=0.007967±0.1 percent (1σ); lat 41°4'53" N., long 114°52'55" W.							
600	0.05061	0.02522	2.01	15	11.2	0.4	28.6±1.1
700	0.15604	0.06264	2.491	18	30.4	0.9	35.4±0.3
750	0.19724	0.07046	2.799	19	41.1	1.1	39.8±0.5
800	0.24367	0.07927	3.074	20	41.3	1.2	43.6±0.4
850	0.45604	0.15490	2.944	22	69.8	2.3	41.8±0.2
900	0.63587	0.21578	2.947	24	85.6	3.2	41.86±0.10
950	1.1200	0.39217	2.856	28	89.7	5.9	40.59±0.07
1,000	0.98496	0.34639	2.843	34	91.7	5.2	40.41±0.14
1,050	1.2199	0.43316	2.816	40	92.0	6.5	40.03±0.07
1,100	1.9483	0.69260	2.813	52	92.3	10.4	39.98±0.13
1,150	3.0700	1.0943	2.805	71	90.6	16.4	39.88±0.06
*1,200	4.0152	1.4337	2.801	83	90.4	21.4	39.81±0.07
*1,350	4.7112	1.6885	2.790	25	89.4	25.2	39.66±0.06
Total gas			2.812				39.97±0.09
FERGUSON MOUNTAIN							
Sample 12659-92T21/57/DD31; dacite; 307.3 mg hornblende; measured $^{40}Ar/^{36}Ar$=298.9; plateau date=39.80±0.10 Ma; J-value=0.007656±0.1 percent (1σ); lat 40°26'15" N., long 114°8'54" W.							
700	0.19505	0.06734	2.90	2.5	33.4	2.1	39.6±0.3
800	0.17530	0.06337	2.77	1.4	20.9	2.0	37.8±0.7
900	0.02904	0.01411	2.06	0.41	10.9	0.4	28±5
950	0.02155	0.01111	1.94	0.34	11.1	0.4	27±6
1,000	0.14291	0.05322	2.69	0.19	44.0	1.7	37±1
1,050	1.1086	0.38812	2.86	0.16	70.3	12.3	39±1
1,075	1.7045	0.59050	2.887	0.16	79.3	18.7	39.43±0.07
*1,100	1.2910	0.44162	2.923	0.16	87.0	14.0	39.93±0.06
*1,150	3.1788	1.0922	2.911	0.16	80.9	34.5	39.76±0.06
*1,250	1.2243	0.42034	2.913	0.16	80.4	13.3	39.8±0.2
1,350	0.06718	0.02097	3.20	0.18	80.8	0.7	44±2
Total gas			2.889				39.5±0.2
DOLLY VARDEN MOUNTAINS							
Sample 3233-92BDV/54/DD26; dacite; 48.2 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; plateau date=39.08±0.11 Ma; J-value=0.006182±0.25 percent (1σ); lat 40°19'20" N., long 114°31'9" W.							
600	0.01061	0.00551	1.93	1.5	2.5	0.1	21±4
700	0.02629	0.00771	3.41	3.8	34.8	0.2	38±3
800	0.11411	0.02993	3.812	13	27.9	0.7	42.0±0.9
900	0.65604	0.18019	3.641	34	90.9	4.5	40.2±0.4
*1,000	4.1651	1.1738	3.548	233	97.3	29.4	39.14±0.11
*1,050	3.6756	1.0403	3.533	343	98.0	26.0	38.98±0.11
*1,100	2.4423	0.68975	3.541	40	95.9	17.3	39.06±0.11
*1,150	1.5050	0.42405	3.549	115	86.7	10.6	39.15±0.11
*1,300	1.5808	0.44597	3.545	192	78.7	11.2	39.10±0.11
Total gas			3.546				39.12±0.13

Table 5. Abbreviated $^{40}Ar/^{39}Ar$ age-spectrum data for middle Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Temperature (°C)	$^{40}Ar_R$	$^{39}Ar_K$	F	$^{39}Ar/^{37}Ar$	$^{40}Ar_R$ (percent)	$^{39}Ar_K$ (percent)	Apparent age and error (Ma)
SILVER ISLAND MOUNTAINS							
Sample 91T3/60/DD37; andesite; 255.3 mg hornblende; measured $^{40}Ar/^{36}Ar$=296.0; plateau date=42.6±0.3 Ma; J-value=0.007595±0.1 percent (1σ); lat 40°49'59" N., long 113°56'49" W.							
800	0.11850	0.04696	2.52	0.59	24.3	3.9	34±3
900	0.10432	0.03909	2.67	0.23	23.7	3.2	36±2
925	0.02896	0.01029	2.81	0.20	48.2	0.9	38±5
950	0.02547	0.00769	3.31	0.17	57.4	0.6	45±5
1000	0.00965	0.00427	2.26	0.15	32.6	0.4	31±14
1025	0.01097	0.00409	2.68	0.15	34.8	0.3	36±10
1075	0.02506	0.00936	2.68	0.14	45.8	0.8	36±5
1,100	0.06174	0.01977	3.12	0.13	65.5	1.6	42±3
1,125	0.26794	0.08724	3.071	0.12	78.1	7.2	41.6±0.4
1,150	0.43486	0.13881	3.133	0.12	86.2	11.5	42.42±0.14
1,175	0.96583	0.30592	3.157	0.12	92.6	25.4	42.75±0.11
1,200	0.73636	0.23403	3.146	0.12	93.6	19.4	42.60±0.13
1,225	0.32291	0.10260	3.147	0.11	92.7	8.5	42.6±0.8
1,250	0.23418	0.07446	3.145	0.11	92.3	6.2	42.59±0.16
1,350	0.37716	0.12065	3.126	0.11	92.0	10.0	42.3±0.5
Total gas			3.090				41.8±0.7
Sample 91T4/61/DD37; rhyolite; 70.8 mg biotite; measured $^{40}Ar/^{36}Ar$=296.0; no plateau; excess ^{40}Ar; preferred date=42.61±0.08 Ma; J-value=0.007803±0.1 percent (1σ); lat 40°49'56" N., long 113°57'24" W.							
650	0.20173	0.09652	2.090	32	32.7	2.0	29.2±0.5
750	0.25269	0.09054	2.791	51	42.2	1.8	38.9±0.2
850	0.76432	0.24405	3.132	103	84.6	4.9	43.56±0.20
*950	1.6035	0.52348	3.063	174	89.3	10.6	42.61±0.10
*1,000	2.3902	0.78041	3.063	281	92.0	15.8	42.61±0.07
1,050	3.5278	1.1321	3.116	255	90.8	22.9	43.34±0.07
1,100	3.2635	1.0319	3.163	155	90.1	20.9	43.98±0.11
1,150	2.6182	0.81507	3.212	82	91.8	16.5	44.66±0.09
1,350	0.73826	0.22428	3.292	16	91.4	4.5	45.8±0.3
Total gas			3.110				43.26±0.11
SANFORD SPRINGS							
Sample 92B27/61/DD42; ash-flow tuff; 58.9 mg biotite; measured $^{40}Ar/^{36}Ar$=298.9; plateau date=40.64±0.07 Ma; J-value=0.008156±0.1 percent (1σ); lat 39°48'39" N., long 114°7'55" W.							
600	1.2902	0.49008	2.633	43	72.4	8.3	38.33±0.06
750	2.8101	1.0077	2.789	54	76.4	17.0	40.57±0.35
800	0.91643	0.32924	2.783	82	85.0	5.6	40.50±0.08
850	0.64531	0.23191	2.783	70	84.2	3.9	40.48±0.23
900	0.62326	0.22357	2.788	59	82.3	3.9	40.56±0.06
950	0.76540	0.27660	2.767	68	84.4	4.7	40.26±0.15
*1,000	1.3234	0.47289	2.799	156	92.2	8.0	40.71±0.07
*1,050	2.6291	0.94023	2.796	254	95.5	15.9	40.68±0.06
*1,100	3.2377	1.1604	2.790	314	96.1	19.6	40.59±0.06
*1,150	1.5480	0.55418	2.793	119	95.3	9.4	40.64±0.07
*1,300	0.63725	0.22861	2.788	17	91.5	3.9	40.55±0.06
Total gas			2.777				40.40±0.12

Table 5. Abbreviated $^{40}Ar/^{39}Ar$ age-spectrum data for middle Eocene volcanic rocks from the central part of the Northeast Nevada volcanic field—Continued.

Temperature (°C)	$^{40}Ar_R$	$^{39}Ar_K$	F	$^{39}Ar/^{37}Ar$	$^{40}Ar_R$ (percent)	$^{39}Ar_K$ (percent)	Apparent age and error (Ma)
GOLD HILL							
Sample 91CP33/21/DD36; rhyolite; 48.6 mg biotite; measured $^{40}Ar/^{36}Ar$=298.0; plateau date=39.58±0.10 Ma; J-value=0.005305±0.1 percent (1σ); lat 40°12'18" N., long 114°58'15" W.							
650	0.0415	0.0216	1.92	3.7	13.5	0.9	18±2
750	0.2422	0.0597	4.059	19	49.2	2.5	38.4±0.3
850	0.93339	0.22181	4.208	123	86.0	9.4	39.83±0.06
950	1.2850	0.30511	4.211	149	89.3	12.9	39.86±0.07
*1,000	1.2874	0.30708	4.192	168	90.0	13.0	39.7±0.2
*1,050	1.9930	0.47635	4.184	140	92.9	20.1	39.60±0.11
*1,100	1.7783	0.42487	4.185	66	92.5	17.9	39.62±0.06
*1,150	1.7706	0.42515	4.165	78	93.9	18.0	39.42±0.07
*1,350	0.52902	0.12623	4.191	24	83.1	5.3	39.67±0.06
Total gas			4.161				39.42±0.13
Sample 91CP30/22/DD36; dacite; 242.4 mg hornblende; measured $^{40}Ar/^{36}Ar$=296.6; plateau date=39.6±0.2 Ma; J-value=0.005318±0.1 percent (1σ); lat 40°11'23" N., long 114°58'15" W.							
700	0.1485	0.02615	5.68	0.62	27.2	2.3	54±2
800	0.03057	0.00907	3.37	0.31	34.8	0.8	32±1
900	0.0189	0.00435	4.35	0.31	48.5	0.4	41±4
1,000	0.04364	0.01074	4.06	0.23	53.0	0.9	39±3
1,025	0.04991	0.01257	3.97	0.18	70.4	1.1	38±3
1,050	0.20502	0.05046	4.063	0.16	82.8	4.5	38.6±0.5
1,075	0.2893	0.0706	4.099	0.16	87.0	6.2	38.9±0.5
*1,100	1.1110	0.26461	4.199	0.15	93.7	23.3	39.8±0.2
*1,125	1.8807	0.45134	4.167	0.15	95.8	39.8	39.54±0.08
*1,150	0.02452	0.0586	4.180	0.15	91.5	5.2	39.7±0.4
*1,200	0.61772	0.14796	4.175	0.15	95.4	13.1	39.6±0.2
1,350	0.11054	0.02693	4.10	0.13	83.2	2.4	39±2
Total gas			4.192				39.8±0.4
COAL MINE CANYON							
Sample 12624/56/DD31; ash-flow tuff; 267.4 mg hornblende; measured $^{40}Ar/^{36}Ar$=298.9; plateau date=40.4±0.2 Ma; J-value=0.007631±0.1 percent (1σ); lat 40°6'52" N., long 115°37'46" W.							
700	0.0287	0.0085	3.37	0.64	2.5	0.3	46±10
800	0.0227	0.00579	3.91	0.55	14	0.2	53±14
900	0.0321	0.01020	3.15	0.20	39	0.4	43±7
950	0.04995	0.01711	2.92	0.16	52	0.6	40±4
*1,000	0.29047	0.09773	2.972	0.16	64	3.5	40.5±1.1
*1,025	0.95399	0.32126	2.970	0.16	80	11.6	40.4±0.2
*1,050	3.0453	1.0264	2.967	0.16	91	36.9	40.39±0.10
*1,100	2.7655	0.92929	2.976	0.16	94	33.4	40.51±0.11
*1,150	0.65701	0.22110	2.972	0.15	87	8.0	40.4±0.3
*1,350	0.42209	0.14267	2.959	0.14	79	5.1	40.3±0.4
Total gas			2.974				40.5±0.3

Table 6. Production ratios for interfering isotopes of argon produced during irradiation.
[Leaders (--) indicate not available]

Reactor package	$(^{36}Ar/^{37}Ar)_{Ca}$	$(^{39}Ar/^{37}Ar)_{Ca}$	$(^{38}Ar/^{37}Ar)_{Ca}$	$(^{40}Ar/^{39}Ar)_K$	$(^{37}Ar/^{39}Ar)_K$	$(^{38}Ar/^{39}Ar)_K$
DD9	2.55×10^{-4}	1.25×10^{-3}	6.91×10^{-5}	1.26×10^{-2}	4.48×10^{-4}	1.30×10^{-2}
DD12	2.66×10^{-4}	6.99×10^{-4}	2.75×10^{-5}	9.07×10^{-3}	1.82×10^{-4}	1.30×10^{-2}
DD26	2.70×10^{-4}	6.48×10^{-4}	3.7×10^{-5}	1.011×10^{-2}	2.35×10^{-4}	1.31×10^{-2}
DD28	2.61×10^{-4}	7.68×10^{-4}	3.02×10^{-5}	8.78×10^{-3}	8.30×10^{-5}	1.306×10^{-2}
DD31	2.70×10^{-4}	6.36×10^{-4}	3.17×10^{-5}	9.18×10^{-3}	8.20×10^{-5}	1.306×10^{-2}
DD33	2.70×10^{-4}	6.81×10^{-4}	2.64×10^{-5}	9.76×10^{-3}	1.10×10^{-4}	1.307×10^{-2}
DD36	--	--	--	--	--	--
DD37	2.80×10^{-4}	6.94×10^{-4}	3.67×10^{-5}	8.99×10^{-3}	1.49×10^{-4}	1.313×10^{-2}
DD42	2.90×10^{-4}	6.30×10^{-4}	2.11×10^{-5}	7.5×10^{-3}	9.9×10^{-5}	1.318×10^{-2}
DD49	2.70×10^{-4}	5.95×10^{-4}	2.4×10^{-5}	7.8×10^{-3}	1.1×10^{-4}	1.306×10^{-2}
Approx. error	$\pm0.01\times10^{-4}$	$\pm0.03\times10^{-4}$	$\pm0.2\times10^{-5}$	$\pm0.4\times10^{-3}$	$\pm0.6\times10^{-4}$	$\pm0.01\times10^{-2}$

Table 7. U-Th-Pb isotopic ages of sphene from pyroxene diorite (sample 91T22, table 3), southern East Humboldt Range, central part of Northeast Nevada volcanic field.

[Ages and decay constants from R.E. Zartman (U.S. Geological Survey, written commun., 1994). Decay constants: $^{238}U=1.55125\times10^{-10}\ yr^{-1}$; $^{235}U=9.8485\times10^{-10}\ yr^{-1}$; $^{232}Th=4.9375\times10^{-11}\ yr^{-1}$; $^{238}U/^{235}U=137.88$. Isotopic composition of common lead assumed to be $^{204}Pb{:}^{206}Pb{:}^{207}Pb{:}^{208}Pb=1{:}18.10{:}15.66{:}38.80$]

Sample designation	Concentration (parts per million)			Isotopic composition of lead (atom percent)				Age (mega-annum)			
	U	Th	Pb	^{204}Pb	^{206}Pb	^{207}Pb	^{208}Pb	$^{206}Pb/^{238}U$	$^{207}Pb/^{235}U$	$^{207}Pb/^{206}Pb$	$^{208}Pb/^{232}Th$
Light yellow	21.17	86.2	1.293	1.0799	28.08	17.31	53.53	39.1±0.3	39.3±1.7	54±65	39.5±0.4
Dark yellow	25.30	112.9	1.255	1.0073	28.63	16.26	54.11	38.6±0.2	38.3±1.2	20±50	37.8±0.3

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