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# Geochronology and Correlation of Tertiary Volcanic and Intrusive Rocks in Part of the Southern Toquima Range, Nye County, Nevada

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**U.S. Department of the Interior**
**U.S. Geological Survey**

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# Contents

## Plate



## Figures

## Table



## Abbreviations Used in This Report

km kilometer

m meter

Ma million years ago

PI phenocryst index

# Geochronology and Correlation of Tertiary Volcanic and Intrusive Rocks in Part of the Southern Toquima Range, Nye County, Nevada

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## Abstract

Extensive volcanic and intrusive igneous activity, partly localized along regional structural zones, characterized the southern Toquima Range, Nevada, in the late Eocene, Oligocene, and Miocene. The general chronology of igneous activity has been defined previously. This major episode of Tertiary magmatism began with emplacement of a variety of intrusive rocks, followed by formation of nine major calderas and associated with voluminous extrusive and additional intrusive activity. Emplacement of volcanic eruptive and collapse megabreccias accompanied formation of some calderas. Penecontemporaneous volcanism in central Nevada resulted in deposition of distally derived outflow facies ash-flow tuff units that are interleaved in the Toquima Range with proximally derived ash-flow tuffs.

Eruption of the Northumberland Tuff in the north part of the southern Toquima Range and collapse of the Northumberland caldera occurred about 32.3 million years ago. The poorly defined Corcoran Canyon caldera farther to the southeast formed following eruption of the tuff of Corcoran Canyon about 27.2 million years ago. The Big Ten Peak caldera in the south part of the southern Toquima Range Tertiary volcanic complex formed about 27 million years ago during eruption of the tuff of Big Ten Peak and associated air-fall tuffs. The inferred Ryecroft Canyon caldera formed in the south end of the Monitor Valley adjacent to the southern Toquima Range and just north of the Big Ten Peak caldera in response to eruption of the tuff of Ryecroft Canyon about 27 million years ago, and the Moores Creek caldera just south of the Northumberland caldera developed at about the same time. Eruption of the tuff of Mount Jefferson about 26.8 million years ago was accompanied by collapse of the Mount Jefferson caldera in the central part of the southern Toquima Range. An inferred caldera, mostly buried beneath alluvium of Big Smoky Valley southwest of the Mount Jefferson caldera, formed about 26.5 million years ago with eruption of the tuff of Round Mountain. The Manhattan caldera south of the Mount Jefferson caldera and northwest of the Big Ten Peak caldera formed in association with eruption of a series of tuffs, principally the Round Rock Formation, mostly ash-flow tuff, about 24.4 million years ago.

Extensive $^{40}Ar/^{39}Ar$ dating of about 60 samples that represent many of the Tertiary extrusive and intrusive rocks in the southern Toquima Range provides precise ages that refine the chronology of previously dated units. New geochronologic data indicate that the petrogenetically related Corcoran Canyon, Ryecroft Canyon, and Mount Jefferson calderas formed during a period of about 560,000 years.

Electron microprobe analyses of phenocrysts from 20 samples of six dated units underscore inferred petrogenetic relations among some of these units. In particular, compositions of augite, hornblende, and biotite in tuffs erupted from the Corcoran Canyon, Ryecroft Canyon, and Mount Jefferson calderas are similar, which suggests that magmas represented by these tuffs have similar petrogenetic histories. The unique occurrence of hypersthene in Isom-type tuff confirms its derivation from a source beyond the southern Toquima Range.


## Introduction

Rocks in the southern Toquima Range in south-central Nevada define a major episode of Tertiary magmatism that culminated in late Oligocene time with formation of several calderas and associated major ash-flow tuff eruptions (fig. 1). Caldera formation was preceded by emplacement of a variety of intrusive rocks and involved additional intrusive and voluminous extrusive activity. Formation of volcanic eruptive and collapse megabreccias accompanied the evolution of some calderas. Penecontemporaneous volcanism elsewhere in the region also resulted in deposition of outflow facies ash-flow tuff units in the Toquima Range.

Our interest is focused on a block of six 1:24,000-scale quadrangles (fig. 1) mapped between 1967 and 1993, mostly by the senior author (see Shawe, 1995, 1998, 1999a, b, 2001, 2003a; Shawe and Byers, 1999; Shawe, Hardyman, and Byers, 2000). A recompiled 1:48,000-scale geologic map of the six quadrangles provides a synoptic view of the Tertiary igneous rocks (Shawe, 2002) in this area. The purpose of the present report is to clarify chronology and correlations of the numerous volcanic and intrusive units exposed in the area and to interpret the petrogenesis of a few of the volcanic units.

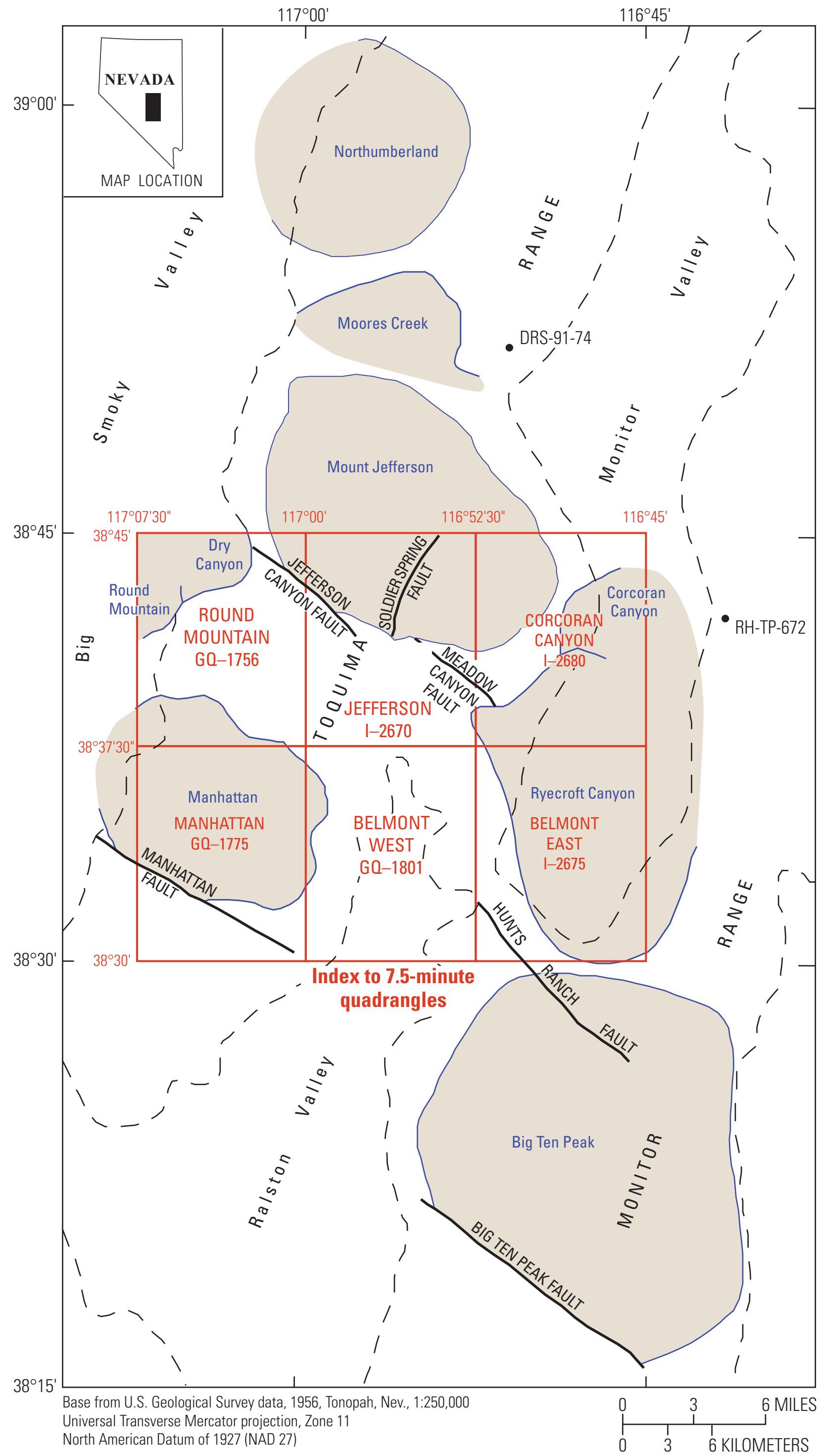



**Figure 1.** Southern Toquima Range, Nevada, showing calderas discussed in this report, area of plate 1, and locations of samples discussed in report that fall outside plate 1. Tan shading, calderas.

Geologic mapping in the area by Shawe and associates produced a general framework for the Tertiary igneous activity of the southern Toquima Range. A generalized geologic map of this area (plate 1) portrays the distribution of the intrusive and volcanic units that are the subject of this study. Several earlier studies, including K-Ar age dating (Silberman and others, 1975) of many of the intrusive and volcanic units, resulted in a chronology of events that define basic volcanic stratigraphic relations and helped define several calderas. Petrographic studies (modal analyses) (Shawe, 1995; 1998; 1999a, b; Shawe and Byers, 1999; Shawe, Hardyman, and Byers, 2000) were also important in defining volcanic unit correlations. Microprobe analyses of volcanic rock phenocrysts, reported here, also facilitate stratigraphic correlations. Recent $^{40}Ar/^{39}Ar$ geochronology investigations presented here further refine stratigraphic relations and confirm correlation of several units, either with units elsewhere in the southern Toquima Range or with units derived from distant sources. Studies of the Tertiary igneous rocks in the area by others (as referenced in later sections) have provided critical additional information used to establish the Tertiary igneous history of the area.

Data presented in this report are used to refine earlier interpretations concerning the identity and ages of some units and to confirm the identity of some units derived from sources beyond the southern Toquima Range. All volcanic rock composition names are in accord with the International Union of Geological Sciences' chemical classification nomenclature (Le Bas and others, 1986).

## General Geology of the Southern Toquima Range

The oldest rocks exposed in the southern Toquima Range are of Paleozoic age, chiefly marine sedimentary rocks. Cambrian and Ordovician rocks deposited in the ocean west and outboard of the North American craton were thrust into the study area during several episodes of tectonism that began in the late Paleozoic and continued until the Late Cretaceous. During tectonism, individual thrust plates were strongly folded and internally deformed. In the Late Cretaceous, as thrust faulting waned, three granite plutons were emplaced into the Paleozoic rocks. Intrusion was accompanied by metamorphism of adjacent Paleozoic rocks; subsequently the plutons were domed by additional intrusive activity, metamorphosed, and mineralized locally.

Igneous activity during the Tertiary included formation of several calderas, eruption of large volumes of ash-flow tuff, and emplacement of associated intrusive bodies and volcanic megabreccia throughout large parts of the southern Toquima Range (fig. 1). Mineralizing episodes, some commercially important, are related to igneous events described elsewhere (Shawe, 1988, 2003b; Shawe, Marvin, and others, 1986; Shawe, Naeser, and others, 1987; and Shawe, Kucks, and Hildenbrand, 2004).

Several studies in parts of the southern Toquima Range beyond the area considered herein are pertinent to understanding the Tertiary igneous activity within our study area and are frequently referenced in the following text.

## Summary of Tertiary Igneous Activity

Tertiary magmatism began about 36–35 million years ago (Ma) (Shawe, Marvin, and others, 1986) when a swarm of rhyolite dikes, a granodiorite stock (granodiorite of Dry Canyon; Shawe, 1995) and, a few kilometers east of Round Mountain, several andesite dikes were intruded into one of the Cretaceous granite plutons. About 33 Ma, a caldera (now mostly covered by alluvium in Big Smoky Valley just west of the Toquima Range) formed during ash-flow tuff eruption (Henry, 1997). About the same time, eruption of the Northumberland Tuff from a source about 25 kilometers (km) to the north formed the Northumberland caldera (McKee, 1974). As summarized by Henry (1997), volcanic activity culminated in the southern Toquima Range between about 27.2 and 24.4 Ma, with formation of successive calderas that erupted the tuff of Corcoran Canyon (Boden, 1986) from the poorly defined Corcoran Canyon caldera (Shawe, Hardyman, and Byers, 2000; Shawe, Kucks, and Hildenbrand, 2004), the tuff of Big Ten Peak (Keith, 1993) from the Big Ten Peak caldera southeast of our map area, the tuff of Ryecroft Canyon (Boden, 1986) from a proposed caldera mostly covered by alluvium in Monitor Valley (Shawe and Byers, 1999), the tuff of Moores Creek (McKee, 1974) from the Moores Creek caldera north of our map area, the tuff of Mount Jefferson (Boden, 1986) from the Mount Jefferson caldera, the tuff of Round Mountain (Boden, 1986; Shawe, 1995; Henry, 1997) from a caldera mostly covered by alluvium in Big Smoky Valley, and the Round Rock Formation (Shawe, 1999a) from the Manhattan caldera. Several intrusive bodies, commonly localized near or along caldera margins, were emplaced during the same period. The ash-flow tuffs erupted from these calderas are calc-alkalic trachydacites to rhyolites. Eruptive megabreccias, localized along structural margins, are a notable feature of several of the southern Toquima Range calderas (Shawe and Snyder, 1988). Several eruptive megabreccia deposits are associated with the Manhattan and Mount Jefferson calderas and are probably derived from other calderas in the area. Diagnostic characteristics of the megabreccia deposits include their occurrence as outflow facies deposits, large clasts of rock types not present at the surface, basal zones of welded ash (vitrophyre), and occasional clasts encased in volcanic glass, which are indicative of derivation from deeper, hotter levels within the source magma reservoir.

# Tertiary Intrusive and Volcanic Rocks: Synthesis of Previous Findings

Stratigraphic positions summarized in this section of previously described volcanic and intrusive rocks and those documented in the present study are shown in the correlation of map units on plate 1.

## Rhyolite and Andesite Dikes and Granodiorite Stock East of Round Mountain

Radiometric dates of rhyolite dikes (Tr) from a swarm that intrudes Cretaceous granite and its wall rocks east of Round Mountain include a K-Ar date on sanidine of 34.3±0.9 Ma (Marvin and others, 1973) and K-Ar dates on impure sanidine of 34.4±1.2, sanidine of 34.7±1.2 Ma, biotite of 36.0±1.2 Ma, and biotite of 35.1±1.2 Ma (Shawe, Marvin, and others, 1986). A fission-track date on zircon from a mineralized rhyolite dike is 36.3±1.7 Ma (Shawe, Marvin, and others, 1986).

- 34.3±0.9 Ma (K-Ar on sanidine; Marvin and others, 1973)
- 34.4±1.2 Ma (K-Ar on impure sanidine; Shawe, Marvin, and others, 1986)
- 34.7±1.2 Ma (K-Ar on sanidine; Shawe, Marvin, and others, 1986)
- 35.1±1.2 Ma (K-Ar on biotite; Shawe, Marvin, and others, 1986)
- 36.0±1.2 Ma (K-Ar on biotite; Shawe, Marvin, and others, 1986)
- 36.3±1.7 Ma (fission-track on zircon; Shawe, Marvin, and others, 1986)

The granodiorite stock of Dry Canyon (Tgd) (Shawe, 1981, 1995) intruded the rhyolite dike swarm and granite east of Round Mountain. Two fission-track dates on zircon from the granodiorite are 36.1±1.6 Ma and 37.4±2.3 Ma. A fission-track date on sphene from the same rock is 36.2±2.0 Ma (Shawe and others, 1986).

- 36.1±1.6 Ma (fission-track on zircon; Shawe and others, 1986)
- 36.2±2.0 Ma (fission-track on sphene; Shawe and others, 1986).
- 37.4±2.3 Ma (fission-track on zircon; Shawe and others, 1986)

Andesite dikes (Ta) intrude the granodiorite stock and rhyolite dikes. A K-Ar date on biotite from a latite dike of the andesite set is 36.5±1.2 Ma (Shawe, Marvin, and others, 1986).

- 36.5±1.2 Ma (K-Ar on biotite; Shawe, Marvin, and others, 1986)

None of the rhyolite, granodiorite, or andesite intrusions has been dated by the $^{40}Ar/^{39}Ar$ method. Given that sanidine usually provides more accurate K-Ar ages than biotite and that the method is more accurate than fission track ages, radiometric data suggest that the biotite K-Ar and the fission-track ages presented in the previous discussion are slightly too old. However, because sanidine is known to not completely melt and release all of its contained $^{40}Ar$ in conventional K-Ar dating, anomalously young ages may result.

## Rocks of a Caldera Mostly Buried Beneath Alluvium of Big Smoky Valley

Henry (1997) described a 32.18 [32.37]±0.13 Ma ($^{40}Ar/^{39}Ar$ on sanidine) tuff; the bracketed age is explained later in this paragraph. This tuff erupted from a caldera, which he named the Dry Canyon caldera (fig. 1) that is mostly buried beneath alluvium of Big Smoky Valley near Round Mountain. (See discussion in following paragraph.) All ages reported for samples from the Toquima Range by Henry (1997) assumed a standard age of 27.84 Ma for Fish Canyon Tuff sanidine. Consequently, these ages (and others cited herein that were also calculated assuming an age of 27.84 Ma for Fish Canyon Tuff sanidine) must be increased by 0.19 Ma to facilitate direct comparison with new data described herein. Ages recalculated in this fashion are enclosed in square brackets [ ] herein.

- 32.18 [32.37]±0.13 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Henry, 1997)

## Megabreccia of Jefferson Canyon (Unit Tjc)

A megabreccia unit exposed in Jefferson Canyon (Tjc) at the southwest margin of the Mount Jefferson caldera was inferred by Shawe and Snyder (1988) and Shawe (1995, 1999b) to be a product of a 27-Ma caldera-forming eruption. However, the unit, designated as megabreccia of Dry Canyon by Boden (1986) and megabreccia of Jefferson Canyon by Shawe (1995), has a biotite K-Ar date of 32.3±0.7 Ma (Boden, 1986). Henry (1997) related the unit to ash-flow tuff erupted from a caldera (Dry Canyon caldera) buried beneath alluvium of Big Smoky Valley (see previous discussion). The tuff unit yielded a sanidine $^{40}Ar/^{39}Ar$ date of 32.18 [32.37]±0.13 Ma (Henry, 1997) and a sanidine $^{40}Ar/^{39}Ar$ date of 32.56 [32.75]±0.07 Ma on vitrophyric material (DRS-92-1) from the megabreccia unit (Shawe, 1995). Shawe (1995, 1999b) suggested that contamination of the matrix of the megabreccia unit by assimilated granitic material may have compromised the determined ages of the unit, or that the dated material in the unit consists of 32-Ma clasts contained in a younger megabreccia matrix related to the Mount Jefferson caldera. Phenocryst composition data for sample DRS-91-92 cited later in this report suggest that the megabreccia and the tuff of Mount Jefferson (Tmj) are unrelated, and the presence of a 32-Ma caldera buried beneath Big Smoky Valley alluvium seems plausible.

- 32.18 [32.37]±0.13 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Henry, 1997)
- 32.3±0.7 Ma (K-Ar on biotite; Boden, 1986).
- 32.56 [32.75]±0.07 Ma ($^{40}Ar/^{39}Ar$ on vitrophyric sanidine; Shawe, 1999)

## Northumberland Tuff and Volcanic Megabreccia of Northumberland Caldera

According to McKee (1974), collapse of the Northumberland caldera (fig. 1) and eruption of the composite ash-flow Northumberland Tuff occurred about 32.3±1 Ma (K-Ar on sanidine). The caldera is about 32 km in diameter, about half of which is buried beneath alluvium of Big Smoky Valley to the west. Prior to major caldera collapse, a relatively thin ash-flow sheet was emplaced as far as about 25 km beyond the present caldera margin. Enormous "landslide" blocks and chaotic breccia of Paleozoic rocks are preserved along the northeast and south caldera margins. These materials, locally enclosed in an ash matrix, may consist of caldera collapse deposits or represent eruptive megabreccia. The Northumberland Tuff consists of two or more ash-flow cooling units, interlayered in places with thin water-laid sediments. The tuff is a crystal-rich calc-alkalic rhyolite; quartz and sanidine are the principal phenocrysts; biotite and plagioclase phenocrysts are rare but ubiquitous (McKee, 1974).

- 32.3±1 Ma (K-Ar on sanidine; McKee, 1974)

## Ash-Flow Tuffs of Poorly Defined Corcoran Canyon Caldera (Unit Tcc)

Evidence cited by Shawe, Hardyman, and Byers (2000) and Shawe, Kucks, and Hildenbrand (2004) indicates the presence of a poorly defined Corcoran Canyon caldera (fig. 1) from which the trachydacite tuff of Corcoran Canyon (Tcc) (Boden, 1986) was erupted. Boden (1986, 1992) reported a sanidine K-Ar date of 27.7±0.7 Ma and McKee and John (1987) reported a biotite K-Ar date of 27.1±0.7 Ma, both for samples from the upper part of the unit. Sanidine from another sample (DRS-91-82) of this unit yielded a $^{40}Ar/^{39}Ar$ date of 27.36±0.06 Ma. Locally, slabs of a lower member overlie an upper member of the tuff of Corcoran Canyon (Tcc). Shawe, Hardyman, and Byers (2000) suggested that the juxtaposition resulted from collapse near the margin of the Mount Jefferson caldera. Alternatively, an earlier collapse may have occurred along an inferred margin of the Corcoran Canyon caldera.

- 27.1±0.7 Ma (K-Ar on biotite; McKee and John, 1987)
- 27.36±0.06 Ma ($^{40}Ar/^{39}Ar$ on sanidine, this report)
- 27.7±0.7 Ma (K-Ar on sanidine; Boden, 1986, 1992)

## Layered Pumice Tuff, Ash-Flow Tuff, and Volcanic Megabreccia Related to Big Ten Peak Caldera

On the basis of an association between caldera rocks and dated rocks in the southeast corner of the map area (Shawe, Naeser, and others, 1987), Keith (1993) inferred a minimum age of about 27 Ma for formation of the Big Ten Peak caldera (fig. 1) southeast of our study area. Volcanic and intrusive units in that area (Shawe and Byers, 1999) include andesite plugs and flows (Tap); Shawe, Naeser, and others (1987) reported biotite K-Ar dates of 26.3±0.9 Ma to 26.8±1.0 Ma for unit Tap and a K-Ar date of 27.0±1.0 Ma for biotite in a white ash-fall tuff unit (Tat). A tuffaceous claystone-siltstone-sandstone unit (Tcs) that underlies, and in part interfingers with, the white ash-fall tuff (Tat), a layered pumice tuff (Tpt), and a biotite-quartz latite ash-flow tuff (Tbql) that underlies the white ash-fall tuff unit, the claystone-siltstone-sandstone unit, and the layered pumice tuff, all appear to be continuous with the tuff of Big Ten Peak to the south (Keith, 1987). Volcanic megabreccia within and near the Big Ten caldera was interpreted by Keith (1993) to be of eruptive origin. A northwest-southeast-striking fault marks the southwest margin of the caldera, which locally also includes a zone of megabreccia.

- 26.3±0.9 to 26.8±1.0 Ma (K-Ar on biotite; Shawe, Naeser, and others, 1987)
- 27.0±1.0 Ma (K-Ar on biotite; Shawe, Naeser, and others, 1987)

## Ash-Flow Tuff of Ryecroft Canyon (Unit Trc) and Related Rocks of an Inferred Caldera Mostly Buried Beneath Alluvium of Monitor Valley

Shawe and Byers (1999) proposed that the ash-flow tuff of Ryecroft Canyon (Trc) (Boden, 1986) was erupted from a caldera (fig. 1) mostly buried beneath alluvium in the south part of Monitor Valley. Thick sections of the Ryecroft Canyon, believed to be intracaldera fill, border the south part of Monitor Valley. Shawe and Byers (1999) and Shawe, Hardyman, and Byers (2000) described two types of rhyolite in the Ryecroft Canyon: typical (22–35 percent of phenocrysts are quartz), and quartz-rich (35–45 percent of phenocrysts are quartz). Shawe and Byers (1999) discerned no consistent spatial or stratigraphic distribution of the two rhyolite types. Boden (1986, 1992) reported a sanidine K-Ar date of 25.0±0.5 Ma for what he defined as the upper quartz-rich part of the tuff of Ryecroft Canyon, whereas we report $^{40}Ar/^{39}Ar$ dates of 27.05±0.06 Ma (DRS-91-31) and 26.82±0.04 Ma (DRS-85-224) on sanidine and a sanidine $^{40}Ar/^{39}Ar$ isochron date (DRS-85-225) of 27.13±0.03 Ma for samples from the (undivided) Ryecroft Canyon. (Sample locations are shown on pl. 1

unless otherwise noted.) Henry (1997) reported a sanidine $^{40}Ar/^{39}Ar$ date of 27.08 [27.27]±0.09 Ma for the tuff of Ryecroft Canyon.

- 25.0±0.5 Ma (K-Ar on sanidine; Boden, 1986, 1992)
- 26.82±0.04 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 27.05±0.06 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 27.13±0.03 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 27.08 [27.27]±0.09 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Henry, 1997)

A cluster of undated rhyolite flow domes (Tfd) at the south end of Monitor Valley (Shawe and Byers, 1999) form an arc coincident with the inferred south margin of the caldera from which the tuff of Ryecroft Canyon seemingly was erupted. These domes may represent a late magmatic event associated with evolution of the inferred caldera.

The megabreccia of Meadow Canyon (Tmc) and the tuff of Antone Canyon (Tac) are related to the tuff of Ryecroft Canyon (Trc) inasmuch as they interfinger with, and are petrologically similar to, the tuff of Ryecroft Canyon. They were emplaced probably late during development of the caldera from which the Ryecroft Canyon was erupted (Shawe, 1999b). The megabreccia of Hunts Canyon (Tmh) (Shawe and Byers, 1999), southwest of the inferred structural margin of the Ryecroft Canyon caldera, contains mostly clasts of the Ryecroft Canyon and likely represents outflow facies tuff erupted in the late stages of caldera development.

## Volcanic Units between Big Ten Peak Caldera and Inferred Ryecroft Canyon Caldera

As suggested by their position between and marginal to both calderas, several volcanic units, including rhyolite flows and domes (Tfd) (see previous discussion), a rhyolitic lahar (Tlh) (flow breccia), a vitrophyric rhyolitic lava (Trv), megabreccia of Hunts Canyon (Tmh) (discussed previously), and a mesobreccia unit (Tms) (Shawe, 1998; Shawe and Byers, 1999), could be cogenetic. These units have not been radiometrically dated.

## Moores Creek Caldera

A thick accumulation of apparently intracaldera high-silica rhyolite ash-flow tuff (27.3±0.5 Ma on sanidine, 27.0±0.8 Ma on biotite) is peripheral to the north margin of the Mount Jefferson caldera (Boden, 1986) and is locally adjacent to volcanic megabreccia. Boden (1986) reported a K-Ar date of 26.1±1.1 Ma for sanidine from a rhyolite plug that intruded the north margin of the Moores Creek caldera (fig. 1).

- 26.1±1.1 Ma (K-Ar on sanidine; Boden, 1986)
- 27.0±0.8 Ma (K-Ar on biotite; Boden, 1986)
- 27.3±0.5 Ma (K-Ar on sanidine; Boden, 1986)

## Tuff of Mount Jefferson and Eruptive and Intrusive Rocks of the Mount Jefferson Caldera (Unit Tmj)

The rocks of the Mount Jefferson caldera (fig. 1) were initially described in some detail by Boden (1986, 1992). He defined three members of the tuff of Mount Jefferson (Tmj), including a lower member (not within area of plate 1) that is exposed only north of the area of our mapped quadrangles, an upper member, and a capping member. He also designated an outflow member, the tuff of Round Mountain (Ttr), which is now thought to have been erupted from a caldera largely buried beneath alluvium of Big Smoky Valley (discussed in the next section). Boden (1986, 1992) reported sanidine K-Ar dates of 26.5±0.5 Ma and 25.9±0.5 Ma, and a biotite K-Ar date of 26.6±0.6 Ma for his upper member. He reported a sanidine K-Ar date of 25.8±0.5 Ma for his capping member. We describe Boden's upper member as the principal member of this formation (because his lower member is absent in our map area) and Boden's capping member (lowest unit thereof) as an upper member (Shawe, 1999b). Henry (1997) considered Boden's (1986, 1992) lower member of the tuff of Mount Jefferson to be associated with the Moores Creek caldera (Boden, 1986).

- 25.8±0.5 Ma (K-Ar on sanidine; Boden, 1986, 1992)
- 25.9±0.5 Ma (K-Ar on sanidine; Boden, 1986, 1992)
- 26.5±0.5 Ma (K-Ar on sanidine; Boden, 1986, 1992)
- 26.6±0.6 Ma (K-Ar on biotite; Boden, 1986, 1992).

The principal member of the tuff of Mount Jefferson (Tmj) (Shawe, 1999b) is the volumetrically dominant part of the formation exposed in the map area. As previously described (Shawe, 1995, 1998, 1999a, b; Shawe and Byers, 1999; Shawe, Hardyman, and Byers, 2000), the unit consists chiefly of quartz latitic to rhyodacitic welded ash-flow tuff. The geochemistry of these rocks indicates that they are composed of rhyolite ($SiO_2$ 69.6–74.2 percent). Analyzed vitrophyric units are trachydacite to dacite to rhyolite-dacite in composition ($SiO_2$ 67.1 percent, 68.2 percent, and 69.3 percent). Modal analyses of these rocks have allowed their classification using the phenocryst index (PI; the sum of quartz and alkali feldspar contents divided by the sum of plagioclase and mafic minerals, including biotite, hornblende, pyroxene, and opaque minerals) of Shawe (1999b) and Shawe, Hardyman, and Byers (2000). Five categories based on modal PI data for rocks of the tuff of Mount Jefferson are as follows:

1. Category 1 PI=0.81–1.00
2. Category 2 PI=0.61–0.80
3. Category 3 PI=0.41–0.60
4. Category 4 PI=0.21–0.40
5. Category 5 PI=0.00–0.20

The composition of phenocryst assemblages ranges from more evolved (PI 1) to less evolved (PI 5), although the chemistry of these rocks is uniformly moderately evolved.

Boden (1986, 1992) considered the southeast part of what we have included in the Mount Jefferson caldera (and the associated principal member of the tuff of Mount Jefferson) to form a separate, younger eruptive center designated as the Trail Canyon caldera. He apparently defined the caldera on the basis of the determined age of the tuff of Trail Canyon, namely sanidine K-Ar dates of 23.9±0.5 Ma and 23.5±0.4 Ma (Boden's lower member) and 23.5±0.4 Ma (Boden's upper member). We believe Boden's tuff of Trail Canyon to be equivalent to tuff of Mount Jefferson, on the basis of field mapping in the 1980s and petrographic studies by R.F. Hardyman, then of the U.S. Geological Survey (written commun., 1985). To test that hypothesis, we determined numerous radiometric ages.

- 23.5±0.4 Ma (K-Ar on sanidine; lower member; Boden, 1986, 1992)
- 23.5±0.4 Ma (K-Ar on sanidine; upper member; Boden, 1986, 1992)
- 23.9±0.5 Ma (K-Ar on sanidine; Boden, 1986, 1992)

Samples collected west of the area of Boden's Trail Canyon caldera (west of the Soldier Spring fault—that is, the area mapped as tuff of Mount Jefferson, fig. 1), yielded sanidine $^{40}Ar/^{39}Ar$ dates of 26.78±0.05 Ma (sample DRS-85-10), 26.78±0.06 Ma (DRS-85-78), and 26.86±0.04 Ma (DRS-85-48), and biotite $^{40}Ar/^{39}Ar$ dates of 26.79±0.04 Ma (sample DRS-85-10), 26.85±0.05 Ma (DRS-85-78), 26.89±0.05 Ma (DRS-85-48).

- 26.78±0.05 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 26.78±0.06 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 26.86±0.04 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 26.79±0.04 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 26.85±0.05 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 26.89±0.05 Ma ($^{40}Ar/^{39}Ar$ on (biotite; this report)

Samples collected within the area of Boden's Trail Canyon caldera (east of the Soldier Spring fault) yielded sanidine $^{40}Ar/^{39}Ar$ dates of 27.07±0.05 Ma (sample DRS-91-98), 26.83±0.05 Ma (DRS-91-171), 27.00±0.06 Ma (RH-TP-571), 26.87±0.04 Ma (RH-TP-583), 26.85±0.04 Ma (RH-TP-590), 26.83±0.07 Ma (RH-TP-644), and 26.91±0.07 Ma (RH-TP-646); biotite dates of 27.06±0.06 Ma (sample DRS-91-98), 27.10±0.04 Ma (DRS-91-171), 27.02±0.07 Ma (RH-TP-571), 26.86±0.05 Ma (RH-TP-583), 26.99±0.06 Ma (RH-TP-590), 27.08±0.04 Ma (RH-TP-644), and 26.93±0.07 Ma (RH-TP-646); and hornblende ages of 27.07±0.05 Ma (sample DRS-91-171), 26.69±0.04 Ma (RH-TP-583), and 26.78±0.14 Ma (RH-TP-644).

- 26.83±0.05 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 26.83±0.07 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 26.85±0.04 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 26.87±0.04 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 26.91±0.07 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 27.00±0.06 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 27.07±0.05 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

- 26.86±0.05 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 26.93±0.07 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 26.99±0.06 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 27.02±0.07 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 27.06±0.06 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 27.08±0.04 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 27.10±0.04 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)

- 26.69±0.04 Ma ($^{40}Ar/^{39}Ar$ on hornblende; this report)
- 26.78±0.14 Ma ($^{40}Ar/^{39}Ar$ on hornblende; this report)
- 27.07±0.05 Ma ($^{40}Ar/^{39}Ar$ on hornblende; this report)

The age of ash-flow tuffs in the two areas are statistically indistinguishable, which substantiates their correlation. Petrographic data (Shawe, 1999b; Shawe, Hardyman, and Byers, 2000) and phenocryst composition data reported in a later section of this report also support correlation of these tuffs.

Several intrusive bodies were emplaced along the structural margin of the Mount Jefferson caldera or in northwest-striking structural zones near the caldera during, or closely following, its collapse and fill by ash-flow tuff, volcanic-eruptive megabreccia, and possibly volcanic-collapse megabreccias. A rhyolite plug (Trp) intrudes the megabreccia of Meadow Canyon (Tmc) along the Meadow Canyon fault (fig. 1), a northwest-striking structure just south of the south structural margin of the caldera. The Meadow Canyon fault is southeast of, and is en echelon to, the northwest-striking Jefferson Canyon fault (fig. 1), which marks the southwest margin of the Mount Jefferson caldera. Reported ages for the plug include a sanidine K-Ar date of 26.4±0.3 Ma (Boden, 1986, 1992), a biotite K-Ar date of 26.4±0.8 (McKee and John, 1987) and a sanidine $^{40}Ar/^{39}Ar$ date of 26.96 [27.15]±0.06 (Henry, 1997).

- 26.4±0.3 Ma (K-Ar on sanidine; Boden, 1986, 1992)
- 26.4±0.8 (K-Ar on biotite; McKee and John, 1987)
- 26.96 [27.15]±0.06 ($^{40}Ar/^{39}Ar$ on sanidine; Henry, 1997)

About 1 km southeast of this plug and also intruded along the Meadow Canyon fault, two small plugs intruded the megabreccia of Meadow Canyon. These plugs are surrounded by a zone of heterolithic breccia (Thb) interpreted to have resulted from forceful intrusion of the plugs into the megabreccia (Shawe, 1999b; Shawe, Hardyman, and Byers, 2000). Henry (1997) reported a sanidine $^{40}$Ar/$^{39}$Ar date of 27.14 [27.33]±0.06 Ma for one of these plugs. A plug (Tooth Rock) that intruded the tuff of Mount Jefferson in the east part of the Mount Jefferson caldera, about 1 km inside the caldera structural margin, was dated by Boden (1986, 1992) as 21.7±0.4 Ma on sanidine, by McKee and John (1987) as 26.2±0.8 Ma by K-Ar on biotite, and by Henry (1997) as 26.65 [26.84]±0.06 Ma by $^{40}$Ar/$^{39}$Ar on biotite.

- 26.2±0.8 Ma (K-Ar on biotite; McKee and John, 1987)
- 26.65 [26.84]±0.06 Ma ($^{40}$Ar/$^{39}$Ar on biotite; Henry, 1997)
- 21.7±0.4 Ma (K-Ar on sanidine; Boden, 1986, 1992)
- 27.14 [27.33]±0.06 Ma ($^{40}$Ar/$^{39}$Ar on sanidine; Henry, 1997)

A small hydrothermally altered and slightly mineralized plug (Trp) that appears to intrude the tuff of Mount Jefferson (Tmj) (sample DRS-91-58A) but is surrounded by Quaternary alluvium (Qs) and Miocene(?) megabreccia (Tcm) (Shawe, Hardyman, and Byers, 2000), about 0.5 km inside the east structural margin of the Mount Jefferson caldera, was dated by $^{40}$Ar/$^{39}$Ar on potassium feldspar as 26.73±0.05 Ma.

- (26.73±0.05 Ma; $^{40}$Ar/$^{39}$Ar on potassium feldspar; Shawe, Hardyman, and Byers, 2000)

Several small plugs close to or along the structural margin of the Mount Jefferson caldera north of our study area were dated by Henry (1997) by $^{40}$Ar/$^{39}$Ar on sanidine as 26.60 [26.79]±0.07 Ma, 26.54 [26.73]±0.08 Ma, 26.60 [26.79]±0.08 Ma, 26.93 [27.12]±0.09 Ma, 26.93 [27.12]±0.06 Ma, and 26.57 [26.76]±0.05 Ma.

- 26.54 [26.73]±0.08 Ma ($^{40}$Ar/$^{39}$Ar on sanidine; Henry, 1997)
- 26.57 [26.76]±0.05 Ma ($^{40}$Ar/$^{39}$Ar on sanidine; Henry, 1997)
- 26.60 [26.79]±0.07 Ma ($^{40}$Ar/$^{39}$Ar on sanidine; Henry, 1997)
- 26.60 [26.79]±0.08 Ma ($^{40}$Ar/$^{39}$Ar on sanidine; Henry, 1997)
- 26.93 [27.12]±0.06 Ma ($^{40}$Ar/$^{39}$Ar on sanidine; Henry, 1997)
- 26.93 [27.12]±0.09 Ma ($^{40}$Ar/$^{39}$Ar on sanidine; Henry, 1997)

## Megabreccia of Jefferson Summit (Unit Tjs)

The megabreccia of Jefferson Summit (Tjs) (Shawe, 1999b) consists mostly of granitic material that fills three inferred pipes and a dike (the inferred emplacement conduits) and an inferred outflow sheet (with tuff matrix locally near base) lying conformably on the ash-flow tuff of Mount Jefferson (Tmj). Abundant cobble-size clasts of granite in the uppermost tuff of Mount Jefferson indicate that the megabreccia likely is transitional from the underlying tuff. The locally altered megabreccia is younger than at least part of the 26.8–26.7 Ma tuff of Mount Jefferson, and it probably is older than an alteration event that affected a nearby exposure of tuff of Mount Jefferson. Biotite from this tuff produced a K-Ar date of 25.7±0.6 Ma (Shawe, 1999b); the date of the altered exposure is thought to reflect the date of alteration.

- 25.7±0.6 Ma (K-Ar on biotite; Shawe, 1999b)

$^{40}$Ar/$^{39}$Ar dates for samples of three clasts (DRS-85-122, DRS-85-128, DRS-85-176; appendix 1) from the megabreccia of Jefferson Summit dike (Tjs on map plate this report; unit Tjsi of Shawe (1999b)), provide information about some dike components. A date on a white-mica–mineralized clast of quartzite of Cambrian Gold Hill Formation (80.2±0.14 Ma; sample DRS-85-122) suggests that quartzite underlying or enclosed in the Round Mountain granite pluton was affected by postgranite emplacement metamorphism and mineralization (Shawe, 1995, 2003b) and became entrained in the Jefferson Summit megabreccia (Tjs) when the megabreccia was erupted. A clast of porphyritic granite (DRS-85-128) gave a date of approximately 80 Ma and a clast of andesite (DRS-85-176) gave a $^{40}$Ar/$^{39}$Ar date of 33.35±0.06 Ma. The andesite clast indicates the presence of a blind intrusion at depth because the nearest surface exposure of andesite is at least 6 km distant.

- 80.2±0.14 Ma ($^{40}$Ar/$^{39}$Ar on white mica; Shawe (1999b)
- 80 Ma (approximately); ($^{40}$Ar/$^{39}$Ar on porphyritic granite; Shawe (1999b)
- 33.35±0.06 Ma (40Ar/39Ar on andesite; Shawe (1999b)

## Tuff of Round Mountain (Unit Ttr)

Henry (1997) defined a caldera mostly covered by alluvium in Big Smoky Valley as the source of the tuff of Round Mountain (Ttr), and he dated intracaldera tuff of the caldera as 26.51 [26.70]±0.03 Ma ($^{40}$Ar/$^{39}$Ar on sanidine). Boden (1986, 1992) previously reported dates for the tuff of Round Mountain (described by him as the Round Mountain member of the tuff of Mount Jefferson, which he considered to be outflow facies tuff) as 26.5±0.4 Ma, 26.8±0.8 Ma, 27.3±1.1 Ma, and 26.8±0.5 Ma (all K-Ar on sanidine), and 27.2±0.6 Ma, 25.5±0.6 Ma, and 24.4±0.6 Ma (all K-Ar on biotite). Shawe and others (1987) reported a sanidine K-Ar date of 27.0±1.0 Ma, a biotite K-Ar date of 26.7±1.7 Ma, a zircon fission-track date of 26.0±2.6 Ma, and an apatite fission-track date of 28.4±7.8 Ma for the tuff of Round Mountain.

- 24.4±0.6 Ma (K-Ar on biotite; Boden, 1986, 1992)
- 25.5±0.6 Ma (K-Ar on biotite; Boden, 1986, 1992)
- 26.7±1.7 Ma (K-Ar on biotite; Shawe and others, 1987)
- 27.2±0.6 Ma (K-Ar on biotite; Boden, 1986, 1992)

- 26.5±0.4 Ma (K-Ar on sanidine; Boden, 1986, 1992)
- 26.51 [26.70]±0.03 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Henry, 1997)
- 26.8±0.5 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Boden, 1986, 1992)
- 26.8±0.8 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Boden, 1986, 1992)
- 27.0±1.0 Ma (K-Ar on sanidine; Shawe and others, 1987)
- 27.3±1.1 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Boden, 1986, 1992)
- 26.0±2.6 Ma (zircon fission-track; Shawe and others, 1987)
- 28.4±7.8 Ma (apatite fission-track; Shawe and others, 1987)

## Volcaniclastic Rocks of Little Table Mountain (Unit Tlt) and Megabreccia of Bull Frame Canyon (Unit Tbf)

The tuff of Mount Jefferson (Tmj) is overlain by a sequence of interlayered volcaniclastic rocks including tuffaceous clastic units, ash-flow tuff, and zeolitic tuff. Tuffaceous sandstone (Tlt) (sample DRS-92-16) near the base of the volcaniclastic rocks is 26.65±0.07 Ma ($^{40}Ar/^{39}Ar$ on sanidine). The volcaniclastic rocks are petrographically similar to, and therefore probably related to, the tuff of Mount Jefferson; they may represent products of Mount Jefferson caldera deposited during its waning stages.

- 26.65±0.07 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

The megabreccia of Bull Frame Canyon (Tbf) occupies a small area above volcaniclastic rocks of Little Table Mountain (Tlt). The megabreccia is lithologically similar to that of the tuff of Ryecroft Canyon (Trc) and is probably a local deposit of reworked megabreccia of Meadow Canyon (Tmc).

## Isom-Type Ash-Flow Tuff (Unit Ti)

Locally, an ash-flow tuff unit (Ti) petrographically akin to the 27-Ma Isom Formation in eastern Nevada and western Utah (Best and others, 1989) apparently conformably overlies the volcaniclastic rocks of Little Table Mountain (Tlt). According to Best and others (1989), the Isom to the east is about 27 Ma; sanidine from a sample (RH-TP-616) of the tuff (Ti) collected in the northeast part of our study area gave a $^{40}Ar/^{39}Ar$ date of 27.22±0.07 Ma. However, this date may not be accurate owing to excess $^{40}Ar$; the Isom-type unit clearly lies above the tuff of Mount Jefferson (Tmj) (27.07–26.69 Ma) and the overlying volcaniclastic rocks of Little Table Mountain (Tlt) (26.65 Ma).

- 26.65 Ma (volcaniclastic rocks of Little Table Mountain; this report)
- 27 Ma (Isom Formation ash-fall tuff; Best and others, 1989)
- 27.07–26.69 Ma (tuff of Mount Jefferson; this report)
- 27.22±0.07 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

## Shingle Pass Tuff (Unit Tsp)

The Shingle Pass Tuff (Tsp) in the southern Toquima Range consists of an upper and a lower member. The formation appears to be conformable upon Isom-type ash-flow tuff (Ti) and conformable beneath unit D of the Bates Mountain Tuff (included in unit Ty, map plate this report). The upper member, however, is disconformable above the lower member. According to Best and others (1989) the upper member has a sanidine $^{40}Ar/^{39}Ar$ date of 26.00±0.03 [26.19±0.03] Ma and the lower member has a sanidine $^{40}Ar/^{39}Ar$ date of 26.68±0.03 [26.87±0.03] Ma. The apparent notable interval between the ages of the two units may indicate that the lower member was considerably eroded before deposition of the upper member (separated locally by unit D of the Bates Mountain Tuff), as is true in the north-central part of our study area (Shawe, 1999b).

- 26.00±0.03 [26.19±0.03] Ma ($^{40}Ar/^{39}Ar$ on sanidine, upper member; Best and others, 1989)
- 26.68±0.03 [26.87±0.03] Ma ($^{40}Ar/^{39}Ar$ on sanidine, lower member; Best and others, 1989)

## Eruptive and Intrusive Rocks of the Manhattan Caldera and Associated Volcanic Units

Early studies that referred to Tertiary igneous rocks in the southern Toquima Range (Ferguson, 1921, 1924; Ferguson and Cathcart, 1954) attempted correlation of these rocks with units identified outside the area. Ferguson (1924) originally assigned some of the silicic ash-flow tuffs in the Manhattan mining district to the Esmeralda Formation, a late Miocene to late Pliocene unit of somewhat similar lithology in the Tonopah district, 70 km south of the town of Manhattan, Nev. Ferguson considered the silicic ash-flow tuffs to be rhyolite lava flows, although he recognized breccias, tuffs, and sandstones within the volcanic section. However, radiometric age studies by Shawe and others (1986) showed that the rocks in the southern Toquima Range are of latest Oligocene age (25.0±0.8 Ma, K-Ar on biotite). (Epochs as related to dates rely upon U.S. Geological Survey Geologic Names Committee, 2010.) The Round Rock Member of Ferguson's Esmeralda Formation was raised in rank to Round Rock Formation (Trr) and the name Esmeralda is not used in the southern Toquima Range (Shawe, 1987). Subsequently, Henry (1997) provided a $^{40}Ar/^{39}Ar$ date of 24.44 [24.63]±0.11 Ma on sanidine from an ash-flow tuff of the Round Rock Formation in the south part of the Manhattan caldera.

- 24.44 [24.63]±0.11 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Henry, 1997)
- 25.0±0.8 Ma (K-Ar on biotite; Shawe and others, 1986)

Ferguson (1924) recognized a breccia unit in his Round Rock Member, but he considered it to be a talus unit; he named it the Hedwig Breccia Member (name now abandoned) of the Esmeralda Formation. This unit was redefined as the megabreccia of Sloppy Gulch (Tsg), an eruptive ash-flow megabreccia in the lower member of the Round Rock Formation (Trr) (Shawe, 1987; Shawe and Snyder, 1988).

Rhyolite blocks in a middle megabreccia unit of the Round Rock Formation (Shawe, 1987) were described by Ferguson (1924) as the Maris Rhyolite (name now abandoned). Ferguson and Cathcart (1954) subsequently correlated the Maris Rhyolite with the Oddie Rhyolite of the Tonopah area, also a Miocene formation. No radiometric age determinations have been made on rocks of the middle megabreccia unit of the Round Rock Formation. An inferred rhyolite-andesite volcanic neck was mapped within the Manhattan caldera near its southwest margin; the feature is interpreted as the source of the middle megabreccia member of the Round Rock Formation (Shawe, 1999a).

The Diamond King Member (Ferguson, 1924) of the Esmeralda Formation (Diamond King raised to formation rank by Shawe, 1987) overlies the Round Rock Formation (Trr) in the Manhattan caldera. The Diamond King Member was considered to be about 25 Ma (Shawe, 1999a) because Shawe, Marvin, and others (1986) reported biotite K-Ar dates of 24.6±0.8 Ma and 24.8±0.8 Ma for the tuff of The Bald Sister (Tbs), which overlies the Diamond King. In a more recent study (published earlier than the Shawe (1999a) report), the ash-flow tuff of the Diamond King Formation (Tdk) from the east part of the Manhattan caldera was dated by $^{40}Ar/^{39}Ar$ on sanidine as 24.34 [24.53]±0.07 Ma (Henry, 1997). Shawe (1998) speculated, on the basis of similar age and petrography, that the Diamond King correlates with the tuff of Arc Dome exposed in the Toiyabe Range about 35 km northeast of Manhattan (Brem and others, 1991; John, 1992), and was erupted from the Arc Dome caldera in the Toiyabe Range. Henry (1997), however, described the Diamond King as part of the tuffs that fill the Manhattan caldera, even though composition of the Diamond King is considerably different from the composition of the underlying Round Rock Formation within the caldera. Shawe and Byers (1999) described a crystal-rich tuff having a composition and age similar to those of the Diamond King; this tuff, which is exposed in the south part of the map area east of Ralston Valley and described as a crystal-rich, ash-flow tuff unit, Tos, also is likely equivalent to the Diamond King Formation (Tdk).

- 24.34 [24.53]±0.07 Ma ($^{40}Ar/^{39}Ar$ on sanidine; Henry, 1997)
- 24.6±0.8 Ma (K-Ar on biotite; Shawe and others, 1986)
- 24.8±0.8 Ma (K-Ar on biotite; Shawe and others, 1986)

Immediately overlying the Diamond King Formation is a sequence of tuffaceous lakebed sediments and minor fluvial sandstone and conglomerate layers composed mostly of volcanic clasts. Ferguson (1924) designated the unit as Bald Mountain Lake Beds Member of the Esmeralda Formation. Shawe (1987) revised the unit as the Bald Mountain Formation (Tbm). These materials probably were deposited in a shallow basin formed by minor collapse of the Manhattan caldera following the latest eruptions that produced the upper member of the Round Rock Formation and deposition of the Diamond King Formation.

An ash-flow tuff was designated as the quartz latite member of the Esmeralda Formation by Ferguson (1924), who considered these materials to be composed of lava flows; the tuff was deposited above the Bald Mountain Formation (Tbm). Radiometric age studies (K-Ar on biotite) provided dates of 24.8±0.8 Ma and 24.6±0.8 Ma for the unit (Shawe and others, 1986). Shawe (1987) tentatively correlated the unit with the tuff of Peavine Creek (Brem and Snyder, 1983) in the Toiyabe Range about 20 km west of Manhattan, Nev., on the basis of similar petrography and age. Subsequently, Shawe (1999a) renamed this tuff where it is exposed within the Manhattan caldera as the tuff of The Bald Sister (his unit Tbs).

- 24.6±0.8 Ma (K-Ar on biotite; Shawe and others, 1986)
- 24.8±0.8 Ma (K-Ar on biotite; Shawe and others, 1986)

Two principal intrusive units were emplaced within the Manhattan caldera. An andesite that Ferguson and Cathcart (1954) designated Gilbert Andesite was correlated with a unit of that name in the Gilbert mining district 65 km southwest of Manhattan and was assigned to the Pliocene. According to Silberman and McKee (1972), the Gilbert in its type area is Miocene (15.1±0.6 Ma, K-Ar on sanidine(?)). An uncertain K-Ar date on plagioclase from what was Ferguson's (1924) Gilbert Andesite in the Manhattan caldera, now named Crone Gulch Andesite (Tca) by Shawe (1987), is 22.6±1.4 Ma (earliest Miocene, but the range of uncertainty straddles the Oligocene-Miocene boundary of 23.03 Ma; Shawe and others, 1986). However, Shawe and Snyder (1988) inferred the unit to be latest Oligocene on the basis of geologic relations with dated units. A second intrusive unit was identified by Ferguson (1924) as dacite; Ferguson and Cathcart (1954) considered the unit to be an outlier of the Toiyabe Quartz Latite (name abandoned by John, 1992) exposed in the Toiyabe Range 30 km west of Manhattan. However, the Toiyabe in its type area consists mostly of ash-flow tuffs and cannot be correlated with the dacite intrusions in the Manhattan caldera. These rocks were designated dacite of Ferguson Hill (Tf) by Shawe (1987). Two radiometric age determinations have been made on a satellitic dike near the plugs of this unit; one K-Ar date on biotite is 25.5±0.9 Ma and another on biotite is 23.5±0.8 Ma (Shawe and others, 1986).

- 15.1±0.6 Ma (K-Ar on sanidine(?); Silberman and McKee, 1972)
- 22.6±1.4 Ma (K-Ar on plagioclase; Ferguson, 1924)
- 23.5±0.8 Ma (K-Ar on biotite; Shawe and others, 1986)
- 25.5±0.9 Ma (K-Ar on biotite; Shawe and others, 1986)

Several small rhyolite to rhyodacite plugs (Trd) were intruded into megabreccia along the east and northeast structural margins of the Manhattan caldera (Shawe, 1988). One of these plugs was dated (Shawe, 1988) as 24.8±0.9 Ma (K-Ar on biotite). The Manhattan caldera also includes four associated eruptive megabreccia units (Shawe and Snyder, 1988).

- 24.8±0.9 Ma (K-Ar on biotite; Shawe and Snyder, 1988)

### Bates Mountain Tuff (Unit TbtD), Tuff of Clipper Gap (Unit Tcg), and Tuff of Pipe Organ Spring (unit Tpo)

Two ash-flow tuff units, unit D of the Bates Mountain Tuff (unit TbtD of Shawe and Byers, 1999, and tuff of Clipper Gap, unit Tcg of Shawe, 1999b), from different sources outside but near our mapped area, are similar to the tuff of Pipe Organ Spring (unit Tpo of Shawe, 1999b). Unit D (upper Oligocene–lower Miocene, on the basis of correlation with rocks in various localities outside our mapped area) consists mostly of crystal-poor rhyolitic ash-flow tuff and minor tuffaceous sediments, aggregating less than about 60 meters (m) in thickness. The tuff of Clipper Gap and the Bates Mountain Tuff have limited distributions in the map area (they are included in younger ash-flow tuffs, unit Ty, pl. 1). The tuff of Pipe Organ Spring (late Oligocene–early Miocene), named for a locality in the northeast part of our study area (Shawe, 1999b; Shawe, Hardyman, and Byers, 2000), is a crystal-poor rhyolitic ash-flow tuff mostly less than about 90 m thick. The tuff of Pipe Organ Spring consists locally of two members, an upper member (unit Tpu of Shawe, Hardyman, and Byers, 2000), and a lower member (unit Tpl of Shawe, 1999b), which appears to be equivalent, on the basis of petrographic similarity, to member 2 (unit Trt2) of Boden's tuffs and sedimentary rocks of Road Canyon (Boden, 1986, 1992), about 12 km north of our map area. The upper member of the tuff of Pipe Organ Spring (unit Tpu of Shawe, Hardyman, and Byers, 2000), is separated locally from the lower member (unit Tpl of Shawe, 1999b), by unit D of the Bates Mountain Tuff, mentioned earlier. A sanidine $^{40}Ar/^{39}Ar$ date (sample DRS-85-27) for the lower member is 25.49±0.05 Ma. Unit D of the Bates Mountain Tuff is similar to a unit in the lower member of Boden's tuffs of Road Canyon, for which he determined a sanidine K-Ar date of 23.6±0.4 Ma (Boden, 1986, 1992). However, a sample (DRS-91-74) (fig. 1) collected from a tuff unit in the lower part of Boden's Road Canyon section (Boden, 1986, 1992), and underlying a tuff unit similar to unit D of the Bates Mountain Tuff, gave a sanidine age of 25.61±0.05 Ma. The tuff of Clipper Gap (late Oligocene), which is similar to an upper member of the tuffs of Road Canyon near our study area and dated by Boden (1992) as 22.1±0.3 Ma, is a crystal-poor rhyolitic ash-flow tuff, generally less than 45 m thick.

- 22.1±0.3 Ma (tuff of Clipper Gap; Boden, 1992)
- 23.6±0.4 Ma (K-Ar on sanidine; Boden, 1986, 1992)
- 25.49±0.05 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 25.61±0.05 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

### Vitrophyric Ash-Fall Tuff (Unit Tva)

A vitrophyric (glass-shard) ash-fall tuff (Tva) dated as 12.6±2.6 Ma (fission-track on zircon, Shawe, Naeser, and others, 1987) forms a small outcrop at the northwest edge of Ralston Valley (unit Tva, rhyolite volcanic ash, of Shawe, 1998). The vitrophyric tuff is from an unknown source (Shawe and others, 1987), possibly southeast of the southern Toquima Range.

- 12.6±2.6 Ma (fission-track on zircon; Shawe, Naeser, and others, 1987)

## $^{40}Ar/^{39}Ar$ Geochronology of Volcanic Units

Sixty mineral separates extracted from 28 rock samples from the Toquima Range, Nevada, were dated by the $^{40}Ar/^{39}Ar$ age-spectrum technique in the U.S. Geological Survey Denver Argon Laboratory. The new argon dates were determined by assuming a standard age of 28.03 Ma for Fish Canyon Tuff sanidine. Earlier reported ages for samples from the Toquima Range (Shawe, Hardyman, and Byers, 2000) analyzed in the Denver Argon Laboratory assumed a standard age of 27.84 Ma for Fish Canyon Tuff sanidine. Consequently, the earlier-determined ages must be increased by 0.19 Ma to facilitate direct comparison with new data described herein. Ages recalculated in this fashion are enclosed in square brackets [ ] herein. The dated samples are primarily of Tertiary age; two Cretaceous-age clasts recovered from Tertiary breccias also were dated. Geochronology results are summarized in table 1 and raw data are presented in appendix 1. Standard procedures, summarized in the footnote of appendix 1 and by Snee (2002), were used to determine ages of the analyzed samples. New $^{40}Ar/^{39}Ar$ dates for numerous Toquima Range Tertiary volcanic rocks range from 33.35±0.06 Ma to 24.92±0.05 Ma.

A sample of the tuff of Clipper Gap (Ty) (RH-TP-659) yielded biotite, hornblende, and sanidine separates. The biotite age spectrum (fig. 2*A*) defines a plateau that includes more than 72.9 percent of the released $^{39}Ar$, with an age of 24.88±0.05 Ma. The hornblende spectrum (fig. 2*B*) is slightly disturbed and saddle-shaped, and it indicates excess $^{40}Ar$; 42.2 percent of the released $^{39}Ar$ indicates a date of 24.85±0.18 Ma. The sanidine spectrum (fig. 2*C*) indicates excess $^{40}Ar$, but more than 24.7 percent of the released $^{39}Ar$ suggests a date of 24.99±0.11 Ma. All of these apparent ages overlap within error, but because the biotite age spectrum is undisturbed, it provides our best estimate of the age of the tuff.

- 24.85±0.18 Ma ($^{40}Ar/^{39}Ar$ on hornblende; this report)
- 24.88±0.05 Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 24.99±0.11 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

**Table 1.** Summary of $^{40}Ar/^{39}Ar$ dates for Toquima Range, Nevada, mineral separates.

[≈, nearly equal to; Can., Canyon; Ma, million years ago]

| Sample | Description | Minerals | Latitude | Longitude | Character of spectrum | Date (Ma) and 1σ error |
|---|---|---|---|---|---|---|
| DRS-85-122 | Quartzite (prospect)[1] | White mica | 38°42′36″N | 116°58′47″W | Preferred $^{40}$Ar loss | 80.2±0.14 |
| DRS-85-128 | Porphyry clast (in Tjsi)[2] | Actinolite | 38°42′30″N | 116°58′12″W | No plateau | 80s |
| DRS-85-176 | Andesite clast (in Tjsi)[3] | Biotite | 38°42′20″N | 116°58′03″W | Plateau | 33.35±0.06 |
| DRS-85-176 | Andesite clast (in Tjsi)[3] | Plagioclase | 38°42′20″N | 116°58′03″W | Preferred $^{40}$Ar loss | 33.09±0.07 |
| DRS-92-1 | Tjc[4] | Biotite | 38°43′24″N | 117°01′10″W | Plateau | 32.74±0.05 |
| DRS-92-1 | Tjc[4] | Sanidine | 38°43′24″N | 117°01′10″W | Preferred—Excess $^{40}$Ar | 32.81±0.06 |
| RH-TP-672 | Tuff of Haystack Canyon | Hornblende | 38°42′35″N | 116°41′30″W | Plateau | 29.70±0.12 |
| RH-TP-672 | Tuff of Haystack Canyon | Sanidine | 38°42′35″N | 116°41′30″W | Plateau | 29.87±0.07 |
| DRS-91-17 | Clast in Tmb[5] | Biotite | 38°30′33″N | 116°51′25″W | Plateau | 27.51±0.05 |
| DRS-91-17 | Clast in Tmb[5] | Hornblende | 38°30′33″N | 116°51′25″W | Preferred $^{40}$Ar loss | 27.39±0.09 |
| DRS-91-17 | Clast in Tmb[5] | Sanidine | 38°30′33″N | 116°51′25″W | Plateau | 27.24±0.06 |
| DRS-91-82 | Tcc (Tccu)[6] | Biotite | 38°41′11″N | 116°49′41″W | Plateau | 27.35±0.05 |
| DRS-91-82 | Tcc (Tccu)[6] | Sanidine | 38°41′11″N | 116°49′41″W | Plateau | 27.36±0.06 |
| DRS-91-92 | Tmj breccia | Biotite | 38°41′20″N | 116°50′49″W | Plateau | 27.32±0.04 |
| DRS-91-31 | Trc | Biotite | 38°30′51″N | 116°51′10″W | Disturbed | Undetermined |
| DRS-91-31 | Trc | Hornblende | 38°30′51″N | 116°51′10″W | Plateau | 26.85±0.14 |
| DRS-91-31 | Trc | Sanidine | 38°30′51″N | 116°51′10″W | Plateau | 27.01±0.04 |
| DRS-85-224 | Trc | Biotite | 38°38′39″N | 116°58′07″W | Disturbed | Undetermined |
| DRS-85-224 | Trc | Sanidine | 38°38′39″N | 116°58′07″W | Plateau | 26.98±0.05 |
| DRS-85-225 | Trc | Sanidine | 38°36′27″N | 116°50′26″W | $^{40}$Ar loss or excess $^{40}$Ar | ≈27.32±0.08 |
| RH-TP-616 | Ti | Sanidine | 38°42′27″N | 116°48′55″W | Preferred—Excess $^{40}$Ar | 27.22±0.07 |
| DRS-91-98 | Tmj (Tmjv)[7] | Biotite | 38°41′49″N | 116°50′59″W | Plateau | 27.06±0.06 |
| DRS-91-98 | Tmj (Tmjv)[7] | Sanidine | 38°41′49″N | 116°50′59″W | Preferred $^{40}$Ar loss | 27.07±0.05 |
| DRS-91-171 | Tmj | Biotite | 38°42′07″N | 116°50′38″W | Plateau | 27.10±0.04 |
| DRS-91-171 | Tmj | Hornblende | 38°42′07″N | 116°50′38″W | Preferred $^{40}$Ar loss | 27.07±0.05 |
| DRS-91-171 | Tmj | Sanidine | 38°42′07″N | 116°50′38″W | Plateau | 26.83±0.05 |
| RH-TP-571 | Tmj | Biotite | 38°42′15″N | 116°50′01″W | Plateau | 27.02±0.07 |
| RH-TP-571 | Tmj | Sanidine | 38°42′15″N | 116°50′01″W | Plateau | 27.00±0.06 |
| RH-TP-583 | Tmj | Biotite | 38°42′36″N | 116°50′06″W | Plateau | 26.86±0.05 |
| RH-TP-583 | Tmj | Hornblende | 38°42′36″N | 116°50′06″W | Plateau | 26.69±0.04 |
| RH-TP-583 | Tmj | Sanidine | 38°42′36″N | 116°50′06″W | Plateau | 26.87±0.04 |
| RH-TP-590 | Tmj | Biotite | 38°43′30″N | 116°49′10″W | Plateau | 26.99±0.06 |
| RH-TP-590 | Tmj | Sanidine | 38°43′30″N | 116°49′10″W | Plateau | 26.85±0.04 |
| RH-TP-644 | Tmj | Biotite | 38°44′54″N | 116°51′23″W | Plateau | 27.08±0.04 |
| RH-TP-644 | Tmj | Hornblende | 38°44′54″N | 116°51′23″W | Plateau | 26.78±0.14 |
| RH-TP-644 | Tmj | Sanidine | 38°44′54″N | 116°51′23″W | Preferred $^{40}$Ar loss | 26.83±0.07 |
| RH-TP-646 | Tmj | Biotite | 38°45′27″N | 116°50′10″W | Plateau | 26.93±0.07 |
| RH-TP-646 | Tmj | Sanidine | 38°45′27″N | 116°50′10″W | Plateau | 26.91±0.07 |
| DRS-85-48 | Tmj | Biotite | 38°41′19″N | 116°59′18″W | Plateau | 26.89±0.05 |
| DRS-85-48 | Tmj | Sanidine | 38°41′19″N | 116°59′18″W | Plateau | 26.86±0.04 |
| DRS-85-78 | Tmj(Tmjv)[7] | Biotite | 38°43′27″N | 116°58′39″W | Plateau | 26.85±0.05 |
| DRS-85-78 | Tmj(Tmjv)[7] | Sanidine | 38°43′27″N | 116°58′39″W | Plateau | 26.78±0.06 |
| DRS-85-10 | Tmj | Biotite | 38°41′57″N | 116°55′56″W | Plateau | 26.79±0.04 |
| DRS-85-10 | Tmj | Sanidine | 38°41′57″N | 116°55′56″W | Preferred $^{40}$Ar loss | 26.78±0.05 |
| DRS-91-58A | Trp | Orthoclase | 38°41′52″N | 116°50′02″W | Plateau | 26.73±0.05 |
| DRS-92-16 | Tlt[8] | Biotite | 38°42′29″N | 116°50′48″W | Disturbed | Undetermined |
| DRS-92-16 | Tlt[8] | Sanidine | 38°42′29″N | 116°50′48″W | Preferred—Excess $^{40}$Ar | 26.47±0.05 |
| DRS-85-27 | Ty (Tpl)[9] | Biotite | 38°42′19″N | 116°53′33″W | Plateau | 27.36±0.05 |
| DRS-85-27 | Ty (Tpl)[9] | Hornblende | 38°42′19″N | 116°53′33″W | Plateau | 25.33±0.10 |
| DRS-85-27 | Ty (Tpl)[9] | Sanidine | 38°42′19″N | 116°53′33″W | Plateau | 25.49±0.05 |
| DRS-92-59 | Ty (Tpl)[9] | Biotite | 38°42′23″N | 116°52′57″W | Disturbed | ≈26.35±0.06 |
| DRS-92-59 | Ty (Tpl)[9] | Hornblende | 38°42′23″N | 116°52′57″W | Plateau | 25.71±0.15 |
| DRS-92-59 | Ty (Tpl)[9] | Orthoclase | 38°42′23″N | 116°52′57″W | Plateau | 25.57±0.05 |
| DRS-91-74 | Ty (tuffs of Road Can.)[10] | Biotite | 38°51′29″N | 116°51′04″W | Disturbed | 26.13±0.08 |
| DRS-91-74 | Ty (tuffs of Road Can.)[10] | Sanidine | 38°51′29″N | 116°51′04″W | Plateau | 25.61±0.05 |
| DRS-85-54 | Ty(Tspl)[11] | Biotite | 38°43′03″N | 116°52′35″W | Disturbed | ≈26.00±0.05 |
| DRS-85-54 | Ty(Tspl)[11] | Sanidine | 38°43′03″N | 116°52′35″W | Plateau | 25.13±0.19 |
| RH-TP-659 | Ty(Tcg)[12] | Biotite | 38°42′54″N | 116°49′15″W | Plateau | 24.88±0.05 |
| RH-TP-659 | Ty(Tcg)[12] | Hornblende | 38°42′54″N | 116°49′15″W | Preferred—Excess $^{40}$Ar | 24.85±0.18 |
| RH-TP-659 | Ty(Tcg)[12] | Sanidine | 38°42′54″N | 116°49′15″W | Preferred—Excess $^{40}$Ar | 24.99±0.11 |

[1]Mineralized quartzite, Gold Hill Formation (Cgq, Shawe, 1999b), from prospect dump.

[2]Porphyritic granite clast in intrusive phase of megabreccia of Jefferson Summit (Tjsi, Shawe, 1999b).

[3]Andesite clast in intrusive phase of megabreccia of Jefferson Summit (Tjsi, Shawe, 1999b).

[4]Vitrophyric matrix(?) at base of megabreccia of Jefferson (Tjc, Shawe, 1995).

[5]Clast in monolithologic megabreccia (Tmb, Shawe and others, 2000).

[6]Tuff of Corcoran Canyon (Tcc), upper unit (Shawe and others, 2000).

[7]Tuff of Mount Jefferson, vitrophyre unit (Tmjv, Shawe, 1999b).

[8]Biotite-rich layer in fine-grained tuffaceous sandstone-siltstone in volcaniclastic rocks of Little Table Mountain (Tltl, Shawe, 1999b).

[9]Tuff of Pipe Organ Spring, lower (Tpl, Shawe, 1999b), in Ty.

[10]Grayish-buff layered tuff in lower part of tuffs of Road Canyon, just northeast of our map area (Boden, 1986).

[11]Shingle Pass Tuff, lower (Tspl, Shawe, 1999b), in Ty.

[12]Tuff of Clipper Gap (Tcg, Shawe and others, 2000), in Ty.

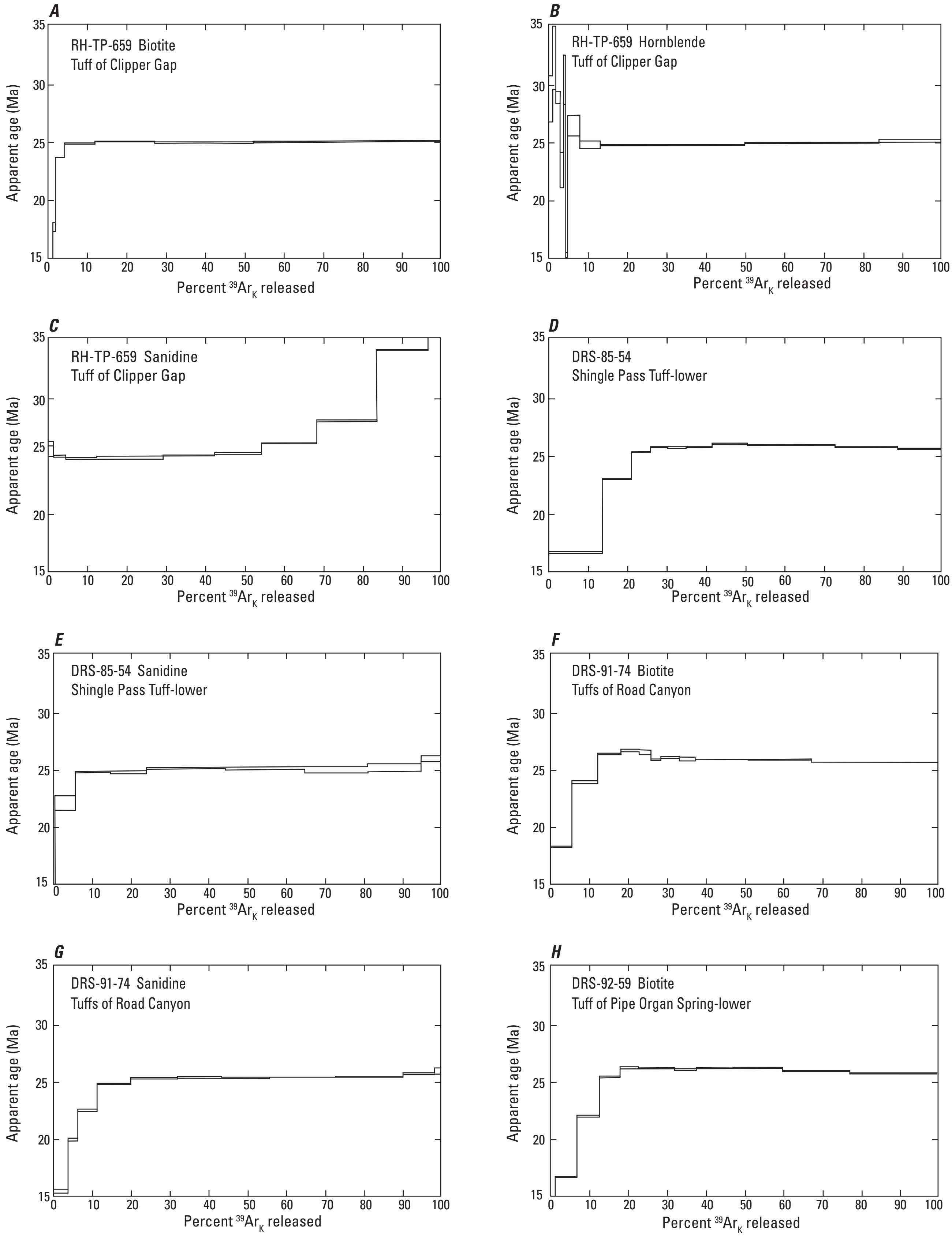
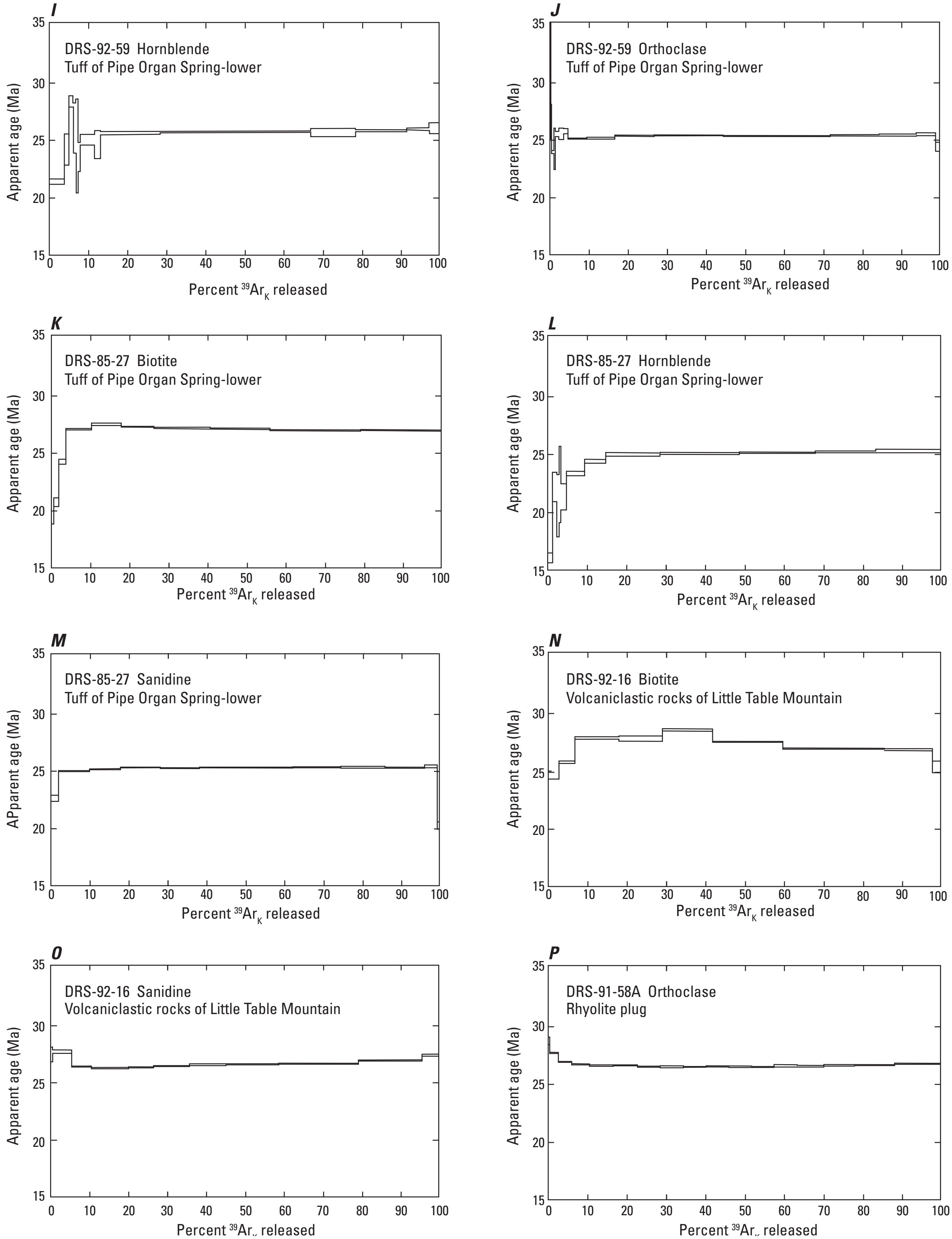



**Figure 2 (above and following pages).** $^{40}Ar/^{39}Ar$ age spectra of minerals in volcanic rocks of the southern Toquima Range, Nye County, Nevada. Letters *A* through *HHH* correspond with the identifier in upper left of each view and link to discussion in text.

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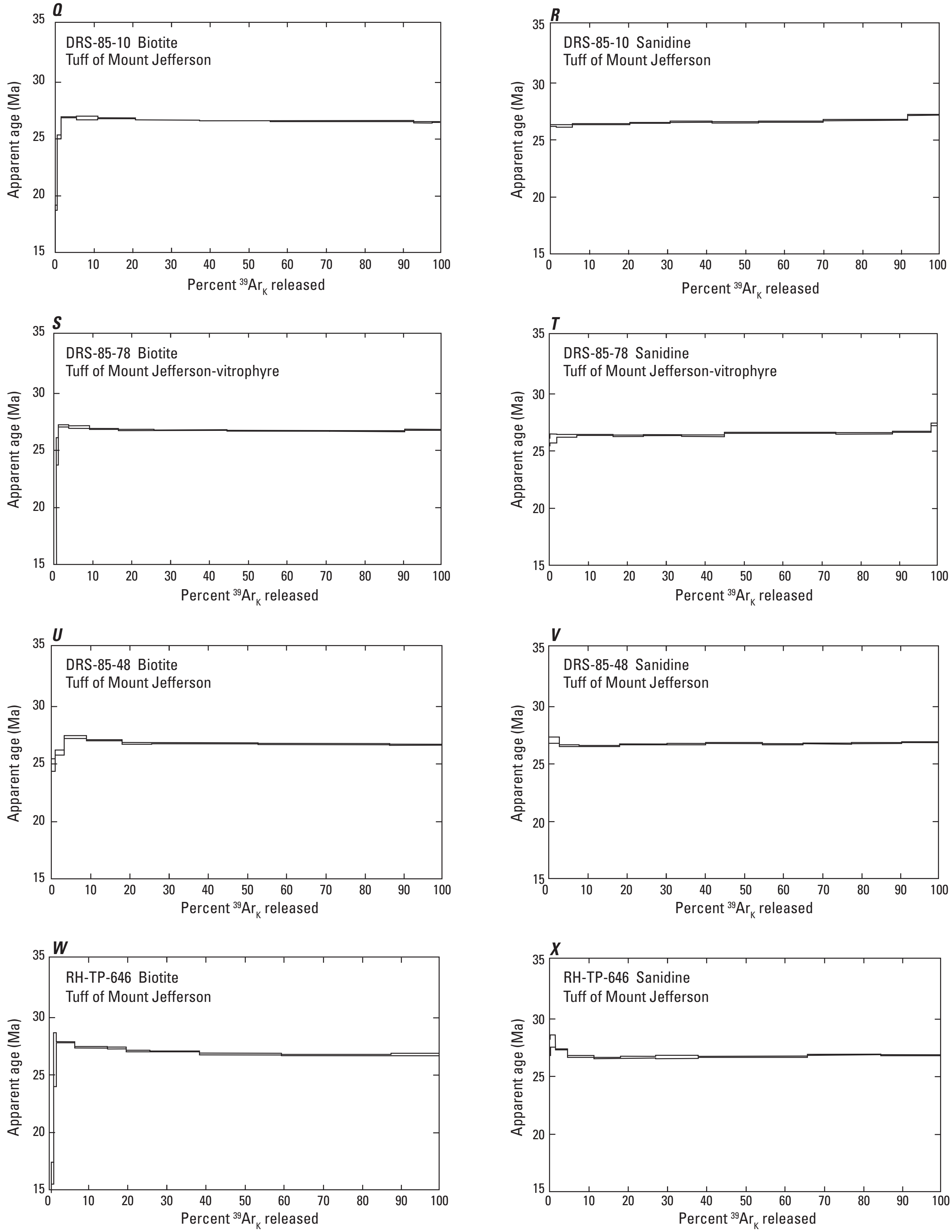


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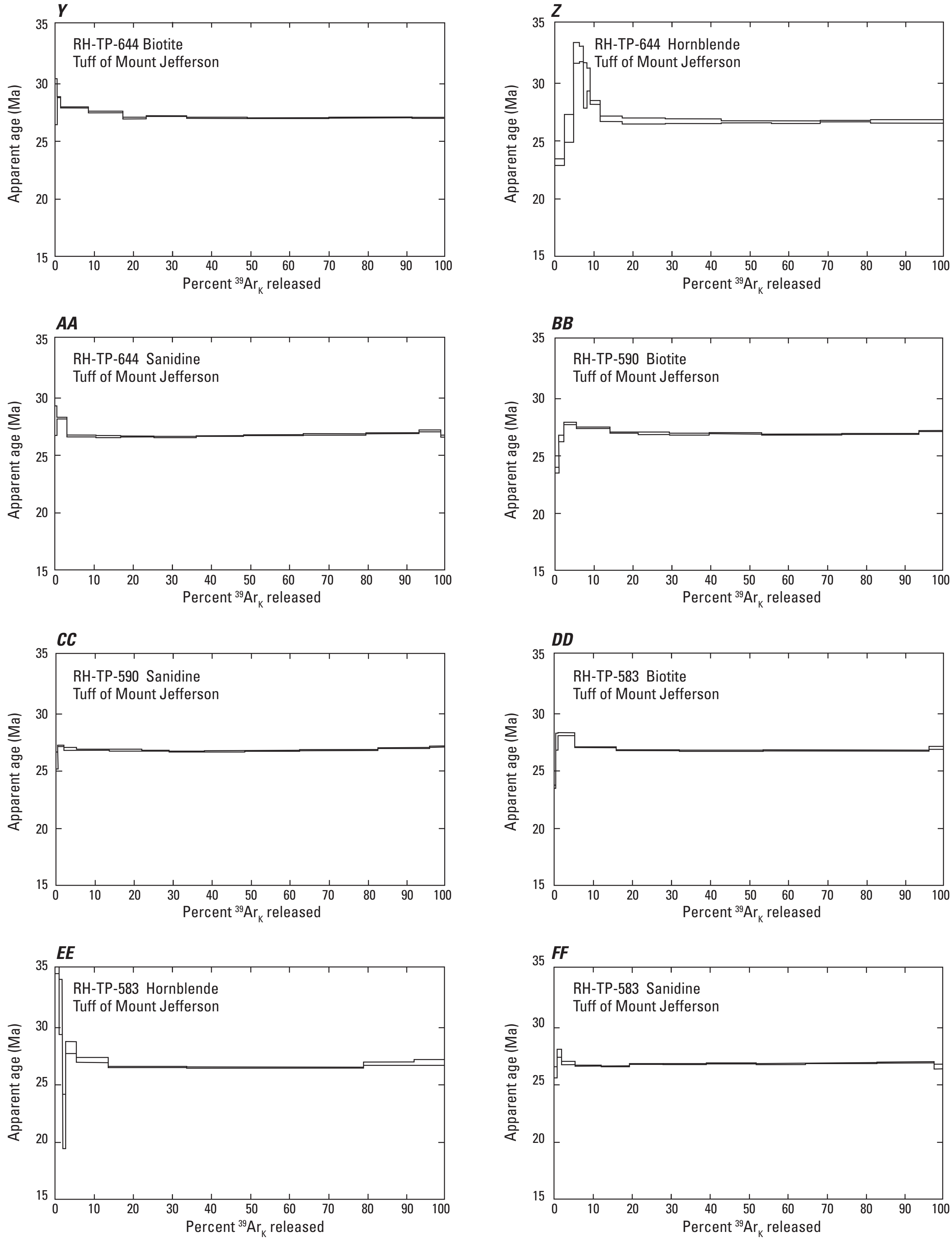


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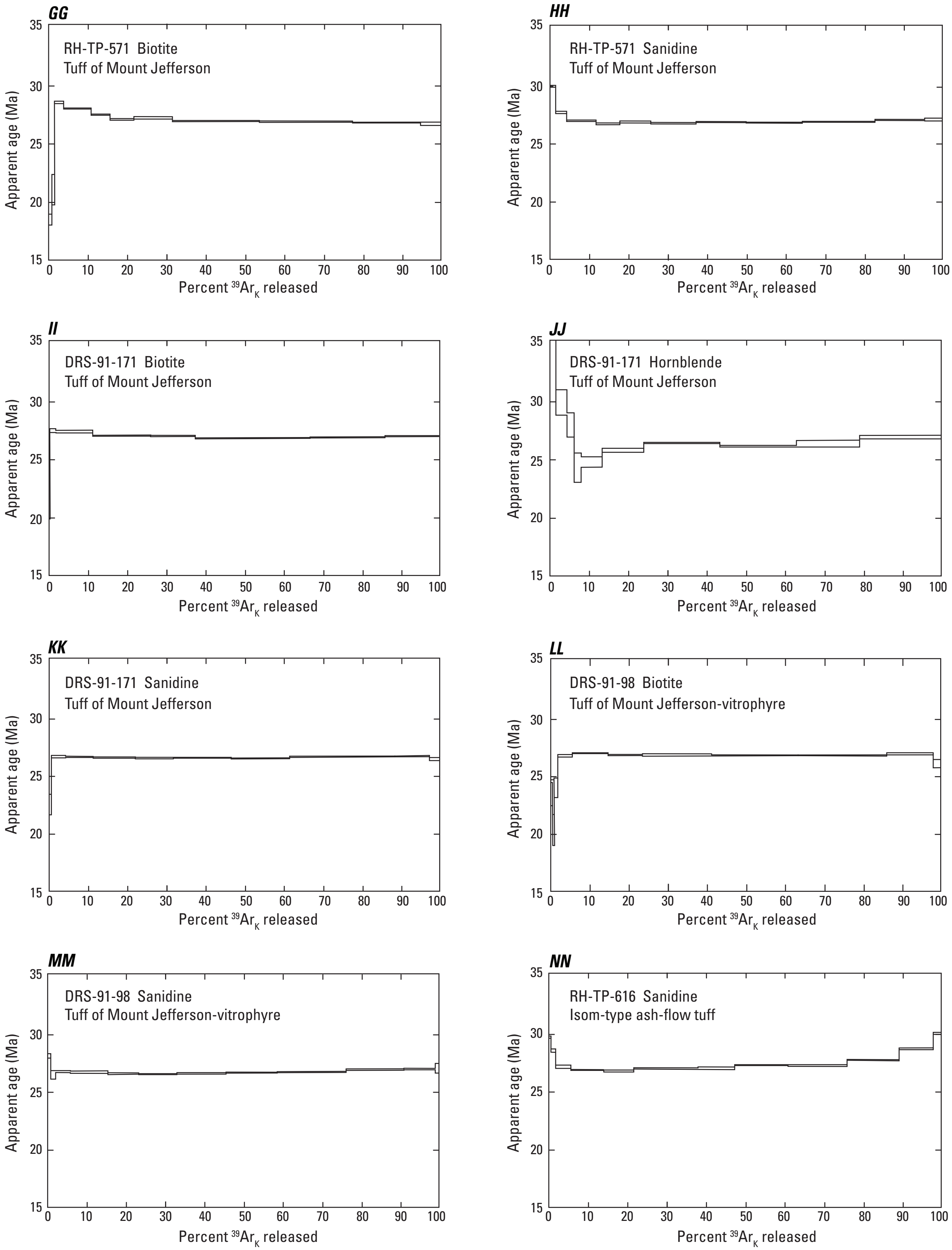


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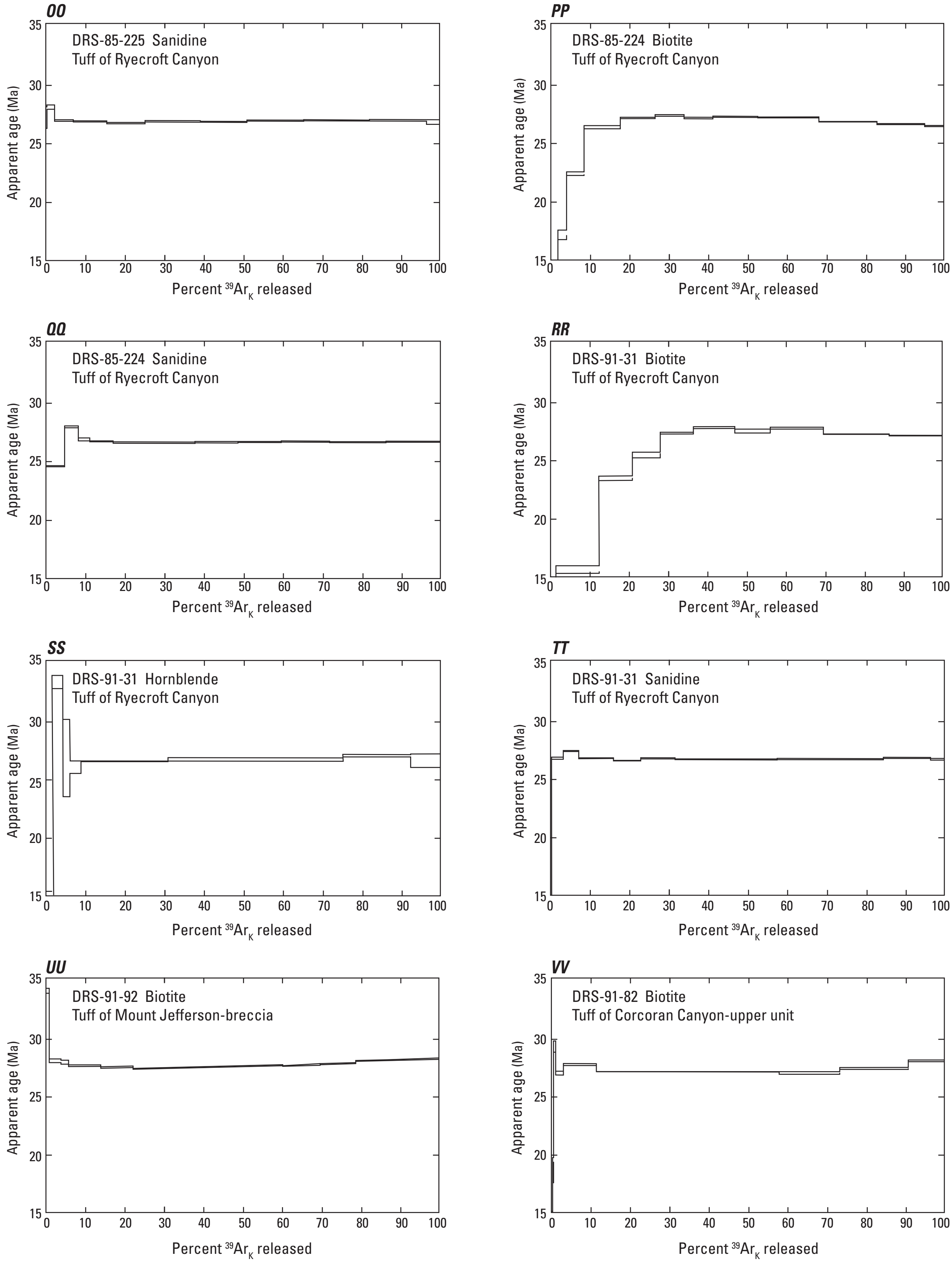


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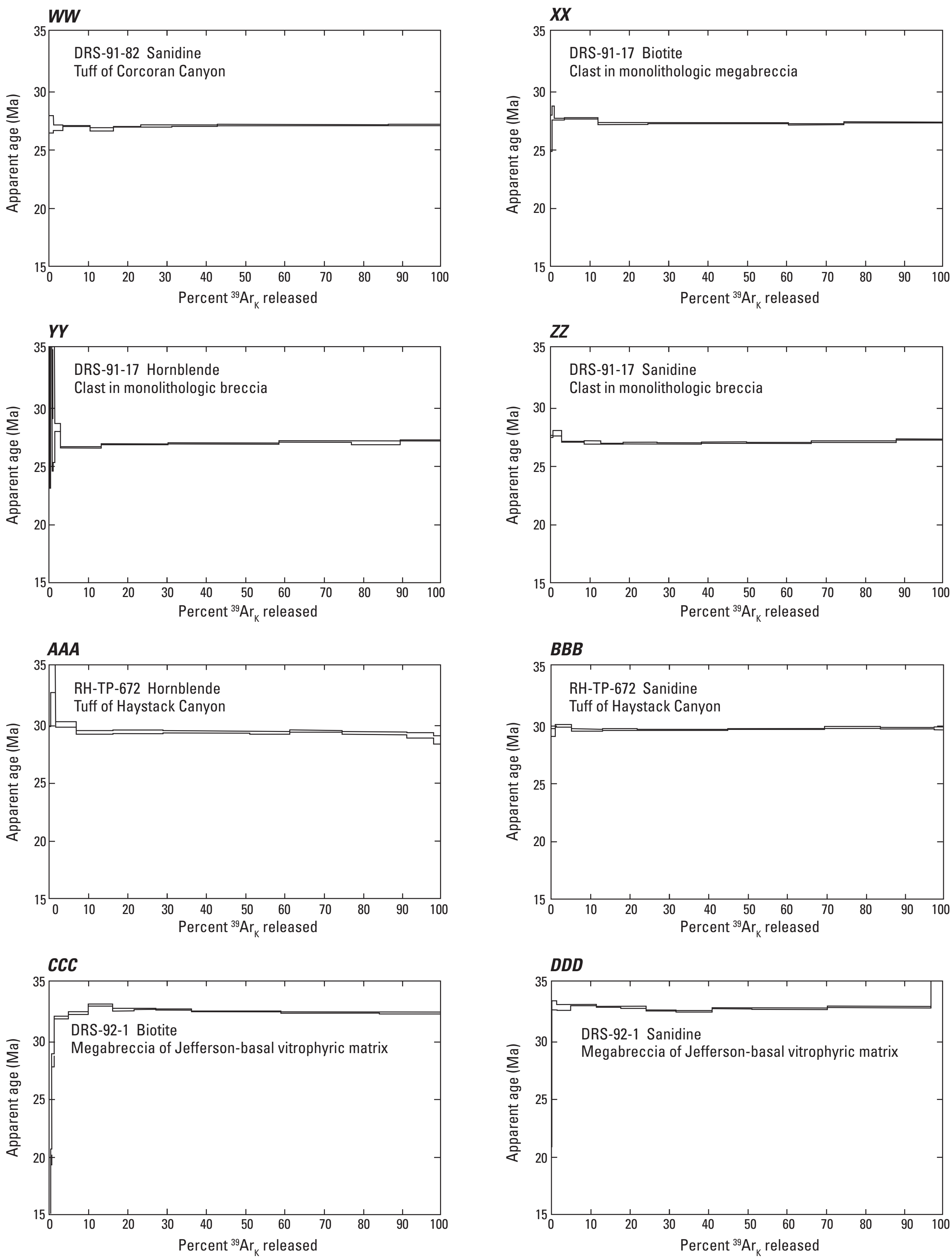


**Figure 2.** $^{40}Ar/^{39}Ar$ age spectra of minerals in volcanic rocks of the southern Toquima Range, Nye County, Nevada. Letters *A* through *HHH* correspond with the identifier in upper left of each view and link to discussion in text.—Continued

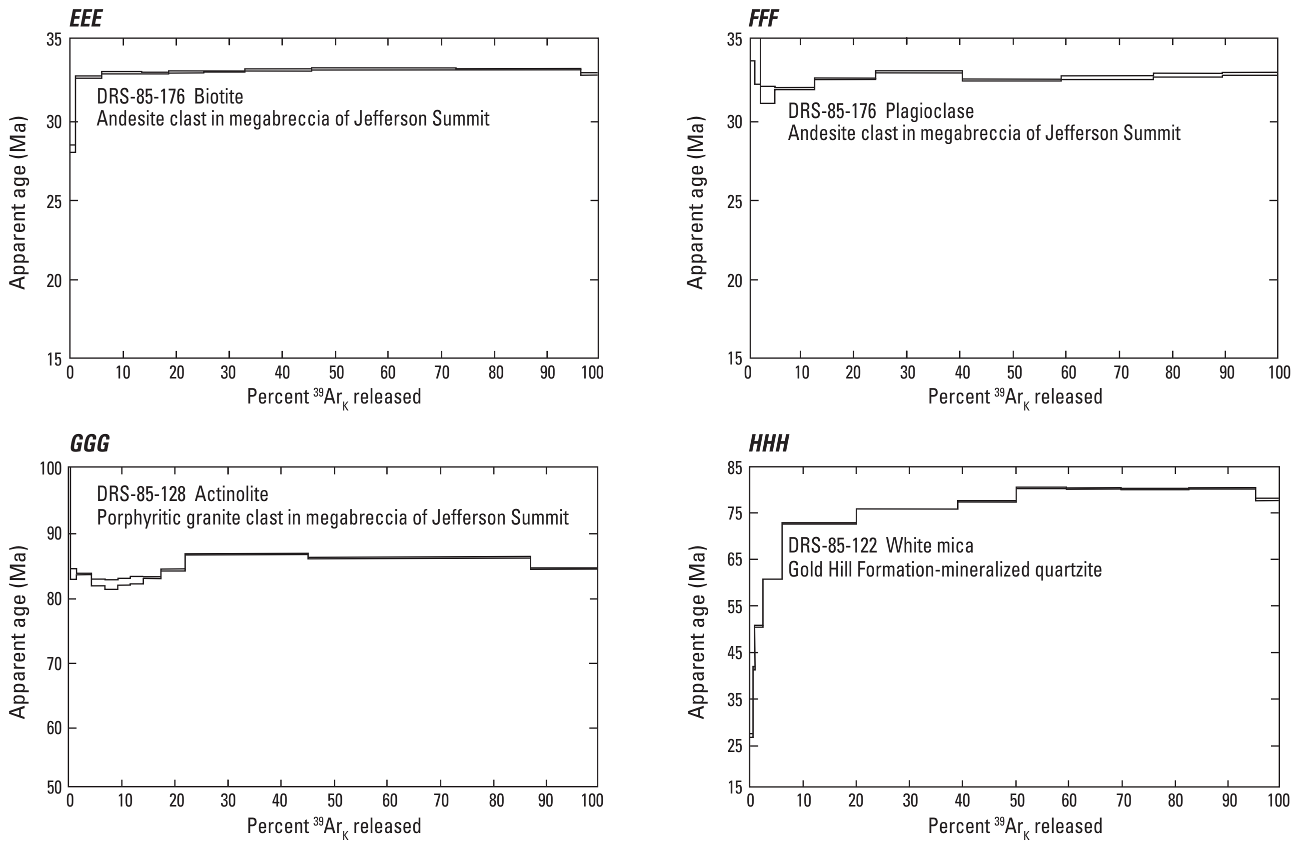


**Figure 2.** $^{40}Ar/^{39}Ar$ age spectra of minerals in volcanic rocks of the southern Toquima Range, Nye County, Nevada. Letters *A* through *HHH* correspond with the identifier in upper left of each view and link to discussion in text.—Continued

A sample from the lower part of the Shingle Pass Tuff (Tsp) (DRS-85-54) yielded biotite and sanidine separates. The biotite age spectrum (fig. 2*D*) is slightly disturbed and includes an excess $^{40}Ar$ hump, likely the result of minor secondary chlorite. Analytical issues caused the sanidine to produce a low isotopic signal; however, the sample yielded a plateau (fig. 2*E*) that includes more than 70.7 percent of the released $^{39}Ar$ with a date of 25.13±0.19 Ma, which is our best estimate for the age of the unit.

- 25.13±0.19 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

A sample of the tuff of Road Canyon (DRS-91-74; fig. 1) collected in Road Canyon 12 km north of our map area yielded biotite and sanidine separates. The biotite argon spectrum (fig. 2*F*) is disturbed but the sanidine (fig. 2*G*) yielded a plateau age of 25.61±0.05 Ma, which is our best estimate for the age of the tuff.

- 25.61±0.05 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

Two samples of the tuff of Pipe Organ Spring (Ty) were analyzed. Sample DRS-92-59 yielded orthoclase, hornblende, and biotite separates. The biotite spectrum indicates excess $^{40}Ar$ (fig. 2*H*); the hornblende (fig. 2*I*) and orthoclase (fig. 2*J*) spectra include plateaus of 25.71±0.15 Ma and 25.57±0.05 Ma, respectively. Sample DRS-85-27 biotite (fig. 2*K*), hornblende (fig. 2*L*) and sanidine (fig. 2*M*) plateau dates are 25.36±0.05, 25.33±0.10, and 25.49±0.05 Ma, respectively. The age spread among these analyses may reflect real age differences or routine analytical error. Our preference is to average these four dates to obtain an average arithmetic age of 25.53±0.16 Ma for the tuff of Pipe Organ Spring.

- 25.33±0.10 ($^{40}Ar/^{39}Ar$ on hornblende; this report)
- 25.36±0.05 ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 25.49±0.05 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 25.53±0.16 Ma ($^{40}Ar/^{39}$ average age; this report)
- 25.57±0.05 Ma ($^{40}Ar/^{39}Ar$ on orthoclase; this report)
- 25.71±0.15 Ma ($^{40}Ar/^{39}Ar$ on hornblende; this report)

Biotite (fig. 2*N*) and sanidine (fig. 2*O*) separates from sample DRS-92-16 of the Little Table Mountain unit (Tlt) yielded disturbed age spectra. The biotite date is unreliable. However, the sanidine spectrum, although it indicates minor excess $^{40}Ar$, defines an apparent age of 26.47±0.05 Ma in its low-age segment, which we consider to be the best estimate of the age of the unit.

- 26.47±0.05 Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

An orthoclase separate from a rhyolite plug (Trp), sample DRS-91-58A, yielded an argon plateau date of 26.73±0.05 Ma (fig. 2*P*), our accepted date for alteration of the intrusion.

- 26.73±0.05 Ma ($^{40}Ar/^{39}Ar$ on orthoclase; this report)

Twenty-one of the dated mineral separates (sanidine, biotite, and hornblende) from 10 Mount Jefferson samples range in age from 27.07 Ma to 26.69; an additional Mount Jefferson sample is a vitrophyre that produced sanidine and biotite separates with apparent ages in this same range (figs. 2*Q–MM*). Of the 23 samples, 18 yield plateau age spectra with a mean age of 26.90±0.10 (1σ) Ma. Of the 5 samples that did not produce plateaus, 4 are sanidine that indicate gradually increasing age with increasing release temperature, which is a common characteristic of sanidine age spectra; our preferred ages for these 4 samples are also coincident with the age range defined by the 18 samples included in the mean age. The fifth sample is hornblende, separated from vitrophyre, that produced an $^{40}Ar$ loss spectrum that steps up in apparent age to 27.07 Ma, which is identical to the age of coexisting biotite from the vitrophyre. The average of all 21 apparent ages is 26.90±0.11 (1σ) Ma. The 0.38-m.y. range of ages among the 21 samples may represent analytical error or, alternatively, may reflect the true duration of eruptive activity responsible for the tuff of Mount Jefferson (Tmj).

- 26.90±0.11 (1σ) Ma (mean age $^{40}Ar/^{39}Ar$ on tuff; this report)
- 27.07 Ma ($^{40}Ar/^{39}Ar$ on hornblende; this report)

Sanidine from sample RH-TP-616 collected from the Isom-type ash-flow tuff (Ti) defines a disturbed age spectrum that indicates excess $^{40}Ar$. The low-age part of the age-spectrum saddle yields an apparent age of 27.22±0.07 (1σ) Ma (fig. 2*NN*). However, the presence of excess $^{40}Ar$ suggests that the preferred age may be older than the actual eruption age.

- 27.22±0.07 (1σ) Ma ($^{40}Ar/^{39}Ar$ on tuff; this report)

Three samples of the tuff of Ryecroft Canyon (Trc) yielded sanidine (fig. 2*OO*) (DRS-85-225), biotite (fig. 2*PP*) and sanidine (fig. 2*QQ*) (DRS-85-224), and biotite (fig. 2*RR*), hornblende (fig. 2*SS*), and sanidine (fig. 2*TT*) (DRS-91-31) separates that were analyzed. Both biotite age spectra are strongly disturbed and produce indeterminate results. The sanidine age spectrum for sample DRS-85-225 is difficult to interpret because it reflects characteristics of either $^{40}Ar$ loss or excess $^{40}Ar$. Sanidine from sample DRS-85-224, and sanidine and hornblende from sample DRS-91-31 produced plateau spectra with an average age of 26.95±0.08 (1σ) Ma.

- 26.95±0.08 (1σ) Ma (average age, $^{40}Ar/^{39}Ar$ on tuff; this report)

Biotite in sample DRS-91-92 from a breccia clast contained in the tuff of Mount Jefferson (Tmj) yielded an argon spectrum (fig. 2*UU*) indicative of minor excess $^{40}Ar$ but includes a plateau with an apparent age of 27.32±0.04 (1σ) Ma. We interpret this plateau to be the age of the clast and therefore a maximum age for the enclosing tuff.

- 27.32±0.04 (1σ) Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)

Sample DRS-91-82, tuff of Corcoran Canyon (Tcc), yielded biotite (fig. 2*VV*) and sanidine (fig. 2*WW*) separates that produced concordant apparent plateau ages of 27.35±0.05 (1σ) and 27.36±0.06 (1σ) Ma, respectively. The average of these dates is our preferred age for eruption of the Corcoran Canyon tuff.

- 27.35±0.05 (1σ) Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 27.36±0.06 (1σ) Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

Biotite (fig. 2*XX*), hornblende (fig. 2*YY*), and sanidine (fig. 2*ZZ*) separates were recovered from and $^{40}Ar/^{39}Ar$ ages determined for a sample (DRS-91-17) of the monolithologic megabreccia (Tmb). The hornblende spectrum indicates $^{40}Ar$ loss and defines a near plateau age of 27.39±0.09 (1σ) Ma (fig. 2*YY*). Biotite and sanidine separates yielded plateaus with apparent ages of 27.51±0.05 (1σ) and 27.24±0.06 (1σ) Ma, respectively. The biotite and sanidine dates are statistically distinct and the hornblende date is intermediate. The average of these three dates, 27.38±0.14 (1σ) Ma, probably represents the best estimate of the age of this unit. Alternatively, because the biotite and sanidine ages are statistically distinct their age discordance may indicate geologic processes rather than analytical error. Thus, the biotite apparent age may represent the best age of the monolithologic megabreccia (Tmb) because the amphibole and sanidine age spectra both indicate $^{40}Ar$ loss.

- 27.24±0.06 (1σ) Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)
- 27.38±0.14 (1σ) Ma (average age, $^{40}Ar/^{39}Ar$ on sanidine; this report)
- 27.39±0.09 (1σ) Ma ( $^{40}Ar/^{39}Ar$ on hornblende; this report)
- 27.51±0.05 (1σ) ($^{40}Ar/^{39}Ar$ on biotite; this report)

Sample RH-TP-672 (fig. 1) was collected in the nearby Monitor Range and represents the informally named tuff of Haystack Canyon (R.F. Hardyman, oral commun., 2012). Hornblende (fig. 2*AAA*) and sanidine (fig. 2*BBB*) separates yielded concordant dates of 27.70±0.12 (1σ) and 27.87±0.07 (1σ) Ma, respectively. The average apparent age of 27.79±0.10 (1σ) Ma is our estimate of the age of the tuff.

- 27.79±0.10 (1σ) Ma (average age, $^{40}Ar/^{39}Ar$ on tuff; this report)
- 27.70±0.12 (1σ) ($^{40}Ar/^{39}Ar$ on hornblende; this report)
- 27.87±0.07 (1σ) Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

A sample of Jefferson Canyon megabreccia (Tjc) (DRS-92-1) yielded a biotite plateau age (fig. 2*CCC*) of 32.74±0.05 (1σ) Ma and a sanidine preferred age (fig. 2*DDD*) of 32.81±0.06 (1σ) Ma. The sanidine age spectrum is disturbed and indicates either $^{40}Ar$ loss or excess $^{40}Ar$. Therefore the biotite date is our best estimate for the age of this unit.

- 32.74±0.05 (1σ) Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)
- 32.81±0.06 (1σ) Ma ($^{40}Ar/^{39}Ar$ on sanidine; this report)

Sample DRS-85-176 is from an andesite porphyry clast in the intrusive phase of megabreccia of Jefferson Summit (Tjs) from which biotite (fig. 2*EEE*) and plagioclase (fig. 2*FFF*) separates were obtained. The plagioclase age spectrum is disturbed, but the biotite produced an age spectrum with a plateau age of 33.35±0.06 (1σ) Ma, our accepted age.

- 33.35±0.06 (1σ) Ma ($^{40}Ar/^{39}Ar$ on biotite; this report)

Sample DRS-85-128 represents clasts in the intrusive phase of the megabreccia of Jefferson Summit (Tjs). Actinolite from DRS-85-128 yielded a disturbed argon spectrum (fig.2*GGG*) with an apparent Late Cretaceous age. Argon derived from muscovite in DRS-85-122 produced an argon-loss spectrum (fig. 2*HHH*) with an interpreted age of 80.2±0.1 (1σ) Ma, which is a reasonable estimate for the cooling age of the muscovite.

- 80.2±0.1 (1σ) Ma ($^{40}Ar/^{39}Ar$ on muscovite; this report)

# Phenocryst Compositions as Determined by Electron Microprobe

## Analytical Methods, Mineral Structural Formula Calculations, and Samples Analyzed

Polished thin sections of selected samples were prepared to determine compositions of plagioclase, sanidine, biotite, hornblende, clinopyroxene, and orthopyroxene phenocrysts by electron microprobe analysis. Not all of these minerals were present or analyzed in each of the samples examined. Resulting microprobe analyses were used to calculate mineral structural formulas.

Phenocryst compositions were determined using a JEOL 8900® electron microprobe with 5 wavelength-dispersive crystal spectrometers, 5–20 micrometer (µm) beam, 15 kilovolt (kV) accelerating voltage, and 20 nanoampere (nA) beam current were used to make 20-second analyses on numerous grains of each mineral species. Analyzed spots were at grain cores and rims, and in some instances at intermediate spots to ensure that the full composition range of each mineral was recorded. In tables of analytical data (appendixes 2–8), “Probe sample no.” entries ending in “1” identify grain core analyses, whereas “2” indicates grain rim analyses, and “3” or “4” indicate analyses of intermediate parts of grains.

Microprobe determinations report total iron in biotite in the ferrous ($Fe^{2+}$) state. Prior to structural formula calculation total iron was partitioned to $Fe^{2+}$ and $Fe^{3+}$ by assuming $Fe^{2+}/(Fe^{2+}+Fe^{3+}) = 0.85$ (Dodge and others, 1969); $H_2O$ abundances were determined by stoichiometry by assuming 24 anions (O, OH, F, Cl).

Microprobe determinations report total iron in amphibole in the ferrous ($Fe^{2+}$) state. As part of structural formula calculations, total iron was partitioned to $Fe^{2+}$ and $Fe^{3+}$ by charge balancing; $H_2O$ abundances were determined by stoichiometry assuming 24 anions (O, OH, F, Cl). Amphibole names were assigned according to the classification of Leake and others (1997). Compositions of each of the minerals analyzed are presented in variation diagrams (figs. 3–27).

Several volcanic units were selected for phenocryst composition determinations in order to confirm the identity or correlation of their host units. Studied were Isom-type tuff (Ti) (3 samples), Bates Mountain Tuff (Ty) (3 samples), tuff of Mount Jefferson (Tmj) (8 samples, identified in the next section, including 5 from a unit identified as tuff of Trail Canyon by Boden (1986), which we believe is part of the tuff of Mount Jefferson), tuff of Ryecroft Canyon (Trc) (3 samples), tuff of Corcoran Canyon (Tcc) (2 samples), and megabreccia of Jefferson Canyon (1 sample). The megabreccia of Jefferson Canyon (Tjc) was described by Boden (1986) as the megabreccia of Dry Canyon and correlated by Henry (1997) with a 32.3 Ma caldera underlying Big Smoky Valley.

## Results of Phenocryst Analyses

Phenocryst compositions are discussed in subsequent sections by individual volcanic unit: megabreccia of Jefferson Canyon (Tjc), tuff of Corcoran Canyon (Tcc), tuff of Ryecroft Canyon (Trc), tuff of Mount Jefferson (Tmj), Isom-type tuff (Ti), and Bates Mountain Tuff (Ti). Phenocryst composition variations may mimic the compositional variations of host magmas arrayed in vertically zoned reservoirs; during single eruptions magma may have been derived from multiple zones. In most cases, because of the relatively limited number of samples studied and the relative uncertainty of each sample’s stratigraphic position (general position estimated for tuff of Mount Jefferson samples), interpreting the nature and extent of magma evolution and eruptive histories are possible to a limited extent only. However, the data provide evidence that in some of the formations studied, conditions prevailing during phenocryst crystallization varied between eruptive episodes, attesting to likely derivation of magma from different levels in zoned reservoirs. Although geologic evidence implies more than one cooling unit (representing discrete eruptive episodes) in some formations, and there is petrographic evidence of compositional variation in magma during an episode, the data are generally insufficient to define the nature and extent of magma evolution during the petrogenesis of individual ash-flow tuffs. However, mineral composition data define magma composition characteristics pertinent to the histories of the different formations, and the data bear on proposed unit correlations. Locations of samples for which mineral compositions were determined are shown on plate 1 and figure 1.

## Megabreccia of Jefferson Canyon (Unit Tjc)

We determined phenocryst compositions in only one sample (vitrophyre, DRS-92-1; figs. 3–6) of the megabreccia of Jefferson Canyon (Tjc). The vitrophyric sample was collected where the rock appears to be a basal chilled ash matrix of the megabreccia. Accordingly, the ages of its contained phenocrysts probably define the age of the vitrophyre and the associated megabreccia. Alternatively, the vitrophyre may constitute a large clast derived from an older unit, in which case phenocrysts would not be representative of the megabreccia. The compositions of biotite, amphibole, and pyroxene phenocrysts were determined by microprobe analysis and are compared here to those in the tuff of Mount Jefferson (Tmj), described in later paragraphs.

Biotite compositions shown in figure 3 are virtually identical to those of Mg-rich biotites in samples from the lower part of the tuff of Mount Jefferson (see later discussion of fig. 12) and are more Mg-rich than samples from the upper part of the tuff of Mount Jefferson (see later discussion of figs. 13, 14). The similarity of biotite compositions suggests that the megabreccia of Jefferson Canyon (Tjc) is akin to the lower part of the tuff of Mount Jefferson. The composition of one biotite in the vitrophyre of sample DRS-92-1 (fig. 3), which plots off the general trend, may represent an inaccurate analysis.

Compositions of hornblende in sample DRS-92-1 (fig. 4) lie along the less Ca-rich hornblende composition trend defined for tuff of Mount Jefferson (Tmj) samples (see later discussion of fig. 16), and appear to be most akin to the older (lower) part of the tuff of Mount Jefferson. Amphibole in the sample is composed of edenite and pargasite/magnesiohastingsite (see later discussion of fig. 5).

Compositions of augite in the sample of the megabreccia of Jefferson Canyon (Tjc) (DRS-92-1, fig. 6) are virtually identical to those of clinopyroxene in tuff of Mount Jefferson samples (see subsequent discussion of fig. 19).

Compositional similarities among biotite, hornblende, and augite in the megabreccia of Jefferson Canyon (Tjc) and those in the tuff of Mount Jefferson (Tmj) suggest that the two units had a common magma source. If this correlation is correct, then the inference that the megabreccia is related to the Mount Jefferson caldera, as suggested earlier by Shawe (1995, 1999b) and by Shawe, Hardyman, and Byers (2000), is corroborated. The 32 Ma dates for the megabreccia of Jefferson Canyon obtained by Boden (1986, 1992), Henry (1997), and Shawe (1999b) may represent older material incorporated as clasts in the younger megabreccia. $^{40}Ar/^{39}Ar$ dating of the sample of vitrophyre (DRS-92-1) would clarify these relationships.

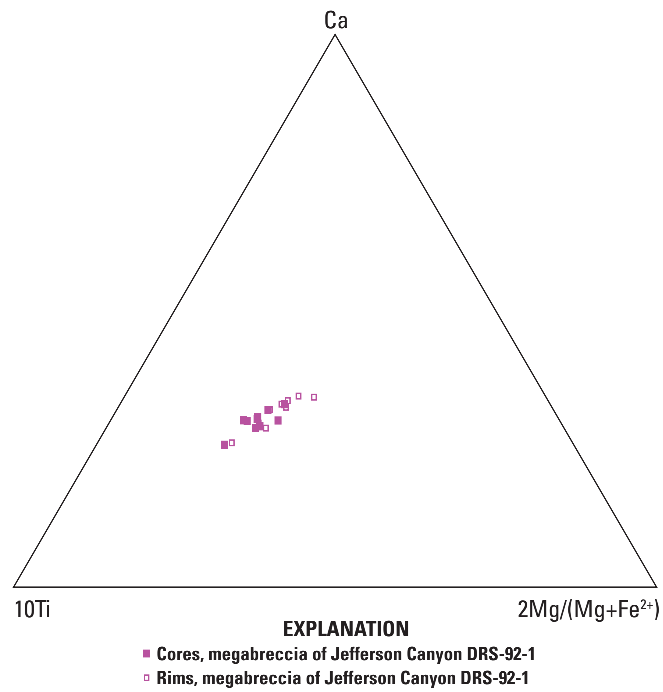


**Figure 4.** Ternary diagram of Ca–10Ti–2Mg/(Mg+$Fe^{2+}$) showing relative cation abundances in hornblende of one sample, southern Toquima Range, Nye County, Nevada. (Sample DRS-92-1; unit Tgs of Shawe, 1995)

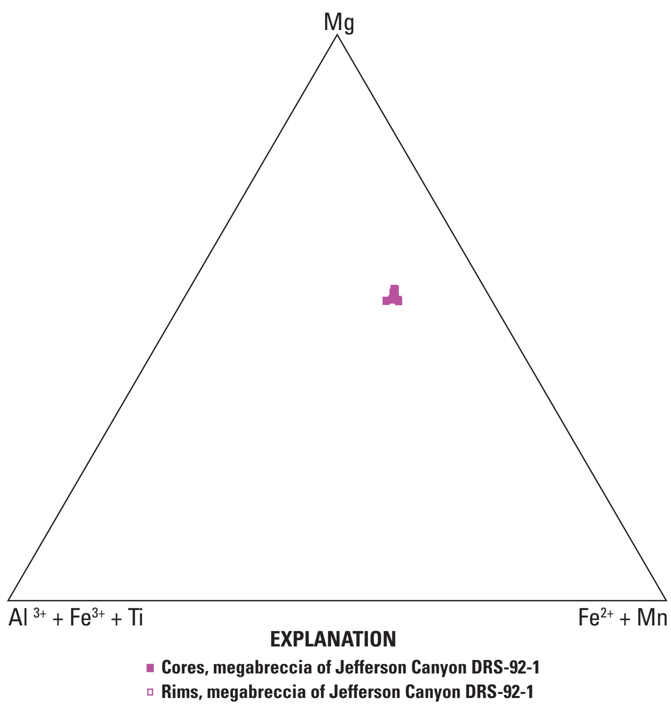


**Figure 3.** Ternary diagram of Mg–$Al^{3+}$+$Fe^{3+}$+Ti–$Fe^{2+}$+Mn showing relative cation abundances in biotite of one sample, southern Toquima Range, Nye County, Nevada (Sample DRS-92-1; unit Tgs of Shawe, 1995)

## Tuff of Corcoran Canyon (Unit Tcc)

Compositions of biotite were determined for two samples of the tuff of Corcoran Canyon (unit Tcc). Sample DRS-91-59 is from the lower member and sample DRS-91-89 is from the upper member. Biotite compositions form two well-defined clusters (fig. 7); biotite of DRS-91-89 is relatively enriched in Mg-$Fe^{2+}$+Mn, whereas biotite of DRS-91-59 is more enriched in $Al^{3+}$+$Fe^{3+}$+Ti. The upper member sample (DRS-91-89) seems to have crystallized from a more mafic magma than the sample from the lower member (DRS-91-59), which suggests that the earlier eruption may have come from the upper, more evolved part of a compositionally stratified magma reservoir, whereas the later eruption came from the lower, less evolved part.

Compositions of biotite phenocrysts in the tuff of Corcoran Canyon (Tcc) are similar to those in the tuffs of Mount Jefferson (Tmj), and of Ryecroft Canyon (Trc), although compositions of biotite phenocrysts in all three units suggest compositional variation within their source reservoirs. Inferred magma composition variation may indicate compositionally stratified magma reservoirs or periodic eruptions from differently evolved magmas, or both. Overall biotite compositional similarity among the three units suggests that they had similar petrogenetic histories.

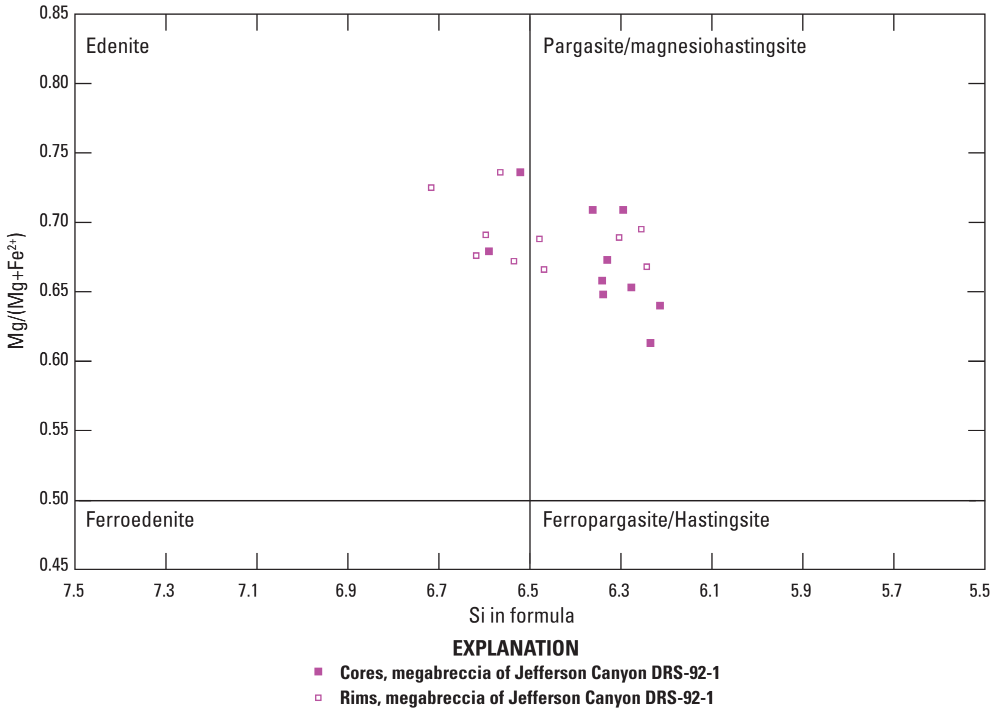


**Figure 5.** Diagram showing relative cation abundances of Si and Mg/(Mg+$Fe^{2+}$) in hornblende of one sample, southern Toquima Range, Nye County, Nevada. (Sample DRS-92-1; unit Tgs of Shawe, 1995)

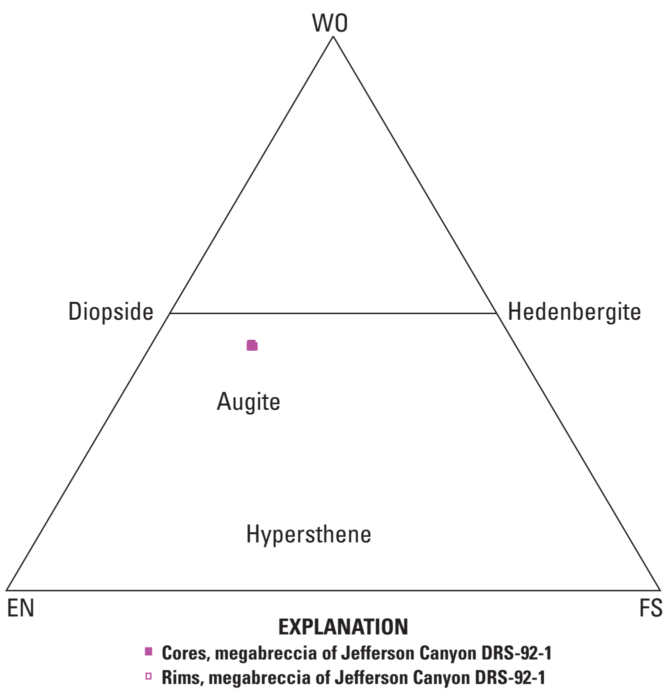


**Figure 6.** Ternary diagram showing proportions of wollastonite, enstatite, and ferrosilite in clinopyroxene of one sample, southern Toquima Range, Nye County, Nevada; EN, enstatite; FS, ferrosilite; WO, wollastonite. (Sample DRS-92-1; unit Tgc of Shawe, 1995)

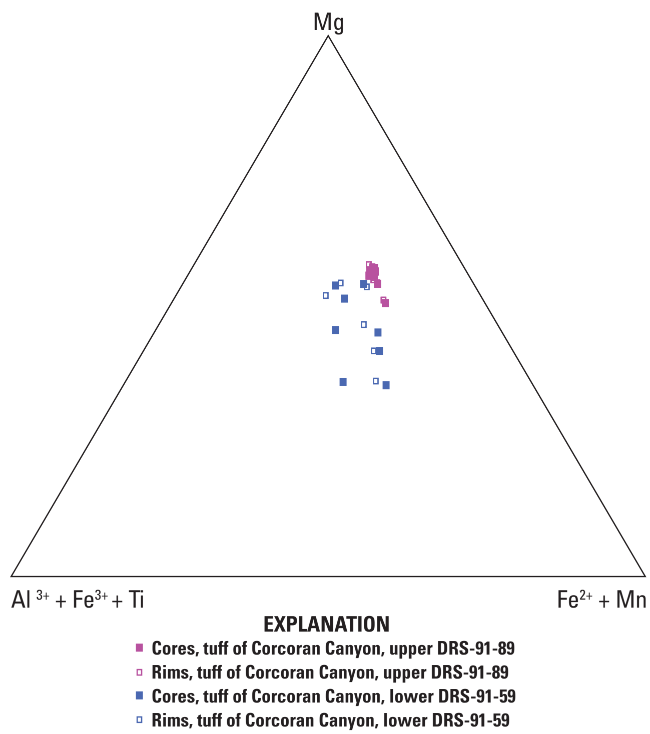


**Figure 7.** Ternary diagram of Mg–$Al^{3+}$+$Fe^{3+}$+Ti–$Fe^{2+}$+Mn showing relative cation abundances in biotite of two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-89 and DRS-91-59; unit Tcc of Shawe, Hardyman, and Byers, 2000)

No composition data were obtained for hornblende or pyroxene in the tuff of Corcoran Canyon (Tcc) because no unaltered phenocrysts could be identified. Similarly, no analyses of feldspar phenocrysts in samples DRS-91-59 and DRS-91-89 from the tuff of Corcoran Canyon were obtained.

## Tuff of Ryecroft Canyon (Unit Trc)

We determined compositions of biotite and amphibole in samples DRS-91-19, DRS-91-21, and DRS-91-24 of the tuff of Ryecroft Canyon (Trc). Sample DRS-91-19 was collected near the base of exposed tuff of Ryecroft Canyon; samples DRS-91-21 and DRS-91-24 came from relatively higher stratigraphic positions, possibly less than about 90 m higher; disparate compaction foliation attitudes (suggestive of fault disruption) in the sampled area precluded more accurate assessment of relative stratigraphic position.

Compositions of biotite in samples DRS-91-21 and DRS-91-24 (fig. 8) form nearly coincident well-defined trends, whereas those in sample DRS-91-19 (fig. 8) cluster near the $Fe^{2+}$+Mn-rich (hence more silicic) end of the DRS-91-21 and DRS-91-24 compositional arrays. Apparently, prior to eruption the source magma became compositionally stratified such that the initial eruption may have been from the upper part of a zoned reservoir and later eruption may have come from lower in the reservoir. Compositions of biotite in samples from the tuff of Ryecroft Canyon are also nearly coincident with those of biotite in the tuff of Mount Jefferson (Tmj), which suggests their possible cogenesis. However, compositions of biotite in the tuff of Ryecroft Canyon are less Fe-Mn rich and more Mg rich, which suggests that magma represented by the slightly younger tuff of Mount Jefferson was less evolved than magma represented by the tuff of Ryecroft Canyon.

Compositions of amphiboles (fig. 9) in samples DRS-91-19, DRS-91-21, and DRS-91-24 of the tuff of Ryecroft Canyon (Trc) form a linear trend that extends from a separate cluster of DRS-91-19 analyses with relatively Ca- to Mg-Fe–rich compositions (mostly edenite) to a broad cluster of DRS-91-21 and DRS-91-24 compositions (mostly pargasite/magnesiohastingsite, fig. 10) that are relatively enriched in Ti. These compositional variations suggest that sample DRS-91-19, from near the base of the Ryecroft Canyon, crystallized from a less evolved magma than did samples DRS-91-21 and DRS-91-24 from several hundred meters higher in the formation. The variations suggest eruption of discrete magma batches, either from a zoned magma reservoir or from distinct reservoirs having different compositions

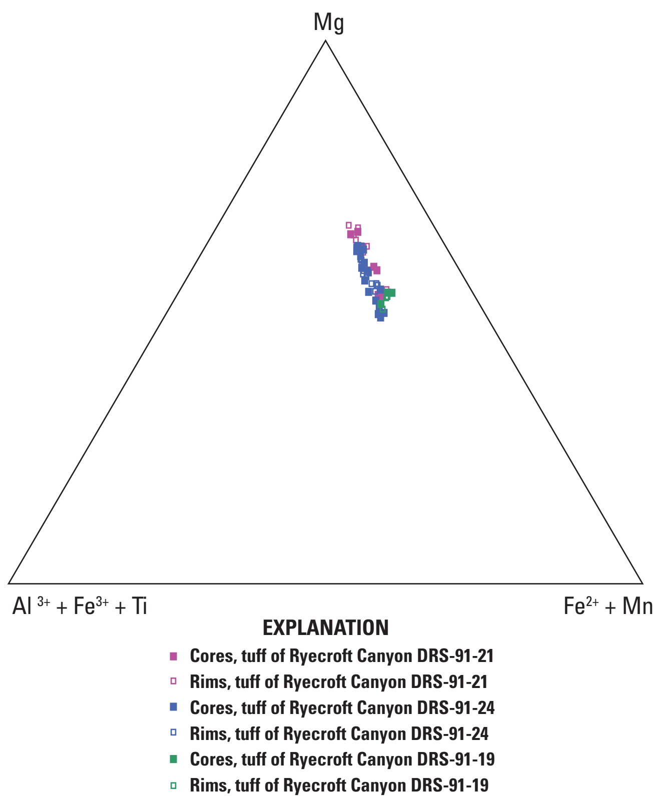


**Figure 8.** Ternary diagram of Mg–$Al^{3+}$+$Fe^{3+}$+Ti–$Fe^{2+}$+Mn showing relative cation abundances in biotite of three samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-21, DRS-91-24, and DRS-91-19; unit Trc of Shawe, Hardyman, and Byers, 2000)

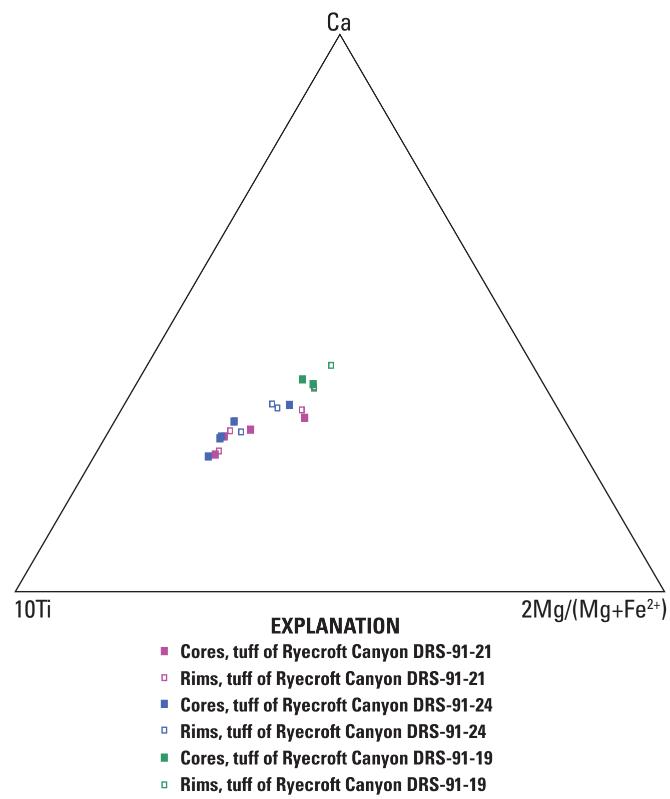


**Figure 9.** Ternary diagram of Ca–10Ti–2Mg/(Mg+$Fe^{2+}$) showing relative cation abundances in hornblende of three samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-21, DRS-91-24, and DRS-91-19; unit Trc of Shawe, 1999b)

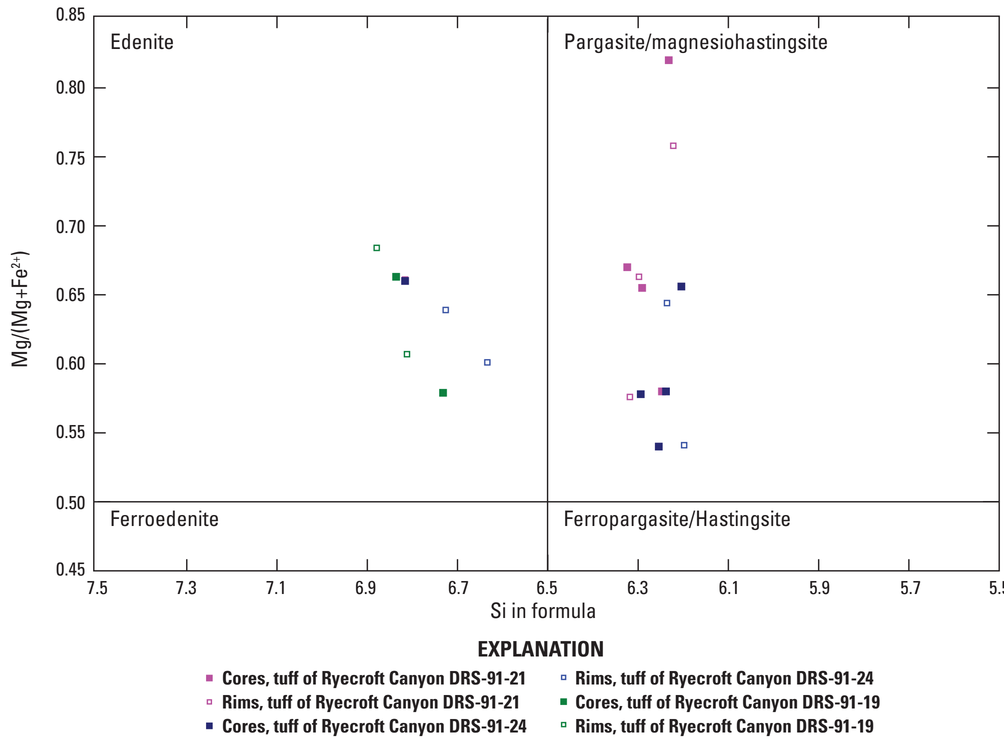


**Figure 10.** Diagram showing relative cation abundances of Si and $Mg/(Mg+Fe^{2+})$ in hornblende of three samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-21, DRS-91-24, and DRS-91-19; unit Trc of Shawe, 1999b)

We determined compositions of feldspar phenocrysts in samples DRS-91-21 and DRS-91-24 of the tuff of Ryecroft Canyon Trc (fig. 11). Sanidine compositions are similar in the two samples and are slightly enriched in albite in sample DRS-91-24 relative to sample DRS-91-21. Plagioclase compositions in the two samples are similar, except that some plagioclase in sample DRS-91-21 is enriched in CaO. Also, compositions of plagioclase in the tuff of Mount Jefferson (Tmj) (see later discussion of fig. 20) and tuff of Ryecroft Canyon (fig. 11) are indistinguishable, and sanidine compositions are similar, which suggests similar petrogenetic histories for magma represented by the two tuffs.

## Tuff of Mount Jefferson (Unit Tmj)

The tuff of Mount Jefferson (Tmj) provided the largest set of samples for which phenocryst compositions were determined, including samples from the unit we mapped as tuff of Mount Jefferson (3 samples analyzed) and the unit mapped by Boden (1986, 1992) as tuff of Trail Canyon (5 samples analyzed). Whole-rock chemistry and phenocryst index (PI) data for the tuff of Mount Jefferson (unit (Tmj) of Shawe, 1999b), do not vary systematically relative to stratigraphic position. Nonsystematic data of this sort are consistent with derivation of successive ash flow eruptions by nonsystematically tapping various levels within a vertically zoned magma reservoir, or by top-down eruption from a

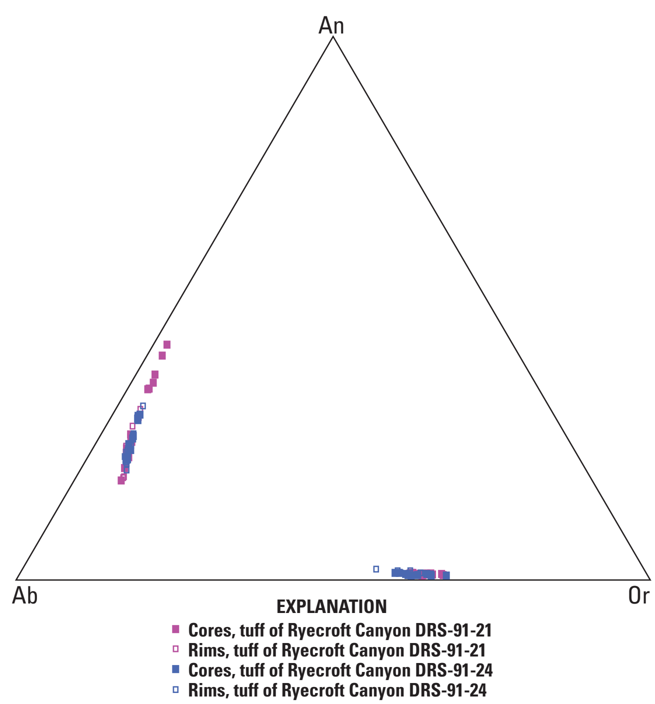


**Figure 11.** Ternary diagram showing molecular end-member proportions of albite, anorthite, and orthoclase feldspars in two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-21 and DRS-91-24; unit Trc of Shawe, 1999b; Ab, albite, An, anorthite; Or, orthoclase)

nonsystematically zoned reservoir. The eight analyzed samples from the tuff of Mount Jefferson were collected from the upper 700 m of the (intracaldera) principal member of the formation. Because this member is probably more than 2,000 m thick (Shawe, 1999b), these analyses depict only the latest intervals of its petrogenetic history.

Estimates of relative stratigraphic position suggest that samples (DRS-85-44, DRS-85-203, and DRS-85-204) collected on the west side of the Soldier Spring fault are likely from the middle part of the principal member. Samples (DRS-92-20, DRS-85-199, DRS-85-197, DRS-91-168, and DRS-91-169), collected on the east side of the Soldier Spring fault, are from the upper part of the principal member.

We determined the compositions of biotite in eight samples (fig. 12—DRS-85-44, DRS-85-203, DRS-85-204; fig. 13—DRS-92-20, DRS-85-199, DRS-85-197, and fig. 14—DRS-91-168, DRS-91-169). Biotite in the two lowest samples (DRS-85-44 and DRS-85-203, fig. 12) has compositions that cluster in a small field with somewhat more Mg than $Fe^{2+}$+Mn. Biotite from the stratigraphically next higher sample (DRS-85-204, fig. 12) has similar compositions, except that one analysis indicates slightly less Mg than $Fe^{2+}$+Mn. Samples apparently stratigraphically higher (fig. 13—DRS-92-20, DRS-85-199, and DRS-85-197; and fig. 14—DRS-91-168, and DRS-91-169) have compositions that define two fields, one similar to those of the lower three samples, and a second that indicates compositions with slightly less Mg than

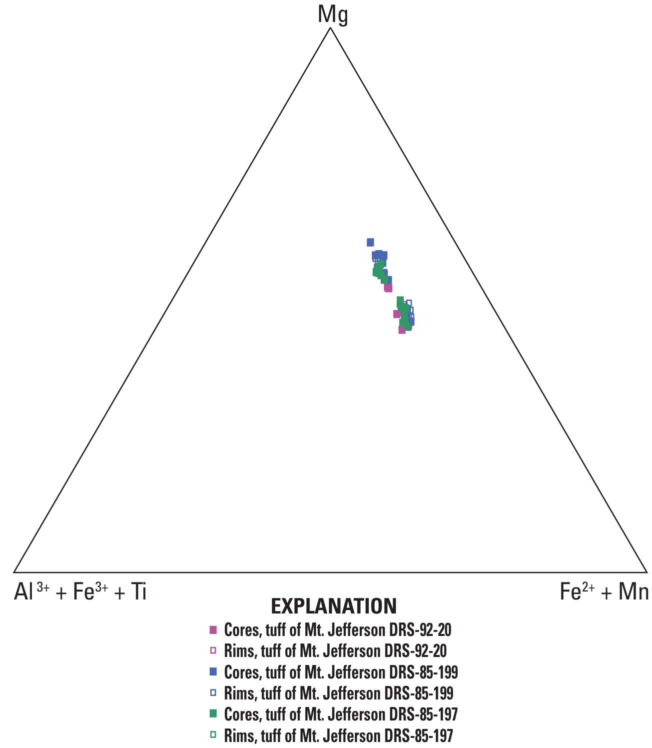


**Figure 13.** Ternary diagram of Mg–$Al^{3+}$+$Fe^{3+}$+Ti–$Fe^{2+}$+Mn showing relative cation abundances in biotite of three samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-92-20, DRS-85-199, and DRS-85-197; unit Tmj of Shawe, 1995)

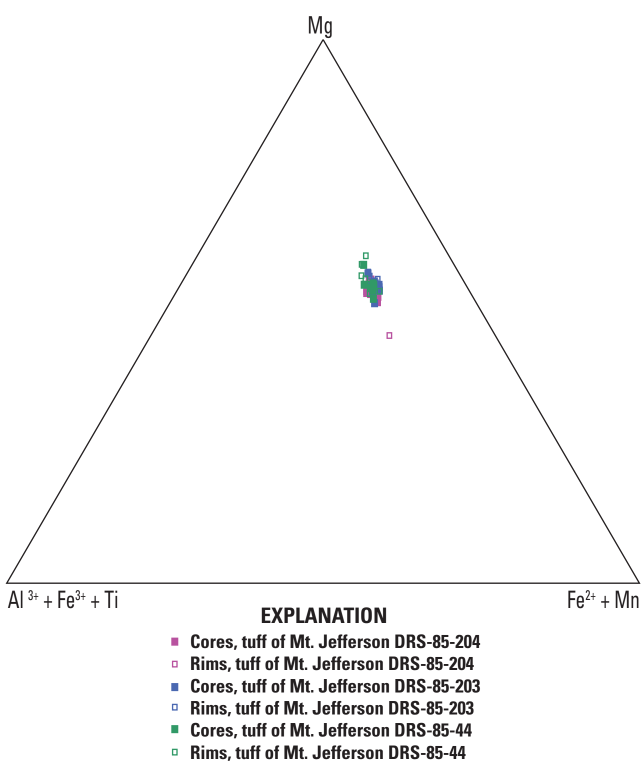


**Figure 12.** Ternary diagram of Mg–$Al^{3+}$+$Fe^{3+}$+Ti–$Fe^{2+}$+Mn showing relative cation abundances in biotite of three samples, southern Toquima Range, Nevada. (Samples DRS-85-204, DRS-85-203, and DRS-85-44; unit Tmi of Shawe, 1995)

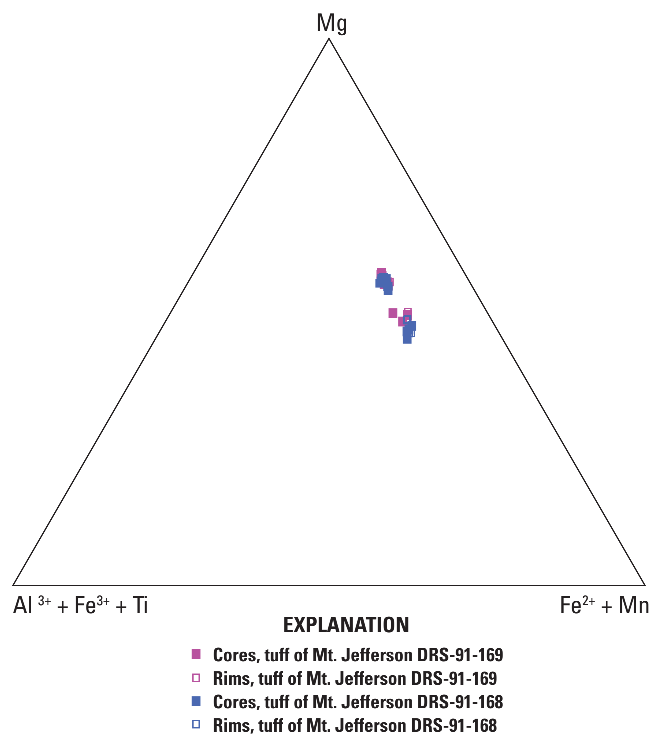


**Figure 14.** Ternary diagram of Mg–$Al^{3+}$+$Fe^{3+}$+Ti–$Fe^{2+}$+Mn showing relative cation abundances in biotite of two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-169 and DRS-91-168; unit Tmj of Shawe, 1995)

$Fe^{2+}$+Mn. The biotite data for all eight samples suggest that initial eruptions were derived from a layer relatively enriched in Mg- in a normally zoned two-layer reservoir and a higher, more evolved, layer relatively enriched in Fe; subsequent eruptions may represent a mixture of both layers.

Compositions of amphibole phenocrysts in seven samples of the principal member of the tuff of Mount Jefferson (Tmj) define two trends (fig. 15—DRS-85-44, DRS-85-203, DRS-85-204, DRS-92-20, DRS-85-199, DRS-85-197, and DRS-91-169). Two samples, DRS-85-199 and DRS-85-197 (fig. 16) from near the top of the formation, characterize the two trends most distinctly. Compositions of amphibole phenocrysts in sample DRS-92-20 (figs. 16, 17) are coincident with only the more Ca-rich of the two trends. The two compositional groups most diagnostic of the tuff of Mount Jefferson (the majority of analyses, fig. 15) suggest that successive eruptions tapped both layers of a compositionally zoned, two-layer magma reservoir. Linear trends define subparallel arrays of amphibole composition—each trend is likely related to a particular layer in a two-layer magma reservoir—which suggest successive amphibole crystallization from either Ca- and Mg-rich magma, or crystallization from more fractionated, Ti-rich (more evolved) magma. Compositions of these amphiboles vary widely within

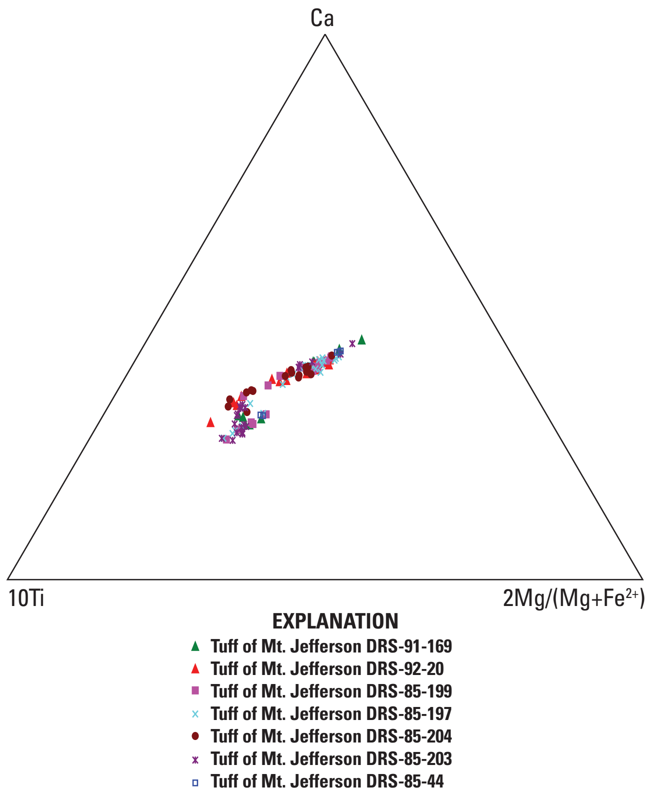


**Figure 15.** Ternary diagram of Ca–10Ti–2Mg/(Mg+$Fe^{2+}$) showing relative cation abundances in hornblende of seven samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-169, DRS-92-20, DRS-85-199, DRS-85-197, DRS-85-204, DRS-85-203, and DRS-85-44; unit Tmj of Shawe, 1995)

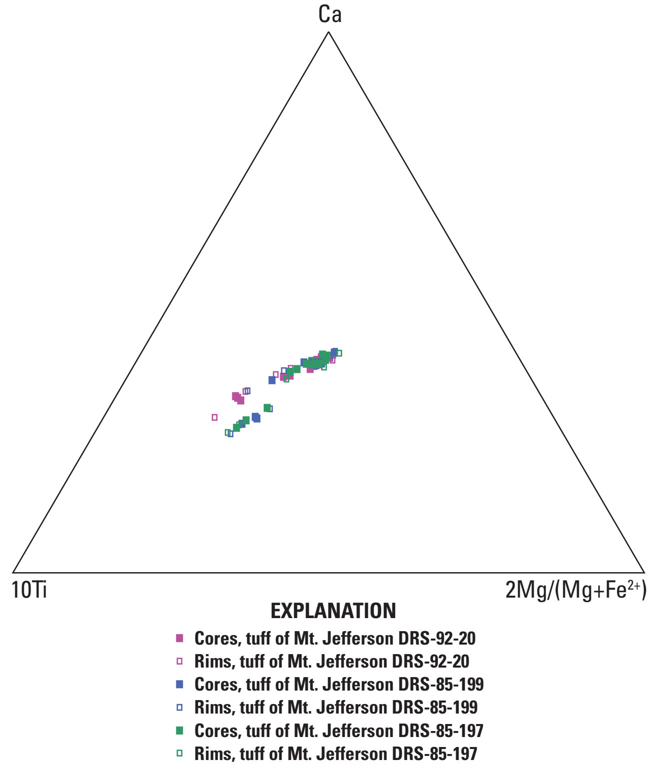


**Figure 16.** Ternary diagram of Ca–10Ti–2Mg/(Mg+$Fe^{2+}$) showing relative cation abundances in hornblende of three samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-92-20, DRS-85-199, and DRS-85-197; unit Tmj of Shawe, 1995)

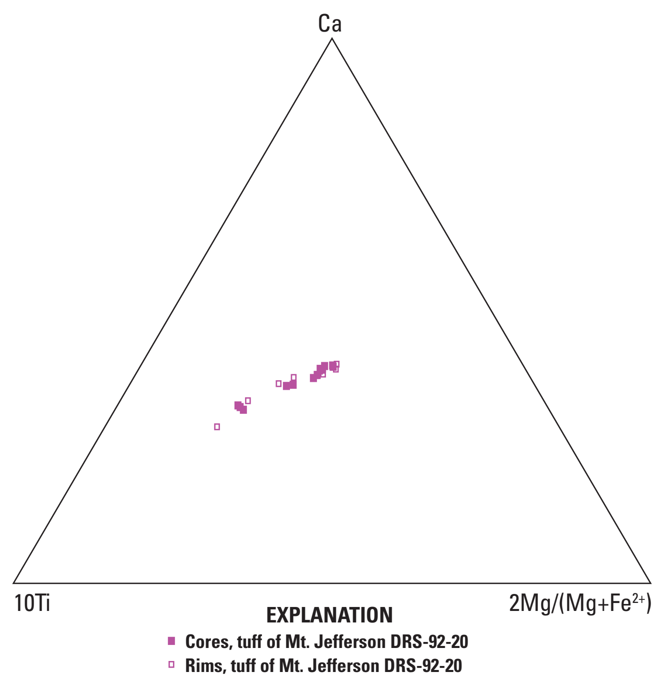


**Figure 17.** Ternary diagram of Ca–10Ti–2Mg/(Mg+$Fe^{2+}$) showing relative cation abundances in hornblende of one sample, southern Toquima Range, Nevada. (Sample DRS-92-20; unit Tmj of Shawe, 1995)

the edenite and pargasite/magnesiohastingsite fields (fig. 18). The well-defined compositional trend of amphibole from sample DRS-92-20 (fig. 18) suggests progressive top-down eruption from a vertically zoned magma reservoir (more evolved compositions near its top and less evolved compositions at depth); the lack of amphibole compositional discontinuities suggests eruption from a single, continuously zoned reservoir. Compositions of amphibole in other samples appear to indicate mixing of lower and upper magma composition layers during eruption of the associated magmas.

Pyroxene compositions (fig. 19) in six analyzed samples of tuff of Mount Jefferson (Tmj) (DRS-85-44, DRS-85-203, DRS-92-20, DRS-85-199, DRS-85-197, and DRS-91-169) define a restricted composition range in the augite field. Inasmuch as compositions of biotite and amphibole suggest crystallization from a zoned magma reservoir, the single augite composition field suggests that augite likely crystallized early in only one (presumably the lower, less fractionated) zone of a two-layer magma reservoir.

We determined compositions of feldspar phenocrysts in two samples of the tuff of Mount Jefferson (Tmj) (fig. 20). One sample, DRS-85-44, was collected approximately 700 m below the top of the tuff, whereas the other sample, DRS-91-168, was collected about 100 m below its top. Although the composition fields of feldspars from the two samples overlap, sanidine in sample DRS-91-168 is potassium rich relative to sanidine in sample DRS-85-44, and the plagioclase feldspar in sample DRS-91-168 is relatively enriched in albite, whereas sample DRS-85-44 plagioclase is relatively enriched in anorthite.

## Isom-Type Ash-Flow Tuff (Unit Ti)

We determined compositions of phenocrysts in three samples of Isom-type tuffs (Ti); however, compositions of biotite were not determined in any of these samples. Analyses of amphiboles in samples DRS-84-34 and DRS-87-52 (fig. 21) indicate compositional trends strikingly similar to those of the tuff of Mount Jefferson (Tmj) (generally two subparallel trends, as in fig. 12). The two trends suggest derivation from a magma reservoir with two compositional layers. Like amphiboles in the tuff of Mount Jefferson, amphiboles in the Isom-type tuff cluster near the boundary of the edenite and the pargasite/magnesiohastingsite composition fields (fig. 22).

Samples DRS-87-52, DRS-87-59, and DRS-84-34 all contain hypersthene but only DRS-84-34 also contains augite (fig. 23). Sample DRS-87-52 was collected from the upper part of the formation. The stratigraphic positions of sample DRS-87-59 and DRS-84-34, as deduced from sample locations on the geologic map, are from the upper and lower parts, respectively. Compositions of hypersthene in samples DRS-87-52 and DRS-87-59 (from the upper part of the formation) are similar, whereas hypersthene compositions in sample DRS-84-34 are more enriched in enstatite (more mafic)

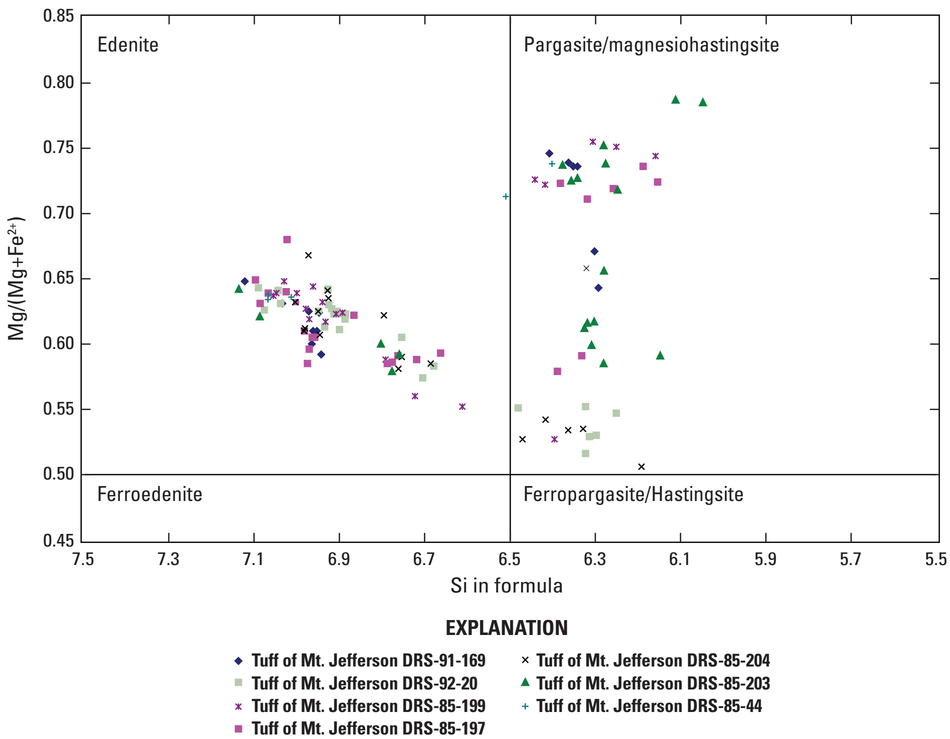


**Figure 18.** Diagram showing relative cation abundances of Si and Mg/(Mg+$Fe^{2+}$) in hornblende of seven samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-169, DRS-92-20, DRS-85-199, DRS-85-197, DRS-85-204, DRS-85-203, and DRS-85-44; unit Tmj of Shawe, 1995)

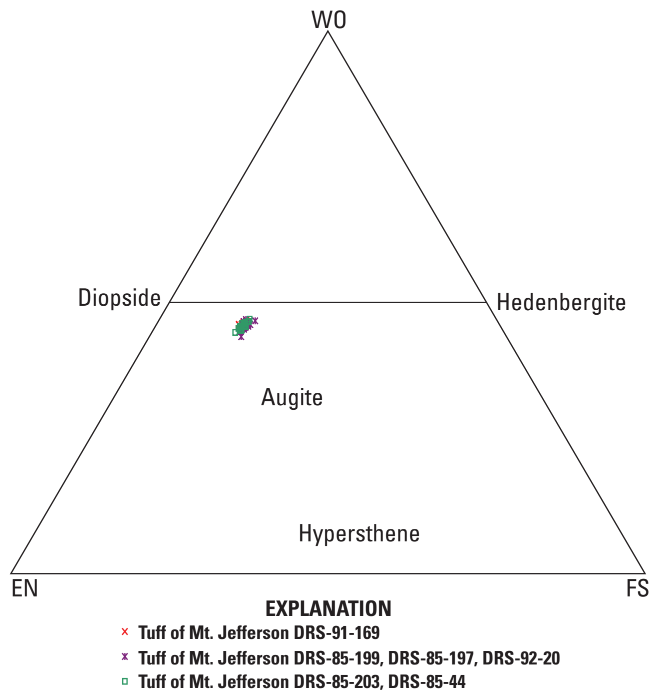


**Figure 19.** Ternary diagram showing proportions of wollastonite, enstatite, and ferrosilite clinopyroxene in six samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-169, DRS-85-199, DRS-85-197, DRS-92-20, DRS-85-203, and DRS-85-44; unit Tmj of Shawe, 1995; WO, wollastonite; EN, enstatite; FS, ferrosilite)

than are the other two samples. The presence of abundant hypersthene in the Isom-type ash-flow tuff (Ti) and ferrosilite-molecule-enriched augite preclude an affinity with the tuff of Mount Jefferson (Tmj).

Plagioclase feldspar in sample DRS-87-52 is relatively enriched in anorthite, whereas that in sample DRS-84-34 is enriched in albite (fig. 24), which suggests that the tuff was erupted top down from a normally zoned reservoir. Sanidine phenocrysts in Isom-type tuff samples have generally overlapping, indistinguishable compositions.

Most compositions of phenocrysts in Isom-type tuff samples are dissimilar to those in the volcanic rocks erupted from the southern Toquima Range, which confirms derivation of Isom-type ash-flow tuffs from outside the area.

## Bates Mountain Tuff (Part of Unit Ty)

Three ash-flow tuff units grouped in the unit designated on plate 1 as unit Ty are the Bates Mountain Tuff, the tuff of Clipper Gap, and the tuff of Pipe Organ Spring, all younger than the Isom-type ash-flow tuff (see earlier section, Bates Mountain Tuff, Tuff of Clipper Gap, and Tuff of Pipe Organ Spring, that describes these units). We determined compositions of phenocrysts in three samples (DRS-91-3, DRS-91-6, and DRS-91-25) of the Bates Mountain Tuff, the oldest of these three tuffs. Relative stratigraphic positions of these samples are uncertain, so constraining the petrogenetic history of the Bates

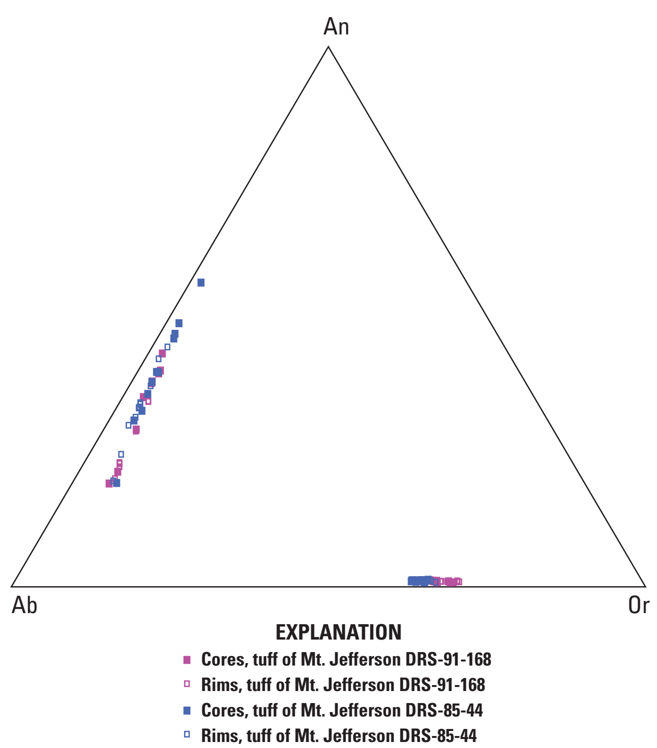


**Figure 20.** Ternary diagram showing molecular end-member proportions of albite, anorthite, and orthoclase feldspars in two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-168, and DRS-85-44; unit Tmj of Shawe, 1995; Ab, albite; An, anorthite; Or, orthoclase)

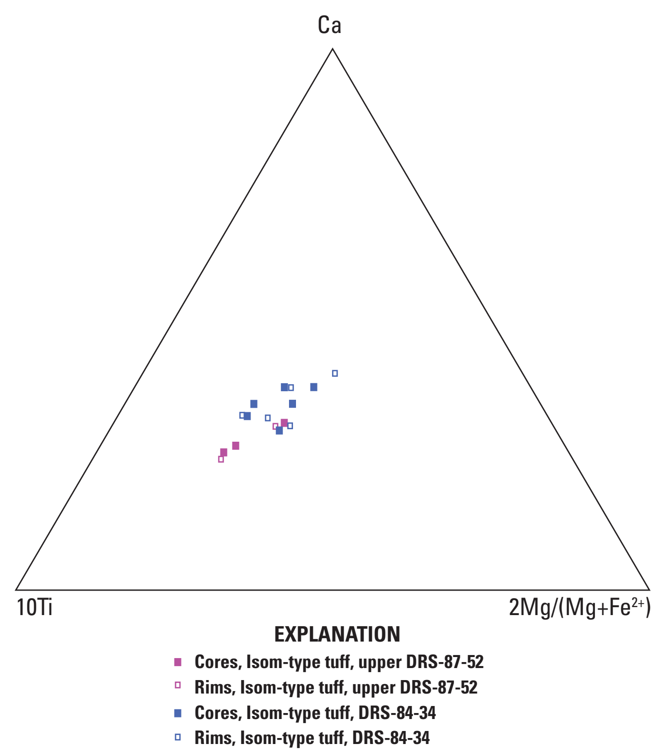


**Figure 21.** Ternary diagram of Ca–10Ti–2Mg/(Mg+$Fe^{2+}$) showing relative cation abundances in hornblende of two samples southern Toquima Range, Nye County, Nevada. (Samples DRS-87-52 and DRS-84-34; unit Ti of Shawe, 1999b)

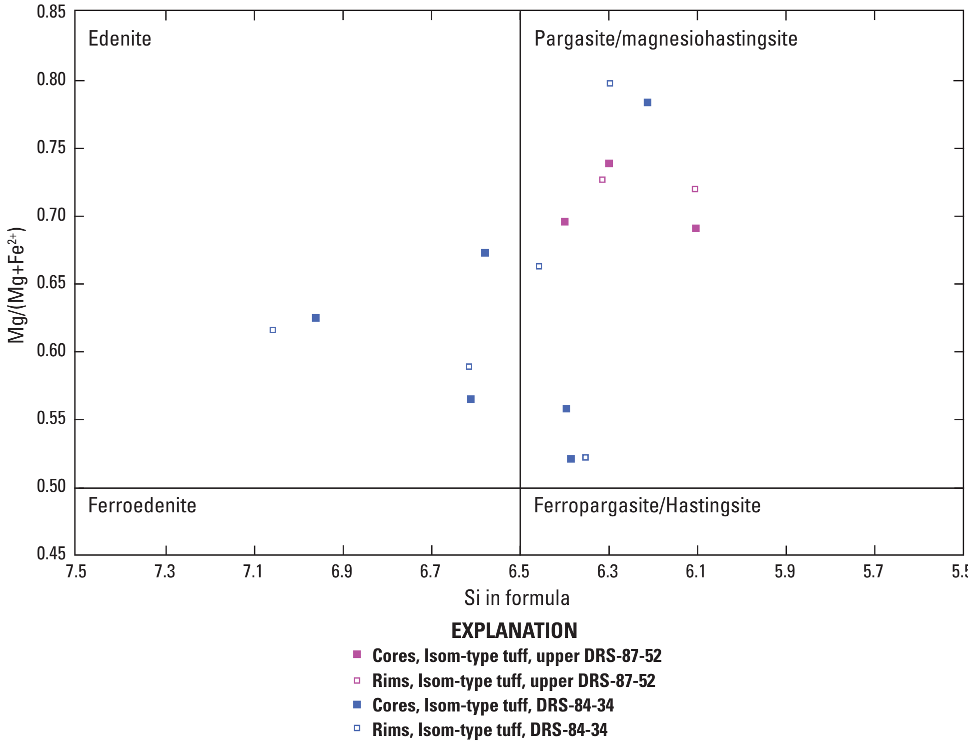


**Figure 22.** Diagram showing relative cation abundances of Si and Mg/(Mg+$Fe^{2+}$) in hornblende of two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-87-52 and DRS-84-34; unit Ti of Shawe, 1999b)

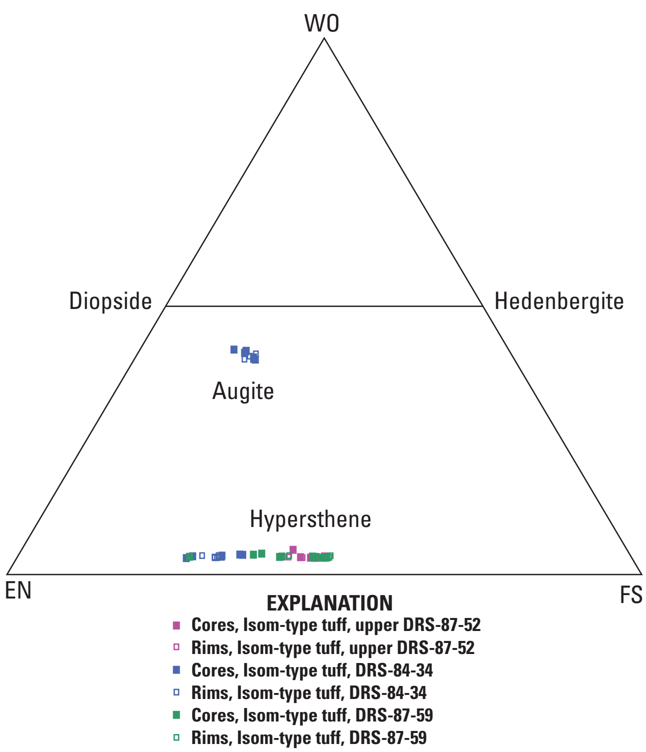


**Figure 23.** Ternary diagram showing proportions of wollastonite, enstatite, and ferrosilite in pyroxenes in three samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-87-52, DRS-84-34, and DRS-87-59, unit Ti of Shawe, 1999b; WO, wollastonite; EN, enstatite; FS, ferrosilite)

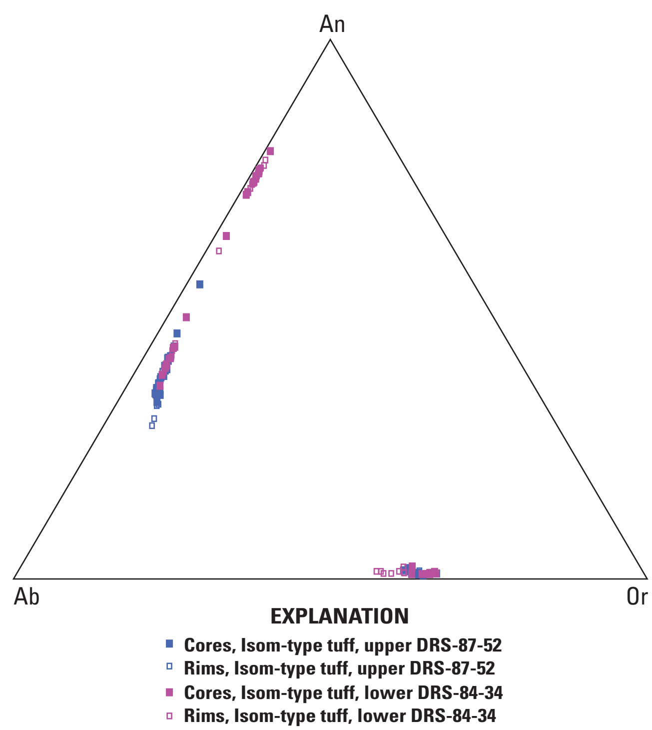


**Figure 24.** Ternary diagram showing molecular end-member proportions of albite, anorthite, and orthoclase feldspars in two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-87-52 and DRS-87-34; unit Ti of Shawe,1999b; Ab, albite; An, anorthite; Or, orthoclase)

Mountain Tuff is not possible. Establishing the petrogenesis of the Bates Mountain is further stymied because the map area includes at least three eruptive units of unknown relative stratigraphic position. Nevertheless, amphibole and feldspar composition variations indicate that their source magmas had distinct compositions. The composition of amphibole in sample DRS-91-3 (fig. 25) has slightly elevated abundances of Ca and values for 2Mg/(Mg+$Fe^{2+}$) relative to Ti abundances as compared with amphibole from sample DRS-91-6 (fig. 25). Amphibole in sample DRS-91-3 is ferroedenite, whereas that in sample DRS-91-6 is pargasite/magnesiohastingsite (fig. 26). Plagioclase in sample DRS-91-3 contains approximately equal amounts of anorthite and albite components (fig. 27), whereas that in sample DRS-91-25 contains a distinctly greater albite component, which suggests a distinctly more evolved source magma. Likewise, sanidine in sample DRS-91-25 is distinctly enriched in the orthoclase component, also indicative of slightly more evolved source magma. Consequently, magma represented by sample DRS-91-3 was less evolved than that of either sample DRS-91-6 or sample DRS-91-25.

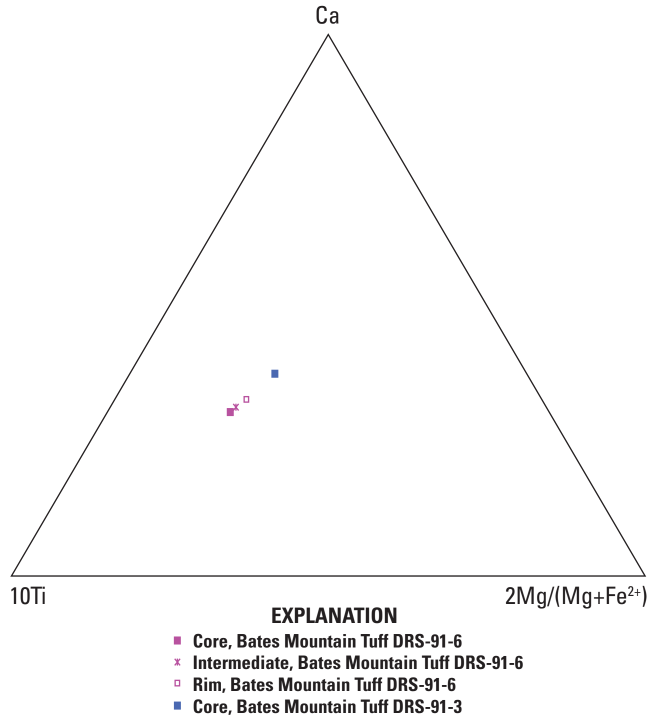


**Figure 25.** Ternary diagram of Ca–10Ti–2Mg/(Mg+$Fe^{2+}$) showing relative cation abundances in hornblende of two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-6 and DRS-91-3; unit Ty of Shawe, 1999b)

# Petrogenesis of the Tuff of Mount Jefferson (Unit Tmj), and Its Possible Relation to Other Tuffs

A transitional zone a few hundred meters thick, near the top of the principal member of the tuff of Mount Jefferson (Tmj) and just below overlying volcaniclastic rocks of Little Table Mountain (Tlt), contains several features that help characterize the late evolution of the source magma reservoir. The zone is exposed on the southwest side of Corcoran Canyon about 2 km east of the summit of Little Table Mountain (Shawe, Hardyman, and Byers, 2000) (fig. 1). A dark-gray crystal-poor vitrophyre crops out between underlying crystal-poor welded ash-flow tuff and overlying crystal-rich welded ash-flow tuff; this tuff grades upward through interlayered tuff, tuff breccia, and sandstone-conglomerate into sandstone and siltstone at the base of volcaniclastic rocks of Little Table Mountain (Tlt). A $^{40}Ar/^{39}Ar$ date on a sample of the dark-gray vitrophyric layer is 26.80±0.03 Ma (sample R9, Shawe, Hardyman, and Byers, 2000; sample DRS-91-98, Tmj, this report), and a $^{40}Ar/^{39}Ar$ date on a sample of ash-flow tuff collected about 50 m higher in the section is 26.70±0.03 Ma (sample DRS-91-169, Tmj, pl. 1; also, sample R8, Shawe, Hardyman, and Byers, 2000; sample DRS-91-171, Tmj, this report). As indicated by Shawe, Hardyman, and Byers (2000), tuff immediately underlying the vitrophyre has a PI of 3, the vitrophyre a PI of 4, and immediately overlying tuff a PI of 1. Higher tuff layers have PIs of 3, 4, and 5, but the geologic context of these samples is such that stratigraphic positions are uncertain. The sample of the tuff underlying the vitrophyre (DRS-91-168), and a sample of the vitrophyre (DRS-91-169), collected about 15 m apart stratigraphically, have similar PIs (3 and 4, respectively) and have virtually indistinguishable biotite compositions (fig. 12), but each sample includes two distinct biotite composition fields that vary slightly in relative MgO and $Fe^{2+}$+MnO ratios. Analyses of hornblende phenocrysts in sample DRS-91-169 (fig. 13, no data for DRS-91-168) also define two distinct compositional fields characterized by significantly different MgO/$Fe^{2+}$+MnO ratios. Analyses of pyroxene phenocrysts in samples of the tuff of Mount Jefferson (Tmj) indicate its crystallization only in the lower, less evolved layer of a zoned magma reservoir (fig. 19).

- 26.70±0.03 Ma ($^{40}Ar/^{39}Ar$ on ash-flow tuff; this report)
- 26.80±0.03 Ma ($^{40}Ar/^{39}Ar$ on dark-gray vitrophyric layer; this report)

Boden (1989) used compositions of glass (fiamme) and biotite to suggest that the ash-flow tuff units erupted from his Toquima caldera complex reflect eruption from a compositionally zoned magma reservoir. Our results corroborate Boden's (1989) conclusion. However, we conclude that the compositional similarity of phenocrysts in the tuff of Mount Jefferson and in Boden's tuff of Trail Canyon (Boden, 1986, 1992) indicates that the two are parts of a single ash-flow tuff (tuff of Mount Jefferson (Tmj)), as is consistent with $^{40}Ar/^{39}Ar$ age dates and petrographic data.

Compositions of biotite, hornblende, and clinopyroxene in a sample (DRS-92-1) of vitrophyre from the megabreccia of Jefferson Canyon (Tjc) are distinct relative to those from samples of the tuff of Mount Jefferson (see appendixes 3, 6,

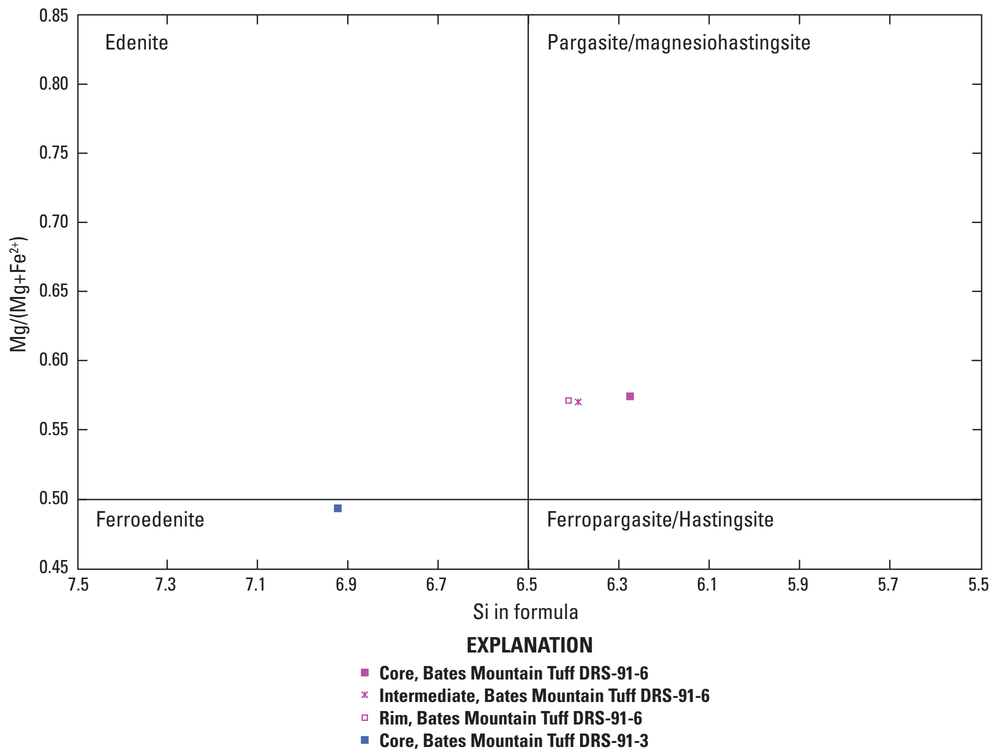


**Figure 26.** Diagram showing relative cation abundances of Si and Mg/(Mg + $Fe^{2+}$) in hornblende of two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-6 and DRS-91-3; unit Ty of Shawe, 1999b)

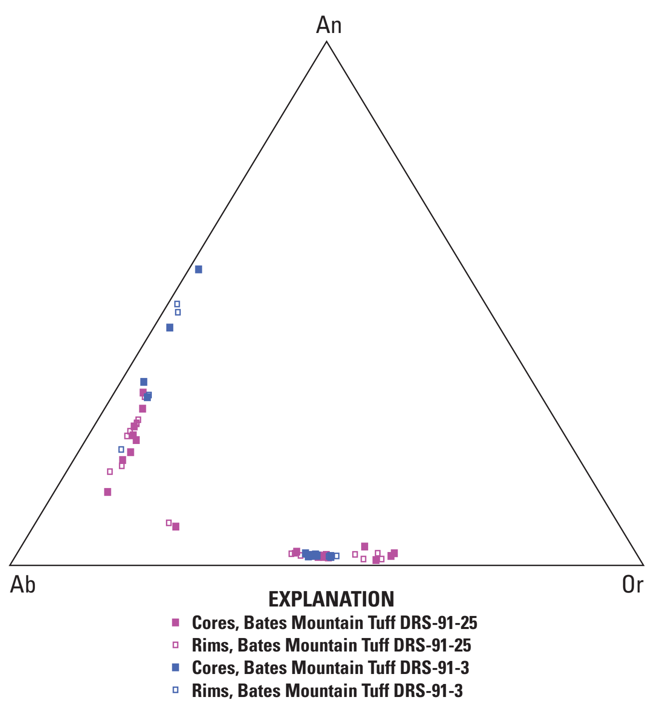


**Figure 27.** Ternary diagram showing molecular end-member proportions of albite, anorthite, and orthoclase in feldspars in two samples, southern Toquima Range, Nye County, Nevada. (Samples DRS-91-25 and DRS-91-3; unit Ty of Shawe, 1999b; Ab, albite; An, anorthite; Or, orthoclase)

and 8 and figs. 3, 12–17, and 19). The distinction suggests that the megabreccia is not related to the volcanic rocks of the Mount Jefferson caldera, as Shawe (1995) previously suggested. Provided that the vitrophyre is not a clast in the megabreccia of Jefferson Canyon, the distinction makes more probable the conclusions of Boden (1986, 1992), Henry and others (1996), and Henry (1997) and, supported by age data, that the megabreccia is related to a caldera now largely buried beneath the alluvium of Big Smoky Valley.

# Interpretative Summary of Phenocryst Compositions

Compositions of biotite, amphibole, and augite in parts of both the tuffs of Corcoran Canyon and Ryecroft Canyon are remarkably similar to those in parts of the tuff of Mount Jefferson. In samples of these tuffs for which compositions of augite and feldspars were also determined, compositions of these phenocrysts are particularly similar as well. Phenocryst composition similarities among the tuffs of Corcoran Canyon, Ryecroft Canyon, and Mount Jefferson suggest a common origin and petrogenesis of the magmas that produced these welded ash-flow tuffs. The apparent age span of the petrogenetically related calderas that produced ash-flow tuffs extends from about 27.17 to 26.61 Ma. Consequently, development of this segment of the southern Toquima caldera complex transpired during about 560,000 years.

Compositions of phenocrysts from the younger Isom-type and Bates Mountain Tuff indicate that the petrogenesis of these units is unrelated to that of the tuffs that had sources within our map area; consequently they are derived from sources external to the Toquima Range.

## The Southern Toquima Range Caldera Complex, a Summary

Nine calderas characterize the southern Toquima Range as a major center of volcanic activity during the late Eocene, Oligocene, and earliest Miocene (about 34–24 million years ago; see plate 1, list of map units). In succession (oldest to youngest) these are the inferred Dry Canyon, the Northumberland, the poorly defined Corcoran Canyon, the Big Ten Peak, the inferred Ryecroft Canyon, the Moores Creek, the Mount Jefferson, the Round Mountain (which is mostly covered by alluvium in the Big Smoky Valley), and the Manhattan calderas. The ash-flow tuffs erupted from these calderas are calc-alkalic trachydacites to rhyolites. Plugs and dikes are associated with all of the calderas, have compositions similar to those of the associated tuffs, and were emplaced along or near caldera margins. Eruptive megabreccias at or near caldera margins, or forming outflow or interlayered units, characterize several of the calderas. Collapse megabreccias are probable components of some of the calderas and may be associated with eruptive megabreccia deposits.

Regional northwest-southeast-striking faults likely controlled development of some of the calderas; the southwest structural margins of the Manhattan, Mount Jefferson, and Big Ten Peak calderas seem to have been particularly influenced by these faults.

Tertiary igneous activity prior to development of the southern Toquima Range caldera complex included late Eocene (about 36 million years ago) emplacement of a few plugs and many dikes composed of granodiorite and andesite to rhyolite. Volcanic rocks in the area derived from outside sources and having ages similar to those of the younger caldera rocks were emplaced during the Oligocene (about 26–25 million years ago).

## Acknowledgments

Greg Meeker of the U.S. Geological Survey provided valuable suggestions to Byers on operation of the microprobe and results of the microprobe analyses. Shawe acknowledges the U.S. Geological Survey Pecora Fellowship and Bradley Scholarship programs for its support. Similarly, U.S. Geological Survey Mineral Resources Program support for work in the Toquima Range has been critical to the success of these activities. Constructive reviews by R.D. Taylor and Harald Drewes helped clarify our presentation and are much appreciated.

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# Appendixes

## Appendix 1. $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.

[Ninety-nine-percent-pure mineral separates were prepared from rock samples collected throughout the Toquima Mountains, Nevada. Mineral separates were packaged in aluminum foil and stacked in quartz glass vials with monitor minerals placed between every second sample and at the top and bottom of each vial. Samples were irradiated in the U.S. Geological Survey's TRIGA reactor in Denver, Colo., in irradiation packages DD54, DD57, and DD58.

Irradiated samples were heated in temperature steps in a double-vacuum furnace, and the released gasses were cleaned according to procedures described in Snee (2002). Argon isotopic total abundances ($^{40}ArT$, $^{39}ArT$, $^{38}ArT$, $^{37}ArT$, and $^{36}ArT$) were measured on a MAP 215 mass spectrometer on a Faraday collector in volts to five decimal places. The corrected abundances for $^{40}Ar_R$ (radiogenic $^{40}Ar$), $^{40}Ar_K$ (irradiation-produced K-derived $^{40}Ar$), $^{40}Ar_I$ (initial $^{40}Ar$), $^{39}Ar_K$ (irradiation-produced K-derived $^{39}Ar$), $^{38}Ar_{Cl}$ (irradiation-produced Cl-derived $^{38}Ar$), $^{37}Ar_{Ca}$ (irradiation produced Ca-derived $^{37}Ar$, and $^{36}Ar_I$ (initial $^{36}Ar$) are shown in volts. All errors on measured voltages are cited at 1 sigma. Voltages may be converted to moles using $1.160\times10^{-12}$ moles argon per volt signal. The "F" value ($^{40}Ar_R/^{39}Ar_K$) for each temperature step is directly calculated from $^{40}Ar_R$ divided by $^{39}Ar_K$ as shown in the table. K/Ca is calculated from the expression $K/Ca=0.5(^{39}Ar_K/^{37}Ar_{Ca})$.

All isotopic abundances have been corrected for mass discrimination. Mass discrimination was determined by calculating the $^{40}Ar/^{36}Ar$ ratio of aliquots of atmospheric argon pipetted from a fixed pipette on the extraction line; the ratio during this experiment was 298.9, which was corrected to 295.5 to account for mass discrimination. Final isotopic abundances were corrected for all interfering isotopes of argon including atmospheric argon.

$^{37}Ar$ and $^{39}Ar$, which are produced during irradiation, are radioactive and their abundances were corrected for radioactive decay. Abundances of interfering isotopes from K and Ca were calculated from reactor production ratios determined by irradiating and analyzing pure $CaF_2$ and $K_2SO_4$; the $K_2SO_4$ was degassed in a vacuum furnace prior to irradiation to release extraneous argon.

Corrections for Cl-derived $^{36}Ar$ were determined using the method of Roddick (1983). Production ratios for this experiment are available in Snee (2002). Apparent ages of each fraction include the error in J value (0.1 percent), which was calculated from the reproducibility of splits of the argon from several standards. The standards for this experiment were hornblende MMhb-1 (Samson and Alexander, 1987), and K-Ar age of +523.1+2.6 Ma (age reevaluated by Renne and others, 1998) and sanidine FCT1 with a measured age of 28.03 Ma in the Denver Argon Laboratory against MMhb-1 (Snee, 2002). Apparent ages were calculated using decay constants of Steiger and Jäger (1977). All apparent age errors are cited at 1 sigma. Uncertainties in the calculations for apparent age of individual fractions were calculated using equations of Dalrymple and others (1981).

Isochron diagrams were produced for all samples and may be derived by using $^{40}Ar_I$ (initial $^{40}Ar$) and $^{36}Ar_I$ (initial $^{36}Ar$) listed in the table. Fractions included in plateau or preferred dates (weighted-mean date) are shown in bold type. Plateaus were determined according to the method of Fleck and others (1977)]

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample:** | **RH-TP-571/2/DD57** | | **BIOTITE** | | **Wt.=57.8 mg** | | | | | | | | | | | | | |
| 850 | 0.58866 | 0.0004 | 0.10444 | 0.00065 | 0.58801 | 0.06932 | 0.00001 | 0.00165 | 0.00459 | 0.00164 | 0.00001 | 0.00164 | 1.51 | 7.5512 | 17.74 | 0.9 | 18.7 | ± 0.45 |
| 950 | 0.22946 | 0.00038 | 0.08497 | 0.00046 | 0.229 | 0.04963 | 0.00001 | 0.00164 | 0.0013 | 0.00049 | 0.00002 | 0.00049 | 1.71 | 19.08846 | 37.03 | 0.6 | 21.3 | ± 1.28 |
| 1050 | 1.07708 | 0.00144 | 0.41545 | 0.00168 | 1.0754 | 0.17979 | 0.00019 | 0.00927 | 0.00295 | 0.00224 | 0.00001 | 0.00223 | 2.31 | 30.47288 | 38.57 | 2.3 | 28.7 | ± 0.09 |
| 1150 | 1.44123 | 0.00157 | 1.23946 | 0.00511 | 1.43612 | 0.5463 | 0.00033 | 0.026 | 0.00448 | 0.00067 | 0 | 0.00067 | 2.27 | 60.97098 | 86 | 7 | 28.1 | ± 0.04 |
| 1200 | 0.91245 | 0.00076 | 0.82847 | 0.00348 | 0.90897 | 0.37214 | 0.00038 | 0.01691 | 0.00291 | 0.00028 | 0 | 0.00027 | 2.23 | 63.94158 | 90.8 | 4.8 | 27.6 | ± 0.04 |
| 1250 | 1.13435 | 0.0005 | 1.03318 | 0.0044 | 1.12995 | 0.47085 | 0.00031 | 0.02119 | 0.0045 | 0.00033 | 0.00001 | 0.00033 | 2.19 | 52.31667 | 91.08 | 6.1 | 27.2 | ± 0.06 |
| 1300 | 1.79955 | 0.00168 | 1.66593 | 0.00706 | 1.79249 | 0.75552 | 0.00082 | 0.03387 | 0.0044 | 0.00044 | 0.00002 | 0.00043 | 2.21 | 85.85455 | 92.57 | 9.7 | 27.4 | ± 0.1 |
| 1350 | 4.09434 | 0.00345 | **3.75967** | **0.0161** | **4.07824** | **1.72191** | **0.00162** | **0.07835** | **0.01776** | **0.0011** | **0.00002** | **0.00108** | 2.18 | 48.4772 | **91.83** | **22.2** | **27.1** | **± 0.05** |
| 1400 | 4.41266 | **0.00407** | **4.02585** | **0.01727** | **4.39539** | **1.84682** | **0.00162** | **0.08519** | **0.02316** | **0.00128** | **0.00001** | **0.00125** | 2.18 | 39.8709 | **91.23** | **23.8** | **27.1** | **± 0.04** |
| 1450 | **3.19535** | **0.00055** | **2.90237** | **0.0125** | **3.18285** | **1.33638** | **0.0008** | **0.05868** | **0.01415** | **0.00097** | **0.00001** | **0.00095** | 2.17 | 47.22191 | **90.83** | **17.2** | **27** | **± 0.04** |
| **1600** | **1.00222** | **0.00024** | **0.88219** | **0.00381** | **0.99841** | **0.40759** | **0.00012** | **0.01809** | **0.01995** | **0.0004** | **0.00002** | **0.00039** | 2.16 | 10.21529 | **88.02** | **5.3** | **26.9** | **± 0.15** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00693±0.1%
**Plateau date: 27.02±0.07 Ma on steps: 8 to 11 containing 68.5% $^{39}Ar_k$**
Total-gas date: 27.1±0.07 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample:** | **RH-TP-571/1/DD57** | | **SANIDINE** | | **Wt.=66 mg** | | | | | | | | | | | | | |
| 900 | 0.26897 | 0.0002 | 0.02094 | 0.00014 | 0.26882 | 0.0153 | 0.00002 | 0.00028 | 0.00279 | 0.00084 | 0.00001 | 0.00084 | 1.37 | 2.74194 | 7.79 | 0.2 | 16.9 | ± 1.61 |
| 1000 | 0.52187 | 0.00052 | 0.29801 | 0.00114 | 0.52073 | 0.1217 | 0.00009 | 0.00059 | 0.00842 | 0.00076 | 0 | 0.00075 | 2.45 | 7.22684 | 57.11 | 1.2 | 30.1 | ± 0.07 |
| 1100 | 1.10488 | 0.0004 | 0.62463 | 0.00258 | 1.1023 | 0.27574 | 0.00004 | 0.00018 | 0.01122 | 0.00162 | 0.00001 | 0.00162 | 2.27 | 12.28788 | 56.53 | 2.8 | 27.8 | ± 0.11 |
| 1200 | 1.77232 | 0.0006 | 1.6216 | 0.00686 | 1.76546 | 0.73399 | 0.00031 | 0.0001 | 0.02324 | 0.00049 | 0.00001 | 0.00049 | 2.21 | 15.79152 | 91.5 | 7.5 | 27.2 | ± 0.06 |
| **1250** | **1.36872** | **0.00016** | **1.29136** | **0.00552** | **1.3632** | **0.59032** | **0.00054** | **0.00009** | **0.01378** | **0.00025** | **0.00001** | **0.00024** | 2.19 | 21.41945 | **94.35** | **6** | **26.9** | **± 0.09** |
| **1300** | **1.77598** | **0.00153** | **1.69563** | **0.0072** | **1.76878** | **0.77051** | **0.00086** | **0** | **0.01447** | **0.00025** | **0.00001** | **0.00025** | 2.2 | 26.6244 | **95.48** | **7.9** | **27.1** | **± 0.07** |
| **1350** | **2.55379** | **0.00069** | **2.46525** | **0.01051** | **2.54328** | **1.12426** | **0.00051** | **0** | **0.01661** | **0.00027** | **0.00001** | **0.00026** | 2.19 | 33.84287 | 96.53 | **11.5** | **27** | **± 0.05** |
| **1400** | **2.84537** | **0.00075** | **2.76261** | **0.01174** | **2.83362** | **1.25587** | **0.00042** | **0.00015** | **0.01704** | **0.00024** | **0.00001** | **0.00024** | 2.2 | 36.85065 | **97.09** | **12.8** | **27** | **± 0.04** |
| 1450 | 3.1498 | 0.00077 | 3.05318 | 0.01299 | 3.13681 | 1.38898 | 0 | 0.00011 | 0.0183 | 0.00029 | 0.00001 | 0.00028 | 2.2 | 37.95027 | **96.93** | **14.2** | **27** | **± 0.04** |
| 1500 | 4.08606 | 0.00152 | 4.00001 | 0.01696 | 4.06909 | 1.81425 | 0.00109 | 0.00001 | 0.02159 | 0.00024 | 0 | 0.00023 | 2.2 | 42.01598 | 97.89 | 18.5 | 27.1 | ± 0.04 |
| 1550 | 2.82096 | 0.00208 | 2.74422 | 0.01158 | 2.80939 | 1.23815 | 0.00063 | 0 | 0.01397 | 0.00022 | 0.00001 | 0.00022 | 2.22 | 44.3146 | 97.28 | 12.7 | 27.2 | ± 0.04 |
| 1600 | 1.05788 | 0.0009 | 1.00901 | 0.00425 | 1.05363 | 0.45427 | 0.00041 | 0.00003 | 0.00658 | 0.00015 | 0.00001 | 0.00015 | 2.22 | 34.519 | 95.38 | 4.6 | 27.3 | ± 0.12 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.006865±0.1%
**Plateau date: 27.00±0.06 Ma on steps: 5 to 9 containing 52.4% $^{39}Ar_k$**
Total-gas date: 27.12±0.06 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-TP-583/6/DD57** | | | **BIOTITE** | | **Wt.=60.2 mg** | | | | | | | | | | | | | |
| 800 | 0.27551 | 0.00023 | 0.00594 | 0.00008 | 0.27543 | 0.00867 | 0.00001 | 0.00025 | 0.00103 | 0.00091 | 0.00001 | 0.00091 | 0.69 | 4.20874 | 2.2 | 0.1 | –14.8 | ± –3.93 |
| 900 | 0.31693 | 0.00021 | 0.00461 | 0.00022 | 0.31671 | 0.02434 | 0.00001 | 0.00054 | 0.00121 | 0.00092 | 0 | 0.00092 | 0.19 | 10.05785 | 14.1 | 0.3 | 12.8 | ± 18.48 |
| 1000 | 0.64621 | 0.00038 | 0.10605 | 0.00046 | 0.64575 | 0.04954 | 0.00002 | 0.00177 | 0.00201 | 0.00183 | 0 | 0.00183 | 2.14 | 12.32338 | 16.4 | 0.6 | 24.9 | ± 2.22 |
| 1100 | 1.39608 | 0.00142 | 0.79534 | 0.00339 | 1.39269 | 0.36293 | 0.00048 | 0.01586 | 0.00268 | 0.00201 | 0.00001 | 0.002 | 2.19 | 67.71082 | 57.2 | 4.3 | 27.8 | ± 0.16 |
| 1200 | 2.40417 | 0.00218 | 1.95324 | 0.00868 | 2.39549 | 0.92879 | 0.00072 | 0.03902 | 0.00459 | 0.00151 | 0.00001 | 0.0015 | 2.1 | 101.17538 | 81.2 | 10.8 | 27 | ± 0.06 |
| 1300 | 3.39837 | 0.00257 | 2.9199 | 0.0131 | 3.38527 | **1.40157** | **0.00138** | **0.05662** | **0.00538** | **0.00159** | **0.00001** | **0.00157** | 2.08 | 130.25743 | **85.9** | **16.2** | **26.8** | **± 0.06** |
| 1350 | 4.49043 | 0.00296 | 3.85797 | 0.01734 | **4.47309** | **1.85481** | **0.00135** | **0.07632** | **0.00708** | **0.0021** | **0.00001** | **0.00208** | 2.08 | 130.98941 | **85.9** | **21.5** | **26.9** | **± 0.04** |
| 1400 | 5.65979 | 0.00547 | 4.58835 | **0.0206** | **5.63919** | **2.20353** | **0.00175** | **0.09305** | **0.00911** | **0.00358** | **0.00001** | **0.00356** | 2.08 | 120.94018 | **81.1** | **25.5** | **26.9** | **± 0.04** |
| 1450 | 3.79729 | 0.00181 | **3.0734** | **0.0138** | **3.78349** | **1.47646** | **0.00027** | **0.05826** | **0.01084** | **0.00242** | **0.00001** | **0.0024** | 2.08 | 68.1024 | **80.9** | **17.7** | **26.8** | **± 0.04** |
| 1600 | 0.82212 | 0.00035 | 0.66433 | 0.00295 | 0.81917 | 0.31605 | 0.00016 | 0.01257 | 0.02919 | 0.00053 | 0.00001 | 0.00052 | 2.1 | 5.41367 | 80.8 | 3.7 | 26.4 | ± 0.16 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007237±0.1%
**Plateau date: 26.86±0.05 Ma on steps: 6 to 9 containing 80.3% $^{39}Ar_k$**
Total-gas date: 26.81±0.16 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-TP-583/7/DD57** | | | **HORNBLENDE** | | **Wt.=190 mg** | | | | | | | | | | | | | |
| 900 | 0.34952 | 0.00006 | 0.00445 | 0.00002 | 0.34949 | 0.00259 | 0.00003 | 0.00015 | 0.00663 | 0.00117 | 0.00001 | 0.00117 | 1.72 | 0.19532 | 1.27 | 0.1 | 22.4 | ± 11.55 |
| 1050 | 0.83759 | 0.00027 | 0.07567 | 0.00025 | 0.83734 | 0.02677 | 0.00002 | 0.0005 | 0.01853 | 0.00258 | 0.00001 | 0.00258 | 2.83 | 0.72234 | 9.03 | 1.1 | 36.7 | ± 1.96 |
| 1200 | 0.20707 | 0.0005 | 0.04363 | 0.00017 | 0.2069 | 0.01778 | 0 | 0.00137 | 0.02392 | 0.00056 | 0.00001 | 0.00055 | 2.45 | 0.37166 | 21.07 | 0.7 | 31.9 | ± 2.35 |
| 1275 | 0.19221 | 0.00006 | 0.03238 | 0.00018 | 0.19203 | 0.01911 | 0.00005 | 0.00252 | 0.05226 | 0.00056 | 0.00001 | 0.00054 | 1.69 | 0.18284 | 16.84 | 0.8 | 22.1 | ± 2.35 |
| 1325 | 0.38396 | 0.00073 | 0.14993 | 0.00064 | 0.38332 | 0.06863 | 0.00001 | 0.01559 | 0.3082 | 0.00088 | 0.00001 | 0.00079 | 2.18 | 0.11134 | 39.05 | 2.9 | 28.4 | ± 0.51 |
| 1350 | 0.71897 | 0.00014 | 0.40959 | 0.00182 | 0.71714 | 0.19503 | 0.0001 | 0.06712 | 1.30516 | 0.00142 | 0.00001 | 0.00104 | 2.1 | 0.07471 | 56.97 | 8.1 | 27.3 | ± 0.22 |
| **1375** | **1.2811** | **0.00042** | **0.99358** | **0.00452** | **1.27658** | **0.48354** | **0.00005** | **0.17509** | **3.48899** | **0.00197** | **0** | **0.00096** | 2.05 | 0.0693 | **77.56** | **20.1** | **26.7** | **± 0.04** |
| **1400** | **1.15953** | **0.00069** | **0.93163** | **0.00424** | **1.15528** | **0.454** | **0.00035** | **0.14076** | **3.10588** | **0.00165** | **0** | **0.00076** | 2.05 | 0.07309 | **80.35** | **18.8** | **26.7** | **± 0.04** |
| **1450** | **1.65274** | **0.00908** | **1.30457** | **0.00594** | **1.6468** | **0.63567** | **0.00284** | **0.11319** | **3.95383** | **0.00227** | **0.00001** | **0.00116** | 2.05 | 0.08039 | **78.93** | **26.4** | **26.7** | **± 0.04** |
| 1500 | 0.91897 | 0.00012 | 0.65228 | 0.00293 | 0.91604 | 0.31359 | 0.00017 | 0.06234 | 1.97256 | 0.00145 | 0.00001 | 0.00089 | 2.08 | 0.07949 | 70.98 | 13 | 27 | ± 0.15 |
| 1600 | 0.6854 | 0.00024 | 0.40314 | 0.0018 | 0.68359 | 0.19303 | 0.00013 | 0.03725 | 1.19907 | 0.00129 | 0.00001 | 0.00095 | 2.09 | 0.08049 | 58.82 | 8 | 27.2 | ± 0.25 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00726±0.1%
**Plateau date: 26.69±0.04 Ma on steps: 7 to 9 containing 65.3% $^{39}Ar_k$**
Total-gas date: 26.98±0.16 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-TP-583/8/DD57** | | | **SANIDINE** | | **Wt.=68.4 mg** | | | | | | | | | | | | | |
| 900 | 0.19224 | 0.00019 | 0.11591 | 0.00054 | 0.1917 | 0.05772 | 0.00008 | 0.00015 | 0.00083 | 0.00026 | 0.00001 | 0.00026 | 2.01 | 34.77108 | 60.3 | 0.6 | 26.2 | ± 0.5 |
| 1000 | 0.63019 | 0.00027 | 0.27965 | 0.00122 | 0.62897 | 0.13084 | 0.00009 | 0.00011 | 0.00285 | 0.00118 | 0.00001 | 0.00118 | 2.14 | 22.95439 | 44.38 | 1.3 | 27.9 | ± 0.34 |
| 1100 | 0.90223 | 0.00128 | 0.74085 | 0.00335 | 0.89889 | 0.35796 | 0.0004 | 0 | 0.00575 | 0.00054 | 0.00001 | 0.00053 | 2.07 | 31.12696 | 82.11 | 3.4 | 27 | ± 0.15 |
| 1200 | 1.50223 | 0.00056 | 1.42037 | 0.00647 | 1.49576 | 0.69194 | 0.00051 | 0 | 0.01276 | 0.00026 | 0 | 0.00026 | 2.05 | 27.11364 | 94.55 | 6.6 | 26.8 | ± 0.04 |
| 1250 | 1.6414 | 0.00148 | 1.55617 | 0.00711 | 1.63429 | 0.76024 | 0.00073 | 0 | 0.01301 | 0.00027 | 0 | 0.00026 | 2.05 | 29.21752 | 94.81 | 7.3 | 26.7 | ± 0.04 |
| 1300 | 1.93269 | 0.00197 | 1.87006 | 0.00848 | 1.92422 | 0.90671 | 0.00065 | 0 | **0.01298** | **0.00019** | **0** | **0.00018** | 2.06 | 34.9272 | **96.76** | **8.7** | **26.9** | **± 0.04** |
| 1350 | 2.44973 | 0.00194 | 2.39 | 0.01084 | 2.43888 | 1.15987 | 0.00116 | **0** | **0.0139** | **0.00017** | **0** | **0.00017** | 2.06 | 41.72194 | **97.56** | **11.1** | **26.9** | **± 0.04** |
| 1400 | 2.82173 | 0.00201 | 2.76277 | 0.01252 | 2.80921 | 1.33891 | **0.00097** | **0** | **0.01702** | **0.00016** | **0** | **0.00016** | 2.06 | 39.33343 | **97.91** | **12.8** | **26.9** | **± 0.04** |
| 1450 | 2.78698 | 0.00094 | 2.72191 | 0.01237 | 2.77462 | **1.32283** | **0.00057** | **0** | **0.0143** | **0.00018** | **0.00001** | **0.00018** | 2.06 | 46.2528 | **97.66** | **12.7** | **26.8** | **± 0.05** |
| 1500 | 4.01961 | 0.00166 | 3.94224 | 0.01789 | **4.00172** | **1.91349** | **0.00087** | **0** | **0.01914** | **0.00021** | **0.00001** | **0.0002** | 2.06 | 49.98668 | **98.08** | **18.4** | **26.9** | **± 0.04** |
| 1550 | 3.26702 | 0.00282 | 3.17749 | **0.01441** | **3.25261** | **1.54089** | **0.00143** | **0** | **0.01497** | **0.00026** | **0.00001** | **0.00025** | 2.06 | 51.46593 | **97.26** | **14.8** | **26.9** | **± 0.04** |
| 1600 | 0.54268 | 0.00034 | 0.49532 | 0.00228 | 0.5404 | 0.2436 | 0.00014 | 0 | 0.0058 | 0.00015 | 0.00001 | 0.00015 | 2.03 | 21 | 91.27 | 2.3 | 26.5 | ± 0.21 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00728±0.1%
**Plateau date: 26.87±0.04 Ma on steps: 6 to 11 containing 78.5% $^{39}Ar_k$**
Total-gas date: 26.85±0.05 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample: RH-TP-590/10/DD57 | | BIOTITE | | Wt.=63.7 mg | | | | | | | | | | | | | | |
| 850 | 0.47355 | 0.00059 | 0.18927 | 0.00097 | 0.47258 | 0.10331 | 0.0001 | 0.00326 | 0.00259 | 0.00096 | 0.00001 | 0.00096 | 1.83 | 19.94402 | 39.97 | 1.12 | 23.82 | ± 0.25 |
| 950 | 0.40217 | 0.00046 | 0.2594 | 0.00118 | 0.40098 | 0.12669 | 0.00012 | 0.00435 | 0.00189 | 0.00048 | 0.00001 | 0.00048 | 2.05 | 33.51587 | 64.5 | 1.38 | 26.6 | ± 0.28 |
| 1050 | 1.28548 | 0.00113 | 0.61826 | 0.00269 | 1.28279 | 0.28789 | 0.00028 | 0.01174 | 0.00347 | 0.00225 | 0.00001 | 0.00225 | 2.15 | 41.48271 | 48.1 | 3.13 | 27.89 | ± 0.11 |
| 1150 | 2.06427 | 0.00201 | 1.70346 | 0.00752 | 2.05676 | 0.80384 | 0.00075 | 0.03249 | 0.00449 | 0.00121 | 0.00001 | 0.0012 | 2.12 | 89.51448 | 82.52 | 8.75 | 27.52 | ± 0.06 |
| 1200 | 1.53909 | 0.00127 | 1.39257 | 0.00625 | 1.53284 | 0.66795 | 0.00031 | 0.0258 | 0.00363 | 0.00048 | 0 | 0.00047 | 2.08 | 92.00413 | 90.48 | 7.27 | 27.08 | ± 0.04 |
| 1250 | 1.6545 | 0.00108 | 1.51974 | 0.00683 | 1.64767 | 0.73053 | 0.00059 | 0.02798 | 0.00305 | 0.00044 | 0.00002 | 0.00043 | 2.08 | 119.75902 | 91.86 | 7.95 | 27.02 | ± 0.11 |
| 1300 | 2.16217 | 0.00119 | 1.97015 | 0.00887 | 2.1533 | 0.94869 | 0.0005 | 0.03652 | 0.00567 | 0.00063 | 0.00002 | 0.00062 | 2.08 | 83.65873 | 91.12 | 10.33 | 26.98 | ± 0.08 |
| 1350 | 2.86816 | 0.00176 | 2.56738 | 0.01152 | 2.85664 | 1.23243 | 0.00127 | 0.04912 | 0.02036 | 0.001 | 0.00001 | 0.00098 | 2.08 | 30.26596 | 89.51 | 13.41 | 27.06 | ± 0.05 |
| 1400 | 4.52354 | 0.00055 | 3.94546 | 0.01779 | 4.50575 | 1.90297 | 0.00133 | 0.07762 | 0.03347 | 0.00193 | 0.00001 | 0.0019 | 2.07 | 28.428 | 87.22 | 20.71 | 26.93 | ± 0.04 |
| 1450 | 4.37153 | 0.00055 | 3.80131 | 0.01711 | 4.35442 | 1.83013 | 0.00075 | 0.06813 | 0.01571 | 0.00189 | 0.00001 | 0.00187 | 2.08 | 58.24729 | 86.96 | 19.92 | 26.98 | ± 0.04 |
| 1550 | 1.38677 | 0.0052 | 1.15971 | 0.00517 | 1.3816 | 0.55327 | 0.0021 | 0.02035 | 0.03035 | 0.00076 | 0.00001 | 0.00075 | 2.1 | 9.11483 | 83.63 | 6.02 | 27.23 | ± 0.04 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007255±0.1%
**Plateau date: 26.99±0.06 Ma on steps: 6 to 10 containing 72.32% $^{39}Ar_k$**
Total-gas date: 27.04±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample: RH-TP-590/9/DD57 | | SANIDINE | | Wt.=73.8 mg | | | | | | | | | | | | | | |
| 900 | 0.45763 | 0.00045 | 0.12599 | 0.00059 | 0.45704 | 0.06262 | 0.00001 | 0.00021 | 0.00157 | 0.00112 | 0.00001 | 0.00112 | 2.01 | 19.94268 | 27.53 | 0.5 | 26.1 | ± 0.74 |
| 1000 | 0.71014 | 0.00047 | 0.4302 | 0.00191 | 0.70824 | 0.20389 | 0.00013 | 0.00003 | 0.0078 | 0.00094 | 0 | 0.00094 | 2.11 | 13.06987 | 60.58 | 1.6 | 27.3 | ± 0.04 |
| 1100 | 1.21792 | 0.00078 | 0.87723 | 0.00392 | 1.21399 | 0.41975 | 0.00023 | 0.00009 | 0.01319 | 0.00114 | 0.00001 | 0.00114 | 2.09 | 15.91168 | 72.03 | 3.2 | 27.1 | ± 0.12 |
| 1200 | 2.422 | 0.00125 | 2.30107 | 0.01033 | 2.41167 | 1.10501 | 0.00089 | 0.00006 | 0.02269 | 0.00038 | 0.00001 | 0.00037 | 2.08 | 24.35015 | 95.01 | 8.5 | 27 | ± 0.04 |
| 1250 | 2.32895 | 0.00075 | 2.24667 | 0.0101 | 2.31885 | 1.08019 | 0.00041 | 0.00015 | 0.01723 | 0.00025 | 0.00002 | 0.00024 | 2.08 | 31.3462 | 96.47 | 8.3 | 26.9 | ± 0.07 |
| 1300 | 2.02219 | 0.00176 | 1.93372 | 0.00871 | 2.01348 | 0.93164 | 0.00058 | 0 | 0.01148 | 0.00027 | 0 | 0.00027 | 2.08 | 40.57666 | 95.63 | 7.2 | 26.9 | ± 0.04 |
| 1350 | 2.51091 | 0.00222 | 2.43062 | 0.01097 | 2.49993 | 1.17363 | 0.00093 | 0.00008 | 0.01346 | 0.00024 | 0.00001 | 0.00023 | 2.07 | 43.59695 | 96.8 | 9 | 26.8 | ± 0.04 |
| 1400 | 2.88157 | 0.00073 | 2.79825 | 0.01263 | 2.86894 | 1.35084 | 0.00033 | 0.00003 | 0.01491 | 0.00024 | 0.00001 | 0.00024 | 2.07 | 45.2998 | 97.11 | 10.4 | 26.8 | ± 0.05 |
| 1450 | 3.94041 | 0.0006 | 3.8428 | 0.01734 | 3.92307 | 1.85429 | 0.00072 | 0.00001 | 0.01942 | 0.00028 | 0 | 0.00027 | 2.07 | 47.74176 | 97.52 | 14.2 | 26.8 | ± 0.04 |
| 1500 | 5.58655 | 0.00235 | 5.45295 | 0.02456 | 5.56199 | 2.62653 | 0.0008 | 0 | 0.02819 | 0.00038 | 0 | 0.00037 | 2.08 | 46.5862 | 97.61 | 20.2 | 26.9 | ± 0.04 |
| 1550 | 3.72369 | 0.00096 | 3.63657 | 0.01627 | 3.70743 | 1.73969 | 0.00122 | 0 | 0.01949 | 0.00025 | 0 | 0.00024 | 2.09 | 44.63032 | 97.66 | 13.4 | 27.1 | ± 0.04 |
| 1600 | 1.05737 | 0.00012 | 1.00646 | 0.00449 | 1.05288 | 0.47977 | 0.00003 | 0 | 0.00666 | 0.00016 | 0 | 0.00016 | 2.1 | 36.01877 | 95.19 | 3.7 | 27.2 | ± 0.04 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007231±0.1%
**Plateau date: 26.85±0.04 Ma on steps: 5 to 10 containing 69.3% $^{39}Ar_k$**
Total-gas date: 26.92±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample: RH-TP-616/11/DD57 | | SANIDINE | | Wt.=63.7 mg | | | | | | | | | | | | | | |
| 900 | 0.80476 | 0.00113 | 0.06802 | 0.00027 | 0.80449 | 0.02927 | 0.00003 | 0.00055 | 0.00443 | 0.00249 | 0 | 0.00249 | 2.32 | 3.30361 | 8.45 | 0.3 | 29.9 | ± 0.08 |
| 1000 | 1.05496 | 0.0011 | 0.30425 | 0.00127 | 1.05369 | 0.13609 | 0.00009 | 0.00048 | 0.01296 | 0.00254 | 0.00001 | 0.00254 | 2.24 | 5.25039 | 28.84 | 1.3 | 28.7 | ± 0.15 |
| 1100 | 1.19407 | 0.00116 | 0.84954 | 0.00373 | 1.19034 | 0.39884 | 0.00044 | 0.00014 | 0.03983 | 0.00116 | 0.00001 | 0.00115 | 2.13 | 5.00678 | 71.15 | 3.9 | 27.4 | ± 0.14 |
| 1200 | 1.9865 | 0.00213 | 1.80979 | 0.00801 | 1.97848 | 0.85721 | 0.00105 | 0.00003 | 0.07231 | 0.00059 | 0 | 0.00057 | 2.11 | 5.92733 | 91.1 | 8.3 | 27.2 | ± 0.04 |
| 1250 | 1.79782 | 0.00071 | 1.67583 | 0.00745 | 1.79037 | 0.79631 | 0.00063 | 0.00004 | 0.05547 | 0.0004 | 0.00001 | 0.00039 | 2.1 | 7.17784 | 93.21 | 7.7 | 27.1 | ± 0.08 |
| 1300 | 3.70609 | 0.00045 | 3.55237 | 0.01566 | 3.69043 | 1.67492 | 0.00232 | 0.00008 | 0.09622 | 0.00049 | 0.00002 | 0.00047 | 2.12 | 8.7036 | 95.85 | 16.3 | 27.3 | ± 0.08 |
| 1350 | 2.14576 | 0.00201 | 2.05639 | 0.00905 | 2.13671 | 0.96787 | 0.00099 | 0.00007 | 0.04358 | 0.00028 | 0.00002 | 0.00027 | 2.12 | 11.10452 | 95.84 | 9.4 | 27.3 | ± 0.09 |
| 1400 | 3.11588 | 0.00284 | 2.99635 | 0.01306 | 3.10282 | 1.39703 | 0.00119 | 0.0001 | 0.04884 | 0.00037 | 0.00001 | 0.00036 | 2.14 | 14.30211 | 96.16 | 13.6 | 27.6 | ± 0.04 |
| 1450 | 3.43539 | 0.00172 | 3.31223 | 0.01445 | 3.42095 | 1.54495 | 0.00153 | 0.00011 | 0.04122 | 0.00038 | 0.00001 | 0.00037 | 2.14 | 18.7403 | 96.41 | 15 | 27.6 | ± 0.05 |
| 1500 | 3.10852 | 0.00259 | 3.01665 | 0.01294 | 3.09558 | 1.38408 | 0.00105 | 0.00007 | 0.03035 | 0.00028 | 0.00001 | 0.00027 | 2.18 | 22.80198 | 97.04 | 13.5 | 28 | ± 0.04 |
| 1550 | 2.09314 | 0.00166 | 2.00039 | 0.00829 | 2.08485 | 0.88703 | 0.00124 | 0.00003 | 0.02372 | 0.00029 | 0.00001 | 0.00029 | 2.26 | 18.69793 | 95.57 | 8.6 | 29 | ± 0.06 |
| 1600 | 0.585 | 0.00033 | 0.49938 | 0.00198 | 0.58302 | 0.21198 | 0.0001 | 0.00002 | 0.01547 | 0.00029 | 0 | 0.00028 | 2.36 | 6.85133 | 85.36 | 2.1 | 30.3 | ± 0.08 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007181±0.1%
**Preferred date: 27.22±0.07 Ma on steps: 4 to 7 containing 41.8% $^{39}Ar_k$**
Total-gas date: 27.67±0.06 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample:** | **RH-TP-644/3/DD57** | | **BIOTITE** | | **Wt.=75.3 mg** | | | | | | | | | | | | | | |
| 800 | 0.77113 | 0.00018 | 0.0127 | 0.00012 | 0.771 | 0.01312 | 0.00004 | 0.00051 | 0.00099 | 0.00257 | 0.00002 | 0.00257 | 0.97 | 6.62626 | 1.65 | 0.1 | 12.2 | ± | 4.64 |
| 900 | 1.08309 | 0.0012 | 0.08416 | 0.00035 | 1.08275 | 0.03699 | 0.00004 | 0.0016 | 0.00459 | 0.00338 | 0.00002 | 0.00338 | 2.28 | 4.02941 | 7.77 | 0.4 | 28.5 | ± | 1.97 |
| 1000 | 1.0946 | 0.00196 | 0.19629 | 0.0008 | 1.09381 | 0.08509 | 0.00006 | 0.00396 | 0.0112 | 0.00304 | 0.00001 | 0.00304 | 2.31 | 3.79866 | 17.93 | 0.9 | 28.9 | ± | 0.05 |
| 1100 | 2.73904 | 0.00121 | 1.58714 | 0.00664 | 2.7324 | 0.71015 | 0.00002 | 0.02656 | 0.00688 | 0.00389 | 0.00001 | 0.00388 | 2.23 | 51.60974 | 57.94 | 7.2 | 28 | ± | 0.04 |
| 1200 | 2.28236 | 0.00042 | 1.9244 | 0.00817 | 2.27419 | 0.87342 | 0.00098 | 0.02899 | 0.00629 | 0.00119 | 0.00001 | 0.00118 | 2.2 | 69.42925 | 84.32 | 8.8 | 27.6 | ± | 0.07 |
| 1250 | 1.50108 | 0.00019 | 1.26893 | 0.00549 | 1.49559 | 0.58685 | 0.00063 | 0.01856 | 0.00373 | 0.00077 | 0.00001 | 0.00077 | 2.16 | 78.66622 | 84.53 | 5.9 | 27.1 | ± | 0.08 |
| 1300 | 2.59478 | 0.0015 | 2.24388 | 0.00965 | 2.58513 | 1.03169 | 0.00097 | 0.03215 | 0.00641 | 0.00117 | 0 | 0.00115 | 2.17 | 80.47504 | 86.48 | 10.4 | 27.2 | ± | 0.04 |
| 1350 | 3.98811 | 0.00172 | 3.36059 | 0.01453 | 3.97358 | 1.55359 | 0.00124 | 0.05018 | 0.03028 | 0.0021 | 0.00001 | 0.00207 | 2.16 | 25.65373 | 84.27 | 15.7 | 27.1 | ± | 0.04 |
| 1400 | 5.40579 | 0.00604 | 4.46978 | 0.01934 | 5.38645 | 2.06882 | 0.00266 | 0.06975 | 0.03404 | 0.00313 | 0.00001 | 0.0031 | 2.16 | 30.38807 | 82.69 | 20.9 | 27.1 | ± | 0.04 |
| 1450 | 5.62325 | 0.00296 | 4.59258 | 0.01986 | 5.60339 | 2.12432 | 0.00107 | 0.06416 | 0.01732 | 0.00344 | 0 | 0.00342 | 2.16 | 61.32564 | 81.67 | 21.4 | 27.1 | ± | 0.04 |
| 1550 | 2.33313 | 0.00267 | 1.8019 | 0.0078 | 2.32533 | 0.83415 | 0.00151 | 0.02586 | 0.03611 | 0.00179 | 0.00001 | 0.00177 | 2.16 | 11.55012 | 77.23 | 8.4 | 27.1 | ± | 0.05 |
| $^{40}Ar/^{36}Ar$ measured atmosphere: 298.9 | | | | | | | | | | | | | | | | | | | |
| J-value and its error: 0.006996±0.1% | | | | | | | | | | | | | | | | | | | |
| **Plateau date: 27.12±0.04 Ma on steps: 6 to 11 containing 82.7%** $^{39}Ar_k$ | | | | | | | | | | | | | | | | | | | |
| Total-gas date: 27.21±0.07 Ma | | | | | | | | | | | | | | | | | | | |
| **Sample:** | **RH-TP-644/4/DD57** | | **HORNBLENDE** | | **Wt.=217.2 mg** | | | | | | | | | | | | | | |
| 900 | 0.91635 | 0.00094 | 0.12448 | 0.00063 | 0.91572 | 0.06782 | 0.00006 | 0.00332 | 0.01989 | 0.00268 | 0.00001 | 0.00268 | 1.84 | 1.70488 | 13.58 | 2.3 | 23.3 | ± | 0.29 |
| 1000 | 1.30722 | 0.00118 | 0.14914 | 0.00068 | 1.30655 | 0.07221 | 0.00008 | 0.00393 | 0.0213 | 0.00392 | 0.00002 | 0.00392 | 2.07 | 1.69507 | 11.41 | 2.5 | 26.2 | ± | 1.19 |
| 1100 | 0.84993 | 0.00041 | 0.12098 | 0.00044 | 0.84949 | 0.04689 | 0.00005 | 0.00267 | 0.02095 | 0.00247 | 0.00001 | 0.00247 | 2.58 | 1.11909 | 14.23 | 1.6 | 32.6 | ± | 0.88 |
| 1150 | 0.2849 | 0.00006 | 0.07262 | 0.00026 | 0.28464 | 0.02826 | 0.00002 | 0.00162 | 0.01343 | 0.00072 | 0 | 0.00072 | 2.57 | 1.05212 | 25.49 | 1 | 32.5 | ± | 0.65 |
| 1200 | 0.2327 | 0.0002 | 0.0614 | 0.00024 | 0.23245 | 0.02605 | 0.00001 | 0.00188 | 0.01523 | 0.00058 | 0.00001 | 0.00058 | 2.36 | 0.85522 | 26.39 | 0.9 | 29.8 | ± | 1.93 |
| 1250 | 0.20552 | 0.00003 | 0.0664 | 0.00026 | 0.20526 | 0.02768 | 0.00002 | 0.00249 | 0.01908 | 0.00048 | 0.00001 | 0.00047 | 2.4 | 0.72537 | 32.31 | 0.9 | 30.4 | ± | 0.99 |
| 1300 | 0.38332 | 0.00008 | 0.17026 | 0.00071 | 0.38261 | 0.07596 | 0.00002 | 0.00911 | 0.11036 | 0.00075 | 0 | 0.00072 | 2.24 | 0.34415 | 44.42 | 2.6 | 28.4 | ± | 0.17 |
| 1350 | 0.60483 | 0.00026 | 0.34692 | 0.00152 | 0.60331 | 0.16269 | 0.00005 | 0.04027 | 0.70602 | 0.00107 | 0.00001 | 0.00087 | 2.13 | 0.11522 | 57.36 | 5.5 | 27 | ± | 0.24 |
| 1375 | 0.99314 | 0.00028 | 0.69553 | 0.00307 | 0.99006 | 0.32862 | 0.00004 | 0.10849 | 2.04451 | 0.00158 | 0.00002 | 0.001 | 2.12 | 0.08037 | 70.03 | 11.2 | 26.8 | ± | 0.25 |
| 1400 | 1.14295 | 0.0006 | 0.89247 | 0.00395 | 1.139 | 0.42203 | 0.00024 | 0.13958 | 2.72577 | 0.00161 | 0.00002 | 0.00083 | 2.11 | 0.07741 | 78.08 | 14.4 | 26.8 | ± | 0.2 |
| 1425 | 1.00365 | 0.00069 | 0.80319 | 0.00355 | 1.0001 | 0.38021 | 0.00031 | 0.09875 | 2.24996 | 0.00131 | 0.00001 | 0.00067 | 2.11 | 0.08449 | 80.03 | 12.9 | 26.8 | ± | 0.07 |
| 1450 | 0.95789 | 0.00064 | 0.77797 | 0.00345 | 0.95444 | 0.36893 | 0.00032 | 0.05834 | 2.00426 | 0.00116 | 0.00001 | 0.0006 | 2.11 | 0.09204 | 81.22 | 12.6 | 26.7 | ± | 0.11 |
| 1500 | 1.01039 | 0.00109 | 0.80362 | 0.00355 | 1.00684 | 0.37978 | 0.00033 | 0.08878 | 2.28923 | 0.00133 | 0.00001 | 0.00069 | 2.12 | 0.08295 | 79.54 | 12.9 | 26.8 | ± | 0.07 |
| 1600 | 1.4618 | 0.00014 | 1.16707 | 0.00516 | 1.45664 | 0.5521 | 0.00044 | 0.168 | 3.70381 | 0.00203 | 0.00002 | 0.00098 | 2.11 | 0.07453 | 79.84 | 18.8 | 26.8 | ± | 0.14 |
| $^{40}Ar/^{36}Ar$ measured atmosphere: 298.9 | | | | | | | | | | | | | | | | | | | |
| J-value and its error: 0.007076±0.1% | | | | | | | | | | | | | | | | | | | |
| **Plateau date: 26.80±0.14 Ma on steps: 8 to 14 containing 88.2%** $^{39}Ar_k$ | | | | | | | | | | | | | | | | | | | |
| Total-gas date: 26.95±0.21 Ma | | | | | | | | | | | | | | | | | | | |
| **Sample:** | **RH-TP-644/5/DD57** | | **SANIDINE** | | **Wt.=75.2 mg** | | | | | | | | | | | | | | |
| 900 | 0.187 | 0.00009 | 0.02987 | 0.00007 | 0.18693 | 0.00737 | 0.00001 | 0.00022 | 0.00072 | 0.00053 | 0 | 0.00053 | 4.05 | 5.11806 | 15.97 | 0.1 | 51.5 | ± | 2.12 |
| 1000 | 0.34383 | 0.00026 | 0.15388 | 0.00065 | 0.34318 | 0.06995 | 0.00002 | 0.00048 | 0.00482 | 0.00064 | 0.00002 | 0.00064 | 2.2 | 7.25622 | 44.75 | 0.6 | 28.2 | ± | 1.26 |
| 1100 | 1.16856 | 0.00053 | 0.64032 | 0.0027 | 1.16586 | 0.28867 | 0.00008 | 0.00027 | 0.01595 | 0.00178 | 0 | 0.00178 | 2.22 | 9.04922 | 54.8 | 2.6 | 28.4 | ± | 0.05 |
| 1200 | 1.88362 | 0.00024 | 1.75724 | 0.00783 | 1.87578 | 0.83775 | 0.00067 | 0.00011 | 0.03991 | 0.00041 | 0.00001 | 0.0004 | 2.1 | 10.49549 | 93.29 | 7.5 | 26.9 | ± | 0.08 |
| 1250 | 1.54141 | 0.00121 | 1.45702 | 0.0065 | 1.53491 | 0.69541 | 0.00054 | 0.00016 | 0.02839 | 0.00027 | 0.00001 | 0.00026 | 2.1 | 12.24745 | 94.52 | 6.2 | 26.8 | ± | 0.09 |
| 1300 | 2.10339 | 0.00061 | 2.02674 | 0.00905 | 2.09434 | 0.96787 | 0.00052 | 0.00003 | 0.03239 | 0.00024 | 0.00001 | 0.00023 | 2.09 | 14.94088 | 96.36 | 8.6 | 26.8 | ± | 0.04 |
| 1350 | 2.61754 | 0.00204 | 2.53651 | 0.01135 | 2.60619 | 1.21371 | 0.00105 | 0.00011 | 0.03409 | 0.00025 | 0 | 0.00024 | 2.09 | 17.80155 | 96.9 | 10.8 | 26.8 | ± | 0.04 |
| 1400 | 2.92033 | 0.00223 | 2.84988 | 0.01271 | 2.90763 | 1.35905 | 0.00119 | 0 | 0.031 | 0.0002 | 0.00001 | 0.0002 | 2.1 | 21.92016 | 97.59 | 12.1 | 26.8 | ± | 0.04 |
| 1450 | 3.67273 | 0.00079 | 3.59458 | 0.01597 | 3.65676 | 1.70793 | 0.00044 | 0.00016 | 0.03463 | 0.00022 | 0.00001 | 0.00021 | 2.1 | 24.65969 | 97.87 | 15.2 | 26.9 | ± | 0.04 |
| 1500 | 3.87926 | 0.00079 | 3.808 | 0.01689 | 3.86238 | 1.80618 | 0.00152 | 0 | 0.02598 | 0.00019 | 0.00002 | 0.00018 | 2.11 | 34.76097 | 98.16 | 16.1 | 27 | ± | 0.06 |
| 1550 | 3.35293 | 0.00221 | 3.25073 | 0.01437 | 3.33856 | 1.53686 | 0.0012 | 0 | 0.02196 | 0.0003 | 0.00001 | 0.0003 | 2.12 | 34.99226 | 96.95 | 13.7 | 27.1 | ± | 0.04 |
| 1600 | 1.38965 | 0.00108 | 1.33658 | 0.00586 | 1.38379 | 0.62659 | 0.00049 | 0 | 0.01131 | 0.00016 | 0.00001 | 0.00016 | 2.13 | 27.70071 | 96.18 | 5.6 | 27.3 | ± | 0.08 |
| 1650 | 0.25593 | 0.00009 | 0.21388 | 0.00095 | 0.25498 | 0.10201 | 0.00004 | 0.00002 | 0.00607 | 0.00014 | 0 | 0.00014 | 2.1 | 8.4028 | 83.57 | 0.9 | 26.8 | ± | 0.09 |
| $^{40}Ar/^{36}Ar$ measured atmosphere: 298.9 | | | | | | | | | | | | | | | | | | | |
| J-value and its error: 0.007148±0.1% | | | | | | | | | | | | | | | | | | | |
| **Plateau date: 26.83±0.07 Ma on steps: 4 to 9 containing 60.4%** $^{39}Ar_k$ | | | | | | | | | | | | | | | | | | | |
| Total-gas date: 26.99±0.06 Ma | | | | | | | | | | | | | | | | | | | |

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-646/12/DD57** | | | **BIOTITE** | | **Wt.=57.5 mg** | | | | | | | | | | | | | | |
| 800 | 0.40587 | 0.00003 | 0.01903 | 0.00028 | 0.40559 | 0.03013 | 0.00001 | 0.0009 | 0.00256 | 0.00131 | 0.00001 | 0.00131 | 0.63 | 5.88477 | 4.69 | 0.4 | 8.3 | ± | 0.83 |
| 900 | 0.26992 | 0.00032 | 0.05785 | 0.00042 | 0.2695 | 0.04534 | 0.00005 | 0.00175 | 0.00295 | 0.00072 | 0.00001 | 0.00072 | 1.28 | 7.68475 | 21.43 | 0.6 | 16.7 | ± | 0.96 |
| 1000 | 0.32958 | 0.00021 | 0.11267 | 0.00052 | 0.32906 | 0.0555 | 0 | 0.00219 | 0.00425 | 0.00073 | 0.00003 | 0.00073 | 2.03 | 6.52941 | 34.19 | 0.7 | 26.4 | ± | 2.32 |
| 1100 | 1.58804 | 0.00184 | 0.79266 | 0.00345 | 1.58459 | 0.36932 | 0.0004 | 0.01332 | 0.00391 | 0.00269 | 0 | 0.00268 | 2.15 | 47.22762 | 49.91 | 4.8 | 27.9 | ± | 0.04 |
| 1200 | 1.57215 | 0.00148 | 1.37393 | 0.00607 | 1.56608 | 0.64972 | 0.00076 | 0.02151 | 0.00477 | 0.00066 | 0.00001 | 0.00065 | 2.11 | 68.10482 | 87.39 | 8.4 | 27.5 | ± | 0.07 |
| 1250 | 0.86547 | 0.00088 | 0.77547 | 0.00344 | 0.86203 | 0.36764 | 0.00039 | 0.01194 | 0.00271 | 0.0003 | 0.00001 | 0.00029 | 2.11 | 67.83026 | 89.6 | 4.7 | 27.5 | ± | 0.08 |
| 1300 | 1.09798 | 0.00066 | 0.98456 | 0.0044 | 1.09357 | 0.47109 | 0.00022 | 0.01546 | 0.00327 | 0.00037 | 0.00001 | 0.00037 | 2.09 | 72.03211 | 89.67 | 6.1 | 27.2 | ± | 0.05 |
| 1350 | 2.30395 | 0.00019 | 2.07681 | 0.0093 | 2.29465 | 0.9949 | 0.00035 | 0.03346 | 0.01181 | 0.00075 | 0 | 0.00074 | 2.09 | 42.12108 | 90.14 | 12.8 | 27.2 | ± | 0.04 |
| **1400** | **3.73285** | **0.00294** | **3.36739** | **0.0152** | **3.71765** | **1.6253** | **0.00091** | **0.05768** | **0.04464** | **0.00122** | **0.00003** | **0.00119** | 2.07 | 18.20453 | **90.21** | **21** | **27** | ± | **0.07** |
| **1450** | **4.96515** | **0.00055** | **4.5054** | **0.02038** | **4.94477** | **2.18006** | **0.00031** | **0.07006** | **0.03027** | **0.00152** | **0.00001** | **0.00149** | 2.07 | 36.01024 | **90.74** | **28.1** | **26.9** | ± | **0.04** |
| **1550** | **2.21167** | **0.0013** | **2.0002** | **0.00904** | **2.20263** | **0.96683** | **0.00024** | **0.02967** | **0.04061** | **0.00071** | **0.00002** | **0.00069** | 2.07 | 11.90384 | **90.44** | **12.5** | **26.9** | ± | **0.1** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00727±0.1%
**Plateau date: 26.93±0.07 Ma on steps: 9 to 11 containing 61.5% $^{39}Ar_k$**
Total-gas date: 26.96±0.09 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-TP-646/13/DD57** | | | **SANIDINE** | | **Wt.=61.7 mg** | | | | | | | | | | | | | | |
| 900 | 0.37763 | 0.00047 | 0.05882 | 0.00026 | 0.37738 | 0.02764 | 0.00004 | 0.0004 | 0.00187 | 0.00108 | 0.00001 | 0.00108 | 2.13 | 7.39037 | 15.58 | 0.3 | 27.8 | ± | 0.7 |
| 1000 | 0.9458 | 0.00038 | 0.29852 | 0.00129 | 0.94452 | 0.13744 | 0.00006 | 0.00026 | 0.00417 | 0.00219 | 0.00002 | 0.00219 | 2.17 | 16.47962 | 31.56 | 1.3 | 28.3 | ± | 0.53 |
| 1100 | 1.05824 | 0.00067 | 0.71364 | 0.00316 | 1.05508 | 0.33756 | 0.00027 | 0.00007 | 0.00553 | 0.00116 | 0 | 0.00116 | 2.11 | 30.5208 | 67.44 | 3.1 | 27.6 | ± | 0.04 |
| **1200** | **1.84372** | **0.00236** | **1.49873** | **0.00678** | **1.83694** | **0.72527** | **0.00071** | **0.00008** | **0.00925** | **0.00115** | **0.00001** | **0.00114** | **2.07** | **39.20378** | **81.29** | **6.8** | **27** | ± | **0.07** |
| **1250** | **1.73986** | **0.00159** | **1.49649** | **0.00681** | **1.73305** | **0.72827** | **0.00072** | **0.00001** | **0.00812** | **0.0008** | **0.00001** | **0.0008** | 2.05 | 44.84421 | **86.01** | **6.8** | **26.8** | ± | **0.04** |
| **1300** | **2.15807** | **0.00058** | **1.98675** | **0.00901** | **2.14906** | **0.96372** | **0.00063** | **0.00002** | **0.01041** | **0.00055** | **0.00002** | **0.00055** | 2.06 | 46.28818 | **92.06** | **9** | **26.9** | ± | **0.08** |
| **1350** | **2.54889** | **0.00075** | **2.41301** | **0.01094** | **2.53795** | **1.1705** | **0.00662** | **0.00005** | **0.01286** | **0.00043** | **0** | **0.00042** | 2.06 | 45.50933 | **94.67** | **10.9** | **26.9** | ± | **0.15** |
| **1400** | **2.90457** | **0.00035** | **2.79301** | **0.01267** | **2.8919** | **1.35497** | **0.00004** | **0.00002** | **0.01284** | **0.00034** | **0** | **0.00033** | 2.06 | 52.76363 | **96.16** | **12.6** | **26.9** | ± | **0.04** |
| **1450** | **3.50811** | **0.00349** | **3.38045** | **0.01534** | **3.49278** | **1.64018** | **0.00092** | **0** | **0.01524** | **0.00038** | **0.00001** | **0.00038** | 2.06 | 53.81168 | **96.36** | **15.3** | **26.9** | ± | **0.04** |
| 1500 | 4.29756 | 0.00036 | 4.17341 | 0.01882 | 4.27874 | 2.01263 | 0.00039 | 0.00007 | 0.01821 | 0.00036 | 0.00001 | 0.00036 | 2.07 | 55.26167 | 97.11 | 18.7 | 27.1 | ± | 0.04 |
| 1600 | 3.54299 | 0.00102 | 3.40393 | 0.01539 | 3.5276 | 1.64571 | 0.00092 | 0 | 0.01649 | 0.00042 | 0.00001 | 0.00042 | 2.07 | 49.90024 | 96.08 | 15.3 | 27 | ± | 0.05 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007291±0.1%
**Plateau date: 26.90±0.07 Ma on steps: 5 to 9 containing 61.3% $^{39}Ar_k$**
Total-gas date: 27±0.07 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-TP-659/14/DD57** | | | **BIOTITE** | | **Wt.=49.5 mg** | | | | | | | | | | | | | | |
| 800 | 0.27445 | 0.00005 | 0.04222 | 0.00048 | 0.27397 | 0.05133 | 0.00005 | 0.00105 | 0.00174 | 0.00079 | 0.00002 | 0.00078 | 0.82 | 14.75 | 15.38 | 0.8 | 10.8 | ± | 1.74 |
| 900 | 0.22278 | 0.00007 | 0.06451 | 0.00045 | 0.22233 | 0.04786 | 0.00005 | 0.00107 | 0.00106 | 0.00053 | 0 | 0.00053 | 1.35 | 22.57547 | 28.96 | 0.8 | 17.7 | ± | 0.39 |
| 1000 | 1.04545 | 0.00094 | 0.27888 | 0.00144 | 1.04401 | 0.15417 | 0.00006 | 0.00409 | 0.00342 | 0.00259 | 0 | 0.00259 | 1.81 | 22.53947 | 26.68 | 2.4 | 23.7 | ± | 0.04 |
| **1100** | **1.25281** | **0.00099** | **0.93506** | **0.00461** | **1.2482** | **0.49254** | **0.00051** | **0.01245** | **0.00376** | **0.00106** | **0** | **0.00106** | 1.9 | 65.49734 | **74.64** | **7.8** | **24.9** | ± | **0.05** |
| **1200** | **2.11822** | **0.00035** | **1.85101** | **0.00905** | **2.10917** | **0.96845** | **0.00115** | **0.02351** | **0.00364** | **0.00088** | **0** | **0.00087** | 1.91 | 133.02885 | **87.39** | **15.3** | **25** | ± | **0.04** |
| **1250** | **1.74012** | **0.00127** | **1.51346** | **0.00744** | **1.73268** | **0.79607** | **0.00094** | **0.01901** | **0.00168** | **0.00075** | **0** | **0.00074** | 1.9 | 236.9256 | **86.97** | **12.6** | **24.9** | ± | **0.04** |
| **1300** | **1.82143** | **0.00184** | **1.50136** | **0.00739** | **1.81404** | **0.79003** | **0.00066** | **0.01875** | **0.0065** | **0.00107** | **0.00001** | **0.00106** | 1.9 | 60.77154 | **82.43** | **12.5** | **24.9** | ± | **0.06** |
| **1350** | **1.99129** | **0.0007** | **1.55762** | **0.00765** | **1.98364** | **0.81852** | **0.00098** | **0.02029** | **0.0433** | **0.00146** | **0.00001** | **0.00144** | 1.9 | 9.45173 | **78.22** | **12.9** | **24.9** | ± | **0.07** |
| **1400** | **2.05022** | **0.0018** | **1.60274** | **0.00788** | **2.04234** | **0.84306** | **0.00066** | **0.02047** | **0.02931** | **0.0015** | **0.00001** | **0.00149** | 1.9 | 14.38178 | **78.17** | **13.3** | **24.9** | ± | **0.04** |
| **1550** | **3.22282** | **0.00021** | **2.60405** | **0.01281** | **3.21001** | **1.36978** | **0.00001** | **0.03254** | **0.02548** | **0.00207** | **0.00001** | **0.00205** | 1.9 | 26.87951 | **80.8** | **21.6** | **24.9** | ± | **0.04** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007305±0.1%
**Plateau date: 24.92±0.05 Ma on steps: 4 to 10 containing 96.0% $^{39}Ar_k$**
Total-gas date: 24.7±0.08 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-TP-659/16/57/DD57** | | | **HORNBLENDE** | | **Wt.=226.4 mg** | | | | | | | | | | | | | |
| 900 | 0.36487 | 0.00055 | 0.03629 | 0.00015 | 0.36472 | 0.01644 | 0.00001 | 0.00039 | 0.01424 | 0.00112 | 0.00001 | 0.00111 | 2.21 | 0.57725 | 10 | 0.8 | 28.9 | ± 2 |
| 1000 | 0.31574 | 0.00041 | 0.04734 | 0.00014 | 0.3156 | 0.01508 | 0.00002 | 0.0002 | 0.0089 | 0.00091 | 0.00002 | 0.00091 | 3.14 | 0.84719 | 15 | 0.8 | 40.9 | ± 5.55 |
| 1100 | 0.43337 | 0.00078 | 0.05158 | 0.00022 | 0.43315 | 0.02327 | 0.00001 | 0.00058 | 0.01494 | 0.0013 | 0.00001 | 0.00129 | 2.22 | 0.77878 | 11.9 | 1.2 | 29 | ± 0.54 |
| 1200 | 0.15006 | 0 | 0.02918 | 0.00016 | 0.1499 | 0.01687 | 0.00002 | 0.00095 | 0.02221 | 0.00041 | 0.00001 | 0.00041 | 1.73 | 0.37978 | 19.5 | 0.8 | 22.7 | ± 1.54 |
| 1250 | 0.11556 | 0.00007 | 0.02714 | 0.00011 | 0.11545 | 0.01161 | 0.00002 | 0.00099 | 0.0362 | 0.00031 | 0.00001 | 0.0003 | 2.34 | 0.16036 | 23.5 | 0.6 | 30.6 | ± 2.14 |
| 1300 | 0.10637 | 0.00016 | 0.01042 | 0.00009 | 0.10628 | 0.01 | 0.00001 | 0.00137 | 0.08968 | 0.00035 | 0 | 0.00032 | 1.04 | 0.05575 | 9.8 | 0.5 | 13.7 | ± 0.37 |
| 1350 | 0.27254 | 0.00019 | 0.12516 | 0.00058 | 0.27197 | 0.06168 | 0.00002 | 0.01061 | 0.46804 | 0.00063 | 0.00001 | 0.0005 | 2.03 | 0.06589 | 45.9 | 3.1 | 26.6 | ± 0.89 |
| **1375** | **0.36529** | **0.00018** | **0.19851** | **0.00098** | **0.36432** | **0.10439** | **0.00007** | **0.02027** | **0.7619** | **0.00077** | **0.00001** | **0.00056** | 1.9 | 0.06851 | **54.3** | **5.2** | **24.9** | **± 0.31** |
| **1425** | **1.88539** | **0.00155** | **1.40325** | **0.00692** | **1.87848** | **0.73961** | **0.00079** | **0.13696** | **5.20595** | **0.00306** | **0** | **0.00161** | 1.9 | 0.07104 | **74.4** | **36.9** | **24.8** | **± 0.04** |
| **1450** | **1.6355** | **0.00085** | **1.31542** | **0.00643** | **1.62907** | **0.6877** | **0.00001** | **0.10152** | **4.49257** | **0.00231** | **0** | **0.00106** | 1.91 | 0.07654 | **80.4** | **34.3** | **25** | **± 0.04** |
| 1600 | 0.87496 | 0.00003 | 0.60801 | 0.00295 | 0.87201 | 0.31568 | 0.0002 | 0.0509 | 2.27421 | 0.00152 | 0.00001 | 0.00089 | 1.93 | 0.0694 | 69.5 | 15.8 | 25.2 | ± 0.12 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007308±0.1%
**Plateau date: 24.92±0.18 Ma on steps: 8 to 10 containing 76.4% $^{39}Ar_k$**
Total-gas date: 25.19±0.16 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-TP-659/15/DD57** | | | **SANIDINE** | | **Wt.=59.9 mg** | | | | | | | | | | | | | |
| 900 | 0.13283 | 0.00012 | 0.01563 | 0.00009 | 0.13275 | 0.00922 | 0 | 0.00052 | 0.00091 | 0.0004 | 0.00001 | 0.0004 | 1.7 | 5.06593 | 11.77 | 0.1 | 22.2 | ± 5.27 |
| 1000 | 0.5649 | 0.00053 | 0.23541 | 0.0011 | 0.5638 | 0.11762 | 0.00001 | 0.00168 | 0.00932 | 0.00111 | 0.00001 | 0.00111 | 2 | 6.31009 | 41.67 | 1.3 | 26.2 | ± 0.2 |
| **1100** | **1.04117** | **0.00145** | **0.55923** | **0.00273** | **1.03845** | **0.29149** | **0.00045** | **0.00108** | **0.01126** | **0.00163** | **0.00001** | **0.00162** | 1.92 | 12.94361 | **53.71** | **3.1** | **25.1** | **± 0.07** |
| **1200** | **1.66203** | **0.00156** | **1.39922** | **0.00687** | **1.65516** | **0.73452** | **0.00079** | **0.00101** | **0.02279** | **0.00087** | **0.00001** | **0.00087** | 1.9 | 16.11496 | **84.19** | **7.9** | **25** | **± 0.06** |
| **1250** | **1.41771** | **0.00038** | **1.2946** | **0.00634** | **1.41136** | **0.67847** | **0.00008** | **0.00051** | **0.01664** | **0.0004** | **0.00002** | **0.0004** | 1.91 | 20.38672 | **91.32** | **7.3** | **25** | **± 0.11** |
| **1300** | **1.79113** | **0.00194** | **1.68665** | **0.00826** | **1.78287** | **0.88392** | **0.00064** | **0.00061** | **0.01689** | **0.00033** | **0.00003** | **0.00033** | 1.91 | 26.16696 | **94.17** | **9.5** | **25** | **± 0.15** |
| **1350** | **2.46997** | **0.00031** | **2.35623** | **0.01147** | **2.4585** | **1.22674** | **0.00057** | **0.00083** | **0.02084** | **0.00035** | **0** | **0.00035** | 1.92 | 29.43234 | **95.4** | **13.2** | **25.2** | **± 0.03** |
| **1400** | **2.24338** | **0.00174** | **2.14731** | **0.01038** | **2.233** | **1.1102** | **0.00163** | **0.00073** | **0.01623** | **0.00029** | **0.00002** | **0.00029** | 1.93 | 34.20209 | **95.72** | **11.9** | **25.3** | **± 0.09** |
| 1450 | 2.68734 | 0.00197 | 2.60429 | 0.01218 | 2.67515 | 1.30285 | 0.001 | 0.00046 | 0.01597 | 0.00024 | 0.00001 | 0.00024 | 2 | 40.79054 | 96.91 | 14 | 26.2 | ± 0.04 |
| 1500 | 3.17757 | 0.00104 | 3.07745 | 0.0134 | 3.16417 | 1.43278 | 0.00036 | 0.00013 | 0.01771 | 0.0003 | 0.00003 | 0.00029 | 2.15 | 40.45116 | 96.85 | 15.4 | 28.1 | ± 0.08 |
| 1550 | 3.33051 | 0.00176 | 3.20014 | 0.01146 | 3.31905 | 1.22592 | 0.00083 | 0.00006 | 0.01267 | 0.00041 | 0.00001 | 0.0004 | 2.61 | 48.37885 | 96.09 | 13.2 | 34.1 | ± 0.04 |
| 1600 | 1.15792 | 0.0004 | 1.03361 | 0.0027 | 1.15521 | 0.28905 | 0.00031 | 0.00003 | 0.00472 | 0.00041 | 0.00001 | 0.00041 | 3.58 | 30.6197 | 89.26 | 3.1 | 46.6 | ± 0.11 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007313±0.1%
**Plateau date: 25.21±0.11 Ma on steps: 3 to 8 containing 52.9% $^{39}Ar_k$**
Total-gas date: 27.6±0.08 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: RH-TP-672/18/57/DD57** | | | **HORNBLENDE** | | **Wt.=191.1 mg** | | | | | | | | | | | | | |
| 1050 | 0.55278 | 0.00083 | 0.02949 | 0.0001 | 0.55268 | 0.01111 | 0.00002 | 0.00058 | 0.01696 | 0.00178 | 0.00001 | 0.00177 | 2.65 | 0.32754 | 5.33 | 0.42 | 33.05 | ± 2.98 |
| 1275 | 0.28868 | 0.00016 | 0.08845 | 0.0003 | 0.28837 | 0.03236 | 0.00005 | 0.00503 | 0.14807 | 0.00072 | 0.00001 | 0.00068 | 2.73 | 0.10927 | 30.64 | 1.24 | 34.02 | ± 1.06 |
| 1325 | 0.61433 | 0.00018 | 0.33752 | 0.0013 | 0.61303 | 0.13887 | 0.00012 | 0.03011 | 0.68488 | 0.00113 | 0.00001 | 0.00093 | 2.43 | 0.10138 | 54.94 | 5.31 | 30.28 | ± 0.23 |
| **1350** | **0.82904** | **0.00039** | **0.57809** | **0.00227** | **0.82677** | **0.24309** | **0.00016** | **0.05345** | **1.16654** | **0.00118** | **0.00001** | **0.00084** | **2.38** | **0.10419** | **69.73** | **9.29** | **29.64** | **± 0.17** |
| **1375** | **1.01807** | **0.00076** | **0.79497** | **0.00312** | **1.01495** | **0.33373** | **0.00034** | **0.07204** | **1.62694** | **0.00121** | **0.00001** | **0.00074** | **2.38** | **0.10256** | **78.09** | **12.75** | **29.69** | **± 0.16** |
| **1400** | **1.6441** | **0.00077** | **1.38112** | **0.00542** | **1.63868** | **0.57937** | **0.00062** | **0.11124** | **2.7932** | **0.00167** | **0.00001** | **0.00087** | **2.38** | **0.10371** | **84** | **22.14** | **29.71** | **± 0.08** |
| **1425** | **0.84441** | **0.00028** | **0.64281** | **0.00252** | **0.84188** | **0.26998** | **0.00014** | **0.04666** | **1.31974** | **0.00105** | **0.00001** | **0.00067** | **2.38** | **0.10229** | **76.13** | **10.32** | **29.67** | **± 0.13** |
| **1450** | **1.03596** | **0.00044** | **0.8314** | **0.00325** | **1.03272** | **0.34747** | **0.00028** | **0.06582** | **1.766** | **0.00118** | **0.00001** | **0.00068** | **2.39** | **0.09838** | **80.25** | **13.28** | **29.82** | **± 0.08** |
| **1500** | **1.24925** | **0.00141** | **1.03249** | **0.00406** | **1.24519** | **0.43374** | **0.0011** | **0.08105** | **2.17744** | **0.00134** | **0.00001** | **0.00072** | **2.38** | **0.0996** | **82.65** | **16.57** | **29.66** | **± 0.11** |
| 1550 | 0.57742 | 0.00012 | 0.42851 | 0.00169 | 0.57573 | 0.18102 | 0.00012 | 0.03389 | 0.91164 | 0.00076 | 0.00001 | 0.0005 | 2.37 | 0.09928 | 74.21 | 6.92 | 29.5 | ± 0.23 |
| 1600 | 0.25026 | 0.00007 | 0.10796 | 0.00043 | 0.24982 | 0.04622 | 0.00005 | 0.00861 | 0.23272 | 0.00055 | 0 | 0.00048 | 2.34 | 0.0993 | 43.14 | 1.77 | 29.11 | ± 0.35 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.006965±0.1%
**Plateau date: 29.70±0.12 Ma on steps: 4 to 9 containing 84.35% $^{39}Ar_k$**
Total-gas date: 29.77±0.15 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample: RH-TP-672/17/DD57 | | | SANIDINE | | Wt.=59.7 mg | | | | | | | | | | | | | |
| 900 | 0.15101 | 0.00181 | 0.03239 | 0.00012 | 0.15089 | 0.01256 | 0.00023 | 0.00033 | 0.00339 | 0.0004 | 0.00001 | 0.0004 | 2.58 | 1.85251 | 21.45 | 0.14 | 32.66 | ± 2.41 |
| 1000 | 0.65471 | 0.00039 | 0.22741 | 0.00088 | 0.65383 | 0.09443 | 0.00002 | 0.0002 | 0.00646 | 0.00144 | 0.00001 | 0.00144 | 2.41 | 7.308824 | 34.73 | 1.02 | 29.58 | ± 0.34 |
| 1100 | 1.04862 | 0.00012 | 0.92212 | 0.00351 | 1.0451 | 0.37566 | 0.00014 | 0.00003 | 0.01716 | 0.00042 | 0.00001 | 0.00042 | 2.45 | 10.9458 | 87.94 | 4.07 | 30.14 | ± 0.1 |
| **1200** | **1.86798** | **0.00192** | **1.76599** | **0.00681** | **1.86117** | **0.72818** | **0.00128** | **0.00018** | **0.02279** | **0.00033** | **0.00001** | **0.00032** | **2.43** | **15.97587** | **94.54** | **7.88** | **29.78** | **± 0.08** |
| **1250** | **2.10969** | **0.00149** | **1.99083** | **0.00766** | **2.10203** | **0.81953** | **0.00118** | **0.00006** | **0.02166** | **0.00038** | **0.00001** | **0.00038** | **2.43** | **18.91805** | **94.37** | **8.87** | **29.83** | **± 0.09** |
| **1300** | **2.56644** | **0.00104** | **2.46314** | **0.0095** | **2.55695** | **1.01553** | **0.00048** | **0.00011** | **0.02104** | **0.00032** | **0.00001** | **0.00032** | **2.43** | **24.13332** | **95.97** | **10.99** | **29.79** | **± 0.05** |
| **1350** | **2.80392** | **0.00149** | **2.71019** | **0.01045** | **2.79346** | **1.11797** | **0.0007** | **0.00008** | **0.0177** | **0.00029** | **0.00001** | **0.00028** | **2.42** | **31.58107** | **96.66** | **12.1** | **29.77** | **± 0.05** |
| **1400** | **2.68215** | **0.00105** | **2.59338** | **0.00997** | **2.67219** | **1.06592** | **0.00064** | **0.00008** | **0.0166** | **0.00027** | **0.00001** | **0.00027** | **2.43** | **32.10602** | **96.69** | **11.54** | **29.88** | **± 0.05** |
| **1450** | **3.04226** | **0.00007** | **2.94138** | **0.01131** | **3.03095** | **1.20933** | **0.00064** | **0.00007** | **0.01369** | **0.00031** | **0.00001** | **0.0003** | **2.43** | **44.16837** | **96.68** | **13.09** | **29.87** | **± 0.05** |
| **1500** | **3.306** | **0.00045** | **3.20853** | **0.01228** | **3.29372** | **1.31362** | **0.00039** | **0.00003** | **0.01524** | **0.00029** | **0.00002** | **0.00029** | **2.44** | **43.09777** | **97.05** | **14.22** | **29.99** | **± 0.07** |
| **1550** | **3.1831** | **0.00057** | **3.08726** | **0.01184** | **3.17126** | **1.26675** | **0.00046** | **0.00005** | **0.01384** | **0.00029** | **0.00002** | **0.00028** | **2.44** | **45.76409** | **96.99** | **13.71** | **29.93** | **± 0.06** |
| **1600** | **0.62881** | **0.00012** | **0.53304** | **0.00205** | **0.62676** | **0.21884** | **0.00018** | **0.00001** | **0.00616** | **0.00032** | **0.00001** | **0.00032** | **2.44** | **17.76299** | **84.77** | **2.37** | **29.91** | **± 0.13** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.006864±0.1%
**Plateau date: 29.87±0.07 Ma on steps: 4 to 12 containing 94.78% $^{39}Ar_k$**
Total-gas date: 29.88±0.07 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample: DRS-85-10/43/DD58 | | | SANIDINE | | Wt.=81.7 mg | | | | | | | | | | | | | |
| 900 | 0.27875 | 0.00016 | 0.03921 | 0.00015 | 0.2786 | 0.01599 | 0.00002 | 0.00019 | 0.00049 | 0.00082 | 0.00001 | 0.00082 | 2.45 | 16.31633 | 14.1 | 0.1 | 30.7 | ± 1.41 |
| 1000 | 1.0484 | 0.00077 | 0.48348 | 0.00223 | 1.04617 | 0.23864 | 0.00022 | 0.00016 | 0.00436 | 0.00192 | 0 | 0.00192 | 2.03 | 27.36697 | 46.1 | 1.4 | 26.4 | ± 0.05 |
| 1100 | 1.5218 | 0.00078 | 1.39408 | 0.0065 | 1.5153 | 0.69513 | 0.00032 | 0.00002 | 0.01 | 0.00042 | 0.00002 | 0.00041 | 2.01 | 34.7565 | 91.6 | 4.1 | 26.4 | ± 0.12 |
| 1200 | 2.57081 | 0.00154 | 2.45082 | 0.01135 | 2.55946 | 1.21384 | 0.00039 | 0.00008 | 0.01702 | 0.00038 | 0.00001 | 0.00037 | 2.02 | 35.65922 | 95.4 | 7.1 | 26.6 | ± 0.04 |
| 1250 | 2.79677 | 0.00161 | 2.65289 | 0.01228 | 2.78449 | 1.31349 | 0.00061 | 0.00011 | 0.01293 | 0.00045 | 0.00001 | 0.00045 | 2.02 | 50.79234 | 94.9 | 7.7 | 26.6 | ± 0.04 |
| **1300** | **3.68023** | **0.00089** | **3.57661** | **0.01648** | **3.66375** | **1.76272** | **0.00127** | **0.00018** | **0.01784** | **0.0003** | **0.00001** | **0.0003** | 2.03 | 49.40359 | **97.2** | **10.4** | **26.7** | **± 0.04** |
| **1350** | **3.80941** | **0.00029** | **3.72037** | **0.01708** | **3.79233** | **1.82621** | **0.00028** | **0.00031** | **0.01751** | **0.00025** | **0.00001** | **0.00025** | 2.04 | 52.14763 | **97.7** | **10.7** | **26.8** | **± 0.04** |
| **1400** | **4.23108** | **0.00284** | **4.13235** | **0.01901** | **4.21207** | **2.03317** | **0.00013** | **0.00027** | **0.02028** | **0.00028** | **0.00001** | **0.00027** | 2.03 | 50.12747 | **97.7** | **12** | **26.7** | **± 0.04** |
| **1450** | **5.91141** | **0.00045** | **5.77116** | **0.02647** | **5.88494** | **2.83122** | **0.00007** | **0.00018** | **0.02681** | **0.0004** | **0.00001** | **0.00039** | 2.04 | 52.80157 | **97.7** | **16.6** | **26.8** | **± 0.04** |
| 1500 | 7.77669 | 0.00227 | 7.59204 | 0.03464 | 7.74205 | 3.7046 | 0.00147 | 0.00029 | 0.03762 | 0.00052 | 0.00001 | 0.00051 | 2.05 | 49.23711 | 97.7 | 21.8 | 27 | ± 0.04 |
| 1600 | 2.98631 | 0.00143 | 2.87178 | 0.01228 | 2.97403 | 1.3774 | 0.00065 | 0.00013 | 0.01441 | 0.00035 | 0.00002 | 0.00035 | 2.08 | 47.7932 | 96.2 | 8.1 | 27.4 | ± 0.05 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00736±0.1%
**Preferred date: 26.78±0.05 Ma on steps: 6 to 9 containing 49.7% $^{39}Ar_k$**
Total-gas date: 26.82±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample: DRS-85-27/46/DD58 | | | BIOTITE | | Wt.=43.9 mg | | | | | | | | | | | | | |
| 800 | 0.47403 | 0.00044 | 0.0777 | 0.00045 | 0.47358 | 0.04783 | 0.00006 | 0.00095 | 0.00329 | 0.00135 | 0.00001 | 0.00135 | 1.62 | 7.269 | 16.4 | 0.7 | 19.8 | ± 0.79 |
| 900 | 0.64718 | 0.00043 | 0.15698 | 0.00087 | 0.64631 | 0.09295 | 0.00009 | 0.00196 | 0.00734 | 0.00167 | 0.00001 | 0.00167 | 1.69 | 6.33174 | 24.3 | 1.4 | 20.9 | ± 0.4 |
| 1000 | 1.29919 | 0.001 | 0.25281 | 0.00119 | 1.298 | 0.12707 | 0.00009 | 0.0029 | 0.00437 | 0.00357 | 0.00001 | 0.00357 | 1.99 | 14.5389 | 19.5 | 1.9 | 24.4 | ± 0.19 |
| 1100 | 1.45362 | 0.00062 | 0.98325 | 0.00427 | 1.44935 | 0.45637 | 0.00019 | 0.01028 | 0.00692 | 0.0016 | 0.00001 | 0.00159 | 2.15 | 32.97471 | 67.6 | 6.7 | 27.3 | ± 0.06 |
| 1200 | 1.57523 | 0.00108 | 1.12597 | 0.00481 | 1.57042 | 0.51484 | 0.00033 | 0.01157 | 0.00925 | 0.00152 | 0.00001 | 0.00152 | 2.19 | 27.82919 | 71.5 | 7.6 | 27.7 | ± 0.09 |
| **1250** | **1.68248** | **0.00056** | **1.24389** | **0.00535** | **1.67713** | **0.57272** | **0.00036** | **0.01285** | **0.00955** | **0.00149** | **0.00001** | **0.00148** | 2.17 | 29.98534 | **73.8** | **8.4** | **27.5** | **± 0.06** |
| **1300** | **2.63964** | **0.00071** | **2.10952** | **0.00912** | **2.63052** | **0.97579** | **0.00004** | **0.02204** | **0.0119** | **0.00179** | **0.00001** | **0.00178** | 2.16 | 40.99958 | **79.8** | **14.3** | **27.4** | **± 0.04** |
| **1350** | **2.73165** | **0.00143** | **2.26098** | **0.00979** | **2.72186** | **1.04695** | **0.00065** | **0.02402** | **0.04104** | **0.00159** | **0.00001** | **0.00157** | 2.16 | 12.75524 | **82.7** | **15.4** | **27.4** | **± 0.04** |
| **1400** | **3.90215** | **0.0016** | **3.39939** | **0.0148** | **3.88735** | **1.5825** | **0.00088** | **0.03613** | **0.0426** | **0.00169** | **0.00001** | **0.00166** | 2.15 | 18.57394 | **87.1** | **23.2** | **27.3** | **± 0.04** |
| **1500** | **3.40459** | **0.00024** | **3.01169** | **0.01308** | **3.39151** | **1.3991** | **0.00027** | **0.03497** | **0.13379** | **0.00134** | **0.00001** | **0.0013** | 2.15 | 5.22872 | **88.4** | **20.5** | **27.3** | **± 0.04** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007103±0.1%
**Plateau date: 27.36±0.05 Ma on steps: 6 to 10 containing 81.8% $^{39}Ar_k$**
Total-gas date: 27.16±0.06 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar±$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar±$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar±$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-27/45/DD58** | | | **AMPHIBOLE** | | **Wt.=207.7 mg** | | | | | | | | | | | | | |
| 900 | 0.32449 | 0.0003 | 0.06194 | 0.00044 | 0.32405 | 0.04729 | 0.00005 | 0.00173 | 0.01429 | 0.0009 | 0.00001 | 0.00089 | 1.31 | 1.65465 | 19.1 | 1.4 | 16.3 | ± 0.42 |
| 1000 | 0.71247 | 0.00058 | 0.07131 | 0.00036 | 0.71211 | 0.04739 | 0.00002 | 0.00152 | 0.0209 | 0.00219 | 0.00001 | 0.00219 | 1.5 | 1.13373 | 10 | 1.1 | 22.4 | ± 1.25 |
| 1100 | 0.16085 | 0.00012 | 0.03283 | 0.00018 | 0.16067 | 0.01974 | 0.00001 | 0.00099 | 0.01742 | 0.00044 | 0.00001 | 0.00044 | 1.66 | 0.56659 | 20.4 | 0.6 | 20.8 | ± 2.64 |
| 1200 | 0.13919 | 0.00005 | 0.0318 | 0.00017 | 0.13902 | 0.01766 | 0 | 0.00167 | 0.03294 | 0.00038 | 0.00001 | 0.00037 | 1.8 | 0.26806 | 22.8 | 0.5 | 22.6 | ± 3.24 |
| 1250 | 0.23633 | 0.00015 | 0.08239 | 0.00045 | 0.23588 | 0.04853 | 0.00005 | 0.00727 | 0.17028 | 0.00057 | 0.00001 | 0.00052 | 1.7 | 0.1425 | 34.9 | 1.4 | 21.5 | ± 1.13 |
| 1300 | 0.53394 | 0.00017 | 0.29381 | 0.00149 | 0.53245 | 0.15941 | 0.00006 | 0.03073 | 0.80411 | 0.00105 | 0.00001 | 0.00082 | 1.84 | 0.09912 | 55 | 4.6 | 23.5 | ± 0.18 |
| 1325 | 0.50758 | 0.00027 | 0.36525 | 0.00178 | 0.5058 | 0.19052 | 0.0001 | 0.03973 | 1.05409 | 0.00078 | 0.00001 | 0.00048 | 1.92 | 0.09037 | 72 | 5.4 | 24.6 | ± 0.17 |
| 1350 | 1.12114 | 0.00048 | 0.94605 | 0.00451 | 1.11663 | 0.4823 | 0.00021 | 0.09987 | 2.75031 | 0.00137 | 0.00002 | 0.00059 | 1.96 | 0.08768 | 84.4 | 13.8 | 25.2 | ± 0.15 |
| 1375 | 1.53621 | 0.00079 | 1.39313 | 0.00662 | 1.52959 | 0.70776 | 0.00036 | 0.13644 | 4.05046 | 0.00163 | 0.00001 | 0.00047 | 1.97 | 0.08737 | 90.7 | 20.2 | 25.3 | ± 0.07 |
| 1400 | 1.4671 | 0.00097 | 1.33999 | 0.00635 | 1.46075 | 0.67887 | 0.00036 | 0.11149 | 3.86091 | 0.00151 | 0.00001 | 0.00042 | 1.97 | 0.08792 | 91.2 | 19.4 | 25.3 | ± 0.05 |
| 1450 | 1.20601 | 0.00056 | 1.06735 | 0.00504 | 1.20097 | 0.53913 | 0.00023 | 0.07429 | 3.06632 | 0.00132 | 0.00001 | 0.00046 | 1.98 | 0.08791 | 88.5 | 15.4 | 25.4 | ± 0.08 |
| 1600 | 1.31424 | 0.00035 | 1.14817 | 0.0054 | 1.30884 | 0.57739 | 0.00025 | 0.10159 | 3.51127 | 0.00155 | 0.00002 | 0.00055 | 1.99 | 0.08222 | 87.4 | 16.5 | 25.5 | ± 0.15 |
| **Sample: DRS-85-27/47/DD58** | | | **SANIDINE** | | **Wt.=68.5 mg** | | | | | | | | | | | | | |
| 900 | 0.88874 | 0.00054 | 0.47455 | 0.00246 | 0.88628 | 0.26272 | 0.00013 | 0.00555 | 0.01659 | 0.00141 | 0.00002 | 0.0014 | 1.81 | 7.91802 | 53.4 | 2 | 22.6 | ± 0.27 |
| 1000 | 2.73959 | 0.00196 | 2.08032 | 0.00975 | 2.72984 | 1.04254 | 0.00068 | 0.02754 | 0.0561 | 0.00224 | 0.00002 | 0.00222 | 2 | 9.2918 | 75.8 | 8 | 25.1 | ± 0.06 |
| 1100 | 2.29389 | 0.00115 | 2.08015 | 0.00968 | 2.28421 | 1.03515 | 0.00056 | 0.01231 | 0.04488 | 0.00071 | 0 | 0.0007 | 2.01 | 11.53242 | 90.7 | 8 | 25.3 | ± 0.04 |
| 1200 | 2.93981 | 0.00178 | 2.69911 | 0.01249 | 2.92732 | 1.33557 | 0.00089 | 0.00153 | 0.04025 | 0.00079 | 0 | 0.00078 | 2.02 | 16.59093 | 91.8 | 10.3 | 25.5 | ± 0.04 |
| 1250 | 2.84233 | 0.00164 | 2.64386 | 0.01226 | 2.83007 | 1.31092 | 0.00072 | 0.00034 | 0.03395 | 0.00064 | 0.00001 | 0.00064 | 2.02 | 19.30663 | 93 | 10.1 | 25.4 | ± 0.04 |
| 1300 | 3.28231 | 0.00159 | 3.11223 | 0.01438 | 3.26793 | 1.53831 | 0.0008 | 0.00031 | 0.02438 | 0.00054 | 0.00001 | 0.00053 | 2.02 | 31.54861 | 94.8 | 11.8 | 25.5 | ± 0.04 |
| 1350 | 3.34471 | 0.00168 | 3.18699 | 0.01475 | 3.32996 | 1.55718 | 0.00109 | 0.00031 | 0.01983 | 0.00049 | 0.00001 | 0.00049 | 2.05 | 39.26324 | 95.3 | 12.1 | 25.5 | ± 0.04 |
| 1400 | 3.42156 | 0.00132 | 3.25966 | 0.01505 | 3.40651 | 1.60934 | 0.00099 | 0.00022 | 0.01568 | 0.00051 | 0.00001 | 0.0005 | 2.03 | 51.31824 | 95.3 | 12.4 | 25.5 | ± 0.04 |
| 1450 | 3.14626 | 0.00178 | 2.98972 | 0.01381 | 3.13245 | 1.47662 | 0.00087 | 0.00016 | 0.00881 | 0.00049 | 0.00003 | 0.00049 | 2.02 | 83.80363 | 95 | 11.4 | 25.5 | ± 0.09 |
| 1500 | 2.84585 | 0.00035 | 2.67623 | 0.01238 | 2.83347 | 1.32432 | 0.00089 | 0.00007 | 0.01219 | 0.00054 | 0 | 0.00054 | 2.02 | 54.31993 | 94.1 | 10.2 | 25.5 | ± 0.04 |
| 1550 | 1.00086 | 0.00043 | 0.86488 | 0.00398 | 0.99688 | 0.4257 | 0.00014 | 0.00003 | 0.00502 | 0.00045 | 0.00001 | 0.00045 | 2.03 | 42.4004 | 86.4 | 3.3 | 25.6 | ± 0.13 |
| 1600 | 0.32709 | 0.00038 | 0.0892 | 0.00056 | 0.32653 | 0.05992 | 0.00013 | 0.00008 | 0.00363 | 0.00081 | 0.00001 | 0.00081 | 1.49 | 8.25344 | 26.7 | 0.5 | 18.4 | ± 0.64 |
| **Sample: DRS-85-48/49/DD58** | | | **BIOTITE** | | **Wt.=63.9 mg** | | | | | | | | | | | | | |
| 800 | 0.13917 | 0.00006 | 0.00424 | 0.00006 | 0.13911 | 0.0078 | 0.00004 | 0.00027 | 0.00235 | 0.00046 | 0 | 0.00046 | 0.54 | 1.65957 | 3 | 0.1 | 5.1 | ± 1.78 |
| 900 | 0.65703 | 0.00026 | 0.1867 | 0.00085 | 0.65618 | 0.09056 | 0 | 0.00122 | 0.00706 | 0.0016 | 0.00001 | 0.0016 | 2.06 | 6.4136 | 28.4 | 1 | 25.1 | ± 0.53 |
| 1000 | 1.14076 | 0.00006 | 0.44787 | 0.00196 | 1.1388 | 0.20991 | 0.00014 | 0.00359 | 0.01357 | 0.00236 | 0.00001 | 0.00236 | 2.13 | 7.73434 | 39.3 | 2.3 | 26.1 | ± 0.21 |
| 1100 | 1.40634 | 0.00066 | 1.15851 | 0.00488 | 1.40146 | 0.52222 | 0.00024 | 0.02016 | 0.01884 | 0.00084 | 0.00001 | 0.00083 | 2.22 | 13.85934 | 82.4 | 5.7 | 27.5 | ± 0.11 |
| 1200 | 2.03144 | 0.00118 | 1.83931 | 0.00785 | 2.02359 | 0.83916 | 0.00051 | 0.03668 | 0.01395 | 0.00065 | 0.00001 | 0.00063 | 2.19 | 30.07742 | 90.5 | 9.2 | 27.2 | ± 0.04 |
| 1250 | 1.64373 | 0.00085 | 1.50562 | 0.00648 | 1.63725 | 0.69285 | 0.00034 | 0.02768 | 0.00623 | 0.00046 | 0.00001 | 0.00045 | 2.17 | 55.60594 | 91.6 | 7.6 | 26.9 | ± 0.06 |
| 1300 | 2.79313 | 0.00171 | 2.57731 | 0.01109 | 2.78204 | 1.18622 | 0.00075 | 0.04593 | 0.01228 | 0.00072 | 0.00001 | 0.0007 | 2.17 | 48.29886 | 92.3 | 12.9 | 26.9 | ± 0.05 |
| 1350 | 3.1065 | 0.00119 | 2.82129 | 0.01214 | 3.09436 | 1.29883 | 0.00081 | 0.05469 | 0.01051 | 0.00096 | 0 | 0.00093 | 2.17 | 61.7902 | 90.8 | 14.2 | 26.9 | ± 0.04 |
| 1400 | 4.08378 | 0.00201 | 3.70561 | 0.01597 | 4.06781 | 1.7077 | 0.00073 | 0.06971 | 0.01371 | 0.00127 | 0 | 0.00124 | 2.17 | 62.27936 | 90.7 | 18.6 | 26.9 | ± 0.04 |
| 1450 | 3.30886 | 0.00151 | 2.97267 | 0.01281 | 3.29605 | 1.36983 | 0.00041 | 0.05504 | 0.02092 | 0.00113 | 0.00001 | 0.0011 | 2.17 | 32.73972 | 89.8 | 15 | 26.9 | ± 0.04 |
| 1550 | 3.05048 | 0.00174 | 2.68697 | 0.0116 | 3.03888 | 1.24042 | 0.00051 | 0.04716 | 0.04672 | 0.00123 | 0 | 0.0012 | 2.17 | 13.27504 | 88.1 | 13.5 | 26.8 | ± 0.04 |

Notes for sample DRS-85-27/45/DD58 (amphibole):

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007199±0.1%
**Plateau date: 25.33±0.1 Ma on steps: 8 to 12 containing 85.1% $^{39}Ar_k$**
Total-gas date: 24.96±0.18 Ma

Notes for sample DRS-85-27/47/DD58 (sanidine):

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007048±0.1%
**Plateau date: 25.49±0.05 Ma on steps: 4 to 11 containing 81.6% $^{39}Ar_k$**
Total-gas date: 25.35±0.06 Ma

Notes for sample DRS-85-48/49/DD58 (biotite):

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.006935±0.1%
**Plateau date: 26.89±0.05 Ma on steps: 6 to 11 containing 81.8% $^{39}Ar_k$**
Total-gas date: 26.89±0.06 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-48/48/DD58** | | | **SANIDINE** | | **Wt.=58.7 mg** | | | | | | | | | | | | | | |
| 900 | 0.15099 | 4.00E-05 | 0.0308 | 0.00012 | 0.15087 | 0.01466 | 0.00003 | 0.00013 | 0.00189 | 0.00041 | 0.00001 | 0.00041 | 2.1 | 3.87831 | 20.4 | 0.1 | 25.4 | ± | 1.39 |
| 1000 | 1.09674 | 0.00013 | 0.66292 | 0.00284 | 1.0939 | 0.30334 | 0.00013 | 0.00011 | 0.00907 | 0.00147 | 0.00002 | 0.00147 | 2.19 | 16.72216 | 60.4 | 2.7 | 27.2 | ± | 0.26 |
| 1100 | 1.30356 | 0.0004 | 1.22521 | 0.00536 | 1.2982 | 0.5736 | 0.00023 | 0.00009 | 0.00717 | 0.00025 | 0.00001 | 0.00025 | 2.14 | 40 | 94 | 5 | 26.7 | ± | 0.07 |
| 1200 | 2.61653 | 0.00133 | 2.50771 | 0.01099 | 2.60554 | 1.17573 | 0.00058 | 0.00018 | 0.01293 | 0.00034 | 0.00001 | 0.00033 | 2.13 | 45.4652 | 95.9 | 10.3 | 26.6 | ± | 0.05 |
| **1250** | **3.06205** | **0.00228** | **2.95923** | **0.01292** | **3.04913** | **1.38181** | **0.00133** | **0.00016** | **0.0144** | **0.00031** | **0** | **0.00031** | 2.14 | 47.97951 | **96.7** | **12.1** | **26.8** | **±** | **0.04** |
| **1300** | **2.50193** | **0.00144** | **2.43378** | **0.0106** | **2.49133** | **1.13394** | **0.0006** | **0.00013** | **0.10146** | **0.0002** | **0.00001** | **0.0002** | 2.15 | 5.58811 | **97.3** | **10** | **26.8** | **±** | **0.04** |
| **1350** | **3.62081** | **0.00169** | **3.55174** | **0.01543** | **3.60538** | **1.64997** | **0.00085** | **0.00019** | **0.01397** | **0.00019** | **0.00001** | **0.00018** | 2.15 | 59.05404 | **98.1** | **14.5** | **26.9** | **±** | **0.04** |
| **1400** | **2.62795** | **0.00133** | **2.56292** | **0.01117** | **2.61678** | **1.9419** | **0.00071** | **0.00014** | **0.00965** | **0.00019** | **0.00001** | **0.00018** | 1.32 | 100.61658 | **97.6** | **10.5** | **26.8** | **±** | **0.04** |
| **1450** | **3.14778** | **0.00127** | **3.05115** | **0.01327** | **3.13451** | **1.4189** | **0.00026** | **0.00018** | **0.01457** | **0.00029** | **0.00001** | **0.00028** | 2.15 | 48.69252 | **97** | **12.5** | **26.9** | **±** | **0.04** |
| **1500** | **3.28448** | **0.00147** | **3.16623** | **0.01375** | **3.27073** | **1.47057** | **0.00083** | **0.00011** | **0.01424** | **0.00036** | **0** | **0.00036** | 2.15 | 51.63518 | **96.4** | **12.9** | **26.9** | **±** | **0.04** |
| 1600 | 2.47051 | 0.00132 | 2.33158 | 0.01009 | 2.46042 | 1.07961 | 0.00055 | 0.00008 | 0.0171 | 0.00044 | 0.00001 | 0.00044 | 2.16 | 31.56754 | 94.4 | 9.5 | 27 | ± | 0.05 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.006988±0.1%
**Plateau date: 26.86±0.04 Ma on steps: 5 to 10 containing 72.4% $^{39}Ar_k$**
Total-gas date: 26.83±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-54/50/DD58** | | | **BIOTITE** | | **Wt.=60.2 mg** | | | | | | | | | | | | | | |
| 800 | 0.13109 | 0.00017 | 0.01979 | 0.00012 | 0.13097 | 0.01322 | 0.00003 | 0.00041 | 0.00235 | 0.00038 | 0.00001 | 0.00038 | 1.5 | 2.81277 | 15.1 | 0.1 | 19.3 | ± | 2.34 |
| 900 | 6.39068 | 0.00455 | 1.62831 | 0.01189 | 6.37879 | 1.27194 | 0.00098 | 0.03791 | 0.02869 | 0.0161 | 0.00003 | 0.01606 | 1.28 | 22.16696 | 25.5 | 13.4 | 16.9 | ± | 0.06 |
| 1000 | 4.2813 | 0.00164 | 1.25064 | 0.00667 | 4.27463 | 0.71377 | 0.00014 | 0.02334 | 0.01373 | 0.01025 | 0.00001 | 0.01023 | 1.75 | 25.99308 | 29.2 | 7.5 | 23.2 | ± | 0.04 |
| 1050 | 2.3101 | 0.00135 | 0.89437 | 0.00437 | 2.30573 | 0.46739 | 0.00005 | 0.01627 | 0.00722 | 0.00478 | 0.00001 | 0.00478 | 1.91 | 32.36773 | 38.7 | 4.9 | 25.5 | ± | 0.04 |
| **1100** | **1.51932** | **0.00009** | **0.80666** | **0.00389** | **1.51543** | **0.41627** | **0.00011** | **0.01514** | **0.00756** | **0.00243** | **0** | **0.00242** | 1.94 | 27.53108 | **53.1** | **4.4** | **25.9** | **±** | **0.04** |
| **1150** | **1.23108** | **0.00057** | **0.85377** | **0.00414** | **1.22694** | **0.44327** | **0.00014** | **0.01629** | **0.00713** | **0.00128** | **0.00001** | **0.00127** | 1.93 | 31.08485 | **69.4** | **4.7** | **25.9** | **±** | **0.08** |
| **1200** | **1.75508** | **0.00058** | **1.23016** | **0.00596** | **1.74912** | **0.63746** | **0.0002** | **0.02347** | **0.00954** | **0.00178** | **0** | **0.00177** | 1.93 | 33.40985 | **70.1** | **6.7** | **25.9** | **±** | **0.04** |
| **1250** | **2.5449** | **0.00104** | **1.66161** | **0.00796** | **2.53694** | **0.85178** | **0.0004** | **0.03155** | **0.01105** | **0.003** | **0.00001** | **0.00299** | 1.95 | 38.54208 | **65.3** | **8.9** | **26.2** | **±** | **0.07** |
| **1300** | **4.48836** | **0.00248** | **2.486** | **0.01194** | **4.47642** | **1.27657** | **0.00052** | **0.04639** | **0.02107** | **0.00681** | **0** | **0.00679** | 1.95 | 30.29355 | **55.4** | **13.4** | **26.1** | **±** | **0.04** |
| **1350** | **2.68778** | **0.00154** | **1.65841** | **0.00797** | **2.67981** | **0.85246** | **0.00048** | **0.03168** | **0.0188** | **0.0035** | **0.00001** | **0.00348** | 1.95 | 22.67181 | **61.7** | **8.9** | **26.1** | **±** | **0.05** |
| **1400** | **3.60644** | **0.0018** | **2.95656** | **0.01435** | **3.59209** | **1.5343** | **0.00081** | **0.06002** | **0.06558** | **0.00221** | **0** | **0.00217** | 1.93 | 11.69793 | **82** | **16.1** | **25.9** | **±** | **0.04** |
| 1500 | 2.24701 | 0.00121 | 2.01089 | 0.00983 | 2.23718 | 1.05129 | 0.00055 | 0.0451 | 0.12354 | 0.00082 | 0.00001 | 0.00077 | 1.91 | 4.25486 | 89.5 | 11 | 25.7 | ± | 0.04 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007531±0.1%
**Plateau date: 26.00±0.05 Ma on steps: 5 to 11 containing 63.1% $^{39}Ar_k$**
Total-gas date: 24.5±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-54/51/DD58** | | | **FELDSPAR** | | **Wt.=52.7 mg** | | | | | | | | | | | | | | |
| 900 | 0.20065 | 0.00021 | 0.01603 | 0.00011 | 0.20054 | 0.01289 | 0.00002 | 0.00039 | 0.00124 | 0.00063 | 0.00001 | 0.00063 | 1.24 | 5.19758 | 8 | 0.9 | 15.4 | ± | 3.51 |
| 1000 | 0.56447 | 0.00001 | 0.12725 | 0.00073 | 0.56374 | 0.07759 | 0.00005 | 0.00036 | 0.00278 | 0.00149 | 0.00001 | 0.00149 | 1.64 | 13.95504 | 22.5 | 5.3 | 21.6 | ± | 0.67 |
| 1100 | 0.30645 | 0.00018 | 0.24573 | 0.00125 | 0.3052 | 0.13335 | 0.00018 | 0.00008 | 0.00166 | 0.0002 | 0 | 0.0002 | 1.84 | 40.16566 | 80.1 | 9 | 24.9 | ± | 0.06 |
| 1200 | 0.32597 | 0.00074 | 0.253 | 0.00129 | 0.32468 | 0.13776 | 0.0001 | 0.00006 | 0.00298 | 0.00025 | 0.00001 | 0.00024 | 1.84 | 23.11409 | 77.5 | 9.3 | 24.8 | ± | 0.12 |
| **1300** | **0.613** | **0.00036** | **0.55955** | **0.00281** | **0.61019** | **0.30038** | **0.0002** | **0.00003** | **0.00264** | **0.00017** | **0** | **0.00017** | 1.86 | 56.89015 | **91.3** | **20.3** | **25.2** | **±** | **0.05** |
| **1400** | **0.61075** | **0.00048** | **0.56021** | **0.00282** | **0.60793** | **0.30166** | **0.0003** | **0.00004** | **0.00127** | **0.00016** | **0.00001** | **0.00016** | 1.86 | 118.76378 | **91.7** | **20.4** | **25.2** | **±** | **0.11** |
| **1450** | **0.47834** | **0.00011** | **0.44375** | **0.00225** | **0.47609** | **0.2418** | **0.00003** | **0.00005** | **0.00219** | **0.00011** | **0.00001** | **0.00011** | 1.84 | 55.20548 | **92.8** | **16.3** | **25** | **±** | **0.26** |
| **1500** | **0.4097** | **0.00022** | **0.37528** | **0.00189** | **0.40781** | **0.20222** | **0.00015** | **0** | **0.00255** | **0.00011** | **0.00002** | **0.00011** | 1.86 | 39.65098 | **91.6** | **13.7** | **25.1** | **±** | **0.36** |
| 1550 | 0.15077 | 0.00004 | 0.12999 | 0.00064 | 0.15013 | 0.068 | 0.00005 | 0.00004 | 0.0011 | 0.00007 | 0 | 0.00007 | 1.91 | 30.90909 | 86.2 | 4.6 | 25.9 | ± | 0.24 |
| 1600 | 0.0307 | 0.00001 | -0.00063 | 0.00003 | 0.03067 | 0.00407 | 0.00002 | 0.00001 | 0.00002 | 0.00011 | 0.00001 | 0.00011 | 0.15 | 101.75 | –2.1 | 0.3 | –3 | ± | –5.52 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007578±0.1%
**Plateau date: 25.13±0.19 Ma on steps: 5 to 8 containing 70.7% $^{39}Ar_k$**
Total-gas date: 24.78±0.11 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar±$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar±$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar±$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-78/53/DD58** | | | | **Wt.=51.5 mg** | | | | | | | | | | | | | | |
| 800 | 0.65708 | 0.00052 | 0.05789 | 0.00056 | 0.65652 | 0.05976 | 0.00001 | 0.00144 | 0.00655 | 0.00203 | 0 | 0.00203 | 0.97 | 4.56183 | 8.8 | 0.7 | 12.1 | ± 0.23 |
| 900 | 0.86798 | 0.00035 | 0.09263 | 0.00044 | 0.86754 | 0.04695 | 0.00002 | 0.00249 | 0.00137 | 0.00264 | 0.00001 | 0.00264 | 1.97 | 17.13504 | 10.7 | 0.6 | 25.1 | ± 1.18 |
| 1000 | 0.62902 | 0.00006 | 0.45187 | 0.0021 | 0.62692 | 0.22495 | 0.00001 | 0.01134 | 0.0029 | 0.0006 | 0 | 0.0006 | 2.01 | 38.78448 | 71.8 | 2.7 | 27.3 | ± 0.09 |
| 1100 | 1.01421 | 0.00024 | 0.90474 | 0.00424 | 1.00997 | 0.45299 | 0.00026 | 0.02164 | 0.00225 | 0.00037 | 0.00001 | 0.00036 | 2 | 100.66444 | 89.2 | 5.3 | 27.2 | ± 0.12 |
| 1200 | 1.50446 | 0.00062 | 1.25746 | 0.00592 | 1.49854 | 0.63272 | 0.00029 | 0.02972 | 0.00473 | 0.00083 | 0.00001 | 0.00082 | 1.99 | 66.88372 | 83.5 | 7.5 | 27 | ± 0.05 |
| **1250** | **1.63334** | **0.0008** | **1.53193** | **0.00724** | **1.6261** | **0.77455** | **0.00046** | **0.0359** | **0.00354** | **0.00034** | **0.00001** | **0.00032** | 1.98 | 109.39972 | **93.8** | **9.1** | **26.9** | **± 0.07** |
| **1300** | **3.31022** | **0.00188** | **3.15723** | **0.01495** | **3.29527** | **1.59856** | **0.00092** | **0.07508** | **0.00226** | **0.00051** | **0.00001** | **0.00047** | 1.98 | 353.03887 | **95.4** | **18.8** | **26.9** | **± 0.04** |
| **1350** | **4.65781** | **0.00278** | **4.40462** | **0.02088** | **4.63693** | **2.329** | **0.00112** | **0.10562** | **0.03168** | **0.00084** | **0.00001** | **0.00079** | 1.89 | 36.75821 | **94.6** | **26.3** | **26.8** | **± 0.04** |
| **1400** | **3.48035** | **0.00231** | **3.25215** | **0.01544** | **3.46491** | **1.65163** | **0.0009** | **0.07698** | **0.02183** | **0.00076** | **0.00001** | **0.00073** | 1.97 | 37.82936 | **93.5** | **19.5** | **26.8** | **± 0.04** |
| **1500** | **1.72609** | **0.00084** | **1.60241** | **0.00757** | **1.71852** | **0.80964** | **0.00006** | **0.03647** | **0.03802** | **0.00042** | **0.00001** | **0.0004** | 1.98 | 10.64755 | **92.8** | **9.5** | **26.9** | **± 0.05** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007612±0.1%
**Plateau date: 26.85±0.05 Ma on steps: 6 to 10 containing 83.4% $^{39}Ar_k$**
Total-gas date: 26.79±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar±$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar±$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar±$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-78/52/DD58** | | | **SANIDINE** | | **Wt.=48.8 mg** | | | | | | | | | | | | | |
| 900 | 0.74851 | 0.00065 | 0.06584 | 0.0003 | 0.74821 | 0.03159 | 0.00002 | 0.00076 | 0.00507 | 0.00233 | 0 | 0.00233 | 2.08 | 3.11538 | 8.8 | 0.3 | 26 | ± 0.33 |
| 1000 | 0.78099 | 0.00017 | 0.33098 | 0.00158 | 0.77941 | 0.16946 | 0.00007 | 0.00125 | 0.00817 | 0.00153 | 0.00002 | 0.00153 | 1.95 | 10.37087 | 42.4 | 1.8 | 26.3 | ± 0.4 |
| 1100 | 1.05172 | 0.0001 | 0.94244 | 0.00452 | 1.0472 | 0.48331 | 0.0001 | 0.00022 | 0.0156 | 0.00036 | 0.00001 | 0.00036 | 1.95 | 15.49071 | 89.6 | 5.2 | 26.5 | ± 0.11 |
| 1200 | 1.77501 | 0.00095 | 1.68126 | 0.00805 | 1.76696 | 0.8605 | 0.00047 | 0.00019 | 0.02006 | 0.0003 | 0.00001 | 0.00029 | 1.95 | 21.44816 | 94.7 | 9.2 | 26.6 | ± 0.04 |
| 1250 | 1.49941 | 0.00074 | 1.42299 | 0.00682 | 1.49259 | 0.72986 | 0.00041 | 0.00013 | 0.01222 | 0.00024 | 0.00001 | 0.00024 | 1.95 | 29.86334 | 94.9 | 7.8 | 26.5 | ± 0.05 |
| 1300 | 1.86457 | 0.00092 | 1.78478 | 0.00853 | 1.85604 | 0.91259 | 0.00044 | 0.00017 | 0.01363 | 0.00025 | 0.00001 | 0.00024 | 1.96 | 33.47726 | 95.8 | 9.8 | 26.6 | ± 0.04 |
| 1350 | 2.07631 | 0.00097 | 2.0084 | 0.0096 | 2.06671 | 1.02658 | 0.00054 | 0.00022 | 0.01349 | 0.00022 | 0.00001 | 0.00022 | 1.96 | 38.04967 | 96.5 | 11 | 26.5 | ± 0.06 |
| **1400** | **2.21982** | **0.00021** | **2.1576** | **0.10124** | **2.11858** | **1.09517** | **0.00011** | **0.00024** | **0.01131** | **0.00018** | **0** | **0.00018** | 1.97 | 48.416 | **97.2** | **11.8** | **26.8** | **± 0.04** |
| **1450** | **3.19791** | **0.00167** | **3.10588** | **0.01475** | **3.18316** | **1.57757** | **0.00097** | **0.0003** | **0.01854** | **0.00027** | **0.00001** | **0.00026** | 1.97 | 42.54504 | **97.2** | **16.9** | **26.8** | **± 0.04** |
| **1500** | **2.73113** | **0.00106** | **2.65733** | **0.01264** | **2.71849** | **1.35177** | **0.00058** | **0.00013** | **0.01556** | **0.00021** | **0.00002** | **0.00021** | 1.97 | 43.43734 | **97.3** | **14.5** | **26.7** | **± 0.06** |
| **1550** | **1.8808** | **0.00081** | **1.82543** | **0.00864** | **1.87216** | **0.92438** | **0.00043** | **0.00006** | **0.01086** | **0.00016** | **0.00001** | **0.00016** | 1.97 | 42.55893 | **97.1** | **9.9** | **26.8** | **± 0.05** |
| 1600 | 0.33283 | 0.00013 | 0.30632 | 0.00141 | 0.33142 | 0.15134 | 0.00003 | 0.00008 | 0.00217 | 0.00009 | 0 | 0.00009 | 2.02 | 34.87097 | 92 | 1.6 | 27.5 | ± 0.12 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007602±0.1%
**Plateau date: 26.78±0.06 Ma on steps: 8 to 11 containing 53.1% $^{39}Ar_k$**
Total-gas date: 26.66±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar±$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar±$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar±$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-122C/54/DD58** | | | **MUSCOVITE** | | **Wt.=34.9 mg** | | | | | | | | | | | | | |
| 750 | 0.35626 | 0.00003 | 0.08151 | 0.00037 | 0.35589 | 0.0396 | 0.00002 | 0.00028 | 0.00201 | 0.00094 | 0 | 0.00094 | 2.06 | 9.85075 | 22.9 | 0.6 | 27.2 | ± 0.33 |
| 850 | 0.20374 | 0 | 0.1049 | 0.00032 | 0.20342 | 0.03383 | 0.00001 | 0.00004 | 0.00109 | 0.00034 | 0 | 0.00034 | 3.1 | 15.51835 | 51.5 | 0.5 | 41.7 | ± 0.3 |
| 950 | 0.5637 | 0.00005 | 0.39524 | 0.00098 | 0.56272 | 0.10492 | 0.00002 | 0.00008 | 0.00117 | 0.00057 | 0 | 0.00057 | 3.77 | 44.83761 | 70.1 | 1.5 | 50.7 | ± 0.19 |
| 1050 | 1.79278 | 0.00091 | 1.18691 | 0.00245 | 1.79033 | 0.26154 | 0.00012 | 0.00015 | 0 | 0.00206 | 0 | 0.00206 | 4.54 | | 66.2 | 3.7 | 60.9 | ± 0.09 |
| 1150 | 5.99093 | 0.00275 | 5.35029 | 0.00922 | 5.98171 | 0.98592 | 0.00028 | 0.0002 | 0 | 0.00215 | 0.00001 | 0.00215 | 5.43 | | 89.2 | 14 | 72.8 | ± 0.11 |
| 1200 | 8.07911 | 0.00566 | 7.668 | 0.01268 | 8.06643 | 1.35589 | 0.00072 | 0.00023 | 0.00168 | 0.00136 | 0.00001 | 0.00136 | 5.66 | 403.53869 | 94.9 | 19.3 | 75.8 | ± 0.12 |
| 1250 | 4.76134 | 0.00171 | 4.46328 | 0.00722 | 4.75412 | 0.77167 | 0.00024 | 0.00013 | 0 | 0.00099 | 0.00002 | 0.00099 | 5.78 | | 93.7 | 11 | 77.5 | ± 0.12 |
| **1300** | **4.40616** | **0.00134** | **4.02152** | **0.00626** | **4.3999** | **0.66982** | **0.00029** | **0.00016** | **0.00116** | **0.00129** | **0.00001** | **0.00129** | 6 | 288.71552 | **91.3** | **9.5** | **80.4** | **± 0.12** |
| **1350** | **4.68048** | **0.00213** | **4.34229** | **0.00678** | **4.6737** | **0.72507** | **0.00033** | **0.00013** | **0** | **0.00113** | **0.00001** | **0.00113** | 5.99 | | **92.8** | **10.3** | **80.2** | **± 0.12** |
| **1400** | **5.64711** | **0.00244** | **5.40021** | **0.00845** | **5.63866** | **0.90373** | **0.00056** | **0.00012** | **0.0009** | **0.00081** | **0.00001** | **0.00081** | 5.98 | 502.07222 | **95.6** | **12.8** | **80** | **± 0.12** |
| **1450** | **5.488** | **0.00258** | **5.32307** | **0.00831** | **5.47969** | **0.88926** | **0.00031** | **0.00011** | **0.00285** | **0.00054** | **0.00002** | **0.00053** | 5.99 | 156.01053 | **97** | **12.6** | **80.2** | **± 0.12** |
| 1550 | 1.85698 | 0.00101 | 1.73389 | 0.00389 | 1.85309 | 0.29846 | 0.00015 | 0.00003 | 0 | 0.00041 | 0.00001 | 0.00041 | 5.81 | | 93.4 | 4.2 | 77.8 | ± 0.15 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007606±0.1%
**Preferred date: 80.2±0.14 Ma on steps: 8 to 11 containing 45.2% $^{39}Ar_k$**
Total-gas date: 76.27±0.13 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-128/36/DD58** | | | | | **Wt.=265.9 mg** | | | | | | | | | | | | | |
| 1000 | 3.91024 | 0.00246 | 0.16608 | 0.00014 | 3.9101 | 0.0149 | 0.00027 | 0.00062 | 0.76352 | 0.01288 | 0.00001 | 0.01267 | 11.15 | 0.00976 | 4.2 | 0.6 | 118.9 | ± 5.42 |
| 1100 | 0.94613 | 0.00033 | 0.18946 | 0.00027 | 0.94586 | 0.02922 | 0.00004 | 0.00016 | 0.05549 | 0.00257 | 0.00001 | 0.00256 | 6.48 | 0.26329 | 20 | 1.1 | 83.8 | ± 0.83 |
| 1200 | 1.30056 | 0.00066 | 0.48294 | 0.00071 | 1.29985 | 0.07593 | 0.00004 | 0.0004 | 0.10838 | 0.00278 | 0 | 0.00276 | 6.36 | 0.3503 | 37.1 | 2.8 | 83.8 | ± 0.13 |
| 1250 | 0.84717 | 0.00011 | 0.43583 | 0.00066 | 0.84651 | 0.07007 | 0.00002 | 0.00061 | 0.16586 | 0.00143 | 0.00001 | 0.00139 | 6.22 | 0.21123 | 51.4 | 2.6 | 82.5 | ± 0.52 |
| 1275 | 0.69931 | 0.00038 | 0.40538 | 0.00061 | 0.6987 | 0.06555 | 0.00002 | 0.00094 | 0.21842 | 0.00105 | 0.00001 | 0.00099 | 6.18 | 0.15005 | 57.6 | 2.4 | 82.1 | ± 0.8 |
| 1300 | 0.6264 | 0.00046 | 0.38772 | 0.00058 | 0.62582 | 0.06236 | 0.00004 | 0.00137 | 0.29294 | 0.00088 | 0.00001 | 0.00081 | 6.22 | 0.10644 | 61.6 | 2.3 | 82.6 | ± 0.47 |
| 1325 | 0.66636 | 0.00018 | 0.43142 | 0.00065 | 0.66571 | 0.06916 | 0.00004 | 0.0022 | 0.42933 | 0.00091 | 0.00001 | 0.0008 | 6.24 | 0.08054 | 64.7 | 2.6 | 82.9 | ± 0.54 |
| 1350 | 0.82027 | 0.00031 | 0.55682 | 0.00083 | 0.81944 | 0.08893 | 0.00001 | 0.00316 | 0.61844 | 0.00105 | 0 | 0.0009 | 6.26 | 0.0719 | 67.9 | 3.3 | 83.2 | ± 0.13 |
| 1375 | 1.12318 | 0.00019 | 0.78728 | 0.00116 | 1.12202 | 0.12389 | 0 | 0.00565 | 0.99026 | 0.0014 | 0 | 0.00114 | 6.35 | 0.06255 | 70.1 | 4.6 | 84.4 | ± 0.16 |
| 1400 | 4.99576 | 0.00265 | 4.08097 | 0.00584 | 4.98992 | 0.62475 | 0.0003 | 0.03696 | 6.67278 | 0.0049 | 0.00002 | 0.00308 | 6.53 | 0.04681 | 81.7 | 23.1 | 86.8 | ± 0.13 |
| 1450 | 8.41361 | 0.00444 | 7.35796 | 0.01061 | 8.403 | 1.13521 | 0.00036 | 0.06268 | 12.75325 | 0.00702 | 0.00002 | 0.00354 | 6.48 | 0.04451 | 87.5 | 42.1 | 86.2 | ± 0.13 |
| 1600 | 2.75525 | 0.00111 | 2.15894 | 0.00318 | 2.75207 | 0.34004 | 0.00002 | 0.01437 | 3.3024 | 0.00291 | 0 | 0.00201 | 6.35 | 0.05148 | 78.4 | 12.6 | 84.4 | ± 0.13 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007595±0.1%
No plateau
Total-gas date: 85.63±0.2 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-176/56/DD58** | | | | | **Wt.=56.4 mg** | | | | | | | | | | | | | |
| 800 | 0.14701 | 0 | 0.01306 | 0.00006 | 0.14695 | 0.00899 | 0.00002 | 0.00023 | 0.00721 | 0.00046 | 0.00001 | 0.00046 | 1.45 | 0.62344 | 8.9 | 0.1 | 18.1 | ± 2.77 |
| 900 | 0.68262 | 0.0004 | 0.21696 | 0.00095 | 0.68167 | 0.10152 | 0.00007 | 0.00303 | 0.11752 | 0.00162 | 0.00001 | 0.00159 | 2.14 | 0.43193 | 31.8 | 1.1 | 28.5 | ± 0.21 |
| 1000 | 1.37259 | 0.00071 | 1.13321 | 0.00435 | 1.36824 | 0.46572 | 0.00024 | 0.01706 | 0.08486 | 0.00083 | 0.00001 | 0.0008 | 2.43 | 2.74405 | 82.6 | 5.1 | 32.9 | ± 0.05 |
| 1100 | 1.83813 | 0.00054 | 1.71274 | 0.00653 | 1.8316 | 0.69885 | 0.00018 | 0.026 | 0.01645 | 0.00042 | 0.00001 | 0.00041 | 2.45 | 21.24164 | 93.2 | 7.6 | 33.1 | ± 0.09 |
| 1150 | 1.17883 | 0.00054 | 1.11606 | 0.00426 | 1.17457 | 0.45572 | 0.0002 | 0.01703 | 0.01075 | 0.00021 | 0.00001 | 0.0002 | 2.45 | 21.19628 | 94.7 | 5 | 33.1 | ± 0.06 |
| 1200 | 1.57889 | 0.00062 | 1.51184 | 0.00576 | 1.57313 | 0.61579 | 0.00029 | 0.02322 | 0.0139 | 0.00022 | 0 | 0.00021 | 2.46 | 22.15072 | 95.8 | 6.7 | 33.2 | ± 0.05 |
| 1250 | 1.8819 | 0.00122 | 1.777 | 0.00676 | 1.87514 | 0.72346 | 0.00036 | 0.02737 | 0.01567 | 0.00035 | 0.00001 | 0.00033 | 2.46 | 23.08424 | 94.4 | 7.9 | 33.2 | ± 0.05 |
| **1300** | **2.92385** | **0.00049** | **2.84521** | **0.0108** | **2.91305** | **1.15512** | **0.00035** | **0.04341** | **0.02508** | **0.00025** | **0.00001** | **0.00023** | 2.46 | 23.02871 | **97.3** | **12.6** | **33.3** | **± 0.07** |
| **1350** | **6.31225** | **0.00344** | **6.20064** | **0.02351** | **6.28874** | **2.51441** | **0.00125** | **0.09429** | **0.03296** | **0.00035** | **0.00001** | **0.0003** | 2.47 | 38.14336 | **98.2** | **27.3** | **33.4** | **± 0.05** |
| **1400** | **5.43756** | **0.00264** | **5.34407** | **0.02027** | **5.41729** | **2.16784** | **0.00089** | **0.0815** | **0.03327** | **0.00029** | **0.00001** | **0.00025** | 2.47 | 32.5795 | **98.3** | **23.6** | **33.4** | **± 0.05** |
| 1500 | 0.75313 | 0.00017 | 0.70791 | 0.00271 | 0.75042 | 0.28965 | 0.00001 | 0.01733 | 0.09534 | 0.00018 | 0 | 0.00015 | 2.44 | 1.51904 | 94 | 3.1 | 33.1 | ± 0.08 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007581±0.1%
**Plateau date: 33.35±0.06 Ma on steps: 8 to 10 containing 63.5% $^{39}Ar_k$**
Total-gas date: 33.2±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar$± | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar$± | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar$± | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-176/55/DD58** | | | | | **Wt.=209.7 mg** | | | | | | | | | | | | | |
| 750 | 0.26976 | 0.00003 | 0.06322 | 0.00022 | 0.26957 | 0.02369 | 0.00008 | 0.00025 | 0.02997 | 0.00071 | 0.00001 | 0.0007 | 2.67 | 0.39523 | 23.4 | 0.9 | 35.2 | ± 1.34 |
| 850 | 0.22015 | 0.00058 | 0.07834 | 0.00029 | 0.2199 | 0.03085 | 0.00008 | 0.00013 | 0.04537 | 0.0005 | 0.00001 | 0.00048 | 2.54 | 0.33998 | 35.6 | 1.2 | 33.9 | ± 1.47 |
| 950 | 0.59936 | 0.00021 | 0.16984 | 0.00066 | 0.59878 | 0.07091 | 0.00002 | 0.00028 | 0.28349 | 0.00154 | 0.00001 | 0.00146 | 2.4 | 0.12507 | 28.3 | 2.7 | 31.8 | ± 0.52 |
| 1050 | 1.08009 | 0.00038 | 0.48654 | 0.00189 | 1.07842 | 0.20258 | 0.00005 | 0.0003 | 1.14354 | 0.00233 | 0 | 0.00202 | 2.4 | 0.08858 | 45 | 7.6 | 32.2 | ± 0.07 |
| **1150** | **0.91454** | **0.00014** | **0.75227** | **0.0029** | **0.91199** | **0.31027** | **0.00004** | **0.00022** | **1.43732** | **0.00094** | **0** | **0.00055** | 2.42 | 0.10793 | **82.1** | **11.6** | **32.8** | **± 0.05** |
| **1250** | **1.24282** | **0.0007** | **1.08136** | **0.00412** | **1.23919** | **0.44036** | **0.00021** | **0.0004** | **2.04759** | **0.0011** | **0** | **0.00054** | 2.46 | 0.10753 | **87** | **16.5** | **33.2** | **± 0.05** |
| **1350** | **1.39813** | **0.00069** | **1.21079** | **0.00468** | **1.39401** | **0.50056** | **0.00034** | **0.00059** | **2.20808** | **0.00123** | **0** | **0.00063** | 2.42 | 0.11335 | **86.6** | **18.7** | **32.7** | **± 0.05** |
| **1450** | **1.37348** | **0.00058** | **1.14049** | **0.00439** | **1.36962** | **0.46936** | **0.00028** | **0.00117** | **1.96057** | **0.00132** | **0.00001** | **0.00078** | 2.43 | 0.1197 | **83** | **17.6** | **32.9** | **± 0.12** |
| **1550** | **1.02849** | **0.00044** | **0.84754** | **0.00325** | **1.02563** | **0.34709** | **0.00023** | **0.00169** | **1.57627** | **0.00104** | **0.00001** | **0.00061** | 2.44 | 0.1101 | **82.4** | **13** | **33** | **± 0.11** |
| **1650** | **0.79423** | **0.00034** | **0.68277** | **0.00261** | **0.79193** | **0.27897** | **0.00005** | **0.00225** | **1.27772** | **0.00072** | **0** | **0.00037** | 2.45 | 0.10917 | **86** | **10.4** | **33.1** | **± 0.07** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.0076±0.1%
**Plateau date: 32.93±0.08 Ma on steps: 5 to 10 containing 87.7% $^{39}Ar_k$**
Total-gas date: 32.87±0.11 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-224/57/DD58** | | | | | **Wt.=54.7 mg** | | | | | | | | | | | | | |
| 800 | 0.78515 | 0.00048 | 0.10541 | 0.0012 | 0.78394 | 0.14691 | 0 | 0.00362 | 0.00415 | 0.0023 | 0.00001 | 0.0023 | 0.72 | 17.7 | 14.1 | 1.6 | 9.8 | ± 0.19 |
| 900 | 0.67821 | 0.00002 | 0.26031 | 0.00166 | 0.67655 | 0.20251 | 0.00007 | 0.0053 | 0.0047 | 0.00141 | 0.00001 | 0.00141 | 1.29 | 21.54362 | 38.4 | 2.3 | 17.5 | ± 0.19 |
| 1000 | 1.68241 | 0.00095 | 0.67763 | 0.00332 | 1.67909 | 0.40521 | 0.00011 | 0.01122 | 0.00806 | 0.0034 | 0 | 0.00339 | 1.67 | 25.1371 | 40.7 | 4.5 | 22.7 | ± 0.04 |
| 1100 | 2.3961 | 0.00069 | 1.62925 | 0.00679 | 2.38931 | 0.82803 | 0.00037 | 0.02398 | 0.01042 | 0.00258 | 0.00002 | 0.00257 | 1.97 | 39.73273 | 68.2 | 9.2 | 26.7 | ± 0.13 |
| 1150 | 2.07295 | 0.00036 | 1.63008 | 0.0066 | 2.06635 | 0.80546 | 0.00018 | 0.0225 | 0.00714 | 0.00149 | 0 | 0.00148 | 2.02 | 56.40476 | 78.8 | 9 | 27.4 | ± 0.04 |
| 1200 | 1.66644 | 0.00085 | 1.34099 | 0.00539 | 1.66105 | 0.65725 | 0.00033 | 0.01812 | 0.00545 | 0.00109 | 0.00001 | 0.00108 | 2.04 | 60.29817 | 80.6 | 7.3 | 27.6 | ± 0.07 |
| 1250 | 1.69671 | 0.00073 | 1.3377 | 0.00542 | 1.69129 | 0.66061 | 0.00035 | 0.01814 | 0.00466 | 0.00121 | 0.00001 | 0.0012 | 2.02 | 70.8809 | 79 | 7.4 | 27.4 | ± 0.07 |
| 1300 | 2.87405 | 0.0013 | 2.09544 | 0.00845 | 2.8656 | 1.03016 | 0.00041 | 0.0284 | 0.01341 | 0.00262 | 0.00001 | 0.00261 | 2.03 | 38.41014 | 73.1 | 11.5 | 27.6 | ± 0.05 |
| 1350 | 3.90072 | 0.00131 | 2.83807 | 0.01146 | 3.88926 | 1.39747 | 0.00038 | 0.03885 | 0.03271 | 0.00358 | 0.00001 | 0.00356 | 2.03 | 21.36151 | 72.9 | 15.5 | 27.5 | ± 0.04 |
| 1400 | 3.29114 | 0.00133 | 2.67875 | 0.01097 | 3.28016 | 1.33821 | 0.00072 | 0.0369 | 0.04422 | 0.00206 | 0.00001 | 0.00204 | 2 | 15.13128 | 81.5 | 14.9 | 27.1 | ± 0.04 |
| 1450 | 2.57112 | 0.00114 | 2.16141 | 0.00891 | 2.56222 | 1.08606 | 0.00042 | 0.02989 | 0.02251 | 0.00137 | 0.00001 | 0.00136 | 1.99 | 24.12394 | 84.1 | 12.1 | 27 | ± 0.06 |
| 1550 | 1.01047 | 0.0005 | 0.85934 | 0.00356 | 1.00691 | 0.43471 | 0.00021 | 0.01336 | 0.0387 | 0.00052 | 0 | 0.0005 | 1.98 | 5.61641 | 85.1 | 4.8 | 26.8 | ± 0.05 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007565±0.1%
**Plateau date: Disturbed and undetermined**
Total-gas date: 26.54±0.07 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-224/58/DD58** | | **SANIDINE** | | | **Wt.=66.7 mg** | | | | | | | | | | | | | |
| 900 | 2.03604 | 0.00133 | 1.18095 | 0.00594 | 2.0301 | 0.63558 | 0.00044 | 0.00258 | 0.04673 | 0.00291 | 0 | 0.0029 | 1.86 | 6.80056 | 58 | 4.8 | 24.9 | ± 0.04 |
| 1000 | 1.75731 | 0.00023 | 0.97818 | 0.00434 | 1.75297 | 0.46441 | 0.00002 | 0.00075 | 0.02412 | 0.00265 | 0.00001 | 0.00264 | 2.11 | 9.62707 | 55.7 | 3.5 | 28.2 | ± 0.1 |
| 1100 | 1.09539 | 0.00016 | 0.7608 | 0.00352 | 1.09187 | 0.37616 | 0.00003 | 0.00051 | 0.01826 | 0.00113 | 0.00001 | 0.00113 | 2.02 | 10.30011 | 69.5 | 2.8 | 27.2 | ± 0.12 |
| **1150** | **1.9823** | **0.00099** | **1.58678** | **0.00738** | **1.97492** | **0.78978** | **0.00027** | **0.00034** | **0.03455** | **0.00133** | **0** | **0.00132** | 2.01 | 11.42952 | **79.9** | **6** | **27** | **± 0.04** |
| **1200** | **1.50712** | **0.00003** | **1.28129** | **0.00599** | **1.50113** | **0.64042** | **0.00014** | **0.00014** | **0.02112** | **0.00076** | **0.00001** | **0.00075** | 2 | 15.16146 | **85** | **4.8** | **26.9** | **± 0.06** |
| **1250** | **2.11293** | **0.00034** | **1.86348** | **0.00872** | **2.10421** | **0.9323** | **0.00001** | **0.00022** | **0.02528** | **0.00083** | **0.00001** | **0.00082** | 2 | 18.43948 | **88.2** | **7** | **26.9** | **± 0.06** |
| **1300** | **2.53097** | **0.00104** | **2.33264** | **0.01092** | **2.52005** | **1.16768** | **0.00045** | **0.00022** | **0.02561** | **0.00065** | **0.00001** | **0.00064** | 2 | 22.79734 | **92.2** | **8.8** | **26.9** | **± 0.05** |
| **1350** | **3.06071** | **0.0021** | **2.88662** | **0.01349** | **3.04722** | **1.44325** | **0.00081** | **0.00038** | **0.02352** | **0.00055** | **0.00001** | **0.00055** | 2 | 30.68134 | **94.3** | **10.9** | **26.9** | **± 0.05** |
| **1400** | **3.03704** | **0.00158** | **2.89501** | **0.01353** | **3.02351** | **1.44655** | **0.00079** | **0.00052** | **0.01739** | **0.00044** | **0.00001** | **0.00044** | 2 | 41.59143 | **95.3** | **10.9** | **27** | **± 0.04** |
| **1450** | **3.35608** | **0.00158** | **3.25917** | **0.01521** | **3.34087** | **1.62658** | **0.00083** | **0.00055** | **0.01651** | **0.00028** | **0.00001** | **0.00028** | 2 | 49.26045 | **97.2** | **12.3** | **27** | **± 0.04** |
| **1500** | **3.88341** | **0.00207** | **3.78514** | **0.01768** | **3.86573** | **1.89132** | **0.0008** | **0.00019** | **0.0167** | **0.00028** | **0.00001** | **0.00027** | 2 | 56.62635 | **97.5** | **14.3** | **27** | **± 0.04** |
| **1600** | **3.83722** | **0.00198** | **3.66412** | **0.01709** | **3.82013** | **1.82746** | **0.00091** | **0.00006** | **0.02384** | **0.00054** | **0.00002** | **0.00053** | 2.01 | 38.3276 | **95.5** | **13.8** | **27** | **± 0.05** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007537±0.1%
**Plateau date: 26.98±0.05 Ma on steps: 4 to 12 containing 88.9% $^{39}Ar_k$**
Total-gas date: 26.91±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-85-225/59/DD58** | | **SANIDINE** | | | **Wt.=55.7 mg** | | | | | | | | | | | | | |
| 900 | 0.53421 | 0.00019 | 0.08093 | 0.00035 | 0.53386 | 0.03778 | 0.00002 | 0.00032 | 0.00308 | 0.00155 | 0.00001 | 0.00155 | 2.14 | 6.13312 | 15.2 | 0.3 | 27.5 | ± 0.89 |
| 1000 | 1.22155 | 0.0008 | 0.4805 | 0.0021 | 1.21945 | 0.22472 | 0.00013 | 0.00037 | 0.02667 | 0.00253 | 0.00001 | 0.00252 | 2.14 | 4.21297 | 39.3 | 1.9 | 28.3 | ± 0.17 |
| 1100 | 1.297 | 0.00054 | 1.14762 | 0.00528 | 1.29172 | 0.56486 | 0.00044 | 0.00004 | 0.01369 | 0.0005 | 0.00001 | 0.00049 | 2.03 | 20.63039 | 88.4 | 4.8 | 27.2 | ± 0.07 |
| 1200 | 2.11572 | 0.00103 | 1.9967 | 0.00922 | 2.1065 | 0.98571 | 0.00035 | 0.00011 | 0.01581 | 0.00038 | 0.00001 | 0.00037 | 2.03 | 31.17362 | 94.4 | 8.4 | 27.2 | ± 0.04 |
| 1250 | 2.36664 | 0.00126 | 2.26949 | 0.01053 | 2.35611 | 1.12642 | 0.00054 | 0.00005 | 0.01601 | 0.0003 | 0.00001 | 0.0003 | 2.01 | 35.17864 | 95.9 | 9.6 | 27 | ± 0.05 |
| **1300** | **3.43134** | **0.00181** | **3.34299** | **0.01542** | **3.41592** | **1.64952** | **0.00088** | **0.00014** | **0.01741** | **0.00025** | **0.00002** | **0.00025** | 2.03 | 47.37277 | **97.5** | **14.1** | **27.2** | **± 0.05** |
| **1350** | **2.86175** | **0.00145** | **2.79302** | **0.01289** | **2.84886** | **1.37866** | **0.00075** | **0.00012** | **0.01467** | **0.00019** | **0.00001** | **0.00019** | 2.03 | 46.98909 | **97.6** | **11.8** | **27.2** | **± 0.04** |
| **1400** | **3.48389** | **0.00128** | **3.40905** | **0.01567** | **3.46822** | **1.67623** | **0.00115** | **0.00008** | **0.0183** | **0.00021** | **0.00001** | **0.0002** | 2.03 | 45.79863 | **97.9** | **14.4** | **27.3** | **± 0.04** |
| **1450** | **4.06078** | **0.00167** | **3.9807** | **0.01828** | **4.0425** | **1.95463** | **0.00109** | **0.00009** | **0.01657** | **0.00022** | **0** | **0.00021** | 2.04 | 58.98099 | **98.1** | **16.7** | **27.3** | **± 0.04** |
| **1500** | **3.51417** | **0.00072** | **3.4347** | **0.01576** | **3.49841** | **1.68534** | **0.00029** | **0.00004** | **0.01705** | **0.00022** | **0.00003** | **0.00022** | 2.04 | 49.42346 | **97.8** | **14.4** | **27.4** | **± 0.07** |
| **1600** | **0.8609** | **0.0002** | **0.81071** | **0.00373** | **0.85717** | **0.39933** | **0.00012** | **0** | **0.00509** | **0.00016** | **0.00002** | **0.00016** | 2.03 | 39.22692 | **94.2** | **3.4** | **27.2** | **± 0.17** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007507±0.1%
**Plateau date: 27.30±0.08 Ma on steps: 6 to 11 containing 74.8% $^{39}Ar_k$**
Total-gas date: 27.26±0.06 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-17/20/DD57** | | | **BIOTITE** | | **Wt.=80.1 mg** | | | | | | | | | | | | | |
| 800 | 0.36532 | 0.00112 | 0.01064 | 0.00006 | 0.36526 | 0.0069 | 0.00025 | 0.00026 | 0.00313 | 0.0012 | 0 | 0.0012 | 1.54 | 1.10224 | 2.91 | 0.1 | 19.7 | ± 1.29 |
| 900 | 0.36132 | 0.00025 | 0.04984 | 0.00022 | 0.3611 | 0.02386 | 0.00001 | 0.00061 | 0.00283 | 0.00105 | 0.00001 | 0.00105 | 2.09 | 4.21555 | 13.79 | 0.3 | 26.7 | ± 1.47 |
| 1000 | 0.6799 | 0.00011 | 0.12495 | 0.00053 | 0.67938 | 0.05619 | 0.00003 | 0.00156 | 0.00629 | 0.00188 | 0.00001 | 0.00188 | 2.22 | 4.46661 | 18.38 | 0.6 | 28.4 | ± 0.58 |
| 1100 | 0.95 | 0.00029 | 0.55648 | 0.00239 | 0.94761 | 0.25523 | 0.00013 | 0.00872 | 0.00934 | 0.00133 | 0 | 0.00132 | 2.18 | 13.66328 | 58.58 | 2.6 | 27.8 | ± 0.08 |
| 1200 | 2.17778 | 0.00029 | 1.79342 | 0.00766 | 2.17012 | 0.81926 | 0.00021 | 0.02599 | 0.01149 | 0.00129 | 0.00001 | 0.00127 | 2.19 | 35.651 | 82.35 | 8.5 | 27.9 | ± 0.04 |
| **1250** | **3.06621** | **0.00481** | **2.69533** | **0.01171** | **3.05451** | **1.25191** | **0.00375** | **0.03661** | **0.00787** | **0.00123** | **0.00001** | **0.00122** | 2.15 | 79.53685 | **87.9** | **12.9** | **27.5** | **± 0.07** |
| **1300** | **4.60475** | **0.00105** | **4.04815** | **0.01755** | **4.5872** | **1.8773** | **0.00183** | **0.0547** | **0.00946** | **0.00185** | **0.00001** | **0.00182** | 2.16 | 99.22304 | **87.91** | **19.4** | **27.5** | **± 0.04** |
| **1350** | **4.23999** | **0.00333** | **3.41327** | **0.0148** | **4.2252** | **1.58255** | **0.00082** | **0.04743** | **0.06311** | **0.00278** | **0** | **0.00275** | 2.16 | 12.53803 | **80.5** | **16.3** | **27.5** | **± 0.04** |
| **1400** | **4.05321** | **0.00071** | **2.95956** | **0.01287** | **4.04034** | **1.37674** | **0.00131** | **0.04413** | **0.16399** | **0.00372** | **0** | **0.00366** | 2.15 | 4.19763 | **73.02** | **14.2** | **27.4** | **± 0.04** |
| **1550** | **7.21878** | **0.0026** | **5.27153** | **0.02281** | **7.19597** | **2.43942** | **0.00095** | **0.07365** | **0.11262** | **0.00657** | **0.00001** | **0.00651** | 2.16 | 10.83031 | **73.03** | **25.2** | **27.6** | **± 0.04** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007126±0.1%
**Plateau date: 27.51±0.05 Ma on steps: 6 to 10 containing 88.0% $^{39}Ar_k$**
Total-gas date: 27.55±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-17/21/DD57** | | | **AMPHIBOLE** | | **Wt.=205.7 mg** | | | | | | | | | | | | | |
| 900 | 0.32428 | 0.00117 | 0.02434 | 0.00006 | 0.32422 | 0.0064 | 0.00026 | 0.00122 | 0.00805 | 0.00102 | 0 | 0.00101 | 3.8 | 0.39752 | 7.51 | 0.2 | 48.6 | ± 0.83 |
| 1000 | 0.53886 | 0.00009 | 0.0183 | 0.00008 | 0.53879 | 0.00853 | 0.00005 | 0.0003 | 0.01366 | 0.00177 | 0.00001 | 0.00176 | 2.15 | 0.31223 | 3.4 | 0.3 | 27.6 | ± 4.14 |
| 1100 | 0.11695 | 0.00007 | 0.02794 | 0.00009 | 0.11686 | 0.00937 | 0.00002 | 0.00041 | 0.01267 | 0.0003 | 0.00001 | 0.0003 | 2.98 | 0.36977 | 23.89 | 0.3 | 38.2 | ± 2.3 |
| 1200 | 0.11112 | 0.0003 | 0.01902 | 0.00008 | 0.11104 | 0.00904 | 0.00003 | 0.0007 | 0.01304 | 0.00032 | 0.00001 | 0.00031 | 2.1 | 0.34663 | 17.12 | 0.3 | 27.1 | ± 2.21 |
| 1275 | 0.14348 | 0.00033 | 0.0335 | 0.00012 | 0.14336 | 0.01271 | 0.00003 | 0.00141 | 0.02253 | 0.00038 | 0.00003 | 0.00037 | 2.64 | 0.28207 | 23.35 | 0.4 | 33.8 | ± 8.25 |
| 1325 | 0.25647 | 0.00022 | 0.1017 | 0.00043 | 0.25604 | 0.04581 | 0.00001 | 0.00718 | 0.17616 | 0.00057 | 0 | 0.00052 | 2.22 | 0.13002 | 39.65 | 1.4 | 28.5 | ± 0.33 |
| 1375 | 1.11217 | 0.00038 | 0.69632 | 0.00311 | 1.10906 | 0.33306 | 0.00012 | 0.0604 | 1.69783 | 0.00188 | 0 | 0.0014 | 2.09 | 0.09808 | 62.61 | 10.4 | 26.9 | ± 0.06 |
| 1400 | 1.49152 | 0.00421 | 1.15045 | 0.0051 | 1.48643 | 0.54516 | 0.00118 | 0.09631 | 2.78431 | 0.00192 | 0.00001 | 0.00114 | 2.11 | 0.0979 | 77.13 | 17 | 27.1 | ± 0.05 |
| 1425 | 2.31298 | 0.00066 | 1.92797 | 0.00851 | 2.30447 | 0.91026 | 0.00013 | 0.13167 | 4.59831 | 0.00256 | 0 | 0.00127 | 2.12 | 0.09898 | 83.35 | 28.4 | 27.2 | ± 0.04 |
| **1450** | **1.54916** | **0.00099** | **1.26366** | **0.00554** | **1.54362** | **0.593** | **0.00035** | **0.06684** | **3.01898** | **0.00179** | **0.00001** | **0.00095** | 2.13 | 0.09821 | **81.57** | **18.5** | **27.4** | **± 0.06** |
| **1500** | **1.10865** | **0.00061** | **0.84602** | **0.00372** | **1.10493** | **0.39824** | **0.00019** | **0.05291** | **2.1413** | **0.00147** | **0.00002** | **0.00088** | 2.12 | 0.09299 | **76.31** | **12.4** | **27.3** | **± 0.17** |
| **1600** | **0.95357** | **0.00028** | **0.71319** | **0.00312** | **0.95045** | **0.33357** | **0.00036** | **0.04791** | **1.81811** | **0.00131** | **0** | **0.0008** | 2.14 | 0.09174 | **74.79** | **10.4** | **27.5** | **± 0.04** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00718±0.1%
**Preferred date: 27.39±0.09 Ma on steps: 10 to 12 containing 41.3% $^{39}Ar_k$**
Total-gas date: 27.36±0.11 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-17/19/DD57** | | | **SANIDINE** | | **Wt.=52.8 mg** | | | | | | | | | | | | | |
| 900 | 0.07172 | 0.00004 | 0.0027 | 0.00002 | 0.0717 | 0.00185 | 0.00002 | 0.00005 | 0.00001 | 0.00023 | 0.00001 | 0.00023 | 1.46 | 92.5 | 3.76 | 0 | 18.5 | ± 11.51 |
| 1000 | 0.60895 | 0.001 | 0.15479 | 0.00066 | 0.60829 | 0.07053 | 0.00007 | 0.00008 | 0.00403 | 0.00154 | 0 | 0.00153 | 2.19 | 8.75062 | 25.42 | 0.8 | 27.8 | ± 0.09 |
| 1100 | 1.078 | 0.00066 | 0.41402 | 0.00175 | 1.07625 | 0.18687 | 0.0001 | 0.00011 | 0.00768 | 0.00224 | 0.00001 | 0.00224 | 2.22 | 12.16602 | 38.41 | 2.1 | 28.1 | ± 0.24 |
| **1200** | **1.54229** | **0.00169** | **1.08156** | **0.00469** | **1.5376** | **0.50112** | **0.00043** | **0.00008** | **0.01953** | **0.00155** | **0.00001** | **0.00154** | 2.16 | 12.82949 | **70.13** | **5.7** | **27.3** | **± 0.04** |
| **1250** | **0.93824** | **0.00006** | **0.7966** | **0.00346** | **0.93479** | **0.36978** | **0.00027** | **0.00003** | **0.01115** | **0.00047** | **0.00001** | **0.00047** | 2.15 | 16.58206 | **84.9** | **4.2** | **27.3** | **± 0.14** |
| **1300** | **1.21407** | **0.00116** | **1.07261** | **0.00467** | **1.20939** | **0.49991** | **0.00016** | **0.00004** | **0.01335** | **0.00047** | **0** | **0.00046** | 2.15 | 18.72322 | **88.35** | **5.7** | **27.2** | **± 0.04** |
| **1350** | **1.70066** | **0.00028** | **1.59526** | **0.00693** | **1.69373** | **0.74171** | **0.00082** | **0.00002** | **0.01574** | **0.00034** | **0.00001** | **0.00033** | 2.15 | 23.56131 | **93.8** | **8.5** | **27.2** | **± 0.06** |
| **1400** | **2.25157** | **0.00121** | **2.13689** | **0.0093** | **2.24228** | **0.99444** | **0.00062** | **0.00003** | **0.01819** | **0.00036** | **0.00001** | **0.00036** | 2.15 | 27.3348 | **94.91** | **11.4** | **27.2** | **± 0.04** |
| **1450** | **2.26742** | **0.00028** | **2.16005** | **0.00938** | **2.25805** | **1.00297** | **0.00031** | **0.00003** | **0.01782** | **0.00034** | **0.00001** | **0.00033** | 2.15 | 28.14169 | **95.26** | **11.5** | **27.3** | **± 0.04** |
| **1500** | **3.18163** | **0.00064** | **3.08434** | **0.0134** | **3.16823** | **1.43356** | **0.0012** | **0.00003** | **0.02154** | **0.00029** | **0** | **0.00028** | 2.15 | 33.27669 | **96.94** | **16.4** | **27.3** | **± 0.04** |
| 1550 | 4.25355 | 0.0003 | 4.07617 | 0.01765 | 4.2359 | 1.88737 | 0.00118 | 0 | 0.02386 | 0.00055 | 0.00001 | 0.00054 | 2.16 | 39.55092 | 95.83 | 21.6 | 27.4 | ± 0.05 |
| 1600 | 2.39943 | 0.00079 | 2.26782 | 0.00975 | 2.38969 | 1.04257 | 0.0005 | 0 | 0.01356 | 0.00042 | 0.00001 | 0.00041 | 2.18 | 38.44285 | 94.51 | 11.9 | 27.5 | ± 0.05 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007073±0.1%
**Plateau date: 27.24±0.06 Ma on steps 4 to 10 containing 63.4% $^{39}Ar_k$**
Total-gas date: 27.32±0.06 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}$Ar | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-31/22/DD57** | | | **BIOTITE** | | **Wt.=29.2 mg** | | | | | | | | | | | | | |
| 850 | 0.68834 | 0.00012 | 0.02328 | 0.00041 | 0.68793 | 0.04345 | 0.00002 | 0.00138 | 0.00137 | 0.00225 | 0 | 0.00225 | 0.54 | 15.85766 | 3.38 | 1.3 | 7 | ± 0.37 |
| 950 | 1.91384 | 0.00118 | 0.44052 | 0.00334 | 1.9105 | 0.35708 | 0.0003 | 0.00941 | 0.00595 | 0.00498 | 0.00001 | 0.00497 | 1.23 | 30.00672 | 23.02 | 11.1 | 16 | ± 0.07 |
| 1050 | 1.58616 | 0.00028 | 0.51107 | 0.0026 | 1.58356 | 0.27792 | 0.00012 | 0.00766 | 0.00558 | 0.00363 | 0.00001 | 0.00363 | 1.84 | 24.90323 | 32.22 | 8.6 | 23.8 | ± 0.11 |
| 1100 | 0.99362 | 0.0005 | 0.45589 | 0.00214 | 0.99148 | 0.22897 | 0.00017 | 0.00649 | 0.00432 | 0.00182 | 0.00001 | 0.00181 | 1.99 | 26.50116 | 45.88 | 7.1 | 25.7 | ± 0.2 |
| 1200 | 0.95496 | 0.00037 | 0.58426 | 0.00256 | 0.95241 | 0.27345 | 0.00002 | 0.0077 | 0.00351 | 0.00125 | 0 | 0.00125 | 2.14 | 38.95299 | 61.18 | 8.5 | 27.6 | ± 0.06 |
| 1300 | 1.18607 | 0.00042 | 0.74288 | 0.00319 | 1.18287 | 0.34169 | 0 | 0.00945 | 0.00602 | 0.00149 | 0.00001 | 0.00149 | 2.17 | 28.37957 | 62.63 | 10.6 | 28.1 | ± 0.08 |
| 1350 | 1.08322 | 0.00061 | 0.62817 | 0.00273 | 1.08049 | 0.29215 | 0.00033 | 0.00805 | 0.00572 | 0.00154 | 0.00001 | 0.00153 | 2.15 | 25.53759 | 57.99 | 9 | 27.8 | ± 0.2 |
| 1400 | 1.66213 | 0.00016 | 0.95932 | 0.00413 | 1.65799 | 0.44205 | 0.0004 | 0.01217 | 0.01451 | 0.00237 | 0.00001 | 0.00236 | 2.17 | 15.2326 | 57.72 | 13.7 | 28 | ± 0.09 |
| 1450 | 1.72144 | 0.00097 | 1.1444 | 0.00503 | 1.71641 | 0.53746 | 0.00033 | 0.01524 | 0.03628 | 0.00195 | 0 | 0.00194 | 2.13 | 7.40711 | 66.48 | 16.6 | 27.5 | ± 0.04 |
| 1550 | 1.21622 | 0.00072 | 0.92838 | 0.00409 | 1.21213 | 0.43787 | 0.00039 | 0.01238 | 0.02553 | 0.00097 | 0 | 0.00096 | 2.12 | 8.5756 | 76.33 | 13.6 | 27.4 | ± 0.04 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007214±0.1%
**Preferred date: Disturbed and undetermined**
Total-gas date: 25.66±0.1 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}$Ar | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-31/24/DD57** | | | **AMPHIBOLE** | | **Wt.=84.7 mg** | | | | | | | | | | | | | |
| 950 | 0.18097 | 0.00171 | 0.01341 | 0.00014 | 0.18084 | 0.0145 | 0.00042 | 0.00056 | 0.00426 | 0.00057 | 0.00002 | 0.00057 | 0.92 | 1.70188 | 7.41 | 1.4 | 12.1 | ± 3.88 |
| 1100 | 0.64964 | 0.00008 | 0.07642 | 0.00028 | 0.64937 | 0.02966 | 0.00004 | 0.00085 | 0.01276 | 0.00194 | 0 | 0.00194 | 2.58 | 1.16223 | 11.76 | 2.9 | 33.5 | ± 0.55 |
| 1200 | 0.12422 | 0.0002 | 0.03691 | 0.00017 | 0.12405 | 0.01781 | 0 | 0.00078 | 0.01047 | 0.0003 | 0.00001 | 0.00029 | 2.07 | 0.85053 | 29.72 | 1.7 | 27 | ± 3.35 |
| 1300 | 0.17747 | 0.00008 | 0.05842 | 0.00027 | 0.1772 | 0.02898 | 0.00003 | 0.00232 | 0.15379 | 0.00044 | 0 | 0.0004 | 2.02 | 0.09422 | 32.92 | 2.8 | 26.2 | ± 0.6 |
| **1375** | **0.68312** | **0.00017** | **0.46852** | **0.00213** | **0.68099** | **0.22793** | **0.00018** | **0.03895** | **1.53119** | **0.00115** | **0** | **0.00072** | 2.06 | 0.07443 | **68.58** | **22.1** | **26.7** | **± 0.09** |
| **1425** | **1.18477** | **0.00011** | **0.94524** | **0.00427** | **1.1805** | **0.45703** | **0.00019** | **0.08028** | **3.15681** | **0.00168** | **0** | **0.0008** | 2.07 | 0.07239 | **79.78** | **44.3** | **26.9** | **± 0.06** |
| 1500 | 0.50049 | 0.00026 | 0.37177 | 0.00166 | 0.49883 | 0.17701 | 0.00014 | 0.02991 | 1.14851 | 0.00075 | 0 | 0.00043 | 2.1 | 0.07706 | 74.28 | 17.2 | 27.3 | ± 0.11 |
| 1600 | 0.26464 | 0.00028 | 0.16157 | 0.00073 | 0.26391 | 0.07822 | 0.00008 | 0.01315 | 0.5032 | 0.00049 | 0.00001 | 0.00035 | 2.07 | 0.07772 | 61.05 | 7.6 | 26.9 | ± 0.58 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007266±0.1%
**Plateau date: 26.85±0.14 Ma on steps 5 to 6 containing 66.4% $^{39}Ar_k$**
Total-gas date: 26.9±0.31 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}$Ar | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-31/23/DD57** | | | **SANIDINE** | | **Wt.=59.8 mg** | | | | | | | | | | | | | |
| 900 | 0.13974 | 0.00005 | 0.02454 | 0.00019 | 0.13955 | 0.02016 | 0.00002 | 0.00011 | 0.00267 | 0.00039 | 0.00001 | 0.00039 | 1.22 | 3.77528 | 17.56 | 0.2 | 15.8 | ± 1.1 |
| 1000 | 0.76007 | 0.00088 | 0.61373 | 0.00275 | 0.75731 | 0.29431 | 0.00032 | 0.00064 | 0.02119 | 0.00049 | 0.00001 | 0.00049 | 2.09 | 6.94455 | 80.75 | 3 | 27 | ± 0.08 |
| 1100 | 1.23889 | 0.00123 | 0.79688 | 0.00349 | 1.2354 | 0.37338 | 0.00029 | 0.00037 | 0.01913 | 0.00149 | 0 | 0.00148 | 2.13 | 9.75902 | 64.32 | 3.9 | 27.7 | ± 0.04 |
| 1200 | 1.87837 | 0.00085 | 1.79253 | 0.00803 | 1.87034 | 0.85906 | 0.00006 | 0.00028 | 0.03028 | 0.00027 | 0 | 0.00026 | 2.09 | 14.18527 | 95.43 | 8.9 | 27.1 | ± 0.04 |
| 1250 | 1.43999 | 0.00143 | 1.37524 | 0.00621 | 1.43378 | 0.66437 | 0.00073 | 0.00015 | 0.01797 | 0.0002 | 0 | 0.0002 | 2.07 | 18.48553 | 95.5 | 6.9 | 26.8 | ± 0.04 |
| **1300** | **1.82556** | **0.00114** | **1.76759** | **0.00792** | **1.81764** | **0.84729** | **0.00083** | **0.00024** | **0.01787** | **0.00017** | **0** | **0.00017** | 2.09 | 23.70705 | **96.82** | **8.7** | **27** | **± 0.04** |
| **1350** | **2.6498** | **0.00098** | **2.59229** | **0.01165** | **2.63815** | **1.24589** | **0.00096** | **0.0003** | **0.02056** | **0.00016** | **0** | **0.00016** | 2.08 | 30.29888 | **97.83** | **12.9** | **27** | **± 0.04** |
| **1400** | **2.69179** | **0.00186** | **2.63111** | **0.01182** | **2.67997** | **1.26439** | **0.00118** | **0.0004** | **0.01696** | **0.00017** | **0** | **0.00017** | 2.08 | 37.27565 | **97.75** | **13** | **27** | **± 0.04** |
| **1450** | **2.78912** | **0.00153** | **2.73044** | **0.01225** | **2.77687** | **1.30967** | **0.00086** | **0.00014** | **0.01308** | **0.00016** | **0.00001** | **0.00016** | 2.08 | 50.06384 | **97.9** | **13.5** | **27** | **± 0.04** |
| **1500** | **2.77414** | **0.00288** | **2.71406** | **0.01218** | **2.76196** | **1.30214** | **0.00082** | **0** | **0.01171** | **0.00017** | **0.00001** | **0.00016** | 2.08 | 55.59949 | **97.83** | **13.4** | **27** | **± 0.04** |
| **1550** | **2.48119** | **0.00386** | **2.42051** | **0.01082** | **2.47037** | **1.15704** | **0.00132** | **0.00002** | **0.01217** | **0.00017** | **0.00001** | **0.00017** | 2.09 | 47.53657 | **97.55** | **11.9** | **27.1** | **± 0.04** |
| **1600** | **0.79906** | **0.0006** | **0.75311** | **0.00338** | **0.79568** | **0.36138** | **0.00038** | **0** | **0.00678** | **0.00015** | **0.00001** | **0.00014** | 2.08 | 26.65044 | **94.25** | **3.7** | **27** | **± 0.09** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00724±0.1%
**Plateau date: 27.01±0.04 Ma on steps 6 to 12 containing 77.2% $^{39}Ar_k$**
Total-gas date: 27.01±0.05 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-74/25/DD57** | | | **BIOTITE** | | **Wt.=94.6 mg** | | | | | | | | | | | | | |
| 800 | 0.26783 | 0.00016 | 0.01004 | 0.00008 | 0.26774 | 0.00883 | 0.00003 | 0.00013 | 0.00001 | 0.00087 | 0.00001 | 0.00087 | 1.14 | 441.5 | 3.75 | 0.1 | 14.9 | ± 3.22 |
| 900 | 5.17447 | 0.00168 | 0.83996 | 0.00554 | 5.16893 | 0.59247 | 0.00014 | 0.01744 | 0.01033 | 0.01466 | 0.00001 | 0.01465 | 1.42 | 28.67715 | 16.23 | 5.4 | 18.6 | ± 0.03 |
| 1000 | 4.30605 | 0.00159 | 1.35075 | 0.00683 | 4.29922 | 0.73072 | 0.00048 | 0.02482 | 0.00541 | 0.00999 | 0.00002 | 0.00998 | 1.85 | 67.5342 | 31.37 | 6.7 | 24.2 | ± 0.13 |
| 1050 | 3.11583 | 0.0004 | 1.3376 | 0.00614 | 3.10969 | 0.65722 | 0.00026 | 0.02355 | 0.00769 | 0.00601 | 0.00001 | 0.006 | 2.04 | 42.73212 | 42.93 | 6 | 26.6 | ± 0.06 |
| 1100 | 2.20163 | 0.00032 | 1.04456 | 0.00474 | 2.19688 | 0.50745 | 0.0002 | 0.01843 | 0.0063 | 0.00391 | 0.00001 | 0.0039 | 2.06 | 40.27381 | 47.44 | 4.7 | 26.9 | ± 0.12 |
| 1150 | 1.20892 | 0.00003 | 0.67806 | 0.0031 | 1.20582 | 0.33148 | 0.00018 | 0.01217 | 0.00397 | 0.00179 | 0.00002 | 0.00179 | 2.05 | 41.74811 | 56.09 | 3 | 26.7 | ± 0.21 |
| **1200** | **1.01965** | **0.00035** | **0.55159** | **0.00258** | **1.01707** | **0.27596** | **0.00018** | **0.01027** | **0.00425** | **0.00158** | **0** | **0.00158** | 2 | 32.46588 | **54.1** | **2.5** | **26.1** | **± 0.07** |
| **1250** | **1.60594** | **0.00042** | **1.06599** | **0.00495** | **1.60099** | **0.52955** | **0.00019** | **0.01977** | **0.00652** | **0.00182** | **0.00001** | **0.00181** | 2.01 | 40.60966 | **66.38** | **4.9** | **26.3** | **± 0.09** |
| **1300** | **1.26916** | **0.00013** | **0.89321** | **0.00417** | **1.265** | **0.44585** | **0.00061** | **0.01661** | **0.00725** | **0.00127** | **0.00001** | **0.00126** | 2 | 30.74828 | **70.38** | **4.1** | **26.2** | **± 0.16** |
| **1350** | **4.3066** | **0.00354** | **2.9934** | **0.01401** | **4.29259** | **1.4981** | **0.00136** | **0.05599** | **0.02056** | **0.00442** | **0** | **0.0044** | 2 | 36.43239 | **69.51** | **13.7** | **26.1** | **± 0.03** |
| **1400** | **4.94478** | **0.00492** | **3.55031** | **0.0166** | **4.92818** | **1.77508** | **0.00103** | **0.06697** | **0.03707** | **0.0047** | **0.00003** | **0.00466** | 2 | 23.94227 | **71.8** | **16.3** | **26.1** | **± 0.04** |
| 1550 | 8.37421 | 0.00233 | 7.07066 | 0.03336 | 8.34086 | 3.56757 | 0.00368 | 0.13597 | 0.10176 | 0.00438 | 0.00001 | 0.0043 | 1.98 | 17.52933 | 84.43 | 32.7 | 25.9 | ± 0.03 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007291±00%
**Preferred date: 26.13±0.08 Ma on steps 7 to 11 containing 41.4% $^{39}Ar_k$**
Total-gas date: 25.58±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-74/26/DD57** | | | **SANIDINE** | | **Wt.=67.5 mg** | | | | | | | | | | | | | |
| 900 | 1.59544 | 0.0004 | 0.37678 | 0.00293 | 1.59251 | 0.31357 | 0.00004 | 0.00029 | 0.02451 | 0.00412 | 0.00001 | 0.00411 | 1.2 | 6.39678 | 23.62 | 3.8 | 15.8 | ± 0.15 |
| 1000 | 0.86061 | 0.00048 | 0.33065 | 0.002 | 0.85861 | 0.21436 | 0.00014 | 0.00007 | 0.02075 | 0.00179 | 0.00001 | 0.00179 | 1.54 | 5.1653 | 38.42 | 2.6 | 20.2 | ± 0.13 |
| 1100 | 0.83204 | 0.00011 | 0.70091 | 0.00378 | 0.82827 | 0.40389 | 0.00051 | 0 | 0.04168 | 0.00044 | 0.00001 | 0.00043 | 1.74 | 4.84513 | 84.24 | 4.9 | 22.7 | ± 0.09 |
| 1200 | 1.4886 | 0.00116 | 1.37598 | 0.00672 | 1.48187 | 0.71922 | 0.00029 | 0 | 0.06559 | 0.00038 | 0.00001 | 0.00036 | 1.91 | 5.4827 | 92.43 | 8.7 | 25.1 | ± 0.05 |
| **1300** | **2.06584** | **0.00038** | **1.92908** | **0.00926** | **2.05658** | **0.99038** | **0.00031** | **0.00016** | **0.06122** | **0.00045** | **0.00001** | **0.00043** | 1.95 | 8.0887 | **93.38** | **12** | **25.5** | **± 0.07** |
| **1350** | **1.93105** | **0.00098** | **1.82199** | **0.00871** | **1.92235** | **0.93125** | **0.00052** | **0** | **0.03929** | **0.00035** | **0.00002** | **0.00034** | 1.96 | 11.85098 | **94.35** | **11.3** | **25.6** | **± 0.07** |
| **1400** | **2.10996** | **0.00013** | **2.02149** | **0.00968** | **2.10028** | **1.03532** | **0.00096** | **0.00001** | **0.03177** | **0.00028** | **0.00001** | **0.00027** | 1.95 | 16.29399 | **95.81** | **12.6** | **25.6** | **± 0.05** |
| **1450** | **2.8127** | **0.00074** | **2.72217** | **0.01302** | **2.79968** | **1.39234** | **0.00013** | **0** | **0.03506** | **0.00027** | **0.00001** | **0.00026** | 1.96 | 19.85653 | **96.78** | **16.9** | **25.6** | **± 0.04** |
| **1500** | **2.93616** | **0.00042** | **2.84011** | **0.01355** | **2.92262** | **1.44868** | **0.00035** | **0** | **0.02765** | **0.00029** | **0.00001** | **0.00028** | 1.96 | 26.19675 | **96.73** | **17.6** | **25.7** | **± 0.05** |
| 1550 | 1.39939 | 0.00024 | 1.32176 | 0.00623 | 1.39316 | 0.66676 | 0.00025 | 0 | 0.01428 | 0.00025 | 0.00001 | 0.00024 | 1.98 | 23.34594 | 94.45 | 8.1 | 26 | ± 0.08 |
| 1600 | 0.35494 | 0.00059 | 0.26737 | 0.00125 | 0.35369 | 0.13374 | 0.00003 | 0.00006 | 0.00992 | 0.00029 | 0.00001 | 0.00029 | 2 | 6.74093 | 75.33 | 1.6 | 26.2 | ± 0.27 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00731±0.1%
**Plateau date: 25.61±0.05 Ma on steps 5 to 9 containing 60.3% $^{39}Ar_k$**
Total-gas date: 24.94±0.07 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-82/27/DD57** | | | **BIOTITE** | | **Wt.=61.5 mg** | | | | | | | | | | | | | |
| 800 | 0.21611 | 0.00045 | 0.02645 | 0.00022 | 0.21589 | 0.02346 | 0.00002 | 0.00037 | 0.00366 | 0.00064 | 0.00001 | 0.00064 | 1.13 | 3.20492 | 12.24 | 0.3 | 14.9 | ± 0.81 |
| 900 | 0.22421 | 0.00011 | 0.049 | 0.00032 | 0.22389 | 0.03405 | 0.00001 | 0.00039 | 0.00172 | 0.00059 | 0.00001 | 0.00059 | 1.44 | 9.89826 | 21.86 | 0.4 | 18.9 | ± 0.88 |
| 1000 | 0.54392 | 0.0005 | 0.08611 | 0.00036 | 0.54356 | 0.03827 | 0.00003 | 0.00079 | 0.00129 | 0.00155 | 0.00001 | 0.00155 | 2.25 | 14.83333 | 15.83 | 0.5 | 29.5 | ± 0.47 |
| 1100 | 0.61338 | 0.00032 | 0.32806 | 0.00148 | 0.6119 | 0.15824 | 0.00012 | 0.00322 | 0.00299 | 0.00096 | 0.00001 | 0.00096 | 2.07 | 26.46154 | 53.48 | 2 | 27.2 | ± 0.22 |
| 1200 | 1.7133 | 0.00039 | 1.4276 | 0.00626 | 1.70704 | 0.66965 | 0.00031 | 0.01229 | 0.00574 | 0.00095 | 0.00001 | 0.00095 | 2.13 | 58.33188 | 83.32 | 8.3 | 28 | ± 0.05 |
| **1300** | **4.05684** | **0.00103** | **3.71529** | **0.01666** | **4.04018** | **1.78163** | **0.00085** | **0.03079** | **0.0074** | **0.00111** | **0.00001** | **0.0011** | 2.09 | 120.38041 | **91.58** | **22.1** | **27.4** | **± 0.04** |
| **1350** | **4.62166** | **0.00177** | **4.12362** | **0.0185** | **4.60316** | **1.97899** | **0.00087** | **0.03348** | **0.00782** | **0.00164** | **0.00001** | **0.00162** | 2.08 | 126.53389 | **89.22** | **24.5** | **27.4** | **± 0.04** |
| **1400** | **3.13762** | **0.00055** | **2.57765** | **0.01161** | **3.12601** | **1.24164** | **0.00153** | **0.02151** | **0.01668** | **0.00187** | **0.00001** | **0.00186** | 2.08 | 37.21942 | **82.15** | **15.4** | **27.3** | **± 0.06** |
| 1450 | 3.56108 | 0.00083 | 2.97513 | 0.01321 | 3.54787 | 1.41324 | 0.00032 | 0.02432 | 0.00954 | 0.00195 | 0.00001 | 0.00194 | 2.11 | 74.06918 | 83.55 | 17.5 | 27.6 | ± 0.04 |
| 1550 | 1.99052 | 0.00021 | 1.59214 | 0.0069 | 1.98361 | 0.73842 | 0.00013 | 0.01366 | 0.01573 | 0.00133 | 0.00001 | 0.00132 | 2.16 | 23.47171 | 79.99 | 9.1 | 28.3 | ± 0.05 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007335±0.1%
**Plateau date: 27.35±0.05 Ma on steps 6 to 8 containing 61.9% $^{39}Ar_k$**
Total-gas date: 27.48±0.06 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | $\%^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-82/28/DD57** | | | **SANIDINE** | | **Wt.=59.8 mg** | | | | | | | | | | | | | | |
| 900 | 0.0333 | 0.00001 | 0.00369 | 0.00005 | 0.03326 | 0.00519 | 0.00002 | 0.00002 | 0.00086 | 0.0001 | 0.00001 | 0.0001 | 0.71 | 3.01744 | 11.07 | 0.1 | 9.4 | ± | 11.39 |
| 1000 | 0.39132 | 0.00053 | 0.2252 | 0.00101 | 0.39031 | 0.10804 | 0.00007 | 0.0001 | 0.01632 | 0.00056 | 0.00002 | 0.00056 | 2.08 | 3.31005 | 57.55 | 1.1 | 27.4 | ± | 0.73 |
| 1100 | 0.83696 | 0.00008 | 0.49487 | 0.00224 | 0.83472 | 0.2399 | 0.00024 | 0 | 0.00874 | 0.00115 | 0.00001 | 0.00115 | 2.06 | 13.72426 | 59.13 | 2.5 | 27.1 | ± | 0.25 |
| 1200 | 1.48776 | 0.00135 | 1.40362 | 0.00634 | 1.48142 | 0.6778 | 0.00077 | 0.00006 | 0.02469 | 0.00027 | 0.00001 | 0.00026 | 2.07 | 13.7262 | 94.34 | 6.9 | 27.3 | ± | 0.05 |
| 1250 | 1.26797 | 0.0008 | 1.19777 | 0.00546 | 1.26251 | 0.58397 | 0.00039 | 0.00006 | 0.0169 | 0.00022 | 0.00002 | 0.00022 | 2.05 | 17.27722 | 94.46 | 6 | 27 | ± | 0.14 |
| 1300 | 1.45323 | 0.00051 | 1.38809 | 0.00627 | 1.44695 | 0.67112 | 0.00046 | 0.00002 | 0.0169 | 0.0002 | 0.00001 | 0.0002 | 2.07 | 19.85562 | 95.52 | 6.9 | 27.2 | ± | 0.05 |
| 1350 | 1.67371 | 0.00143 | 1.61561 | 0.00729 | 1.66642 | 0.77956 | 0.00112 | 0.00006 | 0.01671 | 0.00018 | 0.00001 | 0.00017 | 2.07 | 23.32615 | 96.53 | 8 | 27.3 | ± | 0.09 |
| 1400 | 2.42938 | 0.00052 | 2.3636 | 0.01065 | 2.41873 | 1.13885 | 0.00121 | 0.00003 | 0.02055 | 0.00019 | 0.00001 | 0.00019 | 2.08 | 27.70925 | 97.29 | 11.7 | 27.3 | ± | 0.05 |
| 1450 | 2.12255 | 0.00217 | 2.05914 | 0.00925 | 2.1133 | 0.98913 | 0.00146 | 0.00001 | 0.01606 | 0.00019 | 0.00001 | 0.00018 | 2.08 | 30.79483 | 97.01 | 10.1 | 27.4 | ± | 0.05 |
| 1500 | 2.36042 | 0.00188 | 2.29272 | 0.01031 | 2.35011 | 1.10254 | 0.00004 | 0 | 0.01843 | 0.0002 | 0.00001 | 0.00019 | 2.08 | 29.91156 | 97.13 | 11.3 | 27.4 | ± | 0.04 |
| 1550 | 4.65472 | 0.00256 | 4.52013 | 0.02031 | 4.63441 | 2.17228 | 0.00109 | 0 | 0.03655 | 0.0004 | 0.00002 | 0.00039 | 2.08 | 29.71655 | 97.11 | 22.3 | 27.4 | ± | 0.04 |
| 1600 | 2.79823 | 0.00285 | 2.69012 | 0.01209 | 2.78615 | 1.2926 | 0.00126 | 0 | 0.02582 | 0.00033 | 0.00002 | 0.00032 | 2.08 | 25.03098 | 96.14 | 13.2 | 27.4 | ± | 0.06 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007349±0.1%
**Plateau date: 27.36±0.06 Ma on steps 6 to 12 containing 83.5% $^{39}Ar_k$**
Total-gas date: 27.3±0.08 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | $\%^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-92/29/DD58** | | | **BIOITITE** | | **Wt.=63.5 mg** | | | | | | | | | | | | | | |
| 800 | 2.19149 | 0.0013 | 0.28958 | 0.00107 | 2.19042 | 0.11461 | 0.00012 | 0.00181 | 0.00737 | 0.00649 | 0.00001 | 0.00648 | 2.53 | 7.77544 | 13.2 | 1.2 | 32.2 | ± | 0.21 |
| 900 | 1.26302 | 0.00005 | 0.56189 | 0.00252 | 1.2605 | 0.26901 | 0.00007 | 0.00596 | 0.1148 | 0.00239 | 0.00001 | 0.00238 | 2.09 | 1.17165 | 44.5 | 2.8 | 27.9 | ± | 0.16 |
| 950 | 0.7611 | 0.0001 | 0.40041 | 0.0018 | 0.7593 | 0.19264 | 0.00004 | 0.00544 | 0.00441 | 0.00123 | 0.00001 | 0.00122 | 2.08 | 21.84127 | 52.6 | 2 | 27.8 | ± | 0.17 |
| 1000 | 0.85971 | 0.00033 | 0.69147 | 0.00314 | 0.85657 | 0.33635 | 0.00018 | 0.01054 | 0.0055 | 0.00057 | 0 | 0.00056 | 2.06 | 30.57727 | 80.3 | 3.4 | 27.7 | ± | 0.07 |
| 1050 | 1.10725 | 0.00071 | 0.94423 | 0.0043 | 1.10295 | 0.45953 | 0.00036 | 0.01471 | 0.00607 | 0.00055 | 0 | 0.00054 | 2.05 | 37.85255 | 85.2 | 4.7 | 27.7 | ± | 0.05 |
| 1100 | 1.81793 | 0.00102 | 1.62964 | 0.00747 | 1.81046 | 0.79862 | 0.00034 | 0.02404 | 0.00515 | 0.00063 | 0.00001 | 0.00062 | 2.04 | 77.53592 | 89.6 | 8.2 | 27.5 | ± | 0.05 |
| 1150 | 2.8341 | 0.00109 | 2.62413 | 0.01211 | 2.82199 | 1.29545 | 0.0005 | 0.03669 | 0.00504 | 0.00069 | 0.00001 | 0.00068 | 2.03 | 128.51687 | 92.6 | 13.3 | 27.3 | ± | 0.04 |
| 1200 | 2.95558 | 0.00144 | 2.7559 | 0.01271 | 2.94287 | 1.35928 | 0.00061 | 0.03674 | 0.00713 | 0.00065 | 0.00001 | 0.00064 | 2.03 | 95.32118 | 93.2 | 13.9 | 27.3 | ± | 0.05 |
| 1250 | 2.29755 | 0.00093 | 2.12265 | 0.00979 | 2.28776 | 1.0474 | 0.00052 | 0.0278 | 0.0056 | 0.00058 | 0 | 0.00056 | 2.03 | 93.51786 | 92.4 | 10.7 | 27.3 | ± | 0.04 |
| 1300 | 2.10045 | 0.00123 | 1.87255 | 0.00865 | 2.0918 | 0.9256 | 0.0004 | 0.02478 | 0.00621 | 0.00076 | 0 | 0.00075 | 2.02 | 74.52496 | 89.1 | 9.5 | 27.3 | ± | 0.04 |
| 1350 | 2.12063 | 0.00161 | 1.77343 | 0.00818 | 2.11245 | 0.87438 | 0.00051 | 0.02397 | 0.01383 | 0.00117 | 0.00001 | 0.00116 | 2.03 | 31.61171 | 83.5 | 9 | 27.3 | ± | 0.04 |
| 1400 | 2.01697 | 0.00119 | 1.58564 | 0.00726 | 2.00971 | 0.77669 | 0.00046 | 0.02185 | 0.01765 | 0.00146 | 0 | 0.00145 | 2.04 | 22.00255 | 78.5 | 8 | 27.5 | ± | 0.04 |
| 1500 | 3.43807 | 0.00169 | 2.68593 | 0.01229 | 3.42578 | 1.31422 | 0.0008 | 0.03802 | 0.05299 | 0.00255 | 0.00001 | 0.00252 | 2.04 | 12.40064 | 78 | 13.5 | 27.5 | ± | 0.05 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007547±0.1%
**Plateau date: 27.32±0.04 Ma on steps 7 to 11 containing 56.4% $^{39}Ar_k$**
Total-gas date: 27.49±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | $\%^{39}Ar$ | Apparent age | | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-98/30/DD58** | | | **BIOTITE** | | **Wt.=50.5 mg** | | | | | | | | | | | | | | |
| 800 | 0.60391 | 0.00031 | 0.06129 | 0.00027 | 0.60364 | 0.03263 | 0.00008 | 0.00073 | 0.00255 | 0.00185 | 0.00001 | 0.00185 | 1.88 | 6.39804 | 9.4 | 0.4 | 23.8 | ± | 0.99 |
| 900 | 0.34531 | 0.00035 | 0.06707 | 0.00035 | 0.34495 | 0.04262 | 0.00003 | 0.00102 | 0.01476 | 0.00095 | 0.00001 | 0.00095 | 1.57 | 1.44377 | 18.8 | 0.5 | 20.8 | ± | 1.3 |
| 1000 | 0.79845 | 0.0002 | 0.13019 | 0.00057 | 0.79787 | 0.06992 | 0 | 0.00274 | 0.01533 | 0.00228 | 0.00001 | 0.00228 | 1.86 | 2.2805 | 15.6 | 0.9 | 24.3 | ± | 0.82 |
| 1100 | 1.01921 | 0.00027 | 0.62957 | 0.0026 | 1.01661 | 0.31586 | 0.0001 | 0.01117 | 0.00211 | 0.00132 | 0.00001 | 0.00132 | 1.99 | 74.84834 | 61.5 | 3.9 | 27 | ± | 0.09 |
| 1200 | 1.77971 | 0.00071 | 1.49122 | 0.00612 | 1.77359 | 0.74461 | 0.00029 | 0.0234 | 0.00698 | 0.00097 | 0 | 0.00096 | 2 | 53.33883 | 83.7 | 9.1 | 27.2 | ± | 0.04 |
| 1250 | 1.62257 | 0.00074 | 1.43051 | 0.0059 | 1.61667 | 0.71861 | 0.00044 | 0.02185 | 0.00414 | 0.00064 | 0.00001 | 0.00063 | 1.99 | 86.78865 | 88.1 | 8.8 | 27.1 | ± | 0.04 |
| 1300 | 3.25263 | 0.00203 | 2.88681 | 0.01192 | 3.24071 | 1.45015 | 0.00067 | 0.04385 | 0.0072 | 0.00122 | 0.00003 | 0.0012 | 1.99 | 100.70486 | 88.7 | 17.7 | 27.1 | ± | 0.08 |
| 1350 | 4.16333 | 0.00216 | 3.60634 | 0.01492 | 4.14841 | 1.81548 | 0.0007 | 0.05718 | 0.02154 | 0.00187 | 0 | 0.00184 | 1.99 | 42.14206 | 86.6 | 22.2 | 27 | ± | 0.04 |
| 1400 | 4.36848 | 0.00217 | 3.69055 | 0.01527 | 4.35321 | 1.85815 | 0.00114 | 0.05847 | 0.02316 | 0.00228 | 0.00001 | 0.00225 | 1.99 | 40.1155 | 84.4 | 22.7 | 27 | ± | 0.04 |
| 1450 | 2.27847 | 0.00052 | 1.95685 | 0.00806 | 2.2704 | 0.98148 | 0.0003 | 0.02793 | 0.01899 | 0.00108 | 0.00002 | 0.00107 | 1.99 | 25.84202 | 85.8 | 12 | 27.1 | ± | 0.08 |
| 1550 | 0.37647 | 0.00011 | 0.30012 | 0.00127 | 0.3752 | 0.15505 | 0.00004 | 0.00509 | 0.02877 | 0.00027 | 0.00001 | 0.00026 | 1.94 | 2.69465 | 79.6 | 1.9 | 26.3 | ± | 0.38 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007621±0.1%
**Plateau date: 27.06±0.06 Ma on steps 6 to 10 containing 83.4% $^{39}Ar_k$**
Total-gas date: 27.00±0.08 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-98/31/DD58** | | | **SANIDINE** | | **Wt.=53.5 mg** | | | | | | | | | | | | | |
| 900 | 1.34796 | 0.00028 | 0.19361 | 0.00083 | 1.34713 | 0.08903 | 0.00007 | 0.0004 | 0.02147 | 0.00394 | 0 | 0.00394 | 2.17 | 2.07336 | 14.4 | 0.9 | 28.3 | ± 0.18 |
| 1000 | 0.86216 | 0.0003 | 0.21927 | 0.00103 | 0.86113 | 0.10979 | 0.00002 | 0.00018 | 0.01339 | 0.00219 | 0.00001 | 0.00219 | 2 | 4.0997 | 25.4 | 1.2 | 26.7 | ± 0.36 |
| 1100 | 0.99478 | 0.0006 | 0.72145 | 0.00341 | 0.99137 | 0.36499 | 0.00041 | 0.00007 | 0.01937 | 0.00093 | 0.00001 | 0.00092 | 1.98 | 9.42153 | 72.5 | 3.8 | 27 | ± 0.09 |
| 1200 | 2.05875 | 0.00129 | 1.80612 | 0.00858 | 2.05017 | 0.91778 | 0.00065 | 0.00017 | 0.03619 | 0.00084 | 0.00002 | 0.00083 | 1.97 | 12.68002 | 87.7 | 9.6 | 26.9 | ± 0.1 |
| **1250** | **1.57767** | **0.00071** | **1.47529** | **0.00704** | **1.57063** | **0.7533** | **0.00035** | **0.00017** | **0.02332** | **0.00033** | **0.00001** | **0.00033** | 1.96 | 16.15137 | **93.5** | **7.9** | **26.8** | **± 0.04** |
| **1300** | **1.93727** | **0.00065** | **1.82724** | **0.00874** | **1.92853** | **0.93525** | **0.00048** | **0.00013** | **0.01839** | **0.00035** | **0.00001** | **0.00035** | 1.95 | 25.42822 | **94.3** | **9.8** | **26.7** | **± 0.05** |
| **1350** | **2.45539** | **0.00139** | **2.35588** | **0.01125** | **2.44414** | **1.20325** | **0.00045** | **0.0002** | **0.02161** | **0.00031** | **0** | **0.0003** | 1.96 | 27.84012 | **96** | **12.6** | **26.8** | **± 0.04** |
| 1400 | 2.51754 | 0.00102 | 2.43404 | 0.01159 | 2.50595 | 1.24004 | 0.00072 | 0.00018 | 0.02177 | 0.00025 | 0.00001 | 0.00025 | 1.96 | 28.48048 | 96.7 | 12.9 | 26.9 | ± 0.04 |
| 1450 | 3.42226 | 0.00012 | 3.31883 | 0.01279 | 3.40947 | 1.68852 | 0.00027 | 0.00023 | 0.02837 | 0.00031 | 0 | 0.0003 | 1.97 | 29.7589 | 97 | 17.6 | 26.9 | ± 0.04 |
| 1500 | 2.8844 | 0.00123 | 2.80516 | 0.01326 | 2.87114 | 1.41781 | 0.00074 | 0.00014 | 0.02318 | 0.00023 | 0.00001 | 0.00023 | 1.98 | 30.58261 | 97.3 | 14.8 | 27.1 | ± 0.04 |
| 1550 | 1.62338 | 0.0007 | 1.51952 | 0.00716 | 1.61622 | 0.79907 | 0.00044 | 0.00006 | 0.0209 | 0.00034 | 0.00001 | 0.00033 | 1.9 | 19.11651 | 93.6 | 8 | 27.1 | ± 0.06 |
| 1600 | 0.26876 | 0.00005 | 0.19089 | 0.0009 | 0.26786 | 0.0958 | 0.00003 | 0.0001 | 0.01531 | 0.00027 | 0.00001 | 0.00026 | 1.99 | 3.12867 | 70.8 | 1 | 27.2 | ± 0.4 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007653±0.1%
**Preferred date: 26.76±0.05 Ma on steps 5 to 7 containing 30.2% $^{39}Ar_k$**
Total-gas date: 26.91±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-171/33/DD58** | | | **BIOTITE** | | **Wt.=52.7 mg** | | | | | | | | | | | | | |
| 800 | 0.32771 | 0.0005 | 0.00954 | 0.00007 | 0.32764 | 0.00837 | 0.00001 | 0.00021 | 0.00152 | 0.0011 | 0.00001 | 0.0011 | 1.14 | 2.75329 | 1.8 | 0.1 | 5.5 | ± 2.63 |
| 900 | 0.37334 | 0.00081 | 0.06087 | 0.00031 | 0.37303 | 0.03781 | 0.00007 | 0.00115 | 0.00296 | 0.00107 | 0.00001 | 0.00106 | 1.61 | 6.38682 | 16.3 | 0.4 | 21.2 | ± 1 |
| 1000 | 0.97605 | 0.00027 | 0.29963 | 0.0012 | 0.97485 | 0.14589 | 0.00005 | 0.00631 | 0 | 0.00231 | 0.00001 | 0.0023 | 2.05 | 0 | 30.7 | 1.6 | 27.7 | ± 0.16 |
| 1100 | 2.09271 | 0.00125 | 1.66114 | 0.00677 | 2.08594 | 0.82445 | 0.00065 | 0.0342 | 0.00391 | 0.00146 | 0.00002 | 0.00145 | 2.01 | 105.42839 | 79.3 | 9.3 | 27.6 | ± 0.1 |
| 1200 | 2.88937 | 0.00089 | 2.62815 | 0.01088 | 2.87849 | 1.32389 | 0.00071 | 0.05384 | 0.00528 | 0.00087 | 0.00001 | 0.00085 | 1.99 | 125.36837 | 90.9 | 14.9 | 27.2 | ± 0.04 |
| 1250 | 2.22312 | 0.00108 | 1.99537 | 0.00827 | 2.21485 | 1.00649 | 0.00052 | 0.03908 | 0.00163 | 0.00076 | 0.00001 | 0.00074 | 1.98 | 308.73926 | 89.7 | 11.3 | 27.2 | ± 0.04 |
| **1300** | **2.7809** | **0.00139** | **2.44184** | **0.0102** | **2.77071** | **1.24098** | **0.00067** | **0.04919** | **0.00408** | **0.00114** | **0.00001** | **0.00112** | 1.97 | 152.08088 | **87.8** | **14** | **27** | **± 0.04** |
| **1350** | **3.10929** | **0.00134** | **2.69694** | **0.01126** | **3.09803** | **1.37091** | **0.00085** | **0.05597** | **0.00495** | **0.00138** | **0.00001** | **0.00136** | 1.97 | 138.47576 | **86.7** | **15.4** | **27** | **± 0.04** |
| **1400** | **3.86384** | **0.00192** | **3.35107** | **0.01397** | **3.84986** | **1.70078** | **0.00074** | **0.06753** | **0.00593** | **0.00172** | **0.00001** | **0.0017** | 1.97 | 143.40472 | **86.7** | **19.1** | **27** | **± 0.04** |
| **1500** | **2.83747** | **0.00074** | **2.44046** | **0.01014** | **2.82733** | **1.23396** | **0.00033** | **0.04713** | **0.01673** | **0.00134** | **0.00001** | **0.00132** | 1.98 | 36.87866 | **86** | **13.9** | **27.1** | **± 0.04** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007671±0.1%
**Plateau date: 27.1±0.04 Ma on steps 7 to 10 containing 62.4% $^{39}Ar_k$**
Total-gas date: 27.07±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-171/34/DD58** | | | **AMPHIBOLE** | | **Wt.=187 mg** | | | | | | | | | | | | | |
| 900 | 0.11153 | 0.00007 | 0.00422 | 0.00003 | 0.1115 | 0.00381 | 0.00001 | 0.00015 | 0.01095 | 0.00037 | 0.00001 | 0.00036 | 1.11 | 0.17397 | 3.8 | 0.2 | 15.3 | ± 9.36 |
| 1000 | 0.34358 | 0.00037 | 0.08685 | 0.00016 | 0.34342 | 0.01973 | 0 | 0.00049 | 0.01853 | 0.00087 | 0.00001 | 0.00087 | 4.4 | 0.53238 | 25.3 | 0.9 | 59.8 | ± 1.26 |
| 1100 | 0.43941 | 0.0004 | 0.03094 | 0.00008 | 0.43933 | 0.0095 | 0.00001 | 0.00043 | 0.00736 | 0.00138 | 0.00002 | 0.00138 | 3.26 | 0.64538 | 7 | 0.4 | 44.4 | ± 8.53 |
| 1200 | 0.35419 | 0.00005 | 0.13492 | 0.00051 | 0.35369 | 0.06163 | 0.00001 | 0.00309 | 0.02779 | 0.00075 | 0.00002 | 0.00074 | 2.19 | 1.10885 | 38.1 | 2.8 | 30 | ± 1.09 |
| 1250 | 0.11734 | 0.00007 | 0.08212 | 0.00033 | 0.11701 | 0.04005 | 0.00001 | 0.00252 | 0.05748 | 0.00013 | 0.00001 | 0.00012 | 2.05 | 0.34838 | 70 | 1.8 | 28.1 | ± 1.02 |
| **1275** | **0.11596** | **0.00007** | **0.06939** | **0.00032** | **0.11564** | **0.03887** | **0.00003** | **0.00377** | **0.00005** | **0.00015** | **0.00001** | **0.00016** | 1.79 | 388.7 | **59.8** | **1.8** | **24.5** | **± 1.23** |
| **1300** | **0.33314** | **0.0004** | **0.21083** | **0.00095** | **0.33219** | **0.1158** | **0.00016** | **0.02463** | **0.49154** | **0.00055** | **0.00001** | **0.00041** | 1.82 | 0.11779 | **63.3** | **5.3** | **25** | **± 0.42** |
| **1325** | **0.61081** | **0.00062** | **0.44282** | **0.00192** | **0.60889** | **0.23379** | **0.00026** | **0.07392** | **1.44204** | **0.00097** | **0.00001** | **0.00056** | 1.89 | 0.08106 | **72.5** | **10.7** | **26** | **± 0.15** |
| **1375** | **0.95242** | **0.00066** | **0.82729** | **0.0035** | **0.94892** | **0.427** | **0.00043** | **0.11335** | **2.74874** | **0.00118** | **0** | **0.00041** | 1.94 | 0.07767 | **86.9** | **19.5** | **26.6** | **± 0.05** |
| **1400** | **0.949** | **0.00089** | **0.82036** | **0.00351** | **0.94549** | **0.42789** | **0.00045** | **0.06097** | **2.50206** | **0.00111** | **0.00001** | **0.00042** | 1.92 | 0.08551 | **86.4** | **19.6** | **26.3** | **± 0.06** |
| **1450** | **0.80729** | **0.00027** | **0.68626** | **0.00291** | **0.80438** | **0.35489** | **0.00021** | **0.07228** | **2.191** | **0.00101** | **0.00002** | **0.0004** | 1.93 | 0.08099 | **85** | **16.2** | **26.5** | **± 0.3** |
| **1550** | **1.03317** | **0.00074** | **0.89239** | **0.00371** | **1.02946** | **0.4522** | **0.00038** | **0.09657** | **2.82082** | **0.00125** | **0.00001** | **0.00046** | 1.97 | 0.08015 | **86.4** | **20.7** | **27.1** | **± 0.14** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.00766±0.1%
**Preferred date: 26.91±0.34 Ma on steps 6 to 12 containing 78.1% $^{39}Ar_k$**
Total-gas date: 26.92±0.26 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-171/32/DD58** | | | **SANIDINE** | | **Wt.=57.5 mg** | | | | | | | | | | | | | |
| 900 | 0.79115 | 0.00028 | 0.11057 | 0.00059 | 0.79056 | 0.06316 | 0.00007 | 0.00008 | 0.00219 | 0.00232 | 0.00001 | 0.00232 | 1.75 | 14.42009 | 14 | 0.6 | 22.8 | ± 0.88 |
| 1000 | 1.63523 | 0.00107 | 0.7773 | 0.00367 | 1.63156 | 0.39239 | 0.00019 | 0.00018 | 0.01818 | 0.00292 | 0.00001 | 0.00291 | 1.98 | 10.7918 | 47.5 | 3.7 | 26.9 | ± 0.11 |
| 1100 | 1.62231 | 0.00087 | 1.46224 | 0.00697 | 1.61534 | 0.74497 | 0.00031 | 0.00017 | 0.02832 | 0.00053 | 0.00001 | 0.00052 | 1.96 | 13.15272 | 90.1 | 7 | 26.9 | ± 0.04 |
| 1200 | 2.44436 | 0.00143 | 2.26728 | 0.01083 | 2.43353 | 1.15791 | 0.00064 | 0.00017 | 0.03045 | 0.00058 | 0.00002 | 0.00057 | 1.96 | 19.0133 | 92.8 | 10.9 | 26.8 | ± 0.07 |
| 1250 | 2.1709 | 0.00114 | 2.02358 | 0.00967 | 2.16123 | 1.03475 | 0.0006 | 0.00017 | 0.02067 | 0.00048 | 0.00001 | 0.00047 | 1.96 | 25.03024 | 93.2 | 9.7 | 26.8 | ± 0.06 |
| 1300 | 3.26235 | 0.0022 | 3.09033 | 0.01478 | 3.24757 | 1.58035 | 0.00115 | 0.00027 | 0.02307 | 0.00054 | 0.00001 | 0.00054 | 1.96 | 34.25119 | 94.7 | 14.8 | 26.8 | ± 0.04 |
| 1350 | 3.2639 | 0.00161 | 3.09769 | 0.01482 | 3.24908 | 1.58509 | 0.00079 | 0.00023 | 0.02095 | 0.00052 | 0.00001 | 0.00052 | 1.95 | 37.83031 | 94.9 | 14.9 | 26.8 | ± 0.04 |
| 1400 | 3.32018 | 0.00109 | 3.16056 | 0.01506 | 3.30512 | 1.61069 | 0.00056 | 0.00023 | 0.02617 | 0.0005 | 0 | 0.00049 | 1.96 | 30.7736 | 95.2 | 15.1 | 26.9 | ± 0.04 |
| 1450 | 2.6375 | 0.00109 | 2.49495 | 0.01188 | 2.62562 | 1.27075 | 0.00055 | 0.00012 | 0.01987 | 0.00045 | 0.00001 | 0.00045 | 1.96 | 31.9766 | 94.6 | 11.9 | 26.9 | ± 0.04 |
| 1500 | 1.98057 | 0.00139 | 1.84311 | 0.00877 | 1.9718 | 0.938 | 0.00056 | 0.00006 | 0.01408 | 0.00044 | 0.00001 | 0.00044 | 1.96 | 33.30966 | 93.1 | 8.8 | 26.9 | ± 0.04 |
| 1600 | 0.69752 | 0.00009 | 0.56054 | 0.00269 | 0.69483 | 0.28746 | 0.00003 | 0.00001 | 0.00573 | 0.00046 | 0.00001 | 0.00046 | 1.95 | 25.08377 | 80.4 | 2.7 | 26.7 | ± 0.11 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9

J-value and its error: 0.007664±0.1%

**Plateau date: 26.83±0.05 Ma on steps 3 to 11 containing 95.7% $^{39}Ar_k$**

Total-gas date: 26.81±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-92-1/38/DD57** | | | **BIOTITE** | | **Wt.=59 mg** | | | | | | | | | | | | | |
| 800 | 0.33251 | 0.00018 | 0.02303 | 0.0002 | 0.33232 | 0.02092 | 0.00004 | 0.00036 | 0.00037 | 0.00105 | 0 | 0.00105 | 1.1 | 28.27027 | 6.93 | 0.3 | 14.4 | ± 0.11 |
| 900 | 0.28039 | 0.00008 | 0.04209 | 0.00026 | 0.28014 | 0.02728 | 0 | 0.00056 | 0.00027 | 0.00081 | 0 | 0.00081 | 1.54 | 50.51852 | 15.01 | 0.3 | 20.2 | ± 0.44 |
| 1000 | 0.44528 | 0.00043 | 0.11989 | 0.00051 | 0.44477 | 0.0549 | 0.00009 | 0.00152 | 0.00498 | 0.0011 | 0.00001 | 0.0011 | 2.18 | 5.51205 | 26.92 | 0.7 | 28.5 | ± 0.47 |
| 1100 | 1.7234 | 0.00077 | 0.76127 | 0.00288 | 1.72052 | 0.30849 | 0.00019 | 0.00941 | 0.00454 | 0.00325 | 0.00001 | 0.00325 | 2.47 | 33.97467 | 44.17 | 3.6 | 32.2 | ± 0.08 |
| 1150 | 1.39677 | 0.00113 | 1.07081 | 0.00401 | 1.39276 | 0.42877 | 0.00039 | 0.01306 | 0.00259 | 0.00109 | 0.00001 | 0.00109 | 2.5 | 82.77413 | 76.66 | 5 | 32.6 | ± 0.1 |
| 1200 | 1.62602 | 0.00029 | 1.35815 | 0.00498 | 1.62104 | 0.5329 | 0.00008 | 0.01617 | 0.0037 | 0.00089 | 0.00001 | 0.00089 | 2.55 | 72.01351 | 83.53 | 6.3 | 33.3 | ± 0.07 |
| 1250 | 1.25961 | 0.00059 | 1.17401 | 0.00436 | 1.25525 | 0.46595 | 0.00024 | 0.01415 | 0.00197 | 0.00028 | 0.00001 | 0.00027 | 2.52 | 118.26142 | 93.2 | 5.5 | 32.9 | ± 0.13 |
| 1300 | 1.28933 | 0.00028 | 1.2107 | 0.00448 | 1.28484 | 0.47948 | 0.00027 | 0.01458 | 0.00259 | 0.00026 | 0 | 0.00025 | 2.53 | 92.56371 | 93.9 | 5.6 | 33 | ± 0.06 |
| 1350 | 2.08672 | 0.00249 | 1.95405 | 0.00725 | 2.07947 | 0.775 | 0.00029 | 0.02369 | 0.00617 | 0.00043 | 0.00001 | 0.00042 | 2.52 | 62.80389 | 93.64 | 9.1 | 32.9 | ± 0.05 |
| 1400 | 5.09248 | 0.00544 | 4.8717 | 0.01814 | 5.07434 | 1.93977 | 0.00191 | 0.05853 | 0.01537 | 0.0007 | 0.00001 | 0.00069 | 2.51 | 63.10247 | 95.66 | 22.8 | 32.8 | ± 0.05 |
| 1450 | 5.58371 | 0.00432 | 5.3815 | 0.0201 | 5.56362 | 2.14938 | 0.0017 | 0.0652 | 0.02482 | 0.00064 | 0.00001 | 0.00062 | 2.5 | 43.29936 | 96.38 | 25.3 | 32.7 | ± 0.05 |
| 1600 | 3.49792 | 0.00095 | 3.32526 | 0.01243 | 3.4855 | 1.32888 | 0.00021 | 0.04167 | 0.0358 | 0.00056 | 0.00001 | 0.00054 | 2.5 | 18.55978 | 95.06 | 15.6 | 32.7 | ± 0.05 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9

J-value and its error: 0.0073±0.1%

**Plateau date: 32.74±0.05 Ma on steps 10 to 12 containing 63.7% $^{39}Ar_k$**

Total-gas date: 32.65±0.06 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-92-1/37/DD57** | | | **SANIDINE** | | **Wt.=54.9 mg** | | | | | | | | | | | | | |
| 900 | 0.13085 | 0.00001 | 0.02935 | 0.00015 | 0.13071 | 0.01573 | 0.00002 | 0.0001 | 0.0023 | 0.00034 | 0.00001 | 0.00034 | 1.87 | 3.41957 | 22.43 | 0.2 | 24.6 | ± 3.22 |
| 1000 | 0.58447 | 0.00045 | 0.30167 | 0.00111 | 0.58335 | 0.1192 | 0.00004 | 0.00018 | 0.02491 | 0.00096 | 0.00001 | 0.00095 | 2.53 | 2.39261 | 51.62 | 1.4 | 33.2 | ± 0.39 |
| 1100 | 1.04927 | 0.00124 | 0.72236 | 0.00268 | 1.04658 | 0.28703 | 0.0003 | 0 | 0.02201 | 0.0011 | 0.00002 | 0.0011 | 2.52 | 6.52045 | 68.84 | 3.4 | 33.1 | ± 0.24 |
| 1200 | 1.46899 | 0.00113 | 1.37686 | 0.00508 | 1.4639 | 0.54348 | 0.0002 | 0 | 0.02508 | 0.0003 | 0 | 0.00029 | 2.53 | 10.83493 | 93.73 | 6.5 | 33.3 | ± 0.05 |
| 1250 | 1.41339 | 0.00111 | 1.31841 | 0.00489 | 1.4085 | 0.52258 | 0.00047 | 0.00003 | 0.01593 | 0.00031 | 0 | 0.0003 | 2.52 | 16.40239 | 93.28 | 6.3 | 33.1 | ± 0.05 |
| 1300 | 1.48614 | 0.00096 | 1.39436 | 0.00517 | 1.48096 | 0.55342 | 0.00007 | 0 | 0.01325 | 0.0003 | 0.00001 | 0.00029 | 2.52 | 20.88377 | 93.82 | 6.6 | 33.1 | ± 0.07 |
| 1350 | 1.70146 | 0.00043 | 1.58774 | 0.00594 | 1.69553 | 0.63509 | 0.0001 | 0 | 0.01255 | 0.00037 | 0 | 0.00036 | 2.5 | 25.30239 | 93.32 | 7.6 | 32.8 | ± 0.05 |
| 1400 | 2.07891 | 0.00082 | 1.92819 | 0.00722 | 2.07169 | 0.77231 | 0.00019 | 0 | 0.0169 | 0.00049 | 0.00001 | 0.00049 | 2.5 | 22.84941 | 92.75 | 9.2 | 32.8 | ± 0.07 |
| 1450 | 2.3003 | 0.00013 | 2.13332 | 0.00792 | 2.29238 | 0.84758 | 0.00036 | 0.00004 | 0.01823 | 0.00054 | 0 | 0.00054 | 2.52 | 23.24685 | 92.74 | 10.1 | 33.1 | ± 0.05 |
| 1500 | 4.28762 | 0.00222 | 4.05117 | 0.01506 | 4.27255 | 1.6112 | 0.00081 | 0.00001 | 0.03527 | 0.00076 | 0.00001 | 0.00075 | 2.51 | 22.84094 | 94.49 | 19.3 | 33 | ± 0.05 |
| 1550 | 5.94425 | 0.00349 | 5.65584 | 0.02092 | 5.92334 | 2.23716 | 0.00119 | 0 | 0.04326 | 0.00092 | 0.00001 | 0.00091 | 2.53 | 25.85714 | 95.15 | 26.8 | 33.2 | ± 0.05 |
| 1600 | 0.65268 | 0.00005 | 0.57898 | 0.00201 | 0.65068 | 0.2145 | 0.00012 | 0.00005 | 0.00911 | 0.00025 | 0.00001 | 0.00024 | 2.7 | 11.77278 | 88.71 | 2.6 | 35.4 | ± 0.17 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9

J-value and its error: 0.007348±0.1%

**Preferred date: 32.81±0.06 Ma on steps 7 to 8 containing 16.8% $^{39}Ar_k$**

Total-gas date: 33.12±0.07 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-92-16/39/DD57** | | | **BIOTITE** | | **Wt.=25.6 mg** | | | | | | | | | | | | | |
| 850 | 1.84638 | 0.00163 | 0.2427 | 0.0012 | 1.84519 | 0.12812 | 0.00013 | 0.00383 | 0.00618 | 0.00543 | 0.00001 | 0.00542 | 1.89 | 10.3657 | 13.14 | 2.93 | 24.78 | ± 0.28 |
| 1000 | 1.71886 | 0.00119 | 0.34434 | 0.00162 | 1.71723 | 0.17367 | 0.00001 | 0.00629 | 0.00887 | 0.00465 | 0.00001 | 0.00465 | 1.98 | 9.78974 | 20.03 | 3.97 | 25.92 | ± 0.12 |
| 1150 | 2.23011 | 0.00109 | 1.04681 | 0.00457 | 2.22554 | 0.48858 | 0.00033 | 0.01907 | 0.01013 | 0.004 | 0.00001 | 0.00399 | 2.14 | 24.1155 | 46.94 | 11.17 | 28 | ± 0.11 |
| 1250 | 2.61608 | 0.00187 | 1.04376 | 0.00456 | 2.61152 | 0.48763 | 0.00024 | 0.01792 | 0.01126 | 0.00531 | 0.00003 | 0.00531 | 2.14 | 21.6532 | 39.9 | 11.15 | 27.97 | ± 0.22 |
| 1300 | 2.26857 | 0.0013 | 1.22063 | 0.0052 | 2.26338 | 0.55564 | 0.00019 | 0.02124 | 0.01058 | 0.00354 | 0.00002 | 0.00353 | 2.2 | 26.25898 | 53.81 | 12.7 | 28.7 | ± 0.11 |
| **1350** | **2.29749** | **0.0017** | **1.64769** | **0.00727** | **2.29022** | **0.77705** | **0.00068** | **0.03081** | **0.0095** | **0.00218** | **0.00001** | **0.00217** | **2.12** | **40.89737** | **71.72** | **17.77** | **27.71** | **± 0.04** |
| **1400** | **2.53492** | **0.00155** | **2.34314** | **0.01056** | **2.52437** | **1.12898** | **0.00089** | **0.04638** | **0.00972** | **0.00063** | **0** | **0.00061** | **2.08** | **58.0751** | **92.43** | **25.81** | **27.13** | **± 0.04** |
| **1450** | **1.17209** | **0.00075** | **1.10958** | **0.00502** | **1.16708** | **0.53637** | **0.00028** | **0.02077** | **0.00992** | **0.0002** | **0.00001** | **0.00019** | **2.07** | **27.03478** | **94.67** | **12.26** | **27.04** | **± 0.07** |
| **1600** | **0.23716** | **0.00002** | **0.19117** | **0.00091** | **0.23624** | **0.09772** | **0.00007** | **0.00379** | **0.0091** | **0.00016** | **0.00001** | **0.00015** | **1.96** | **5.36923** | **80.61** | **2.23** | **25.58** | **± 0.49** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007300±0.1%
**Plateau date: 27.29±0.05 Ma on steps: 6 to 8 containing 55.84%** $^{39}Ar_k$
Total-gas date: 27.46±0.10 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-92-16/62/DD58** | | | **SANIDINE** | | **Wt.=48.9 mg** | | | | | | | | | | | | | |
| 900 | 0.45226 | 0.00032 | 0.12935 | 0.0005 | 0.45176 | 0.06119 | 0.00004 | 0.00019 | 0.00191 | 0.0011 | 0.00001 | 0.0011 | 2.11 | 16.01832 | 28 | 0.7 | 27.6 | ± 0.63 |
| 1000 | 1.44946 | 0.00095 | 0.91637 | 0.00359 | 1.44588 | 0.43656 | 0.0002 | 0 | 0.0152 | 0.00181 | 0.00001 | 0.0018 | 2.1 | 14.36053 | 63 | 4.9 | 27.8 | ± 0.13 |
| **1100** | **1.07828** | **0.00025** | **0.91789** | **0.00378** | **1.0745** | **0.46005** | **0.00004** | **0.00007** | **0.01671** | **0.00054** | **0.00001** | **0.00053** | 2 | 13.76571 | **85.1** | **5.1** | **26.6** | **± 0.06** |
| **1200** | **1.89201** | **0.0015** | **1.69974** | **0.00703** | **1.88497** | **0.85598** | **0.00069** | **0.00015** | **0.02614** | **0.00064** | **0** | **0.00063** | 1.99 | 16.37299 | **89.8** | **9.5** | **26.5** | **± 0.04** |
| **1250** | **1.28386** | **0.00034** | **1.1433** | **0.00472** | **1.27914** | **0.57466** | **0.00022** | **0.0001** | **0.01275** | **0.00046** | **0** | **0.00046** | 1.99 | 22.53569 | **89** | **6.4** | **26.5** | **± 0.04** |
| **1300** | **1.81212** | **0.00087** | **1.65203** | **0.0068** | **1.80532** | **0.82765** | **0.00039** | **0.00013** | **0.0139** | **0.00052** | **0** | **0.00052** | 2 | 29.77158 | **91.2** | **9.2** | **26.6** | **± 0.04** |
| **1350** | **1.80239** | **0.00146** | **1.68897** | **0.00691** | **1.79548** | **0.84135** | **0.00058** | **0.00015** | **0.01218** | **0.00036** | **0.00002** | **0.00036** | 2.01 | 34.53818 | **93.7** | **9.4** | **26.7** | **± 0.08** |
| **1400** | **2.59354** | **0.00116** | **2.46037** | **0.01007** | **2.58347** | **1.22545** | **0.00066** | **0.00016** | **0.01636** | **0.00042** | **0.00001** | **0.00042** | 2.01 | 37.45263 | **94.9** | **13.7** | **26.8** | **± 0.04** |
| **1450** | **3.83924** | **0.00087** | **3.67331** | **0.01501** | **3.82423** | **1.82656** | **0.00035** | **0.00021** | **0.02877** | **0.00052** | **0.00001** | **0.00051** | 2.01 | 31.74418 | **95.7** | **20.4** | **26.8** | **± 0.04** |
| 1500 | 3.17249 | 0.00168 | 3.00908 | 0.01217 | 3.16033 | 1.48087 | 0.00075 | 0.00011 | 0.01821 | 0.00052 | 0 | 0.00051 | 2.03 | 40.6609 | 94.9 | 16.5 | 27.1 | ± 0.04 |
| 1600 | 0.92773 | 0.00027 | 0.79012 | 0.00314 | 0.92459 | 0.38165 | 0.0001 | 0.00005 | 0.00646 | 0.00046 | 0.00001 | 0.00046 | 2.07 | 29.53947 | 85.1 | 4.3 | 27.6 | ± 0.08 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007454±0.1%
**Preferred date: 26.67±0.05 Ma on steps 3 to 9 containing 73.7%** $^{39}Ar_k$
Total-gas date: 26.83±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-91-58A/40/DD58** | | | **ORTHOCLASE** | | **Wt.=60.9 mg** | | | | | | | | | | | | | |
| 800 | 1.7484 | 0.00157 | 0.13715 | 0.00054 | 1.74786 | 0.05781 | 0.00006 | 0.00035 | 0 | 0.0045 | 0.00001 | 0.00549 | 2.37 | | 7.1 | 0.3 | 28.9 | ± 0.33 |
| 900 | 1.10776 | 0 | 0.80284 | 0.00362 | 1.10414 | 0.38677 | 0.00011 | 0.00011 | 0.00402 | 0.00103 | 0.00001 | 0.00103 | 2.08 | 48.10572 | 72.3 | 2.2 | 27.8 | ± 0.08 |
| 950 | 1.36496 | 0.00085 | 1.21673 | 0.00564 | 1.35932 | 0.60363 | 0.00041 | 0.00002 | 0.00221 | 0.00049 | 0 | 0.00049 | 2.02 | 136.56787 | 89.1 | 3.5 | 27.1 | ± 0.04 |
| 1000 | 2.01904 | 0.00104 | 1.53859 | 0.00719 | 2.01185 | 0.76869 | 0.00039 | 0.00014 | 0.00215 | 0.00162 | 0 | 0.00161 | 2 | 178.76512 | 76.1 | 4.5 | 26.9 | ± 0.04 |
| **1050** | **2.13683** | **0.00114** | **2.0534** | **0.00964** | **2.12719** | **1.03095** | **0.00056** | **0.0001** | **0.00356** | **0.00026** | **0.00001** | **0.00026** | 1.99 | 144.79635 | **96.1** | **6** | **26.8** | **± 0.04** |
| **1100** | **2.25055** | **0.00105** | **2.17503** | **0.01021** | **2.24034** | **1.09247** | **0.00072** | **0.00012** | **0.00178** | **0.00022** | **0.00001** | **0.00022** | 1.99 | 306.8736 | **96.7** | **6.3** | **26.8** | **± 0.05** |
| **1150** | **2.02642** | **0.00111** | **1.95278** | **0.0092** | **2.01722** | **0.98447** | **0.00049** | **0.00008** | **0** | **0.00022** | **0.00001** | **0.00022** | 1.98 | | **96.4** | **5.7** | **26.7** | **± 0.05** |
| **1200** | **2.13669** | **0.00108** | **2.04483** | **0.00964** | **2.12705** | **1.03135** | **0.00063** | **0.00017** | **0.00454** | **0.00028** | **0.00001** | **0.00028** | 1.98 | 113.5848 | **95.7** | **6** | **26.7** | **± 0.07** |
| **1250** | **2.08097** | **0.00107** | **1.97423** | **0.00931** | **2.07166** | **0.99545** | **0.00047** | **0.00011** | **0.00298** | **0.00033** | **0.00001** | **0.00033** | 1.98 | 167.02181 | **94.9** | **5.8** | **26.7** | **± 0.04** |
| **1300** | **2.09321** | **0.00115** | **1.98177** | **0.00933** | **2.08388** | **0.99749** | **0.0005** | **0.00012** | **0** | **0.00035** | **0.00001** | **0.00035** | 1.99 | | **94.7** | **5.8** | **26.7** | **± 0.05** |
| **1350** | **2.10172** | **0.00104** | **2.00226** | **0.00943** | **2.09229** | **1.00873** | **0.00032** | **0.00011** | **0.00077** | **0.00031** | **0.00001** | **0.00031** | 1.98 | 655.01948 | **95.3** | **5.8** | **26.7** | **± 0.06** |
| **1400** | **2.04844** | **0.00103** | **1.95881** | **0.00924** | **2.0392** | **0.9877** | **0.00031** | **0.0001** | **0** | **0.00027** | **0.00001** | **0.00027** | 1.98 | | **95.7** | **5.7** | **26.7** | **± 0.04** |
| **1450** | **2.11685** | **0.00125** | **2.02018** | **0.00949** | **2.10736** | **1.01475** | **0.00049** | **0.00011** | **0.00537** | **0.0003** | **0.00002** | **0.0003** | 1.99 | 94.48324 | **95.5** | **5.9** | **26.8** | **± 0.09** |
| **1500** | **2.54113** | **0.00128** | **2.34607** | **0.01103** | **2.5301** | **1.18** | **0.00059** | **0.00011** | **0.00172** | **0.00063** | **0.00001** | **0.00063** | 1.99 | 343.02326 | **92.3** | **6.8** | **26.7** | **± 0.05** |
| **1550** | **3.00613** | **0.00076** | **2.68413** | **0.01259** | **2.99354** | **1.34638** | **0.00061** | **0.00022** | **0.00594** | **0.00106** | **0.00002** | **0.00106** | 1.99 | 113.33165 | **89.3** | **7.8** | **26.8** | **± 0.06** |
| **1600** | **4.00411** | **0.00188** | **3.53372** | **0.01655** | **3.98756** | **1.77038** | **0.00074** | **0.00034** | **0.00438** | **0.00155** | **0.00001** | **0.00155** | 2 | 202.09817 | **88.2** | **10.2** | **26.8** | **± 0.04** |
| 1700 | 4.52003 | 0.0034 | 4.06908 | 0.01898 | 4.50105 | 2.02981 | 0.00184 | 0.00043 | 0.0058 | 0.00148 | 0.00001 | 0.00147 | 2 | 174.98362 | 90 | 11.7 | 27 | ± 0.04 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9
J-value and its error: 0.007527±0.1%
**Plateau date: 26.75±0.05 Ma on steps 5 to 16 containing 77.8%** $^{39}Ar_k$
Total-gas date: 26.82±0.05 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-92-59/42/DD58** | | | **BIOTITE** | | **Wt.=60.9 mg** | | | | | | | | | | | | | |
| 800 | 1.06695 | 0.00047 | 0.08514 | 0.00076 | 1.06619 | 0.0926 | 0.00006 | 0.00309 | 0.0037 | 0.00335 | 0 | 0.00335 | 0.92 | 12.51351 | 8 | 1 | 11.1 | ± 0.16 |
| 900 | 2.66336 | 0.00034 | 0.65339 | 0.00412 | 2.65924 | 0.50118 | 0.0001 | 0.01683 | 0.00939 | 0.00685 | 0 | 0.00684 | 1.3 | 26.6869 | 24.5 | 5.6 | 16.9 | ± 0.03 |
| 1000 | 3.69688 | 0.00264 | 0.90639 | 0.00435 | 3.69253 | 0.52911 | 0.00029 | 0.01912 | 0.01035 | 0.00951 | 0.00002 | 0.0095 | 1.71 | 25.56087 | 24.5 | 5.9 | 22.2 | ± 0.09 |
| 1050 | 2.3547 | 0.00128 | 0.93558 | 0.00394 | 2.35077 | 0.47938 | 0.00023 | 0.01781 | 0.00849 | 0.00484 | 0.00001 | 0.00483 | 1.95 | 28.23204 | 39.7 | 5.3 | 25.6 | ± 0.07 |
| **1100** | **1.60516** | **0.00058** | **0.82725** | **0.00339** | **1.60177** | **0.4129** | **0.0001** | **0.01542** | **0.00705** | **0.00265** | **0.00001** | **0.00264** | 2 | 29.28369 | **51.5** | **4.6** | **26.4** | **± 0.08** |
| **1150** | **1.30632** | **0.00059** | **0.81943** | **0.00337** | **1.30295** | **0.41067** | **0.00018** | **0.01513** | **0.00645** | **0.00166** | **0** | **0.00165** | 2 | 31.83488 | **62.7** | **4.6** | **26.4** | **± 0.04** |
| **1200** | **1.38369** | **0.00049** | **0.8745** | **0.0036** | **1.38008** | **0.4383** | **0.00013** | **0.01605** | **0.0039** | **0.00173** | **0** | **0.00172** | 2 | 56.19231 | **63.2** | **4.9** | **26.4** | **± 0.04** |
| **1250** | **1.57619** | **0.00056** | **1.01122** | **0.00418** | **1.57201** | **0.50911** | **0.00017** | **0.01857** | **0.00386** | **0.00192** | **0.00001** | **0.00191** | 1.99 | 65.94689 | **64.2** | **5.7** | **26.2** | **± 0.09** |
| **1300** | **2.59478** | **0.00158** | **1.69554** | **0.00699** | **2.5878** | **0.85059** | **0.00061** | **0.03107** | **0.01079** | **0.00306** | **0.00001** | **0.00304** | 1.99 | 39.41566 | **65.3** | **9.5** | **26.3** | **± 0.04** |
| **1350** | **3.43274** | **0.00143** | **2.28406** | **0.0094** | **3.42334** | **1.14383** | **0.00031** | **0.0418** | **0.01393** | **0.0039** | **0.00001** | **0.00388** | 2 | 41.05635 | **66.5** | **12.8** | **26.4** | **± 0.04** |
| 1400 | 3.98015 | 0.00354 | 3.06993 | 0.01279 | 3.96736 | 1.55706 | 0.00144 | 0.05679 | 0.03684 | 0.00309 | 0.00001 | 0.00306 | 1.97 | 21.13274 | 77.1 | 17.4 | 26.1 | ± 0.04 |
| 1500 | 4.69492 | 0.00267 | 3.99739 | 0.0168 | 4.67812 | 2.04482 | 0.00109 | 0.074 | 0.06106 | 0.00236 | 0.00001 | 0.00231 | 1.95 | 16.74435 | 85.1 | 22.8 | 25.9 | ± 0.04 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9

J-value and its error: 0.007422±0.1%

**Preferred date: 26.35±0.06 Ma on steps 5 to 10 containing 42.0% $^{39}Ar_k$**

Total-gas date: 25.24±0.05 Ma

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-92-59/60/DD57** | | | **AMPHIBOLE** | | **Wt.=215 mg** | | | | | | | | | | | | | |
| 900 | 0.4858 | 0.00048 | 0.15519 | 0.00087 | 0.48493 | 0.09324 | 0.00009 | 0.00331 | 0.02748 | 0.00112 | 0.00001 | 0.00112 | 1.66 | 1.69651 | 32 | 3.8 | 21.5 | ± 0.21 |
| 1000 | 0.41137 | 0.00038 | 0.05819 | 0.00029 | 0.41108 | 0.03095 | 0.00001 | 0.00119 | 0.01245 | 0.0012 | 0.00001 | 0.00119 | 1.88 | 1.24297 | 14.2 | 1.3 | 24.3 | ± 1.35 |
| 1100 | 0.42465 | 0.00039 | 0.05703 | 0.00024 | 0.42441 | 0.02591 | 0.00002 | 0.00134 | 0.01915 | 0.00125 | 0 | 0.00124 | 2.2 | 0.6765 | 13.4 | 1.1 | 28.4 | ± 0.47 |
| 1150 | 0.18014 | 0.00021 | 0.03317 | 0.00015 | 0.17998 | 0.01641 | 0.00001 | 0.00105 | 0.01304 | 0.0005 | 0.00001 | 0.0005 | 2.02 | 0.62922 | 18.4 | 0.7 | 26.1 | ± 2.14 |
| 1200 | 0.17293 | 0.00019 | 0.02787 | 0.00014 | 0.17279 | 0.01467 | 0.00002 | 0.00118 | 0.01416 | 0.00049 | 0.00001 | 0.00049 | 1.9 | 0.51801 | 16.1 | 0.6 | 24.5 | ± 4.07 |
| 1250 | 0.14267 | 0.00368 | 0.02355 | 0.00012 | 0.14255 | 0.01289 | 0.00022 | 0.00117 | 0.01061 | 0.00041 | 0.00001 | 0.0004 | 1.83 | 0.60745 | 16.5 | 0.5 | 23.6 | ± 1.25 |
| 1350 | 0.39413 | 0.00034 | 0.1785 | 0.00086 | 0.39327 | 0.09187 | 0.00009 | 0.0159 | 0.37309 | 0.00083 | 0.00001 | 0.00073 | 1.94 | 0.12312 | 45.3 | 3.7 | 25.1 | ± 0.44 |
| 1400 | 0.10908 | 0.00205 | 0.06354 | 0.00031 | 0.10877 | 0.03328 | 0.00008 | 0.00664 | 0.17501 | 0.0002 | 0.00002 | 0.00015 | 1.91 | 0.09508 | 58.3 | 1.4 | 24.7 | ± 1.22 |
| **1450** | **0.89609** | **0.00014** | **0.74557** | **0.00351** | **0.89258** | **0.3755** | **0.00026** | **0.07459** | **2.12585** | **0.0011** | **0.00001** | **0.0005** | 1.99 | 0.08832 | **83.2** | **15.3** | **25.6** | **± 0.12** |
| **1475** | **2.19397** | **0.00126** | **1.88767** | **0.00886** | **2.18511** | **0.94768** | **0.00079** | **0.16363** | **5.35426** | **0.00251** | **0.00001** | **0.00101** | 1.99 | 0.0885 | **86** | **38.6** | **25.7** | **± 0.04** |
| **1500** | **0.74063** | **0.00003** | **0.55602** | **0.00262** | **0.73801** | **0.27991** | **0.00109** | **0.04143** | **1.58434** | **0.00106** | **0.00002** | **0.00062** | 1.99 | 0.08834 | **75.1** | **11.4** | **25.7** | **± 0.34** |
| **1550** | **0.81813** | **0.00275** | **0.64635** | **0.00302** | **0.8151** | **0.32352** | **0** | **0.05642** | **1.91248** | **0.00111** | **0** | **0.00057** | 2 | 0.08458 | **79** | **13.2** | **25.8** | **± 0.08** |
| **1600** | **0.42154** | **0.00003** | **0.28522** | **0.00133** | **0.42022** | **0.14205** | **0.00016** | **0.02584** | **0.83615** | **0.00069** | **0** | **0.00046** | 2.01 | 0.08494 | **67.7** | **5.8** | **25.9** | **± 0.11** |
| **1650** | **0.29154** | **0.00033** | **0.13341** | **0.00062** | **0.29092** | **0.06622** | **0.0001** | **0.01165** | **0.38705** | **0.00064** | **0.00001** | **0.00053** | 2.01 | 0.08554 | **45.8** | **2.7** | **26** | **± 0.48** |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9

J-value and its error: 0.007209±0.1%

**Plateau date: 25.73±0.15 Ma on steps 9 to 14 containing 87.0% $^{39}Ar_k$**

Total-gas date: 25.53±0.21 Ma

**Appendix 1.** $^{40}Ar/^{39}Ar$ Data for Mineral Separates from Tertiary Igneous Rocks, Southern Toquima Range, Nye County, Nevada.—Continued

| TEMP °C | $^{40}Ar_T$ | $^{40}Ar\pm$ | $^{40}Ar_R$ | $^{40}Ar_K$ | $^{40}Ar_I$ | $^{39}Ar_K$ | $^{39}Ar\pm$ | $^{38}Ar_{Cl}$ | $^{37}Ar_{Ca}$ | $^{36}Ar_T$ | $^{36}Ar\pm$ | $^{36}Ar_I$ | F | K/Ca | Rad yield | %$^{39}Ar$ | Apparent age | Error |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample: DRS-92-59/41/DD58** | | | **ORTHOCLASE** | | **Wt.=47.8 mg** | | | | | | | | | | | | | |
| 700 | 0.40655 | 0.0023 | 0.03575 | 0.00023 | 0.40632 | 0.02464 | 0.00004 | 0.00065 | 0.00441 | 0.00126 | 0 | 0.00125 | 1.45 | 2.79365 | 8.8 | 0.2 | | |
| 850 | 0.06657 | 0.00005 | 0.05092 | 0.00024 | 0.06633 | 0.02541 | 0.00001 | 0.00049 | 0.00416 | 0.00005 | 0.00001 | 0.00005 | 2 | 3.05409 | 76.4 | 0.2 | 26.7 | ± 1.5 |
| 900 | 0.1482 | 0.00001 | 0.11756 | 0.00061 | 0.14759 | 0.0651 | 0.00001 | 0.00076 | 0.00436 | 0.0001 | 0 | 0.0001 | 1.81 | 7.4656 | 79.2 | 0.6 | 24.1 | ± 0.14 |
| 950 | 0.07022 | 0 | 0.05426 | 0.00028 | 0.06994 | 0.02969 | 0.00002 | 0.00024 | 0.00452 | 0.00005 | 0.00001 | 0.00005 | 1.83 | 3.28429 | 77.3 | 0.3 | 24.4 | ± 1.79 |
| 1000 | 0.5311 | 0.00024 | 0.20086 | 0.00097 | 0.53013 | 0.1033 | 0.00002 | 0.00041 | 0.00755 | 0.00113 | 0.00001 | 0.00112 | 1.94 | 6.84106 | 37.8 | 1 | 25.7 | ± 0.22 |
| 1050 | 0.27496 | 0.00016 | 0.24584 | 0.0012 | 0.27376 | 0.12783 | 0.00011 | 0.00019 | 0.00313 | 0.0001 | 0.00001 | 0.0001 | 1.92 | 20.42013 | 89.4 | 1.2 | 25.7 | ± 0.49 |
| 1100 | 0.25324 | 0.00168 | 0.23658 | 0.00114 | 0.2521 | 0.12208 | 0.00011 | 0.00014 | 0.00527 | 0.00005 | 0.00001 | 0.00005 | 1.94 | 11.58254 | 93.4 | 1.2 | 25.9 | ± 0.24 |
| 1150 | 1.0304 | 0.00018 | 0.98588 | 0.00488 | 1.02552 | 0.52181 | 0.00019 | 0.00016 | 0.00916 | 0.00014 | 0 | 0.00014 | 1.89 | 28.48308 | 95.7 | 4.9 | 25.3 | ± 0.04 |
| 1200 | 1.48794 | 0.00032 | 1.4377 | 0.0071 | 1.48084 | 0.75943 | 0.00015 | 0.00012 | 0.01371 | 0.00015 | 0.00001 | 0.00015 | 1.89 | 27.69621 | 96.7 | 7.1 | 25.3 | ± 0.08 |
| **1250** | **2.09001** | **0.00128** | **2.04111** | **0.01** | **2.08001** | **1.06955** | **0.00063** | **0.00017** | **0.01579** | **0.00014** | **0.00001** | **0.00013** | 1.91 | 33.86795 | **97.7** | **10** | **25.5** | **± 0.06** |
| **1300** | **3.65475** | **0.00163** | **3.59291** | **0.01757** | **3.63718** | **1.87866** | **0.00105** | **0.00022** | **0.01909** | **0.00016** | **0.00001** | **0.00015** | 1.91 | 49.20534 | **98.4** | **17.6** | **25.6** | **± 0.04** |
| **1350** | **2.65358** | **0.00009** | **2.61149** | **0.01279** | **2.64079** | **1.36807** | **0.00021** | **0.00021** | **0.01505** | **0.0001** | **0.00001** | **0.0001** | 1.91 | 45.45083 | **98.5** | **12.6** | **25.6** | **± 0.04** |
| **1400** | **3.0134** | **0.00116** | **2.965** | **0.01453** | **2.99887** | **1.55446** | **0.00107** | **0.00015** | **0.01566** | **0.00012** | **0.00001** | **0.00012** | 1.91 | 49.63155 | **98.4** | **14.6** | **25.5** | **± 0.04** |
| **1450** | **2.60472** | **0.00152** | **2.56191** | **0.01253** | **2.59219** | **1.34007** | **0.00088** | **0.00008** | **0.01059** | **0.00011** | **0.00002** | **0.0001** | 1.91 | 63.27054 | **98.4** | **12.6** | **25.6** | **± 0.06** |
| **1500** | **1.9902** | **0.00094** | **1.95294** | **0.00954** | **1.98066** | **1.02053** | **0.00057** | **0.00008** | **0.00802** | **0.0001** | **0.00002** | **0.00009** | 1.91 | 63.62406 | **98.2** | **9.6** | **25.6** | **± 0.09** |
| **1550** | **1.01922** | **0.00015** | **0.99457** | **0.00484** | **1.01438** | **0.51774** | **0.00024** | **0.00012** | **0.00745** | **0.00007** | **0.00001** | **0.00007** | 1.92 | 34.74765 | **97.6** | **4.9** | **25.7** | **± 0.12** |
| 1600 | 0.29524 | 0.00006 | 0.24679 | 0.00125 | 0.29399 | 0.13407 | 0 | 0.00013 | 0.00513 | 0.00016 | 0.00001 | 0.00016 | 1.84 | 13.06725 | 83.5 | 1.3 | 24.6 | ± 0.39 |

$^{40}Ar/^{36}Ar$ measured atmosphere: 298.9

J-value and its error: 0.007483±0.1%

**Plateau date: 25.59±0.05 Ma on steps 10 to 16 containing 82.2% $^{39}Ar_k$**

Total-gas date: 28.79±0.1 Ma

**Appendix 2.** Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.

| Original sample no. | Unit | Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | FeO | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | F | Cl | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-6 | Bates Mountain Tuff | 06TA1 | 36.62 | 14.50 | 6.23 | 14.56 | 0.17 | 13.11 | 0.06 | 0.64 | 7.71 | 0.53 | 0.06 | 93.95 |
| DRS-91-6 | Bates Mountain Tuff | 06TA2 | 36.29 | 14.81 | 6.11 | 15.11 | 0.19 | 13.16 | 0.02 | 0.76 | 7.93 | 0.48 | 0.05 | 94.68 |
| DRS-91-6 | Bates Mountain Tuff | 06TB1 | 37.91 | 13.96 | 5.35 | 15.83 | 0.26 | 10.99 | 0.19 | 0.39 | 7.72 | 0.51 | 0.07 | 92.97 |
| DRS-91-6 | Bates Mountain Tuff | 06TD1 | 37.20 | 14.04 | 5.62 | 17.73 | 0.27 | 11.07 | 0.04 | 0.52 | 8.37 | 0.48 | 0.11 | 95.21 |
| DRS-91-6 | Bates Mountain Tuff | 06TD2 | 36.09 | 13.93 | 5.32 | 17.55 | 0.31 | 10.66 | 0.05 | 0.48 | 7.77 | 0.38 | 0.08 | 92.45 |
| DRS-91-6 | Bates Mountain Tuff | 06TE1 | 38.34 | 13.44 | 5.49 | 17.34 | 0.29 | 10.00 | 0.14 | 0.38 | 7.99 | 0.34 | 0.08 | 93.68 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TA1 | 35.97 | 14.10 | 4.71 | 15.81 | 0.31 | 13.99 | 0.00 | 0.59 | 8.71 | 0.48 | 0.05 | 94.49 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TB1 | 36.44 | 13.56 | 4.57 | 16.10 | 0.36 | 13.97 | 0.00 | 0.61 | 8.65 | 0.49 | 0.07 | 94.60 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TB2 | 36.26 | 13.51 | 4.60 | 16.16 | 0.37 | 13.83 | 0.00 | 0.54 | 8.82 | 0.34 | 0.09 | 94.36 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TC1 | 36.50 | 13.28 | 4.56 | 15.96 | 0.37 | 14.08 | 0.00 | 0.51 | 8.68 | 0.44 | 0.09 | 94.26 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TC2 | 36.46 | 13.34 | 4.36 | 16.39 | 0.40 | 13.70 | 0.00 | 0.54 | 8.70 | 0.71 | 0.10 | 94.38 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TD1 | 35.10 | 13.78 | 4.47 | 19.97 | 0.46 | 11.08 | 0.00 | 0.54 | 8.56 | 0.48 | 0.21 | 94.39 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TD2 | 36.83 | 12.72 | 4.12 | 19.23 | 0.45 | 12.01 | 0.00 | 0.53 | 8.70 | 0.91 | 0.19 | 95.26 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TE1 | 36.12 | 13.36 | 4.48 | 15.86 | 0.35 | 13.84 | 0.02 | 0.54 | 8.57 | 0.49 | 0.09 | 93.48 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TE2 | 36.07 | 13.31 | 4.55 | 16.33 | 0.40 | 13.60 | 0.00 | 0.51 | 8.51 | 0.96 | 0.10 | 93.93 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TL1 | 36.41 | 12.87 | 4.19 | 19.99 | 0.43 | 11.78 | 0.00 | 0.56 | 8.93 | 0.50 | 0.19 | 95.59 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TL2 | 35.92 | 13.09 | 4.50 | 19.95 | 0.44 | 11.36 | 0.00 | 0.53 | 8.69 | 0.57 | 0.20 | 94.97 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TM1 | 35.88 | 13.62 | 4.62 | 16.51 | 0.37 | 13.49 | 0.02 | 0.54 | 8.65 | 0.39 | 0.13 | 94.01 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TM2 | 35.81 | 13.58 | 4.59 | 16.24 | 0.40 | 13.63 | 0.00 | 0.50 | 8.62 | 0.69 | 0.10 | 93.83 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TN1 | 36.19 | 13.74 | 4.51 | 15.58 | 0.33 | 14.08 | 0.00 | 0.60 | 8.55 | 0.40 | 0.09 | 93.87 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TN2 | 36.06 | 14.24 | 4.61 | 15.86 | 0.36 | 14.04 | 0.00 | 0.62 | 8.70 | 0.45 | 0.09 | 94.81 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TQ1 | 36.15 | 13.77 | 4.43 | 15.53 | 0.32 | 13.84 | 0.00 | 0.60 | 8.69 | 0.41 | 0.10 | 93.63 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TQ2 | 36.29 | 14.23 | 4.63 | 15.71 | 0.33 | 13.97 | 0.00 | 0.57 | 8.58 | 0.38 | 0.11 | 94.61 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TR1 | 35.77 | 13.27 | 4.35 | 19.87 | 0.43 | 11.58 | 0.00 | 0.55 | 8.63 | 0.54 | 0.17 | 94.90 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TR2 | 35.43 | 13.39 | 4.45 | 19.74 | 0.44 | 11.20 | 0.00 | 0.54 | 8.49 | 0.45 | 0.20 | 94.10 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TT2 | 35.72 | 13.23 | 4.42 | 20.21 | 0.45 | 11.44 | 0.00 | 0.56 | 8.62 | 0.57 | 0.20 | 95.13 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TU1 | 35.93 | 13.01 | 4.47 | 19.59 | 0.45 | 11.38 | 0.00 | 0.54 | 8.49 | 0.60 | 0.22 | 94.39 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TU2 | 36.79 | 12.66 | 4.28 | 19.26 | 0.48 | 12.08 | 0.00 | 0.52 | 8.86 | 0.53 | 0.21 | 95.40 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TV1 | 36.15 | 13.54 | 4.50 | 15.72 | 0.31 | 14.09 | 0.00 | 0.61 | 8.53 | 0.35 | 0.09 | 93.73 |
| DRS-91-168 | Tuff of Mount Jefferson | 168TV2 | 36.55 | 13.41 | 4.24 | 15.50 | 0.34 | 14.11 | 0.00 | 0.58 | 8.51 | 0.65 | 0.09 | 93.66 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TA1 | 36.87 | 13.42 | 4.58 | 15.58 | 0.33 | 14.28 | 0.00 | 0.54 | 8.60 | 0.43 | 0.09 | 94.51 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TA2 | 36.74 | 13.47 | 4.45 | 15.47 | 0.32 | 14.08 | 0.01 | 0.53 | 8.73 | 0.56 | 0.09 | 94.20 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TAC1 | 36.84 | 13.06 | 4.30 | 19.13 | 0.40 | 12.00 | 0.02 | 0.44 | 8.72 | 1.18 | 0.19 | 95.74 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TAC2 | 36.16 | 12.77 | 4.25 | 19.69 | 0.44 | 11.50 | 0.00 | 0.50 | 8.59 | 0.66 | 0.23 | 94.46 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TC1 | 35.95 | 13.78 | 4.68 | 16.04 | 0.33 | 13.82 | 0.00 | 0.56 | 8.54 | 0.48 | 0.09 | 94.04 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TC2 | 36.57 | 13.77 | 4.49 | 15.75 | 0.32 | 14.10 | 0.00 | 0.57 | 8.71 | 0.40 | 0.09 | 94.62 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TG1 | 36.44 | 13.80 | 4.32 | 15.77 | 0.32 | 14.22 | 0.00 | 0.53 | 8.62 | 0.51 | 0.10 | 94.38 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TG2 | 36.56 | 13.44 | 4.49 | 15.27 | 0.27 | 14.23 | 0.00 | 0.58 | 8.64 | 0.49 | 0.11 | 93.84 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TJ1 | 36.29 | 13.28 | 4.41 | 16.36 | 0.37 | 13.73 | 0.00 | 0.48 | 8.49 | 0.46 | 0.11 | 93.77 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TJ2 | 36.23 | 12.96 | 4.45 | 16.24 | 0.37 | 13.81 | 0.01 | 0.51 | 8.64 | 0.45 | 0.12 | 93.58 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TK1 | 36.36 | 13.59 | 4.30 | 15.81 | 0.29 | 14.18 | 0.01 | 0.56 | 8.44 | 0.46 | 0.08 | 93.86 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TL1 | 36.51 | 13.77 | 4.34 | 15.47 | 0.30 | 14.47 | 0.01 | 0.58 | 8.73 | 0.38 | 0.10 | 94.47 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TP1 | 36.31 | 13.10 | 4.37 | 16.02 | 0.37 | 13.78 | 0.00 | 0.50 | 8.61 | 0.54 | 0.09 | 93.45 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TP2 | 36.64 | 13.56 | 4.46 | 16.00 | 0.40 | 13.86 | 0.00 | 0.50 | 8.59 | 0.49 | 0.09 | 94.36 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TT1 | 38.38 | 12.22 | 4.06 | 17.53 | 0.40 | 12.12 | 0.05 | 0.37 | 8.80 | 0.81 | 0.21 | 94.56 |

**Appendix 2.** Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | FeO | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | F | Cl | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-169 | Tuff of Mount Jefferson | 169TT2 | 37.06 | 12.05 | 4.20 | 18.91 | 0.45 | 12.34 | 0.00 | 0.47 | 8.67 | 0.83 | 0.18 | 94.78 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TX1 | 37.34 | 12.40 | 3.97 | 19.15 | 0.44 | 12.29 | 0.00 | 0.49 | 8.78 | 0.53 | 0.18 | 95.30 |
| DRS-91-169 | Tuff of Mount Jefferson | 169TX2 | 36.81 | 12.63 | 4.13 | 19.35 | 0.46 | 12.01 | 0.01 | 0.49 | 8.68 | 0.70 | 0.19 | 95.11 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TAB1 | 36.77 | 13.16 | 4.36 | 19.39 | 0.39 | 11.80 | 0.00 | 0.20 | 8.85 | 0.00 | 0.00 | 94.92 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TAB2 | 36.65 | 13.21 | 4.31 | 19.36 | 0.38 | 11.96 | 0.00 | 0.16 | 8.98 | 0.00 | 0.00 | 95.00 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TAF1 | 37.27 | 14.47 | 4.43 | 16.32 | 0.26 | 14.08 | 0.00 | 0.30 | 8.81 | 0.00 | 0.00 | 95.93 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TC1 | 36.50 | 13.93 | 4.16 | 15.39 | 0.26 | 14.09 | 0.00 | 0.27 | 8.55 | 0.00 | 0.00 | 93.15 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TC2 | 36.39 | 13.79 | 4.35 | 15.38 | 0.22 | 14.00 | 0.00 | 0.27 | 8.62 | 0.00 | 0.00 | 93.01 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TD1 | 36.68 | 13.65 | 4.32 | 15.40 | 0.24 | 14.28 | 0.00 | 0.28 | 8.60 | 0.00 | 0.00 | 93.44 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TD2 | 36.64 | 13.59 | 4.35 | 15.40 | 0.26 | 14.21 | 0.00 | 0.33 | 8.71 | 0.00 | 0.00 | 93.49 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TE1 | 36.06 | 13.89 | 4.53 | 16.33 | 0.30 | 13.48 | 0.00 | 0.16 | 8.65 | 0.00 | 0.00 | 93.38 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TE2 | 35.93 | 13.88 | 4.36 | 16.25 | 0.26 | 13.49 | 0.00 | 0.18 | 8.54 | 0.00 | 0.00 | 92.89 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TF1 | 36.98 | 12.76 | 4.27 | 19.32 | 0.34 | 12.09 | 0.00 | 0.11 | 8.87 | 0.00 | 0.00 | 94.74 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TF2 | 37.27 | 13.06 | 4.29 | 18.65 | 0.33 | 12.31 | 0.00 | 0.16 | 8.90 | 0.00 | 0.00 | 94.96 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TJ1 | 36.74 | 13.48 | 3.72 | 18.81 | 0.19 | 12.56 | 0.00 | 0.18 | 8.83 | 0.00 | 0.00 | 94.52 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TJ2 | 36.73 | 13.45 | 3.64 | 18.77 | 0.22 | 12.48 | 0.00 | 0.24 | 8.71 | 0.00 | 0.00 | 94.25 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TL1 | 37.04 | 13.75 | 4.35 | 15.31 | 0.28 | 13.84 | 0.00 | 0.13 | 8.38 | 0.00 | 0.00 | 93.09 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TL2 | 36.76 | 13.50 | 4.42 | 15.49 | 0.20 | 13.67 | 0.00 | 0.14 | 8.27 | 0.00 | 0.00 | 92.45 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TM1 | 34.98 | 13.67 | 4.25 | 20.02 | 0.32 | 11.08 | 0.00 | 0.20 | 8.37 | 0.00 | 0.00 | 92.89 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TM2 | 35.43 | 13.49 | 4.68 | 19.55 | 0.37 | 11.28 | 0.00 | 0.17 | 8.41 | 0.00 | 0.00 | 93.38 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TN1 | 36.77 | 13.42 | 4.21 | 19.59 | 0.37 | 11.34 | 0.00 | 0.16 | 8.73 | 0.00 | 0.00 | 94.58 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TN2 | 36.43 | 13.27 | 4.16 | 19.52 | 0.33 | 11.49 | 0.00 | 0.20 | 8.58 | 0.00 | 0.00 | 93.97 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TQ1 | 36.29 | 13.33 | 4.24 | 19.64 | 0.37 | 11.36 | 0.00 | 0.22 | 8.43 | 0.00 | 0.00 | 93.89 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TQ2 | 35.94 | 13.39 | 4.65 | 19.82 | 0.30 | 11.50 | 0.00 | 0.12 | 8.60 | 0.00 | 0.00 | 94.33 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TY1 | 36.51 | 13.98 | 4.36 | 15.54 | 0.26 | 14.09 | 0.00 | 0.19 | 8.51 | 0.00 | 0.00 | 93.44 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TY2 | 36.89 | 13.95 | 4.35 | 15.62 | 0.20 | 14.13 | 0.00 | 0.17 | 8.69 | 0.00 | 0.00 | 94.00 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TZ1 | 37.81 | 12.67 | 4.13 | 18.89 | 0.33 | 12.16 | 0.00 | 0.08 | 8.73 | 0.00 | 0.00 | 94.82 |
| DRS-85-197 | Tuff of Mount Jefferson | 197TZ2 | 37.38 | 13.15 | 4.19 | 19.41 | 0.37 | 12.13 | 0.00 | 0.09 | 8.93 | 0.00 | 0.00 | 95.66 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TA1 | 37.27 | 13.66 | 4.45 | 14.74 | 0.16 | 14.79 | 0.00 | 0.32 | 8.71 | 0.00 | 0.00 | 94.10 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TA2 | 37.45 | 13.60 | 4.27 | 14.77 | 0.20 | 14.55 | 0.00 | 0.36 | 8.69 | 0.00 | 0.00 | 93.89 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TAE1 | 37.40 | 12.99 | 4.24 | 19.96 | 0.29 | 12.00 | 0.00 | 0.28 | 8.56 | 0.00 | 0.00 | 95.71 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TAE2 | 37.47 | 12.85 | 4.29 | 20.16 | 0.44 | 12.29 | 0.00 | 0.26 | 8.61 | 0.00 | 0.00 | 96.37 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TAH1 | 35.89 | 13.99 | 4.34 | 16.12 | 0.16 | 13.68 | 0.00 | 0.34 | 8.60 | 0.00 | 0.00 | 93.12 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TAH2 | 35.91 | 14.17 | 4.24 | 16.49 | 0.18 | 13.61 | 0.00 | 0.22 | 8.14 | 0.00 | 0.00 | 92.98 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TAL1 | 36.51 | 14.03 | 4.41 | 16.35 | 0.22 | 14.06 | 0.00 | 0.26 | 8.29 | 0.00 | 0.00 | 94.11 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TAL2 | 36.60 | 13.82 | 4.51 | 16.45 | 0.23 | 14.03 | 0.00 | 0.34 | 8.17 | 0.00 | 0.00 | 94.15 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TB1 | 37.19 | 13.24 | 4.42 | 15.44 | 0.29 | 14.32 | 0.00 | 0.34 | 8.87 | 0.00 | 0.00 | 94.09 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TB2 | 37.42 | 13.78 | 4.31 | 15.61 | 0.25 | 14.02 | 0.00 | 0.25 | 8.91 | 0.00 | 0.00 | 94.56 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TC1 | 37.65 | 12.40 | 4.15 | 19.47 | 0.33 | 11.92 | 0.00 | 0.24 | 9.01 | 0.00 | 0.00 | 95.17 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TC2 | 36.94 | 12.99 | 4.24 | 19.92 | 0.43 | 11.78 | 0.00 | 0.18 | 8.89 | 0.00 | 0.00 | 95.38 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TE1 | 37.93 | 13.03 | 4.37 | 15.48 | 0.25 | 14.91 | 0.00 | 0.25 | 9.13 | 0.00 | 0.00 | 95.35 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TE2 | 38.13 | 13.00 | 4.24 | 15.48 | 0.27 | 14.78 | 0.00 | 0.31 | 9.09 | 0.00 | 0.00 | 95.30 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TF1 | 37.79 | 13.60 | 4.45 | 13.79 | 0.17 | 15.51 | 0.00 | 0.39 | 8.73 | 0.00 | 0.00 | 94.41 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TF1 | 36.01 | 13.75 | 4.29 | 16.91 | 0.18 | 13.53 | 0.00 | 0.25 | 8.20 | 0.00 | 0.00 | 93.11 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TF2 | 38.25 | 13.64 | 4.31 | 13.89 | 0.11 | 15.53 | 0.00 | 0.43 | 8.77 | 0.00 | 0.00 | 94.93 |

**Appendix 2.** Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | FeO | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | F | Cl | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-85-199 | Tuff of Mount Jefferson | 199TF2 | 36.23 | 13.85 | 4.42 | 16.96 | 0.30 | 13.70 | 0.00 | 0.24 | 8.27 | 0.00 | 0.00 | 93.99 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TH1 | 37.04 | 13.15 | 4.12 | 19.40 | 0.38 | 12.33 | 0.00 | 0.15 | 8.40 | 0.00 | 0.00 | 94.98 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TH2 | 37.06 | 12.83 | 4.21 | 19.74 | 0.35 | 12.60 | 0.00 | 0.17 | 8.53 | 0.00 | 0.00 | 95.50 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TQ1 | 36.48 | 14.16 | 4.35 | 15.63 | 0.15 | 14.14 | 0.00 | 0.37 | 8.11 | 0.00 | 0.00 | 93.39 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TQ2 | 36.95 | 13.98 | 4.36 | 15.50 | 0.10 | 14.24 | 0.00 | 0.34 | 8.28 | 0.00 | 0.00 | 93.76 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TR1 | 36.22 | 13.19 | 4.37 | 20.46 | 0.34 | 11.52 | 0.00 | 0.23 | 8.47 | 0.00 | 0.00 | 94.80 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TR2 | 36.97 | 13.15 | 4.32 | 20.62 | 0.36 | 11.96 | 0.00 | 0.18 | 8.52 | 0.00 | 0.00 | 96.08 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TV1 | 36.86 | 13.69 | 4.42 | 15.08 | 0.18 | 14.98 | 0.00 | 0.35 | 8.33 | 0.00 | 0.00 | 93.88 |
| DRS-85-199 | Tuff of Mount Jefferson | 199TV2 | 36.93 | 13.96 | 4.39 | 15.32 | 0.21 | 14.68 | 0.00 | 0.44 | 8.02 | 0.00 | 0.00 | 93.96 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TA1 | 36.54 | 13.80 | 4.43 | 16.44 | 0.27 | 13.96 | 0.00 | 0.36 | 8.54 | 0.00 | 0.00 | 94.33 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TA2 | 37.21 | 13.96 | 4.07 | 16.03 | 0.25 | 14.02 | 0.00 | 0.33 | 8.54 | 0.00 | 0.00 | 94.40 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TB1 | 36.29 | 13.89 | 4.36 | 16.49 | 0.24 | 13.75 | 0.00 | 0.43 | 8.58 | 0.00 | 0.00 | 94.04 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TB2 | 36.74 | 14.12 | 4.58 | 15.57 | 0.21 | 13.68 | 0.00 | 0.37 | 8.51 | 0.00 | 0.00 | 93.78 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TB3 | 36.35 | 13.80 | 4.38 | 16.25 | 0.22 | 13.84 | 0.00 | 0.36 | 8.47 | 0.00 | 0.00 | 93.65 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TC1 | 36.90 | 14.30 | 4.40 | 16.27 | 0.27 | 13.68 | 0.00 | 0.31 | 8.22 | 0.00 | 0.00 | 94.34 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TC2 | 36.53 | 13.90 | 4.38 | 15.96 | 0.15 | 14.00 | 0.00 | 0.35 | 8.35 | 0.00 | 0.00 | 93.62 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TE1 | 37.39 | 14.20 | 3.88 | 17.13 | 0.15 | 13.12 | 0.03 | 0.23 | 7.72 | 0.00 | 0.00 | 93.85 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TE3 | 36.62 | 14.00 | 4.12 | 16.32 | 0.20 | 13.68 | 0.00 | 0.24 | 8.31 | 0.00 | 0.00 | 93.49 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TE4 | 36.70 | 13.97 | 4.38 | 16.24 | 0.24 | 14.03 | 0.00 | 0.32 | 8.48 | 0.00 | 0.00 | 94.36 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TF1 | 37.00 | 13.96 | 4.28 | 16.01 | 0.25 | 14.21 | 0.00 | 0.36 | 8.26 | 0.00 | 0.00 | 94.34 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TF2 | 35.73 | 14.41 | 4.76 | 16.25 | 0.27 | 13.56 | 0.00 | 0.27 | 8.33 | 0.00 | 0.00 | 93.56 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TF3 | 36.85 | 13.78 | 4.10 | 16.18 | 0.26 | 14.32 | 0.00 | 0.31 | 8.39 | 0.00 | 0.00 | 94.19 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TH1 | 36.31 | 14.19 | 4.39 | 14.96 | 0.18 | 14.40 | 0.00 | 0.41 | 8.42 | 0.00 | 0.00 | 93.26 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TH2 | 35.58 | 14.41 | 4.44 | 14.74 | 0.16 | 14.30 | 0.00 | 0.38 | 8.46 | 0.00 | 0.00 | 92.47 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TH3 | 36.19 | 14.34 | 4.10 | 14.94 | 0.17 | 14.48 | 0.00 | 0.47 | 8.35 | 0.00 | 0.00 | 93.04 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TJ1 | 35.94 | 14.39 | 4.52 | 15.84 | 0.22 | 13.89 | 0.00 | 0.38 | 8.21 | 0.00 | 0.00 | 93.39 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TJ2 | 36.23 | 13.94 | 4.37 | 15.21 | 0.16 | 14.23 | 0.00 | 0.30 | 8.21 | 0.00 | 0.00 | 92.64 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TP1 | 36.74 | 14.04 | 4.48 | 16.20 | 0.25 | 14.13 | 0.00 | 0.29 | 8.36 | 0.00 | 0.00 | 94.48 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TP2 | 36.90 | 14.11 | 4.28 | 16.56 | 0.24 | 14.01 | 0.00 | 0.38 | 8.16 | 0.00 | 0.00 | 94.64 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TQ1 | 36.86 | 13.84 | 4.59 | 16.83 | 0.28 | 13.76 | 0.00 | 0.28 | 8.50 | 0.00 | 0.00 | 94.94 |
| DRS-85-203 | Tuff of Mount Jefferson | 203TQ2 | 36.99 | 13.88 | 4.03 | 16.46 | 0.27 | 13.74 | 0.00 | 0.26 | 8.52 | 0.00 | 0.00 | 94.17 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TA1 | 37.51 | 14.35 | 4.64 | 16.10 | 0.36 | 13.92 | 0.01 | 0.54 | 8.66 | 0.64 | 0.08 | 96.53 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TA2 | 36.42 | 14.94 | 4.69 | 16.15 | 0.31 | 13.66 | 0.00 | 0.58 | 8.82 | 0.57 | 0.07 | 95.95 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TAB2 | 37.81 | 13.88 | 4.18 | 19.37 | 0.34 | 11.38 | 0.08 | 0.49 | 8.69 | 0.80 | 0.20 | 96.82 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TAC1 | 36.44 | 15.34 | 4.70 | 15.87 | 0.23 | 13.59 | 0.01 | 0.57 | 8.83 | 1.35 | 0.09 | 96.44 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TAC2 | 36.05 | 15.19 | 4.77 | 16.06 | 0.35 | 13.50 | 0.00 | 0.55 | 8.66 | 0.64 | 0.11 | 95.57 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TB1 | 37.19 | 14.53 | 4.47 | 16.27 | 0.33 | 13.85 | 0.02 | 0.56 | 8.83 | 0.95 | 0.11 | 96.69 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TB2 | 37.11 | 14.44 | 4.44 | 15.84 | 0.29 | 13.93 | 0.00 | 0.50 | 8.96 | 0.99 | 0.11 | 96.17 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TC1 | 36.65 | 14.63 | 4.76 | 16.31 | 0.34 | 13.60 | 0.00 | 0.58 | 8.84 | 0.91 | 0.10 | 96.33 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TC2 | 37.50 | 14.29 | 4.56 | 15.60 | 0.32 | 14.37 | 0.00 | 0.54 | 9.03 | 0.67 | 0.12 | 96.69 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TD1 | 36.23 | 14.72 | 4.61 | 16.00 | 0.29 | 13.78 | 0.00 | 0.57 | 8.96 | 0.99 | 0.09 | 95.80 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TF1 | 37.37 | 14.49 | 4.68 | 16.05 | 0.30 | 14.21 | 0.01 | 0.57 | 8.94 | 0.71 | 0.09 | 97.10 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TF2 | 37.00 | 14.56 | 4.72 | 15.92 | 0.34 | 14.24 | 0.00 | 0.55 | 8.88 | 0.76 | 0.09 | 96.70 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TG1 | 36.24 | 14.77 | 4.75 | 17.00 | 0.36 | 13.11 | 0.00 | 0.54 | 8.85 | 0.92 | 0.09 | 96.22 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TG2 | 36.79 | 14.49 | 4.68 | 16.79 | 0.43 | 13.45 | 0.00 | 0.51 | 8.93 | 0.62 | 0.08 | 96.49 |

**Appendix 2.** Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | FeO | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | F | Cl | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-85-204 | Tuff of Mount Jefferson | 204TJ1 | 37.64 | 14.63 | 4.50 | 15.74 | 0.26 | 13.70 | 0.08 | 0.55 | 8.60 | 0.83 | 0.09 | 96.24 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TJ2 | 36.82 | 14.53 | 4.86 | 16.21 | 0.33 | 13.96 | 0.00 | 0.55 | 8.91 | 1.05 | 0.09 | 96.85 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TM1 | 37.16 | 14.71 | 4.46 | 16.04 | 0.33 | 13.80 | 0.02 | 0.60 | 8.54 | 0.61 | 0.11 | 96.09 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TM2 | 36.34 | 15.05 | 5.01 | 16.35 | 0.35 | 13.81 | 0.00 | 0.60 | 8.84 | 0.56 | 0.11 | 96.76 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TN1 | 36.44 | 14.83 | 4.77 | 16.04 | 0.36 | 13.68 | 0.00 | 0.51 | 8.81 | 0.70 | 0.11 | 95.94 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TN2 | 37.09 | 14.64 | 4.56 | 15.54 | 0.35 | 13.92 | 0.00 | 0.55 | 8.97 | 0.87 | 0.09 | 96.19 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TP1 | 36.26 | 14.96 | 4.73 | 16.25 | 0.26 | 13.80 | 0.00 | 0.52 | 8.90 | 1.07 | 0.12 | 96.39 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TQ1 | 36.21 | 14.22 | 4.58 | 16.56 | 0.37 | 13.20 | 0.01 | 0.52 | 8.84 | 0.90 | 0.13 | 95.11 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TQ2 | 36.78 | 14.53 | 4.70 | 16.90 | 0.41 | 13.30 | 0.00 | 0.53 | 8.77 | 0.62 | 0.11 | 96.35 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TS1 | 36.96 | 14.78 | 4.55 | 16.32 | 0.29 | 13.95 | 0.00 | 0.57 | 8.88 | 0.87 | 0.09 | 96.87 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TS2 | 37.00 | 14.82 | 4.69 | 16.08 | 0.32 | 13.99 | 0.00 | 0.54 | 8.95 | 0.62 | 0.09 | 96.81 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TU1 | 37.48 | 14.48 | 4.49 | 15.97 | 0.29 | 13.87 | 0.04 | 0.56 | 8.80 | 0.92 | 0.11 | 96.59 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TU2 | 37.52 | 14.46 | 4.46 | 16.01 | 0.31 | 13.83 | 0.04 | 0.54 | 8.84 | 0.88 | 0.10 | 96.58 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TX1 | 37.05 | 14.50 | 4.72 | 15.45 | 0.30 | 14.23 | 0.00 | 0.55 | 8.89 | 0.67 | 0.10 | 96.15 |
| DRS-85-204 | Tuff of Mount Jefferson | 204TX2 | 37.48 | 14.60 | 4.56 | 16.02 | 0.34 | 14.25 | 0.00 | 0.59 | 8.87 | 0.86 | 0.09 | 97.26 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TA2 | 37.30 | 13.89 | 5.09 | 11.81 | 0.18 | 16.46 | 0.00 | 0.64 | 8.38 | 4.73 | 0.12 | 96.59 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TB1 | 37.76 | 13.47 | 4.35 | 14.83 | 0.34 | 14.90 | 0.00 | 0.58 | 8.62 | 4.57 | 0.10 | 97.58 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TB2 | 37.93 | 13.68 | 4.38 | 11.72 | 0.34 | 16.94 | 0.01 | 0.61 | 8.79 | 5.51 | 0.07 | 97.63 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TC1 | 37.07 | 13.69 | 4.25 | 16.72 | 0.32 | 13.36 | 0.03 | 0.49 | 8.29 | 3.76 | 0.10 | 96.46 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TC2 | 36.26 | 13.98 | 4.50 | 14.15 | 0.32 | 14.43 | 0.00 | 0.60 | 8.31 | 4.69 | 0.13 | 95.36 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TD1 | 35.96 | 13.80 | 4.34 | 16.32 | 0.36 | 13.19 | 0.06 | 0.47 | 7.94 | 3.52 | 0.10 | 94.58 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TD2 | 35.90 | 13.65 | 4.22 | 16.78 | 0.46 | 13.73 | 0.06 | 0.48 | 7.79 | 4.40 | 0.11 | 95.68 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TE1 | 38.05 | 13.71 | 4.45 | 12.05 | 0.23 | 16.77 | 0.00 | 0.58 | 8.69 | 5.25 | 0.12 | 97.67 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TE2 | 36.79 | 13.42 | 4.37 | 12.41 | 0.21 | 15.29 | 0.55 | 0.58 | 8.03 | 4.64 | 0.13 | 94.46 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TF1 | 37.34 | 13.57 | 4.43 | 15.23 | 0.37 | 14.73 | 0.00 | 0.60 | 8.72 | 3.77 | 0.11 | 97.26 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TF2 | 37.66 | 13.49 | 4.55 | 13.40 | 0.29 | 15.97 | 0.00 | 0.62 | 8.64 | 4.19 | 0.10 | 97.17 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TG1 | 37.42 | 13.87 | 4.51 | 13.09 | 0.31 | 15.90 | 0.00 | 0.55 | 8.55 | 4.31 | 0.12 | 96.77 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TG2 | 38.83 | 13.53 | 4.38 | 12.21 | 0.22 | 16.25 | 0.05 | 0.64 | 8.53 | 4.51 | 0.10 | 97.38 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TH1 | 36.29 | 14.13 | 4.69 | 16.22 | 0.45 | 13.39 | 0.01 | 0.55 | 8.17 | 2.85 | 0.15 | 95.66 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TH2 | 37.43 | 13.89 | 4.57 | 13.27 | 0.34 | 15.65 | 0.01 | 0.54 | 8.44 | 4.12 | 0.11 | 96.63 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TM1 | 37.37 | 14.05 | 4.87 | 11.39 | 0.24 | 16.41 | 0.00 | 0.60 | 8.49 | 3.86 | 0.15 | 95.76 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21TM2 | 38.13 | 13.94 | 4.69 | 10.83 | 0.29 | 17.00 | 0.03 | 0.63 | 8.59 | 4.05 | 0.17 | 96.59 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TA1 | 37.61 | 13.50 | 4.55 | 16.27 | 0.42 | 13.69 | 0.00 | 0.60 | 8.66 | 3.55 | 0.12 | 97.46 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TA2 | 38.50 | 13.49 | 4.52 | 14.60 | 0.37 | 14.51 | 0.01 | 0.61 | 8.65 | 3.98 | 0.10 | 97.63 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TC1 | 36.79 | 13.98 | 4.71 | 16.77 | 0.45 | 12.72 | 0.00 | 0.49 | 8.29 | 2.62 | 0.11 | 95.80 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TC2 | 37.80 | 13.42 | 4.47 | 15.57 | 0.41 | 13.91 | 0.00 | 0.61 | 8.70 | 3.38 | 0.09 | 96.91 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TD1 | 37.77 | 13.78 | 4.65 | 13.85 | 0.24 | 14.99 | 0.00 | 0.63 | 8.58 | 3.71 | 0.10 | 96.70 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TD2 | 37.70 | 13.51 | 4.53 | 12.88 | 0.21 | 15.80 | 0.00 | 0.61 | 8.69 | 3.80 | 0.12 | 96.21 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TE1 | 38.37 | 13.61 | 4.57 | 12.46 | 0.31 | 15.85 | 0.05 | 0.59 | 8.75 | 3.78 | 0.09 | 96.82 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TE2 | 38.29 | 13.49 | 4.60 | 12.28 | 0.31 | 15.66 | 0.00 | 0.57 | 8.65 | 3.92 | 0.10 | 96.19 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TF1 | 38.57 | 13.34 | 4.17 | 13.08 | 0.36 | 15.68 | 0.00 | 0.60 | 8.72 | 4.12 | 0.08 | 96.97 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TF2 | 39.00 | 13.32 | 4.31 | 12.97 | 0.32 | 15.92 | 0.02 | 0.55 | 8.75 | 4.40 | 0.09 | 97.77 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TG1 | 38.50 | 13.51 | 4.86 | 12.73 | 0.17 | 15.53 | 0.00 | 0.53 | 8.78 | 3.67 | 0.11 | 96.83 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TG2 | 37.49 | 13.74 | 4.95 | 13.32 | 0.21 | 15.06 | 0.01 | 0.62 | 8.45 | 3.60 | 0.10 | 96.02 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TH1 | 38.48 | 13.72 | 4.67 | 13.26 | 0.28 | 15.40 | 0.02 | 0.62 | 8.78 | 3.94 | 0.12 | 97.59 |

**Appendix 2.** Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | FeO | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | F | Cl | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TH2 | 38.31 | 13.63 | 4.83 | 13.51 | 0.24 | 15.10 | 0.00 | 0.63 | 8.82 | 3.61 | 0.11 | 97.24 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TK1 | 36.75 | 14.06 | 4.66 | 17.50 | 0.45 | 12.50 | 0.00 | 0.50 | 8.50 | 2.10 | 0.12 | 96.23 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TK2 | 38.14 | 13.51 | 4.67 | 15.94 | 0.38 | 13.97 | 0.00 | 0.60 | 8.94 | 3.53 | 0.10 | 98.30 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TL1 | 36.13 | 14.26 | 4.76 | 17.21 | 0.45 | 12.13 | 0.03 | 0.49 | 8.27 | 1.51 | 0.11 | 94.70 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TL2 | 37.52 | 13.75 | 4.69 | 15.19 | 0.42 | 13.94 | 0.03 | 0.47 | 8.41 | 3.35 | 0.10 | 96.43 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TM1 | 36.94 | 14.27 | 4.91 | 15.22 | 0.44 | 13.46 | 0.02 | 0.51 | 8.41 | 3.09 | 0.13 | 96.05 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TM2 | 37.91 | 13.60 | 4.55 | 15.78 | 0.42 | 13.94 | 0.00 | 0.61 | 8.59 | 3.23 | 0.09 | 97.32 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TN1 | 36.27 | 14.41 | 4.91 | 16.95 | 0.47 | 12.37 | 0.01 | 0.56 | 8.17 | 3.09 | 0.12 | 96.00 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TN2 | 37.98 | 13.70 | 4.62 | 13.95 | 0.30 | 14.46 | 0.02 | 0.58 | 8.69 | 4.29 | 0.09 | 96.85 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TR1 | 37.63 | 13.59 | 4.59 | 14.30 | 0.33 | 14.48 | 0.06 | 0.55 | 8.50 | 3.19 | 0.12 | 95.97 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TR2 | 38.11 | 13.72 | 4.70 | 13.28 | 0.33 | 15.20 | 0.01 | 0.60 | 8.60 | 3.33 | 0.10 | 96.56 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TU1 | 36.65 | 13.37 | 4.62 | 15.79 | 0.46 | 12.74 | 0.05 | 0.50 | 8.03 | 3.22 | 0.14 | 94.19 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TU2 | 37.92 | 13.30 | 4.38 | 15.56 | 0.45 | 13.36 | 0.02 | 0.58 | 8.58 | 3.55 | 0.10 | 96.28 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TV1 | 38.74 | 13.64 | 4.68 | 13.90 | 0.22 | 14.75 | 0.02 | 0.56 | 8.72 | 3.52 | 0.12 | 97.35 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TV2 | 38.57 | 13.22 | 4.55 | 14.50 | 0.28 | 14.16 | 0.05 | 0.58 | 8.31 | 3.67 | 0.12 | 96.43 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TW1 | 37.53 | 14.16 | 5.18 | 14.71 | 0.25 | 14.12 | 0.00 | 0.63 | 8.49 | 3.30 | 0.14 | 97.09 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24TW2 | 37.59 | 14.13 | 5.03 | 14.23 | 0.29 | 14.44 | 0.01 | 0.60 | 8.49 | 3.54 | 0.12 | 96.95 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TA1 | 36.93 | 14.69 | 4.52 | 15.11 | 0.23 | 13.84 | 0.03 | 0.60 | 8.66 | 2.21 | 0.09 | 95.95 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TA2 | 36.58 | 14.55 | 4.37 | 14.87 | 0.22 | 14.07 | 0.03 | 0.54 | 8.84 | 2.77 | 0.10 | 95.74 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TB1 | 37.26 | 13.97 | 4.65 | 16.32 | 0.30 | 13.08 | 0.03 | 0.42 | 8.87 | 1.04 | 0.09 | 95.57 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TB2 | 37.67 | 14.05 | 4.47 | 15.88 | 0.30 | 13.41 | 0.06 | 0.40 | 8.69 | 1.33 | 0.09 | 95.76 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TC1 | 36.57 | 14.17 | 4.48 | 15.91 | 0.27 | 13.88 | 0.04 | 0.48 | 8.66 | 1.17 | 0.10 | 95.21 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TC2 | 36.26 | 13.99 | 4.41 | 16.58 | 0.26 | 13.48 | 0.01 | 0.62 | 8.70 | 1.94 | 0.10 | 95.52 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TD1 | 36.15 | 14.43 | 4.68 | 14.13 | 0.24 | 14.82 | 0.01 | 0.68 | 8.46 | 0.84 | 0.07 | 94.13 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TD2 | 36.59 | 14.84 | 4.53 | 14.49 | 0.21 | 14.31 | 0.01 | 0.66 | 8.53 | 2.00 | 0.05 | 95.39 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TE1 | 36.23 | 14.53 | 4.56 | 16.00 | 0.31 | 13.59 | 0.00 | 0.44 | 8.77 | 0.79 | 0.08 | 94.96 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TE2 | 36.34 | 14.22 | 4.55 | 15.74 | 0.29 | 13.70 | 0.00 | 0.52 | 8.76 | 1.46 | 0.09 | 95.02 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TF1 | 36.06 | 14.00 | 4.66 | 15.83 | 0.18 | 13.58 | 0.00 | 0.37 | 9.04 | 2.40 | 0.19 | 95.25 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TF2 | 37.11 | 14.42 | 4.60 | 14.06 | 0.16 | 14.88 | 0.00 | 0.40 | 9.40 | 2.71 | 0.20 | 96.75 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TH2 | 37.07 | 13.52 | 4.48 | 13.84 | 0.16 | 15.12 | 0.00 | 0.20 | 9.73 | 2.37 | 0.15 | 95.61 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TR1 | 36.41 | 14.03 | 4.42 | 15.44 | 0.26 | 13.43 | 0.01 | 0.42 | 8.83 | 1.39 | 0.06 | 94.13 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TR2 | 36.66 | 14.28 | 4.31 | 15.58 | 0.20 | 13.85 | 0.05 | 0.45 | 8.67 | 2.21 | 0.08 | 95.40 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TS1 | 36.21 | 13.92 | 4.57 | 15.48 | 0.28 | 13.72 | 0.00 | 0.48 | 8.93 | 1.00 | 0.10 | 94.24 |
| DRS-85-44 | Tuff of Mount Jefferson | 44TS2 | 36.37 | 13.95 | 4.51 | 15.47 | 0.29 | 13.64 | 0.00 | 0.45 | 8.96 | 1.71 | 0.09 | 94.71 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4A1 | 36.84 | 14.60 | 5.00 | 15.28 | 0.24 | 14.33 | 0.00 | 0.57 | 8.76 | 0.51 | 0.07 | 95.97 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4A2 | 36.36 | 14.64 | 5.02 | 15.34 | 0.23 | 14.22 | 0.00 | 0.55 | 8.72 | 0.43 | 0.07 | 95.37 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4B1 | 37.06 | 14.37 | 4.94 | 15.44 | 0.26 | 14.50 | 0.00 | 0.59 | 8.84 | 0.46 | 0.07 | 96.33 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4B2 | 36.41 | 14.61 | 4.89 | 15.27 | 0.26 | 14.08 | 0.00 | 0.55 | 8.72 | 0.39 | 0.05 | 95.05 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4D1 | 35.87 | 14.27 | 5.74 | 17.34 | 0.39 | 12.72 | 0.00 | 0.57 | 8.62 | 0.94 | 0.11 | 96.14 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4D2 | 35.72 | 14.20 | 5.69 | 16.98 | 0.39 | 12.81 | 0.01 | 0.54 | 8.47 | 0.81 | 0.11 | 95.38 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4E1 | 36.34 | 14.63 | 5.10 | 15.17 | 0.22 | 14.24 | 0.00 | 0.65 | 8.62 | 0.52 | 0.08 | 95.33 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4E2 | 36.26 | 14.76 | 4.90 | 15.61 | 0.21 | 13.96 | 0.00 | 0.60 | 8.39 | 0.36 | 0.06 | 94.93 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4F1 | 36.61 | 14.52 | 5.00 | 15.39 | 0.25 | 14.24 | 0.00 | 0.57 | 8.74 | 0.42 | 0.08 | 95.62 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4F2 | 36.72 | 14.46 | 4.97 | 15.62 | 0.28 | 14.10 | 0.00 | 0.55 | 8.60 | 0.48 | 0.09 | 95.64 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4G1 | 37.07 | 14.39 | 4.90 | 15.21 | 0.21 | 14.67 | 0.00 | 0.57 | 8.93 | 0.55 | 0.06 | 96.34 |

**Appendix 2.** Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | FeO | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | F | Cl | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4G2 | 36.37 | 14.64 | 5.00 | 15.40 | 0.24 | 14.26 | 0.00 | 0.60 | 8.60 | 0.50 | 0.06 | 95.45 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4H1 | 36.39 | 14.60 | 5.31 | 14.96 | 0.19 | 14.45 | 0.01 | 0.59 | 8.46 | 0.77 | 0.07 | 95.45 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4H2 | 36.94 | 14.45 | 5.12 | 14.51 | 0.23 | 14.74 | 0.00 | 0.67 | 8.69 | 0.44 | 0.05 | 95.64 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4J1 | 36.11 | 14.89 | 5.34 | 15.04 | 0.21 | 14.17 | 0.00 | 0.63 | 8.37 | 0.39 | 0.06 | 95.03 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4J2 | 36.31 | 14.90 | 5.15 | 14.88 | 0.18 | 14.53 | 0.00 | 0.68 | 8.54 | 0.43 | 0.06 | 95.47 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4K1 | 36.03 | 14.60 | 5.04 | 14.91 | 0.21 | 14.18 | 0.00 | 0.57 | 8.52 | 0.41 | 0.08 | 94.36 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4K2 | 36.98 | 14.45 | 4.89 | 15.02 | 0.23 | 14.71 | 0.01 | 0.61 | 8.70 | 0.48 | 0.08 | 95.94 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4L1 | 35.91 | 14.68 | 5.15 | 16.14 | 0.24 | 13.79 | 0.00 | 0.61 | 8.37 | 0.69 | 0.08 | 95.38 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4L2 | 35.97 | 14.35 | 5.01 | 15.81 | 0.26 | 13.65 | 0.00 | 0.57 | 8.58 | 0.69 | 0.08 | 94.64 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4M1 | 36.74 | 14.41 | 4.98 | 15.22 | 0.25 | 14.67 | 0.00 | 0.58 | 8.73 | 0.41 | 0.05 | 95.85 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89T4M2 | 37.04 | 14.37 | 5.19 | 15.03 | 0.24 | 14.75 | 0.00 | 0.59 | 8.65 | 0.47 | 0.08 | 96.19 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TA1 | 36.84 | 14.60 | 5.00 | 15.28 | 0.24 | 14.33 | 0.00 | 0.57 | 8.76 | 0.51 | 0.07 | 95.97 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TA2 | 36.36 | 14.64 | 5.02 | 15.34 | 0.23 | 14.22 | 0.00 | 0.55 | 8.72 | 0.43 | 0.07 | 95.37 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TB1 | 37.06 | 14.37 | 4.94 | 15.44 | 0.26 | 14.50 | 0.00 | 0.59 | 8.84 | 0.46 | 0.07 | 96.33 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TB2 | 36.41 | 14.61 | 4.89 | 15.27 | 0.26 | 14.08 | 0.00 | 0.55 | 8.72 | 0.39 | 0.05 | 95.05 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TD1 | 35.87 | 14.27 | 5.74 | 17.34 | 0.39 | 12.72 | 0.00 | 0.57 | 8.62 | 0.94 | 0.11 | 96.14 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TD2 | 35.72 | 14.20 | 5.69 | 16.98 | 0.39 | 12.81 | 0.01 | 0.54 | 8.47 | 0.81 | 0.11 | 95.38 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TE1 | 36.34 | 14.63 | 5.10 | 15.17 | 0.22 | 14.24 | 0.00 | 0.65 | 8.62 | 0.52 | 0.08 | 95.33 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TE2 | 36.26 | 14.76 | 4.90 | 15.61 | 0.21 | 13.96 | 0.00 | 0.60 | 8.39 | 0.36 | 0.06 | 94.93 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TF1 | 36.61 | 14.52 | 5.00 | 15.39 | 0.25 | 14.24 | 0.00 | 0.57 | 8.74 | 0.42 | 0.08 | 95.62 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TF2 | 36.72 | 14.46 | 4.97 | 15.62 | 0.28 | 14.10 | 0.00 | 0.55 | 8.60 | 0.48 | 0.09 | 95.64 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TG1 | 37.07 | 14.39 | 4.90 | 15.21 | 0.21 | 14.67 | 0.00 | 0.57 | 8.93 | 0.55 | 0.06 | 96.34 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TG2 | 36.37 | 14.64 | 5.00 | 15.40 | 0.24 | 14.26 | 0.00 | 0.60 | 8.60 | 0.50 | 0.06 | 95.45 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TH1 | 36.39 | 14.60 | 5.31 | 14.96 | 0.19 | 14.45 | 0.01 | 0.59 | 8.46 | 0.77 | 0.07 | 95.45 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TH2 | 36.94 | 14.45 | 5.12 | 14.51 | 0.23 | 14.74 | 0.00 | 0.67 | 8.69 | 0.44 | 0.05 | 95.64 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TJ1 | 36.11 | 14.89 | 5.34 | 15.04 | 0.21 | 14.17 | 0.00 | 0.63 | 8.37 | 0.39 | 0.06 | 95.03 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TJ2 | 36.31 | 14.90 | 5.15 | 14.88 | 0.18 | 14.53 | 0.00 | 0.68 | 8.54 | 0.43 | 0.06 | 95.47 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TK1 | 36.03 | 14.60 | 5.04 | 14.91 | 0.21 | 14.18 | 0.00 | 0.57 | 8.52 | 0.41 | 0.08 | 94.36 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TK2 | 36.98 | 14.45 | 4.89 | 15.02 | 0.23 | 14.71 | 0.01 | 0.61 | 8.70 | 0.48 | 0.08 | 95.94 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TL1 | 35.91 | 14.68 | 5.15 | 16.14 | 0.24 | 13.79 | 0.00 | 0.61 | 8.37 | 0.69 | 0.08 | 95.38 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TL2 | 35.97 | 14.35 | 5.01 | 15.81 | 0.26 | 13.65 | 0.00 | 0.57 | 8.58 | 0.69 | 0.08 | 94.64 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TM1 | 36.74 | 14.41 | 4.98 | 15.22 | 0.25 | 14.67 | 0.00 | 0.58 | 8.73 | 0.41 | 0.05 | 95.85 |
| DRS-91-89 | Tuff of Corcoran Canyon, upper | 89TM2 | 37.04 | 14.37 | 5.19 | 15.03 | 0.24 | 14.75 | 0.00 | 0.59 | 8.65 | 0.47 | 0.08 | 96.19 |
| DRS-91-3 | Tuff of Corcoran Canyon, upper | 913TC1 | 35.84 | 13.70 | 5.57 | 20.09 | 0.31 | 11.51 | 0.00 | 0.63 | 8.88 | 1.07 | 0.08 | 97.24 |
| DRS-91-3 | Tuff of Corcoran Canyon, upper | 913TD1 | 37.25 | 13.51 | 5.22 | 18.32 | 0.34 | 12.37 | 0.00 | 0.67 | 8.87 | 0.40 | 0.08 | 96.85 |
| DRS-91-3 | Tuff of Corcoran Canyon, upper | 913TE1 | 36.26 | 13.20 | 5.15 | 22.82 | 0.25 | 9.09 | 0.02 | 0.69 | 8.37 | 0.56 | 0.10 | 96.24 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919TB1 | 37.61 | 13.45 | 3.97 | 17.32 | 0.65 | 13.70 | 0.00 | 0.50 | 9.15 | 0.74 | 0.12 | 96.87 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919TB2 | 38.03 | 13.64 | 3.99 | 17.00 | 0.64 | 13.40 | 0.05 | 0.48 | 9.01 | 1.22 | 0.12 | 97.05 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919TG1 | 37.05 | 13.92 | 4.85 | 17.10 | 0.38 | 13.04 | 0.09 | 0.42 | 8.28 | 1.11 | 0.12 | 95.86 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919TG2 | 36.68 | 13.92 | 4.77 | 17.37 | 0.39 | 12.74 | 0.09 | 0.42 | 8.02 | 1.24 | 0.12 | 95.21 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919TM1 | 37.81 | 13.45 | 4.12 | 16.89 | 0.63 | 13.67 | 0.42 | 0.47 | 8.94 | 1.15 | 0.10 | 97.14 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919TM2 | 37.75 | 13.70 | 4.21 | 16.94 | 0.58 | 13.65 | 0.04 | 0.47 | 8.77 | 0.82 | 0.10 | 96.66 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919TM3 | 37.98 | 13.44 | 3.93 | 16.88 | 0.63 | 13.63 | 0.08 | 0.49 | 8.56 | 0.74 | 0.10 | 96.14 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919TM4 | 37.84 | 13.51 | 4.09 | 17.09 | 0.66 | 13.51 | 0.04 | 0.47 | 8.68 | 0.76 | 0.10 | 96.41 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TA2 | 36.65 | 13.17 | 4.26 | 19.23 | 0.41 | 11.75 | 0.03 | 0.50 | 8.81 | 0.66 | 0.19 | 95.32 |

**Appendix 2.** Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | FeO | MnO | MgO | CaO | $Na_2O$ | $K_2O$ | F | Cl | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-92-20 | Tuff of Mount Jefferson | 920TAE1 | 37.93 | 13.30 | 3.93 | 18.84 | 0.36 | 11.85 | 0.19 | 0.46 | 8.19 | 0.72 | 0.18 | 95.60 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TAE2 | 37.74 | 13.03 | 4.13 | 19.10 | 0.47 | 12.45 | 0.06 | 0.48 | 8.63 | 0.67 | 0.19 | 96.62 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TE1 | 35.67 | 14.30 | 4.69 | 16.86 | 0.36 | 13.12 | 0.03 | 0.51 | 8.64 | 0.72 | 0.10 | 94.68 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TE2 | 36.61 | 14.21 | 4.47 | 16.48 | 0.35 | 13.65 | 0.15 | 0.48 | 8.25 | 0.50 | 0.09 | 95.03 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TF1 | 36.76 | 13.41 | 4.29 | 19.14 | 0.39 | 12.04 | 0.24 | 0.44 | 8.03 | 0.57 | 0.18 | 95.22 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TF2 | 36.39 | 13.55 | 4.43 | 19.98 | 0.44 | 11.49 | 0.07 | 0.57 | 8.75 | 0.96 | 0.20 | 96.40 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TG1 | 37.01 | 13.66 | 4.48 | 19.80 | 0.47 | 12.01 | 0.00 | 0.52 | 8.94 | 0.74 | 0.22 | 97.50 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TG2 | 37.42 | 13.64 | 4.23 | 19.40 | 0.41 | 12.03 | 0.03 | 0.52 | 8.83 | 0.64 | 0.21 | 97.03 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TN2 | 36.33 | 13.65 | 4.35 | 19.68 | 0.41 | 11.54 | 0.12 | 0.47 | 8.24 | 0.60 | 0.22 | 95.30 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TQ1 | 35.96 | 14.10 | 4.52 | 20.37 | 0.50 | 11.42 | 0.01 | 0.48 | 8.90 | 0.47 | 0.21 | 96.69 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TQ2 | 37.22 | 13.53 | 4.28 | 20.20 | 0.42 | 11.67 | 0.00 | 0.53 | 8.82 | 0.75 | 0.20 | 97.25 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TS1 | 36.17 | 14.36 | 4.71 | 17.16 | 0.36 | 13.19 | 0.01 | 0.53 | 8.97 | 0.60 | 0.14 | 95.92 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TS2 | 36.42 | 14.29 | 4.68 | 17.02 | 0.43 | 13.46 | 0.00 | 0.51 | 8.90 | 0.45 | 0.12 | 96.06 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TT1 | 36.34 | 14.07 | 4.30 | 19.83 | 0.44 | 11.07 | 0.06 | 0.47 | 8.40 | 0.57 | 0.22 | 95.50 |
| DRS-92-20 | Tuff of Mount Jefferson | 920TT2 | 35.68 | 13.99 | 4.48 | 20.46 | 0.39 | 11.24 | 0.09 | 0.53 | 8.48 | 0.53 | 0.21 | 95.82 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921T1 | 37.76 | 13.69 | 4.82 | 16.55 | 0.20 | 13.92 | 0.00 | 0.49 | 9.11 | 0.57 | 0.13 | 96.96 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921T2 | 37.60 | 13.61 | 4.72 | 16.61 | 0.16 | 14.05 | 0.03 | 0.52 | 9.05 | 0.51 | 0.15 | 96.76 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TAC1 | 37.55 | 13.81 | 4.61 | 16.67 | 0.18 | 13.99 | 0.00 | 0.43 | 9.18 | 0.55 | 0.13 | 96.84 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TAC2 | 36.77 | 14.09 | 4.74 | 16.84 | 0.21 | 13.61 | 0.00 | 0.48 | 8.97 | 0.62 | 0.13 | 96.18 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TK1 | 37.06 | 13.70 | 5.02 | 16.60 | 0.13 | 13.39 | 0.00 | 0.43 | 8.74 | 0.49 | 0.14 | 95.49 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TK2 | 37.31 | 13.61 | 4.78 | 16.32 | 0.23 | 13.71 | 0.00 | 0.50 | 8.95 | 0.54 | 0.13 | 95.81 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TL1 | 37.49 | 13.41 | 4.71 | 16.30 | 0.20 | 13.94 | 0.01 | 0.49 | 9.00 | 0.51 | 0.13 | 95.94 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TL2 | 37.75 | 13.47 | 4.68 | 16.45 | 0.21 | 13.99 | 0.03 | 0.52 | 8.87 | 0.52 | 0.13 | 96.38 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TM1 | 36.82 | 14.60 | 4.38 | 16.94 | 0.18 | 13.91 | 0.00 | 0.50 | 9.18 | 0.54 | 0.05 | 96.85 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TM2 | 36.63 | 14.31 | 4.60 | 16.86 | 0.22 | 13.63 | 0.00 | 0.48 | 9.13 | 0.53 | 0.08 | 96.22 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TN1 | 37.11 | 14.00 | 4.65 | 16.81 | 0.21 | 13.72 | 0.00 | 0.47 | 8.93 | 0.51 | 0.12 | 96.31 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TN2 | 36.88 | 14.14 | 4.88 | 16.73 | 0.20 | 13.75 | 0.00 | 0.49 | 9.03 | 0.48 | 0.14 | 96.51 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TP1 | 37.07 | 13.95 | 4.79 | 16.91 | 0.20 | 13.64 | 0.01 | 0.51 | 8.87 | 0.59 | 0.14 | 96.39 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TP2 | 37.12 | 13.97 | 4.64 | 16.65 | 0.19 | 13.91 | 0.02 | 0.49 | 8.92 | 0.57 | 0.13 | 96.34 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TU1 | 38.38 | 13.57 | 4.50 | 16.06 | 0.14 | 13.23 | 0.02 | 0.54 | 8.78 | 0.46 | 0.15 | 95.60 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TV1 | 37.29 | 13.82 | 4.57 | 17.10 | 0.25 | 13.49 | 0.03 | 0.53 | 9.09 | 0.56 | 0.13 | 96.60 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921TV2 | 37.15 | 13.83 | 4.78 | 17.31 | 0.21 | 13.47 | 0.00 | 0.50 | 9.06 | 0.50 | 0.14 | 96.71 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TA1 | 36.21 | 15.53 | 5.22 | 19.03 | 0.17 | 10.26 | 0.04 | 0.46 | 8.34 | 2.73 | 0.13 | 96.94 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TA2 | 36.06 | 16.24 | 5.16 | 18.70 | 0.14 | 10.33 | 0.02 | 0.53 | 8.17 | 2.38 | 0.14 | 96.82 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TD1 | 37.83 | 17.97 | 4.39 | 17.20 | 0.17 | 8.69 | 0.00 | 0.45 | 7.69 | 2.16 | 0.19 | 95.80 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TD2 | 38.67 | 17.50 | 4.64 | 12.37 | 0.12 | 13.11 | 0.02 | 0.39 | 8.27 | 3.19 | 0.20 | 97.08 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TG1 | 36.73 | 15.44 | 4.69 | 18.21 | 0.21 | 11.25 | 0.00 | 0.56 | 8.36 | 3.21 | 0.19 | 97.44 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TH1 | 36.32 | 14.84 | 5.44 | 14.84 | 0.08 | 13.48 | 0.00 | 0.60 | 8.61 | 4.03 | 0.19 | 96.71 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TH2 | 36.40 | 14.76 | 5.25 | 15.20 | 0.12 | 13.35 | 0.00 | 0.58 | 8.65 | 4.26 | 0.18 | 96.90 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TL1 | 36.64 | 15.76 | 4.79 | 20.90 | 0.20 | 8.60 | 0.01 | 0.37 | 8.36 | 1.98 | 0.16 | 96.90 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TL2 | 37.10 | 16.23 | 4.74 | 19.99 | 0.16 | 8.81 | 0.00 | 0.43 | 8.24 | 2.22 | 0.16 | 97.10 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TM1 | 38.56 | 17.27 | 4.49 | 14.49 | 0.15 | 11.21 | 0.08 | 0.44 | 8.34 | 2.86 | 0.22 | 96.88 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TM2 | 36.70 | 15.61 | 5.21 | 16.48 | 0.13 | 11.42 | 0.04 | 0.40 | 8.79 | 2.86 | 0.21 | 96.59 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TQ1 | 37.60 | 16.10 | 5.34 | 12.40 | 0.13 | 13.27 | 0.06 | 0.53 | 8.56 | 4.24 | 0.27 | 96.63 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TQ2 | 37.52 | 16.03 | 6.01 | 12.99 | 0.09 | 13.63 | 0.04 | 0.46 | 8.77 | 3.94 | 0.19 | 97.99 |
| DRS-91-59 | Tuff of Corcoran Canyon, lower | 959TR1 | 38.61 | 16.11 | 4.12 | 13.85 | 0.18 | 12.82 | 0.04 | 0.45 | 8.44 | 3.78 | 0.20 | 96.98 |

**Appendix 3.** Recomputed Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.

| Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | $Fe_2O_3$ | FeO | MnO | MgO | $Na_2O$ | $K_2O$ | F | Cl | $H_2O$ | Total | O=F;Cl | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 06TA1 | 36.62 | 14.50 | 6.23 | 2.43 | 12.37 | 0.17 | 13.11 | 0.64 | 7.71 | 0.53 | 0.06 | 3.73 | 98.10 | 0.24 | 97.86 |
| 06TA2 | 36.29 | 14.81 | 6.11 | 2.52 | 12.84 | 0.19 | 13.16 | 0.76 | 7.93 | 0.48 | 0.05 | 3.77 | 98.91 | 0.21 | 98.70 |
| 06TB1 | 37.91 | 13.96 | 5.35 | 2.64 | 13.46 | 0.26 | 10.99 | 0.39 | 7.72 | 0.51 | 0.07 | 3.68 | 96.94 | 0.23 | 96.71 |
| 06TD1 | 37.20 | 14.04 | 5.62 | 2.96 | 15.07 | 0.27 | 11.07 | 0.52 | 8.37 | 0.48 | 0.11 | 3.73 | 99.44 | 0.23 | 99.21 |
| 06TD2 | 36.09 | 13.93 | 5.32 | 2.93 | 14.92 | 0.31 | 10.66 | 0.48 | 7.77 | 0.38 | 0.08 | 3.67 | 96.54 | 0.18 | 96.37 |
| 06TE1 | 38.34 | 13.44 | 5.49 | 2.89 | 14.74 | 0.29 | 10.00 | 0.38 | 7.99 | 0.34 | 0.08 | 3.77 | 97.75 | 0.16 | 97.59 |
| 168TA1 | 35.97 | 14.10 | 4.71 | 2.63 | 13.43 | 0.31 | 13.99 | 0.59 | 8.71 | 0.48 | 0.05 | 3.72 | 98.69 | 0.21 | 98.48 |
| 168TB1 | 36.44 | 13.56 | 4.57 | 2.68 | 13.69 | 0.36 | 13.97 | 0.61 | 8.65 | 0.49 | 0.07 | 3.71 | 98.80 | 0.22 | 98.58 |
| 168TB2 | 36.26 | 13.51 | 4.60 | 2.69 | 13.74 | 0.37 | 13.83 | 0.54 | 8.82 | 0.34 | 0.09 | 3.77 | 98.56 | 0.16 | 98.39 |
| 168TC1 | 36.50 | 13.28 | 4.56 | 2.66 | 13.56 | 0.37 | 14.08 | 0.51 | 8.68 | 0.44 | 0.09 | 3.72 | 98.45 | 0.21 | 98.25 |
| 168TC2 | 36.46 | 13.34 | 4.36 | 2.73 | 13.93 | 0.40 | 13.70 | 0.54 | 8.70 | 0.71 | 0.10 | 3.58 | 98.55 | 0.32 | 98.23 |
| 168TD1 | 35.10 | 13.78 | 4.47 | 3.33 | 16.97 | 0.46 | 11.08 | 0.54 | 8.56 | 0.48 | 0.21 | 3.59 | 98.57 | 0.25 | 98.32 |
| 168TD2 | 36.83 | 12.72 | 4.12 | 3.20 | 16.34 | 0.45 | 12.01 | 0.53 | 8.70 | 0.91 | 0.19 | 3.44 | 99.44 | 0.43 | 99.02 |
| 168TE1 | 36.12 | 13.36 | 4.48 | 2.64 | 13.48 | 0.35 | 13.84 | 0.54 | 8.57 | 0.49 | 0.09 | 3.66 | 97.62 | 0.23 | 97.40 |
| 168TE2 | 36.07 | 13.31 | 4.55 | 2.72 | 13.88 | 0.40 | 13.60 | 0.51 | 8.51 | 0.96 | 0.10 | 3.44 | 98.05 | 0.43 | 97.62 |
| 168TL1 | 36.41 | 12.87 | 4.19 | 3.33 | 16.99 | 0.43 | 11.78 | 0.56 | 8.93 | 0.50 | 0.19 | 3.64 | 99.82 | 0.25 | 99.57 |
| 168TL2 | 35.92 | 13.09 | 4.50 | 3.33 | 16.96 | 0.44 | 11.36 | 0.53 | 8.69 | 0.57 | 0.20 | 3.58 | 99.17 | 0.29 | 98.88 |
| 168TM1 | 35.88 | 13.62 | 4.62 | 2.75 | 14.03 | 0.37 | 13.49 | 0.54 | 8.65 | 0.39 | 0.13 | 3.71 | 98.18 | 0.19 | 97.99 |
| 168TM2 | 35.81 | 13.58 | 4.59 | 2.71 | 13.80 | 0.40 | 13.63 | 0.50 | 8.62 | 0.69 | 0.10 | 3.57 | 98.00 | 0.31 | 97.68 |
| 168TN1 | 36.19 | 13.74 | 4.51 | 2.60 | 13.24 | 0.33 | 14.08 | 0.60 | 8.55 | 0.40 | 0.09 | 3.73 | 98.06 | 0.19 | 97.87 |
| 168TN2 | 36.06 | 14.24 | 4.61 | 2.64 | 13.48 | 0.36 | 14.04 | 0.62 | 8.70 | 0.45 | 0.09 | 3.74 | 99.03 | 0.21 | 98.82 |
| 168TQ1 | 36.15 | 13.77 | 4.43 | 2.59 | 13.20 | 0.32 | 13.84 | 0.60 | 8.69 | 0.41 | 0.10 | 3.71 | 97.81 | 0.20 | 97.62 |
| 168TQ2 | 36.29 | 14.23 | 4.63 | 2.62 | 13.35 | 0.33 | 13.97 | 0.57 | 8.58 | 0.38 | 0.11 | 3.77 | 98.83 | 0.18 | 98.65 |
| 168TR1 | 35.77 | 13.27 | 4.35 | 3.31 | 16.89 | 0.43 | 11.58 | 0.55 | 8.63 | 0.54 | 0.17 | 3.60 | 99.09 | 0.27 | 98.82 |
| 168TR2 | 35.43 | 13.39 | 4.45 | 3.29 | 16.78 | 0.44 | 11.20 | 0.54 | 8.49 | 0.45 | 0.20 | 3.61 | 98.27 | 0.23 | 98.03 |
| 168TT2 | 35.72 | 13.23 | 4.42 | 3.37 | 17.18 | 0.45 | 11.44 | 0.56 | 8.62 | 0.57 | 0.20 | 3.58 | 99.34 | 0.29 | 99.06 |
| 168TU1 | 35.93 | 13.01 | 4.47 | 3.27 | 16.65 | 0.45 | 11.38 | 0.54 | 8.49 | 0.60 | 0.22 | 3.54 | 98.55 | 0.30 | 98.25 |
| 168TU2 | 36.79 | 12.66 | 4.28 | 3.21 | 16.37 | 0.48 | 12.08 | 0.52 | 8.86 | 0.53 | 0.21 | 3.63 | 99.62 | 0.27 | 99.35 |
| 168TV1 | 36.15 | 13.54 | 4.50 | 2.62 | 13.36 | 0.31 | 14.09 | 0.61 | 8.53 | 0.35 | 0.09 | 3.75 | 97.90 | 0.17 | 97.73 |
| 168TV2 | 36.55 | 13.41 | 4.24 | 2.58 | 13.17 | 0.34 | 14.11 | 0.58 | 8.51 | 0.65 | 0.09 | 3.61 | 97.84 | 0.29 | 97.54 |
| 169TA1 | 36.87 | 13.42 | 4.58 | 2.60 | 13.24 | 0.33 | 14.28 | 0.54 | 8.60 | 0.43 | 0.09 | 3.75 | 98.73 | 0.20 | 98.53 |
| 169TA2 | 36.74 | 13.47 | 4.45 | 2.58 | 13.15 | 0.32 | 14.08 | 0.53 | 8.73 | 0.56 | 0.09 | 3.67 | 98.37 | 0.26 | 98.11 |
| 169TAC1 | 36.84 | 13.06 | 4.30 | 3.19 | 16.26 | 0.40 | 12.00 | 0.44 | 8.72 | 1.18 | 0.19 | 3.34 | 99.92 | 0.54 | 99.38 |
| 169TAC2 | 36.16 | 12.77 | 4.25 | 3.28 | 16.74 | 0.44 | 11.50 | 0.50 | 8.59 | 0.66 | 0.23 | 3.51 | 98.63 | 0.33 | 98.30 |
| 169TC1 | 35.95 | 13.78 | 4.68 | 2.67 | 13.63 | 0.33 | 13.82 | 0.56 | 8.54 | 0.48 | 0.09 | 3.69 | 98.22 | 0.22 | 98.00 |
| 169TC2 | 36.57 | 13.77 | 4.49 | 2.63 | 13.39 | 0.32 | 14.10 | 0.57 | 8.71 | 0.40 | 0.09 | 3.76 | 98.80 | 0.19 | 98.61 |
| 169TG1 | 36.44 | 13.80 | 4.32 | 2.63 | 13.40 | 0.32 | 14.22 | 0.53 | 8.62 | 0.51 | 0.10 | 3.70 | 98.59 | 0.24 | 98.35 |
| 169TG2 | 36.56 | 13.44 | 4.49 | 2.55 | 12.98 | 0.27 | 14.23 | 0.58 | 8.64 | 0.49 | 0.11 | 3.69 | 98.03 | 0.23 | 97.80 |
| 169TJ1 | 36.29 | 13.28 | 4.41 | 2.73 | 13.90 | 0.37 | 13.73 | 0.48 | 8.49 | 0.46 | 0.11 | 3.68 | 97.93 | 0.22 | 97.71 |
| 169TJ2 | 36.23 | 12.96 | 4.45 | 2.71 | 13.80 | 0.37 | 13.81 | 0.51 | 8.64 | 0.45 | 0.12 | 3.67 | 97.72 | 0.22 | 97.50 |
| 169TK1 | 36.36 | 13.59 | 4.30 | 2.64 | 13.44 | 0.29 | 14.18 | 0.56 | 8.44 | 0.46 | 0.08 | 3.71 | 98.05 | 0.21 | 97.84 |
| 169TL1 | 36.51 | 13.77 | 4.34 | 2.58 | 13.15 | 0.30 | 14.47 | 0.58 | 8.73 | 0.38 | 0.10 | 3.77 | 98.68 | 0.18 | 98.49 |
| 169TP1 | 36.31 | 13.10 | 4.37 | 2.67 | 13.62 | 0.37 | 13.78 | 0.50 | 8.61 | 0.54 | 0.09 | 3.63 | 97.59 | 0.25 | 97.35 |
| 169TP2 | 36.64 | 13.56 | 4.46 | 2.67 | 13.60 | 0.40 | 13.86 | 0.50 | 8.59 | 0.49 | 0.09 | 3.71 | 98.57 | 0.23 | 98.34 |
| 169TT1 | 38.38 | 12.22 | 4.06 | 2.92 | 14.90 | 0.40 | 12.12 | 0.37 | 8.80 | 0.81 | 0.21 | 3.50 | 98.69 | 0.39 | 98.31 |

**Appendix 3.** Recomputed Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | $Fe_2O_3$ | FeO | MnO | MgO | $Na_2O$ | $K_2O$ | F | Cl | $H_2O$ | Total | O=F;Cl | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 169TT2 | 37.06 | 12.05 | 4.20 | 3.15 | 16.07 | 0.45 | 12.34 | 0.47 | 8.67 | 0.83 | 0.18 | 3.47 | 98.94 | 0.39 | 98.55 |
| 169TX1 | 37.34 | 12.40 | 3.97 | 3.19 | 16.27 | 0.44 | 12.29 | 0.49 | 8.78 | 0.53 | 0.18 | 3.64 | 99.52 | 0.26 | 99.26 |
| 169TX2 | 36.81 | 12.63 | 4.13 | 3.23 | 16.44 | 0.46 | 12.01 | 0.49 | 8.68 | 0.70 | 0.19 | 3.54 | 99.31 | 0.34 | 98.97 |
| 197TAB1 | 36.77 | 13.16 | 4.36 | 3.23 | 16.48 | 0.39 | 11.80 | 0.20 | 8.85 | 0.00 | 0.00 | 3.94 | 99.18 | 0.00 | 99.18 |
| 197TAB2 | 36.65 | 13.21 | 4.31 | 3.23 | 16.45 | 0.38 | 11.96 | 0.16 | 8.98 | 0.00 | 0.00 | 3.94 | 99.27 | 0.00 | 99.27 |
| 197TAF1 | 37.27 | 14.47 | 4.43 | 2.72 | 13.87 | 0.26 | 14.08 | 0.30 | 8.81 | 0.00 | 0.00 | 4.05 | 100.26 | 0.00 | 100.26 |
| 197TC1 | 36.50 | 13.93 | 4.16 | 2.57 | 13.08 | 0.26 | 14.09 | 0.27 | 8.55 | 0.00 | 0.00 | 3.94 | 97.35 | 0.00 | 97.35 |
| 197TC2 | 36.39 | 13.79 | 4.35 | 2.56 | 13.07 | 0.22 | 14.00 | 0.27 | 8.62 | 0.00 | 0.00 | 3.93 | 97.20 | 0.00 | 97.20 |
| 197TD1 | 36.68 | 13.65 | 4.32 | 2.57 | 13.09 | 0.24 | 14.28 | 0.28 | 8.60 | 0.00 | 0.00 | 3.95 | 97.66 | 0.00 | 97.66 |
| 197TD2 | 36.64 | 13.59 | 4.35 | 2.57 | 13.09 | 0.26 | 14.21 | 0.33 | 8.71 | 0.00 | 0.00 | 3.95 | 97.70 | 0.00 | 97.70 |
| 197TE1 | 36.06 | 13.89 | 4.53 | 2.72 | 13.88 | 0.30 | 13.48 | 0.16 | 8.65 | 0.00 | 0.00 | 3.93 | 97.60 | 0.00 | 97.60 |
| 197TE2 | 35.93 | 13.88 | 4.36 | 2.71 | 13.81 | 0.26 | 13.49 | 0.18 | 8.54 | 0.00 | 0.00 | 3.91 | 97.07 | 0.00 | 97.07 |
| 197TF1 | 36.98 | 12.76 | 4.27 | 3.22 | 16.42 | 0.34 | 12.09 | 0.11 | 8.87 | 0.00 | 0.00 | 3.94 | 99.00 | 0.00 | 99.00 |
| 197TF2 | 37.27 | 13.06 | 4.29 | 3.11 | 15.85 | 0.33 | 12.31 | 0.16 | 8.90 | 0.00 | 0.00 | 3.96 | 99.24 | 0.00 | 99.24 |
| 197TJ1 | 36.74 | 13.48 | 3.72 | 3.14 | 15.99 | 0.19 | 12.56 | 0.18 | 8.83 | 0.00 | 0.00 | 3.94 | 98.77 | 0.00 | 98.77 |
| 197TJ2 | 36.73 | 13.45 | 3.64 | 3.13 | 15.96 | 0.22 | 12.48 | 0.24 | 8.71 | 0.00 | 0.00 | 3.93 | 98.49 | 0.00 | 98.49 |
| 197TL1 | 37.04 | 13.75 | 4.35 | 2.55 | 13.01 | 0.28 | 13.84 | 0.13 | 8.38 | 0.00 | 0.00 | 3.95 | 97.28 | 0.00 | 97.28 |
| 197TL2 | 36.76 | 13.50 | 4.42 | 2.58 | 13.17 | 0.20 | 13.67 | 0.14 | 8.27 | 0.00 | 0.00 | 3.92 | 96.63 | 0.00 | 96.63 |
| 197TM1 | 34.98 | 13.67 | 4.25 | 3.34 | 17.02 | 0.32 | 11.08 | 0.20 | 8.37 | 0.00 | 0.00 | 3.84 | 97.07 | 0.00 | 97.07 |
| 197TM2 | 35.43 | 13.49 | 4.68 | 3.26 | 16.62 | 0.37 | 11.28 | 0.17 | 8.41 | 0.00 | 0.00 | 3.87 | 97.58 | 0.00 | 97.58 |
| 197TN1 | 36.77 | 13.42 | 4.21 | 3.27 | 16.65 | 0.37 | 11.34 | 0.16 | 8.73 | 0.00 | 0.00 | 3.93 | 98.85 | 0.00 | 98.85 |
| 197TN2 | 36.43 | 13.27 | 4.16 | 3.25 | 16.59 | 0.33 | 11.49 | 0.20 | 8.58 | 0.00 | 0.00 | 3.90 | 98.20 | 0.00 | 98.20 |
| 197TQ1 | 36.29 | 13.33 | 4.24 | 3.27 | 16.69 | 0.37 | 11.36 | 0.22 | 8.43 | 0.00 | 0.00 | 3.90 | 98.10 | 0.00 | 98.10 |
| 197TQ2 | 35.94 | 13.39 | 4.65 | 3.30 | 16.84 | 0.30 | 11.50 | 0.12 | 8.60 | 0.00 | 0.00 | 3.91 | 98.55 | 0.00 | 98.55 |
| 197TY1 | 36.51 | 13.98 | 4.36 | 2.59 | 13.21 | 0.26 | 14.09 | 0.19 | 8.51 | 0.00 | 0.00 | 3.96 | 97.66 | 0.00 | 97.66 |
| 197TY2 | 36.89 | 13.95 | 4.35 | 2.60 | 13.28 | 0.20 | 14.13 | 0.17 | 8.69 | 0.00 | 0.00 | 3.98 | 98.24 | 0.00 | 98.24 |
| 197TZ1 | 37.81 | 12.67 | 4.13 | 3.15 | 16.06 | 0.33 | 12.16 | 0.08 | 8.73 | 0.00 | 0.00 | 3.96 | 99.08 | 0.00 | 99.08 |
| 197TZ2 | 37.38 | 13.15 | 4.19 | 3.24 | 16.50 | 0.37 | 12.13 | 0.09 | 8.93 | 0.00 | 0.00 | 3.98 | 99.96 | 0.00 | 99.96 |
| 199TA1 | 37.27 | 13.66 | 4.45 | 2.46 | 12.53 | 0.16 | 14.79 | 0.32 | 8.71 | 0.00 | 0.00 | 4.00 | 98.35 | 0.00 | 98.35 |
| 199TA2 | 37.45 | 13.60 | 4.27 | 2.46 | 12.55 | 0.20 | 14.55 | 0.36 | 8.69 | 0.00 | 0.00 | 3.99 | 98.12 | 0.00 | 98.12 |
| 199TAE1 | 37.40 | 12.99 | 4.24 | 3.33 | 16.97 | 0.29 | 12.00 | 0.28 | 8.56 | 0.00 | 0.00 | 3.98 | 100.04 | 0.00 | 100.04 |
| 199TAE2 | 37.47 | 12.85 | 4.29 | 3.36 | 17.14 | 0.44 | 12.29 | 0.26 | 8.61 | 0.00 | 0.00 | 4.00 | 100.71 | 0.00 | 100.71 |
| 199TAH1 | 35.89 | 13.99 | 4.34 | 2.69 | 13.70 | 0.16 | 13.68 | 0.34 | 8.60 | 0.00 | 0.00 | 3.92 | 97.31 | 0.00 | 97.31 |
| 199TAH2 | 35.91 | 14.17 | 4.24 | 2.75 | 14.02 | 0.18 | 13.61 | 0.22 | 8.14 | 0.00 | 0.00 | 3.92 | 97.16 | 0.00 | 97.16 |
| 199TAL1 | 36.51 | 14.03 | 4.41 | 2.73 | 13.90 | 0.22 | 14.06 | 0.26 | 8.29 | 0.00 | 0.00 | 3.98 | 98.39 | 0.00 | 98.39 |
| 199TAL2 | 36.60 | 13.82 | 4.51 | 2.74 | 13.98 | 0.23 | 14.03 | 0.34 | 8.17 | 0.00 | 0.00 | 3.98 | 98.40 | 0.00 | 98.40 |
| 199TB1 | 37.19 | 13.24 | 4.42 | 2.57 | 13.12 | 0.29 | 14.32 | 0.34 | 8.87 | 0.00 | 0.00 | 3.98 | 98.34 | 0.00 | 98.34 |
| 199TB2 | 37.42 | 13.78 | 4.31 | 2.60 | 13.27 | 0.25 | 14.02 | 0.25 | 8.91 | 0.00 | 0.00 | 4.00 | 98.81 | 0.00 | 98.81 |
| 199TC1 | 37.65 | 12.40 | 4.15 | 3.25 | 16.55 | 0.33 | 11.92 | 0.24 | 9.01 | 0.00 | 0.00 | 3.95 | 99.45 | 0.00 | 99.45 |
| 199TC2 | 36.94 | 12.99 | 4.24 | 3.32 | 16.93 | 0.43 | 11.78 | 0.18 | 8.89 | 0.00 | 0.00 | 3.95 | 99.65 | 0.00 | 99.65 |
| 199TE1 | 37.93 | 13.03 | 4.37 | 2.58 | 13.16 | 0.25 | 14.91 | 0.25 | 9.13 | 0.00 | 0.00 | 4.03 | 99.64 | 0.00 | 99.64 |
| 199TE2 | 38.13 | 13.00 | 4.24 | 2.58 | 13.16 | 0.27 | 14.78 | 0.31 | 9.09 | 0.00 | 0.00 | 4.03 | 99.59 | 0.00 | 99.59 |
| 199TF1 | 37.79 | 13.60 | 4.45 | 2.30 | 11.72 | 0.17 | 15.51 | 0.39 | 8.73 | 0.00 | 0.00 | 4.03 | 98.69 | 0.00 | 98.69 |
| 199TF1 | 36.01 | 13.75 | 4.29 | 2.82 | 14.37 | 0.18 | 13.53 | 0.25 | 8.20 | 0.00 | 0.00 | 3.92 | 97.32 | 0.00 | 97.32 |
| 199TF2 | 38.25 | 13.64 | 4.31 | 2.32 | 11.80 | 0.11 | 15.53 | 0.43 | 8.77 | 0.00 | 0.00 | 4.06 | 99.22 | 0.00 | 99.22 |

**Appendix 3.** Recomputed Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | $Fe_2O_3$ | FeO | MnO | MgO | $Na_2O$ | $K_2O$ | F | Cl | $H_2O$ | Total | O=F;Cl | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 199TF2 | 36.23 | 13.85 | 4.42 | 2.83 | 14.42 | 0.30 | 13.70 | 0.24 | 8.27 | 0.00 | 0.00 | 3.95 | 98.21 | 0.00 | 98.21 |
| 199TH1 | 37.04 | 13.15 | 4.12 | 3.23 | 16.49 | 0.38 | 12.33 | 0.15 | 8.40 | 0.00 | 0.00 | 3.96 | 99.25 | 0.00 | 99.25 |
| 199TH2 | 37.06 | 12.83 | 4.21 | 3.29 | 16.78 | 0.35 | 12.60 | 0.17 | 8.53 | 0.00 | 0.00 | 3.97 | 99.79 | 0.00 | 99.79 |
| 199TQ1 | 36.48 | 14.16 | 4.35 | 2.61 | 13.28 | 0.15 | 14.14 | 0.37 | 8.11 | 0.00 | 0.00 | 3.96 | 97.61 | 0.00 | 97.61 |
| 199TQ2 | 36.95 | 13.98 | 4.36 | 2.58 | 13.17 | 0.10 | 14.24 | 0.34 | 8.28 | 0.00 | 0.00 | 3.98 | 97.98 | 0.00 | 97.98 |
| 199TR1 | 36.22 | 13.19 | 4.37 | 3.41 | 17.39 | 0.34 | 11.52 | 0.23 | 8.47 | 0.00 | 0.00 | 3.92 | 99.06 | 0.00 | 99.06 |
| 199TR2 | 36.97 | 13.15 | 4.32 | 3.44 | 17.53 | 0.36 | 11.96 | 0.18 | 8.52 | 0.00 | 0.00 | 3.98 | 100.41 | 0.00 | 100.41 |
| 199TV1 | 36.86 | 13.69 | 4.42 | 2.51 | 12.82 | 0.18 | 14.98 | 0.35 | 8.33 | 0.00 | 0.00 | 3.99 | 98.13 | 0.00 | 98.13 |
| 199TV2 | 36.93 | 13.96 | 4.39 | 2.55 | 13.02 | 0.21 | 14.68 | 0.44 | 8.02 | 0.00 | 0.00 | 3.99 | 98.19 | 0.00 | 98.19 |
| 203TA1 | 36.54 | 13.80 | 4.43 | 2.74 | 13.97 | 0.27 | 13.96 | 0.36 | 8.54 | 0.00 | 0.00 | 3.97 | 98.58 | 0.00 | 98.58 |
| 203TA2 | 37.21 | 13.96 | 4.07 | 2.67 | 13.62 | 0.25 | 14.02 | 0.33 | 8.54 | 0.00 | 0.00 | 3.99 | 98.66 | 0.00 | 98.66 |
| 203TB1 | 36.29 | 13.89 | 4.36 | 2.75 | 14.02 | 0.24 | 13.75 | 0.43 | 8.58 | 0.00 | 0.00 | 3.96 | 98.27 | 0.00 | 98.27 |
| 203TB2 | 36.74 | 14.12 | 4.58 | 2.60 | 13.24 | 0.21 | 13.68 | 0.37 | 8.51 | 0.00 | 0.00 | 3.97 | 98.02 | 0.00 | 98.02 |
| 203TB3 | 36.35 | 13.80 | 4.38 | 2.71 | 13.81 | 0.22 | 13.84 | 0.36 | 8.47 | 0.00 | 0.00 | 3.95 | 97.89 | 0.00 | 97.89 |
| 203TC1 | 36.90 | 14.30 | 4.40 | 2.71 | 13.83 | 0.27 | 13.68 | 0.31 | 8.22 | 0.00 | 0.00 | 3.99 | 98.61 | 0.00 | 98.61 |
| 203TC2 | 36.53 | 13.90 | 4.38 | 2.66 | 13.56 | 0.15 | 14.00 | 0.35 | 8.35 | 0.00 | 0.00 | 3.96 | 97.84 | 0.00 | 97.84 |
| 203TE1 | 37.39 | 14.20 | 3.88 | 2.86 | 14.56 | 0.15 | 13.12 | 0.23 | 7.72 | 0.00 | 0.00 | 3.98 | 98.09 | 0.00 | 98.09 |
| 203TE3 | 36.62 | 14.00 | 4.12 | 2.72 | 13.87 | 0.20 | 13.68 | 0.24 | 8.31 | 0.00 | 0.00 | 3.95 | 97.71 | 0.00 | 97.71 |
| 203TE4 | 36.70 | 13.97 | 4.38 | 2.71 | 13.80 | 0.24 | 14.03 | 0.32 | 8.48 | 0.00 | 0.00 | 3.98 | 98.61 | 0.00 | 98.61 |
| 203TF1 | 37.00 | 13.96 | 4.28 | 2.67 | 13.61 | 0.25 | 14.21 | 0.36 | 8.26 | 0.00 | 0.00 | 3.99 | 98.59 | 0.00 | 98.59 |
| 203TF2 | 35.73 | 14.41 | 4.76 | 2.71 | 13.81 | 0.27 | 13.56 | 0.27 | 8.33 | 0.00 | 0.00 | 3.94 | 97.79 | 0.00 | 97.79 |
| 203TF3 | 36.85 | 13.78 | 4.10 | 2.70 | 13.75 | 0.26 | 14.32 | 0.31 | 8.39 | 0.00 | 0.00 | 3.98 | 98.44 | 0.00 | 98.44 |
| 203TH1 | 36.31 | 14.19 | 4.39 | 2.49 | 12.72 | 0.18 | 14.40 | 0.41 | 8.42 | 0.00 | 0.00 | 3.96 | 97.47 | 0.00 | 97.47 |
| 203TH2 | 35.58 | 14.41 | 4.44 | 2.46 | 12.53 | 0.16 | 14.30 | 0.38 | 8.46 | 0.00 | 0.00 | 3.92 | 96.64 | 0.00 | 96.64 |
| 203TH3 | 36.19 | 14.34 | 4.10 | 2.49 | 12.70 | 0.17 | 14.48 | 0.47 | 8.35 | 0.00 | 0.00 | 3.95 | 97.24 | 0.00 | 97.24 |
| 203TJ1 | 35.94 | 14.39 | 4.52 | 2.64 | 13.46 | 0.22 | 13.89 | 0.38 | 8.21 | 0.00 | 0.00 | 3.95 | 97.60 | 0.00 | 97.60 |
| 203TJ2 | 36.23 | 13.94 | 4.37 | 2.54 | 12.93 | 0.16 | 14.23 | 0.30 | 8.21 | 0.00 | 0.00 | 3.93 | 96.84 | 0.00 | 96.84 |
| 203TP1 | 36.74 | 14.04 | 4.48 | 2.70 | 13.77 | 0.25 | 14.13 | 0.29 | 8.36 | 0.00 | 0.00 | 3.99 | 98.75 | 0.00 | 98.75 |
| 203TP2 | 36.90 | 14.11 | 4.28 | 2.76 | 14.07 | 0.24 | 14.01 | 0.38 | 8.16 | 0.00 | 0.00 | 4.00 | 98.91 | 0.00 | 98.91 |
| 203TQ1 | 36.86 | 13.84 | 4.59 | 2.81 | 14.31 | 0.28 | 13.76 | 0.28 | 8.50 | 0.00 | 0.00 | 4.00 | 99.23 | 0.00 | 99.23 |
| 203TQ2 | 36.99 | 13.88 | 4.03 | 2.74 | 13.99 | 0.27 | 13.74 | 0.26 | 8.52 | 0.00 | 0.00 | 3.97 | 98.39 | 0.00 | 98.39 |
| 204TA1 | 37.51 | 14.35 | 4.64 | 2.68 | 13.69 | 0.36 | 13.92 | 0.54 | 8.66 | 0.64 | 0.08 | 3.74 | 100.81 | 0.29 | 100.52 |
| 204TA2 | 36.42 | 14.94 | 4.69 | 2.69 | 13.73 | 0.31 | 13.66 | 0.58 | 8.82 | 0.57 | 0.07 | 3.74 | 100.22 | 0.26 | 99.96 |
| 204TAB2 | 37.81 | 13.88 | 4.18 | 3.23 | 16.46 | 0.34 | 11.38 | 0.49 | 8.69 | 0.80 | 0.20 | 3.58 | 101.04 | 0.38 | 100.66 |
| 204TAC1 | 36.44 | 15.34 | 4.70 | 2.64 | 13.49 | 0.23 | 13.59 | 0.57 | 8.83 | 1.35 | 0.09 | 3.37 | 100.64 | 0.59 | 100.05 |
| 204TAC2 | 36.05 | 15.19 | 4.77 | 2.68 | 13.65 | 0.35 | 13.50 | 0.55 | 8.66 | 0.64 | 0.11 | 3.68 | 99.83 | 0.29 | 99.53 |
| 204TB1 | 37.19 | 14.53 | 4.47 | 2.71 | 13.83 | 0.33 | 13.85 | 0.56 | 8.83 | 0.95 | 0.11 | 3.57 | 100.93 | 0.42 | 100.50 |
| 204TB2 | 37.11 | 14.44 | 4.44 | 2.64 | 13.46 | 0.29 | 13.93 | 0.50 | 8.96 | 0.99 | 0.11 | 3.53 | 100.40 | 0.44 | 99.96 |
| 204TC1 | 36.65 | 14.63 | 4.76 | 2.72 | 13.87 | 0.34 | 13.60 | 0.58 | 8.84 | 0.91 | 0.10 | 3.57 | 100.57 | 0.41 | 100.16 |
| 204TC2 | 37.50 | 14.29 | 4.56 | 2.60 | 13.26 | 0.32 | 14.37 | 0.54 | 9.03 | 0.67 | 0.12 | 3.72 | 100.98 | 0.31 | 100.67 |
| 204TD1 | 36.23 | 14.72 | 4.61 | 2.67 | 13.60 | 0.29 | 13.78 | 0.57 | 8.96 | 0.99 | 0.09 | 3.51 | 100.02 | 0.44 | 99.58 |
| 204TF1 | 37.37 | 14.49 | 4.68 | 2.68 | 13.64 | 0.30 | 14.21 | 0.57 | 8.94 | 0.71 | 0.09 | 3.72 | 101.40 | 0.32 | 101.08 |
| 204TF2 | 37.00 | 14.56 | 4.72 | 2.65 | 13.53 | 0.34 | 14.24 | 0.55 | 8.88 | 0.76 | 0.09 | 3.67 | 100.99 | 0.34 | 100.65 |
| 204TG1 | 36.24 | 14.77 | 4.75 | 2.83 | 14.45 | 0.36 | 13.11 | 0.54 | 8.85 | 0.92 | 0.09 | 3.55 | 100.46 | 0.41 | 100.05 |
| 204TG2 | 36.79 | 14.49 | 4.68 | 2.80 | 14.27 | 0.43 | 13.45 | 0.51 | 8.93 | 0.62 | 0.08 | 3.72 | 100.77 | 0.28 | 100.49 |

**Appendix 3.** Recomputed Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | $Fe_2O_3$ | FeO | MnO | MgO | $Na_2O$ | $K_2O$ | F | Cl | $H_2O$ | Total | O=F;Cl | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 204TJ1 | 37.64 | 14.63 | 4.50 | 2.62 | 13.38 | 0.26 | 13.70 | 0.55 | 8.60 | 0.83 | 0.09 | 3.64 | 100.44 | 0.37 | 100.07 |
| 204TJ2 | 36.82 | 14.53 | 4.86 | 2.70 | 13.78 | 0.33 | 13.96 | 0.55 | 8.91 | 1.05 | 0.09 | 3.53 | 101.11 | 0.46 | 100.65 |
| 204TM1 | 37.16 | 14.71 | 4.46 | 2.67 | 13.63 | 0.33 | 13.80 | 0.60 | 8.54 | 0.61 | 0.11 | 3.73 | 100.35 | 0.28 | 100.06 |
| 204TM2 | 36.34 | 15.05 | 5.01 | 2.73 | 13.90 | 0.35 | 13.81 | 0.60 | 8.84 | 0.56 | 0.11 | 3.76 | 101.06 | 0.26 | 100.80 |
| 204TN1 | 36.44 | 14.83 | 4.77 | 2.67 | 13.63 | 0.36 | 13.68 | 0.51 | 8.81 | 0.70 | 0.11 | 3.66 | 100.17 | 0.32 | 99.85 |
| 204TN2 | 37.09 | 14.64 | 4.56 | 2.59 | 13.21 | 0.35 | 13.92 | 0.55 | 8.97 | 0.87 | 0.09 | 3.60 | 100.44 | 0.39 | 100.06 |
| 204TP1 | 36.26 | 14.96 | 4.73 | 2.71 | 13.81 | 0.26 | 13.80 | 0.52 | 8.90 | 1.07 | 0.12 | 3.49 | 100.63 | 0.48 | 100.15 |
| 204TQ1 | 36.21 | 14.22 | 4.58 | 2.76 | 14.07 | 0.37 | 13.20 | 0.52 | 8.84 | 0.90 | 0.13 | 3.51 | 99.31 | 0.41 | 98.90 |
| 204TQ2 | 36.78 | 14.53 | 4.70 | 2.82 | 14.37 | 0.41 | 13.30 | 0.53 | 8.77 | 0.62 | 0.11 | 3.71 | 100.65 | 0.29 | 100.36 |
| 204TS1 | 36.96 | 14.78 | 4.55 | 2.72 | 13.87 | 0.29 | 13.95 | 0.57 | 8.88 | 0.87 | 0.09 | 3.62 | 101.15 | 0.39 | 100.76 |
| 204TS2 | 37.00 | 14.82 | 4.69 | 2.68 | 13.67 | 0.32 | 13.99 | 0.54 | 8.95 | 0.62 | 0.09 | 3.75 | 101.12 | 0.28 | 100.84 |
| 204TU1 | 37.48 | 14.48 | 4.49 | 2.66 | 13.57 | 0.29 | 13.87 | 0.56 | 8.80 | 0.92 | 0.11 | 3.59 | 100.82 | 0.41 | 100.41 |
| 204TU2 | 37.52 | 14.46 | 4.46 | 2.67 | 13.61 | 0.31 | 13.83 | 0.54 | 8.84 | 0.88 | 0.10 | 3.61 | 100.83 | 0.39 | 100.44 |
| 204TX1 | 37.05 | 14.50 | 4.72 | 2.57 | 13.13 | 0.30 | 14.23 | 0.55 | 8.89 | 0.67 | 0.10 | 3.70 | 100.41 | 0.30 | 100.11 |
| 204TX2 | 37.48 | 14.60 | 4.56 | 2.67 | 13.62 | 0.34 | 14.25 | 0.59 | 8.87 | 0.86 | 0.09 | 3.65 | 101.58 | 0.38 | 101.20 |
| 21TA2 | 37.30 | 13.89 | 5.09 | 1.97 | 10.04 | 0.18 | 16.46 | 0.64 | 8.38 | 4.73 | 0.12 | 1.76 | 100.56 | 2.02 | 98.54 |
| 21TB1 | 37.76 | 13.47 | 4.35 | 2.47 | 12.61 | 0.34 | 14.90 | 0.58 | 8.62 | 4.57 | 0.10 | 1.84 | 101.61 | 1.95 | 99.66 |
| 21TB2 | 37.93 | 13.68 | 4.38 | 1.95 | 9.96 | 0.34 | 16.94 | 0.61 | 8.79 | 5.51 | 0.07 | 1.43 | 101.59 | 2.34 | 99.25 |
| 21TC1 | 37.07 | 13.69 | 4.25 | 2.79 | 14.21 | 0.32 | 13.36 | 0.49 | 8.29 | 3.76 | 0.10 | 2.16 | 100.49 | 1.61 | 98.89 |
| 21TC2 | 36.26 | 13.98 | 4.50 | 2.36 | 12.03 | 0.32 | 14.43 | 0.60 | 8.31 | 4.69 | 0.13 | 1.68 | 99.29 | 2.00 | 97.28 |
| 21TD1 | 35.96 | 13.80 | 4.34 | 2.72 | 13.87 | 0.36 | 13.19 | 0.47 | 7.94 | 3.52 | 0.10 | 2.20 | 98.47 | 1.50 | 96.97 |
| 21TD2 | 35.90 | 13.65 | 4.22 | 2.80 | 14.26 | 0.46 | 13.73 | 0.48 | 7.79 | 4.40 | 0.11 | 1.80 | 99.60 | 1.88 | 97.72 |
| 21TE1 | 38.05 | 13.71 | 4.45 | 2.01 | 10.25 | 0.23 | 16.77 | 0.58 | 8.69 | 5.25 | 0.12 | 1.55 | 101.66 | 2.24 | 99.42 |
| 21TE2 | 36.79 | 13.42 | 4.37 | 2.07 | 10.55 | 0.21 | 15.29 | 0.58 | 8.03 | 4.64 | 0.13 | 1.68 | 97.76 | 1.98 | 95.78 |
| 21TF1 | 37.34 | 13.57 | 4.43 | 2.54 | 12.94 | 0.37 | 14.73 | 0.60 | 8.72 | 3.77 | 0.11 | 2.20 | 101.32 | 1.61 | 99.71 |
| 21TF2 | 37.66 | 13.49 | 4.55 | 2.23 | 11.39 | 0.29 | 15.97 | 0.62 | 8.64 | 4.19 | 0.10 | 2.03 | 101.16 | 1.79 | 99.37 |
| 21TG1 | 37.42 | 13.87 | 4.51 | 2.18 | 11.12 | 0.31 | 15.90 | 0.55 | 8.55 | 4.31 | 0.12 | 1.96 | 100.80 | 1.84 | 98.95 |
| 21TG2 | 38.83 | 13.53 | 4.38 | 2.04 | 10.38 | 0.22 | 16.25 | 0.64 | 8.53 | 4.51 | 0.10 | 1.91 | 101.32 | 1.92 | 99.40 |
| 21TH1 | 36.29 | 14.13 | 4.69 | 2.70 | 13.79 | 0.45 | 13.39 | 0.55 | 8.17 | 2.85 | 0.15 | 2.57 | 99.73 | 1.23 | 98.50 |
| 21TH2 | 37.43 | 13.89 | 4.57 | 2.21 | 11.28 | 0.34 | 15.65 | 0.54 | 8.44 | 4.12 | 0.11 | 2.05 | 100.63 | 1.76 | 98.87 |
| 21TM1 | 37.37 | 14.05 | 4.87 | 1.90 | 9.68 | 0.24 | 16.41 | 0.60 | 8.49 | 3.86 | 0.15 | 2.16 | 99.78 | 1.66 | 98.12 |
| 21TM2 | 38.13 | 13.94 | 4.69 | 1.81 | 9.21 | 0.29 | 17.00 | 0.63 | 8.59 | 4.05 | 0.17 | 2.11 | 100.62 | 1.74 | 98.87 |
| 24TA1 | 37.61 | 13.50 | 4.55 | 2.71 | 13.83 | 0.42 | 13.69 | 0.60 | 8.66 | 3.55 | 0.12 | 2.30 | 101.54 | 1.52 | 100.02 |
| 24TA2 | 38.50 | 13.49 | 4.52 | 2.43 | 12.41 | 0.37 | 14.51 | 0.61 | 8.65 | 3.98 | 0.10 | 2.14 | 101.71 | 1.70 | 100.02 |
| 24TC1 | 36.79 | 13.98 | 4.71 | 2.80 | 14.25 | 0.45 | 12.72 | 0.49 | 8.29 | 2.62 | 0.11 | 2.70 | 99.91 | 1.13 | 98.78 |
| 24TC2 | 37.80 | 13.42 | 4.47 | 2.60 | 13.23 | 0.41 | 13.91 | 0.61 | 8.70 | 3.38 | 0.09 | 2.39 | 101.01 | 1.44 | 99.57 |
| 24TD1 | 37.77 | 13.78 | 4.65 | 2.31 | 11.78 | 0.24 | 14.99 | 0.63 | 8.58 | 3.71 | 0.10 | 2.25 | 100.79 | 1.58 | 99.20 |
| 24TD2 | 37.70 | 13.51 | 4.53 | 2.15 | 10.94 | 0.21 | 15.80 | 0.61 | 8.69 | 3.80 | 0.12 | 2.19 | 100.25 | 1.63 | 98.62 |
| 24TE1 | 38.37 | 13.61 | 4.57 | 2.08 | 10.59 | 0.31 | 15.85 | 0.59 | 8.75 | 3.78 | 0.09 | 2.24 | 100.83 | 1.61 | 99.22 |
| 24TE2 | 38.29 | 13.49 | 4.60 | 2.05 | 10.44 | 0.31 | 15.66 | 0.57 | 8.65 | 3.92 | 0.10 | 2.15 | 100.23 | 1.67 | 98.56 |
| 24TF1 | 38.57 | 13.34 | 4.17 | 2.18 | 11.12 | 0.36 | 15.68 | 0.60 | 8.72 | 4.12 | 0.08 | 2.08 | 101.02 | 1.75 | 99.26 |
| 24TF2 | 39.00 | 13.32 | 4.31 | 2.16 | 11.02 | 0.32 | 15.92 | 0.55 | 8.75 | 4.40 | 0.09 | 1.97 | 101.81 | 1.87 | 99.94 |
| 24TG1 | 38.50 | 13.51 | 4.86 | 2.12 | 10.82 | 0.17 | 15.53 | 0.53 | 8.78 | 3.67 | 0.11 | 2.29 | 100.89 | 1.57 | 99.32 |
| 24TG2 | 37.49 | 13.74 | 4.95 | 2.22 | 11.32 | 0.21 | 15.06 | 0.62 | 8.45 | 3.60 | 0.10 | 2.28 | 100.04 | 1.54 | 98.50 |
| 24TH1 | 38.48 | 13.72 | 4.67 | 2.21 | 11.27 | 0.28 | 15.40 | 0.62 | 8.78 | 3.94 | 0.12 | 2.18 | 101.67 | 1.69 | 99.98 |

**Appendix 3.** Recomputed Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | $Fe_2O_3$ | FeO | MnO | MgO | $Na_2O$ | $K_2O$ | F | Cl | $H_2O$ | Total | O=F;Cl | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24TH2 | 38.31 | 13.63 | 4.83 | 2.25 | 11.48 | 0.24 | 15.10 | 0.63 | 8.82 | 3.61 | 0.11 | 2.32 | 101.33 | 1.54 | 99.79 |
| 24TK1 | 36.75 | 14.06 | 4.66 | 2.92 | 14.88 | 0.45 | 12.50 | 0.50 | 8.50 | 2.10 | 0.12 | 2.95 | 100.39 | 0.91 | 99.48 |
| 24TK2 | 38.14 | 13.51 | 4.67 | 2.66 | 13.55 | 0.38 | 13.97 | 0.60 | 8.94 | 3.53 | 0.10 | 2.36 | 102.41 | 1.51 | 100.90 |
| 24TL1 | 36.13 | 14.26 | 4.76 | 2.87 | 14.63 | 0.45 | 12.13 | 0.49 | 8.27 | 1.51 | 0.11 | 3.19 | 98.80 | 0.66 | 98.14 |
| 24TL2 | 37.52 | 13.75 | 4.69 | 2.53 | 12.91 | 0.42 | 13.94 | 0.47 | 8.41 | 3.35 | 0.10 | 2.39 | 100.48 | 1.43 | 99.05 |
| 24TM1 | 36.94 | 14.27 | 4.91 | 2.54 | 12.93 | 0.44 | 13.46 | 0.51 | 8.41 | 3.09 | 0.13 | 2.49 | 100.12 | 1.33 | 98.79 |
| 24TM2 | 37.91 | 13.60 | 4.55 | 2.63 | 13.41 | 0.42 | 13.94 | 0.61 | 8.59 | 3.23 | 0.09 | 2.48 | 101.46 | 1.38 | 100.08 |
| 24TN1 | 36.27 | 14.41 | 4.91 | 2.83 | 14.41 | 0.47 | 12.37 | 0.56 | 8.17 | 3.09 | 0.12 | 2.46 | 100.07 | 1.33 | 98.75 |
| 24TN2 | 37.98 | 13.70 | 4.62 | 2.32 | 11.85 | 0.30 | 14.46 | 0.58 | 8.69 | 4.29 | 0.09 | 1.97 | 100.85 | 1.83 | 99.02 |
| 24TR1 | 37.63 | 13.59 | 4.59 | 2.38 | 12.15 | 0.33 | 14.48 | 0.55 | 8.50 | 3.19 | 0.12 | 2.46 | 99.97 | 1.37 | 98.60 |
| 24TR2 | 38.11 | 13.72 | 4.70 | 2.21 | 11.28 | 0.33 | 15.20 | 0.60 | 8.60 | 3.33 | 0.10 | 2.44 | 100.62 | 1.42 | 99.20 |
| 24TU1 | 36.65 | 13.37 | 4.62 | 2.63 | 13.42 | 0.46 | 12.74 | 0.50 | 8.03 | 3.22 | 0.14 | 2.34 | 98.12 | 1.39 | 96.73 |
| 24TU2 | 37.92 | 13.30 | 4.38 | 2.59 | 13.23 | 0.45 | 13.36 | 0.58 | 8.58 | 3.55 | 0.10 | 2.28 | 100.32 | 1.52 | 98.80 |
| 24TV1 | 38.74 | 13.64 | 4.68 | 2.32 | 11.82 | 0.22 | 14.75 | 0.56 | 8.72 | 3.52 | 0.12 | 2.37 | 101.46 | 1.51 | 99.95 |
| 24TV2 | 38.57 | 13.22 | 4.55 | 2.42 | 12.32 | 0.28 | 14.16 | 0.58 | 8.31 | 3.67 | 0.12 | 2.25 | 100.45 | 1.57 | 98.88 |
| 24TW1 | 37.53 | 14.16 | 5.18 | 2.45 | 12.50 | 0.25 | 14.12 | 0.63 | 8.49 | 3.30 | 0.14 | 2.44 | 101.19 | 1.42 | 99.77 |
| 24TW2 | 37.59 | 14.13 | 5.03 | 2.37 | 12.09 | 0.29 | 14.44 | 0.60 | 8.49 | 3.54 | 0.12 | 2.33 | 101.02 | 1.52 | 99.51 |
| 44TA1 | 36.93 | 14.69 | 4.52 | 2.52 | 12.84 | 0.23 | 13.84 | 0.60 | 8.66 | 2.21 | 0.09 | 2.94 | 100.07 | 0.95 | 99.12 |
| 44TA2 | 36.58 | 14.55 | 4.37 | 2.48 | 12.64 | 0.22 | 14.07 | 0.54 | 8.84 | 2.77 | 0.10 | 2.64 | 99.80 | 1.19 | 98.62 |
| 44TB1 | 37.26 | 13.97 | 4.65 | 2.72 | 13.87 | 0.30 | 13.08 | 0.42 | 8.87 | 1.04 | 0.09 | 3.48 | 99.75 | 0.46 | 99.29 |
| 44TB2 | 37.67 | 14.05 | 4.47 | 2.65 | 13.50 | 0.30 | 13.41 | 0.40 | 8.69 | 1.33 | 0.09 | 3.36 | 99.92 | 0.58 | 99.34 |
| 44TC1 | 36.57 | 14.17 | 4.48 | 2.65 | 13.52 | 0.27 | 13.88 | 0.48 | 8.66 | 1.17 | 0.10 | 3.40 | 99.35 | 0.52 | 98.84 |
| 44TC2 | 36.26 | 13.99 | 4.41 | 2.76 | 14.10 | 0.26 | 13.48 | 0.62 | 8.70 | 1.94 | 0.10 | 3.01 | 99.63 | 0.84 | 98.79 |
| 44TD1 | 36.15 | 14.43 | 4.68 | 2.36 | 12.01 | 0.24 | 14.82 | 0.68 | 8.46 | 0.84 | 0.07 | 3.56 | 98.30 | 0.37 | 97.93 |
| 44TD2 | 36.59 | 14.84 | 4.53 | 2.42 | 12.32 | 0.21 | 14.31 | 0.66 | 8.53 | 2.00 | 0.05 | 3.04 | 99.50 | 0.85 | 98.65 |
| 44TE1 | 36.23 | 14.53 | 4.56 | 2.67 | 13.60 | 0.31 | 13.59 | 0.44 | 8.77 | 0.79 | 0.08 | 3.58 | 99.15 | 0.35 | 98.80 |
| 44TE2 | 36.34 | 14.22 | 4.55 | 2.62 | 13.38 | 0.29 | 13.70 | 0.52 | 8.76 | 1.46 | 0.09 | 3.25 | 99.18 | 0.64 | 98.55 |
| 44TF1 | 36.06 | 14.00 | 4.66 | 2.64 | 13.45 | 0.18 | 13.58 | 0.37 | 9.04 | 2.40 | 0.19 | 2.76 | 99.33 | 1.05 | 98.27 |
| 44TF2 | 37.11 | 14.42 | 4.60 | 2.34 | 11.95 | 0.16 | 14.88 | 0.40 | 9.40 | 2.71 | 0.20 | 2.70 | 100.87 | 1.19 | 99.68 |
| 44TH2 | 37.07 | 13.52 | 4.48 | 2.31 | 11.77 | 0.16 | 15.12 | 0.20 | 9.73 | 2.37 | 0.15 | 2.83 | 99.71 | 1.03 | 98.67 |
| 44TR1 | 36.41 | 14.03 | 4.42 | 2.57 | 13.12 | 0.26 | 13.43 | 0.42 | 8.83 | 1.39 | 0.06 | 3.26 | 98.20 | 0.60 | 97.60 |
| 44TR2 | 36.66 | 14.28 | 4.31 | 2.60 | 13.25 | 0.20 | 13.85 | 0.45 | 8.67 | 2.21 | 0.08 | 2.91 | 99.47 | 0.95 | 98.52 |
| 44TS1 | 36.21 | 13.92 | 4.57 | 2.58 | 13.16 | 0.28 | 13.72 | 0.48 | 8.93 | 1.00 | 0.10 | 3.44 | 98.39 | 0.44 | 97.95 |
| 44TS2 | 36.37 | 13.95 | 4.51 | 2.58 | 13.15 | 0.29 | 13.64 | 0.45 | 8.96 | 1.71 | 0.09 | 3.11 | 98.81 | 0.74 | 98.07 |
| 89T4A1 | 36.84 | 14.60 | 5.00 | 2.55 | 12.99 | 0.24 | 14.33 | 0.57 | 8.76 | 0.51 | 0.07 | 3.79 | 100.25 | 0.23 | 100.02 |
| 89T4A2 | 36.36 | 14.64 | 5.02 | 2.56 | 13.04 | 0.23 | 14.22 | 0.55 | 8.72 | 0.43 | 0.07 | 3.80 | 99.64 | 0.20 | 99.44 |
| 89T4B1 | 37.06 | 14.37 | 4.94 | 2.57 | 13.13 | 0.26 | 14.50 | 0.59 | 8.84 | 0.46 | 0.07 | 3.82 | 100.61 | 0.21 | 100.40 |
| 89T4B2 | 36.41 | 14.61 | 4.89 | 2.55 | 12.98 | 0.26 | 14.08 | 0.55 | 8.72 | 0.39 | 0.05 | 3.81 | 99.30 | 0.18 | 99.12 |
| 89T4D1 | 35.87 | 14.27 | 5.74 | 2.89 | 14.74 | 0.39 | 12.72 | 0.57 | 8.62 | 0.94 | 0.11 | 3.52 | 100.38 | 0.42 | 99.96 |
| 89T4D2 | 35.72 | 14.20 | 5.69 | 2.83 | 14.43 | 0.39 | 12.81 | 0.54 | 8.47 | 0.81 | 0.11 | 3.56 | 99.56 | 0.37 | 99.19 |
| 89T4E1 | 36.34 | 14.63 | 5.10 | 2.53 | 12.89 | 0.22 | 14.24 | 0.65 | 8.62 | 0.52 | 0.08 | 3.75 | 99.57 | 0.24 | 99.33 |
| 89T4E2 | 36.26 | 14.76 | 4.90 | 2.60 | 13.27 | 0.21 | 13.96 | 0.60 | 8.39 | 0.36 | 0.06 | 3.82 | 99.19 | 0.17 | 99.02 |
| 89T4F1 | 36.61 | 14.52 | 5.00 | 2.57 | 13.08 | 0.25 | 14.24 | 0.57 | 8.74 | 0.42 | 0.08 | 3.81 | 99.89 | 0.19 | 99.69 |
| 89T4F2 | 36.72 | 14.46 | 4.97 | 2.60 | 13.27 | 0.28 | 14.10 | 0.55 | 8.60 | 0.48 | 0.09 | 3.78 | 99.90 | 0.22 | 99.68 |
| 89T4G1 | 37.07 | 14.39 | 4.90 | 2.54 | 12.93 | 0.21 | 14.67 | 0.57 | 8.93 | 0.55 | 0.06 | 3.78 | 100.60 | 0.25 | 100.36 |

**Appendix 3.** Recomputed Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | $Fe_2O_3$ | FeO | MnO | MgO | $Na_2O$ | $K_2O$ | F | Cl | $H_2O$ | Total | O=F;Cl | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 89T4G2 | 36.37 | 14.64 | 5.00 | 2.57 | 13.09 | 0.24 | 14.26 | 0.60 | 8.60 | 0.50 | 0.06 | 3.77 | 99.70 | 0.22 | 99.47 |
| 89T4H1 | 36.39 | 14.60 | 5.31 | 2.49 | 12.71 | 0.19 | 14.45 | 0.59 | 8.46 | 0.77 | 0.07 | 3.64 | 99.67 | 0.34 | 99.33 |
| 89T4H2 | 36.94 | 14.45 | 5.12 | 2.42 | 12.34 | 0.23 | 14.74 | 0.67 | 8.69 | 0.44 | 0.05 | 3.83 | 99.92 | 0.20 | 99.72 |
| 89T4J1 | 36.11 | 14.89 | 5.34 | 2.51 | 12.79 | 0.21 | 14.17 | 0.63 | 8.37 | 0.39 | 0.06 | 3.82 | 99.29 | 0.18 | 99.11 |
| 89T4J2 | 36.31 | 14.90 | 5.15 | 2.48 | 12.65 | 0.18 | 14.53 | 0.68 | 8.54 | 0.43 | 0.06 | 3.82 | 99.73 | 0.19 | 99.53 |
| 89T4K1 | 36.03 | 14.60 | 5.04 | 2.49 | 12.68 | 0.21 | 14.18 | 0.57 | 8.52 | 0.41 | 0.08 | 3.77 | 98.58 | 0.19 | 98.39 |
| 89T4K2 | 36.98 | 14.45 | 4.89 | 2.50 | 12.77 | 0.23 | 14.71 | 0.61 | 8.70 | 0.48 | 0.08 | 3.80 | 100.20 | 0.22 | 99.98 |
| 89T4L1 | 35.91 | 14.68 | 5.15 | 2.69 | 13.72 | 0.24 | 13.79 | 0.61 | 8.37 | 0.69 | 0.08 | 3.65 | 99.58 | 0.31 | 99.27 |
| 89T4L2 | 35.97 | 14.35 | 5.01 | 2.64 | 13.44 | 0.26 | 13.65 | 0.57 | 8.58 | 0.69 | 0.08 | 3.62 | 98.86 | 0.31 | 98.55 |
| 89T4M1 | 36.74 | 14.41 | 4.98 | 2.54 | 12.93 | 0.25 | 14.67 | 0.58 | 8.73 | 0.41 | 0.05 | 3.84 | 100.13 | 0.18 | 99.94 |
| 89T4M2 | 37.04 | 14.37 | 5.19 | 2.51 | 12.77 | 0.24 | 14.75 | 0.59 | 8.65 | 0.47 | 0.08 | 3.82 | 100.48 | 0.22 | 100.26 |
| 89TA1 | 36.84 | 14.60 | 5.00 | 2.55 | 12.99 | 0.24 | 14.33 | 0.57 | 8.76 | 0.51 | 0.07 | 3.79 | 100.25 | 0.23 | 100.02 |
| 89TA2 | 36.36 | 14.64 | 5.02 | 2.56 | 13.04 | 0.23 | 14.22 | 0.55 | 8.72 | 0.43 | 0.07 | 3.80 | 99.64 | 0.20 | 99.44 |
| 89TB1 | 37.06 | 14.37 | 4.94 | 2.57 | 13.13 | 0.26 | 14.50 | 0.59 | 8.84 | 0.46 | 0.07 | 3.82 | 100.61 | 0.21 | 100.40 |
| 89TB2 | 36.41 | 14.61 | 4.89 | 2.55 | 12.98 | 0.26 | 14.08 | 0.55 | 8.72 | 0.39 | 0.05 | 3.81 | 99.30 | 0.18 | 99.12 |
| 89TD1 | 35.87 | 14.27 | 5.74 | 2.89 | 14.74 | 0.39 | 12.72 | 0.57 | 8.62 | 0.94 | 0.11 | 3.52 | 100.38 | 0.42 | 99.96 |
| 89TD2 | 35.72 | 14.20 | 5.69 | 2.83 | 14.43 | 0.39 | 12.81 | 0.54 | 8.47 | 0.81 | 0.11 | 3.56 | 99.56 | 0.37 | 99.19 |
| 89TE1 | 36.34 | 14.63 | 5.10 | 2.53 | 12.89 | 0.22 | 14.24 | 0.65 | 8.62 | 0.52 | 0.08 | 3.75 | 99.57 | 0.24 | 99.33 |
| 89TE2 | 36.26 | 14.76 | 4.90 | 2.60 | 13.27 | 0.21 | 13.96 | 0.60 | 8.39 | 0.36 | 0.06 | 3.82 | 99.19 | 0.17 | 99.02 |
| 89TF1 | 36.61 | 14.52 | 5.00 | 2.57 | 13.08 | 0.25 | 14.24 | 0.57 | 8.74 | 0.42 | 0.08 | 3.81 | 99.89 | 0.19 | 99.69 |
| 89TF2 | 36.72 | 14.46 | 4.97 | 2.60 | 13.27 | 0.28 | 14.10 | 0.55 | 8.60 | 0.48 | 0.09 | 3.78 | 99.90 | 0.22 | 99.68 |
| 89TG1 | 37.07 | 14.39 | 4.90 | 2.54 | 12.93 | 0.21 | 14.67 | 0.57 | 8.93 | 0.55 | 0.06 | 3.78 | 100.60 | 0.25 | 100.36 |
| 89TG2 | 36.37 | 14.64 | 5.00 | 2.57 | 13.09 | 0.24 | 14.26 | 0.60 | 8.60 | 0.50 | 0.06 | 3.77 | 99.70 | 0.22 | 99.47 |
| 89TH1 | 36.39 | 14.60 | 5.31 | 2.49 | 12.71 | 0.19 | 14.45 | 0.59 | 8.46 | 0.77 | 0.07 | 3.64 | 99.67 | 0.34 | 99.33 |
| 89TH2 | 36.94 | 14.45 | 5.12 | 2.42 | 12.34 | 0.23 | 14.74 | 0.67 | 8.69 | 0.44 | 0.05 | 3.83 | 99.92 | 0.20 | 99.72 |
| 89TJ1 | 36.11 | 14.89 | 5.34 | 2.51 | 12.79 | 0.21 | 14.17 | 0.63 | 8.37 | 0.39 | 0.06 | 3.82 | 99.29 | 0.18 | 99.11 |
| 89TJ2 | 36.31 | 14.90 | 5.15 | 2.48 | 12.65 | 0.18 | 14.53 | 0.68 | 8.54 | 0.43 | 0.06 | 3.82 | 99.73 | 0.19 | 99.53 |
| 89TK1 | 36.03 | 14.60 | 5.04 | 2.49 | 12.68 | 0.21 | 14.18 | 0.57 | 8.52 | 0.41 | 0.08 | 3.77 | 98.58 | 0.19 | 98.39 |
| 89TK2 | 36.98 | 14.45 | 4.89 | 2.50 | 12.77 | 0.23 | 14.71 | 0.61 | 8.70 | 0.48 | 0.08 | 3.80 | 100.20 | 0.22 | 99.98 |
| 89TL1 | 35.91 | 14.68 | 5.15 | 2.69 | 13.72 | 0.24 | 13.79 | 0.61 | 8.37 | 0.69 | 0.08 | 3.65 | 99.58 | 0.31 | 99.27 |
| 89TL2 | 35.97 | 14.35 | 5.01 | 2.64 | 13.44 | 0.26 | 13.65 | 0.57 | 8.58 | 0.69 | 0.08 | 3.62 | 98.86 | 0.31 | 98.55 |
| 89TM1 | 36.74 | 14.41 | 4.98 | 2.54 | 12.93 | 0.25 | 14.67 | 0.58 | 8.73 | 0.41 | 0.05 | 3.84 | 100.13 | 0.18 | 99.94 |
| 89TM2 | 37.04 | 14.37 | 5.19 | 2.51 | 12.77 | 0.24 | 14.75 | 0.59 | 8.65 | 0.47 | 0.08 | 3.82 | 100.48 | 0.22 | 100.26 |
| 913TC1 | 35.84 | 13.70 | 5.57 | 3.35 | 17.08 | 0.31 | 11.51 | 0.63 | 8.88 | 1.07 | 0.08 | 3.45 | 101.47 | 0.47 | 101.00 |
| 913TD1 | 37.25 | 13.51 | 5.22 | 3.05 | 15.57 | 0.34 | 12.37 | 0.67 | 8.87 | 0.40 | 0.08 | 3.82 | 101.15 | 0.19 | 100.96 |
| 913TE1 | 36.26 | 13.20 | 5.15 | 3.80 | 19.40 | 0.25 | 9.09 | 0.69 | 8.37 | 0.56 | 0.10 | 3.63 | 100.50 | 0.26 | 100.24 |
| 919TB1 | 37.61 | 13.45 | 3.97 | 2.89 | 14.72 | 0.65 | 13.70 | 0.50 | 9.15 | 0.74 | 0.12 | 3.65 | 101.15 | 0.34 | 100.81 |
| 919TB2 | 38.03 | 13.64 | 3.99 | 2.83 | 14.45 | 0.64 | 13.40 | 0.48 | 9.01 | 1.22 | 0.12 | 3.43 | 101.24 | 0.54 | 100.70 |
| 919TG1 | 37.05 | 13.92 | 4.85 | 2.85 | 14.53 | 0.38 | 13.04 | 0.42 | 8.28 | 1.11 | 0.12 | 3.45 | 100.00 | 0.49 | 99.50 |
| 919TG2 | 36.68 | 13.92 | 4.77 | 2.90 | 14.77 | 0.39 | 12.74 | 0.42 | 8.02 | 1.24 | 0.12 | 3.35 | 99.32 | 0.55 | 98.77 |
| 919TM1 | 37.81 | 13.45 | 4.12 | 2.82 | 14.36 | 0.63 | 13.67 | 0.47 | 8.94 | 1.15 | 0.10 | 3.46 | 100.98 | 0.51 | 100.47 |
| 919TM2 | 37.75 | 13.70 | 4.21 | 2.82 | 14.40 | 0.58 | 13.65 | 0.47 | 8.77 | 0.82 | 0.10 | 3.62 | 100.89 | 0.37 | 100.53 |
| 919TM3 | 37.98 | 13.44 | 3.93 | 2.81 | 14.35 | 0.63 | 13.63 | 0.49 | 8.56 | 0.74 | 0.10 | 3.65 | 100.31 | 0.33 | 99.97 |
| 919TM4 | 37.84 | 13.51 | 4.09 | 2.85 | 14.53 | 0.66 | 13.51 | 0.47 | 8.68 | 0.76 | 0.10 | 3.64 | 100.64 | 0.34 | 100.30 |
| 920TA2 | 36.65 | 13.17 | 4.26 | 3.21 | 16.34 | 0.41 | 11.75 | 0.50 | 8.81 | 0.66 | 0.19 | 3.57 | 99.52 | 0.32 | 99.20 |

**Appendix 3.** Recomputed Compositions (in Weight Percent) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | $SiO_2$ | $Al_2O_3$ | $TiO_2$ | $Fe_2O_3$ | FeO | MnO | MgO | $Na_2O$ | $K_2O$ | F | Cl | $H_2O$ | Total | O=F;Cl | TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 920TAE1 | 37.93 | 13.30 | 3.93 | 3.14 | 16.02 | 0.36 | 11.85 | 0.46 | 8.19 | 0.72 | 0.18 | 3.59 | 99.67 | 0.34 | 99.33 |
| 920TAE2 | 37.74 | 13.03 | 4.13 | 3.18 | 16.23 | 0.47 | 12.45 | 0.48 | 8.63 | 0.67 | 0.19 | 3.64 | 100.84 | 0.32 | 100.51 |
| 920TE1 | 35.67 | 14.30 | 4.69 | 2.81 | 14.33 | 0.36 | 13.12 | 0.51 | 8.64 | 0.72 | 0.10 | 3.58 | 98.83 | 0.33 | 98.50 |
| 920TE2 | 36.61 | 14.21 | 4.47 | 2.75 | 14.01 | 0.35 | 13.65 | 0.48 | 8.25 | 0.50 | 0.09 | 3.73 | 99.10 | 0.23 | 98.87 |
| 920TF1 | 36.76 | 13.41 | 4.29 | 3.19 | 16.27 | 0.39 | 12.04 | 0.44 | 8.03 | 0.57 | 0.18 | 3.63 | 99.20 | 0.28 | 98.92 |
| 920TF2 | 36.39 | 13.55 | 4.43 | 3.33 | 16.98 | 0.44 | 11.49 | 0.57 | 8.75 | 0.96 | 0.20 | 3.45 | 100.54 | 0.45 | 100.09 |
| 920TG1 | 37.01 | 13.66 | 4.48 | 3.30 | 16.83 | 0.47 | 12.01 | 0.52 | 8.94 | 0.74 | 0.22 | 3.61 | 101.79 | 0.36 | 101.42 |
| 920TG2 | 37.42 | 13.64 | 4.23 | 3.23 | 16.49 | 0.41 | 12.03 | 0.52 | 8.83 | 0.64 | 0.21 | 3.65 | 101.30 | 0.32 | 100.99 |
| 920TN2 | 36.33 | 13.65 | 4.35 | 3.28 | 16.73 | 0.41 | 11.54 | 0.47 | 8.24 | 0.60 | 0.22 | 3.59 | 99.41 | 0.30 | 99.11 |
| 920TQ1 | 35.96 | 14.10 | 4.52 | 3.40 | 17.31 | 0.50 | 11.42 | 0.48 | 8.90 | 0.47 | 0.21 | 3.69 | 100.96 | 0.25 | 100.72 |
| 920TQ2 | 37.22 | 13.53 | 4.28 | 3.37 | 17.17 | 0.42 | 11.67 | 0.53 | 8.82 | 0.75 | 0.20 | 3.60 | 101.56 | 0.36 | 101.20 |
| 920TS1 | 36.17 | 14.36 | 4.71 | 2.86 | 14.59 | 0.36 | 13.19 | 0.53 | 8.97 | 0.60 | 0.14 | 3.67 | 100.15 | 0.28 | 99.87 |
| 920TS2 | 36.42 | 14.29 | 4.68 | 2.84 | 14.47 | 0.43 | 13.46 | 0.51 | 8.90 | 0.45 | 0.12 | 3.76 | 100.33 | 0.22 | 100.12 |
| 920TT1 | 36.34 | 14.07 | 4.30 | 3.31 | 16.86 | 0.44 | 11.07 | 0.47 | 8.40 | 0.57 | 0.22 | 3.61 | 99.66 | 0.29 | 99.37 |
| 920TT2 | 35.68 | 13.99 | 4.48 | 3.41 | 17.39 | 0.39 | 11.24 | 0.53 | 8.48 | 0.53 | 0.21 | 3.63 | 99.96 | 0.27 | 99.69 |
| 921T1 | 37.76 | 13.69 | 4.82 | 2.76 | 14.06 | 0.20 | 13.92 | 0.49 | 9.11 | 0.57 | 0.13 | 3.76 | 101.27 | 0.27 | 101.00 |
| 921T2 | 37.60 | 13.61 | 4.72 | 2.77 | 14.12 | 0.16 | 14.05 | 0.52 | 9.05 | 0.51 | 0.15 | 3.77 | 101.03 | 0.25 | 100.78 |
| 921TAC1 | 37.55 | 13.81 | 4.61 | 2.78 | 14.17 | 0.18 | 13.99 | 0.43 | 9.18 | 0.55 | 0.13 | 3.76 | 101.14 | 0.26 | 100.88 |
| 921TAC2 | 36.77 | 14.09 | 4.74 | 2.81 | 14.31 | 0.21 | 13.61 | 0.48 | 8.97 | 0.62 | 0.13 | 3.69 | 100.43 | 0.29 | 100.14 |
| 921TK1 | 37.06 | 13.70 | 5.02 | 2.77 | 14.11 | 0.13 | 13.39 | 0.43 | 8.74 | 0.49 | 0.14 | 3.74 | 99.72 | 0.24 | 99.48 |
| 921TK2 | 37.31 | 13.61 | 4.78 | 2.72 | 13.87 | 0.23 | 13.71 | 0.50 | 8.95 | 0.54 | 0.13 | 3.73 | 100.08 | 0.26 | 99.82 |
| 921TL1 | 37.49 | 13.41 | 4.71 | 2.72 | 13.85 | 0.20 | 13.94 | 0.49 | 9.00 | 0.51 | 0.13 | 3.75 | 100.20 | 0.24 | 99.95 |
| 921TL2 | 37.75 | 13.47 | 4.68 | 2.74 | 13.98 | 0.21 | 13.99 | 0.52 | 8.87 | 0.52 | 0.13 | 3.76 | 100.62 | 0.25 | 100.38 |
| 921TM1 | 36.82 | 14.60 | 4.38 | 2.82 | 14.39 | 0.18 | 13.91 | 0.50 | 9.18 | 0.54 | 0.05 | 3.78 | 101.15 | 0.24 | 100.91 |
| 921TM2 | 36.63 | 14.31 | 4.60 | 2.81 | 14.33 | 0.22 | 13.63 | 0.48 | 9.13 | 0.53 | 0.08 | 3.75 | 100.50 | 0.24 | 100.26 |
| 921TN1 | 37.11 | 14.00 | 4.65 | 2.80 | 14.29 | 0.21 | 13.72 | 0.47 | 8.93 | 0.51 | 0.12 | 3.76 | 100.57 | 0.24 | 100.33 |
| 921TN2 | 36.88 | 14.14 | 4.88 | 2.79 | 14.22 | 0.20 | 13.75 | 0.49 | 9.03 | 0.48 | 0.14 | 3.77 | 100.77 | 0.23 | 100.54 |
| 921TP1 | 37.07 | 13.95 | 4.79 | 2.82 | 14.37 | 0.20 | 13.64 | 0.51 | 8.87 | 0.59 | 0.14 | 3.72 | 100.67 | 0.28 | 100.39 |
| 921TP2 | 37.12 | 13.97 | 4.64 | 2.78 | 14.15 | 0.19 | 13.91 | 0.49 | 8.92 | 0.57 | 0.13 | 3.73 | 100.60 | 0.27 | 100.33 |
| 921TU1 | 38.38 | 13.57 | 4.50 | 2.68 | 13.65 | 0.14 | 13.23 | 0.54 | 8.78 | 0.46 | 0.15 | 3.78 | 99.86 | 0.23 | 99.63 |
| 921TV1 | 37.29 | 13.82 | 4.57 | 2.85 | 14.54 | 0.25 | 13.49 | 0.53 | 9.09 | 0.56 | 0.13 | 3.73 | 100.85 | 0.27 | 100.59 |
| 921TV2 | 37.15 | 13.83 | 4.78 | 2.89 | 14.72 | 0.21 | 13.47 | 0.50 | 9.06 | 0.50 | 0.14 | 3.76 | 101.01 | 0.24 | 100.77 |
| 959TA1 | 36.21 | 15.53 | 5.22 | 3.17 | 16.17 | 0.17 | 10.26 | 0.46 | 8.34 | 2.73 | 0.13 | 2.65 | 101.04 | 1.18 | 99.86 |
| 959TA2 | 36.06 | 16.24 | 5.16 | 3.12 | 15.89 | 0.14 | 10.33 | 0.53 | 8.17 | 2.38 | 0.14 | 2.83 | 100.99 | 1.03 | 99.96 |
| 959TD1 | 37.83 | 17.97 | 4.39 | 2.87 | 14.62 | 0.17 | 8.69 | 0.45 | 7.69 | 2.16 | 0.19 | 2.96 | 99.99 | 0.95 | 99.04 |
| 959TD2 | 38.67 | 17.50 | 4.64 | 2.06 | 10.52 | 0.12 | 13.11 | 0.39 | 8.27 | 3.19 | 0.20 | 2.57 | 101.24 | 1.39 | 99.85 |
| 959TG1 | 36.73 | 15.44 | 4.69 | 3.04 | 15.48 | 0.21 | 11.25 | 0.56 | 8.36 | 3.21 | 0.19 | 2.44 | 101.60 | 1.39 | 100.20 |
| 959TH1 | 36.32 | 14.84 | 5.44 | 2.47 | 12.61 | 0.08 | 13.48 | 0.60 | 8.61 | 4.03 | 0.19 | 2.04 | 100.71 | 1.74 | 98.97 |
| 959TH2 | 36.40 | 14.76 | 5.25 | 2.53 | 12.92 | 0.12 | 13.35 | 0.58 | 8.65 | 4.26 | 0.18 | 1.93 | 100.93 | 1.83 | 99.09 |
| 959TL1 | 36.64 | 15.76 | 4.79 | 3.48 | 17.77 | 0.20 | 8.60 | 0.37 | 8.36 | 1.98 | 0.16 | 3.00 | 101.11 | 0.87 | 100.24 |
| 959TL2 | 37.10 | 16.23 | 4.74 | 3.33 | 16.99 | 0.16 | 8.81 | 0.43 | 8.24 | 2.22 | 0.16 | 2.91 | 101.32 | 0.97 | 100.35 |
| 959TM1 | 38.56 | 17.27 | 4.49 | 2.42 | 12.32 | 0.15 | 11.21 | 0.44 | 8.34 | 2.86 | 0.22 | 2.68 | 100.96 | 1.25 | 99.70 |
| 959TM2 | 36.70 | 15.61 | 5.21 | 2.75 | 14.00 | 0.13 | 11.42 | 0.40 | 8.79 | 2.86 | 0.21 | 2.59 | 100.67 | 1.25 | 99.42 |
| 959TQ1 | 37.60 | 16.10 | 5.34 | 2.07 | 10.54 | 0.13 | 13.27 | 0.53 | 8.56 | 4.24 | 0.27 | 1.97 | 100.62 | 1.85 | 98.78 |
| 959TQ2 | 37.52 | 16.03 | 6.01 | 2.16 | 11.04 | 0.09 | 13.63 | 0.46 | 8.77 | 3.94 | 0.19 | 2.19 | 102.03 | 1.70 | 100.32 |
| 959TR1 | 38.61 | 16.11 | 4.12 | 2.31 | 11.78 | 0.18 | 12.82 | 0.45 | 8.44 | 3.78 | 0.20 | 2.23 | 101.03 | 1.64 | 99.39 |

**Appendix 4** Structural Formulas (in Atoms) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.

| Probe sample no. | Si | Al(iv) | $Fe^{3+}$(iv) | Al(vi) | Ti | $Fe^{3+}$ | $Fe^{2+}$ | $Mn^{2+}$ | Mg | Oct total | Na | K | Alk total | F | Cl | OH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 06TA1 | 5.497 | 2.503 | 0.000 | 0.062 | 0.703 | 0.274 | 1.553 | 0.022 | 2.934 | 5.548 | 0.186 | 1.476 | 1.663 | 0.252 | 0.015 | 3.733 |
| 06TA2 | 5.427 | 2.573 | 0.000 | 0.037 | 0.687 | 0.284 | 1.606 | 0.024 | 2.934 | 5.572 | 0.220 | 1.513 | 1.733 | 0.227 | 0.013 | 3.760 |
| 06TB1 | 5.764 | 2.236 | 0.000 | 0.266 | 0.612 | 0.302 | 1.712 | 0.033 | 2.491 | 5.416 | 0.115 | 1.497 | 1.612 | 0.245 | 0.018 | 3.737 |
| 06TD1 | 5.598 | 2.402 | 0.000 | 0.088 | 0.636 | 0.335 | 1.897 | 0.034 | 2.483 | 5.474 | 0.152 | 1.607 | 1.759 | 0.228 | 0.028 | 3.743 |
| 06TD2 | 5.585 | 2.415 | 0.000 | 0.125 | 0.619 | 0.341 | 1.931 | 0.041 | 2.459 | 5.516 | 0.144 | 1.534 | 1.678 | 0.186 | 0.021 | 3.793 |
| 06TE1 | 5.821 | 2.179 | 0.000 | 0.226 | 0.627 | 0.330 | 1.872 | 0.037 | 2.263 | 5.355 | 0.112 | 1.548 | 1.659 | 0.163 | 0.021 | 3.816 |
| 168TA1 | 5.443 | 2.514 | 0.043 | 0.000 | 0.536 | 0.257 | 1.699 | 0.040 | 3.156 | 5.687 | 0.173 | 1.681 | 1.854 | 0.230 | 0.013 | 3.757 |
| 168TB1 | 5.512 | 2.417 | 0.070 | 0.000 | 0.520 | 0.235 | 1.732 | 0.046 | 3.150 | 5.683 | 0.179 | 1.669 | 1.848 | 0.234 | 0.018 | 3.748 |
| 168TB2 | 5.504 | 2.417 | 0.079 | 0.000 | 0.525 | 0.228 | 1.744 | 0.048 | 3.130 | 5.675 | 0.159 | 1.708 | 1.867 | 0.163 | 0.023 | 3.814 |
| 168TC1 | 5.537 | 2.374 | 0.088 | 0.000 | 0.520 | 0.216 | 1.720 | 0.048 | 3.184 | 5.688 | 0.150 | 1.680 | 1.830 | 0.211 | 0.023 | 3.766 |
| 168TC2 | 5.546 | 2.392 | 0.062 | 0.000 | 0.499 | 0.250 | 1.772 | 0.052 | 3.107 | 5.679 | 0.159 | 1.688 | 1.848 | 0.342 | 0.026 | 3.633 |
| 168TD1 | 5.433 | 2.514 | 0.053 | 0.000 | 0.520 | 0.335 | 2.197 | 0.060 | 2.557 | 5.669 | 0.162 | 1.690 | 1.852 | 0.235 | 0.055 | 3.710 |
| 168TD2 | 5.628 | 2.291 | 0.081 | 0.000 | 0.473 | 0.287 | 2.088 | 0.058 | 2.736 | 5.643 | 0.157 | 1.696 | 1.853 | 0.440 | 0.049 | 3.511 |
| 168TE1 | 5.527 | 2.409 | 0.063 | 0.000 | 0.516 | 0.241 | 1.725 | 0.045 | 3.157 | 5.684 | 0.160 | 1.673 | 1.833 | 0.237 | 0.023 | 3.740 |
| 168TE2 | 5.521 | 2.401 | 0.078 | 0.000 | 0.524 | 0.236 | 1.777 | 0.052 | 3.103 | 5.691 | 0.151 | 1.662 | 1.813 | 0.465 | 0.026 | 3.509 |
| 168TL1 | 5.562 | 2.317 | 0.120 | 0.000 | 0.481 | 0.263 | 2.171 | 0.056 | 2.683 | 5.653 | 0.166 | 1.740 | 1.906 | 0.242 | 0.049 | 3.709 |
| 168TL2 | 5.524 | 2.373 | 0.103 | 0.000 | 0.520 | 0.282 | 2.181 | 0.057 | 2.604 | 5.645 | 0.158 | 1.705 | 1.863 | 0.277 | 0.052 | 3.671 |
| 168TM1 | 5.478 | 2.451 | 0.071 | 0.000 | 0.530 | 0.245 | 1.791 | 0.048 | 3.071 | 5.685 | 0.160 | 1.685 | 1.845 | 0.188 | 0.034 | 3.778 |
| 168TM2 | 5.480 | 2.449 | 0.071 | 0.000 | 0.528 | 0.241 | 1.766 | 0.052 | 3.109 | 5.696 | 0.148 | 1.683 | 1.831 | 0.334 | 0.026 | 3.640 |
| 168TN1 | 5.500 | 2.461 | 0.039 | 0.000 | 0.515 | 0.258 | 1.683 | 0.042 | 3.190 | 5.688 | 0.177 | 1.658 | 1.834 | 0.192 | 0.023 | 3.785 |
| 168TN2 | 5.439 | 2.531 | 0.030 | 0.000 | 0.523 | 0.270 | 1.700 | 0.046 | 3.157 | 5.695 | 0.181 | 1.674 | 1.855 | 0.215 | 0.023 | 3.762 |
| 168TQ1 | 5.512 | 2.474 | 0.014 | 0.000 | 0.508 | 0.283 | 1.683 | 0.041 | 3.146 | 5.661 | 0.177 | 1.690 | 1.868 | 0.198 | 0.026 | 3.776 |
| 168TQ2 | 5.470 | 2.528 | 0.002 | 0.000 | 0.525 | 0.295 | 1.683 | 0.042 | 3.139 | 5.684 | 0.167 | 1.650 | 1.816 | 0.181 | 0.028 | 3.791 |
| 168TR1 | 5.500 | 2.405 | 0.095 | 0.000 | 0.503 | 0.288 | 2.172 | 0.056 | 2.655 | 5.674 | 0.164 | 1.693 | 1.857 | 0.263 | 0.044 | 3.693 |
| 168TR2 | 5.490 | 2.445 | 0.065 | 0.000 | 0.519 | 0.319 | 2.174 | 0.058 | 2.587 | 5.657 | 0.162 | 1.678 | 1.841 | 0.221 | 0.053 | 3.727 |
| 168TT2 | 5.491 | 2.397 | 0.113 | 0.000 | 0.511 | 0.277 | 2.208 | 0.059 | 2.621 | 5.677 | 0.167 | 1.690 | 1.857 | 0.277 | 0.052 | 3.671 |
| 168TU1 | 5.548 | 2.368 | 0.085 | 0.000 | 0.519 | 0.295 | 2.150 | 0.059 | 2.619 | 5.642 | 0.162 | 1.672 | 1.834 | 0.293 | 0.058 | 3.649 |
| 168TU2 | 5.610 | 2.275 | 0.115 | 0.000 | 0.491 | 0.253 | 2.087 | 0.062 | 2.746 | 5.639 | 0.154 | 1.723 | 1.877 | 0.256 | 0.054 | 3.690 |
| 168TV1 | 5.506 | 2.431 | 0.063 | 0.000 | 0.515 | 0.237 | 1.702 | 0.040 | 3.199 | 5.694 | 0.180 | 1.658 | 1.838 | 0.169 | 0.023 | 3.808 |
| 168TV2 | 5.568 | 2.408 | 0.025 | 0.000 | 0.486 | 0.271 | 1.678 | 0.044 | 3.204 | 5.682 | 0.171 | 1.654 | 1.825 | 0.313 | 0.023 | 3.664 |
| 169TA1 | 5.558 | 2.384 | 0.058 | 0.000 | 0.519 | 0.237 | 1.669 | 0.042 | 3.209 | 5.677 | 0.158 | 1.654 | 1.812 | 0.205 | 0.023 | 3.772 |
| 169TA2 | 5.565 | 2.405 | 0.030 | 0.000 | 0.507 | 0.264 | 1.666 | 0.041 | 3.179 | 5.657 | 0.156 | 1.687 | 1.843 | 0.268 | 0.023 | 3.709 |
| 169TAC1 | 5.603 | 2.341 | 0.056 | 0.000 | 0.492 | 0.309 | 2.068 | 0.052 | 2.721 | 5.641 | 0.130 | 1.692 | 1.822 | 0.568 | 0.049 | 3.383 |
| 169TAC2 | 5.584 | 2.324 | 0.092 | 0.000 | 0.494 | 0.289 | 2.162 | 0.058 | 2.647 | 5.649 | 0.150 | 1.692 | 1.842 | 0.322 | 0.060 | 3.617 |
| 169TC1 | 5.470 | 2.471 | 0.059 | 0.000 | 0.536 | 0.247 | 1.734 | 0.043 | 3.135 | 5.694 | 0.165 | 1.658 | 1.823 | 0.231 | 0.023 | 3.746 |
| 169TC2 | 5.518 | 2.449 | 0.033 | 0.000 | 0.509 | 0.265 | 1.690 | 0.041 | 3.172 | 5.677 | 0.167 | 1.677 | 1.843 | 0.191 | 0.023 | 3.786 |
| 169TG1 | 5.512 | 2.460 | 0.027 | 0.000 | 0.491 | 0.272 | 1.695 | 0.041 | 3.207 | 5.707 | 0.155 | 1.664 | 1.819 | 0.244 | 0.026 | 3.730 |
| 169TG2 | 5.552 | 2.405 | 0.043 | 0.000 | 0.513 | 0.248 | 1.648 | 0.035 | 3.221 | 5.665 | 0.171 | 1.674 | 1.844 | 0.235 | 0.028 | 3.736 |
| 169TJ1 | 5.542 | 2.390 | 0.068 | 0.000 | 0.506 | 0.246 | 1.775 | 0.048 | 3.126 | 5.701 | 0.142 | 1.654 | 1.796 | 0.222 | 0.028 | 3.749 |
| 169TJ2 | 5.552 | 2.341 | 0.108 | 0.000 | 0.513 | 0.205 | 1.768 | 0.048 | 3.155 | 5.689 | 0.152 | 1.689 | 1.841 | 0.218 | 0.031 | 3.751 |
| 169TK1 | 5.526 | 2.434 | 0.039 | 0.000 | 0.491 | 0.263 | 1.708 | 0.037 | 3.213 | 5.713 | 0.165 | 1.637 | 1.802 | 0.221 | 0.021 | 3.758 |
| 169TL1 | 5.511 | 2.450 | 0.040 | 0.000 | 0.493 | 0.253 | 1.660 | 0.038 | 3.256 | 5.700 | 0.170 | 1.681 | 1.851 | 0.181 | 0.026 | 3.793 |
| 169TP1 | 5.563 | 2.366 | 0.071 | 0.000 | 0.504 | 0.237 | 1.745 | 0.048 | 3.147 | 5.681 | 0.149 | 1.683 | 1.831 | 0.262 | 0.023 | 3.715 |
| 169TP2 | 5.547 | 2.420 | 0.033 | 0.000 | 0.508 | 0.271 | 1.722 | 0.051 | 3.128 | 5.680 | 0.147 | 1.659 | 1.806 | 0.235 | 0.023 | 3.742 |
| 169TT1 | 5.839 | 2.161 | 0.000 | 0.030 | 0.465 | 0.334 | 1.896 | 0.052 | 2.749 | 5.525 | 0.109 | 1.708 | 1.817 | 0.390 | 0.054 | 3.556 |

**Appendix 4** Structural Formulas (in Atoms) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | Si | Al(iv) | $Fe^{3+}$(iv) | Al(vi) | Ti | $Fe^{3+}$ | $Fe^{2+}$ | $Mn^{2+}$ | Mg | Oct total | Na | K | Alk total | F | Cl | OH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 169TT2 | 5.682 | 2.177 | 0.141 | 0.000 | 0.484 | 0.223 | 2.060 | 0.058 | 2.820 | 5.646 | 0.140 | 1.696 | 1.835 | 0.402 | 0.047 | 3.551 |
| 169TX1 | 5.683 | 2.224 | 0.093 | 0.000 | 0.454 | 0.273 | 2.071 | 0.057 | 2.788 | 5.643 | 0.145 | 1.705 | 1.849 | 0.255 | 0.046 | 3.698 |
| 169TX2 | 5.629 | 2.276 | 0.094 | 0.000 | 0.475 | 0.277 | 2.103 | 0.060 | 2.738 | 5.652 | 0.145 | 1.693 | 1.839 | 0.339 | 0.049 | 3.612 |
| 197TAB1 | 5.596 | 2.361 | 0.043 | 0.000 | 0.499 | 0.327 | 2.098 | 0.050 | 2.677 | 5.651 | 0.059 | 1.718 | 1.777 | 0.000 | 0.000 | 4.000 |
| 197TAB2 | 5.577 | 2.369 | 0.054 | 0.000 | 0.493 | 0.316 | 2.093 | 0.049 | 2.713 | 5.665 | 0.047 | 1.743 | 1.790 | 0.000 | 0.000 | 4.000 |
| 197TAF1 | 5.519 | 2.481 | 0.000 | 0.044 | 0.493 | 0.303 | 1.718 | 0.033 | 3.108 | 5.699 | 0.086 | 1.664 | 1.750 | 0.000 | 0.000 | 4.000 |
| 197TC1 | 5.551 | 2.449 | 0.000 | 0.048 | 0.476 | 0.294 | 1.664 | 0.033 | 3.194 | 5.709 | 0.080 | 1.659 | 1.738 | 0.000 | 0.000 | 4.000 |
| 197TC2 | 5.547 | 2.453 | 0.000 | 0.024 | 0.499 | 0.294 | 1.666 | 0.028 | 3.181 | 5.691 | 0.080 | 1.676 | 1.756 | 0.000 | 0.000 | 4.000 |
| 197TD1 | 5.562 | 2.438 | 0.000 | 0.001 | 0.493 | 0.293 | 1.660 | 0.031 | 3.228 | 5.706 | 0.082 | 1.664 | 1.746 | 0.000 | 0.000 | 4.000 |
| 197TD2 | 5.560 | 2.431 | 0.009 | 0.000 | 0.496 | 0.284 | 1.661 | 0.033 | 3.215 | 5.690 | 0.097 | 1.686 | 1.783 | 0.000 | 0.000 | 4.000 |
| 197TE1 | 5.502 | 2.498 | 0.000 | 0.000 | 0.520 | 0.312 | 1.771 | 0.039 | 3.066 | 5.708 | 0.047 | 1.684 | 1.731 | 0.000 | 0.000 | 4.000 |
| 197TE2 | 5.508 | 2.492 | 0.000 | 0.015 | 0.503 | 0.313 | 1.770 | 0.034 | 3.083 | 5.718 | 0.053 | 1.670 | 1.724 | 0.000 | 0.000 | 4.000 |
| 197TF1 | 5.635 | 2.291 | 0.074 | 0.000 | 0.489 | 0.295 | 2.092 | 0.044 | 2.746 | 5.667 | 0.032 | 1.724 | 1.757 | 0.000 | 0.000 | 4.000 |
| 197TF2 | 5.643 | 2.330 | 0.027 | 0.000 | 0.488 | 0.327 | 2.007 | 0.042 | 2.778 | 5.643 | 0.047 | 1.719 | 1.766 | 0.000 | 0.000 | 4.000 |
| 197TJ1 | 5.593 | 2.407 | 0.000 | 0.012 | 0.426 | 0.360 | 2.036 | 0.024 | 2.850 | 5.708 | 0.053 | 1.715 | 1.768 | 0.000 | 0.000 | 4.000 |
| 197TJ2 | 5.605 | 2.395 | 0.000 | 0.024 | 0.418 | 0.359 | 2.037 | 0.028 | 2.839 | 5.705 | 0.071 | 1.696 | 1.767 | 0.000 | 0.000 | 4.000 |
| 197TL1 | 5.619 | 2.381 | 0.000 | 0.077 | 0.496 | 0.291 | 1.650 | 0.036 | 3.130 | 5.680 | 0.038 | 1.622 | 1.660 | 0.000 | 0.000 | 4.000 |
| 197TL2 | 5.619 | 2.381 | 0.000 | 0.051 | 0.508 | 0.297 | 1.684 | 0.026 | 3.115 | 5.681 | 0.041 | 1.613 | 1.654 | 0.000 | 0.000 | 4.000 |
| 197TM1 | 5.464 | 2.517 | 0.020 | 0.000 | 0.499 | 0.373 | 2.223 | 0.042 | 2.580 | 5.718 | 0.061 | 1.668 | 1.728 | 0.000 | 0.000 | 4.000 |
| 197TM2 | 5.490 | 2.463 | 0.047 | 0.000 | 0.545 | 0.333 | 2.154 | 0.049 | 2.606 | 5.686 | 0.051 | 1.662 | 1.713 | 0.000 | 0.000 | 4.000 |
| 197TN1 | 5.612 | 2.388 | 0.000 | 0.025 | 0.483 | 0.376 | 2.125 | 0.048 | 2.580 | 5.637 | 0.047 | 1.700 | 1.747 | 0.000 | 0.000 | 4.000 |
| 197TN2 | 5.597 | 2.403 | 0.000 | 0.000 | 0.481 | 0.376 | 2.132 | 0.043 | 2.632 | 5.663 | 0.060 | 1.682 | 1.741 | 0.000 | 0.000 | 4.000 |
| 197TQ1 | 5.583 | 2.417 | 0.001 | 0.000 | 0.491 | 0.378 | 2.147 | 0.048 | 2.605 | 5.669 | 0.066 | 1.654 | 1.720 | 0.000 | 0.000 | 4.000 |
| 197TQ2 | 5.516 | 2.422 | 0.063 | 0.000 | 0.537 | 0.319 | 2.161 | 0.039 | 2.631 | 5.687 | 0.036 | 1.684 | 1.719 | 0.000 | 0.000 | 4.000 |
| 197TY1 | 5.536 | 2.464 | 0.000 | 0.034 | 0.497 | 0.296 | 1.675 | 0.033 | 3.185 | 5.719 | 0.056 | 1.646 | 1.702 | 0.000 | 0.000 | 4.000 |
| 197TY2 | 5.560 | 2.440 | 0.000 | 0.038 | 0.493 | 0.295 | 1.674 | 0.026 | 3.175 | 5.700 | 0.050 | 1.671 | 1.721 | 0.000 | 0.000 | 4.000 |
| 197TZ1 | 5.726 | 2.261 | 0.013 | 0.000 | 0.470 | 0.346 | 2.034 | 0.042 | 2.745 | 5.638 | 0.023 | 1.687 | 1.710 | 0.000 | 0.000 | 4.000 |
| 197TZ2 | 5.635 | 2.336 | 0.029 | 0.000 | 0.475 | 0.338 | 2.080 | 0.047 | 2.726 | 5.667 | 0.026 | 1.717 | 1.744 | 0.000 | 0.000 | 4.000 |
| 199TA1 | 5.590 | 2.410 | 0.000 | 0.004 | 0.502 | 0.278 | 1.572 | 0.020 | 3.307 | 5.683 | 0.093 | 1.667 | 1.760 | 0.000 | 0.000 | 4.000 |
| 199TA2 | 5.628 | 2.372 | 0.000 | 0.037 | 0.483 | 0.278 | 1.577 | 0.025 | 3.260 | 5.660 | 0.105 | 1.666 | 1.771 | 0.000 | 0.000 | 4.000 |
| 199TAE1 | 5.637 | 2.308 | 0.055 | 0.000 | 0.481 | 0.323 | 2.139 | 0.037 | 2.696 | 5.676 | 0.082 | 1.646 | 1.728 | 0.000 | 0.000 | 4.000 |
| 199TAE2 | 5.620 | 2.272 | 0.108 | 0.000 | 0.484 | 0.271 | 2.150 | 0.056 | 2.748 | 5.709 | 0.076 | 1.648 | 1.723 | 0.000 | 0.000 | 4.000 |
| 199TAH1 | 5.488 | 2.512 | 0.000 | 0.009 | 0.499 | 0.310 | 1.752 | 0.021 | 3.118 | 5.709 | 0.101 | 1.678 | 1.778 | 0.000 | 0.000 | 4.000 |
| 199TAH2 | 5.489 | 2.511 | 0.000 | 0.042 | 0.487 | 0.316 | 1.792 | 0.023 | 3.101 | 5.763 | 0.065 | 1.587 | 1.653 | 0.000 | 0.000 | 4.000 |
| 199TAL1 | 5.507 | 2.493 | 0.000 | 0.001 | 0.500 | 0.310 | 1.753 | 0.028 | 3.162 | 5.755 | 0.076 | 1.595 | 1.671 | 0.000 | 0.000 | 4.000 |
| 199TAL2 | 5.521 | 2.457 | 0.022 | 0.000 | 0.512 | 0.289 | 1.764 | 0.029 | 3.155 | 5.748 | 0.099 | 1.572 | 1.672 | 0.000 | 0.000 | 4.000 |
| 199TB1 | 5.608 | 2.353 | 0.039 | 0.000 | 0.501 | 0.253 | 1.655 | 0.037 | 3.219 | 5.665 | 0.099 | 1.706 | 1.806 | 0.000 | 0.000 | 4.000 |
| 199TB2 | 5.610 | 2.390 | 0.000 | 0.044 | 0.486 | 0.293 | 1.664 | 0.032 | 3.133 | 5.652 | 0.073 | 1.704 | 1.777 | 0.000 | 0.000 | 4.000 |
| 199TC1 | 5.712 | 2.217 | 0.070 | 0.000 | 0.473 | 0.301 | 2.100 | 0.042 | 2.696 | 5.613 | 0.071 | 1.744 | 1.815 | 0.000 | 0.000 | 4.000 |
| 199TC2 | 5.609 | 2.324 | 0.067 | 0.000 | 0.484 | 0.312 | 2.150 | 0.055 | 2.666 | 5.668 | 0.053 | 1.722 | 1.775 | 0.000 | 0.000 | 4.000 |
| 199TE1 | 5.642 | 2.284 | 0.073 | 0.000 | 0.489 | 0.216 | 1.637 | 0.031 | 3.307 | 5.680 | 0.072 | 1.733 | 1.805 | 0.000 | 0.000 | 4.000 |
| 199TE2 | 5.672 | 2.279 | 0.049 | 0.000 | 0.474 | 0.240 | 1.637 | 0.034 | 3.278 | 5.663 | 0.089 | 1.725 | 1.814 | 0.000 | 0.000 | 4.000 |
| 199TF1 | 5.620 | 2.380 | 0.000 | 0.004 | 0.498 | 0.257 | 1.458 | 0.021 | 3.439 | 5.677 | 0.112 | 1.656 | 1.769 | 0.000 | 0.000 | 4.000 |
| 199TF1 | 5.510 | 2.480 | 0.010 | 0.000 | 0.494 | 0.314 | 1.839 | 0.023 | 3.086 | 5.757 | 0.074 | 1.601 | 1.675 | 0.000 | 0.000 | 4.000 |
| 199TF2 | 5.654 | 2.346 | 0.000 | 0.030 | 0.479 | 0.258 | 1.459 | 0.014 | 3.422 | 5.662 | 0.123 | 1.654 | 1.777 | 0.000 | 0.000 | 4.000 |

**Appendix 4** Structural Formulas (in Atoms) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | Si | Al(iv) | $Fe^{3+}$(iv) | Al(vi) | Ti | $Fe^{3+}$ | $Fe^{2+}$ | $Mn^{2+}$ | Mg | Oct total | Na | K | Alk total | F | Cl | OH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 199TF2 | 5.496 | 2.476 | 0.028 | 0.000 | 0.504 | 0.295 | 1.829 | 0.039 | 3.098 | 5.765 | 0.071 | 1.600 | 1.671 | 0.000 | 0.000 | 4.000 |
| 199TH1 | 5.613 | 2.349 | 0.038 | 0.000 | 0.470 | 0.331 | 2.090 | 0.049 | 2.786 | 5.724 | 0.044 | 1.624 | 1.668 | 0.000 | 0.000 | 4.000 |
| 199TH2 | 5.601 | 2.285 | 0.114 | 0.000 | 0.478 | 0.261 | 2.121 | 0.045 | 2.839 | 5.744 | 0.050 | 1.645 | 1.694 | 0.000 | 0.000 | 4.000 |
| 199TQ1 | 5.523 | 2.477 | 0.000 | 0.049 | 0.495 | 0.297 | 1.681 | 0.019 | 3.191 | 5.733 | 0.109 | 1.566 | 1.675 | 0.000 | 0.000 | 4.000 |
| 199TQ2 | 5.567 | 2.433 | 0.000 | 0.049 | 0.494 | 0.293 | 1.659 | 0.013 | 3.198 | 5.706 | 0.099 | 1.591 | 1.691 | 0.000 | 0.000 | 4.000 |
| 199TR1 | 5.541 | 2.378 | 0.081 | 0.000 | 0.503 | 0.312 | 2.225 | 0.044 | 2.627 | 5.710 | 0.068 | 1.653 | 1.721 | 0.000 | 0.000 | 4.000 |
| 199TR2 | 5.572 | 2.336 | 0.092 | 0.000 | 0.490 | 0.298 | 2.209 | 0.046 | 2.687 | 5.730 | 0.053 | 1.638 | 1.691 | 0.000 | 0.000 | 4.000 |
| 199TV1 | 5.544 | 2.427 | 0.029 | 0.000 | 0.500 | 0.255 | 1.613 | 0.023 | 3.359 | 5.750 | 0.102 | 1.598 | 1.701 | 0.000 | 0.000 | 4.000 |
| 199TV2 | 5.545 | 2.455 | 0.000 | 0.016 | 0.496 | 0.288 | 1.635 | 0.027 | 3.286 | 5.747 | 0.128 | 1.536 | 1.664 | 0.000 | 0.000 | 4.000 |
| 203TA1 | 5.515 | 2.455 | 0.030 | 0.000 | 0.503 | 0.282 | 1.763 | 0.035 | 3.141 | 5.724 | 0.105 | 1.644 | 1.750 | 0.000 | 0.000 | 4.000 |
| 203TA2 | 5.588 | 2.412 | 0.000 | 0.058 | 0.460 | 0.302 | 1.710 | 0.032 | 3.139 | 5.700 | 0.096 | 1.636 | 1.732 | 0.000 | 0.000 | 4.000 |
| 203TB1 | 5.502 | 2.482 | 0.016 | 0.000 | 0.497 | 0.297 | 1.778 | 0.031 | 3.108 | 5.710 | 0.126 | 1.659 | 1.786 | 0.000 | 0.000 | 4.000 |
| 203TB2 | 5.548 | 2.452 | 0.000 | 0.061 | 0.520 | 0.295 | 1.672 | 0.027 | 3.079 | 5.654 | 0.108 | 1.639 | 1.748 | 0.000 | 0.000 | 4.000 |
| 203TB3 | 5.520 | 2.470 | 0.010 | 0.000 | 0.500 | 0.300 | 1.754 | 0.028 | 3.133 | 5.716 | 0.106 | 1.641 | 1.747 | 0.000 | 0.000 | 4.000 |
| 203TC1 | 5.542 | 2.458 | 0.000 | 0.073 | 0.497 | 0.306 | 1.737 | 0.034 | 3.063 | 5.710 | 0.090 | 1.575 | 1.665 | 0.000 | 0.000 | 4.000 |
| 203TC2 | 5.534 | 2.466 | 0.000 | 0.016 | 0.499 | 0.303 | 1.718 | 0.019 | 3.162 | 5.716 | 0.103 | 1.614 | 1.716 | 0.000 | 0.000 | 4.000 |
| 203TE1 | 5.636 | 2.364 | 0.000 | 0.158 | 0.440 | 0.324 | 1.835 | 0.019 | 2.948 | 5.725 | 0.067 | 1.484 | 1.552 | 0.000 | 0.000 | 4.000 |
| 203TE3 | 5.558 | 2.442 | 0.000 | 0.062 | 0.470 | 0.311 | 1.760 | 0.026 | 3.095 | 5.725 | 0.071 | 1.609 | 1.680 | 0.000 | 0.000 | 4.000 |
| 203TE4 | 5.526 | 2.474 | 0.000 | 0.004 | 0.496 | 0.307 | 1.738 | 0.031 | 3.149 | 5.725 | 0.093 | 1.629 | 1.722 | 0.000 | 0.000 | 4.000 |
| 203TF1 | 5.555 | 2.445 | 0.000 | 0.026 | 0.483 | 0.302 | 1.709 | 0.032 | 3.181 | 5.732 | 0.105 | 1.582 | 1.687 | 0.000 | 0.000 | 4.000 |
| 203TF2 | 5.432 | 2.568 | 0.000 | 0.013 | 0.544 | 0.310 | 1.756 | 0.035 | 3.073 | 5.731 | 0.080 | 1.615 | 1.695 | 0.000 | 0.000 | 4.000 |
| 203TF3 | 5.553 | 2.447 | 0.000 | 0.000 | 0.465 | 0.306 | 1.733 | 0.033 | 3.217 | 5.754 | 0.091 | 1.613 | 1.703 | 0.000 | 0.000 | 4.000 |
| 203TH1 | 5.504 | 2.496 | 0.000 | 0.039 | 0.500 | 0.284 | 1.612 | 0.023 | 3.254 | 5.712 | 0.120 | 1.628 | 1.749 | 0.000 | 0.000 | 4.000 |
| 203TH2 | 5.444 | 2.556 | 0.000 | 0.042 | 0.511 | 0.283 | 1.603 | 0.021 | 3.262 | 5.722 | 0.113 | 1.651 | 1.764 | 0.000 | 0.000 | 4.000 |
| 203TH3 | 5.497 | 2.503 | 0.000 | 0.064 | 0.468 | 0.285 | 1.613 | 0.022 | 3.279 | 5.731 | 0.138 | 1.618 | 1.756 | 0.000 | 0.000 | 4.000 |
| 203TJ1 | 5.459 | 2.541 | 0.000 | 0.034 | 0.516 | 0.302 | 1.710 | 0.028 | 3.145 | 5.735 | 0.112 | 1.591 | 1.703 | 0.000 | 0.000 | 4.000 |
| 203TJ2 | 5.526 | 2.474 | 0.000 | 0.032 | 0.501 | 0.292 | 1.649 | 0.021 | 3.236 | 5.731 | 0.089 | 1.598 | 1.686 | 0.000 | 0.000 | 4.000 |
| 203TP1 | 5.518 | 2.482 | 0.000 | 0.003 | 0.506 | 0.305 | 1.729 | 0.032 | 3.163 | 5.738 | 0.084 | 1.602 | 1.686 | 0.000 | 0.000 | 4.000 |
| 203TP2 | 5.533 | 2.467 | 0.000 | 0.026 | 0.483 | 0.311 | 1.764 | 0.030 | 3.132 | 5.747 | 0.110 | 1.561 | 1.671 | 0.000 | 0.000 | 4.000 |
| 203TQ1 | 5.529 | 2.447 | 0.025 | 0.000 | 0.518 | 0.293 | 1.795 | 0.036 | 3.077 | 5.718 | 0.081 | 1.626 | 1.708 | 0.000 | 0.000 | 4.000 |
| 203TQ2 | 5.583 | 2.417 | 0.000 | 0.052 | 0.457 | 0.311 | 1.766 | 0.035 | 3.091 | 5.712 | 0.076 | 1.640 | 1.716 | 0.000 | 0.000 | 4.000 |
| 204TA1 | 5.540 | 2.460 | 0.000 | 0.039 | 0.515 | 0.298 | 1.691 | 0.045 | 3.065 | 5.653 | 0.155 | 1.632 | 1.786 | 0.299 | 0.020 | 3.681 |
| 204TA2 | 5.427 | 2.573 | 0.000 | 0.051 | 0.526 | 0.302 | 1.711 | 0.039 | 3.034 | 5.663 | 0.168 | 1.677 | 1.844 | 0.269 | 0.018 | 3.714 |
| 204TAB2 | 5.654 | 2.346 | 0.000 | 0.100 | 0.470 | 0.363 | 2.058 | 0.043 | 2.537 | 5.572 | 0.142 | 1.658 | 1.800 | 0.378 | 0.051 | 3.571 |
| 204TAC1 | 5.418 | 2.582 | 0.000 | 0.106 | 0.525 | 0.295 | 1.677 | 0.029 | 3.012 | 5.645 | 0.164 | 1.675 | 1.839 | 0.635 | 0.023 | 3.343 |
| 204TAC2 | 5.394 | 2.606 | 0.000 | 0.072 | 0.537 | 0.302 | 1.708 | 0.044 | 3.011 | 5.674 | 0.160 | 1.653 | 1.812 | 0.303 | 0.028 | 3.669 |
| 204TB1 | 5.509 | 2.491 | 0.000 | 0.046 | 0.498 | 0.302 | 1.713 | 0.041 | 3.058 | 5.659 | 0.161 | 1.669 | 1.829 | 0.445 | 0.028 | 3.527 |
| 204TB2 | 5.521 | 2.479 | 0.000 | 0.053 | 0.497 | 0.296 | 1.675 | 0.037 | 3.090 | 5.646 | 0.144 | 1.701 | 1.845 | 0.466 | 0.028 | 3.506 |
| 204TC1 | 5.457 | 2.543 | 0.000 | 0.024 | 0.533 | 0.305 | 1.727 | 0.043 | 3.019 | 5.651 | 0.167 | 1.679 | 1.847 | 0.429 | 0.025 | 3.546 |
| 204TC2 | 5.532 | 2.468 | 0.000 | 0.017 | 0.506 | 0.289 | 1.636 | 0.040 | 3.160 | 5.648 | 0.154 | 1.700 | 1.854 | 0.313 | 0.030 | 3.657 |
| 204TD1 | 5.427 | 2.573 | 0.000 | 0.026 | 0.519 | 0.301 | 1.704 | 0.037 | 3.077 | 5.664 | 0.166 | 1.712 | 1.878 | 0.469 | 0.023 | 3.508 |
| 204TF1 | 5.499 | 2.501 | 0.000 | 0.011 | 0.518 | 0.297 | 1.678 | 0.037 | 3.117 | 5.659 | 0.163 | 1.678 | 1.841 | 0.330 | 0.022 | 3.647 |
| 204TF2 | 5.468 | 2.532 | 0.000 | 0.004 | 0.525 | 0.295 | 1.672 | 0.043 | 3.137 | 5.676 | 0.158 | 1.674 | 1.832 | 0.355 | 0.023 | 3.622 |
| 204TG1 | 5.423 | 2.577 | 0.000 | 0.027 | 0.534 | 0.319 | 1.808 | 0.046 | 2.924 | 5.658 | 0.157 | 1.689 | 1.846 | 0.435 | 0.023 | 3.542 |
| 204TG2 | 5.471 | 2.529 | 0.000 | 0.011 | 0.523 | 0.313 | 1.775 | 0.054 | 2.982 | 5.658 | 0.147 | 1.694 | 1.841 | 0.292 | 0.020 | 3.688 |

**Appendix 4** Structural Formulas (in Atoms) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | Si | Al(iv) | $Fe^{3+}$(iv) | Al(vi) | Ti | $Fe^{3+}$ | $Fe^{2+}$ | $Mn^{2+}$ | Mg | Oct total | Na | K | Alk total | F | Cl | OH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 204TJ1 | 5.568 | 2.432 | 0.000 | 0.119 | 0.501 | 0.292 | 1.655 | 0.033 | 3.021 | 5.620 | 0.158 | 1.623 | 1.781 | 0.388 | 0.023 | 3.589 |
| 204TJ2 | 5.454 | 2.537 | 0.009 | 0.000 | 0.541 | 0.292 | 1.707 | 0.041 | 3.083 | 5.665 | 0.158 | 1.684 | 1.842 | 0.492 | 0.023 | 3.485 |
| 204TM1 | 5.512 | 2.488 | 0.000 | 0.083 | 0.497 | 0.298 | 1.691 | 0.041 | 3.051 | 5.662 | 0.173 | 1.616 | 1.788 | 0.286 | 0.028 | 3.686 |
| 204TM2 | 5.379 | 2.621 | 0.000 | 0.004 | 0.558 | 0.304 | 1.721 | 0.044 | 3.047 | 5.678 | 0.172 | 1.669 | 1.841 | 0.262 | 0.028 | 3.710 |
| 204TN1 | 5.435 | 2.565 | 0.000 | 0.042 | 0.535 | 0.300 | 1.700 | 0.045 | 3.042 | 5.664 | 0.147 | 1.676 | 1.824 | 0.330 | 0.028 | 3.642 |
| 204TN2 | 5.506 | 2.494 | 0.000 | 0.068 | 0.509 | 0.289 | 1.640 | 0.044 | 3.081 | 5.631 | 0.158 | 1.699 | 1.857 | 0.408 | 0.023 | 3.569 |
| 204TP1 | 5.402 | 2.598 | 0.000 | 0.029 | 0.530 | 0.304 | 1.721 | 0.033 | 3.065 | 5.681 | 0.150 | 1.692 | 1.842 | 0.504 | 0.030 | 3.466 |
| 204TQ1 | 5.476 | 2.524 | 0.000 | 0.011 | 0.521 | 0.314 | 1.780 | 0.047 | 2.976 | 5.649 | 0.152 | 1.706 | 1.858 | 0.430 | 0.033 | 3.536 |
| 204TQ2 | 5.475 | 2.525 | 0.000 | 0.024 | 0.526 | 0.316 | 1.789 | 0.052 | 2.951 | 5.658 | 0.153 | 1.665 | 1.818 | 0.292 | 0.028 | 3.680 |
| 204TS1 | 5.464 | 2.536 | 0.000 | 0.039 | 0.506 | 0.303 | 1.715 | 0.036 | 3.074 | 5.673 | 0.163 | 1.675 | 1.838 | 0.407 | 0.023 | 3.571 |
| 204TS2 | 5.461 | 2.539 | 0.000 | 0.038 | 0.521 | 0.298 | 1.687 | 0.040 | 3.078 | 5.661 | 0.155 | 1.685 | 1.840 | 0.289 | 0.023 | 3.688 |
| 204TU1 | 5.544 | 2.456 | 0.000 | 0.068 | 0.499 | 0.296 | 1.679 | 0.036 | 3.058 | 5.636 | 0.161 | 1.660 | 1.821 | 0.430 | 0.028 | 3.542 |
| 204TU2 | 5.549 | 2.451 | 0.000 | 0.070 | 0.496 | 0.297 | 1.683 | 0.039 | 3.049 | 5.634 | 0.155 | 1.668 | 1.823 | 0.412 | 0.025 | 3.563 |
| 204TX1 | 5.493 | 2.507 | 0.000 | 0.027 | 0.526 | 0.287 | 1.628 | 0.038 | 3.145 | 5.651 | 0.158 | 1.681 | 1.840 | 0.314 | 0.025 | 3.661 |
| 204TX2 | 5.505 | 2.495 | 0.000 | 0.032 | 0.504 | 0.295 | 1.673 | 0.042 | 3.120 | 5.666 | 0.168 | 1.662 | 1.830 | 0.399 | 0.022 | 3.578 |
| 21TA2 | 5.541 | 2.432 | 0.027 | 0.000 | 0.569 | 0.194 | 1.247 | 0.023 | 3.645 | 5.678 | 0.184 | 1.588 | 1.773 | 2.222 | 0.030 | 1.747 |
| 21TB1 | 5.622 | 2.364 | 0.015 | 0.000 | 0.487 | 0.262 | 1.570 | 0.043 | 3.307 | 5.669 | 0.167 | 1.637 | 1.805 | 2.152 | 0.025 | 1.823 |
| 21TB2 | 5.604 | 2.382 | 0.014 | 0.000 | 0.487 | 0.203 | 1.231 | 0.043 | 3.731 | 5.694 | 0.175 | 1.657 | 1.832 | 2.575 | 0.018 | 1.408 |
| 21TC1 | 5.597 | 2.403 | 0.000 | 0.033 | 0.483 | 0.317 | 1.794 | 0.041 | 3.007 | 5.674 | 0.143 | 1.597 | 1.740 | 1.795 | 0.026 | 2.179 |
| 21TC2 | 5.525 | 2.475 | 0.000 | 0.035 | 0.516 | 0.271 | 1.533 | 0.041 | 3.278 | 5.673 | 0.177 | 1.615 | 1.792 | 2.260 | 0.034 | 1.706 |
| 21TD1 | 5.532 | 2.468 | 0.000 | 0.034 | 0.502 | 0.315 | 1.784 | 0.047 | 3.025 | 5.708 | 0.140 | 1.558 | 1.699 | 1.713 | 0.026 | 2.261 |
| 21TD2 | 5.498 | 2.464 | 0.038 | 0.000 | 0.486 | 0.284 | 1.826 | 0.060 | 3.135 | 5.791 | 0.143 | 1.522 | 1.664 | 2.131 | 0.029 | 1.840 |
| 21TE1 | 5.612 | 2.383 | 0.005 | 0.000 | 0.494 | 0.218 | 1.264 | 0.029 | 3.687 | 5.691 | 0.166 | 1.635 | 1.801 | 2.449 | 0.030 | 1.521 |
| 21TE2 | 5.633 | 2.367 | 0.000 | 0.054 | 0.503 | 0.238 | 1.351 | 0.027 | 3.490 | 5.664 | 0.172 | 1.568 | 1.741 | 2.247 | 0.034 | 1.720 |
| 21TF1 | 5.572 | 2.386 | 0.042 | 0.000 | 0.497 | 0.243 | 1.615 | 0.047 | 3.277 | 5.679 | 0.174 | 1.660 | 1.834 | 1.779 | 0.028 | 2.193 |
| 21TF2 | 5.590 | 2.360 | 0.050 | 0.000 | 0.508 | 0.199 | 1.414 | 0.036 | 3.534 | 5.691 | 0.178 | 1.636 | 1.814 | 1.967 | 0.025 | 2.008 |
| 21TG1 | 5.568 | 2.432 | 0.000 | 0.000 | 0.505 | 0.244 | 1.384 | 0.039 | 3.527 | 5.699 | 0.159 | 1.623 | 1.782 | 2.028 | 0.030 | 1.942 |
| 21TG2 | 5.709 | 2.291 | 0.000 | 0.054 | 0.484 | 0.226 | 1.276 | 0.027 | 3.562 | 5.630 | 0.182 | 1.600 | 1.783 | 2.097 | 0.025 | 1.878 |
| 21TH1 | 5.495 | 2.505 | 0.000 | 0.017 | 0.534 | 0.308 | 1.746 | 0.058 | 3.023 | 5.686 | 0.161 | 1.578 | 1.740 | 1.365 | 0.038 | 2.597 |
| 21TH2 | 5.574 | 2.426 | 0.000 | 0.011 | 0.512 | 0.248 | 1.405 | 0.043 | 3.474 | 5.692 | 0.156 | 1.603 | 1.759 | 1.940 | 0.028 | 2.032 |
| 21TM1 | 5.562 | 2.438 | 0.000 | 0.027 | 0.545 | 0.213 | 1.205 | 0.030 | 3.641 | 5.661 | 0.173 | 1.612 | 1.785 | 1.817 | 0.038 | 2.145 |
| 21TM2 | 5.616 | 2.384 | 0.000 | 0.035 | 0.519 | 0.201 | 1.134 | 0.036 | 3.732 | 5.658 | 0.180 | 1.614 | 1.794 | 1.886 | 0.042 | 2.071 |
| 24TA1 | 5.613 | 2.374 | 0.013 | 0.000 | 0.511 | 0.291 | 1.726 | 0.053 | 3.046 | 5.626 | 0.174 | 1.649 | 1.822 | 1.675 | 0.030 | 2.294 |
| 24TA2 | 5.691 | 2.309 | 0.000 | 0.042 | 0.502 | 0.270 | 1.534 | 0.046 | 3.198 | 5.593 | 0.175 | 1.631 | 1.806 | 1.861 | 0.025 | 2.114 |
| 24TC1 | 5.560 | 2.440 | 0.000 | 0.051 | 0.535 | 0.318 | 1.801 | 0.058 | 2.866 | 5.629 | 0.144 | 1.598 | 1.742 | 1.252 | 0.028 | 2.719 |
| 24TC2 | 5.647 | 2.353 | 0.000 | 0.009 | 0.502 | 0.292 | 1.653 | 0.052 | 3.098 | 5.606 | 0.177 | 1.658 | 1.835 | 1.597 | 0.023 | 2.380 |
| 24TD1 | 5.615 | 2.385 | 0.000 | 0.029 | 0.520 | 0.258 | 1.465 | 0.030 | 3.322 | 5.624 | 0.182 | 1.627 | 1.809 | 1.744 | 0.025 | 2.231 |
| 24TD2 | 5.622 | 2.374 | 0.004 | 0.000 | 0.508 | 0.237 | 1.364 | 0.027 | 3.512 | 5.648 | 0.176 | 1.653 | 1.829 | 1.792 | 0.030 | 2.178 |
| 24TE1 | 5.668 | 2.332 | 0.000 | 0.038 | 0.508 | 0.231 | 1.308 | 0.039 | 3.491 | 5.615 | 0.169 | 1.649 | 1.818 | 1.766 | 0.023 | 2.211 |
| 24TE2 | 5.689 | 2.311 | 0.000 | 0.051 | 0.514 | 0.229 | 1.297 | 0.039 | 3.469 | 5.599 | 0.164 | 1.640 | 1.804 | 1.842 | 0.025 | 2.133 |
| 24TF1 | 5.711 | 2.289 | 0.000 | 0.039 | 0.464 | 0.243 | 1.377 | 0.045 | 3.461 | 5.629 | 0.172 | 1.647 | 1.819 | 1.929 | 0.020 | 2.051 |
| 24TF2 | 5.728 | 2.272 | 0.000 | 0.033 | 0.476 | 0.239 | 1.353 | 0.040 | 3.485 | 5.626 | 0.157 | 1.639 | 1.796 | 2.044 | 0.022 | 1.934 |
| 24TG1 | 5.683 | 2.317 | 0.000 | 0.033 | 0.539 | 0.235 | 1.336 | 0.021 | 3.417 | 5.582 | 0.152 | 1.653 | 1.805 | 1.713 | 0.028 | 2.259 |
| 24TG2 | 5.599 | 2.401 | 0.000 | 0.017 | 0.556 | 0.249 | 1.414 | 0.027 | 3.353 | 5.616 | 0.180 | 1.610 | 1.789 | 1.700 | 0.025 | 2.274 |
| 24TH1 | 5.661 | 2.339 | 0.000 | 0.039 | 0.517 | 0.245 | 1.386 | 0.035 | 3.377 | 5.599 | 0.177 | 1.648 | 1.825 | 1.833 | 0.030 | 2.137 |

**Appendix 4** Structural Formulas (in Atoms) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | Si | Al(iv) | $Fe^{3+}$(iv) | Al(vi) | Ti | $Fe^{3+}$ | $Fe^{2+}$ | $Mn^{2+}$ | Mg | Oct total | Na | K | Alk total | F | Cl | OH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 24TH2 | 5.654 | 2.346 | 0.000 | 0.025 | 0.536 | 0.250 | 1.417 | 0.030 | 3.322 | 5.579 | 0.180 | 1.661 | 1.841 | 1.685 | 0.028 | 2.288 |
| 24TK1 | 5.537 | 2.463 | 0.000 | 0.033 | 0.528 | 0.331 | 1.875 | 0.057 | 2.807 | 5.632 | 0.146 | 1.634 | 1.780 | 1.001 | 0.031 | 2.969 |
| 24TK2 | 5.633 | 2.352 | 0.015 | 0.000 | 0.519 | 0.281 | 1.674 | 0.048 | 3.076 | 5.596 | 0.172 | 1.684 | 1.856 | 1.649 | 0.025 | 2.326 |
| 24TL1 | 5.508 | 2.492 | 0.000 | 0.070 | 0.546 | 0.329 | 1.865 | 0.058 | 2.757 | 5.624 | 0.145 | 1.608 | 1.753 | 0.728 | 0.028 | 3.244 |
| 24TL2 | 5.615 | 2.385 | 0.000 | 0.040 | 0.528 | 0.285 | 1.616 | 0.053 | 3.110 | 5.631 | 0.136 | 1.606 | 1.742 | 1.585 | 0.025 | 2.389 |
| 24TM1 | 5.548 | 2.452 | 0.000 | 0.075 | 0.555 | 0.287 | 1.624 | 0.056 | 3.014 | 5.610 | 0.149 | 1.611 | 1.760 | 1.468 | 0.033 | 2.499 |
| 24TM2 | 5.632 | 2.368 | 0.000 | 0.013 | 0.508 | 0.294 | 1.666 | 0.053 | 3.087 | 5.621 | 0.176 | 1.628 | 1.804 | 1.517 | 0.023 | 2.460 |
| 24TN1 | 5.494 | 2.506 | 0.000 | 0.067 | 0.559 | 0.323 | 1.825 | 0.060 | 2.793 | 5.627 | 0.164 | 1.579 | 1.743 | 1.480 | 0.031 | 2.489 |
| 24TN2 | 5.662 | 2.338 | 0.000 | 0.069 | 0.518 | 0.260 | 1.477 | 0.038 | 3.214 | 5.576 | 0.168 | 1.653 | 1.820 | 2.023 | 0.023 | 1.955 |
| 24TR1 | 5.637 | 2.363 | 0.000 | 0.037 | 0.517 | 0.268 | 1.522 | 0.042 | 3.234 | 5.620 | 0.160 | 1.624 | 1.784 | 1.511 | 0.030 | 2.458 |
| 24TR2 | 5.647 | 2.353 | 0.000 | 0.043 | 0.524 | 0.246 | 1.398 | 0.041 | 3.357 | 5.609 | 0.172 | 1.626 | 1.798 | 1.560 | 0.025 | 2.414 |
| 24TU1 | 5.636 | 2.364 | 0.000 | 0.059 | 0.534 | 0.304 | 1.726 | 0.060 | 2.921 | 5.604 | 0.149 | 1.575 | 1.724 | 1.566 | 0.036 | 2.398 |
| 24TU2 | 5.704 | 2.296 | 0.000 | 0.062 | 0.495 | 0.293 | 1.664 | 0.057 | 2.996 | 5.568 | 0.169 | 1.646 | 1.816 | 1.689 | 0.025 | 2.286 |
| 24TV1 | 5.704 | 2.296 | 0.000 | 0.071 | 0.518 | 0.257 | 1.455 | 0.027 | 3.238 | 5.567 | 0.160 | 1.638 | 1.798 | 1.639 | 0.030 | 2.331 |
| 24TV2 | 5.749 | 2.251 | 0.000 | 0.071 | 0.510 | 0.271 | 1.536 | 0.035 | 3.146 | 5.570 | 0.168 | 1.580 | 1.748 | 1.730 | 0.030 | 2.240 |
| 24TW1 | 5.564 | 2.436 | 0.000 | 0.038 | 0.578 | 0.273 | 1.550 | 0.031 | 3.121 | 5.591 | 0.181 | 1.606 | 1.787 | 1.547 | 0.035 | 2.418 |
| 24TW2 | 5.577 | 2.423 | 0.000 | 0.048 | 0.561 | 0.265 | 1.500 | 0.036 | 3.194 | 5.604 | 0.173 | 1.607 | 1.780 | 1.661 | 0.030 | 2.309 |
| 44TA1 | 5.522 | 2.478 | 0.000 | 0.110 | 0.508 | 0.284 | 1.605 | 0.029 | 3.085 | 5.621 | 0.174 | 1.652 | 1.826 | 1.045 | 0.023 | 2.932 |
| 44TA2 | 5.506 | 2.494 | 0.000 | 0.088 | 0.495 | 0.281 | 1.591 | 0.028 | 3.157 | 5.640 | 0.158 | 1.698 | 1.855 | 1.319 | 0.026 | 2.656 |
| 44TB1 | 5.588 | 2.412 | 0.000 | 0.057 | 0.524 | 0.307 | 1.740 | 0.038 | 2.924 | 5.590 | 0.122 | 1.697 | 1.819 | 0.493 | 0.023 | 3.484 |
| 44TB2 | 5.624 | 2.376 | 0.000 | 0.096 | 0.502 | 0.298 | 1.686 | 0.038 | 2.985 | 5.604 | 0.116 | 1.655 | 1.771 | 0.628 | 0.023 | 3.349 |
| 44TC1 | 5.505 | 2.495 | 0.000 | 0.020 | 0.507 | 0.300 | 1.702 | 0.034 | 3.115 | 5.679 | 0.140 | 1.663 | 1.803 | 0.557 | 0.026 | 3.417 |
| 44TC2 | 5.492 | 2.497 | 0.011 | 0.000 | 0.502 | 0.304 | 1.786 | 0.033 | 3.044 | 5.669 | 0.182 | 1.681 | 1.863 | 0.929 | 0.026 | 3.045 |
| 44TD1 | 5.451 | 2.549 | 0.000 | 0.015 | 0.531 | 0.268 | 1.514 | 0.031 | 3.331 | 5.690 | 0.199 | 1.627 | 1.826 | 0.401 | 0.018 | 3.582 |
| 44TD2 | 5.481 | 2.519 | 0.000 | 0.102 | 0.510 | 0.273 | 1.543 | 0.027 | 3.196 | 5.651 | 0.192 | 1.630 | 1.822 | 0.948 | 0.013 | 3.040 |
| 44TE1 | 5.462 | 2.538 | 0.000 | 0.043 | 0.517 | 0.303 | 1.715 | 0.040 | 3.054 | 5.671 | 0.129 | 1.687 | 1.815 | 0.377 | 0.020 | 3.603 |
| 44TE2 | 5.492 | 2.508 | 0.000 | 0.025 | 0.517 | 0.298 | 1.691 | 0.037 | 3.087 | 5.655 | 0.152 | 1.689 | 1.841 | 0.698 | 0.023 | 3.279 |
| 44TF1 | 5.485 | 2.510 | 0.005 | 0.000 | 0.533 | 0.297 | 1.711 | 0.023 | 3.079 | 5.644 | 0.109 | 1.754 | 1.863 | 1.155 | 0.049 | 2.796 |
| 44TF2 | 5.518 | 2.482 | 0.000 | 0.044 | 0.514 | 0.262 | 1.486 | 0.020 | 3.298 | 5.625 | 0.115 | 1.783 | 1.898 | 1.274 | 0.050 | 2.675 |
| 44TH2 | 5.574 | 2.396 | 0.030 | 0.000 | 0.507 | 0.232 | 1.480 | 0.020 | 3.389 | 5.628 | 0.058 | 1.867 | 1.925 | 1.127 | 0.038 | 2.835 |
| 44TR1 | 5.546 | 2.454 | 0.000 | 0.065 | 0.506 | 0.295 | 1.671 | 0.034 | 3.050 | 5.621 | 0.124 | 1.716 | 1.840 | 0.670 | 0.015 | 3.315 |
| 44TR2 | 5.530 | 2.470 | 0.000 | 0.069 | 0.489 | 0.295 | 1.671 | 0.026 | 3.114 | 5.664 | 0.132 | 1.668 | 1.800 | 1.054 | 0.020 | 2.925 |
| 44TS1 | 5.506 | 2.494 | 0.000 | 0.001 | 0.523 | 0.295 | 1.674 | 0.036 | 3.110 | 5.639 | 0.142 | 1.732 | 1.874 | 0.481 | 0.026 | 3.493 |
| 44TS2 | 5.525 | 2.475 | 0.000 | 0.022 | 0.515 | 0.295 | 1.671 | 0.037 | 3.089 | 5.629 | 0.133 | 1.736 | 1.869 | 0.822 | 0.023 | 3.155 |
| 89T4A1 | 5.459 | 2.541 | 0.000 | 0.009 | 0.557 | 0.284 | 1.610 | 0.030 | 3.166 | 5.656 | 0.164 | 1.656 | 1.820 | 0.239 | 0.018 | 3.743 |
| 89T4A2 | 5.426 | 2.574 | 0.000 | 0.000 | 0.563 | 0.287 | 1.627 | 0.029 | 3.163 | 5.671 | 0.159 | 1.660 | 1.819 | 0.203 | 0.018 | 3.779 |
| 89T4B1 | 5.476 | 2.503 | 0.021 | 0.000 | 0.549 | 0.265 | 1.623 | 0.033 | 3.194 | 5.663 | 0.169 | 1.666 | 1.835 | 0.215 | 0.018 | 3.767 |
| 89T4B2 | 5.448 | 2.552 | 0.000 | 0.024 | 0.550 | 0.287 | 1.624 | 0.033 | 3.140 | 5.659 | 0.160 | 1.664 | 1.824 | 0.185 | 0.013 | 3.803 |
| 89T4D1 | 5.385 | 2.525 | 0.090 | 0.000 | 0.648 | 0.237 | 1.851 | 0.050 | 2.847 | 5.632 | 0.166 | 1.651 | 1.817 | 0.446 | 0.028 | 3.526 |
| 89T4D2 | 5.393 | 2.527 | 0.080 | 0.000 | 0.646 | 0.241 | 1.822 | 0.050 | 2.883 | 5.642 | 0.158 | 1.631 | 1.789 | 0.387 | 0.028 | 3.585 |
| 89T4E1 | 5.424 | 2.574 | 0.002 | 0.000 | 0.572 | 0.282 | 1.609 | 0.028 | 3.169 | 5.660 | 0.188 | 1.641 | 1.829 | 0.245 | 0.020 | 3.734 |
| 89T4E2 | 5.429 | 2.571 | 0.000 | 0.034 | 0.552 | 0.293 | 1.662 | 0.027 | 3.116 | 5.682 | 0.174 | 1.603 | 1.777 | 0.170 | 0.015 | 3.814 |
| 89T4F1 | 5.449 | 2.547 | 0.004 | 0.000 | 0.560 | 0.284 | 1.628 | 0.032 | 3.159 | 5.662 | 0.164 | 1.659 | 1.824 | 0.198 | 0.020 | 3.782 |
| 89T4F2 | 5.466 | 2.534 | 0.000 | 0.003 | 0.556 | 0.291 | 1.652 | 0.035 | 3.129 | 5.667 | 0.159 | 1.633 | 1.792 | 0.226 | 0.023 | 3.751 |
| 89T4G1 | 5.476 | 2.505 | 0.018 | 0.000 | 0.544 | 0.264 | 1.597 | 0.026 | 3.231 | 5.663 | 0.163 | 1.683 | 1.846 | 0.257 | 0.015 | 3.728 |

**Appendix 4** Structural Formulas (in Atoms) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | Si | Al(iv) | $Fe^{3+}$(iv) | Al(vi) | Ti | $Fe^{3+}$ | $Fe^{2+}$ | $Mn^{2+}$ | Mg | Oct total | Na | K | Alk total | F | Cl | OH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 89T4G2 | 5.424 | 2.573 | 0.003 | 0.000 | 0.561 | 0.286 | 1.633 | 0.030 | 3.170 | 5.680 | 0.173 | 1.636 | 1.810 | 0.236 | 0.015 | 3.749 |
| 89T4H1 | 5.421 | 2.563 | 0.016 | 0.000 | 0.595 | 0.263 | 1.583 | 0.024 | 3.209 | 5.674 | 0.170 | 1.608 | 1.778 | 0.363 | 0.018 | 3.620 |
| 89T4H2 | 5.471 | 2.522 | 0.006 | 0.000 | 0.570 | 0.263 | 1.528 | 0.029 | 3.255 | 5.645 | 0.192 | 1.642 | 1.834 | 0.206 | 0.013 | 3.781 |
| 89T4J1 | 5.391 | 2.609 | 0.000 | 0.011 | 0.600 | 0.282 | 1.597 | 0.027 | 3.154 | 5.670 | 0.182 | 1.594 | 1.777 | 0.184 | 0.015 | 3.801 |
| 89T4J2 | 5.397 | 2.603 | 0.000 | 0.008 | 0.576 | 0.277 | 1.573 | 0.023 | 3.220 | 5.676 | 0.196 | 1.619 | 1.815 | 0.202 | 0.015 | 3.783 |
| 89T4K1 | 5.423 | 2.577 | 0.000 | 0.013 | 0.570 | 0.282 | 1.596 | 0.027 | 3.182 | 5.670 | 0.166 | 1.636 | 1.802 | 0.195 | 0.020 | 3.784 |
| 89T4K2 | 5.474 | 2.521 | 0.005 | 0.000 | 0.544 | 0.273 | 1.581 | 0.029 | 3.246 | 5.673 | 0.175 | 1.643 | 1.818 | 0.225 | 0.020 | 3.755 |
| 89T4L1 | 5.385 | 2.594 | 0.021 | 0.000 | 0.581 | 0.282 | 1.720 | 0.030 | 3.083 | 5.697 | 0.177 | 1.601 | 1.778 | 0.327 | 0.020 | 3.652 |
| 89T4L2 | 5.433 | 2.554 | 0.013 | 0.000 | 0.569 | 0.287 | 1.698 | 0.033 | 3.073 | 5.661 | 0.167 | 1.653 | 1.820 | 0.330 | 0.020 | 3.650 |
| 89T4M1 | 5.449 | 2.519 | 0.032 | 0.000 | 0.555 | 0.251 | 1.604 | 0.031 | 3.243 | 5.685 | 0.167 | 1.652 | 1.819 | 0.192 | 0.013 | 3.795 |
| 89T4M2 | 5.466 | 2.499 | 0.035 | 0.000 | 0.576 | 0.244 | 1.576 | 0.030 | 3.245 | 5.671 | 0.169 | 1.628 | 1.797 | 0.219 | 0.020 | 3.761 |
| 89TA1 | 5.459 | 2.541 | 0.000 | 0.009 | 0.557 | 0.284 | 1.610 | 0.030 | 3.166 | 5.656 | 0.164 | 1.656 | 1.820 | 0.239 | 0.018 | 3.743 |
| 89TA2 | 5.426 | 2.574 | 0.000 | 0.000 | 0.563 | 0.287 | 1.627 | 0.029 | 3.163 | 5.671 | 0.159 | 1.660 | 1.819 | 0.203 | 0.018 | 3.779 |
| 89TB1 | 5.476 | 2.503 | 0.021 | 0.000 | 0.549 | 0.265 | 1.623 | 0.033 | 3.194 | 5.663 | 0.169 | 1.666 | 1.835 | 0.215 | 0.018 | 3.767 |
| 89TB2 | 5.448 | 2.552 | 0.000 | 0.024 | 0.550 | 0.287 | 1.624 | 0.033 | 3.140 | 5.659 | 0.160 | 1.664 | 1.824 | 0.185 | 0.013 | 3.803 |
| 89TD1 | 5.385 | 2.525 | 0.090 | 0.000 | 0.648 | 0.237 | 1.851 | 0.050 | 2.847 | 5.632 | 0.166 | 1.651 | 1.817 | 0.446 | 0.028 | 3.526 |
| 89TD2 | 5.393 | 2.527 | 0.080 | 0.000 | 0.646 | 0.241 | 1.822 | 0.050 | 2.883 | 5.642 | 0.158 | 1.631 | 1.789 | 0.387 | 0.028 | 3.585 |
| 89TE1 | 5.424 | 2.574 | 0.002 | 0.000 | 0.572 | 0.282 | 1.609 | 0.028 | 3.169 | 5.660 | 0.188 | 1.641 | 1.829 | 0.245 | 0.020 | 3.734 |
| 89TE2 | 5.429 | 2.571 | 0.000 | 0.034 | 0.552 | 0.293 | 1.662 | 0.027 | 3.116 | 5.682 | 0.174 | 1.603 | 1.777 | 0.170 | 0.015 | 3.814 |
| 89TF1 | 5.449 | 2.547 | 0.004 | 0.000 | 0.560 | 0.284 | 1.628 | 0.032 | 3.159 | 5.662 | 0.164 | 1.659 | 1.824 | 0.198 | 0.020 | 3.782 |
| 89TF2 | 5.466 | 2.534 | 0.000 | 0.003 | 0.556 | 0.291 | 1.652 | 0.035 | 3.129 | 5.667 | 0.159 | 1.633 | 1.792 | 0.226 | 0.023 | 3.751 |
| 89TG1 | 5.476 | 2.505 | 0.018 | 0.000 | 0.544 | 0.264 | 1.597 | 0.026 | 3.231 | 5.663 | 0.163 | 1.683 | 1.846 | 0.257 | 0.015 | 3.728 |
| 89TG2 | 5.424 | 2.573 | 0.003 | 0.000 | 0.561 | 0.286 | 1.633 | 0.030 | 3.170 | 5.680 | 0.173 | 1.636 | 1.810 | 0.236 | 0.015 | 3.749 |
| 89TH1 | 5.421 | 2.563 | 0.016 | 0.000 | 0.595 | 0.263 | 1.583 | 0.024 | 3.209 | 5.674 | 0.170 | 1.608 | 1.778 | 0.363 | 0.018 | 3.620 |
| 89TH2 | 5.471 | 2.522 | 0.006 | 0.000 | 0.570 | 0.263 | 1.528 | 0.029 | 3.255 | 5.645 | 0.192 | 1.642 | 1.834 | 0.206 | 0.013 | 3.781 |
| 89TJ1 | 5.391 | 2.609 | 0.000 | 0.011 | 0.600 | 0.282 | 1.597 | 0.027 | 3.154 | 5.670 | 0.182 | 1.594 | 1.777 | 0.184 | 0.015 | 3.801 |
| 89TJ2 | 5.397 | 2.603 | 0.000 | 0.008 | 0.576 | 0.277 | 1.573 | 0.023 | 3.220 | 5.676 | 0.196 | 1.619 | 1.815 | 0.202 | 0.015 | 3.783 |
| 89TK1 | 5.423 | 2.577 | 0.000 | 0.013 | 0.570 | 0.282 | 1.596 | 0.027 | 3.182 | 5.670 | 0.166 | 1.636 | 1.802 | 0.195 | 0.020 | 3.784 |
| 89TK2 | 5.474 | 2.521 | 0.005 | 0.000 | 0.544 | 0.273 | 1.581 | 0.029 | 3.246 | 5.673 | 0.175 | 1.643 | 1.818 | 0.225 | 0.020 | 3.755 |
| 89TL1 | 5.385 | 2.594 | 0.021 | 0.000 | 0.581 | 0.282 | 1.720 | 0.030 | 3.083 | 5.697 | 0.177 | 1.601 | 1.778 | 0.327 | 0.020 | 3.652 |
| 89TL2 | 5.433 | 2.554 | 0.013 | 0.000 | 0.569 | 0.287 | 1.698 | 0.033 | 3.073 | 5.661 | 0.167 | 1.653 | 1.820 | 0.330 | 0.020 | 3.650 |
| 89TM1 | 5.449 | 2.519 | 0.032 | 0.000 | 0.555 | 0.251 | 1.604 | 0.031 | 3.243 | 5.685 | 0.167 | 1.652 | 1.819 | 0.192 | 0.013 | 3.795 |
| 89TM2 | 5.466 | 2.499 | 0.035 | 0.000 | 0.576 | 0.244 | 1.576 | 0.030 | 3.245 | 5.671 | 0.169 | 1.628 | 1.797 | 0.219 | 0.020 | 3.761 |
| 913TC1 | 5.399 | 2.432 | 0.168 | 0.000 | 0.631 | 0.211 | 2.152 | 0.040 | 2.585 | 5.618 | 0.184 | 1.707 | 1.891 | 0.510 | 0.020 | 3.470 |
| 913TD1 | 5.547 | 2.371 | 0.082 | 0.000 | 0.585 | 0.260 | 1.939 | 0.043 | 2.746 | 5.573 | 0.193 | 1.685 | 1.879 | 0.188 | 0.020 | 3.791 |
| 913TE1 | 5.544 | 2.379 | 0.077 | 0.000 | 0.592 | 0.360 | 2.481 | 0.032 | 2.072 | 5.537 | 0.205 | 1.633 | 1.837 | 0.271 | 0.026 | 3.703 |
| 919TB1 | 5.597 | 2.359 | 0.044 | 0.000 | 0.444 | 0.279 | 1.832 | 0.082 | 3.039 | 5.677 | 0.144 | 1.737 | 1.881 | 0.348 | 0.030 | 3.621 |
| 919TB2 | 5.646 | 2.354 | 0.000 | 0.033 | 0.445 | 0.316 | 1.794 | 0.080 | 2.966 | 5.635 | 0.138 | 1.706 | 1.845 | 0.573 | 0.030 | 3.397 |
| 919TG1 | 5.552 | 2.448 | 0.000 | 0.010 | 0.547 | 0.321 | 1.821 | 0.048 | 2.913 | 5.660 | 0.122 | 1.583 | 1.705 | 0.526 | 0.030 | 3.444 |
| 919TG2 | 5.542 | 2.458 | 0.000 | 0.020 | 0.542 | 0.330 | 1.866 | 0.050 | 2.869 | 5.678 | 0.123 | 1.546 | 1.669 | 0.592 | 0.031 | 3.377 |
| 919TM1 | 5.626 | 2.359 | 0.016 | 0.000 | 0.461 | 0.300 | 1.787 | 0.079 | 3.032 | 5.660 | 0.136 | 1.697 | 1.833 | 0.541 | 0.025 | 3.434 |
| 919TM2 | 5.605 | 2.395 | 0.000 | 0.003 | 0.470 | 0.315 | 1.788 | 0.073 | 3.021 | 5.670 | 0.135 | 1.661 | 1.797 | 0.385 | 0.025 | 3.590 |
| 919TM3 | 5.661 | 2.339 | 0.000 | 0.022 | 0.441 | 0.315 | 1.789 | 0.080 | 3.029 | 5.675 | 0.142 | 1.628 | 1.769 | 0.349 | 0.025 | 3.626 |
| 919TM4 | 5.633 | 2.367 | 0.000 | 0.004 | 0.458 | 0.319 | 1.809 | 0.083 | 2.998 | 5.672 | 0.136 | 1.649 | 1.784 | 0.358 | 0.025 | 3.617 |
| 920TA2 | 5.590 | 2.367 | 0.043 | 0.000 | 0.489 | 0.326 | 2.084 | 0.053 | 2.672 | 5.623 | 0.148 | 1.714 | 1.862 | 0.318 | 0.049 | 3.633 |

**Appendix 4** Structural Formulas (in Atoms) of Biotite in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Probe sample no. | Si | Al(iv) | $Fe^{3+}$(iv) | Al(vi) | Ti | $Fe^{3+}$ | $Fe^{2+}$ | $Mn^{2+}$ | Mg | Oct total | Na | K | Alk total | F | Cl | OH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 920TAE1 | 5.721 | 2.279 | 0.000 | 0.085 | 0.446 | 0.356 | 2.021 | 0.046 | 2.664 | 5.618 | 0.135 | 1.576 | 1.710 | 0.343 | 0.046 | 3.611 |
| 920TAE2 | 5.655 | 2.301 | 0.044 | 0.000 | 0.465 | 0.315 | 2.034 | 0.060 | 2.781 | 5.655 | 0.139 | 1.650 | 1.789 | 0.318 | 0.048 | 3.634 |
| 920TE1 | 5.423 | 2.562 | 0.014 | 0.000 | 0.536 | 0.307 | 1.822 | 0.046 | 2.974 | 5.685 | 0.150 | 1.676 | 1.826 | 0.346 | 0.026 | 3.628 |
| 920TE2 | 5.507 | 2.493 | 0.000 | 0.026 | 0.506 | 0.311 | 1.762 | 0.045 | 3.061 | 5.711 | 0.140 | 1.583 | 1.723 | 0.238 | 0.023 | 3.739 |
| 920TF1 | 5.588 | 2.403 | 0.009 | 0.000 | 0.490 | 0.356 | 2.069 | 0.050 | 2.729 | 5.694 | 0.130 | 1.557 | 1.687 | 0.274 | 0.046 | 3.680 |
| 920TF2 | 5.522 | 2.423 | 0.055 | 0.000 | 0.505 | 0.325 | 2.155 | 0.057 | 2.599 | 5.641 | 0.168 | 1.694 | 1.861 | 0.461 | 0.051 | 3.488 |
| 920TG1 | 5.531 | 2.406 | 0.063 | 0.000 | 0.503 | 0.308 | 2.103 | 0.059 | 2.676 | 5.650 | 0.151 | 1.704 | 1.855 | 0.350 | 0.056 | 3.595 |
| 920TG2 | 5.594 | 2.403 | 0.003 | 0.000 | 0.476 | 0.360 | 2.061 | 0.052 | 2.681 | 5.630 | 0.151 | 1.684 | 1.835 | 0.303 | 0.053 | 3.644 |
| 920TN2 | 5.539 | 2.453 | 0.008 | 0.000 | 0.499 | 0.368 | 2.133 | 0.053 | 2.623 | 5.676 | 0.139 | 1.603 | 1.742 | 0.289 | 0.057 | 3.654 |
| 920TQ1 | 5.435 | 2.512 | 0.053 | 0.000 | 0.514 | 0.334 | 2.188 | 0.064 | 2.573 | 5.673 | 0.141 | 1.716 | 1.857 | 0.225 | 0.054 | 3.722 |
| 920TQ2 | 5.576 | 2.389 | 0.035 | 0.000 | 0.482 | 0.345 | 2.151 | 0.053 | 2.606 | 5.638 | 0.154 | 1.686 | 1.840 | 0.355 | 0.051 | 3.594 |
| 920TS1 | 5.434 | 2.543 | 0.024 | 0.000 | 0.532 | 0.300 | 1.833 | 0.046 | 2.954 | 5.664 | 0.154 | 1.719 | 1.873 | 0.285 | 0.036 | 3.679 |
| 920TS2 | 5.449 | 2.520 | 0.032 | 0.000 | 0.527 | 0.288 | 1.810 | 0.054 | 3.002 | 5.682 | 0.148 | 1.699 | 1.847 | 0.213 | 0.030 | 3.757 |
| 920TT1 | 5.531 | 2.469 | 0.000 | 0.055 | 0.492 | 0.379 | 2.146 | 0.057 | 2.512 | 5.641 | 0.139 | 1.631 | 1.770 | 0.274 | 0.057 | 3.669 |
| 920TT2 | 5.442 | 2.515 | 0.043 | 0.000 | 0.514 | 0.349 | 2.218 | 0.050 | 2.556 | 5.687 | 0.157 | 1.650 | 1.807 | 0.256 | 0.054 | 3.690 |
| 921T1 | 5.573 | 2.381 | 0.045 | 0.000 | 0.535 | 0.261 | 1.736 | 0.025 | 3.063 | 5.620 | 0.140 | 1.715 | 1.856 | 0.266 | 0.033 | 3.701 |
| 921T2 | 5.565 | 2.374 | 0.061 | 0.000 | 0.525 | 0.247 | 1.748 | 0.020 | 3.100 | 5.640 | 0.149 | 1.709 | 1.858 | 0.239 | 0.038 | 3.724 |
| 921TAC1 | 5.555 | 2.408 | 0.037 | 0.000 | 0.513 | 0.272 | 1.753 | 0.023 | 3.085 | 5.646 | 0.123 | 1.732 | 1.856 | 0.257 | 0.033 | 3.710 |
| 921TAC2 | 5.489 | 2.479 | 0.032 | 0.000 | 0.532 | 0.284 | 1.787 | 0.027 | 3.029 | 5.658 | 0.139 | 1.708 | 1.847 | 0.293 | 0.033 | 3.674 |
| 921TK1 | 5.551 | 2.418 | 0.031 | 0.000 | 0.565 | 0.282 | 1.767 | 0.016 | 2.990 | 5.621 | 0.125 | 1.670 | 1.795 | 0.232 | 0.036 | 3.732 |
| 921TK2 | 5.570 | 2.395 | 0.035 | 0.000 | 0.537 | 0.270 | 1.732 | 0.029 | 3.051 | 5.619 | 0.145 | 1.705 | 1.849 | 0.255 | 0.033 | 3.712 |
| 921TL1 | 5.588 | 2.356 | 0.056 | 0.000 | 0.528 | 0.249 | 1.727 | 0.025 | 3.098 | 5.627 | 0.142 | 1.711 | 1.853 | 0.240 | 0.033 | 3.727 |
| 921TL2 | 5.599 | 2.355 | 0.046 | 0.000 | 0.522 | 0.259 | 1.734 | 0.026 | 3.093 | 5.635 | 0.150 | 1.678 | 1.828 | 0.244 | 0.033 | 3.723 |
| 921TM1 | 5.455 | 2.545 | 0.000 | 0.005 | 0.488 | 0.314 | 1.783 | 0.023 | 3.072 | 5.685 | 0.144 | 1.735 | 1.879 | 0.253 | 0.013 | 3.734 |
| 921TM2 | 5.466 | 2.517 | 0.017 | 0.000 | 0.516 | 0.298 | 1.788 | 0.028 | 3.032 | 5.663 | 0.139 | 1.738 | 1.877 | 0.250 | 0.020 | 3.730 |
| 921TN1 | 5.522 | 2.455 | 0.023 | 0.000 | 0.520 | 0.290 | 1.778 | 0.026 | 3.043 | 5.658 | 0.136 | 1.695 | 1.831 | 0.240 | 0.030 | 3.730 |
| 921TN2 | 5.481 | 2.477 | 0.043 | 0.000 | 0.545 | 0.269 | 1.767 | 0.025 | 3.046 | 5.653 | 0.141 | 1.712 | 1.853 | 0.226 | 0.035 | 3.739 |
| 921TP1 | 5.516 | 2.446 | 0.038 | 0.000 | 0.536 | 0.278 | 1.788 | 0.025 | 3.025 | 5.652 | 0.147 | 1.684 | 1.831 | 0.278 | 0.035 | 3.687 |
| 921TP2 | 5.520 | 2.448 | 0.032 | 0.000 | 0.519 | 0.279 | 1.760 | 0.024 | 3.084 | 5.665 | 0.141 | 1.692 | 1.833 | 0.268 | 0.033 | 3.699 |
| 921TU1 | 5.708 | 2.292 | 0.000 | 0.087 | 0.503 | 0.300 | 1.698 | 0.018 | 2.933 | 5.539 | 0.156 | 1.666 | 1.822 | 0.216 | 0.038 | 3.746 |
| 921TV1 | 5.547 | 2.423 | 0.030 | 0.000 | 0.511 | 0.289 | 1.809 | 0.031 | 2.991 | 5.632 | 0.153 | 1.725 | 1.878 | 0.263 | 0.033 | 3.704 |
| 921TV2 | 5.521 | 2.422 | 0.057 | 0.000 | 0.534 | 0.267 | 1.829 | 0.026 | 2.984 | 5.641 | 0.144 | 1.718 | 1.862 | 0.235 | 0.035 | 3.730 |
| 959TA1 | 5.455 | 2.545 | 0.000 | 0.213 | 0.591 | 0.359 | 2.037 | 0.022 | 2.304 | 5.526 | 0.134 | 1.603 | 1.737 | 1.301 | 0.033 | 2.666 |
| 959TA2 | 5.410 | 2.590 | 0.000 | 0.281 | 0.582 | 0.352 | 1.994 | 0.018 | 2.310 | 5.537 | 0.154 | 1.564 | 1.718 | 1.129 | 0.036 | 2.835 |
| 959TD1 | 5.626 | 2.374 | 0.000 | 0.775 | 0.491 | 0.321 | 1.818 | 0.021 | 1.927 | 5.354 | 0.130 | 1.459 | 1.589 | 1.016 | 0.048 | 2.936 |
| 959TD2 | 5.609 | 2.391 | 0.000 | 0.600 | 0.506 | 0.225 | 1.276 | 0.015 | 2.835 | 5.457 | 0.110 | 1.530 | 1.640 | 1.463 | 0.049 | 2.488 |
| 959TG1 | 5.497 | 2.503 | 0.000 | 0.220 | 0.528 | 0.342 | 1.937 | 0.027 | 2.510 | 5.564 | 0.162 | 1.596 | 1.758 | 1.519 | 0.048 | 2.433 |
| 959TH1 | 5.449 | 2.551 | 0.000 | 0.074 | 0.614 | 0.279 | 1.582 | 0.010 | 3.015 | 5.574 | 0.175 | 1.648 | 1.823 | 1.912 | 0.048 | 2.039 |
| 959TH2 | 5.465 | 2.535 | 0.000 | 0.077 | 0.593 | 0.286 | 1.622 | 0.015 | 2.988 | 5.581 | 0.169 | 1.657 | 1.826 | 2.023 | 0.046 | 1.931 |
| 959TL1 | 5.528 | 2.472 | 0.000 | 0.330 | 0.543 | 0.395 | 2.242 | 0.026 | 1.934 | 5.471 | 0.108 | 1.609 | 1.717 | 0.945 | 0.041 | 3.014 |
| 959TL2 | 5.555 | 2.445 | 0.000 | 0.419 | 0.534 | 0.375 | 2.127 | 0.020 | 1.967 | 5.442 | 0.125 | 1.574 | 1.699 | 1.051 | 0.041 | 2.908 |
| 959TM1 | 5.655 | 2.345 | 0.000 | 0.639 | 0.495 | 0.267 | 1.511 | 0.019 | 2.451 | 5.382 | 0.125 | 1.560 | 1.685 | 1.326 | 0.055 | 2.619 |
| 959TM2 | 5.501 | 2.499 | 0.000 | 0.259 | 0.587 | 0.310 | 1.755 | 0.017 | 2.552 | 5.479 | 0.116 | 1.681 | 1.797 | 1.356 | 0.053 | 2.591 |
| 959TQ1 | 5.562 | 2.438 | 0.000 | 0.370 | 0.594 | 0.230 | 1.304 | 0.016 | 2.927 | 5.441 | 0.152 | 1.616 | 1.768 | 1.984 | 0.068 | 1.949 |
| 959TQ2 | 5.484 | 2.516 | 0.000 | 0.245 | 0.661 | 0.238 | 1.349 | 0.011 | 2.970 | 5.473 | 0.130 | 1.635 | 1.766 | 1.821 | 0.047 | 2.132 |
| 959TR1 | 5.684 | 2.316 | 0.000 | 0.479 | 0.456 | 0.256 | 1.450 | 0.022 | 2.814 | 5.478 | 0.128 | 1.585 | 1.714 | 1.760 | 0.050 | 2.190 |

**Appendix 5.** Compositions (in Weight Percent) of Amphiboles in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.

| Original sample no. | Unit | Probe sample no. | F | $Na_2O$ | Cl | $K_2O$ | MgO | CaO | $TiO_2$ | NiO | $Al_2O_3$ | $SiO_2$ | MnO | FeO | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-6 | Bates Mountain Tuff | 06HF1 | 0.33 | 2.28 | 0.06 | 0.82 | 10.79 | 11.36 | 2.69 | 0.00 | 11.66 | 42.69 | 0.43 | 16.87 | 99.98 |
| DRS-91-6 | Bates Mountain Tuff | 06HF2 | 0.09 | 2.32 | 0.06 | 0.76 | 10.90 | 11.43 | 2.56 | 0.00 | 11.31 | 43.64 | 0.42 | 16.37 | 99.85 |
| DRS-91-6 | Bates Mountain Tuff | 06HF3 | 0.10 | 2.13 | 0.07 | 0.77 | 10.78 | 11.31 | 2.30 | 0.02 | 10.84 | 43.31 | 0.43 | 16.85 | 98.90 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HAB1 | 0.31 | 2.53 | 0.04 | 0.74 | 12.06 | 11.27 | 2.61 | 0.00 | 11.70 | 42.21 | 0.26 | 13.65 | 97.38 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HAB2 | 0.28 | 2.54 | 0.02 | 0.77 | 12.60 | 11.18 | 2.58 | 0.03 | 11.41 | 42.18 | 0.17 | 13.09 | 96.85 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HE1 | 0.20 | 2.33 | 0.04 | 0.97 | 13.98 | 10.98 | 2.64 | 0.04 | 10.55 | 42.91 | 0.34 | 11.75 | 96.72 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HE2 | 0.33 | 2.33 | 0.04 | 0.95 | 14.17 | 10.96 | 2.41 | 0.00 | 10.33 | 43.29 | 0.33 | 11.73 | 96.85 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HF1 | 0.35 | 1.57 | 0.11 | 0.58 | 12.38 | 10.67 | 0.96 | 0.00 | 6.06 | 47.19 | 0.80 | 16.56 | 97.22 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HF2 | 0.35 | 1.42 | 0.09 | 0.53 | 12.82 | 10.65 | 0.77 | 0.00 | 5.62 | 48.37 | 0.84 | 16.53 | 97.98 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HH1 | 0.34 | 1.69 | 0.11 | 0.70 | 11.40 | 10.42 | 1.19 | 0.00 | 6.71 | 46.36 | 0.97 | 17.54 | 97.42 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HH2 | 0.39 | 1.66 | 0.11 | 0.61 | 11.70 | 10.51 | 1.20 | 0.00 | 6.36 | 46.79 | 1.05 | 17.64 | 98.02 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HQ1 | 0.25 | 2.35 | 0.02 | 0.98 | 14.06 | 11.10 | 2.86 | 0.00 | 10.33 | 42.62 | 0.30 | 11.68 | 96.57 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HQ2 | 0.27 | 2.33 | 0.04 | 0.98 | 14.11 | 11.21 | 2.73 | 0.00 | 10.23 | 42.69 | 0.35 | 11.72 | 96.67 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HS1 | 0.52 | 1.70 | 0.10 | 0.63 | 12.19 | 10.63 | 1.20 | 0.00 | 6.56 | 46.73 | 1.02 | 16.62 | 97.87 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HS2 | 0.31 | 1.67 | 0.10 | 0.62 | 12.17 | 10.57 | 1.27 | 0.00 | 6.27 | 46.54 | 1.00 | 16.40 | 96.93 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HW1 | 0.37 | 1.69 | 0.12 | 0.62 | 11.82 | 10.48 | 1.21 | 0.00 | 6.47 | 46.55 | 1.00 | 17.02 | 97.34 |
| DRS-91-169 | Tuff of Mount Jefferson | 169HW2 | 0.40 | 1.58 | 0.11 | 0.67 | 11.73 | 10.42 | 1.22 | 0.00 | 6.40 | 46.20 | 1.00 | 17.09 | 96.80 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HA1 | 0.00 | 1.50 | 0.00 | 0.59 | 11.78 | 10.68 | 1.16 | 0.00 | 6.57 | 47.13 | 0.76 | 17.99 | 98.16 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HA2 | 0.00 | 1.56 | 0.00 | 0.63 | 12.01 | 10.73 | 1.13 | 0.00 | 6.41 | 47.36 | 0.82 | 17.59 | 98.24 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HA3 | 0.00 | 1.51 | 0.00 | 0.67 | 11.27 | 10.59 | 1.29 | 0.00 | 7.08 | 46.97 | 0.00 | 18.17 | 97.54 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HA4 | 0.00 | 1.46 | 0.00 | 0.57 | 11.47 | 10.46 | 1.24 | 0.00 | 6.53 | 47.06 | 0.86 | 18.21 | 97.86 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HAE1 | 0.00 | 2.06 | 0.00 | 0.98 | 13.67 | 11.21 | 2.33 | 0.00 | 10.89 | 43.57 | 0.32 | 12.73 | 97.77 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HAF1h | 0.00 | 1.37 | 0.00 | 0.54 | 12.37 | 10.60 | 1.18 | 0.00 | 6.21 | 48.38 | 0.84 | 16.57 | 98.07 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HAF2h | 0.00 | 1.34 | 0.00 | 0.50 | 12.81 | 10.63 | 1.05 | 0.00 | 5.69 | 48.21 | 0.96 | 16.37 | 97.55 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HB1 | 0.00 | 2.24 | 0.00 | 0.93 | 13.71 | 11.43 | 3.11 | 0.00 | 12.57 | 42.35 | 0.07 | 11.31 | 97.72 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HB2 | 0.00 | 2.23 | 0.00 | 0.93 | 13.37 | 11.30 | 3.29 | 0.00 | 12.37 | 41.79 | 0.16 | 11.84 | 97.29 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HG1 | 0.00 | 1.81 | 0.00 | 0.76 | 11.19 | 10.55 | 1.33 | 0.00 | 8.23 | 45.45 | 0.95 | 17.45 | 97.73 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HG2 | 0.00 | 1.46 | 0.00 | 0.57 | 12.52 | 10.49 | 1.05 | 0.00 | 6.25 | 48.45 | 0.95 | 16.74 | 98.49 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HG2r | 0.00 | 1.52 | 0.00 | 0.56 | 12.46 | 10.46 | 1.00 | 0.00 | 6.36 | 47.83 | 0.99 | 16.77 | 97.95 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HG3 | 0.00 | 1.73 | 0.00 | 0.65 | 10.99 | 10.42 | 1.61 | 0.00 | 8.42 | 45.87 | 0.92 | 17.59 | 98.19 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HH1 | 0.00 | 1.89 | 0.00 | 0.80 | 11.17 | 10.69 | 1.46 | 0.00 | 8.99 | 44.77 | 0.71 | 17.27 | 97.76 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HH2 | 0.00 | 2.14 | 0.00 | 0.77 | 10.67 | 10.81 | 2.18 | 0.00 | 11.45 | 42.38 | 0.61 | 16.52 | 97.51 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HH2r | 0.00 | 2.18 | 0.00 | 0.74 | 10.60 | 10.89 | 2.33 | 0.00 | 11.42 | 43.03 | 0.56 | 16.30 | 98.05 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HH3 | 0.00 | 1.62 | 0.00 | 0.69 | 10.96 | 10.48 | 1.26 | 0.00 | 8.26 | 45.85 | 0.79 | 18.21 | 98.12 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HK1 | 0.00 | 1.57 | 0.00 | 0.67 | 11.98 | 10.70 | 1.31 | 0.00 | 7.37 | 46.44 | 1.01 | 16.73 | 97.80 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HK2 | 0.00 | 1.47 | 0.00 | 0.59 | 13.61 | 10.93 | 1.30 | 0.00 | 6.19 | 48.17 | 0.91 | 14.97 | 98.13 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HP1 | 0.00 | 1.76 | 0.00 | 0.74 | 11.26 | 10.82 | 1.56 | 0.00 | 8.10 | 45.16 | 0.91 | 17.70 | 98.00 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HT1 | 0.00 | 1.49 | 0.00 | 0.63 | 12.42 | 10.65 | 1.26 | 0.00 | 6.43 | 47.78 | 0.95 | 16.73 | 98.33 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HV1 | 0.00 | 1.53 | 0.00 | 0.61 | 11.71 | 10.40 | 1.11 | 0.00 | 6.55 | 47.44 | 1.05 | 18.35 | 98.74 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HW1 | 0.00 | 2.19 | 0.00 | 1.02 | 13.46 | 11.19 | 2.77 | 0.00 | 11.24 | 43.27 | 0.37 | 12.75 | 98.27 |
| DRS-85-197 | Tuff of Mount Jefferson | 197HW2 | 0.00 | 2.24 | 0.00 | 0.98 | 13.58 | 11.29 | 2.97 | 0.00 | 11.49 | 42.67 | 0.25 | 12.35 | 97.81 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAA1 | 0.00 | 1.40 | 0.00 | 0.59 | 12.95 | 10.86 | 1.27 | 0.00 | 6.11 | 48.26 | 0.90 | 16.37 | 98.71 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAA2 | 0.00 | 1.42 | 0.00 | 0.63 | 12.75 | 10.90 | 1.33 | 0.00 | 6.39 | 48.37 | 0.97 | 16.77 | 99.53 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAG1 | 0.00 | 2.16 | 0.00 | 1.02 | 14.01 | 11.26 | 2.91 | 0.00 | 10.13 | 43.86 | 0.22 | 12.35 | 97.93 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAG2 | 0.00 | 2.16 | 0.00 | 1.01 | 13.98 | 11.02 | 3.22 | 0.00 | 10.21 | 44.15 | 0.22 | 11.92 | 97.89 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAJ1 | 0.00 | 1.94 | 0.00 | 0.84 | 10.25 | 10.52 | 1.73 | 0.00 | 9.23 | 44.08 | 0.87 | 18.16 | 97.61 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAJ2 | 0.00 | 1.61 | 0.00 | 0.67 | 11.97 | 10.56 | 1.16 | 0.00 | 6.90 | 47.13 | 0.87 | 17.46 | 98.33 |

**Appendix 5.** Compositions (in Weight Percent) of Amphiboles in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | F | $Na_2O$ | Cl | $K_2O$ | MgO | CaO | $TiO_2$ | NiO | $Al_2O_3$ | $SiO_2$ | MnO | FeO | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-85-199 | Tuff of Mount Jefferson | 199HAJ3 | 0.00 | 2.06 | 0.00 | 0.92 | 9.73 | 10.85 | 2.11 | 0.00 | 10.42 | 42.72 | 0.78 | 18.95 | 98.55 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAK1 | 0.00 | 1.45 | 0.00 | 0.59 | 12.76 | 10.76 | 1.08 | 0.00 | 5.87 | 47.96 | 0.94 | 16.60 | 98.02 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAK2 | 0.00 | 1.44 | 0.00 | 0.59 | 12.63 | 10.73 | 1.13 | 0.00 | 5.91 | 47.68 | 0.85 | 16.45 | 97.42 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HD1 | 0.00 | 2.27 | 0.00 | 0.92 | 13.50 | 10.99 | 2.59 | 0.00 | 11.63 | 41.72 | 0.24 | 13.40 | 97.26 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HG1 | 0.00 | 1.42 | 0.00 | 0.57 | 12.27 | 10.53 | 1.16 | 0.00 | 6.19 | 46.75 | 0.93 | 17.45 | 97.27 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HG2 | 0.00 | 1.47 | 0.00 | 0.58 | 12.48 | 10.46 | 1.21 | 0.00 | 6.12 | 46.67 | 1.01 | 16.91 | 96.90 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HJ1 | 0.00 | 1.44 | 0.00 | 0.63 | 12.46 | 10.76 | 1.31 | 0.00 | 6.31 | 45.84 | 0.96 | 16.75 | 96.46 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HJ2 | 0.00 | 1.40 | 0.00 | 0.62 | 12.82 | 10.69 | 1.06 | 0.00 | 6.07 | 46.25 | 0.94 | 16.28 | 96.12 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HK1 | 0.00 | 1.41 | 0.00 | 0.62 | 12.41 | 10.63 | 1.18 | 0.00 | 6.28 | 46.12 | 1.04 | 16.55 | 96.25 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HK2 | 0.00 | 1.49 | 0.00 | 0.62 | 12.26 | 10.53 | 1.26 | 0.00 | 6.40 | 45.36 | 1.05 | 16.67 | 95.64 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HS1 | 0.00 | 2.22 | 0.00 | 0.97 | 14.21 | 11.42 | 2.67 | 0.00 | 11.11 | 42.40 | 0.19 | 11.91 | 97.09 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HS2 | 0.00 | 2.09 | 0.00 | 0.97 | 14.05 | 11.21 | 2.33 | 0.00 | 10.55 | 42.36 | 0.37 | 12.19 | 96.13 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HT1 | 0.00 | 1.62 | 0.00 | 0.76 | 11.25 | 10.77 | 1.36 | 0.00 | 7.88 | 45.72 | 0.92 | 17.68 | 97.96 |
| DRS-85-199 | Tuff of Mount Jefferson | 199HT2 | 0.00 | 1.82 | 0.00 | 0.86 | 10.77 | 10.85 | 1.59 | 0.00 | 8.32 | 45.31 | 0.84 | 18.27 | 98.63 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAC1 | 0.00 | 2.34 | 0.00 | 0.72 | 11.06 | 11.03 | 2.38 | 0.00 | 10.75 | 41.65 | 0.54 | 16.02 | 96.47 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAC2 | 0.00 | 2.38 | 0.00 | 0.73 | 10.78 | 11.05 | 2.35 | 0.00 | 11.01 | 41.46 | 0.59 | 16.30 | 96.65 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAD1 | 0.00 | 2.33 | 0.00 | 0.84 | 14.08 | 11.22 | 2.94 | 0.00 | 12.05 | 40.39 | 0.09 | 11.45 | 95.39 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAD2 | 0.00 | 2.28 | 0.00 | 0.82 | 14.30 | 11.20 | 2.97 | 0.00 | 12.04 | 41.26 | 0.05 | 11.26 | 96.18 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAE1 | 0.00 | 2.65 | 0.00 | 0.77 | 10.76 | 11.16 | 2.33 | 0.00 | 12.41 | 40.60 | 0.58 | 15.35 | 96.62 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAE2 | 0.00 | 2.50 | 0.00 | 0.67 | 12.01 | 10.80 | 2.70 | 0.00 | 11.26 | 41.73 | 0.31 | 14.09 | 96.07 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HD1 | 0.00 | 2.19 | 0.00 | 0.98 | 13.78 | 11.08 | 2.95 | 0.00 | 11.19 | 42.44 | 0.18 | 11.98 | 96.77 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HD2 | 0.00 | 2.11 | 0.00 | 0.93 | 13.75 | 10.72 | 3.10 | 0.00 | 11.25 | 42.59 | 0.20 | 12.06 | 96.71 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS1 | 0.00 | 1.44 | 0.00 | 0.56 | 11.80 | 10.13 | 0.94 | 0.00 | 6.31 | 47.58 | 0.73 | 17.06 | 96.56 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS1 | 0.32 | 1.72 | 0.08 | 0.71 | 11.18 | 10.93 | 1.35 | 0.00 | 7.97 | 45.76 | 0.85 | 17.97 | 98.84 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS2 | 0.00 | 1.62 | 0.00 | 0.68 | 11.32 | 10.59 | 1.21 | 0.00 | 7.47 | 45.15 | 0.72 | 17.74 | 96.50 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS2 | 0.34 | 1.36 | 0.10 | 0.47 | 13.00 | 10.84 | 0.86 | 0.00 | 5.43 | 48.73 | 0.93 | 16.64 | 98.69 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS3r | 0.00 | 1.60 | 0.00 | 0.69 | 11.12 | 10.74 | 1.36 | 0.00 | 7.52 | 44.54 | 0.81 | 17.64 | 96.01 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HT1 | 0.00 | 2.09 | 0.00 | 0.90 | 13.75 | 11.30 | 2.75 | 0.00 | 10.69 | 42.71 | 0.22 | 12.03 | 96.44 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HT1 | 0.23 | 2.24 | 0.04 | 1.03 | 13.73 | 11.41 | 3.35 | 0.00 | 11.34 | 42.74 | 0.27 | 12.11 | 98.49 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HT2 | 0.00 | 2.06 | 0.00 | 0.93 | 13.76 | 10.97 | 2.69 | 0.00 | 10.37 | 42.67 | 0.30 | 11.88 | 95.63 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HT3 | 0.00 | 2.11 | 0.00 | 0.95 | 13.55 | 11.03 | 2.77 | 0.00 | 10.48 | 42.44 | 0.24 | 12.07 | 95.63 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HV1 | 0.00 | 2.34 | 0.00 | 0.72 | 11.43 | 10.95 | 2.50 | 0.00 | 10.34 | 41.76 | 0.43 | 15.97 | 96.45 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HV1 | 0.37 | 2.44 | 0.03 | 0.80 | 11.51 | 11.02 | 2.55 | 0.00 | 10.90 | 42.81 | 0.52 | 16.09 | 99.04 |
| DRS-85-203 | Tuff of Mount Jefferson | 203HV2 | 0.00 | 2.40 | 0.00 | 0.75 | 11.44 | 11.03 | 2.33 | 0.00 | 10.26 | 41.46 | 0.42 | 16.04 | 96.14 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HAA1 | 0.34 | 1.86 | 0.12 | 0.79 | 11.24 | 10.92 | 1.57 | 0.00 | 8.25 | 45.77 | 0.93 | 17.30 | 99.09 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HAA2 | 0.16 | 2.26 | 0.08 | 0.89 | 9.91 | 11.04 | 2.45 | 0.00 | 10.26 | 43.28 | 0.82 | 17.56 | 98.70 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HAD1 | 0.39 | 1.65 | 0.11 | 0.67 | 11.81 | 10.78 | 1.33 | 0.00 | 7.00 | 46.77 | 0.94 | 16.49 | 97.94 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HAE1 | 0.42 | 1.63 | 0.11 | 0.64 | 12.04 | 10.78 | 1.33 | 0.03 | 6.81 | 47.52 | 0.98 | 16.62 | 98.91 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HE1 | 0.35 | 2.51 | 0.06 | 0.77 | 9.27 | 11.28 | 2.36 | 0.00 | 12.12 | 41.40 | 0.90 | 18.47 | 99.48 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HK1 | 0.49 | 1.87 | 0.13 | 0.76 | 11.41 | 10.89 | 1.48 | 0.00 | 7.94 | 45.43 | 0.98 | 17.29 | 98.66 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HK2 | 0.47 | 1.71 | 0.14 | 0.67 | 11.98 | 10.71 | 1.36 | 0.00 | 7.50 | 46.15 | 1.00 | 17.40 | 99.08 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HL1 | 0.27 | 2.22 | 0.12 | 0.91 | 10.22 | 11.04 | 2.00 | 0.00 | 10.30 | 43.29 | 0.94 | 18.49 | 99.79 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HL2 | 0.45 | 1.85 | 0.12 | 0.80 | 11.32 | 11.21 | 1.50 | 0.00 | 8.98 | 45.52 | 0.95 | 17.07 | 99.77 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HR1 | 0.37 | 1.53 | 0.12 | 0.59 | 12.55 | 10.87 | 1.07 | 0.00 | 6.30 | 47.96 | 1.14 | 16.82 | 99.32 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HT1 | 0.37 | 1.52 | 0.10 | 0.68 | 11.94 | 10.82 | 1.31 | 0.01 | 6.84 | 47.29 | 0.96 | 16.51 | 98.33 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HT2 | 0.34 | 1.53 | 0.11 | 0.62 | 12.22 | 10.72 | 1.35 | 0.00 | 6.79 | 47.24 | 1.02 | 16.61 | 98.55 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HV1 | 0.40 | 1.57 | 0.09 | 0.62 | 13.33 | 11.07 | 1.40 | 0.00 | 6.76 | 47.72 | 0.90 | 14.69 | 98.54 |

**Appendix 5.** Compositions (in Weight Percent) of Amphiboles in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | F | $Na_2O$ | Cl | $K_2O$ | MgO | CaO | $TiO_2$ | NiO | $Al_2O_3$ | $SiO_2$ | MnO | FeO | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-85-204 | Tuff of Mount Jefferson | 204HV2 | 0.39 | 1.64 | 0.08 | 0.69 | 12.67 | 11.14 | 1.50 | 0.00 | 6.93 | 47.29 | 0.94 | 15.73 | 99.00 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HW1 | 0.31 | 1.61 | 0.10 | 0.73 | 12.78 | 11.08 | 1.52 | 0.00 | 6.84 | 47.28 | 0.94 | 15.66 | 98.84 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HW2 | 0.31 | 2.27 | 0.04 | 0.98 | 12.55 | 11.47 | 2.50 | 0.00 | 11.42 | 42.98 | 0.54 | 13.61 | 98.67 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HZ1 | 0.28 | 2.22 | 0.07 | 0.94 | 9.94 | 11.07 | 2.01 | 0.00 | 11.26 | 42.88 | 0.67 | 18.15 | 99.47 |
| DRS-85-204 | Tuff of Mount Jefferson | 204HZ2 | 0.20 | 2.17 | 0.08 | 0.95 | 9.97 | 11.23 | 2.11 | 0.00 | 11.30 | 42.48 | 0.70 | 17.95 | 99.13 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HJ1 | 0.69 | 2.39 | 0.06 | 0.79 | 12.15 | 11.01 | 2.66 | 0.00 | 11.46 | 42.43 | 0.39 | 14.23 | 98.26 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HJ2 | 0.75 | 1.62 | 0.07 | 0.77 | 12.65 | 10.83 | 1.49 | 0.00 | 7.66 | 45.11 | 0.72 | 14.31 | 95.97 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HK1 | 0.27 | 2.45 | 0.02 | 0.61 | 15.19 | 11.35 | 2.06 | 0.02 | 12.63 | 42.99 | 0.12 | 9.87 | 97.59 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HK2 | 0.30 | 2.38 | 0.02 | 0.59 | 13.82 | 11.31 | 1.95 | 0.00 | 12.71 | 42.45 | 0.14 | 11.71 | 97.38 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HL1 | 1.46 | 2.58 | 0.06 | 0.81 | 10.74 | 11.02 | 3.03 | 0.00 | 11.27 | 41.79 | 0.93 | 15.91 | 99.59 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HL2 | 0.99 | 2.43 | 0.06 | 0.80 | 10.70 | 11.11 | 2.88 | 0.01 | 10.91 | 42.24 | 1.00 | 15.92 | 99.03 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HN1 | 0.46 | 2.42 | 0.04 | 0.83 | 12.84 | 11.28 | 3.72 | 0.01 | 11.19 | 42.91 | 0.24 | 12.17 | 98.11 |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HN2 | 0.53 | 2.43 | 0.02 | 0.82 | 12.62 | 11.23 | 3.55 | 0.01 | 11.07 | 42.48 | 0.27 | 12.88 | 97.89 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HB1 | 0.72 | 2.39 | 0.02 | 0.78 | 12.40 | 11.44 | 3.91 | 0.04 | 11.55 | 42.12 | 0.66 | 13.02 | 99.07 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HB2 | 1.01 | 2.42 | 0.04 | 1.00 | 11.97 | 11.33 | 2.86 | 0.02 | 11.78 | 41.91 | 0.85 | 13.45 | 98.63 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HJ1 | 0.41 | 1.71 | 0.07 | 0.69 | 12.84 | 10.99 | 1.92 | 0.01 | 8.25 | 46.27 | 0.33 | 14.26 | 97.74 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HJ2 | 0.52 | 1.82 | 0.07 | 0.74 | 12.41 | 11.13 | 2.08 | 0.00 | 8.77 | 45.53 | 0.30 | 14.68 | 98.06 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HQ1 | 0.78 | 2.45 | 0.03 | 0.85 | 10.74 | 11.26 | 3.13 | 0.00 | 11.62 | 42.08 | 0.65 | 14.86 | 98.44 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HQ2 | 1.00 | 1.85 | 0.07 | 0.90 | 11.49 | 11.10 | 2.05 | 0.00 | 8.89 | 44.28 | 0.80 | 15.77 | 98.19 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HS1 | 0.88 | 2.42 | 0.08 | 0.99 | 9.93 | 11.00 | 2.62 | 0.00 | 11.15 | 41.22 | 0.83 | 17.17 | 98.27 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HS2 | 0.94 | 2.37 | 0.06 | 0.85 | 9.95 | 11.12 | 2.63 | 0.00 | 11.30 | 41.10 | 0.78 | 17.87 | 98.96 |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HT1 | 0.75 | 2.42 | 0.03 | 0.83 | 10.76 | 11.26 | 3.19 | 0.00 | 11.83 | 41.92 | 0.65 | 15.39 | 99.02 |
| DRS-84-34 | Isom-type tuff | 34HA1 | 0.21 | 2.01 | 0.23 | 1.09 | 9.56 | 10.77 | 2.02 | 0.00 | 10.24 | 41.97 | 0.71 | 18.85 | 97.68 |
| DRS-84-34 | Isom-type tuff | 34HA2 | 0.23 | 1.40 | 0.12 | 0.59 | 11.75 | 10.17 | 1.07 | 0.04 | 6.09 | 47.36 | 0.95 | 17.39 | 97.16 |
| DRS-84-34 | Isom-type tuff | 34HB1 | 0.29 | 1.54 | 0.10 | 0.59 | 12.00 | 10.40 | 1.35 | 0.00 | 6.62 | 46.83 | 0.85 | 16.86 | 97.45 |
| DRS-84-34 | Isom-type tuff | 34HB2 | 0.15 | 2.10 | 0.09 | 0.93 | 9.45 | 10.61 | 2.25 | 0.00 | 10.66 | 41.97 | 0.76 | 18.77 | 97.74 |
| DRS-84-34 | Isom-type tuff | 34HC1 | 0.37 | 2.07 | 0.07 | 1.32 | 10.26 | 10.75 | 2.26 | 0.00 | 10.70 | 42.03 | 0.38 | 16.68 | 96.89 |
| DRS-84-34 | Isom-type tuff | 34HD1 | 0.18 | 2.10 | 0.02 | 0.70 | 13.84 | 10.82 | 2.28 | 0.01 | 12.03 | 41.85 | 0.14 | 11.91 | 95.88 |
| DRS-84-34 | Isom-type tuff | 34HD2 | 0.24 | 2.10 | 0.03 | 0.72 | 14.47 | 10.95 | 2.14 | 0.00 | 11.93 | 42.92 | 0.08 | 11.05 | 96.62 |
| DRS-84-34 | Isom-type tuff | 34HE1 | 0.30 | 1.73 | 0.11 | 0.94 | 10.64 | 11.02 | 1.63 | 0.00 | 9.04 | 43.63 | 0.65 | 17.30 | 97.00 |
| DRS-84-34 | Isom-type tuff | 34HE2 | 0.38 | 1.75 | 0.08 | 0.86 | 11.09 | 11.02 | 1.59 | 0.01 | 9.17 | 43.86 | 0.57 | 16.68 | 97.04 |
| DRS-84-34 | Isom-type tuff | 34HP1 | 0.25 | 1.94 | 0.06 | 0.63 | 12.70 | 11.08 | 1.79 | 0.00 | 9.98 | 44.64 | 0.48 | 14.07 | 97.63 |
| DRS-84-34 | Isom-type tuff | 34HP2 | 0.26 | 2.11 | 0.05 | 0.71 | 12.35 | 11.08 | 2.20 | 0.00 | 10.82 | 43.38 | 0.40 | 13.50 | 96.86 |
| DRS-85-44 | Tuff of Mount Jefferson | 44HG1 | 0.33 | 1.55 | 0.10 | 0.56 | 12.33 | 10.59 | 0.99 | 0.00 | 6.19 | 46.62 | 0.74 | 16.24 | 96.23 |
| DRS-85-44 | Tuff of Mount Jefferson | 44HG2 | 0.36 | 1.61 | 0.10 | 0.55 | 12.32 | 10.46 | 0.96 | 0.00 | 5.95 | 46.96 | 0.77 | 16.06 | 96.10 |
| DRS-85-44 | Tuff of Mount Jefferson | 44HH1 | 0.42 | 1.59 | 0.08 | 0.54 | 12.44 | 10.54 | 0.95 | 0.00 | 5.92 | 47.05 | 0.78 | 16.02 | 96.33 |
| DRS-85-44 | Tuff of Mount Jefferson | 44HJ1 | 0.27 | 2.21 | 0.04 | 0.93 | 13.93 | 10.99 | 2.33 | 0.00 | 10.15 | 42.89 | 0.37 | 12.06 | 96.18 |
| DRS-85-44 | Tuff of Mount Jefferson | 44HJ2 | 0.42 | 2.13 | 0.05 | 0.98 | 13.66 | 10.99 | 2.34 | 0.00 | 9.78 | 44.07 | 0.45 | 12.56 | 97.42 |
| DRS-87-52 | Isom-type tuff, upper | 52HA1 | 0.38 | 2.35 | 0.05 | 0.79 | 13.27 | 10.52 | 2.05 | 0.00 | 11.20 | 41.93 | 0.30 | 12.80 | 95.63 |
| DRS-87-52 | Isom-type tuff, upper | 52HA2 | 0.56 | 2.37 | 0.04 | 0.82 | 13.17 | 10.63 | 2.20 | 0.00 | 11.42 | 42.32 | 0.26 | 12.68 | 96.46 |
| DRS-87-52 | Isom-type tuff, upper | 52HK1 | 0.24 | 2.54 | 0.02 | 0.81 | 12.47 | 10.83 | 3.31 | 0.00 | 12.17 | 40.55 | 0.13 | 13.00 | 96.07 |
| DRS-87-52 | Isom-type tuff, upper | 52HK2 | 0.34 | 2.42 | 0.03 | 0.78 | 12.82 | 10.67 | 3.49 | 0.01 | 12.29 | 40.69 | 0.14 | 12.28 | 95.95 |
| DRS-87-52 | Isom-type tuff, upper | 52HP1 | 0.68 | 2.29 | 0.07 | 0.91 | 13.08 | 10.73 | 2.98 | 0.02 | 9.67 | 42.33 | 0.18 | 13.09 | 96.01 |
| DRS-91-3 | Bates Mountain Tuff | 913HF1 | 0.60 | 1.88 | 0.17 | 0.68 | 9.49 | 9.98 | 1.51 | 0.00 | 6.52 | 46.04 | 1.00 | 21.18 | 99.04 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HC1 | 0.34 | 1.56 | 0.16 | 0.89 | 11.20 | 11.07 | 1.52 | 0.00 | 8.18 | 45.64 | 0.50 | 18.41 | 99.47 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HC2 | 0.26 | 1.50 | 0.14 | 0.80 | 11.80 | 11.08 | 1.21 | 0.03 | 7.69 | 46.51 | 0.45 | 18.10 | 99.57 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HE1 | 0.32 | 1.54 | 0.08 | 0.76 | 13.27 | 11.55 | 1.57 | 0.00 | 7.54 | 46.75 | 0.86 | 14.56 | 98.80 |

**Appendix 5.** Compositions (in Weight Percent) of Amphiboles in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | F | $Na_2O$ | Cl | $K_2O$ | MgO | CaO | $TiO_2$ | NiO | $Al_2O_3$ | $SiO_2$ | MnO | FeO | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HE2 | 0.36 | 2.03 | 0.04 | 0.90 | 13.34 | 11.74 | 2.58 | 0.00 | 9.82 | 44.71 | 0.48 | 13.29 | 99.29 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HE3 | 0.35 | 2.07 | 0.03 | 0.91 | 12.15 | 11.76 | 2.86 | 0.00 | 10.40 | 43.72 | 0.57 | 14.51 | 99.33 |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HE4 | 0.39 | 1.56 | 0.08 | 0.68 | 13.79 | 11.53 | 1.61 | 0.00 | 7.59 | 47.26 | 0.56 | 13.64 | 98.68 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAA1 | 0.36 | 1.47 | 0.09 | 0.55 | 12.58 | 10.47 | 1.12 | 0.00 | 5.80 | 48.41 | 1.04 | 17.37 | 99.24 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAA2 | 0.32 | 1.52 | 0.11 | 0.59 | 12.66 | 10.58 | 1.09 | 0.00 | 6.03 | 48.17 | 1.09 | 17.11 | 99.26 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAB1 | 0.18 | 1.76 | 0.13 | 0.77 | 11.73 | 10.87 | 1.61 | 0.00 | 7.89 | 45.81 | 0.91 | 17.29 | 98.95 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAB2 | 0.23 | 2.43 | 0.04 | 0.82 | 9.80 | 10.83 | 2.88 | 0.00 | 11.11 | 42.27 | 0.75 | 18.02 | 99.18 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAC1 | 0.39 | 1.97 | 0.09 | 0.69 | 11.20 | 10.81 | 1.66 | 0.00 | 8.46 | 45.34 | 0.98 | 17.96 | 99.54 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAC2 | 0.46 | 1.68 | 0.11 | 0.66 | 12.31 | 10.79 | 1.28 | 0.03 | 6.83 | 47.06 | 1.00 | 17.03 | 99.22 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAF1 | 0.31 | 1.62 | 0.12 | 0.61 | 12.00 | 10.65 | 1.24 | 0.00 | 6.78 | 47.43 | 0.98 | 17.69 | 99.44 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAF2 | 0.36 | 1.82 | 0.15 | 0.79 | 11.11 | 10.92 | 1.53 | 0.01 | 8.19 | 45.48 | 0.95 | 18.43 | 99.74 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HB1 | 0.29 | 2.26 | 0.13 | 0.92 | 9.60 | 11.04 | 2.33 | 0.00 | 10.64 | 42.07 | 0.89 | 18.81 | 98.98 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HB2 | 0.35 | 1.68 | 0.12 | 0.59 | 11.80 | 10.59 | 1.23 | 0.00 | 7.02 | 46.57 | 0.99 | 17.28 | 98.21 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HC1 | 0.46 | 1.59 | 0.10 | 0.64 | 12.49 | 10.91 | 1.22 | 0.00 | 6.47 | 47.18 | 0.95 | 16.85 | 98.86 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HC2 | 0.36 | 1.64 | 0.13 | 0.68 | 12.20 | 10.82 | 1.21 | 0.00 | 6.93 | 46.66 | 1.04 | 16.80 | 98.46 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HD1 | 0.38 | 2.42 | 0.06 | 0.81 | 10.23 | 11.40 | 2.42 | 0.00 | 11.63 | 41.94 | 0.68 | 17.27 | 99.23 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HD2 | 0.47 | 2.04 | 0.14 | 0.91 | 10.27 | 10.81 | 1.68 | 0.00 | 9.45 | 43.35 | 0.95 | 19.06 | 99.13 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HH1 | 0.34 | 1.63 | 0.12 | 0.70 | 12.15 | 10.84 | 1.26 | 0.00 | 6.96 | 46.79 | 0.98 | 17.14 | 98.90 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HH2 | 0.42 | 1.63 | 0.11 | 0.65 | 12.38 | 10.79 | 1.24 | 0.00 | 6.69 | 46.99 | 1.02 | 16.89 | 98.83 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HU1 | 0.34 | 1.63 | 0.10 | 0.61 | 12.43 | 10.77 | 1.33 | 0.00 | 6.78 | 47.43 | 0.93 | 17.02 | 99.36 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HU2 | 0.32 | 2.24 | 0.09 | 1.01 | 9.87 | 11.04 | 2.18 | 0.00 | 10.69 | 42.30 | 0.85 | 18.97 | 99.55 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HV1 | 0.40 | 2.28 | 0.08 | 0.93 | 10.19 | 10.87 | 2.33 | 0.03 | 11.02 | 42.27 | 0.77 | 17.62 | 98.79 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HV2 | 0.35 | 1.59 | 0.11 | 0.55 | 12.52 | 10.68 | 1.28 | 0.00 | 6.81 | 47.29 | 0.90 | 16.77 | 98.85 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HW1 | 0.32 | 1.73 | 0.15 | 0.66 | 12.16 | 10.55 | 1.36 | 0.00 | 6.88 | 47.06 | 1.05 | 17.00 | 98.92 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HW2 | 0.41 | 1.69 | 0.17 | 0.70 | 12.12 | 10.58 | 1.32 | 0.00 | 7.05 | 46.98 | 1.06 | 17.25 | 99.33 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HX1 | 0.31 | 1.50 | 0.10 | 0.55 | 12.92 | 10.81 | 1.15 | 0.00 | 5.93 | 47.97 | 0.93 | 16.39 | 98.55 |
| DRS-92-20 | Tuff of Mount Jefferson | 920HX2 | 0.37 | 1.48 | 0.10 | 0.54 | 12.48 | 10.35 | 1.12 | 0.00 | 6.21 | 48.18 | 0.94 | 16.14 | 97.90 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921H1 | 0.21 | 2.39 | 0.04 | 0.77 | 12.26 | 11.37 | 2.24 | 0.05 | 12.00 | 42.98 | 0.36 | 14.66 | 99.32 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921H2 | 0.29 | 2.15 | 0.05 | 0.82 | 12.98 | 11.18 | 1.99 | 0.00 | 9.96 | 44.78 | 0.45 | 14.34 | 99.00 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAB1 | 0.20 | 2.29 | 0.07 | 0.82 | 12.19 | 11.10 | 2.40 | 0.00 | 10.73 | 42.87 | 0.45 | 15.28 | 98.40 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAB2 | 0.34 | 1.85 | 0.08 | 0.90 | 13.10 | 11.17 | 1.91 | 0.00 | 8.94 | 44.80 | 0.43 | 14.37 | 97.89 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAE1 | 0.26 | 2.31 | 0.07 | 0.86 | 11.97 | 11.42 | 2.63 | 0.01 | 11.89 | 42.12 | 0.35 | 14.91 | 98.80 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAE2 | 0.26 | 2.24 | 0.05 | 0.73 | 12.36 | 11.44 | 2.24 | 0.00 | 11.86 | 42.44 | 0.44 | 14.48 | 98.52 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAF1 | 0.25 | 2.18 | 0.05 | 0.81 | 12.48 | 11.27 | 2.47 | 0.00 | 10.76 | 43.34 | 0.46 | 15.22 | 99.27 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAF2 | 0.24 | 1.83 | 0.08 | 0.86 | 13.41 | 11.30 | 1.79 | 0.00 | 8.95 | 45.22 | 0.41 | 14.83 | 98.92 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HD1 | 0.23 | 2.41 | 0.05 | 1.02 | 12.80 | 11.02 | 3.31 | 0.00 | 11.06 | 43.07 | 0.21 | 13.16 | 98.33 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HD2 | 0.31 | 2.37 | 0.05 | 0.95 | 13.03 | 11.04 | 3.19 | 0.01 | 11.49 | 42.62 | 0.27 | 13.10 | 98.40 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HF1 | 0.17 | 2.36 | 0.04 | 0.86 | 11.43 | 11.24 | 2.61 | 0.02 | 11.63 | 42.04 | 0.37 | 15.77 | 98.54 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HF2 | 0.21 | 2.18 | 0.05 | 0.80 | 12.72 | 11.20 | 2.01 | 0.00 | 10.48 | 44.20 | 0.40 | 14.51 | 98.76 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HG1 | 0.24 | 1.99 | 0.09 | 0.85 | 13.21 | 11.20 | 1.99 | 0.02 | 9.34 | 45.12 | 0.40 | 14.39 | 98.85 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HG2 | 0.22 | 1.84 | 0.06 | 0.65 | 14.08 | 10.91 | 1.63 | 0.00 | 8.55 | 46.57 | 0.45 | 14.14 | 99.10 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HH1 | 0.10 | 1.97 | 0.06 | 0.82 | 14.02 | 10.96 | 2.27 | 0.01 | 9.93 | 44.99 | 0.24 | 13.16 | 98.52 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HH2 | 0.11 | 2.01 | 0.06 | 0.87 | 14.25 | 11.00 | 2.53 | 0.00 | 9.65 | 45.44 | 0.19 | 12.64 | 98.75 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HJ1 | 0.26 | 2.38 | 0.04 | 0.75 | 13.42 | 11.11 | 2.56 | 0.03 | 11.16 | 43.67 | 0.22 | 13.08 | 98.68 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HJ2 | 0.33 | 2.24 | 0.06 | 0.76 | 12.95 | 10.91 | 1.98 | 0.00 | 10.50 | 44.19 | 0.32 | 14.09 | 98.30 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HW1 | 0.26 | 2.28 | 0.02 | 0.72 | 13.29 | 11.21 | 2.66 | 0.00 | 11.35 | 43.03 | 0.21 | 13.35 | 98.39 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HW2 | 0.19 | 2.34 | 0.04 | 0.78 | 12.96 | 11.18 | 2.52 | 0.02 | 11.27 | 42.98 | 0.20 | 13.96 | 98.43 |

**Appendix 6.** Structural Formulas (in Atoms) and Amphibole Species (Leake and Others, 1997) of Amphiboles in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.

[Formulas for amphiboles given as proportions of oxides (total 16.5 ions) and converted end-member proportions]

| Original sample no. | Unit | Probe sample no. | Si | Al(iv) | Al(vi) | Ti | $Fe^{3+}$ | Mg | $Fe^{2+}$ | Mn | $Fe^{2+}$ | Mn | Ca | Na | Na | K | Amphibole species |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Formulas for amphiboles are given as proportions of oxides (total of 16.5 ions) and converted to standard atomic formulas | | | | | | | | | | | | | | | | | |
| DRS-91-6 | Bates Mountain Tuff | 06HF1 | 6.275 | 1.725 | 0.295 | 0.297 | 0.289 | 2.363 | 1.755 | 0.000 | 0.029 | 0.053 | 1.789 | 0.128 | 0.521 | 0.153 | pargasite |
| DRS-91-6 | Bates Mountain Tuff | 06HF2 | 6.390 | 1.610 | 0.342 | 0.281 | 0.203 | 2.378 | 1.795 | 0.000 | 0.006 | 0.052 | 1.793 | 0.149 | 0.509 | 0.142 | pargasite |
| DRS-91-6 | Bates Mountain Tuff | 06HF3 | 6.411 | 1.589 | 0.303 | 0.256 | 0.274 | 2.379 | 1.787 | 0.000 | 0.024 | 0.054 | 1.793 | 0.129 | 0.483 | 0.145 | pargasite |
| DRS-91-169 | Tuff of Mount Jefferson | 169HAB1 | 6.293 | 1.707 | 0.348 | 0.292 | 0.194 | 2.680 | 1.485 | 0.000 | 0.023 | 0.032 | 1.799 | 0.145 | 0.586 | 0.140 | pargasite |
| DRS-91-169 | Tuff of Mount Jefferson | 169HAB2 | 6.302 | 1.698 | 0.310 | 0.290 | 0.220 | 2.806 | 1.374 | 0.000 | 0.041 | 0.022 | 1.790 | 0.147 | 0.587 | 0.148 | pargasite |
| DRS-91-169 | Tuff of Mount Jefferson | 169HE1 | 6.363 | 1.637 | 0.207 | 0.294 | 0.317 | 3.090 | 1.091 | 0.000 | 0.049 | 0.042 | 1.745 | 0.164 | 0.506 | 0.183 | magnesiohastingsite |
| DRS-91-169 | Tuff of Mount Jefferson | 169HE2 | 6.408 | 1.592 | 0.209 | 0.268 | 0.333 | 3.126 | 1.063 | 0.000 | 0.055 | 0.041 | 1.738 | 0.167 | 0.501 | 0.179 | magnesiohastingsite |
| DRS-91-169 | Tuff of Mount Jefferson | 169HF1 | 7.034 | 0.966 | 0.100 | 0.108 | 0.431 | 2.751 | 1.610 | 0.000 | 0.023 | 0.101 | 1.704 | 0.172 | 0.281 | 0.110 | magnesiohornblende |
| DRS-91-169 | Tuff of Mount Jefferson | 169HF2 | 7.122 | 0.878 | 0.097 | 0.085 | 0.473 | 2.814 | 1.531 | 0.000 | 0.032 | 0.105 | 1.679 | 0.184 | 0.221 | 0.100 | magnesiohornblende |
| DRS-91-169 | Tuff of Mount Jefferson | 169HH1 | 6.943 | 1.057 | 0.127 | 0.134 | 0.441 | 2.545 | 1.752 | 0.000 | 0.004 | 0.124 | 1.671 | 0.202 | 0.289 | 0.133 | magnesiohornblende |
| DRS-91-169 | Tuff of Mount Jefferson | 169HH2 | 6.965 | 1.035 | 0.081 | 0.134 | 0.456 | 2.597 | 1.732 | 0.000 | 0.008 | 0.133 | 1.677 | 0.182 | 0.296 | 0.116 | magnesiohornblende |
| DRS-91-169 | Tuff of Mount Jefferson | 169HQ1 | 6.342 | 1.658 | 0.153 | 0.320 | 0.292 | 3.119 | 1.116 | 0.000 | 0.045 | 0.038 | 1.770 | 0.146 | 0.532 | 0.187 | magnesiohastingsite |
| DRS-91-169 | Tuff of Mount Jefferson | 169HQ2 | 6.352 | 1.648 | 0.146 | 0.305 | 0.294 | 3.130 | 1.125 | 0.000 | 0.040 | 0.044 | 1.786 | 0.130 | 0.543 | 0.185 | magnesiohastingsite |
| DRS-91-169 | Tuff of Mount Jefferson | 169HS1 | 6.948 | 1.052 | 0.097 | 0.134 | 0.440 | 2.702 | 1.626 | 0.001 | 0.000 | 0.127 | 1.693 | 0.180 | 0.308 | 0.119 | magnesiohornblende |
| DRS-91-169 | Tuff of Mount Jefferson | 169HS2 | 6.972 | 1.028 | 0.078 | 0.144 | 0.421 | 2.718 | 1.633 | 0.006 | 0.000 | 0.121 | 1.697 | 0.182 | 0.304 | 0.119 | magnesiohornblende |
| DRS-91-169 | Tuff of Mount Jefferson | 169HW1 | 6.962 | 1.038 | 0.102 | 0.137 | 0.443 | 2.635 | 1.684 | 0.000 | 0.001 | 0.126 | 1.679 | 0.193 | 0.296 | 0.118 | magnesiohornblende |
| DRS-91-169 | Tuff of Mount Jefferson | 169HW2 | 6.953 | 1.047 | 0.087 | 0.138 | 0.465 | 2.631 | 1.679 | 0.000 | 0.007 | 0.127 | 1.681 | 0.185 | 0.275 | 0.129 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HA1 | 6.958 | 1.042 | 0.101 | 0.129 | 0.484 | 2.593 | 1.693 | 0.000 | 0.045 | 0.095 | 1.690 | 0.170 | 0.258 | 0.111 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HA2 | 6.982 | 1.018 | 0.096 | 0.125 | 0.456 | 2.639 | 1.685 | 0.000 | 0.029 | 0.103 | 1.695 | 0.174 | 0.272 | 0.118 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HA3 | 6.975 | 1.025 | 0.214 | 0.144 | 0.376 | 2.494 | 1.772 | 0.000 | 0.108 | 0.000 | 1.685 | 0.207 | 0.229 | 0.126 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HA4 | 6.971 | 1.029 | 0.111 | 0.138 | 0.505 | 2.533 | 1.714 | 0.000 | 0.038 | 0.108 | 1.659 | 0.195 | 0.225 | 0.108 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HAE1 | 6.382 | 1.618 | 0.261 | 0.257 | 0.353 | 2.985 | 1.144 | 0.000 | 0.062 | 0.040 | 1.759 | 0.139 | 0.446 | 0.183 | magnesiohastingsite |
| DRS-85-197 | Tuff of Mount Jefferson | 197HAF1h | 7.086 | 0.914 | 0.158 | 0.130 | 0.429 | 2.701 | 1.582 | 0.000 | 0.019 | 0.104 | 1.664 | 0.213 | 0.177 | 0.102 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HAF2h | 7.097 | 0.903 | 0.083 | 0.116 | 0.468 | 2.811 | 1.522 | 0.000 | 0.026 | 0.120 | 1.677 | 0.178 | 0.204 | 0.094 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HB1 | 6.188 | 1.812 | 0.353 | 0.342 | 0.248 | 2.987 | 1.070 | 0.000 | 0.063 | 0.008 | 1.788 | 0.141 | 0.495 | 0.173 | pargasite |
| DRS-85-197 | Tuff of Mount Jefferson | 197HB2 | 6.154 | 1.846 | 0.300 | 0.365 | 0.280 | 2.936 | 1.120 | 0.000 | 0.059 | 0.021 | 1.783 | 0.137 | 0.500 | 0.174 | pargasite |
| DRS-85-197 | Tuff of Mount Jefferson | 197HG1 | 6.763 | 1.237 | 0.206 | 0.149 | 0.447 | 2.483 | 1.716 | 0.000 | 0.008 | 0.120 | 1.682 | 0.190 | 0.333 | 0.144 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HG2 | 7.067 | 0.933 | 0.141 | 0.116 | 0.485 | 2.723 | 1.536 | 0.000 | 0.022 | 0.118 | 1.639 | 0.221 | 0.191 | 0.106 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HG2r | 7.025 | 0.975 | 0.125 | 0.110 | 0.505 | 2.727 | 1.532 | 0.000 | 0.023 | 0.123 | 1.647 | 0.207 | 0.225 | 0.105 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HG3 | 6.776 | 1.224 | 0.242 | 0.179 | 0.450 | 2.421 | 1.708 | 0.000 | 0.015 | 0.115 | 1.649 | 0.222 | 0.274 | 0.122 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HH1 | 6.663 | 1.337 | 0.240 | 0.164 | 0.421 | 2.478 | 1.698 | 0.000 | 0.031 | 0.090 | 1.705 | 0.174 | 0.370 | 0.152 | edenite |
| DRS-85-197 | Tuff of Mount Jefferson | 197HH2 | 6.332 | 1.668 | 0.348 | 0.245 | 0.384 | 2.376 | 1.647 | 0.000 | 0.033 | 0.077 | 1.730 | 0.160 | 0.459 | 0.147 | magnesiohastingsite |
| DRS-85-197 | Tuff of Mount Jefferson | 197HH2r | 6.389 | 1.611 | 0.387 | 0.260 | 0.300 | 2.345 | 1.708 | 0.000 | 0.016 | 0.070 | 1.732 | 0.182 | 0.446 | 0.140 | pargasite |
| DRS-85-197 | Tuff of Mount Jefferson | 197HH3 | 6.788 | 1.212 | 0.230 | 0.140 | 0.496 | 2.418 | 1.715 | 0.000 | 0.044 | 0.099 | 1.662 | 0.195 | 0.270 | 0.130 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HK1 | 6.866 | 1.134 | 0.150 | 0.146 | 0.460 | 2.641 | 1.603 | 0.000 | 0.006 | 0.127 | 1.694 | 0.173 | 0.277 | 0.127 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HK2 | 7.023 | 0.977 | 0.086 | 0.142 | 0.424 | 2.957 | 1.391 | 0.000 | 0.010 | 0.112 | 1.708 | 0.170 | 0.245 | 0.109 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HP1 | 6.719 | 1.281 | 0.140 | 0.174 | 0.441 | 2.497 | 1.748 | 0.000 | 0.013 | 0.114 | 1.724 | 0.149 | 0.359 | 0.140 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HT1 | 7.002 | 0.998 | 0.112 | 0.139 | 0.458 | 2.713 | 1.578 | 0.000 | 0.014 | 0.118 | 1.672 | 0.196 | 0.228 | 0.118 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HV1 | 6.964 | 1.036 | 0.097 | 0.123 | 0.544 | 2.564 | 1.673 | 0.000 | 0.036 | 0.130 | 1.635 | 0.199 | 0.235 | 0.114 | magnesiohornblende |
| DRS-85-197 | Tuff of Mount Jefferson | 197HW1 | 6.319 | 1.681 | 0.253 | 0.305 | 0.321 | 2.931 | 1.190 | 0.000 | 0.046 | 0.046 | 1.752 | 0.156 | 0.463 | 0.191 | magnesiohastingsite |
| DRS-85-197 | Tuff of Mount Jefferson | 197HW2 | 6.258 | 1.742 | 0.245 | 0.328 | 0.301 | 2.968 | 1.159 | 0.000 | 0.055 | 0.031 | 1.774 | 0.140 | 0.499 | 0.182 | magnesiohastingsite |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAA1 | 7.030 | 0.970 | 0.079 | 0.139 | 0.443 | 2.813 | 1.526 | 0.000 | 0.026 | 0.111 | 1.696 | 0.167 | 0.227 | 0.110 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAA2 | 7.000 | 1.000 | 0.089 | 0.145 | 0.461 | 2.750 | 1.555 | 0.000 | 0.014 | 0.119 | 1.689 | 0.178 | 0.221 | 0.117 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAG1 | 6.418 | 1.582 | 0.165 | 0.320 | 0.281 | 3.056 | 1.177 | 0.000 | 0.053 | 0.027 | 1.766 | 0.154 | 0.459 | 0.190 | magnesiohastingsite |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAG2 | 6.442 | 1.558 | 0.198 | 0.353 | 0.259 | 3.040 | 1.149 | 0.000 | 0.047 | 0.028 | 1.723 | 0.203 | 0.409 | 0.187 | magnesiohastingsite |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAJ1 | 6.612 | 1.388 | 0.243 | 0.195 | 0.411 | 2.291 | 1.859 | 0.000 | 0.008 | 0.111 | 1.690 | 0.191 | 0.373 | 0.161 | edenite |

**Appendix 6.** Structural Formulas (in Atoms) and Amphibole Species (Leake and Others, 1997) of Amphiboles in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

[Formulas for amphiboles given as proportions of oxides (total 16.5 ions) and converted end-member proportions]

| Original sample no. | Unit | Probe sample no. | Si | Al(iv) | Al(vi) | Ti | $Fe^{3+}$ | Mg | $Fe^{2+}$ | Mn | $Fe^{2+}$ | Mn | Ca | Na | Na | K | Amphibole species |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-85-199 | Tuff of Mount Jefferson | 199HAJ2 | 6.933 | 1.067 | 0.130 | 0.129 | 0.486 | 2.626 | 1.630 | 0.000 | 0.032 | 0.108 | 1.665 | 0.195 | 0.264 | 0.125 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAJ3 | 6.396 | 1.604 | 0.235 | 0.238 | 0.404 | 2.172 | 1.950 | 0.000 | 0.017 | 0.099 | 1.740 | 0.144 | 0.455 | 0.176 | magnesiohastingsite |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAK1 | 7.055 | 0.945 | 0.073 | 0.120 | 0.415 | 2.797 | 1.595 | 0.000 | 0.032 | 0.117 | 1.696 | 0.154 | 0.260 | 0.111 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HAK2 | 7.048 | 0.952 | 0.078 | 0.126 | 0.441 | 2.784 | 1.571 | 0.000 | 0.022 | 0.107 | 1.700 | 0.171 | 0.241 | 0.112 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HD1 | 6.159 | 1.841 | 0.182 | 0.287 | 0.539 | 2.970 | 1.021 | 0.000 | 0.093 | 0.030 | 1.738 | 0.139 | 0.512 | 0.174 | magnesiohastingsite |
| DRS-85-199 | Tuff of Mount Jefferson | 199HG1 | 6.971 | 1.029 | 0.059 | 0.130 | 0.409 | 2.727 | 1.676 | 0.000 | 0.092 | 0.117 | 1.683 | 0.108 | 0.302 | 0.108 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HG2 | 6.979 | 1.021 | 0.057 | 0.136 | 0.366 | 2.783 | 1.658 | 0.000 | 0.091 | 0.128 | 1.676 | 0.105 | 0.320 | 0.111 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HJ1 | 6.908 | 1.092 | 0.028 | 0.148 | 0.330 | 2.800 | 1.693 | 0.000 | 0.087 | 0.123 | 1.737 | 0.052 | 0.368 | 0.121 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HJ2 | 6.962 | 1.038 | 0.039 | 0.120 | 0.373 | 2.876 | 1.591 | 0.000 | 0.085 | 0.119 | 1.724 | 0.072 | 0.338 | 0.120 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HK1 | 6.940 | 1.060 | 0.054 | 0.134 | 0.407 | 2.783 | 1.622 | 0.000 | 0.054 | 0.132 | 1.714 | 0.100 | 0.311 | 0.120 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HK2 | 6.893 | 1.107 | 0.038 | 0.144 | 0.365 | 2.778 | 1.675 | 0.000 | 0.079 | 0.136 | 1.714 | 0.071 | 0.368 | 0.120 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HS1 | 6.251 | 1.749 | 0.182 | 0.296 | 0.368 | 3.122 | 1.033 | 0.000 | 0.069 | 0.023 | 1.804 | 0.104 | 0.530 | 0.182 | magnesiohastingsite |
| DRS-85-199 | Tuff of Mount Jefferson | 199HS2 | 6.306 | 1.694 | 0.157 | 0.261 | 0.453 | 3.117 | 1.012 | 0.000 | 0.053 | 0.046 | 1.789 | 0.112 | 0.491 | 0.185 | magnesiohastingsite |
| DRS-85-199 | Tuff of Mount Jefferson | 199HT1 | 6.792 | 1.208 | 0.172 | 0.152 | 0.440 | 2.491 | 1.744 | 0.000 | 0.012 | 0.115 | 1.714 | 0.159 | 0.307 | 0.145 | magnesiohornblende |
| DRS-85-199 | Tuff of Mount Jefferson | 199HT2 | 6.723 | 1.277 | 0.177 | 0.177 | 0.387 | 2.383 | 1.876 | 0.000 | 0.005 | 0.106 | 1.725 | 0.164 | 0.359 | 0.163 | edenite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAC1 | 6.309 | 1.691 | 0.227 | 0.271 | 0.328 | 2.498 | 1.675 | 0.000 | 0.025 | 0.069 | 1.790 | 0.116 | 0.570 | 0.139 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAC2 | 6.281 | 1.719 | 0.247 | 0.268 | 0.324 | 2.436 | 1.725 | 0.000 | 0.017 | 0.076 | 1.793 | 0.114 | 0.585 | 0.140 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAD1 | 6.048 | 1.952 | 0.175 | 0.331 | 0.489 | 3.142 | 0.863 | 0.000 | 0.082 | 0.011 | 1.800 | 0.106 | 0.571 | 0.161 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAD2 | 6.112 | 1.888 | 0.214 | 0.331 | 0.439 | 3.158 | 0.857 | 0.000 | 0.098 | 0.006 | 1.778 | 0.118 | 0.536 | 0.155 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAE1 | 6.148 | 1.852 | 0.363 | 0.265 | 0.261 | 2.429 | 1.682 | 0.000 | 0.000 | 0.074 | 1.811 | 0.115 | 0.663 | 0.150 | pargasite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HAE2 | 6.280 | 1.720 | 0.277 | 0.305 | 0.312 | 2.694 | 1.411 | 0.000 | 0.050 | 0.039 | 1.742 | 0.169 | 0.561 | 0.128 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HD1 | 6.276 | 1.724 | 0.226 | 0.328 | 0.330 | 3.036 | 1.079 | 0.000 | 0.073 | 0.022 | 1.755 | 0.150 | 0.477 | 0.184 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HD2 | 6.281 | 1.719 | 0.237 | 0.343 | 0.400 | 3.022 | 0.997 | 0.000 | 0.090 | 0.025 | 1.693 | 0.191 | 0.411 | 0.176 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS1 | 7.087 | 0.913 | 0.195 | 0.105 | 0.478 | 2.621 | 1.602 | 0.000 | 0.045 | 0.093 | 1.616 | 0.246 | 0.170 | 0.106 | magnesiohornblende |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS1 | 6.777 | 1.223 | 0.169 | 0.151 | 0.417 | 2.468 | 1.796 | 0.000 | 0.013 | 0.107 | 1.734 | 0.146 | 0.349 | 0.134 | magnesiohornblende |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS2 | 6.803 | 1.197 | 0.129 | 0.137 | 0.499 | 2.542 | 1.693 | 0.000 | 0.044 | 0.093 | 1.709 | 0.154 | 0.319 | 0.130 | magnesiohornblende |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS2 | 7.136 | 0.864 | 0.073 | 0.095 | 0.411 | 2.838 | 1.584 | 0.000 | 0.043 | 0.116 | 1.701 | 0.140 | 0.244 | 0.087 | magnesiohornblende |
| DRS-85-203 | Tuff of Mount Jefferson | 203HS3r | 6.760 | 1.240 | 0.104 | 0.156 | 0.489 | 2.516 | 1.735 | 0.000 | 0.015 | 0.104 | 1.746 | 0.135 | 0.336 | 0.134 | magnesiohornblende |
| DRS-85-203 | Tuff of Mount Jefferson | 203HT1 | 6.342 | 1.658 | 0.212 | 0.307 | 0.296 | 3.044 | 1.142 | 0.000 | 0.057 | 0.028 | 1.798 | 0.117 | 0.484 | 0.170 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HT1 | 6.248 | 1.752 | 0.201 | 0.368 | 0.262 | 2.992 | 1.176 | 0.000 | 0.042 | 0.033 | 1.787 | 0.138 | 0.498 | 0.193 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HT2 | 6.377 | 1.623 | 0.205 | 0.303 | 0.333 | 3.066 | 1.093 | 0.000 | 0.058 | 0.038 | 1.757 | 0.148 | 0.449 | 0.178 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HT3 | 6.357 | 1.643 | 0.207 | 0.312 | 0.305 | 3.026 | 1.150 | 0.000 | 0.057 | 0.030 | 1.770 | 0.143 | 0.469 | 0.182 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HV1 | 6.319 | 1.681 | 0.164 | 0.284 | 0.363 | 2.580 | 1.610 | 0.000 | 0.049 | 0.055 | 1.776 | 0.120 | 0.567 | 0.139 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HV1 | 6.326 | 1.674 | 0.225 | 0.284 | 0.344 | 2.537 | 1.611 | 0.000 | 0.033 | 0.066 | 1.745 | 0.156 | 0.543 | 0.151 | magnesiohastingsite |
| DRS-85-203 | Tuff of Mount Jefferson | 203HV2 | 6.303 | 1.697 | 0.142 | 0.267 | 0.386 | 2.593 | 1.612 | 0.000 | 0.041 | 0.054 | 1.796 | 0.108 | 0.598 | 0.146 | magnesiohastingsite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HAA1 | 6.762 | 1.238 | 0.198 | 0.174 | 0.351 | 2.475 | 1.787 | 0.016 | 0.000 | 0.101 | 1.729 | 0.171 | 0.363 | 0.149 | edenite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HAA2 | 6.471 | 1.529 | 0.278 | 0.275 | 0.216 | 2.209 | 1.980 | 0.042 | 0.000 | 0.062 | 1.768 | 0.170 | 0.484 | 0.170 | pargasite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HAD1 | 6.946 | 1.054 | 0.171 | 0.148 | 0.353 | 2.615 | 1.695 | 0.017 | 0.000 | 0.101 | 1.715 | 0.184 | 0.290 | 0.127 | magnesiohornblende |
| DRS-85-204 | Tuff of Mount Jefferson | 204HAE1 | 6.981 | 1.019 | 0.160 | 0.147 | 0.373 | 2.637 | 1.668 | 0.015 | 0.000 | 0.107 | 1.697 | 0.196 | 0.269 | 0.119 | magnesiohornblende |
| DRS-85-204 | Tuff of Mount Jefferson | 204HE1 | 6.192 | 1.808 | 0.329 | 0.265 | 0.293 | 2.066 | 2.016 | 0.030 | 0.000 | 0.084 | 1.807 | 0.109 | 0.617 | 0.147 | pargasite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HK1 | 6.754 | 1.246 | 0.146 | 0.166 | 0.391 | 2.528 | 1.758 | 0.011 | 0.000 | 0.112 | 1.734 | 0.154 | 0.386 | 0.145 | edenite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HK2 | 6.796 | 1.204 | 0.097 | 0.150 | 0.522 | 2.631 | 1.599 | 0.000 | 0.021 | 0.124 | 1.690 | 0.164 | 0.323 | 0.125 | magnesiohornblende |
| DRS-85-204 | Tuff of Mount Jefferson | 204HL1 | 6.417 | 1.583 | 0.217 | 0.223 | 0.382 | 2.259 | 1.910 | 0.008 | 0.000 | 0.110 | 1.754 | 0.137 | 0.502 | 0.171 | magnesiohastingsite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HL2 | 6.686 | 1.314 | 0.239 | 0.166 | 0.342 | 2.478 | 1.755 | 0.020 | 0.000 | 0.098 | 1.764 | 0.138 | 0.388 | 0.150 | edenite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HR1 | 7.004 | 0.996 | 0.088 | 0.118 | 0.462 | 2.732 | 1.592 | 0.008 | 0.000 | 0.133 | 1.701 | 0.166 | 0.266 | 0.110 | magnesiohornblende |
| DRS-85-204 | Tuff of Mount Jefferson | 204HT1 | 6.983 | 1.017 | 0.173 | 0.145 | 0.360 | 2.627 | 1.678 | 0.016 | 0.000 | 0.103 | 1.711 | 0.185 | 0.251 | 0.128 | magnesiohornblende |
| DRS-85-204 | Tuff of Mount Jefferson | 204HT2 | 6.950 | 1.050 | 0.128 | 0.149 | 0.439 | 2.679 | 1.604 | 0.000 | 0.000 | 0.127 | 1.690 | 0.183 | 0.253 | 0.116 | magnesiohornblende |
| DRS-85-204 | Tuff of Mount Jefferson | 204HV1 | 6.973 | 1.027 | 0.137 | 0.154 | 0.353 | 2.903 | 1.443 | 0.010 | 0.000 | 0.101 | 1.734 | 0.165 | 0.278 | 0.116 | magnesiohornblende |

**Appendix 6.** Structural Formulas (in Atoms) and Amphibole Species (Leake and Others, 1997) of Amphiboles in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

[Formulas for amphiboles given as proportions of oxides (total 16.5 ions) and converted end-member proportions]

| Original sample no. | Unit | Probe sample no. | Si | Al(iv) | Al(vi) | Ti | $Fe^{3+}$ | Mg | $Fe^{2+}$ | Mn | $Fe^{2+}$ | Mn | Ca | Na | Na | K | Amphibole species |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-85-204 | Tuff of Mount Jefferson | 204HV2 | 6.926 | 1.074 | 0.122 | 0.165 | 0.338 | 2.767 | 1.589 | 0.019 | 0.000 | 0.097 | 1.748 | 0.155 | 0.310 | 0.129 | magnesiohornblende |
| DRS-85-204 | Tuff of Mount Jefferson | 204HW1 | 6.928 | 1.072 | 0.108 | 0.167 | 0.355 | 2.791 | 1.564 | 0.015 | 0.000 | 0.102 | 1.739 | 0.159 | 0.299 | 0.136 | magnesiohornblende |
| DRS-85-204 | Tuff of Mount Jefferson | 204HW2 | 6.321 | 1.679 | 0.301 | 0.276 | 0.242 | 2.751 | 1.431 | 0.000 | 0.002 | 0.067 | 1.807 | 0.124 | 0.525 | 0.184 | pargasite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HZ1 | 6.364 | 1.636 | 0.334 | 0.224 | 0.328 | 2.198 | 1.915 | 0.000 | 0.010 | 0.084 | 1.760 | 0.146 | 0.493 | 0.178 | pargasite |
| DRS-85-204 | Tuff of Mount Jefferson | 204HZ2 | 6.329 | 1.671 | 0.314 | 0.236 | 0.313 | 2.214 | 1.923 | 0.000 | 0.001 | 0.089 | 1.793 | 0.117 | 0.509 | 0.180 | pargasite |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HJ1 | 6.291 | 1.709 | 0.294 | 0.296 | 0.310 | 2.686 | 1.414 | 0.000 | 0.040 | 0.049 | 1.749 | 0.162 | 0.524 | 0.150 | magnesiohastingsite |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HJ2 | 6.816 | 1.184 | 0.179 | 0.170 | 0.341 | 2.849 | 1.462 | 0.000 | 0.006 | 0.092 | 1.753 | 0.150 | 0.326 | 0.149 | magnesiohornblende |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HK1 | 6.232 | 1.768 | 0.389 | 0.225 | 0.381 | 3.284 | 0.721 | 0.000 | 0.095 | 0.015 | 1.763 | 0.127 | 0.562 | 0.113 | pargasite |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HK2 | 6.222 | 1.778 | 0.418 | 0.215 | 0.381 | 3.020 | 0.965 | 0.000 | 0.088 | 0.017 | 1.776 | 0.119 | 0.556 | 0.110 | pargasite |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HL1 | 6.247 | 1.753 | 0.232 | 0.341 | 0.259 | 2.393 | 1.731 | 0.044 | 0.000 | 0.074 | 1.765 | 0.161 | 0.587 | 0.154 | magnesiohastingsite |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HL2 | 6.318 | 1.682 | 0.241 | 0.324 | 0.238 | 2.385 | 1.753 | 0.058 | 0.000 | 0.068 | 1.780 | 0.152 | 0.554 | 0.153 | pargasite |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HN1 | 6.324 | 1.676 | 0.268 | 0.412 | 0.111 | 2.821 | 1.388 | 0.000 | 0.001 | 0.030 | 1.781 | 0.187 | 0.503 | 0.156 | pargasite |
| DRS-91-21 | Tuff of Ryecroft Canyon | 21HN2 | 6.298 | 1.702 | 0.232 | 0.396 | 0.164 | 2.789 | 1.419 | 0.000 | 0.013 | 0.033 | 1.785 | 0.169 | 0.529 | 0.154 | pargasite |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HB1 | 6.204 | 1.796 | 0.209 | 0.433 | 0.179 | 2.723 | 1.425 | 0.031 | 0.000 | 0.051 | 1.806 | 0.143 | 0.539 | 0.147 | pargasite |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HB2 | 6.236 | 1.764 | 0.302 | 0.320 | 0.205 | 2.656 | 1.468 | 0.049 | 0.000 | 0.059 | 1.806 | 0.136 | 0.563 | 0.189 | pargasite |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HJ1 | 6.816 | 1.184 | 0.248 | 0.212 | 0.270 | 2.819 | 1.451 | 0.000 | 0.036 | 0.041 | 1.735 | 0.188 | 0.300 | 0.129 | magnesiohornblende |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HJ2 | 6.726 | 1.274 | 0.252 | 0.231 | 0.240 | 2.734 | 1.544 | 0.000 | 0.031 | 0.038 | 1.762 | 0.170 | 0.352 | 0.139 | magnesiohornblende |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HQ1 | 6.294 | 1.706 | 0.343 | 0.353 | 0.112 | 2.395 | 1.747 | 0.050 | 0.000 | 0.032 | 1.805 | 0.163 | 0.546 | 0.162 | pargasite |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HQ2 | 6.634 | 1.366 | 0.204 | 0.231 | 0.274 | 2.567 | 1.702 | 0.023 | 0.000 | 0.078 | 1.781 | 0.140 | 0.397 | 0.171 | edenite |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HS1 | 6.254 | 1.746 | 0.248 | 0.299 | 0.269 | 2.245 | 1.909 | 0.030 | 0.000 | 0.077 | 1.787 | 0.136 | 0.575 | 0.191 | magnesiohastingsite |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HS2 | 6.198 | 1.802 | 0.207 | 0.298 | 0.358 | 2.238 | 1.895 | 0.004 | 0.000 | 0.095 | 1.797 | 0.108 | 0.585 | 0.163 | magnesiohastingsite |
| DRS-91-24 | Tuff of Ryecroft Canyon | 24HT1 | 6.238 | 1.762 | 0.313 | 0.357 | 0.185 | 2.387 | 1.729 | 0.029 | 0.000 | 0.053 | 1.794 | 0.153 | 0.546 | 0.157 | pargasite |
| DRS-84-34 | Isom-type tuff | 34HA1 | 6.386 | 1.614 | 0.222 | 0.231 | 0.390 | 2.168 | 1.989 | 0.000 | 0.020 | 0.092 | 1.756 | 0.132 | 0.460 | 0.212 | magnesiohastingsite |
| DRS-84-34 | Isom-type tuff | 34HA2 | 7.059 | 0.941 | 0.129 | 0.120 | 0.511 | 2.611 | 1.629 | 0.000 | 0.027 | 0.120 | 1.624 | 0.228 | 0.177 | 0.112 | magnesiohornblende |
| DRS-84-34 | Isom-type tuff | 34HB1 | 6.962 | 1.038 | 0.122 | 0.151 | 0.472 | 2.659 | 1.595 | 0.000 | 0.029 | 0.108 | 1.656 | 0.208 | 0.237 | 0.113 | magnesiohornblende |
| DRS-84-34 | Isom-type tuff | 34HB2 | 6.353 | 1.647 | 0.255 | 0.256 | 0.408 | 2.131 | 1.949 | 0.000 | 0.019 | 0.098 | 1.721 | 0.162 | 0.454 | 0.179 | magnesiohastingsite |
| DRS-84-34 | Isom-type tuff | 34HC1 | 6.396 | 1.604 | 0.314 | 0.258 | 0.254 | 2.327 | 1.846 | 0.000 | 0.023 | 0.049 | 1.753 | 0.174 | 0.436 | 0.256 | pargasite |
| DRS-84-34 | Isom-type tuff | 34HD1 | 6.213 | 1.787 | 0.318 | 0.255 | 0.519 | 3.062 | 0.846 | 0.000 | 0.113 | 0.018 | 1.721 | 0.148 | 0.457 | 0.132 | magnesiohastingsite |
| DRS-84-34 | Isom-type tuff | 34HD2 | 6.298 | 1.702 | 0.361 | 0.236 | 0.441 | 3.164 | 0.798 | 0.000 | 0.117 | 0.010 | 1.722 | 0.151 | 0.446 | 0.134 | magnesiohastingsite |
| DRS-84-34 | Isom-type tuff | 34HE1 | 6.612 | 1.388 | 0.228 | 0.185 | 0.331 | 2.405 | 1.852 | 0.000 | 0.011 | 0.084 | 1.789 | 0.117 | 0.393 | 0.182 | edenite |
| DRS-84-34 | Isom-type tuff | 34HE2 | 6.616 | 1.384 | 0.246 | 0.180 | 0.341 | 2.494 | 1.738 | 0.000 | 0.025 | 0.073 | 1.781 | 0.121 | 0.391 | 0.165 | edenite |
| DRS-84-34 | Isom-type tuff | 34HP1 | 6.580 | 1.420 | 0.314 | 0.199 | 0.341 | 2.790 | 1.356 | 0.000 | 0.037 | 0.060 | 1.750 | 0.152 | 0.402 | 0.118 | edenite |
| DRS-84-34 | Isom-type tuff | 34HP2 | 6.458 | 1.542 | 0.356 | 0.246 | 0.265 | 2.741 | 1.392 | 0.000 | 0.025 | 0.051 | 1.767 | 0.157 | 0.452 | 0.134 | pargasite |
| DRS-85-44 | Tuff of Mount Jefferson | 44HG1 | 7.013 | 0.987 | 0.110 | 0.112 | 0.432 | 2.765 | 1.581 | 0.000 | 0.030 | 0.094 | 1.707 | 0.169 | 0.283 | 0.107 | magnesiohornblende |
| DRS-85-44 | Tuff of Mount Jefferson | 44HG2 | 7.068 | 0.932 | 0.124 | 0.109 | 0.407 | 2.765 | 1.594 | 0.000 | 0.019 | 0.098 | 1.686 | 0.196 | 0.273 | 0.106 | magnesiohornblende |
| DRS-85-44 | Tuff of Mount Jefferson | 44HH1 | 7.067 | 0.933 | 0.114 | 0.107 | 0.410 | 2.786 | 1.583 | 0.000 | 0.019 | 0.099 | 1.696 | 0.186 | 0.278 | 0.103 | magnesiohornblende |
| DRS-85-44 | Tuff of Mount Jefferson | 44HJ1 | 6.402 | 1.598 | 0.188 | 0.262 | 0.353 | 3.099 | 1.098 | 0.000 | 0.054 | 0.047 | 1.757 | 0.142 | 0.499 | 0.177 | magnesiohastingsite |
| DRS-85-44 | Tuff of Mount Jefferson | 44HJ2 | 6.510 | 1.490 | 0.212 | 0.260 | 0.309 | 3.007 | 1.212 | 0.000 | 0.032 | 0.057 | 1.739 | 0.172 | 0.437 | 0.184 | edenite |
| DRS-87-52 | Isom-type tuff, upper | 52HA1 | 6.300 | 1.700 | 0.283 | 0.231 | 0.463 | 2.972 | 1.050 | 0.000 | 0.096 | 0.038 | 1.694 | 0.173 | 0.512 | 0.152 | magnesiohastingsite |
| DRS-87-52 | Isom-type tuff, upper | 52HA2 | 6.315 | 1.685 | 0.324 | 0.247 | 0.399 | 2.930 | 1.101 | 0.000 | 0.083 | 0.032 | 1.699 | 0.186 | 0.498 | 0.156 | magnesiohastingsite |
| DRS-87-52 | Isom-type tuff, upper | 52HK1 | 6.104 | 1.896 | 0.263 | 0.374 | 0.315 | 2.799 | 1.249 | 0.000 | 0.073 | 0.017 | 1.747 | 0.163 | 0.577 | 0.155 | magnesiohastingsite |
| DRS-87-52 | Isom-type tuff, upper | 52HK2 | 6.106 | 1.894 | 0.279 | 0.394 | 0.345 | 2.867 | 1.115 | 0.000 | 0.081 | 0.018 | 1.715 | 0.186 | 0.519 | 0.149 | magnesiohastingsite |
| DRS-87-52 | Isom-type tuff, upper | 52HP1 | 6.400 | 1.600 | 0.123 | 0.338 | 0.305 | 2.948 | 1.285 | 0.000 | 0.064 | 0.023 | 1.737 | 0.175 | 0.495 | 0.175 | magnesiohastingsite |
| DRS-91-3 | Bates Mountain Tuff | 913HF1 | 6.922 | 1.078 | 0.077 | 0.171 | 0.436 | 2.126 | 2.189 | 0.000 | 0.038 | 0.127 | 1.608 | 0.227 | 0.320 | 0.129 | ferrohornblende |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HC1 | 6.732 | 1.268 | 0.154 | 0.169 | 0.429 | 2.462 | 1.786 | 0.000 | 0.055 | 0.063 | 1.749 | 0.133 | 0.314 | 0.167 | magnesiohornblende |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HC2 | 6.812 | 1.188 | 0.139 | 0.133 | 0.484 | 2.577 | 1.666 | 0.000 | 0.067 | 0.056 | 1.738 | 0.139 | 0.287 | 0.150 | magnesiohornblende |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HE1 | 6.836 | 1.164 | 0.135 | 0.173 | 0.308 | 2.893 | 1.473 | 0.018 | 0.000 | 0.088 | 1.810 | 0.102 | 0.335 | 0.142 | magnesiohornblende |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HE2 | 6.513 | 1.487 | 0.199 | 0.282 | 0.201 | 2.897 | 1.419 | 0.002 | 0.000 | 0.057 | 1.833 | 0.110 | 0.464 | 0.168 | edenite |

**Appendix 6.** Structural Formulas (in Atoms) and Amphibole Species (Leake and Others, 1997) of Amphiboles in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

[Formulas for amphiboles given as proportions of oxides (total 16.5 ions) and converted end-member proportions]

| Original sample no. | Unit | Probe sample no. | Si | Al(iv) | Al(vi) | Ti | $Fe^{3+}$ | Mg | $Fe^{2+}$ | Mn | $Fe^{2+}$ | Mn | Ca | Na | Na | K | Amphibole species |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HE3 | 6.420 | 1.580 | 0.220 | 0.316 | 0.170 | 2.659 | 1.612 | 0.022 | 0.000 | 0.048 | 1.850 | 0.102 | 0.488 | 0.171 | pargasite |
| DRS-91-19 | Tuff of Ryecroft Canyon | 919HE4 | 6.879 | 1.121 | 0.181 | 0.176 | 0.271 | 2.991 | 1.381 | 0.000 | 0.008 | 0.069 | 1.797 | 0.125 | 0.316 | 0.126 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAA1 | 7.076 | 0.924 | 0.075 | 0.124 | 0.421 | 2.742 | 1.639 | 0.000 | 0.063 | 0.128 | 1.640 | 0.169 | 0.248 | 0.102 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAA2 | 7.038 | 0.962 | 0.077 | 0.120 | 0.434 | 2.758 | 1.611 | 0.000 | 0.045 | 0.134 | 1.656 | 0.164 | 0.266 | 0.109 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAB1 | 6.754 | 1.246 | 0.124 | 0.178 | 0.436 | 2.578 | 1.684 | 0.000 | 0.011 | 0.114 | 1.716 | 0.158 | 0.344 | 0.145 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAB2 | 6.298 | 1.702 | 0.249 | 0.323 | 0.313 | 2.178 | 1.933 | 0.005 | 0.000 | 0.090 | 1.729 | 0.182 | 0.519 | 0.157 | magnesiohastingsite |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAC1 | 6.679 | 1.321 | 0.149 | 0.184 | 0.445 | 2.461 | 1.762 | 0.000 | 0.006 | 0.122 | 1.706 | 0.166 | 0.396 | 0.129 | edenite |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAC2 | 6.905 | 1.095 | 0.085 | 0.141 | 0.465 | 2.694 | 1.615 | 0.000 | 0.010 | 0.124 | 1.697 | 0.169 | 0.308 | 0.124 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAF1 | 6.935 | 1.065 | 0.104 | 0.136 | 0.492 | 2.616 | 1.651 | 0.000 | 0.021 | 0.121 | 1.669 | 0.189 | 0.270 | 0.114 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HAF2 | 6.705 | 1.295 | 0.128 | 0.170 | 0.451 | 2.441 | 1.811 | 0.000 | 0.011 | 0.118 | 1.725 | 0.146 | 0.375 | 0.148 | edenite |
| DRS-92-20 | Tuff of Mount Jefferson | 920HB1 | 6.323 | 1.677 | 0.208 | 0.264 | 0.351 | 2.151 | 2.013 | 0.013 | 0.000 | 0.101 | 1.777 | 0.122 | 0.535 | 0.177 | magnesiohastingsite |
| DRS-92-20 | Tuff of Mount Jefferson | 920HB2 | 6.900 | 1.100 | 0.127 | 0.137 | 0.471 | 2.607 | 1.658 | 0.000 | 0.012 | 0.124 | 1.682 | 0.183 | 0.299 | 0.111 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HC1 | 6.949 | 1.051 | 0.072 | 0.135 | 0.405 | 2.743 | 1.645 | 0.000 | 0.025 | 0.118 | 1.722 | 0.135 | 0.318 | 0.121 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HC2 | 6.895 | 1.105 | 0.102 | 0.134 | 0.451 | 2.687 | 1.625 | 0.000 | 0.000 | 0.130 | 1.712 | 0.157 | 0.312 | 0.128 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HD1 | 6.251 | 1.749 | 0.294 | 0.272 | 0.268 | 2.273 | 1.885 | 0.009 | 0.000 | 0.077 | 1.820 | 0.103 | 0.595 | 0.153 | pargasite |
| DRS-92-20 | Tuff of Mount Jefferson | 920HD2 | 6.481 | 1.519 | 0.146 | 0.189 | 0.515 | 2.288 | 1.862 | 0.000 | 0.006 | 0.120 | 1.732 | 0.142 | 0.448 | 0.174 | magnesiohastingsite |
| DRS-92-20 | Tuff of Mount Jefferson | 920HH1 | 6.887 | 1.113 | 0.094 | 0.140 | 0.459 | 2.666 | 1.641 | 0.000 | 0.010 | 0.122 | 1.710 | 0.158 | 0.307 | 0.131 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HH2 | 6.918 | 1.082 | 0.080 | 0.137 | 0.450 | 2.718 | 1.616 | 0.000 | 0.014 | 0.127 | 1.702 | 0.156 | 0.311 | 0.123 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HU1 | 6.925 | 1.075 | 0.092 | 0.146 | 0.471 | 2.705 | 1.586 | 0.000 | 0.021 | 0.115 | 1.686 | 0.179 | 0.284 | 0.114 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HU2 | 6.314 | 1.686 | 0.194 | 0.245 | 0.412 | 2.197 | 1.952 | 0.000 | 0.003 | 0.107 | 1.765 | 0.125 | 0.524 | 0.192 | magnesiohastingsite |
| DRS-92-20 | Tuff of Mount Jefferson | 920HV1 | 6.323 | 1.677 | 0.266 | 0.262 | 0.358 | 2.273 | 1.841 | 0.000 | 0.005 | 0.098 | 1.742 | 0.155 | 0.505 | 0.178 | magnesiohastingsite |
| DRS-92-20 | Tuff of Mount Jefferson | 920HV2 | 6.927 | 1.073 | 0.103 | 0.141 | 0.497 | 2.734 | 1.526 | 0.000 | 0.032 | 0.112 | 1.676 | 0.181 | 0.270 | 0.103 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HW1 | 6.913 | 1.087 | 0.104 | 0.150 | 0.473 | 2.663 | 1.610 | 0.000 | 0.006 | 0.131 | 1.661 | 0.203 | 0.289 | 0.124 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HW2 | 6.886 | 1.114 | 0.104 | 0.145 | 0.497 | 2.648 | 1.605 | 0.000 | 0.013 | 0.131 | 1.661 | 0.195 | 0.286 | 0.131 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HX1 | 7.044 | 0.956 | 0.070 | 0.127 | 0.393 | 2.828 | 1.582 | 0.000 | 0.038 | 0.116 | 1.700 | 0.146 | 0.282 | 0.102 | magnesiohornblende |
| DRS-92-20 | Tuff of Mount Jefferson | 920HX2 | 7.090 | 0.910 | 0.166 | 0.123 | 0.452 | 2.738 | 1.520 | 0.000 | 0.014 | 0.117 | 1.631 | 0.238 | 0.182 | 0.101 | magnesiohornblende |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921H1 | 6.277 | 1.723 | 0.342 | 0.246 | 0.324 | 2.670 | 1.417 | 0.000 | 0.049 | 0.044 | 1.779 | 0.128 | 0.548 | 0.144 | pargasite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921H2 | 6.535 | 1.465 | 0.248 | 0.218 | 0.333 | 2.824 | 1.377 | 0.000 | 0.040 | 0.056 | 1.748 | 0.156 | 0.452 | 0.152 | edenite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAB1 | 6.339 | 1.661 | 0.209 | 0.267 | 0.375 | 2.687 | 1.462 | 0.000 | 0.052 | 0.056 | 1.759 | 0.133 | 0.522 | 0.154 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAB2 | 6.618 | 1.382 | 0.174 | 0.212 | 0.349 | 2.884 | 1.381 | 0.000 | 0.046 | 0.054 | 1.768 | 0.132 | 0.398 | 0.170 | edenite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAE1 | 6.214 | 1.786 | 0.280 | 0.292 | 0.309 | 2.633 | 1.485 | 0.000 | 0.045 | 0.044 | 1.806 | 0.106 | 0.555 | 0.162 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAE2 | 6.243 | 1.757 | 0.299 | 0.247 | 0.399 | 2.711 | 1.345 | 0.000 | 0.038 | 0.054 | 1.802 | 0.105 | 0.535 | 0.136 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAF1 | 6.341 | 1.659 | 0.196 | 0.272 | 0.397 | 2.721 | 1.413 | 0.000 | 0.052 | 0.057 | 1.766 | 0.124 | 0.495 | 0.150 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HAF2 | 6.597 | 1.403 | 0.137 | 0.196 | 0.445 | 2.917 | 1.305 | 0.000 | 0.059 | 0.051 | 1.766 | 0.124 | 0.394 | 0.159 | edenite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HD1 | 6.330 | 1.670 | 0.247 | 0.366 | 0.219 | 2.806 | 1.362 | 0.000 | 0.036 | 0.026 | 1.735 | 0.202 | 0.484 | 0.191 | pargasite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HD2 | 6.255 | 1.745 | 0.243 | 0.352 | 0.302 | 2.850 | 1.253 | 0.000 | 0.053 | 0.034 | 1.736 | 0.178 | 0.496 | 0.178 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HF1 | 6.235 | 1.765 | 0.269 | 0.291 | 0.317 | 2.528 | 1.595 | 0.000 | 0.044 | 0.047 | 1.787 | 0.123 | 0.556 | 0.163 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HF2 | 6.469 | 1.531 | 0.276 | 0.222 | 0.338 | 2.774 | 1.390 | 0.000 | 0.048 | 0.049 | 1.756 | 0.147 | 0.471 | 0.150 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HG1 | 6.590 | 1.410 | 0.197 | 0.219 | 0.349 | 2.877 | 1.358 | 0.000 | 0.050 | 0.050 | 1.752 | 0.148 | 0.415 | 0.159 | edenite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HG2 | 6.717 | 1.283 | 0.172 | 0.177 | 0.476 | 3.028 | 1.147 | 0.000 | 0.083 | 0.054 | 1.686 | 0.177 | 0.338 | 0.119 | magnesiohornblende |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HH1 | 6.521 | 1.479 | 0.218 | 0.247 | 0.416 | 3.030 | 1.089 | 0.000 | 0.090 | 0.029 | 1.703 | 0.178 | 0.377 | 0.151 | edenite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HH2 | 6.565 | 1.435 | 0.207 | 0.274 | 0.350 | 3.069 | 1.100 | 0.000 | 0.077 | 0.023 | 1.703 | 0.197 | 0.366 | 0.161 | edenite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HJ1 | 6.362 | 1.638 | 0.279 | 0.281 | 0.329 | 2.914 | 1.197 | 0.000 | 0.067 | 0.027 | 1.734 | 0.172 | 0.501 | 0.139 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HJ2 | 6.479 | 1.521 | 0.293 | 0.218 | 0.373 | 2.830 | 1.286 | 0.000 | 0.068 | 0.039 | 1.713 | 0.180 | 0.457 | 0.142 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HW1 | 6.295 | 1.705 | 0.252 | 0.293 | 0.363 | 2.899 | 1.193 | 0.000 | 0.078 | 0.027 | 1.757 | 0.138 | 0.508 | 0.134 | magnesiohastingsite |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921HW2 | 6.304 | 1.696 | 0.253 | 0.278 | 0.356 | 2.833 | 1.279 | 0.000 | 0.078 | 0.025 | 1.757 | 0.141 | 0.526 | 0.145 | magnesiohastingsite |

**Appendix 7.** Compositions (in Weight Percent) and End-Member Proportions for Pyroxene in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.

| Original sample no. | Unit | Probe sample no. | F | $Na_2O$ | Cl | $K_2O$ | MgO | CaO | $TiO_2$ | $Al_2O_3$ | $SiO_2$ | MnO | FeO | Total | WO | EN | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-169 | Tuff of Mount Jefferson | 169CAA1 | 0.01 | 0.45 | 0.00 | 0.01 | 13.87 | 21.97 | 0.22 | 1.20 | 52.67 | 0.88 | 8.33 | 99.60 | 0.4599 | 0.4041 | 0.1361 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CAA2 | 0.01 | 0.45 | 0.00 | 0.00 | 13.77 | 22.05 | 0.17 | 1.21 | 52.52 | 0.86 | 8.29 | 99.34 | 0.4624 | 0.4018 | 0.1358 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CAD1 | 0.00 | 0.43 | 0.01 | 0.00 | 14.13 | 21.89 | 0.21 | 1.25 | 52.30 | 0.84 | 8.16 | 99.20 | 0.4569 | 0.4102 | 0.1329 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CAD2 | 0.00 | 0.49 | 0.00 | 0.00 | 13.91 | 21.90 | 0.21 | 1.22 | 52.35 | 0.80 | 8.19 | 99.06 | 0.4596 | 0.4062 | 0.1341 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CD1 | 0.00 | 0.51 | 0.01 | 0.01 | 13.90 | 21.61 | 0.27 | 1.59 | 52.40 | 0.92 | 8.53 | 99.75 | 0.4541 | 0.4061 | 0.1398 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CD2 | 0.03 | 0.50 | 0.00 | 0.00 | 13.83 | 21.72 | 0.20 | 1.23 | 52.56 | 0.97 | 8.43 | 99.47 | 0.4569 | 0.4047 | 0.1384 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CM1 | 0.00 | 0.46 | 0.00 | 0.00 | 14.15 | 21.94 | 0.23 | 1.29 | 51.90 | 0.75 | 8.00 | 98.72 | 0.4584 | 0.4112 | 0.1305 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CM2 | 0.00 | 0.49 | 0.00 | 0.00 | 13.53 | 22.20 | 0.13 | 0.90 | 52.64 | 1.11 | 8.41 | 99.41 | 0.4665 | 0.3956 | 0.1379 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CR1 | 0.03 | 0.49 | 0.00 | 0.01 | 13.72 | 22.05 | 0.15 | 1.10 | 52.66 | 0.82 | 8.22 | 99.24 | 0.4637 | 0.4014 | 0.1350 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CR2 | 0.02 | 0.51 | 0.00 | 0.00 | 13.67 | 22.00 | 0.17 | 1.22 | 52.54 | 0.91 | 8.57 | 99.60 | 0.4612 | 0.3986 | 0.1402 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CU1 | 0.02 | 0.43 | 0.00 | 0.00 | 13.85 | 22.03 | 0.10 | 0.97 | 52.47 | 0.97 | 8.37 | 99.20 | 0.4606 | 0.4028 | 0.1366 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CU2 | 0.04 | 0.47 | 0.00 | 0.00 | 13.83 | 21.99 | 0.19 | 1.13 | 52.51 | 0.88 | 8.42 | 99.46 | 0.4600 | 0.4025 | 0.1375 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CY1 | 0.00 | 0.47 | 0.00 | 0.00 | 14.11 | 21.98 | 0.20 | 1.18 | 52.42 | 0.80 | 7.94 | 99.10 | 0.4598 | 0.4106 | 0.1296 |
| DRS-91-169 | Tuff of Mount Jefferson | 169CY2 | 0.00 | 0.47 | 0.00 | 0.00 | 13.87 | 21.97 | 0.20 | 1.20 | 52.62 | 0.83 | 8.25 | 99.41 | 0.4605 | 0.4045 | 0.1350 |
| DRS-85-197 | Tuff of Mount Jefferson | 197CAC1 | 0.00 | 0.39 | 0.00 | 0.00 | 13.74 | 21.81 | 0.17 | 1.09 | 52.17 | 0.90 | 8.35 | 98.60 | 0.4597 | 0.4028 | 0.1374 |
| DRS-85-197 | Tuff of Mount Jefferson | 197CAC2 | 0.00 | 0.42 | 0.00 | 0.00 | 13.91 | 21.91 | 0.16 | 1.14 | 52.20 | 0.84 | 8.33 | 98.91 | 0.4586 | 0.4052 | 0.1362 |
| DRS-85-197 | Tuff of Mount Jefferson | 197CS1 | 0.00 | 0.39 | 0.00 | 0.00 | 13.48 | 22.24 | 0.06 | 0.71 | 52.28 | 0.98 | 8.30 | 98.43 | 0.4684 | 0.3952 | 0.1364 |
| DRS-85-197 | Tuff of Mount Jefferson | 197CS2 | 0.00 | 0.29 | 0.00 | 0.00 | 13.66 | 22.06 | 0.05 | 0.75 | 52.31 | 0.93 | 8.19 | 98.24 | 0.4649 | 0.4004 | 0.1347 |
| DRS-85-197 | Tuff of Mount Jefferson | 197CU1 | 0.00 | 0.39 | 0.00 | 0.00 | 13.58 | 21.61 | 0.19 | 1.08 | 52.13 | 0.90 | 8.40 | 98.27 | 0.4593 | 0.4014 | 0.1394 |
| DRS-85-197 | Tuff of Mount Jefferson | 197CU2 | 0.00 | 0.34 | 0.00 | 0.00 | 13.83 | 21.81 | 0.06 | 1.23 | 51.60 | 0.90 | 8.61 | 98.38 | 0.4565 | 0.4028 | 0.1407 |
| DRS-85-197 | Tuff of Mount Jefferson | 197CX1 | 0.00 | 0.40 | 0.00 | 0.00 | 13.76 | 22.16 | 0.03 | 0.67 | 52.89 | 0.99 | 8.53 | 99.43 | 0.4620 | 0.3992 | 0.1388 |
| DRS-85-197 | Tuff of Mount Jefferson | 197CX2 | 0.00 | 0.31 | 0.00 | 0.00 | 13.47 | 22.06 | 0.11 | 0.88 | 51.82 | 0.97 | 8.73 | 98.36 | 0.4632 | 0.3936 | 0.1431 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CAC1 | 0.00 | 0.38 | 0.00 | 0.00 | 14.43 | 20.94 | 0.07 | 1.39 | 51.91 | 0.78 | 8.90 | 98.80 | 0.4367 | 0.4185 | 0.1448 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CAC2 | 0.00 | 0.38 | 0.00 | 0.00 | 14.44 | 21.49 | 0.08 | 1.15 | 53.01 | 0.78 | 8.46 | 99.79 | 0.4460 | 0.4169 | 0.1371 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CAC3 | 0.00 | 0.30 | 0.00 | 0.00 | 13.97 | 22.50 | 0.11 | 0.70 | 52.87 | 1.00 | 8.67 | 100.14 | 0.4620 | 0.3991 | 0.1390 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CAD1 | 0.00 | 0.39 | 0.00 | 0.00 | 13.59 | 22.05 | 0.13 | 1.41 | 52.40 | 0.88 | 8.79 | 99.64 | 0.4612 | 0.3953 | 0.1435 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CAD2 | 0.00 | 0.40 | 0.00 | 0.00 | 14.10 | 22.08 | 0.13 | 0.87 | 52.65 | 0.95 | 8.74 | 99.92 | 0.4550 | 0.4043 | 0.1406 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CAD3 | 0.00 | 0.36 | 0.00 | 0.00 | 14.14 | 22.25 | 0.08 | 0.87 | 52.94 | 0.85 | 8.62 | 100.09 | 0.4574 | 0.4043 | 0.1383 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CM1 | 0.00 | 0.37 | 0.00 | 0.00 | 13.77 | 21.98 | 0.11 | 0.83 | 52.87 | 1.04 | 9.05 | 100.03 | 0.4561 | 0.3974 | 0.1465 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CM2 | 0.00 | 0.37 | 0.00 | 0.00 | 13.72 | 21.85 | 0.17 | 1.24 | 52.47 | 0.88 | 8.75 | 99.44 | 0.4575 | 0.3995 | 0.1430 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CN1 | 0.00 | 0.44 | 0.00 | 0.00 | 13.44 | 21.84 | 0.19 | 1.28 | 52.65 | 0.97 | 9.03 | 99.82 | 0.4590 | 0.3929 | 0.1481 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CN2 | 0.00 | 0.42 | 0.00 | 0.00 | 13.53 | 21.77 | 0.25 | 1.06 | 52.57 | 0.99 | 8.81 | 99.38 | 0.4586 | 0.3965 | 0.1449 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CP1 | 0.00 | 0.32 | 0.00 | 0.00 | 14.12 | 21.84 | 0.15 | 1.21 | 52.94 | 0.84 | 8.41 | 99.83 | 0.4546 | 0.4088 | 0.1366 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CP2 | 0.00 | 0.31 | 0.00 | 0.00 | 14.38 | 21.53 | 0.15 | 0.88 | 53.19 | 0.88 | 8.61 | 99.92 | 0.4462 | 0.4145 | 0.1393 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CU1 | 0.00 | 0.38 | 0.00 | 0.00 | 13.90 | 21.91 | 0.18 | 1.29 | 52.24 | 0.79 | 8.68 | 99.37 | 0.4562 | 0.4027 | 0.1411 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CU2 | 0.00 | 0.37 | 0.00 | 0.00 | 14.15 | 22.05 | 0.13 | 1.08 | 52.69 | 0.80 | 8.78 | 100.05 | 0.4537 | 0.4052 | 0.1410 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CW1 | 0.00 | 0.29 | 0.00 | 0.00 | 14.10 | 21.75 | 0.13 | 1.00 | 52.68 | 0.83 | 8.82 | 99.60 | 0.4508 | 0.4066 | 0.1426 |
| DRS-85-199 | Tuff of Mount Jefferson | 199CW2 | 0.00 | 0.35 | 0.00 | 0.00 | 14.14 | 21.68 | 0.07 | 0.97 | 52.97 | 0.94 | 8.63 | 99.75 | 0.4509 | 0.4090 | 0.1401 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CG1 | 0.00 | 0.36 | 0.00 | 0.00 | 13.76 | 21.70 | 0.19 | 1.27 | 52.03 | 0.91 | 8.76 | 98.99 | 0.4550 | 0.4016 | 0.1434 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CG2 | 0.00 | 0.35 | 0.00 | 0.00 | 13.78 | 21.76 | 0.09 | 1.16 | 52.40 | 0.88 | 8.55 | 98.95 | 0.4572 | 0.4027 | 0.1402 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CK1 | 0.00 | 0.34 | 0.00 | 0.00 | 13.84 | 21.95 | 0.10 | 0.85 | 52.24 | 0.90 | 8.16 | 98.40 | 0.4614 | 0.4046 | 0.1339 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CK2 | 0.00 | 0.35 | 0.00 | 0.00 | 14.07 | 21.72 | 0.10 | 0.87 | 53.06 | 0.87 | 8.14 | 99.19 | 0.4559 | 0.4109 | 0.1333 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CK3 | 0.00 | 0.29 | 0.00 | 0.00 | 14.33 | 21.74 | 0.11 | 0.90 | 53.15 | 0.87 | 8.18 | 99.58 | 0.4522 | 0.4149 | 0.1329 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CL1 | 0.00 | 0.41 | 0.00 | 0.00 | 14.25 | 21.57 | 0.18 | 1.37 | 52.79 | 0.75 | 8.55 | 99.87 | 0.4486 | 0.4125 | 0.1389 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CL2 | 0.00 | 0.41 | 0.00 | 0.00 | 14.29 | 21.47 | 0.16 | 1.43 | 52.66 | 0.73 | 8.44 | 99.60 | 0.4478 | 0.4148 | 0.1374 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CM1 | 0.00 | 0.35 | 0.00 | 0.00 | 14.23 | 21.59 | 0.19 | 1.43 | 53.52 | 0.70 | 8.62 | 100.63 | 0.4487 | 0.4115 | 0.1398 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CN1 | 0.00 | 0.42 | 0.00 | 0.00 | 14.77 | 21.53 | 0.10 | 1.26 | 53.02 | 0.78 | 8.17 | 100.04 | 0.4444 | 0.4239 | 0.1316 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CR1 | 0.00 | 0.35 | 0.00 | 0.00 | 14.14 | 21.75 | 0.12 | 1.01 | 53.00 | 0.87 | 8.24 | 99.48 | 0.4546 | 0.4111 | 0.1343 |

**Appendix 7.** Compositions (in Weight Percent) and End-Member Proportions for Pyroxene in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | F | $Na_2O$ | Cl | $K_2O$ | MgO | CaO | $TiO_2$ | $Al_2O_3$ | $SiO_2$ | MnO | FeO | Total | WO | EN | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-85-203 | Tuff of Mount Jefferson | 203CU1 | 0.00 | 0.37 | 0.00 | 0.00 | 14.25 | 22.05 | 0.19 | 1.37 | 52.49 | 0.89 | 8.46 | 100.06 | 0.4548 | 0.4090 | 0.1362 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CU1 | 0.00 | 0.50 | 0.01 | 0.00 | 13.59 | 22.42 | 0.25 | 1.53 | 52.34 | 0.93 | 8.83 | 100.38 | 0.4650 | 0.3921 | 0.1429 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CW1 | 0.00 | 0.46 | 0.00 | 0.00 | 13.82 | 22.34 | 0.19 | 1.38 | 52.25 | 0.88 | 8.53 | 99.85 | 0.4632 | 0.3988 | 0.1380 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CX1 | 0.00 | 0.47 | 0.00 | 0.00 | 13.98 | 22.32 | 0.18 | 1.23 | 52.47 | 0.94 | 8.46 | 100.04 | 0.4615 | 0.4020 | 0.1365 |
| DRS-85-203 | Tuff of Mount Jefferson | 203CZ1 | 0.00 | 0.51 | 0.00 | 0.00 | 13.46 | 22.60 | 0.18 | 1.17 | 52.57 | 1.07 | 8.77 | 100.34 | 0.4691 | 0.3888 | 0.1421 |
| DRS-84-34 | Isom-type tuff | 34CF1 | 0.01 | 0.01 | 0.01 | 0.00 | 21.18 | 1.77 | 0.32 | 1.18 | 52.39 | 0.47 | 21.86 | 99.23 | 0.0367 | 0.6101 | 0.3533 |
| DRS-84-34 | Isom-type tuff | 34CF2 | 0.00 | 0.04 | 0.00 | 0.01 | 21.54 | 1.81 | 0.33 | 1.24 | 52.21 | 0.52 | 21.76 | 99.45 | 0.0372 | 0.6145 | 0.3483 |
| DRS-84-34 | Isom-type tuff | 34CG1 | 0.00 | 0.37 | 0.01 | 0.00 | 13.95 | 19.04 | 0.64 | 2.33 | 50.90 | 0.34 | 11.64 | 99.20 | 0.4006 | 0.4082 | 0.1912 |
| DRS-84-34 | Isom-type tuff | 34CG2 | 0.00 | 0.37 | 0.01 | 0.01 | 13.85 | 19.06 | 0.73 | 2.72 | 50.73 | 0.31 | 11.24 | 99.04 | 0.4047 | 0.4090 | 0.1863 |
| DRS-84-34 | Isom-type tuff | 34CH1 | 0.00 | 0.31 | 0.00 | 0.01 | 14.28 | 19.88 | 0.60 | 1.99 | 51.35 | 0.31 | 10.33 | 99.06 | 0.4158 | 0.4156 | 0.1687 |
| DRS-84-34 | Isom-type tuff | 34CH2 | 0.02 | 0.28 | 0.00 | 0.00 | 14.91 | 20.10 | 0.63 | 2.40 | 51.33 | 0.24 | 9.11 | 99.04 | 0.4192 | 0.4326 | 0.1483 |
| DRS-84-34 | Isom-type tuff | 34CI1 | 0.00 | 0.30 | 0.00 | 0.01 | 14.35 | 19.68 | 0.55 | 1.85 | 51.69 | 0.28 | 10.25 | 98.96 | 0.4131 | 0.4190 | 0.1679 |
| DRS-84-34 | Isom-type tuff | 34CI2 | 0.00 | 0.28 | 0.00 | 0.00 | 14.34 | 20.07 | 0.62 | 2.07 | 51.45 | 0.34 | 10.39 | 99.57 | 0.4170 | 0.4144 | 0.1685 |
| DRS-84-34 | Isom-type tuff | 34CJ1 | 0.00 | 0.02 | 0.01 | 0.00 | 25.44 | 1.53 | 0.25 | 1.06 | 54.34 | 0.39 | 17.28 | 100.32 | 0.0304 | 0.7022 | 0.2675 |
| DRS-84-34 | Isom-type tuff | 34CJ2 | 0.03 | 0.03 | 0.01 | 0.01 | 24.73 | 1.69 | 0.36 | 1.36 | 53.76 | 0.40 | 17.61 | 99.97 | 0.0338 | 0.6904 | 0.2758 |
| DRS-84-34 | Isom-type tuff | 34CK1 | 0.00 | 0.01 | 0.00 | 0.00 | 22.76 | 1.73 | 0.34 | 1.34 | 52.82 | 0.42 | 20.25 | 99.67 | 0.0351 | 0.6436 | 0.3213 |
| DRS-84-34 | Isom-type tuff | 34CK2 | 0.00 | 0.05 | 0.01 | 0.01 | 24.00 | 1.73 | 0.35 | 1.45 | 53.55 | 0.46 | 18.39 | 100.00 | 0.0350 | 0.6749 | 0.2900 |
| DRS-84-34 | Isom-type tuff | 34CL1 | 0.00 | 0.02 | 0.00 | 0.00 | 23.36 | 1.55 | 0.30 | 1.30 | 53.22 | 0.45 | 19.77 | 99.96 | 0.0312 | 0.6568 | 0.3119 |
| DRS-84-34 | Isom-type tuff | 34CL2 | 0.00 | 0.02 | 0.00 | 0.00 | 23.01 | 1.58 | 0.27 | 1.16 | 53.08 | 0.48 | 20.53 | 100.12 | 0.0319 | 0.6452 | 0.3229 |
| DRS-84-34 | Isom-type tuff | 34CM1 | 0.00 | 0.04 | 0.01 | 0.00 | 23.51 | 1.61 | 0.28 | 1.01 | 53.15 | 0.51 | 19.85 | 99.97 | 0.0324 | 0.6566 | 0.3110 |
| DRS-84-34 | Isom-type tuff | 34CM2 | 0.00 | 0.05 | 0.01 | 0.01 | 23.13 | 1.54 | 0.30 | 1.09 | 53.49 | 0.52 | 19.91 | 100.04 | 0.0312 | 0.6533 | 0.3155 |
| DRS-84-34 | Isom-type tuff | 34CR1 | 0.00 | 0.04 | 0.01 | 0.00 | 22.79 | 1.71 | 0.36 | 1.40 | 53.07 | 0.43 | 19.79 | 99.60 | 0.0351 | 0.6489 | 0.3161 |
| DRS-84-34 | Isom-type tuff | 34CR2 | 0.00 | 0.04 | 0.00 | 0.00 | 22.66 | 1.57 | 0.33 | 1.24 | 53.20 | 0.51 | 19.86 | 99.43 | 0.0323 | 0.6487 | 0.3190 |
| DRS-84-34 | Isom-type tuff | 34CS1 | 0.00 | 0.32 | 0.00 | 0.00 | 14.06 | 19.23 | 0.60 | 2.13 | 51.41 | 0.28 | 10.85 | 98.87 | 0.4069 | 0.4140 | 0.1791 |
| DRS-84-34 | Isom-type tuff | 34CS2 | 0.00 | 0.32 | 0.01 | 0.00 | 14.08 | 19.06 | 0.63 | 1.83 | 51.63 | 0.34 | 11.43 | 99.31 | 0.4006 | 0.4118 | 0.1876 |
| DRS-84-34 | Isom-type tuff | 34CT1 | 0.00 | 0.28 | 0.01 | 0.02 | 14.58 | 19.15 | 0.34 | 1.41 | 52.07 | 0.37 | 10.61 | 98.84 | 0.4013 | 0.4251 | 0.1736 |
| DRS-84-34 | Isom-type tuff | 34CT2 | 0.00 | 0.29 | 0.02 | 0.02 | 13.62 | 19.40 | 0.48 | 1.58 | 51.74 | 0.34 | 11.27 | 98.75 | 0.4114 | 0.4020 | 0.1866 |
| DRS-85-44 | Tuff of Mount Jefferson | 44CK1 | 0.00 | 0.42 | 0.00 | 0.00 | 13.40 | 21.61 | 0.15 | 1.11 | 52.39 | 0.91 | 8.24 | 98.23 | 0.4629 | 0.3994 | 0.1377 |
| DRS-85-44 | Tuff of Mount Jefferson | 44CK2 | 0.00 | 0.49 | 0.00 | 0.00 | 13.32 | 21.75 | 0.19 | 1.29 | 52.20 | 0.86 | 8.45 | 98.55 | 0.4639 | 0.3954 | 0.1407 |
| DRS-85-44 | Tuff of Mount Jefferson | 44CL1 | 0.00 | 0.51 | 0.01 | 0.00 | 13.14 | 21.65 | 0.16 | 1.24 | 52.58 | 0.90 | 8.53 | 98.71 | 0.4646 | 0.3925 | 0.1429 |
| DRS-85-44 | Tuff of Mount Jefferson | 44CM1 | 0.00 | 0.48 | 0.01 | 0.01 | 13.56 | 21.66 | 0.17 | 1.03 | 52.43 | 0.96 | 8.39 | 98.70 | 0.4601 | 0.4007 | 0.1391 |
| DRS-85-44 | Tuff of Mount Jefferson | 44CM2 | 0.00 | 0.49 | 0.00 | 0.01 | 13.52 | 21.56 | 0.20 | 1.38 | 52.35 | 0.85 | 8.41 | 98.77 | 0.4594 | 0.4008 | 0.1398 |
| DRS-87-52 | Isom-type tuff, upper | 52CB1 | 0.00 | 0.05 | 0.00 | 0.00 | 17.47 | 1.51 | 0.29 | 0.83 | 50.54 | 0.86 | 26.68 | 98.24 | 0.0323 | 0.5212 | 0.4465 |
| DRS-87-52 | Isom-type tuff, upper | 52CD1 | 0.00 | 0.02 | 0.01 | 0.01 | 16.86 | 1.48 | 0.25 | 0.46 | 51.12 | 0.94 | 28.04 | 99.18 | 0.0316 | 0.5009 | 0.4675 |
| DRS-87-52 | Isom-type tuff, upper | 52CD2 | 0.00 | 0.03 | 0.00 | 0.00 | 16.61 | 1.49 | 0.17 | 0.63 | 50.36 | 0.94 | 27.93 | 98.15 | 0.0321 | 0.4981 | 0.4698 |
| DRS-87-52 | Isom-type tuff, upper | 52CE2 | 0.00 | 0.04 | 0.00 | 0.00 | 16.90 | 1.45 | 0.21 | 0.43 | 50.60 | 0.90 | 27.54 | 98.08 | 0.0313 | 0.5060 | 0.4627 |
| DRS-87-52 | Isom-type tuff, upper | 52CF1 | 0.05 | 0.03 | 0.01 | 0.00 | 17.86 | 2.18 | 0.19 | 0.67 | 50.03 | 0.87 | 25.91 | 97.79 | 0.0461 | 0.5260 | 0.4280 |
| DRS-87-52 | Isom-type tuff, upper | 52CF2 | 0.00 | 0.02 | 0.00 | 0.01 | 16.57 | 1.44 | 0.25 | 0.61 | 51.07 | 0.95 | 28.07 | 98.99 | 0.0311 | 0.4967 | 0.4722 |
| DRS-87-52 | Isom-type tuff, upper | 52CG1 | 0.00 | 0.03 | 0.01 | 0.00 | 15.98 | 1.56 | 0.21 | 0.73 | 50.17 | 0.96 | 28.54 | 98.18 | 0.0338 | 0.4826 | 0.4836 |
| DRS-87-52 | Isom-type tuff, upper | 52CH1 | 0.00 | 0.05 | 0.00 | 0.00 | 18.22 | 1.52 | 0.18 | 0.63 | 51.39 | 0.81 | 25.72 | 98.51 | 0.0324 | 0.5400 | 0.4276 |
| DRS-87-52 | Isom-type tuff, upper | 52CH2 | 0.00 | 0.04 | 0.00 | 0.00 | 16.72 | 1.52 | 0.19 | 0.50 | 51.04 | 0.96 | 28.24 | 99.20 | 0.0324 | 0.4967 | 0.4709 |
| DRS-87-52 | Isom-type tuff, upper | 52CJ1 | 0.00 | 0.04 | 0.00 | 0.00 | 16.64 | 1.47 | 0.19 | 0.52 | 50.73 | 0.94 | 27.96 | 98.49 | 0.0316 | 0.4985 | 0.4699 |
| DRS-87-52 | Isom-type tuff, upper | 52CJ2 | 0.01 | 0.03 | 0.00 | 0.00 | 16.35 | 1.44 | 0.20 | 0.48 | 50.94 | 0.97 | 28.09 | 98.51 | 0.0312 | 0.4933 | 0.4755 |
| DRS-87-52 | Isom-type tuff, upper | 52CL1 | 0.00 | 0.03 | 0.00 | 0.00 | 17.45 | 1.47 | 0.24 | 0.62 | 50.38 | 0.90 | 27.00 | 98.10 | 0.0314 | 0.5185 | 0.4501 |
| DRS-87-52 | Isom-type tuff, upper | 52CL2 | 0.00 | 0.00 | 0.00 | 0.01 | 16.56 | 1.54 | 0.17 | 0.46 | 50.26 | 0.93 | 27.99 | 97.91 | 0.0332 | 0.4962 | 0.4706 |
| DRS-87-59 | Isom-type tuff | 59CA1 | 0.00 | 0.04 | 0.01 | 0.00 | 18.80 | 1.55 | 0.25 | 0.75 | 51.37 | 0.94 | 25.01 | 98.71 | 0.0327 | 0.5539 | 0.4133 |
| DRS-87-59 | Isom-type tuff | 59CA2 | 0.00 | 0.01 | 0.00 | 0.00 | 18.56 | 1.57 | 0.23 | 0.66 | 51.41 | 0.89 | 25.10 | 98.43 | 0.0334 | 0.5497 | 0.4169 |
| DRS-87-59 | Isom-type tuff | 59CC1 | 0.00 | 0.04 | 0.01 | 0.01 | 16.15 | 1.45 | 0.18 | 0.46 | 50.32 | 1.06 | 28.66 | 98.32 | 0.0313 | 0.4854 | 0.4833 |

**Appendix 7.** Compositions (in Weight Percent) and End-Member Proportions for Pyroxene in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Probe sample no. | F | $Na_2O$ | Cl | $K_2O$ | MgO | CaO | $TiO_2$ | $Al_2O_3$ | $SiO_2$ | MnO | FeO | Total | WO | EN | FS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-87-59 | Isom-type tuff | 59CC2 | 0.00 | 0.02 | 0.01 | 0.01 | 15.98 | 1.46 | 0.19 | 0.44 | 50.28 | 1.06 | 28.96 | 98.38 | 0.0314 | 0.4802 | 0.4884 |
| DRS-87-59 | Isom-type tuff | 59CD2 | 0.00 | 0.03 | 0.01 | 0.01 | 24.46 | 1.61 | 0.34 | 1.49 | 52.29 | 0.38 | 16.99 | 97.60 | 0.0330 | 0.6958 | 0.2712 |
| DRS-87-59 | Isom-type tuff | 59CE1 | 0.00 | 0.02 | 0.01 | 0.00 | 16.85 | 1.57 | 0.22 | 0.52 | 50.46 | 0.99 | 27.83 | 98.45 | 0.0335 | 0.5017 | 0.4649 |
| DRS-87-59 | Isom-type tuff | 59CE2 | 0.00 | 0.03 | 0.01 | 0.00 | 16.75 | 1.48 | 0.21 | 0.49 | 50.63 | 1.01 | 27.72 | 98.32 | 0.0319 | 0.5020 | 0.4661 |
| DRS-87-59 | Isom-type tuff | 59CF1 | 0.00 | 0.06 | 0.01 | 0.00 | 20.53 | 1.77 | 0.44 | 1.05 | 51.53 | 0.56 | 22.83 | 98.78 | 0.0368 | 0.5932 | 0.3700 |
| DRS-87-59 | Isom-type tuff | 59CF2 | 0.00 | 0.05 | 0.00 | 0.01 | 19.83 | 1.85 | 0.35 | 1.03 | 51.27 | 0.54 | 23.32 | 98.23 | 0.0389 | 0.5790 | 0.3821 |
| DRS-87-59 | Isom-type tuff | 59CG1 | 0.00 | 0.02 | 0.01 | 0.00 | 16.57 | 1.57 | 0.28 | 0.50 | 50.50 | 1.01 | 28.10 | 98.55 | 0.0338 | 0.4951 | 0.4711 |
| DRS-87-59 | Isom-type tuff | 59CG2 | 0.00 | 0.03 | 0.00 | 0.01 | 16.53 | 1.51 | 0.16 | 0.37 | 50.53 | 1.04 | 28.34 | 98.51 | 0.0323 | 0.4934 | 0.4744 |
| DRS-87-59 | Isom-type tuff | 59CH1 | 0.00 | 0.02 | 0.01 | 0.00 | 16.70 | 1.55 | 0.16 | 0.43 | 50.19 | 1.04 | 27.64 | 97.72 | 0.0334 | 0.5012 | 0.4654 |
| DRS-87-59 | Isom-type tuff | 59CH2 | 0.00 | 0.02 | 0.00 | 0.00 | 16.66 | 1.46 | 0.19 | 0.47 | 50.08 | 1.02 | 27.88 | 97.79 | 0.0314 | 0.4996 | 0.4690 |
| DRS-87-59 | Isom-type tuff | 59CR1 | 0.00 | 0.01 | 0.00 | 0.00 | 18.23 | 1.65 | 0.16 | 0.49 | 51.17 | 0.89 | 25.81 | 98.41 | 0.0351 | 0.5377 | 0.4273 |
| DRS-87-59 | Isom-type tuff | 59CR2 | 0.00 | 0.02 | 0.01 | 0.00 | 16.83 | 1.47 | 0.17 | 0.46 | 50.23 | 1.11 | 28.00 | 98.29 | 0.0314 | 0.5010 | 0.4676 |
| DRS-87-59 | Isom-type tuff | 59CS1 | 0.00 | 0.03 | 0.00 | 0.00 | 15.65 | 1.61 | 0.22 | 0.44 | 49.34 | 1.12 | 29.10 | 97.50 | 0.0348 | 0.4724 | 0.4927 |
| DRS-87-59 | Isom-type tuff | 59CS2 | 0.00 | 0.01 | 0.00 | 0.00 | 15.81 | 1.48 | 0.19 | 0.38 | 49.44 | 1.12 | 29.15 | 97.58 | 0.0320 | 0.4758 | 0.4922 |
| DRS-87-59 | Isom-type tuff | 59CU1 | 0.00 | 0.04 | 0.00 | 0.00 | 15.99 | 1.51 | 0.20 | 0.45 | 49.56 | 1.10 | 29.14 | 97.99 | 0.0324 | 0.4785 | 0.4891 |
| DRS-87-59 | Isom-type tuff | 59CU2 | 0.00 | 0.05 | 0.00 | 0.00 | 16.12 | 1.50 | 0.18 | 0.43 | 49.80 | 1.09 | 28.94 | 98.08 | 0.0322 | 0.4821 | 0.4857 |
| DRS-92-20 | Tuff of Mount Jefferson | 920CAD1 | 0.00 | 0.44 | 0.01 | 0.00 | 14.22 | 21.95 | 0.15 | 1.10 | 53.07 | 0.95 | 8.61 | 100.48 | 0.4530 | 0.4083 | 0.1387 |
| DRS-92-20 | Tuff of Mount Jefferson | 920CAD2 | 0.00 | 0.52 | 0.01 | 0.00 | 13.93 | 21.83 | 0.25 | 1.69 | 52.44 | 0.88 | 8.82 | 100.38 | 0.4539 | 0.4030 | 0.1431 |
| DRS-92-20 | Tuff of Mount Jefferson | 920CR1 | 0.04 | 0.48 | 0.00 | 0.02 | 14.08 | 22.36 | 0.31 | 1.51 | 52.59 | 0.88 | 8.51 | 100.78 | 0.4601 | 0.4032 | 0.1367 |
| DRS-92-20 | Tuff of Mount Jefferson | 920CR2 | 0.07 | 0.54 | 0.00 | 0.01 | 13.11 | 22.27 | 0.24 | 1.30 | 52.63 | 1.04 | 9.33 | 100.54 | 0.4660 | 0.3816 | 0.1524 |
| DRS-92-20 | Tuff of Mount Jefferson | 920CZ1 | 0.11 | 0.51 | 0.00 | 0.01 | 13.65 | 22.28 | 0.16 | 1.16 | 52.69 | 0.99 | 8.67 | 100.21 | 0.4638 | 0.3953 | 0.1408 |
| DRS-92-20 | Tuff of Mount Jefferson | 920CZ2 | 0.00 | 0.53 | 0.00 | 0.00 | 14.11 | 22.29 | 0.17 | 1.25 | 52.94 | 0.89 | 8.40 | 100.57 | 0.4599 | 0.4049 | 0.1352 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921CAD1 | 0.00 | 0.43 | 0.00 | 0.00 | 14.19 | 21.67 | 0.24 | 1.07 | 52.43 | 0.55 | 10.02 | 100.59 | 0.4402 | 0.4010 | 0.1588 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921CAD2 | 0.01 | 0.48 | 0.01 | 0.00 | 14.07 | 21.31 | 0.19 | 1.29 | 52.21 | 0.71 | 9.67 | 99.94 | 0.4400 | 0.4042 | 0.1558 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921CT1 | 0.04 | 0.42 | 0.01 | 0.00 | 14.02 | 21.35 | 0.15 | 1.02 | 53.36 | 0.65 | 9.37 | 100.38 | 0.4432 | 0.4050 | 0.1518 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921CT2 | 0.00 | 0.43 | 0.01 | 0.01 | 13.98 | 21.47 | 0.13 | 1.01 | 53.34 | 0.65 | 9.40 | 100.43 | 0.4448 | 0.4031 | 0.1521 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921CX1 | 0.00 | 0.47 | 0.01 | 0.00 | 14.01 | 21.33 | 0.23 | 1.55 | 51.87 | 0.53 | 9.82 | 99.83 | 0.4399 | 0.4020 | 0.1581 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921CX2 | 0.00 | 0.45 | 0.01 | 0.02 | 13.95 | 21.61 | 0.12 | 0.91 | 52.52 | 0.69 | 9.56 | 99.84 | 0.4458 | 0.4002 | 0.1540 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921CY1 | 0.00 | 0.41 | 0.00 | 0.00 | 14.17 | 21.21 | 0.17 | 0.89 | 53.36 | 0.62 | 9.46 | 100.28 | 0.4392 | 0.4080 | 0.1528 |
| DRS-92-1 | Megabreccia of Jefferson Canyon | 921CY2 | 0.00 | 0.42 | 0.00 | 0.01 | 13.88 | 20.96 | 0.10 | 1.00 | 53.23 | 0.71 | 9.56 | 99.86 | 0.4391 | 0.4046 | 0.1563 |

**Appendix 8.** Compositions (in Weight Percent) and End-Member Proportions of Plagioclase and Sanidine in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.

| Original sample no. | Unit | Mineral | Probe sample no. | $Na_2O$ | $K_2O$ | SrO | BaO | CaO | $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | Total | AN mol | AB mol | OR mol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K10C1 | 3.67 | 10.93 | 0.00 | 0.17 | 0.24 | 18.35 | 65.24 | 0.15 | 98.75 | 1.2 | 33.4 | 65.4 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K10R1 | 3.73 | 11.22 | 0.00 | 0.10 | 0.22 | 18.46 | 65.14 | 0.12 | 98.99 | 1.1 | 33.2 | 65.7 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K11C1 | 3.23 | 11.37 | 0.00 | 1.73 | 0.16 | 18.96 | 64.14 | 0.11 | 99.69 | 0.8 | 29.9 | 69.3 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K11R1 | 3.04 | 11.06 | 0.05 | 2.84 | 0.21 | 19.28 | 63.08 | 0.14 | 99.70 | 1.1 | 29.1 | 69.8 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K12C1 | 3.57 | 10.92 | 0.00 | 1.06 | 0.21 | 18.70 | 64.35 | 0.12 | 98.92 | 1.0 | 32.8 | 66.1 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K12R1 | 3.36 | 11.32 | 0.00 | 1.03 | 0.19 | 18.63 | 64.97 | 0.13 | 99.63 | 1.0 | 30.8 | 68.2 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K16C1 | 3.64 | 11.39 | 0.00 | 0.03 | 0.18 | 18.49 | 64.91 | 0.13 | 98.77 | 0.9 | 32.4 | 66.7 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K16R1 | 3.53 | 11.34 | 0.00 | 0.09 | 0.20 | 18.38 | 65.20 | 0.07 | 98.81 | 1.0 | 31.8 | 67.2 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K1C1 | 3.73 | 11.34 | 0.00 | 0.02 | 0.23 | 18.47 | 65.76 | 0.08 | 99.62 | 1.1 | 33.0 | 65.9 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K1R1 | 3.33 | 11.41 | 0.00 | 0.56 | 0.14 | 18.43 | 65.27 | 0.12 | 99.26 | 0.7 | 30.5 | 68.8 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K6C1 | 3.62 | 11.32 | 0.00 | 0.14 | 0.17 | 18.32 | 65.70 | 0.11 | 99.38 | 0.8 | 32.4 | 66.7 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K6R1 | 3.18 | 11.74 | 0.00 | 0.23 | 0.18 | 18.39 | 65.65 | 0.14 | 99.51 | 0.9 | 28.9 | 70.2 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K7C1 | 3.61 | 11.27 | 0.00 | 0.01 | 0.22 | 18.62 | 65.64 | 0.11 | 99.48 | 1.1 | 32.4 | 66.5 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K7R1 | 3.47 | 11.19 | 0.03 | 0.93 | 0.20 | 18.74 | 64.67 | 0.09 | 99.32 | 1.0 | 31.7 | 67.3 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K9C1 | 3.38 | 11.52 | 0.00 | 0.22 | 0.20 | 18.39 | 65.26 | 0.08 | 99.06 | 1.0 | 30.5 | 68.5 |
| DRS-91-168 | Tuff of Mount Jefferson | k-spar | 168K9R1 | 3.22 | 11.74 | 0.00 | 0.19 | 0.20 | 18.47 | 65.23 | 0.07 | 99.12 | 1.0 | 29.1 | 69.9 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P13C1 | 7.58 | 0.90 | 0.11 | 0.15 | 6.08 | 24.08 | 60.18 | 0.28 | 99.36 | 29.1 | 65.7 | 5.1 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P13R1 | 7.53 | 0.91 | 0.12 | 0.16 | 5.96 | 24.09 | 60.29 | 0.28 | 99.33 | 28.8 | 65.9 | 5.2 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P14C1 | 6.33 | 0.39 | 0.12 | 0.12 | 9.07 | 26.98 | 56.59 | 0.23 | 99.83 | 43.2 | 54.6 | 2.2 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P14R1 | 8.29 | 1.00 | 0.00 | 0.08 | 4.78 | 22.94 | 62.01 | 0.18 | 99.29 | 22.8 | 71.5 | 5.7 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P15C1 | 6.78 | 0.56 | 0.09 | 0.07 | 7.94 | 25.70 | 57.59 | 0.29 | 99.02 | 38.0 | 58.8 | 3.2 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P15R1 | 6.72 | 0.59 | 0.00 | 0.04 | 7.79 | 25.67 | 58.24 | 0.28 | 99.33 | 37.7 | 58.9 | 3.4 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P15R1 | 6.78 | 0.58 | 0.05 | 0.02 | 7.81 | 25.77 | 58.12 | 0.29 | 99.42 | 37.6 | 59.1 | 3.3 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P2C1 | 8.78 | 1.05 | 0.00 | 0.00 | 4.05 | 22.17 | 62.73 | 0.17 | 98.94 | 19.1 | 75.0 | 5.9 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P2R1 | 8.50 | 1.11 | 0.00 | 0.01 | 4.18 | 22.10 | 62.54 | 0.19 | 98.63 | 20.0 | 73.6 | 6.3 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P3C1 | 8.39 | 1.08 | 0.00 | 0.01 | 4.45 | 22.40 | 62.13 | 0.22 | 98.68 | 21.3 | 72.6 | 6.1 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P3R1 | 8.34 | 1.05 | 0.00 | 0.12 | 4.67 | 22.69 | 61.81 | 0.22 | 98.91 | 22.2 | 71.8 | 5.9 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P4C1 | 6.62 | 0.62 | 0.12 | 0.02 | 8.30 | 25.76 | 57.08 | 0.34 | 98.85 | 39.5 | 57.0 | 3.5 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P4R1 | 6.98 | 0.77 | 0.11 | 0.14 | 7.10 | 24.64 | 58.69 | 0.29 | 98.72 | 34.4 | 61.2 | 4.4 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P5C1 | 6.42 | 0.61 | 0.05 | 0.11 | 8.24 | 25.46 | 57.20 | 0.31 | 98.40 | 40.0 | 56.5 | 3.5 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P5R1 | 7.02 | 0.77 | 0.00 | 0.17 | 7.12 | 24.54 | 58.54 | 0.32 | 98.48 | 34.3 | 61.2 | 4.4 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P8C1 | 7.04 | 0.57 | 0.09 | 0.05 | 7.27 | 25.05 | 58.03 | 0.22 | 98.31 | 35.1 | 61.6 | 3.3 |
| DRS-91-168 | Tuff of Mount Jefferson | plag | 168P8R1 | 8.34 | 0.99 | 0.00 | 0.07 | 4.87 | 23.02 | 61.44 | 0.21 | 98.93 | 23.0 | 71.4 | 5.5 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K10C1 | 4.18 | 10.48 | 0.03 | 0.10 | 0.24 | 18.67 | 65.37 | 0.11 | 99.17 | 1.2 | 37.3 | 61.5 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K10R1 | 3.88 | 10.76 | 0.00 | 0.56 | 0.22 | 18.65 | 65.66 | 0.13 | 99.85 | 1.1 | 35.0 | 63.9 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K11C1 | 3.95 | 10.83 | 0.00 | 0.00 | 0.20 | 18.56 | 65.40 | 0.10 | 99.04 | 1.0 | 35.3 | 63.7 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K11R1 | 4.05 | 10.25 | 0.00 | 0.48 | 0.26 | 18.69 | 65.24 | 0.13 | 99.11 | 1.3 | 37.0 | 61.6 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K17C1 | 3.61 | 11.40 | 0.00 | 0.05 | 0.19 | 18.40 | 64.51 | 0.11 | 98.27 | 0.9 | 32.2 | 66.9 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K17R1 | 3.83 | 10.78 | 0.00 | 0.26 | 0.27 | 18.67 | 65.25 | 0.17 | 99.22 | 1.3 | 34.6 | 64.1 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K18C1 | 4.00 | 10.87 | 0.00 | 0.19 | 0.16 | 18.49 | 65.34 | 0.11 | 99.16 | 0.8 | 35.6 | 63.6 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K18R1 | 4.10 | 10.63 | 0.00 | 0.21 | 0.23 | 18.50 | 65.59 | 0.22 | 99.47 | 1.1 | 36.5 | 62.3 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K21C1 | 3.94 | 10.78 | 0.00 | 0.03 | 0.19 | 18.52 | 65.87 | 0.07 | 99.39 | 0.9 | 35.4 | 63.7 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K21R1 | 3.98 | 10.25 | 0.00 | 0.85 | 0.29 | 18.83 | 65.50 | 0.12 | 99.82 | 1.4 | 36.6 | 62.0 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K22C1 | 3.82 | 11.07 | 0.00 | 0.29 | 0.24 | 18.67 | 65.67 | 0.09 | 99.86 | 1.2 | 34.0 | 64.8 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K22R1 | 3.96 | 10.30 | 0.00 | 0.98 | 0.24 | 19.02 | 64.94 | 0.16 | 99.60 | 1.2 | 36.4 | 62.4 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K3C1 | 4.11 | 10.45 | 0.05 | 0.51 | 0.25 | 18.43 | 64.60 | 0.10 | 98.51 | 1.3 | 36.9 | 61.8 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K3R1 | 3.85 | 10.54 | 0.00 | 0.52 | 0.27 | 18.53 | 65.48 | 0.13 | 99.31 | 1.3 | 35.2 | 63.4 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K4C1 | 3.95 | 10.87 | 0.00 | 0.07 | 0.21 | 18.34 | 65.46 | 0.06 | 98.96 | 1.0 | 35.2 | 63.7 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K4R1 | 3.80 | 10.66 | 0.00 | 0.41 | 0.21 | 18.55 | 65.44 | 0.15 | 99.22 | 1.1 | 34.8 | 64.2 |

**Appendix 8.** Compositions (in Weight Percent) and End-Member Proportions of Plagioclase and Sanidine in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Mineral | Probe sample no. | $Na_2O$ | $K_2O$ | SrO | BaO | CaO | $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | Total | AN mol | AB mol | OR mol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K5C1 | 3.60 | 11.26 | 0.00 | 0.22 | 0.21 | 18.49 | 65.58 | 0.08 | 99.44 | 1.1 | 32.4 | 66.6 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K5R1 | 3.77 | 10.67 | 0.00 | 1.10 | 0.26 | 18.78 | 65.03 | 0.15 | 99.76 | 1.3 | 34.5 | 64.2 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K9C1 | 3.78 | 11.07 | 0.00 | 0.07 | 0.20 | 18.68 | 65.37 | 0.10 | 99.27 | 1.0 | 33.8 | 65.2 |
| DRS-91-21 | Tuff of Ryecroft Canyon | k-spar | 21K9R1 | 3.99 | 10.85 | 0.00 | 0.02 | 0.22 | 18.53 | 65.56 | 0.08 | 99.25 | 1.1 | 35.5 | 63.4 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P12C1 | 6.86 | 0.61 | 0.17 | 0.22 | 7.48 | 25.51 | 58.48 | 0.18 | 99.51 | 36.3 | 60.2 | 3.5 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P12R1 | 7.84 | 0.75 | 0.00 | 0.03 | 5.96 | 24.10 | 60.44 | 0.19 | 99.30 | 28.3 | 67.4 | 4.2 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P15C1 | 8.61 | 1.31 | 0.00 | 0.03 | 3.83 | 22.14 | 62.98 | 0.17 | 99.07 | 18.3 | 74.3 | 7.4 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P15R1 | 8.62 | 1.33 | 0.00 | 0.04 | 3.99 | 22.32 | 62.68 | 0.16 | 99.14 | 18.8 | 73.7 | 7.5 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P16C1 | 7.99 | 0.98 | 0.00 | 0.06 | 5.32 | 23.31 | 60.50 | 0.26 | 98.41 | 25.4 | 69.0 | 5.6 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P16R1 | 8.17 | 1.01 | 0.03 | 0.00 | 5.04 | 23.19 | 61.07 | 0.22 | 98.73 | 24.0 | 70.3 | 5.7 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P19C1 | 8.11 | 0.98 | 0.01 | 0.01 | 5.01 | 23.11 | 61.23 | 0.23 | 98.69 | 24.0 | 70.4 | 5.6 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P19R1 | 8.14 | 0.89 | 0.00 | 0.00 | 5.16 | 23.11 | 61.34 | 0.20 | 98.84 | 24.6 | 70.3 | 5.0 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P1aC1 | 7.16 | 0.57 | 0.02 | 0.12 | 7.36 | 25.32 | 59.13 | 0.19 | 99.88 | 35.1 | 61.7 | 3.2 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P1aR1 | 8.14 | 1.03 | 0.00 | 0.01 | 5.04 | 22.82 | 61.47 | 0.21 | 98.72 | 24.0 | 70.1 | 5.9 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P1bC1 | 8.14 | 0.99 | 0.00 | 0.04 | 5.00 | 22.75 | 61.53 | 0.25 | 98.70 | 23.9 | 70.4 | 5.6 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P1bR1 | 8.61 | 1.34 | 0.02 | 0.04 | 4.02 | 21.91 | 62.48 | 0.25 | 98.67 | 19.0 | 73.5 | 7.5 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P20C1 | 8.18 | 1.02 | 0.00 | 0.00 | 5.10 | 23.16 | 61.49 | 0.24 | 99.19 | 24.2 | 70.1 | 5.8 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P20R1 | 8.17 | 0.98 | 0.00 | 0.06 | 5.13 | 23.18 | 61.63 | 0.22 | 99.37 | 24.3 | 70.1 | 5.5 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P23C1 | 8.24 | 1.15 | 0.00 | 0.03 | 4.74 | 23.18 | 62.75 | 0.25 | 100.34 | 22.6 | 71.0 | 6.5 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P23R1 | 8.25 | 1.06 | 0.00 | 0.00 | 4.81 | 23.27 | 62.55 | 0.22 | 100.16 | 22.9 | 71.1 | 6.0 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P24C1 | 7.93 | 0.88 | 0.03 | 0.07 | 5.47 | 23.91 | 61.54 | 0.21 | 100.03 | 26.2 | 68.8 | 5.0 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P24R1 | 8.20 | 0.97 | 0.01 | 0.05 | 4.92 | 23.20 | 62.20 | 0.19 | 99.74 | 23.5 | 70.9 | 5.5 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P25C1 | 6.46 | 0.42 | 0.18 | 0.11 | 8.56 | 26.67 | 57.47 | 0.27 | 100.14 | 41.3 | 56.3 | 2.4 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P25R1 | 7.37 | 0.68 | 0.09 | 0.08 | 6.48 | 24.77 | 59.88 | 0.25 | 99.59 | 31.4 | 64.7 | 3.9 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P2C1 | 8.40 | 1.20 | 0.00 | 0.04 | 4.31 | 22.28 | 62.33 | 0.21 | 98.77 | 20.6 | 72.6 | 6.8 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P2R1 | 8.42 | 1.22 | 0.00 | 0.04 | 4.30 | 22.23 | 62.34 | 0.19 | 98.74 | 20.5 | 72.6 | 6.9 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P6C1 | 7.55 | 0.75 | 0.00 | 0.03 | 6.24 | 24.01 | 59.81 | 0.30 | 98.68 | 30.0 | 65.7 | 4.3 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P6C2 | 6.81 | 0.53 | 0.06 | 0.06 | 7.86 | 25.62 | 57.84 | 0.17 | 98.96 | 37.8 | 59.2 | 3.0 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P6C2 | 7.12 | 0.60 | 0.09 | 0.06 | 7.39 | 25.30 | 58.25 | 0.24 | 99.05 | 35.2 | 61.4 | 3.4 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P6R1 | 8.11 | 1.00 | 0.00 | 0.01 | 5.08 | 23.09 | 61.90 | 0.26 | 99.45 | 24.2 | 70.1 | 5.7 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P8C1 | 7.91 | 0.82 | 0.00 | 0.06 | 5.59 | 23.60 | 60.41 | 0.23 | 98.62 | 26.8 | 68.6 | 4.7 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P8C2 | 6.25 | 0.38 | 0.01 | 0.03 | 8.97 | 26.47 | 55.99 | 0.22 | 98.32 | 43.3 | 54.6 | 2.2 |
| DRS-91-21 | Tuff of Ryecroft Canyon | plag | 21P8R1 | 8.19 | 0.91 | 0.00 | 0.03 | 5.11 | 23.20 | 61.48 | 0.21 | 99.14 | 24.3 | 70.5 | 5.2 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K10C1 | 4.07 | 10.75 | 0.00 | 0.00 | 0.18 | 18.95 | 66.07 | 0.08 | 100.10 | 0.9 | 36.2 | 62.9 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K10R1 | 4.14 | 10.41 | 0.00 | 0.39 | 0.27 | 18.81 | 66.42 | 0.11 | 100.56 | 1.3 | 37.2 | 61.5 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K11C1 | 4.25 | 10.35 | 0.02 | 0.14 | 0.22 | 18.85 | 66.49 | 0.09 | 100.41 | 1.1 | 38.0 | 60.9 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K11R1 | 4.32 | 10.05 | 0.00 | 0.76 | 0.29 | 19.07 | 65.95 | 0.14 | 100.57 | 1.4 | 38.9 | 59.6 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K15C1 | 3.86 | 11.14 | 0.00 | 0.05 | 0.20 | 18.87 | 66.94 | 0.07 | 101.14 | 1.0 | 34.2 | 64.9 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K15R1 | 3.95 | 10.64 | 0.00 | 0.22 | 0.26 | 18.85 | 66.88 | 0.13 | 100.93 | 1.3 | 35.6 | 63.1 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K17C1 | 3.60 | 11.63 | 0.00 | 0.01 | 0.17 | 18.68 | 66.69 | 0.11 | 100.90 | 0.8 | 31.7 | 67.4 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K17R1 | 4.37 | 10.11 | 0.00 | 0.34 | 0.34 | 19.02 | 66.65 | 0.16 | 100.99 | 1.7 | 39.0 | 59.3 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K23C1 | 3.95 | 11.12 | 0.00 | 0.18 | 0.23 | 18.92 | 66.78 | 0.12 | 101.29 | 1.1 | 34.7 | 64.2 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K23R1 | 4.12 | 10.38 | 0.00 | 0.63 | 0.35 | 19.20 | 66.08 | 0.11 | 100.86 | 1.7 | 37.0 | 61.3 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K28C1 | 4.28 | 10.80 | 0.00 | 0.02 | 0.17 | 18.65 | 66.74 | 0.08 | 100.73 | 0.8 | 37.3 | 61.9 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K28R1 | 4.39 | 10.35 | 0.00 | 0.00 | 0.27 | 18.86 | 66.74 | 0.09 | 100.70 | 1.3 | 38.7 | 60.0 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K4C1 | 4.35 | 10.16 | 0.00 | 0.00 | 0.27 | 18.72 | 65.53 | 0.09 | 99.12 | 1.3 | 38.9 | 59.8 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K5C1 | 3.76 | 10.90 | 0.00 | 0.04 | 0.17 | 18.52 | 65.86 | 0.07 | 99.31 | 0.8 | 34.1 | 65.1 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K5R1 | 4.01 | 10.83 | 0.00 | 0.09 | 0.26 | 18.68 | 66.56 | 0.09 | 100.52 | 1.3 | 35.5 | 63.2 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K7C1 | 4.41 | 10.01 | 0.00 | 0.76 | 0.27 | 18.87 | 65.32 | 0.08 | 99.71 | 1.3 | 39.6 | 59.1 |

**Appendix 8.** Compositions (in Weight Percent) and End-Member Proportions of Plagioclase and Sanidine in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Mineral | Probe sample no. | $Na_2O$ | $K_2O$ | SrO | BaO | CaO | $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | Total | AN mol | AB mol | OR mol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K7R1 | 4.28 | 10.03 | 0.00 | 0.85 | 0.26 | 18.83 | 65.65 | 0.14 | 100.04 | 1.3 | 38.8 | 59.9 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K9C1 | 4.24 | 10.48 | 0.00 | 0.19 | 0.18 | 18.74 | 66.37 | 0.13 | 100.33 | 0.9 | 37.7 | 61.4 |
| DRS-91-24 | Tuff of Ryecroft Canyon | k-spar | 24K9R1 | 4.59 | 9.22 | 0.07 | 1.61 | 0.39 | 19.59 | 65.22 | 0.10 | 100.79 | 2.0 | 42.2 | 55.8 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P12C1 | 7.62 | 0.77 | 0.00 | 0.06 | 6.43 | 24.69 | 60.94 | 0.25 | 100.75 | 30.4 | 65.2 | 4.3 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P12R1 | 7.90 | 0.90 | 0.01 | 0.05 | 5.66 | 24.06 | 62.31 | 0.30 | 101.19 | 26.9 | 68.0 | 5.1 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P13C1 | 8.22 | 1.14 | 0.00 | 0.00 | 4.64 | 23.21 | 63.24 | 0.18 | 100.62 | 22.2 | 71.3 | 6.5 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P13R1 | 8.01 | 1.02 | 0.00 | 0.02 | 5.14 | 23.45 | 62.89 | 0.19 | 100.72 | 24.7 | 69.5 | 5.8 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P13R2 | 8.34 | 1.19 | 0.00 | 0.07 | 4.49 | 23.11 | 63.46 | 0.23 | 100.89 | 21.4 | 71.9 | 6.8 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P18C1 | 7.54 | 0.72 | 0.00 | 0.14 | 6.28 | 24.60 | 60.51 | 0.25 | 100.05 | 30.2 | 65.7 | 4.1 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P18R1 | 8.16 | 1.07 | 0.00 | 0.00 | 4.85 | 23.27 | 63.03 | 0.25 | 100.63 | 23.2 | 70.7 | 6.1 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P1C1 | 8.16 | 1.11 | 0.00 | 0.02 | 4.57 | 22.85 | 61.85 | 0.24 | 98.81 | 22.1 | 71.5 | 6.4 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P1R1 | 8.19 | 1.01 | 0.00 | 0.11 | 4.70 | 22.78 | 61.93 | 0.23 | 98.95 | 22.7 | 71.5 | 5.8 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P21aC1 | 7.90 | 0.94 | 0.00 | 0.04 | 5.43 | 24.22 | 62.22 | 0.24 | 100.99 | 26.0 | 68.6 | 5.4 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P21aR1 | 7.84 | 0.90 | 0.00 | 0.00 | 5.59 | 23.93 | 61.98 | 0.24 | 100.48 | 26.8 | 68.0 | 5.1 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P21bC1 | 7.63 | 0.76 | 0.05 | 0.05 | 6.22 | 24.67 | 60.90 | 0.22 | 100.50 | 29.7 | 66.0 | 4.3 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P21bR1 | 8.09 | 1.00 | 0.00 | 0.00 | 5.11 | 23.44 | 62.79 | 0.22 | 100.65 | 24.4 | 69.9 | 5.7 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P22aC1 | 8.12 | 1.08 | 0.00 | 0.00 | 5.02 | 23.58 | 62.92 | 0.26 | 100.98 | 23.9 | 70.0 | 6.1 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P22aR1 | 8.12 | 1.05 | 0.00 | 0.10 | 5.00 | 23.43 | 62.79 | 0.27 | 100.76 | 23.9 | 70.1 | 6.0 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P24C1 | 8.37 | 1.12 | 0.00 | 0.03 | 4.67 | 23.24 | 63.25 | 0.28 | 100.95 | 22.1 | 71.6 | 6.3 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P24R1 | 8.46 | 1.30 | 0.00 | 0.02 | 4.28 | 22.85 | 63.78 | 0.17 | 100.86 | 20.2 | 72.4 | 7.3 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P26C1 | 8.30 | 1.10 | 0.00 | 0.05 | 4.68 | 23.22 | 63.56 | 0.21 | 101.12 | 22.3 | 71.5 | 6.2 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P26R1 | 8.43 | 1.15 | 0.00 | 0.06 | 4.62 | 23.14 | 63.53 | 0.23 | 101.16 | 21.7 | 71.8 | 6.4 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P33C1 | 7.90 | 0.92 | 0.06 | 0.09 | 5.54 | 24.02 | 62.13 | 0.25 | 100.91 | 26.5 | 68.3 | 5.2 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P33R1 | 8.19 | 0.98 | 0.00 | 0.03 | 4.92 | 23.65 | 63.02 | 0.24 | 101.03 | 23.5 | 70.9 | 5.6 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P33R1 | 8.15 | 0.99 | 0.00 | 0.11 | 5.01 | 23.72 | 62.78 | 0.24 | 101.00 | 23.9 | 70.4 | 5.6 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P3C1 | 8.28 | 1.10 | 0.00 | 0.00 | 4.74 | 23.22 | 62.62 | 0.22 | 100.18 | 22.5 | 71.2 | 6.2 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P3R1 | 7.98 | 0.98 | 0.00 | 0.09 | 5.03 | 23.26 | 62.09 | 0.21 | 99.63 | 24.4 | 70.0 | 5.6 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P6C1 | 7.62 | 0.79 | 0.02 | 0.06 | 6.14 | 24.24 | 60.71 | 0.25 | 99.83 | 29.4 | 66.1 | 4.5 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P6R1 | 7.35 | 0.70 | 0.00 | 0.03 | 6.66 | 24.61 | 59.91 | 0.26 | 99.52 | 32.0 | 64.0 | 4.0 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P8C1 | 8.14 | 0.94 | 0.00 | 0.10 | 5.27 | 23.55 | 61.42 | 0.20 | 99.62 | 25.0 | 69.8 | 5.3 |
| DRS-91-24 | Tuff of Ryecroft Canyon | plag | 24P8R1 | 8.28 | 1.08 | 0.00 | 0.00 | 4.67 | 23.16 | 62.64 | 0.23 | 100.06 | 22.3 | 71.6 | 6.1 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K?21C1 | 8.86 | 3.08 | 0.00 | 0.04 | 1.50 | 20.04 | 65.77 | 0.10 | 99.40 | 7.1 | 75.6 | 17.3 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K?21R1 | 5.87 | 8.08 | 0.00 | 0.05 | 0.36 | 18.95 | 66.74 | 0.14 | 100.19 | 1.7 | 51.6 | 46.7 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K12C1 | 5.54 | 8.52 | 0.00 | 0.06 | 0.32 | 18.85 | 66.24 | 0.12 | 99.64 | 1.5 | 48.9 | 49.5 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K12R1 | 5.46 | 8.54 | 0.00 | 0.00 | 0.36 | 18.77 | 66.04 | 0.15 | 99.32 | 1.8 | 48.4 | 49.8 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K1C1 | 5.63 | 8.40 | 0.00 | 0.05 | 0.38 | 19.08 | 66.63 | 0.13 | 100.30 | 1.8 | 49.5 | 48.6 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K1R1 | 5.74 | 8.33 | 0.00 | 0.03 | 0.34 | 18.98 | 66.69 | 0.11 | 100.22 | 1.7 | 50.3 | 48.0 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K24C1 | 5.61 | 8.37 | 0.00 | 0.00 | 0.33 | 18.75 | 66.14 | 0.07 | 99.28 | 1.6 | 49.6 | 48.7 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K24R1 | 6.19 | 7.65 | 0.00 | 0.05 | 0.48 | 19.11 | 66.59 | 0.16 | 100.22 | 2.3 | 53.9 | 43.8 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K26C1 | 5.58 | 8.46 | 0.00 | 0.06 | 0.41 | 18.76 | 65.83 | 0.12 | 99.21 | 2.0 | 49.1 | 49.0 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K26R1 | 6.25 | 7.56 | 0.00 | 0.06 | 0.45 | 19.04 | 66.66 | 0.10 | 100.12 | 2.2 | 54.5 | 43.4 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K31C1 | 4.47 | 8.73 | 0.00 | 2.84 | 0.68 | 20.06 | 63.20 | 0.15 | 100.14 | 3.6 | 42.2 | 54.2 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K31M1 | 4.51 | 9.70 | 0.00 | 1.09 | 0.39 | 19.26 | 64.96 | 0.16 | 100.07 | 1.9 | 40.6 | 57.5 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K31R1 | 4.49 | 9.73 | 0.00 | 0.80 | 0.23 | 18.97 | 65.50 | 0.12 | 99.85 | 1.2 | 40.7 | 58.1 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K32C1 | 4.41 | 10.20 | 0.00 | 0.33 | 0.37 | 19.02 | 65.81 | 0.14 | 100.28 | 1.8 | 38.9 | 59.3 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K32R1 | 4.98 | 9.10 | 0.00 | 0.90 | 0.43 | 19.15 | 65.20 | 0.14 | 99.91 | 2.1 | 44.4 | 53.4 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K33C1 | 4.06 | 9.63 | 0.08 | 2.70 | 0.44 | 19.47 | 63.04 | 0.15 | 99.56 | 2.3 | 38.2 | 59.6 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K33M1 | 4.12 | 9.84 | 0.01 | 1.85 | 0.27 | 18.86 | 63.95 | 0.27 | 99.17 | 1.4 | 38.3 | 60.3 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K33R1 | 4.29 | 9.10 | 0.04 | 2.53 | 0.45 | 19.43 | 63.54 | 0.15 | 99.53 | 2.3 | 40.8 | 56.9 |

**Appendix 8.** Compositions (in Weight Percent) and End-Member Proportions of Plagioclase and Sanidine in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Mineral | Probe sample no. | $Na_2O$ | $K_2O$ | SrO | BaO | CaO | $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | Total | AN mol | AB mol | OR mol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K3C1 | 5.84 | 8.09 | 0.00 | 0.06 | 0.42 | 18.98 | 66.58 | 0.17 | 100.14 | 2.0 | 51.2 | 46.7 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K3R1 | 6.10 | 7.84 | 0.00 | 0.01 | 0.40 | 18.86 | 66.18 | 0.10 | 99.48 | 1.9 | 53.1 | 44.9 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K4C1 | 4.78 | 9.98 | 0.00 | 0.06 | 0.20 | 18.84 | 66.15 | 0.07 | 100.09 | 1.0 | 41.7 | 57.3 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K4R1 | 4.95 | 9.53 | 0.00 | 0.03 | 0.24 | 18.80 | 65.97 | 0.11 | 99.63 | 1.2 | 43.6 | 55.2 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K5C1 | 5.76 | 8.29 | 0.00 | 0.08 | 0.33 | 19.07 | 66.33 | 0.12 | 99.98 | 1.6 | 50.6 | 47.9 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K5R1 | 5.80 | 8.32 | 0.00 | 0.08 | 0.35 | 18.99 | 66.50 | 0.15 | 100.19 | 1.7 | 50.6 | 47.7 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K6C1 | 5.90 | 8.23 | 0.00 | 0.02 | 0.39 | 18.96 | 66.65 | 0.11 | 100.27 | 1.9 | 51.2 | 47.0 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K6R1 | 5.72 | 8.30 | 0.00 | 0.11 | 0.40 | 18.82 | 66.47 | 0.16 | 99.98 | 2.0 | 50.2 | 47.9 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K8C1 | 6.06 | 7.58 | 0.00 | 0.00 | 0.54 | 18.95 | 65.97 | 0.13 | 99.23 | 2.6 | 53.4 | 44.0 |
| DRS-91-25 | Bates Mountain Tuff | k-spar | 25K8R1 | 5.83 | 7.96 | 0.00 | 0.11 | 0.41 | 18.91 | 66.38 | 0.15 | 99.76 | 2.0 | 51.6 | 46.4 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P?13C1 | 7.97 | 3.89 | 0.00 | 0.01 | 1.52 | 20.01 | 65.49 | 0.16 | 99.05 | 7.4 | 70.1 | 22.5 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P?13R1 | 8.19 | 3.70 | 0.00 | 0.06 | 1.69 | 20.27 | 65.68 | 0.20 | 99.79 | 8.1 | 70.9 | 21.1 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P?14C1 | 8.39 | 1.37 | 0.00 | 0.11 | 4.24 | 22.65 | 62.99 | 0.24 | 99.99 | 20.1 | 72.1 | 7.7 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P?14R1 | 8.38 | 1.43 | 0.00 | 0.01 | 3.96 | 22.44 | 63.44 | 0.26 | 99.92 | 19.0 | 72.8 | 8.2 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P?15C1 | 7.78 | 1.39 | 0.00 | 0.33 | 4.95 | 23.15 | 61.72 | 0.32 | 99.63 | 23.9 | 68.1 | 8.0 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P?15R1 | 7.60 | 1.12 | 0.00 | 0.26 | 5.64 | 23.96 | 61.20 | 0.26 | 100.04 | 27.2 | 66.4 | 6.4 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P10C1 | 7.86 | 1.24 | 0.00 | 0.26 | 5.19 | 23.37 | 61.01 | 0.26 | 99.19 | 24.8 | 68.1 | 7.1 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P10R1 | 7.93 | 1.07 | 0.02 | 0.11 | 5.13 | 23.35 | 61.36 | 0.33 | 99.30 | 24.7 | 69.1 | 6.2 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P11C1 | 7.24 | 1.03 | 0.08 | 0.52 | 6.11 | 24.20 | 59.97 | 0.34 | 99.49 | 29.9 | 64.1 | 6.0 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P11R1 | 7.15 | 0.90 | 0.01 | 0.26 | 6.65 | 24.90 | 59.34 | 0.30 | 99.50 | 32.2 | 62.6 | 5.2 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P16C1 | 9.07 | 1.50 | 0.00 | 0.07 | 2.96 | 21.34 | 64.42 | 0.17 | 99.53 | 14.0 | 77.6 | 8.4 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P16R1 | 8.80 | 1.22 | 0.00 | 0.00 | 3.78 | 22.39 | 64.00 | 0.18 | 100.37 | 17.9 | 75.3 | 6.9 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P18C1 | 7.81 | 1.13 | 0.04 | 0.20 | 5.58 | 23.78 | 60.93 | 0.26 | 99.73 | 26.5 | 67.1 | 6.4 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P18R1 | 7.64 | 1.13 | 0.02 | 0.24 | 5.83 | 23.93 | 60.66 | 0.33 | 99.77 | 27.8 | 65.8 | 6.4 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P28C1 | 8.03 | 1.44 | 0.00 | 0.13 | 4.48 | 22.89 | 62.50 | 0.23 | 99.70 | 21.6 | 70.1 | 8.3 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P28R1 | 7.90 | 1.09 | 0.00 | 0.11 | 5.37 | 23.63 | 61.14 | 0.25 | 99.49 | 25.6 | 68.2 | 6.2 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P2C1 | 7.20 | 0.80 | 0.00 | 0.00 | 6.87 | 25.05 | 59.67 | 0.26 | 99.85 | 33.0 | 62.5 | 4.6 |
| DRS-91-25 | Bates Mountain Tuff | plag | 25P2R1 | 7.68 | 1.15 | 0.00 | 0.08 | 5.65 | 24.03 | 60.99 | 0.31 | 99.88 | 27.0 | 66.5 | 6.5 |
| DRS-84-34 | Bates Mountain Tuff | k-spar | 34K11C1 | 3.59 | 10.92 | 0.00 | 0.47 | 0.25 | 18.70 | 65.47 | 0.09 | 99.50 | 1.3 | 32.9 | 65.8 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K11R1 | 4.21 | 10.01 | 0.00 | 0.55 | 0.28 | 18.74 | 65.61 | 0.11 | 99.50 | 1.4 | 38.4 | 60.2 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K18C1 | 3.89 | 10.79 | 0.00 | 0.02 | 0.18 | 18.39 | 65.98 | 0.07 | 99.32 | 0.9 | 35.1 | 64.0 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K18R1 | 4.71 | 9.64 | 0.00 | 0.00 | 0.28 | 18.76 | 66.52 | 0.13 | 100.04 | 1.4 | 42.0 | 56.6 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K29C1 | 3.65 | 11.20 | 0.00 | 0.04 | 0.20 | 18.47 | 65.45 | 0.11 | 99.12 | 1.0 | 32.8 | 66.2 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K29R1 | 4.47 | 10.07 | 0.00 | 0.21 | 0.20 | 18.58 | 65.94 | 0.13 | 99.59 | 1.0 | 39.9 | 59.1 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K32C1 | 3.81 | 10.96 | 0.00 | 0.22 | 0.18 | 18.53 | 65.84 | 0.17 | 99.71 | 0.9 | 34.3 | 64.9 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K32R1 | 4.67 | 10.00 | 0.00 | 0.33 | 0.20 | 18.79 | 65.70 | 0.12 | 99.81 | 1.0 | 41.1 | 57.9 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K33C1 | 3.76 | 11.02 | 0.00 | 0.12 | 0.18 | 18.56 | 65.96 | 0.09 | 99.69 | 0.9 | 33.8 | 65.3 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K33R1 | 4.19 | 10.28 | 0.00 | 0.03 | 0.25 | 18.52 | 65.77 | 0.24 | 99.28 | 1.2 | 37.8 | 61.0 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K35C1 | 4.11 | 10.61 | 0.00 | 0.26 | 0.19 | 18.69 | 66.14 | 0.16 | 100.16 | 0.9 | 36.7 | 62.4 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K35R1 | 4.22 | 10.37 | 0.00 | 0.24 | 0.21 | 18.64 | 66.26 | 0.24 | 100.18 | 1.1 | 37.8 | 61.1 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K36C1 | 3.73 | 10.94 | 0.00 | 0.09 | 0.21 | 18.70 | 66.15 | 0.09 | 99.91 | 1.1 | 33.8 | 65.2 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K36R1 | 4.60 | 9.70 | 0.00 | 0.04 | 0.29 | 18.76 | 66.41 | 0.18 | 99.98 | 1.4 | 41.3 | 57.3 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K37C1 | 3.84 | 10.04 | 0.02 | 1.80 | 0.44 | 19.51 | 64.26 | 0.11 | 100.02 | 2.3 | 35.9 | 61.8 |
| DRS-84-34 | Isom-type tuff | k-spar | 34K37R1 | 4.12 | 10.13 | 0.00 | 1.65 | 0.44 | 19.45 | 64.55 | 0.07 | 100.41 | 2.2 | 37.4 | 60.4 |
| DRS-84-34 | Isom-type tuff | plag | 34P13C1 | 5.90 | 0.67 | 0.09 | 0.09 | 8.67 | 26.21 | 56.90 | 0.30 | 98.82 | 43.0 | 53.0 | 4.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P13C2 | 5.98 | 0.65 | 0.10 | 0.11 | 8.67 | 26.35 | 56.74 | 0.35 | 98.96 | 42.8 | 53.4 | 3.8 |
| DRS-84-34 | Isom-type tuff | plag | 34P13R1 | 6.34 | 0.78 | 0.13 | 0.11 | 7.94 | 25.52 | 57.77 | 0.37 | 98.96 | 39.0 | 56.4 | 4.6 |
| DRS-84-34 | Isom-type tuff | plag | 34P13R2 | 5.84 | 0.63 | 0.14 | 0.14 | 8.75 | 26.39 | 56.60 | 0.35 | 98.84 | 43.6 | 52.7 | 3.7 |
| DRS-84-34 | Isom-type tuff | plag | 34P14C1 | 2.57 | 0.16 | 0.04 | 0.00 | 14.98 | 31.54 | 48.64 | 0.62 | 98.55 | 75.6 | 23.5 | 1.0 |

**Appendix 8.** Compositions (in Weight Percent) and End-Member Proportions of Plagioclase and Sanidine in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Mineral | Probe sample no. | $Na_2O$ | $K_2O$ | SrO | BaO | CaO | $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | Total | AN mol | AB mol | OR mol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-84-34 | Isom-type tuff | plag | 34P14M1 | 2.91 | 0.21 | 0.08 | 0.03 | 14.32 | 30.95 | 49.33 | 0.57 | 98.40 | 72.2 | 26.5 | 1.3 |
| DRS-84-34 | Isom-type tuff | plag | 34P14R1 | 2.53 | 0.16 | 0.10 | 0.02 | 15.14 | 31.74 | 48.51 | 0.59 | 98.79 | 76.1 | 23.0 | 0.9 |
| DRS-84-34 | Isom-type tuff | plag | 34P14R2 | 2.81 | 0.19 | 0.09 | 0.08 | 14.76 | 31.28 | 48.89 | 0.59 | 98.70 | 73.5 | 25.3 | 1.2 |
| DRS-84-34 | Isom-type tuff | plag | 34P15C1 | 2.59 | 0.15 | 0.06 | 0.05 | 15.21 | 31.43 | 48.49 | 0.61 | 98.59 | 75.8 | 23.4 | 0.9 |
| DRS-84-34 | Isom-type tuff | plag | 34P15M1 | 2.83 | 0.15 | 0.08 | 0.00 | 14.68 | 31.40 | 49.27 | 0.64 | 99.05 | 73.5 | 25.6 | 0.9 |
| DRS-84-34 | Isom-type tuff | plag | 34P15R1 | 2.63 | 0.17 | 0.09 | 0.02 | 14.93 | 31.52 | 48.66 | 0.54 | 98.57 | 75.0 | 23.9 | 1.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P16C1 | 6.09 | 0.73 | 0.14 | 0.11 | 8.23 | 25.73 | 57.01 | 0.36 | 98.40 | 40.9 | 54.8 | 4.3 |
| DRS-84-34 | Isom-type tuff | plag | 34P16C2 | 6.44 | 0.77 | 0.14 | 0.28 | 7.65 | 25.59 | 57.82 | 0.32 | 99.01 | 37.8 | 57.6 | 4.6 |
| DRS-84-34 | Isom-type tuff | plag | 34P16M1 | 6.39 | 0.79 | 0.11 | 0.15 | 7.70 | 25.63 | 57.92 | 0.28 | 98.97 | 38.1 | 57.2 | 4.6 |
| DRS-84-34 | Isom-type tuff | plag | 34P16M2 | 6.40 | 0.85 | 0.12 | 0.23 | 7.56 | 25.27 | 58.28 | 0.31 | 99.01 | 37.5 | 57.5 | 5.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P16R1 | 6.28 | 0.71 | 0.11 | 0.14 | 8.10 | 25.80 | 57.86 | 0.38 | 99.37 | 39.9 | 56.0 | 4.2 |
| DRS-84-34 | Isom-type tuff | plag | 34P16R2 | 5.97 | 0.73 | 0.12 | 0.11 | 8.15 | 25.77 | 57.33 | 0.37 | 98.54 | 41.1 | 54.5 | 4.4 |
| DRS-84-34 | Isom-type tuff | plag | 34P17C1 | 5.44 | 0.52 | 0.15 | 0.15 | 9.86 | 27.14 | 55.04 | 0.28 | 98.58 | 48.5 | 48.4 | 3.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P17M1 | 5.96 | 0.60 | 0.18 | 0.20 | 8.95 | 26.47 | 56.48 | 0.35 | 99.19 | 43.8 | 52.7 | 3.5 |
| DRS-84-34 | Isom-type tuff | plag | 34P17M2 | 6.13 | 0.65 | 0.17 | 0.11 | 8.58 | 26.22 | 57.04 | 0.33 | 99.23 | 42.0 | 54.3 | 3.8 |
| DRS-84-34 | Isom-type tuff | plag | 34P17R1 | 6.29 | 0.78 | 0.08 | 0.17 | 8.02 | 25.75 | 57.87 | 0.36 | 99.32 | 39.5 | 56.0 | 4.5 |
| DRS-84-34 | Isom-type tuff | plag | 34P17R2 | 6.43 | 0.75 | 0.07 | 0.27 | 8.05 | 25.78 | 57.87 | 0.33 | 99.54 | 39.1 | 56.6 | 4.3 |
| DRS-84-34 | Isom-type tuff | plag | 34P19C1 | 2.20 | 0.15 | 0.09 | 0.05 | 15.93 | 32.54 | 47.85 | 0.61 | 99.42 | 79.3 | 19.8 | 0.9 |
| DRS-84-34 | Isom-type tuff | plag | 34P19R1 | 2.46 | 0.21 | 0.10 | 0.01 | 15.42 | 31.97 | 48.40 | 0.63 | 99.20 | 76.6 | 22.1 | 1.2 |
| DRS-84-34 | Isom-type tuff | plag | 34P20C1 | 6.65 | 0.90 | 0.13 | 0.12 | 7.30 | 25.26 | 59.15 | 0.28 | 99.78 | 35.8 | 59.0 | 5.2 |
| DRS-84-34 | Isom-type tuff | plag | 34P20M1 | 6.45 | 0.74 | 0.08 | 0.10 | 8.09 | 25.84 | 57.74 | 0.31 | 99.35 | 39.2 | 56.5 | 4.3 |
| DRS-84-34 | Isom-type tuff | plag | 34P20R1 | 6.43 | 0.78 | 0.11 | 0.18 | 7.84 | 25.93 | 58.21 | 0.37 | 99.85 | 38.4 | 57.0 | 4.6 |
| DRS-84-34 | Isom-type tuff | plag | 34P20R2 | 6.11 | 0.67 | 0.13 | 0.08 | 8.70 | 26.42 | 57.08 | 0.34 | 99.53 | 42.3 | 53.8 | 3.9 |
| DRS-84-34 | Isom-type tuff | plag | 34P21C1 | 2.71 | 0.15 | 0.10 | 0.11 | 14.98 | 31.93 | 48.83 | 0.61 | 99.42 | 74.7 | 24.4 | 0.9 |
| DRS-84-34 | Isom-type tuff | plag | 34P21R1 | 2.68 | 0.18 | 0.11 | 0.00 | 14.96 | 31.78 | 48.92 | 0.62 | 99.25 | 74.7 | 24.2 | 1.1 |
| DRS-84-34 | Isom-type tuff | plag | 34P22C1 | 3.03 | 0.19 | 0.10 | 0.08 | 14.46 | 31.26 | 49.71 | 0.52 | 99.35 | 71.7 | 27.2 | 1.1 |
| DRS-84-34 | Isom-type tuff | plag | 34P22R1 | 2.87 | 0.17 | 0.13 | 0.03 | 14.97 | 31.57 | 49.24 | 0.58 | 99.56 | 73.5 | 25.5 | 1.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P23C1 | 3.89 | 0.31 | 0.15 | 0.03 | 12.92 | 29.87 | 51.75 | 0.53 | 99.45 | 63.6 | 34.6 | 1.8 |
| DRS-84-34 | Isom-type tuff | plag | 34P23R1 | 4.15 | 0.35 | 0.12 | 0.05 | 12.27 | 29.38 | 52.24 | 0.59 | 99.15 | 60.8 | 37.2 | 2.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P24C1 | 2.81 | 0.19 | 0.15 | 0.04 | 14.84 | 31.66 | 49.28 | 0.55 | 99.52 | 73.6 | 25.2 | 1.1 |
| DRS-84-34 | Isom-type tuff | plag | 34P24R1 | 2.35 | 0.16 | 0.02 | 0.06 | 15.42 | 32.37 | 48.43 | 0.57 | 99.39 | 77.6 | 21.4 | 0.9 |
| DRS-84-34 | Isom-type tuff | plag | 34P26C1 | 2.76 | 0.20 | 0.07 | 0.03 | 15.00 | 31.71 | 49.26 | 0.63 | 99.65 | 74.2 | 24.7 | 1.1 |
| DRS-84-34 | Isom-type tuff | plag | 34P26R1 | 2.86 | 0.18 | 0.13 | 0.05 | 14.68 | 31.75 | 49.21 | 0.68 | 99.55 | 73.1 | 25.8 | 1.1 |
| DRS-84-34 | Isom-type tuff | plag | 34P27C1 | 2.87 | 0.19 | 0.09 | 0.06 | 14.99 | 31.69 | 48.92 | 0.60 | 99.40 | 73.4 | 25.4 | 1.1 |
| DRS-84-34 | Isom-type tuff | plag | 34P27R1 | 2.51 | 0.16 | 0.05 | 0.09 | 15.16 | 31.98 | 48.64 | 0.64 | 99.24 | 76.2 | 22.8 | 1.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P28C1 | 6.47 | 0.74 | 0.11 | 0.15 | 8.26 | 26.25 | 57.71 | 0.33 | 100.01 | 39.6 | 56.1 | 4.2 |
| DRS-84-34 | Isom-type tuff | plag | 34P28R1 | 6.30 | 0.70 | 0.13 | 0.15 | 8.44 | 26.52 | 57.48 | 0.34 | 100.06 | 40.8 | 55.1 | 4.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P30C1 | 2.65 | 0.19 | 0.08 | 0.05 | 15.21 | 31.87 | 48.37 | 0.58 | 98.99 | 75.2 | 23.7 | 1.1 |
| DRS-84-34 | Isom-type tuff | plag | 34P30R1 | 2.73 | 0.18 | 0.11 | 0.05 | 15.05 | 31.90 | 48.86 | 0.63 | 99.51 | 74.5 | 24.5 | 1.0 |
| DRS-84-34 | Isom-type tuff | plag | 34P31C1 | 3.10 | 0.19 | 0.10 | 0.01 | 14.44 | 31.34 | 49.69 | 0.56 | 99.44 | 71.2 | 27.7 | 1.1 |
| DRS-84-34 | Isom-type tuff | plag | 34P31R1 | 2.96 | 0.20 | 0.13 | 0.03 | 14.66 | 31.58 | 49.35 | 0.59 | 99.50 | 72.4 | 26.4 | 1.2 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K10C1 | 6.07 | 8.05 | 0.00 | 0.07 | 0.48 | 19.09 | 65.86 | 0.15 | 99.77 | 2.3 | 52.2 | 45.5 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K10R1 | 6.01 | 8.01 | 0.00 | 0.05 | 0.44 | 19.20 | 66.41 | 0.14 | 100.26 | 2.1 | 52.2 | 45.7 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K11C1 | 5.85 | 8.27 | 0.00 | 0.00 | 0.41 | 18.85 | 66.20 | 0.13 | 99.71 | 2.0 | 50.8 | 47.2 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K11R1 | 5.75 | 8.19 | 0.00 | 0.00 | 0.40 | 18.94 | 66.72 | 0.16 | 100.16 | 1.9 | 50.6 | 47.4 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K11R1 | 5.88 | 8.15 | 0.00 | 0.12 | 0.36 | 18.91 | 66.76 | 0.14 | 100.31 | 1.7 | 51.4 | 46.9 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K12C1 | 5.48 | 8.55 | 0.00 | 0.06 | 0.36 | 18.93 | 66.46 | 0.16 | 99.99 | 1.8 | 48.5 | 49.8 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K12R1 | 5.38 | 8.72 | 0.00 | 0.07 | 0.37 | 18.95 | 66.51 | 0.11 | 100.11 | 1.8 | 47.5 | 50.7 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K13C1 | 5.78 | 8.05 | 0.00 | 0.03 | 0.39 | 18.65 | 65.23 | 0.15 | 98.29 | 1.9 | 51.2 | 46.9 |

**Appendix 8.** Compositions (in Weight Percent) and End-Member Proportions of Plagioclase and Sanidine in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Mineral | Probe sample no. | $Na_2O$ | $K_2O$ | SrO | BaO | CaO | $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | Total | AN mol | AB mol | OR mol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K13R1 | 5.88 | 7.95 | 0.00 | 0.02 | 0.44 | 18.87 | 65.64 | 0.15 | 98.95 | 2.1 | 51.8 | 46.1 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K14C1 | 5.78 | 8.18 | 0.00 | 0.02 | 0.42 | 18.76 | 65.81 | 0.13 | 99.10 | 2.1 | 50.7 | 47.2 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K14R1 | 5.80 | 7.94 | 0.00 | 0.04 | 0.43 | 18.85 | 66.14 | 0.13 | 99.33 | 2.1 | 51.5 | 46.4 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K15C1 | 5.84 | 8.08 | 0.00 | 0.07 | 0.38 | 18.75 | 66.17 | 0.16 | 99.46 | 1.9 | 51.4 | 46.8 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K15R1 | 5.89 | 8.03 | 0.00 | 0.10 | 0.35 | 18.83 | 65.75 | 0.13 | 99.08 | 1.7 | 51.8 | 46.5 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K18C1 | 5.79 | 8.26 | 0.00 | 0.09 | 0.39 | 18.90 | 66.19 | 0.14 | 99.76 | 1.9 | 50.6 | 47.5 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K18R1 | 5.75 | 8.23 | 0.00 | 0.06 | 0.40 | 18.75 | 66.78 | 0.14 | 100.11 | 1.9 | 50.5 | 47.6 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K1C1 | 5.75 | 8.22 | 0.00 | 0.01 | 0.40 | 18.87 | 65.55 | 0.13 | 98.94 | 1.9 | 50.5 | 47.5 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K1R1 | 5.79 | 8.24 | 0.00 | 0.09 | 0.40 | 18.59 | 64.96 | 0.17 | 98.25 | 2.0 | 50.6 | 47.4 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K20C1 | 5.77 | 8.14 | 0.00 | 0.05 | 0.40 | 18.81 | 65.86 | 0.10 | 99.13 | 1.9 | 50.9 | 47.2 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K20R1 | 5.81 | 8.30 | 0.00 | 0.00 | 0.36 | 18.88 | 66.21 | 0.16 | 99.72 | 1.7 | 50.6 | 47.6 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K2C1 | 6.00 | 8.11 | 0.00 | 0.02 | 0.35 | 18.94 | 66.23 | 0.17 | 99.82 | 1.7 | 52.0 | 46.3 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K2R1 | 5.91 | 8.04 | 0.00 | 0.01 | 0.42 | 18.75 | 65.79 | 0.14 | 99.06 | 2.0 | 51.7 | 46.3 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K9C1 | 5.51 | 8.61 | 0.00 | 0.04 | 0.33 | 18.52 | 65.95 | 0.17 | 99.13 | 1.6 | 48.5 | 49.9 |
| DRS-91-3 | Bates Mountain Tuff | k-spar | 3K9R1 | 5.56 | 8.56 | 0.00 | 0.10 | 0.35 | 18.69 | 66.37 | 0.12 | 99.74 | 1.7 | 48.8 | 49.5 |
| DRS-91-3 | Bates Mountain Tuff | plag | 3P16C1 | 7.15 | 0.99 | 0.05 | 0.41 | 6.66 | 24.78 | 59.80 | 0.28 | 100.12 | 32.1 | 62.3 | 5.7 |
| DRS-91-3 | Bates Mountain Tuff | plag | 3P16R1 | 7.00 | 0.99 | 0.09 | 0.40 | 6.66 | 24.63 | 59.42 | 0.40 | 99.58 | 32.5 | 61.8 | 5.7 |
| DRS-91-3 | Bates Mountain Tuff | plag | 3P21C1 | 5.95 | 0.44 | 0.02 | 0.10 | 9.38 | 27.18 | 55.96 | 0.27 | 99.31 | 45.4 | 52.1 | 2.6 |
| DRS-91-3 | Bates Mountain Tuff | plag | 3P21R1 | 5.69 | 0.42 | 0.04 | 0.11 | 10.08 | 27.72 | 55.23 | 0.33 | 99.61 | 48.3 | 49.3 | 2.4 |
| DRS-91-3 | Bates Mountain Tuff | plag | 3P4C1 | 4.84 | 0.28 | 0.00 | 0.07 | 11.78 | 28.77 | 52.43 | 0.34 | 98.50 | 56.5 | 42.0 | 1.6 |
| DRS-91-3 | Bates Mountain Tuff | plag | 3P4R1 | 5.60 | 0.26 | 0.00 | 0.09 | 10.38 | 27.83 | 54.65 | 0.19 | 99.00 | 49.9 | 48.7 | 1.5 |
| DRS-91-3 | Bates Mountain Tuff | plag | 3P8C1 | 7.07 | 0.64 | 0.00 | 0.17 | 7.31 | 25.28 | 58.89 | 0.18 | 99.54 | 35.0 | 61.3 | 3.6 |
| DRS-91-3 | Bates Mountain Tuff | plag | 3P8R1 | 8.25 | 1.15 | 0.00 | 0.13 | 4.63 | 22.87 | 62.41 | 0.24 | 99.68 | 22.1 | 71.3 | 6.5 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K16C1 | 3.88 | 10.84 | 0.00 | 1.20 | 0.24 | 19.18 | 66.12 | 0.09 | 101.55 | 1.2 | 34.8 | 64.0 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K16R1 | 3.88 | 10.83 | 0.00 | 1.07 | 0.26 | 18.97 | 65.86 | 0.11 | 100.98 | 1.3 | 34.8 | 63.9 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K17C1 | 4.10 | 10.85 | 0.00 | 0.05 | 0.22 | 18.65 | 66.88 | 0.11 | 100.86 | 1.1 | 36.1 | 62.8 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K17R1 | 4.02 | 10.70 | 0.00 | 0.00 | 0.27 | 18.67 | 66.78 | 0.09 | 100.52 | 1.3 | 35.9 | 62.8 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K18C1 | 3.97 | 10.90 | 0.00 | 0.06 | 0.21 | 18.60 | 66.95 | 0.11 | 100.80 | 1.0 | 35.3 | 63.7 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K18R1 | 3.87 | 11.12 | 0.00 | 0.04 | 0.20 | 18.69 | 66.92 | 0.11 | 100.95 | 1.0 | 34.3 | 64.8 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K1C1 | 3.81 | 11.03 | 0.00 | 0.00 | 0.25 | 18.30 | 64.72 | 0.07 | 98.18 | 1.2 | 34.0 | 64.8 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K1C2 | 3.80 | 10.91 | 0.00 | 0.03 | 0.20 | 18.29 | 64.80 | 0.12 | 98.16 | 1.0 | 34.3 | 64.7 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K1R1 | 3.91 | 10.61 | 0.00 | 0.97 | 0.26 | 18.56 | 64.04 | 0.12 | 98.47 | 1.3 | 35.4 | 63.3 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K1R2 | 3.85 | 10.79 | 0.00 | 0.10 | 0.22 | 18.31 | 64.87 | 0.15 | 98.29 | 1.1 | 34.8 | 64.1 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K23C1 | 4.03 | 10.82 | 0.00 | 0.01 | 0.22 | 18.87 | 66.65 | 0.10 | 100.69 | 1.1 | 35.8 | 63.2 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K23R1 | 3.82 | 11.03 | 0.00 | 0.08 | 0.24 | 18.85 | 66.48 | 0.14 | 100.63 | 1.2 | 34.1 | 64.7 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K2C1 | 3.70 | 10.89 | 0.00 | 0.71 | 0.27 | 18.55 | 63.93 | 0.09 | 98.14 | 1.3 | 33.6 | 65.1 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K2R1 | 3.59 | 10.27 | 0.06 | 2.63 | 0.26 | 19.16 | 62.99 | 0.12 | 99.07 | 1.3 | 34.2 | 64.4 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K2R2 | 3.75 | 10.97 | 0.00 | 0.48 | 0.22 | 18.37 | 64.79 | 0.08 | 98.66 | 1.1 | 33.8 | 65.1 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K3C1 | 3.99 | 10.75 | 0.02 | 0.07 | 0.19 | 18.48 | 65.69 | 0.11 | 99.30 | 0.9 | 35.7 | 63.3 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K3R1 | 3.68 | 11.02 | 0.00 | 0.53 | 0.22 | 18.34 | 64.21 | 0.14 | 98.13 | 1.1 | 33.3 | 65.6 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K3R2 | 3.61 | 11.16 | 0.00 | 0.51 | 0.17 | 18.38 | 64.91 | 0.05 | 98.79 | 0.8 | 32.7 | 66.5 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K4C1 | 3.87 | 10.99 | 0.00 | 0.09 | 0.24 | 18.45 | 65.21 | 0.10 | 98.94 | 1.2 | 34.5 | 64.4 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K4R1 | 3.73 | 10.83 | 0.00 | 1.15 | 0.25 | 18.67 | 63.79 | 0.11 | 98.53 | 1.2 | 33.9 | 64.8 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K5C1 | 4.09 | 10.68 | 0.00 | 0.06 | 0.20 | 18.40 | 64.53 | 0.21 | 98.17 | 1.0 | 36.4 | 62.6 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K5R1 | 3.67 | 10.82 | 0.00 | 0.61 | 0.22 | 18.49 | 64.12 | 0.11 | 98.04 | 1.1 | 33.6 | 65.3 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K6C1 | 3.90 | 11.14 | 0.00 | 0.11 | 0.17 | 18.39 | 64.13 | 0.10 | 97.94 | 0.8 | 34.4 | 64.7 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K6R1 | 3.83 | 10.94 | 0.00 | 0.07 | 0.24 | 18.47 | 64.82 | 0.13 | 98.49 | 1.2 | 34.3 | 64.5 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K7C1 | 4.08 | 10.72 | 0.00 | 0.31 | 0.24 | 18.50 | 64.30 | 0.08 | 98.23 | 1.2 | 36.2 | 62.6 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K7R1 | 3.87 | 10.72 | 0.00 | 0.27 | 0.24 | 18.34 | 63.89 | 0.12 | 97.45 | 1.2 | 35.0 | 63.8 |

**Appendix 8.** Compositions (in Weight Percent) and End-Member Proportions of Plagioclase and Sanidine in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Mineral | Probe sample no. | $Na_2O$ | $K_2O$ | SrO | BaO | CaO | $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | Total | AN mol | AB mol | OR mol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K8C1 | 3.85 | 10.88 | 0.00 | 0.47 | 0.24 | 18.57 | 63.63 | 0.09 | 97.72 | 1.2 | 34.6 | 64.3 |
| DRS-85-44 | Tuff of Mount Jefferson | k-spar | 44K8R1 | 3.82 | 10.75 | 0.00 | 0.48 | 0.25 | 18.59 | 64.34 | 0.12 | 98.35 | 1.3 | 34.6 | 64.1 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P10C1 | 5.59 | 0.36 | 0.19 | 0.19 | 10.04 | 27.32 | 54.96 | 0.40 | 99.04 | 48.8 | 49.2 | 2.1 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P10R1 | 7.40 | 0.68 | 0.13 | 0.15 | 6.49 | 24.45 | 59.82 | 0.33 | 99.45 | 31.4 | 64.7 | 3.9 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P11C1 | 5.88 | 0.42 | 0.10 | 0.08 | 9.82 | 27.14 | 55.72 | 0.39 | 99.55 | 46.8 | 50.8 | 2.4 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P11R1 | 7.28 | 0.62 | 0.11 | 0.18 | 6.94 | 24.87 | 59.79 | 0.29 | 100.09 | 33.3 | 63.2 | 3.6 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P12C1 | 5.91 | 0.46 | 0.14 | 0.14 | 9.56 | 26.99 | 56.40 | 0.36 | 99.95 | 46.0 | 51.4 | 2.6 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P12R1 | 7.41 | 0.63 | 0.09 | 0.10 | 7.00 | 24.93 | 59.48 | 0.32 | 99.96 | 33.1 | 63.4 | 3.5 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P13C1 | 7.05 | 0.65 | 0.08 | 0.16 | 7.52 | 25.08 | 58.67 | 0.35 | 99.56 | 35.7 | 60.6 | 3.7 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P13R1 | 7.31 | 0.59 | 0.10 | 0.12 | 7.19 | 24.86 | 59.08 | 0.34 | 99.58 | 34.1 | 62.6 | 3.3 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P14C1 | 7.63 | 0.70 | 0.07 | 0.16 | 6.51 | 24.60 | 60.24 | 0.20 | 100.11 | 30.8 | 65.3 | 3.9 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P14M1 | 7.67 | 0.73 | 0.03 | 0.22 | 6.23 | 24.42 | 60.42 | 0.22 | 99.94 | 29.7 | 66.2 | 4.1 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P14R1 | 8.15 | 0.89 | 0.00 | 0.09 | 5.14 | 23.62 | 62.58 | 0.22 | 100.69 | 24.5 | 70.4 | 5.1 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P15C1 | 4.80 | 0.31 | 0.13 | 0.11 | 11.67 | 28.99 | 53.87 | 0.38 | 100.26 | 56.3 | 41.9 | 1.8 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P15M1 | 5.40 | 0.43 | 0.14 | 0.08 | 10.25 | 27.93 | 55.51 | 0.37 | 100.12 | 49.9 | 47.6 | 2.5 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P15R1 | 6.93 | 0.60 | 0.12 | 0.17 | 7.85 | 25.62 | 59.13 | 0.33 | 100.75 | 37.2 | 59.4 | 3.4 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P19C1 | 7.33 | 0.76 | 0.05 | 0.10 | 6.84 | 25.00 | 60.50 | 0.19 | 100.77 | 32.6 | 63.1 | 4.3 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P19R1 | 7.76 | 0.63 | 0.08 | 0.18 | 6.30 | 24.41 | 60.76 | 0.29 | 100.41 | 29.9 | 66.6 | 3.5 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P20C1 | 6.61 | 0.53 | 0.16 | 0.10 | 8.31 | 26.24 | 58.46 | 0.31 | 100.71 | 39.8 | 57.2 | 3.0 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P20R1 | 6.13 | 0.43 | 0.09 | 0.08 | 9.27 | 27.13 | 57.53 | 0.29 | 100.94 | 44.4 | 53.2 | 2.4 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P21C1 | 6.55 | 0.59 | 0.15 | 0.19 | 8.28 | 26.14 | 58.47 | 0.35 | 100.72 | 39.7 | 56.9 | 3.4 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P21R1 | 7.20 | 0.60 | 0.12 | 0.17 | 7.03 | 25.12 | 59.95 | 0.30 | 100.48 | 33.8 | 62.7 | 3.5 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P22C1 | 8.57 | 1.24 | 0.00 | 0.06 | 4.04 | 22.47 | 64.41 | 0.19 | 100.98 | 19.2 | 73.8 | 7.0 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P22R1 | 8.55 | 1.10 | 0.00 | 0.06 | 4.10 | 22.57 | 64.08 | 0.22 | 100.68 | 19.6 | 74.1 | 6.3 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P24C1 | 6.83 | 0.57 | 0.16 | 0.23 | 7.97 | 26.39 | 58.79 | 0.38 | 101.32 | 37.9 | 58.8 | 3.2 |
| DRS-85-44 | Tuff of Mount Jefferson | plag | 44P24R1 | 6.36 | 0.37 | 0.13 | 0.17 | 8.73 | 26.72 | 57.73 | 0.40 | 100.61 | 42.2 | 55.7 | 2.1 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K19C1 | 3.86 | 10.77 | 0.00 | 0.40 | 0.15 | 18.54 | 65.86 | 0.10 | 99.68 | 0.7 | 35.0 | 64.3 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K19R1 | 4.04 | 10.25 | 0.00 | 0.39 | 0.28 | 18.43 | 66.17 | 0.10 | 99.67 | 1.4 | 36.9 | 61.6 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K1C1 | 4.05 | 10.46 | 0.00 | 0.78 | 0.22 | 19.07 | 66.13 | 0.16 | 100.87 | 1.1 | 36.6 | 62.3 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K1R1 | 4.03 | 10.42 | 0.00 | 0.71 | 0.25 | 18.99 | 65.91 | 0.14 | 100.45 | 1.3 | 36.6 | 62.2 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K21C1 | 4.15 | 10.18 | 0.00 | 0.04 | 0.32 | 18.25 | 66.36 | 0.15 | 99.45 | 1.6 | 37.6 | 60.7 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K21R1 | 4.07 | 10.33 | 0.00 | 0.08 | 0.34 | 18.51 | 66.20 | 0.16 | 99.69 | 1.7 | 36.8 | 61.5 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K22C1 | 3.97 | 10.15 | 0.00 | 0.64 | 0.32 | 18.66 | 65.57 | 0.19 | 99.50 | 1.6 | 36.7 | 61.7 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K22R1 | 4.08 | 10.05 | 0.00 | 0.64 | 0.32 | 18.53 | 65.90 | 0.18 | 99.70 | 1.6 | 37.5 | 60.8 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K23C1 | 3.91 | 9.94 | 0.00 | 1.58 | 0.38 | 19.10 | 64.55 | 0.19 | 99.65 | 2.0 | 36.7 | 61.4 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K23R1 | 3.90 | 9.84 | 0.00 | 1.54 | 0.39 | 19.05 | 64.59 | 0.16 | 99.47 | 2.1 | 36.8 | 61.1 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K24C1 | 3.61 | 11.12 | 0.00 | 0.09 | 0.21 | 18.58 | 65.40 | 0.09 | 99.10 | 1.0 | 32.7 | 66.3 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K24R1 | 3.87 | 10.58 | 0.00 | 0.06 | 0.30 | 18.48 | 65.66 | 0.10 | 99.04 | 1.5 | 35.2 | 63.3 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K2C1 | 3.89 | 10.52 | 0.00 | 1.38 | 0.22 | 18.99 | 65.49 | 0.12 | 100.61 | 1.1 | 35.6 | 63.3 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K2R1 | 4.05 | 10.35 | 0.00 | 1.15 | 0.31 | 19.07 | 65.69 | 0.20 | 100.82 | 1.5 | 36.7 | 61.7 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K3C1 | 4.00 | 10.83 | 0.00 | 0.32 | 0.17 | 18.83 | 66.10 | 0.11 | 100.35 | 0.8 | 35.7 | 63.5 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K3R2 | 4.08 | 10.40 | 0.00 | 0.37 | 0.32 | 18.85 | 66.51 | 0.12 | 100.64 | 1.6 | 36.8 | 61.7 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K4C1 | 3.81 | 11.26 | 0.00 | 0.00 | 0.22 | 18.70 | 66.34 | 0.12 | 100.45 | 1.1 | 33.6 | 65.3 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K4R1 | 4.13 | 10.63 | 0.00 | 0.07 | 0.27 | 18.76 | 66.64 | 0.15 | 100.65 | 1.3 | 36.6 | 62.0 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K5C1 | 4.01 | 10.61 | 0.00 | 0.75 | 0.23 | 18.92 | 65.80 | 0.16 | 100.48 | 1.1 | 36.1 | 62.8 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K6C1 | 4.15 | 10.82 | 0.00 | 0.03 | 0.20 | 18.65 | 66.45 | 0.11 | 100.41 | 1.0 | 36.5 | 62.6 |
| DRS-87-52 | Isom-type tuff, upper | k-spar | 52K6R1 | 4.20 | 10.73 | 0.00 | 0.10 | 0.27 | 18.85 | 66.21 | 0.11 | 100.47 | 1.3 | 36.8 | 61.9 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P10C1 | 6.42 | 0.77 | 0.20 | 0.18 | 8.12 | 26.23 | 58.08 | 0.34 | 100.33 | 39.3 | 56.3 | 4.4 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P10M1 | 6.87 | 0.89 | 0.09 | 0.24 | 7.24 | 25.32 | 59.50 | 0.32 | 100.48 | 34.9 | 60.0 | 5.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P10R1 | 6.93 | 0.92 | 0.15 | 0.32 | 7.10 | 25.34 | 59.26 | 0.36 | 100.38 | 34.2 | 60.5 | 5.3 |

**Appendix 8.** Compositions (in Weight Percent) and End-Member Proportions of Plagioclase and Sanidine in Samples of Tertiary Igneous Rocks in the Southern Toquima Range, Nye County, Nevada.—Continued

| Original sample no. | Unit | Mineral | Probe sample no. | $Na_2O$ | $K_2O$ | SrO | BaO | CaO | $Al_2O_3$ | $SiO_2$ | $Fe_2O_3$ | Total | AN mol | AB mol | OR mol |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DRS-87-52 | Isom-type tuff, upper | plag | 52P11C1 | 6.73 | 0.84 | 0.16 | 0.26 | 7.51 | 25.75 | 59.06 | 0.31 | 100.62 | 36.3 | 58.9 | 4.8 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P11R1 | 6.74 | 0.81 | 0.11 | 0.25 | 7.49 | 25.75 | 58.94 | 0.32 | 100.40 | 36.3 | 59.1 | 4.7 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P12C1 | 5.85 | 0.53 | 0.14 | 0.23 | 9.36 | 26.68 | 56.22 | 0.33 | 99.34 | 45.5 | 51.4 | 3.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P12M1 | 6.44 | 0.72 | 0.09 | 0.25 | 8.10 | 25.57 | 57.56 | 0.37 | 99.09 | 39.3 | 56.6 | 4.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P12R1 | 6.79 | 0.81 | 0.10 | 0.22 | 7.56 | 25.12 | 58.42 | 0.32 | 99.34 | 36.3 | 59.0 | 4.6 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P13C1 | 6.46 | 0.72 | 0.10 | 0.22 | 8.18 | 25.70 | 57.51 | 0.33 | 99.21 | 39.5 | 56.4 | 4.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P13M1 | 6.53 | 0.74 | 0.13 | 0.17 | 8.04 | 25.48 | 57.91 | 0.36 | 99.37 | 38.8 | 57.0 | 4.3 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P13R1 | 6.84 | 0.85 | 0.13 | 0.20 | 7.29 | 24.97 | 58.98 | 0.31 | 99.57 | 35.2 | 59.8 | 4.9 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P14C1 | 6.81 | 0.89 | 0.06 | 0.26 | 7.31 | 25.00 | 59.04 | 0.31 | 99.68 | 35.3 | 59.5 | 5.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P14M1 | 6.87 | 0.87 | 0.14 | 0.29 | 7.45 | 25.13 | 59.05 | 0.33 | 100.13 | 35.6 | 59.4 | 5.0 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P14R1 | 6.48 | 0.76 | 0.17 | 0.21 | 8.05 | 25.49 | 58.36 | 0.34 | 99.85 | 38.9 | 56.7 | 4.4 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P15C1 | 6.85 | 0.93 | 0.15 | 0.25 | 7.02 | 24.88 | 59.20 | 0.32 | 99.60 | 34.2 | 60.4 | 5.4 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P15M1 | 6.65 | 0.85 | 0.12 | 0.20 | 7.38 | 25.05 | 59.15 | 0.32 | 99.72 | 36.1 | 58.9 | 4.9 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P15M2 | 7.09 | 1.06 | 0.07 | 0.30 | 6.58 | 24.49 | 59.91 | 0.27 | 99.77 | 31.8 | 62.1 | 6.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P15R1 | 6.95 | 0.89 | 0.11 | 0.25 | 7.18 | 24.89 | 59.15 | 0.30 | 99.72 | 34.5 | 60.4 | 5.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P15R2 | 6.74 | 0.83 | 0.13 | 0.24 | 7.44 | 25.06 | 58.97 | 0.35 | 99.76 | 36.1 | 59.1 | 4.8 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P16C1 | 6.60 | 0.79 | 0.12 | 0.17 | 7.69 | 25.26 | 58.59 | 0.34 | 99.56 | 37.4 | 58.0 | 4.6 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P16M1 | 6.50 | 0.72 | 0.12 | 0.19 | 8.06 | 25.81 | 57.87 | 0.31 | 99.57 | 39.0 | 56.9 | 4.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P16M2 | 6.50 | 0.74 | 0.13 | 0.18 | 7.89 | 25.77 | 58.26 | 0.38 | 99.84 | 38.4 | 57.3 | 4.3 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P16R1 | 6.73 | 0.84 | 0.15 | 0.17 | 7.60 | 25.31 | 58.89 | 0.33 | 100.03 | 36.6 | 58.6 | 4.8 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P16R2 | 6.67 | 0.87 | 0.13 | 0.21 | 7.31 | 25.16 | 59.08 | 0.29 | 99.71 | 35.8 | 59.1 | 5.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P17C1 | 6.61 | 0.79 | 0.13 | 0.19 | 7.69 | 25.09 | 58.39 | 0.36 | 99.24 | 37.4 | 58.1 | 4.6 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P17R1 | 6.58 | 0.82 | 0.14 | 0.20 | 7.54 | 25.13 | 58.44 | 0.34 | 99.19 | 36.9 | 58.3 | 4.8 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P18C1 | 6.88 | 0.89 | 0.15 | 0.18 | 7.28 | 25.05 | 58.96 | 0.32 | 99.72 | 35.0 | 59.9 | 5.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P18M1 | 6.66 | 0.76 | 0.16 | 0.28 | 7.81 | 25.41 | 58.52 | 0.33 | 99.92 | 37.6 | 58.0 | 4.4 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P20C1 | 4.98 | 0.37 | 0.06 | 0.10 | 11.36 | 28.41 | 53.94 | 0.34 | 99.56 | 54.6 | 43.3 | 2.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P20M1 | 7.03 | 0.96 | 0.12 | 0.27 | 6.93 | 24.68 | 59.40 | 0.34 | 99.74 | 33.3 | 61.2 | 5.5 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P20M2 | 7.24 | 1.00 | 0.10 | 0.32 | 6.60 | 24.40 | 59.89 | 0.26 | 99.81 | 31.6 | 62.7 | 5.7 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P20R1 | 6.80 | 0.82 | 0.16 | 0.22 | 7.31 | 24.98 | 58.81 | 0.34 | 99.43 | 35.5 | 59.8 | 4.7 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P20R2 | 6.63 | 0.78 | 0.18 | 0.20 | 7.62 | 25.31 | 58.59 | 0.36 | 99.66 | 37.1 | 58.4 | 4.5 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P7C1 | 6.92 | 0.90 | 0.15 | 0.23 | 7.12 | 25.25 | 59.08 | 0.32 | 99.96 | 34.4 | 60.5 | 5.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P7R1 | 6.50 | 0.73 | 0.16 | 0.20 | 7.92 | 25.93 | 58.35 | 0.33 | 100.12 | 38.5 | 57.2 | 4.2 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P8C1 | 6.33 | 0.68 | 0.09 | 0.21 | 8.50 | 26.64 | 57.66 | 0.37 | 100.48 | 40.9 | 55.2 | 3.9 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P8R1 | 6.24 | 0.69 | 0.17 | 0.16 | 8.56 | 26.74 | 57.77 | 0.27 | 100.60 | 41.4 | 54.6 | 4.0 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P9C1 | 6.25 | 0.73 | 0.16 | 0.21 | 8.26 | 26.23 | 58.05 | 0.32 | 100.20 | 40.4 | 55.3 | 4.2 |
| DRS-87-52 | Isom-type tuff, upper | plag | 52P9R1 | 6.54 | 0.79 | 0.14 | 0.20 | 7.74 | 26.04 | 58.63 | 0.33 | 100.40 | 37.7 | 57.7 | 4.6 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P15C1 | 6.98 | 1.09 | 0.12 | 0.31 | 6.79 | 25.04 | 59.77 | 0.30 | 100.39 | 32.8 | 61.0 | 6.2 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P15R1 | 7.03 | 1.17 | 0.11 | 0.29 | 6.76 | 24.78 | 59.79 | 0.37 | 100.30 | 32.4 | 60.9 | 6.7 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P16C1 | 6.32 | 0.69 | 0.18 | 0.16 | 8.52 | 26.54 | 57.58 | 0.39 | 100.39 | 41.0 | 55.0 | 4.0 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P16R1 | 6.29 | 0.74 | 0.12 | 0.18 | 8.69 | 26.53 | 57.16 | 0.41 | 100.12 | 41.5 | 54.3 | 4.2 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P17C1 | 6.07 | 0.66 | 0.11 | 0.17 | 8.92 | 27.01 | 57.34 | 0.27 | 100.55 | 43.1 | 53.1 | 3.8 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P18C1 | 6.84 | 0.98 | 0.08 | 0.19 | 7.31 | 25.31 | 59.08 | 0.39 | 100.17 | 35.1 | 59.4 | 5.6 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P4C1 | 6.52 | 0.84 | 0.10 | 0.23 | 8.13 | 26.20 | 58.73 | 0.37 | 101.12 | 38.9 | 56.4 | 4.8 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P4R1 | 7.41 | 1.35 | 0.13 | 0.41 | 5.95 | 24.26 | 60.98 | 0.36 | 100.85 | 28.4 | 64.0 | 7.7 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P5C1 | 6.63 | 0.86 | 0.11 | 0.16 | 7.86 | 25.82 | 58.52 | 0.31 | 100.27 | 37.6 | 57.4 | 4.9 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P5R1 | 7.00 | 1.14 | 0.15 | 0.28 | 6.63 | 24.78 | 59.87 | 0.36 | 100.21 | 32.1 | 61.3 | 6.6 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P6C1 | 6.83 | 0.94 | 0.04 | 0.25 | 7.26 | 25.39 | 58.81 | 0.35 | 99.87 | 35.0 | 59.6 | 5.4 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P6R1 | 6.51 | 0.84 | 0.11 | 0.21 | 8.01 | 25.96 | 58.13 | 0.36 | 100.12 | 38.5 | 56.7 | 4.8 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P7C1 | 6.86 | 1.06 | 0.13 | 0.22 | 7.09 | 25.12 | 59.35 | 0.27 | 100.11 | 34.1 | 59.8 | 6.1 |
| DRS-87-52 | Isom-type tuff, upper | plag | 59P7R1 | 7.21 | 1.28 | 0.09 | 0.42 | 6.17 | 24.57 | 60.74 | 0.30 | 100.78 | 29.7 | 62.9 | 7.3 |

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