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## Yucca Mountain Project

# Mineralogic and Chemical Data Supporting Heat Capacity Determination for Tuffaceous Rocks

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# Mineralogic and Chemical Data Supporting Heat Capacity Determination for Tuffaceous Rocks

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ABSTRACT

Bulk chemical, x-ray diffraction, and petrologic data are presented for 20 samples of tuffaceous rocks from Yucca Mountain, Nevada. Uncertainties are presented for quantitative results (bulk chemistry and point-counting results) but have not been estimated for the semi-quantitative x-ray diffraction data.

This report was prepared for a QA Level III Task under WBS 1.2.4.2.1.3.S. The data summarized in the report all have a QA Level of TBD (to be determined) because they were collected before formal institution of the system of QA levels.

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# 1.0 INTRODUCTION

Yucca Mountain, located on and immediately adjacent to the southwestern portion of the Nevada Test Site in southern Nevada (Figure 1), is being evaluated as a potential site for underground disposal of radioactive wastes. At present, investigators are determining the physical, thermal, and mechanical properties of tuffaceous rocks from Yucca Mountain as part of the Yucca Mountain Project (YMP), which is administered by the Nevada Operations Office of the U.S. Department of Energy.

The purpose of this report is to document mineralogic and chemical data obtained by the University of New Mexico [as contractor to Sandia National Laboratories (SNL)] on samples of tuffaceous rocks from Yucca Mountain. These data were gathered so that samples on which heat capacity measurements were to be made could be characterized. This report contains a summary of the data; an analysis of the data and their pertinence to the determination of heat capacity will be presented in a subsequent report.

Each sample discussed in this report has been assigned to a thermal/mechanical unit; these units constitute a thermal/mechanical stratigraphy. A comparison of this stratigraphy with the formal geologic stratigraphy is presented in Figure 2. Each of the thermal/mechanical units has been defined according to its thermal properties, mechanical properties, or both, that are statistically distinguishable from the same properties in adjacent units. More detailed discussions of the thermal/mechanical stratigraphy are provided by Ortiz et al. (1985) and Nimick and Schwartz (1987).

The remainder of this report is composed of two sections. The body of the report describes the methods used to obtain the data, discusses the uncertainties and limitations associated with the data, and presents conclusions. Data are presented in the second section [Appendices A (bulk

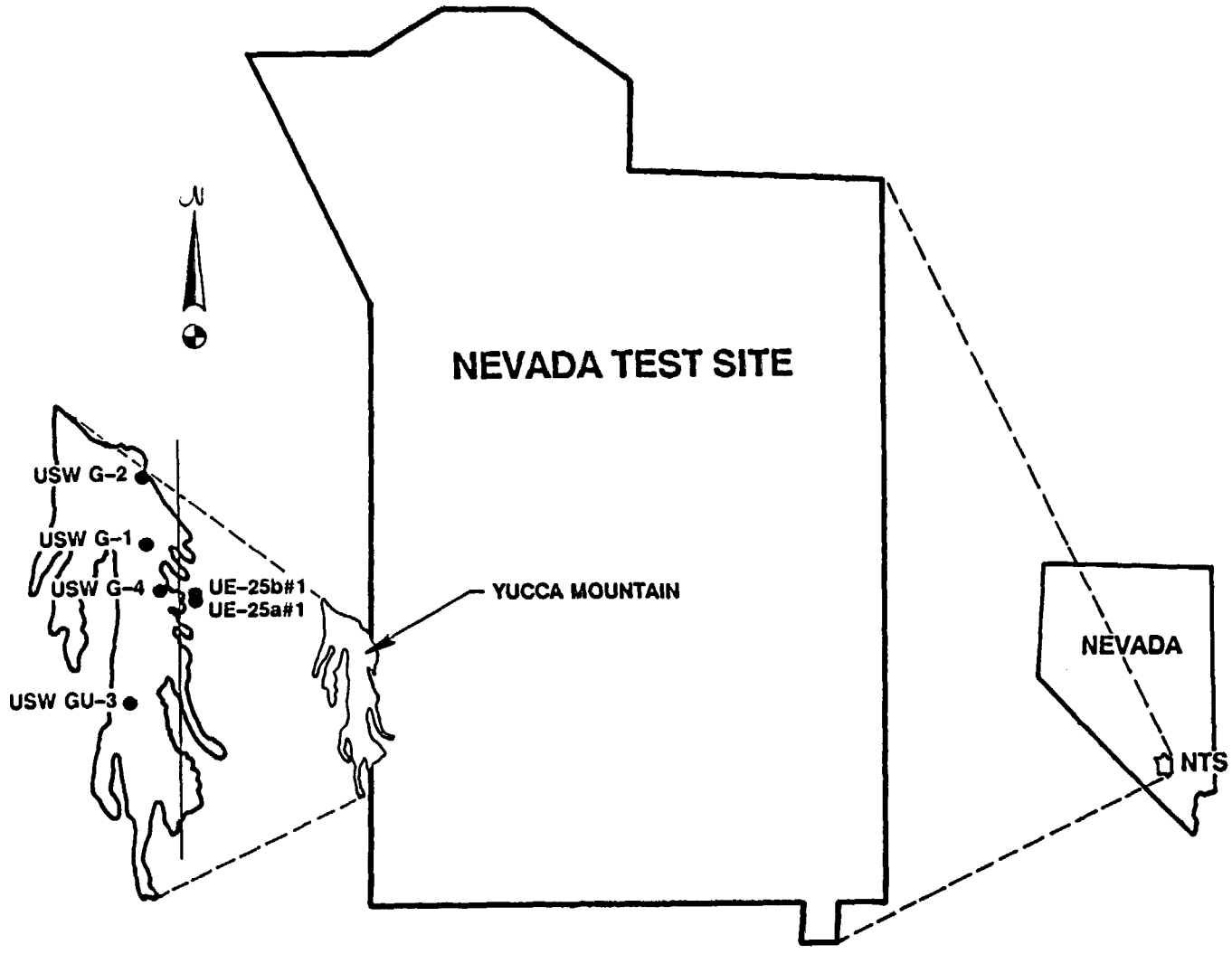
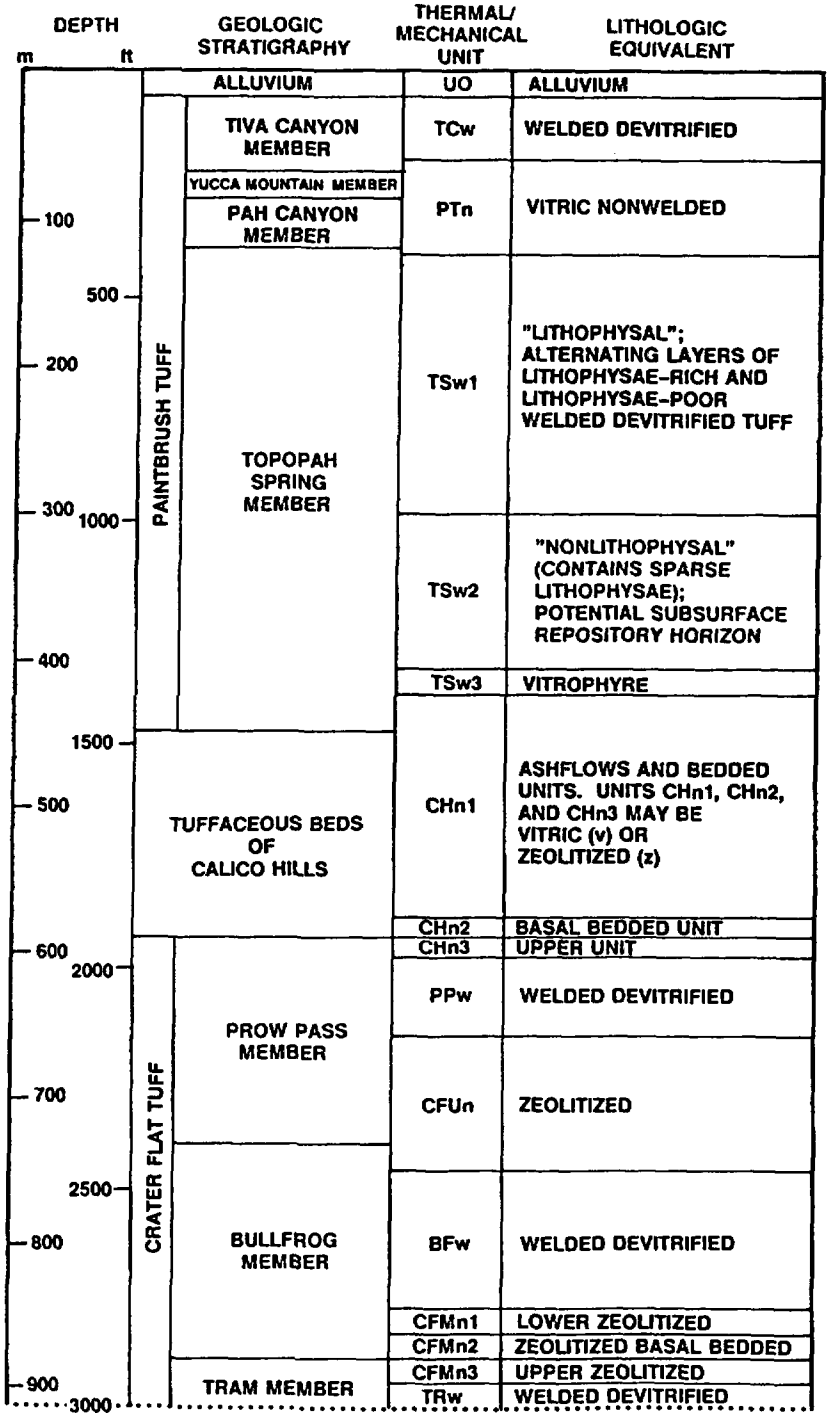



Figure 1. Location of the Nevada Test Site, Yucca Mountain, and Existing Deep Coreholes




Note: Thicknesses are averages for the five deep coreholes shown in Figure 1.

Figure 2. Comparison of Thermal/Mechanical and Formal Geologic Stratigraphies

chemistry) and B (petrography)] on a series of data compilation forms (DCF), which have been completed after examination of all pertinent records stored in SNL's Department 6310 Data Records Management System (DRMS). In addition, data for estimated mineral abundances are presented in the appropriate section of the text.

## 2.0 TECHNIQUES AND ASSOCIATED UNCERTAINTIES AND LIMITATIONS OF DATA GATHERING

The data in this report were obtained by three different methods--chemical analysis, x-ray diffraction (XRD), and petrographic examination. A brief description of each method is presented in this section; each description is accompanied by an assessment of the uncertainties associated with the data produced using the method. A list of the procedures used for this work is provided in Table 1.

### 2.1 Chemical Analysis

#### 2.1.1 Method

The data from whole rock chemical analyses used as input for heat capacity modeling were obtained in the Geochemistry Laboratory in the Department of Geology at the University of New Mexico (UNM) under the direction of staff chemist John W. Husler. These data are presented in Appendix A.

$SiO_2$, $TiO_2$, $Al_2O_3$, total iron as $Fe_2O_3$, MnO, MgO, CaO, $Na_2O$, $K_2O$, and $P_2O_5$ were initially determined using x-ray fluorescence spectroscopy (XRF). The proportions of ferrous iron (as FeO) and ferric iron (as $Fe_2O_3$) were determined volumetrically, and the amount of unbound (pore) water ($H_2O^-$) and bound water ($H_2O^+$) [loss-on-ignition (LOI)] was determined gravimetrically. The criterion used for determining the accuracy of the analyses is that the analytical total for each sample (the sum of the components $SiO_2$, $TiO_2$, $Al_2O_3$, FeO, $Fe_2O_3$, MnO, MgO, CaO, $Na_2O$, $K_2O$, $P_2O_5$, $H_2O^-$, and $H_2O^+$) lies within the range of 99.0 to 100.5% by weight. For the samples in this study, this acceptance criterion was met only when $SiO_2$ was determined gravimetrically rather than by XRF. The analytic methods used are discussed in subsequent sections.

Table 1

LIST OF PROCEDURES USED IN CHARACTERIZATION OF THE SAMPLES DISCUSSED IN THIS REPORT

| Procedure Number* | Description |
|---|---|
| 1 | Abitz, Richard, Husler, J.W., and Connolly, J.R. "Operation of the Rigaku 3064-M X-ray Fluorescence Spectrometer," UNM Geochemistry Lab In-House Document, February, 1988, 7 pp. |
| 2 | Connolly, J.R. "Procedures for Laboratory Sample Petrology Determination," SNL-NNWSI Project Technical Procedure TP-59, Rev. B, November, 1987, 7 pp. |
| 3 | Connolly, J.R. "Procedures for Preparation of Polished Thin Sections," SNL-NNWSI Project Technical Procedure TP-60, Rev. B, October, 1987, 7 pp. |
| 4 | Connolly, J.R. "Laboratory Procedures for Mineralogic Analysis by X-Ray Powder Diffraction Part 1: Data Gathering," SNL-NNWSI Project Technical Procedure TP-62, Rev. 0, September, 1987, 7 pp. |
| 5 | Husler, John W. "Analytical Methods for the Analysis of Rocks, Ores and Minerals," UNM Geochemistry Lab In-House Document, March, 1988, 6 pp. |
| 6 | Husler, John W. "Determination of Ferrous Iron in Silicate Rocks," UNM Geochemistry Lab In-House Document, March, 1988, 3 pp. |
| 7 | Husler, John W. "Gravimetric Determination of Silica in a Silicate Rock," UNM Geochemistry Lab In-House Document, March, 1988, 3 pp. |
| 8 | Husler, John W. "Preparation of Fused Disks for XRF Major Element Determination," UNM Geochemistry Lab In-House Document, May, 1988, 3 pp. |

*The numbers in this column are provided to simplify citation of the procedures in the text of this report and have no other significance.

#### 2.1.1.1 Sample Preparation

Samples for analyses of whole rock must be crushed to a fine powder (<100 mesh = <150 $\mu$m). Crushing is accomplished by breaking the whole rock samples into small (pea-sized) pieces using a hardened steel mortar and pestle. These pieces are then crushed in a tungsten-carbide ball-mixer mill and passed through a 100-mesh nylon screen using special steps to minimize any possibility of sample contamination. Details of the procedure are discussed in Procedure 2.

The resulting powder is used for all analytical techniques except XRF. To analyze a rock sample for major elements using XRF, a fused disk of the sample must be prepared using a lithium tetraborate flux. Procedure 8 was used to prepare these disks.

#### 2.1.1.2 X-Ray Fluorescence Spectroscopy

XRF is used to determine the composition of a sample by measuring the intensity of characteristic x-rays generated by the sample when subjected to high-energy x-radiation. The measured intensities are compared with standardized intensity data stored in the microcomputer used to operate the XRF spectrometer and are used by the XRF data analysis software to calculate weight percentages of oxides.

The samples in this study were analyzed by comparing them with a variety of internationally recognized rock standards. These standards were analyzed to create digitally stored calibration curves for all of the elements analyzed. Equipment is calibrated only when there is a major change in the equipment (e.g., when a new x-ray tube is installed) or when the analytical results for the internal drift-correcting standard or for the samples indicate that the calibration for a particular element or elements is not yielding accurate results. Instrumental drift is corrected by analyzing each element in a known standard [usually U.S. Geological Survey (USGS) Basalt BCR-1, which was used for all of the samples analyzed here] before analyzing for that same element in each group of samples. The

data collected on this standard are used to correct for instrumental drift in the final calculations of oxide weight percentages for the samples.

Detailed procedures for operation of the Rigaku XRF system, as used to obtain these major element analyses, are contained in Procedure 1. Although these data were gathered before completion of this document, the equipment and procedure used were substantially the same as those described in this report.

#### 2.1.1.3 Gravimetric Analysis for Silica

The procedure for gravimetrically analyzing for silica content ($SiO_2$) involves a number of steps. The powdered sample is fused with sodium carbonate, leached with HCl, and dehydrated, and the silica is filtered, ignited, and weighed. Step-by-step procedures are detailed in Procedure 7.

#### 2.1.1.4 Gravimetric Analysis for $H_2O$

The content of hygroscopic or nonessential water ($H_2O^-$) is determined by weighing a quantity of powdered sample (0.5-0.6 g), heating the sample for 1 hr at 110°C in a clean, preweighed, platinum crucible, cooling for 1 hr in a desiccator, reweighing, and calculating the difference in weight before and after heating.

Structurally bound water ($H_2O^+$) is determined by ignition of the powdered sample used for determining $H_2O^-$ content for 1 hr in a muffle furnace at 1,000°C. LOI is determined by measuring the weight lost during ignition and by calculating the weight percentage of that loss. A correction of the final amount is made for the weight gained by oxidation of any FeO to $Fe_2O_3$, based on the proportions of ferrous and ferric iron as

determined by the procedures described in Section 2.1.1.5. As the result of petrographic examination of this group of samples, it was assumed that no significant carbonate was present; any carbonate or other volatiles present (such as sulfur and chlorine) would be incorporated in the amount reported for $H_2O^+$. Details of the procedures used are provided in Procedure 5.

#### 2.1.1.5 Volumetric Determination of Ferrous Iron

XRF analyses report all iron in the sample as if it were in the ferric state as $Fe_2O_3$. The procedure for analyzing what proportion of the total iron is actually FeO involves a number of steps. The sample is dissolved with hydrofluoric and sulfuric acids. The ferrous iron is then titrated with standard potassium dichromate using sodium diphenylamine sulfionate as an indicator. Details of the procedure are discussed in Procedure 6.

The LOI was corrected, based on the proportion of FeO as determined above. It is assumed that all FeO is oxidized to $Fe_2O_3$ during ignition. The conversion factor is

$$\text{preignition FeO} \times 1.1113 = \text{postignition } Fe_2O_3 \ ,$$

where the amounts of FeO and $Fe_2O_3$ are expressed in weight percent.

The weight percent of $H_2O^+$ (as LOI) was corrected by subtracting the percentage of weight gained in oxidizing FeO to $Fe_2O_3$ from the actual weight percent loss on ignition.

### 2.1.2 Uncertainties

Uncertainties in analyses of whole rock have been estimated based on multiple analyses of internationally accepted rock standards, synthetic

materials, and UNM in-house rock standards. These uncertainties are incorporated in the acceptance criteria as described in the following paragraphs.

For components that make up more than 1 wt% of the sample, the analyzed value should be within ±3% of the actual amount of the component present. For the samples analyzed in this study, these components included some or all of the following: $SiO_2$, $Al_2O_3$, $Fe_2O_3$, $Na_2O$, and $K_2O$.

For components that make up between 0.1 wt% and 1.0 wt% of the sample, the analyzed value should be within ±5% of the actual amount of the component present. For the samples analyzed in this study, these components included some or all of the following: $TiO_2$, $Fe_2O_3$, FeO, MgO, and CaO.

For components that make up between 0.01 wt% and 0.1 wt% of the sample, the analyzed value should be within ±30% of the actual amount of the component present. For the samples analyzed in this study, these components included some or all of the following: FeO, MnO, and $P_2O_5$.

For components that make up less than 0.01 wt% of the sample, the amounts reported should be considered to be present in an amount below the reliable detection limit for the methods used to produce the analyses described in this report.

For $H_2O^+$, the method used is indirect. The presence of volatile elements that have not been the explicit object of analysis may produce inaccuracies in addition to the random variations inherent in the analytical technique. For this reason, the amount of $H_2O^+$ reported is estimated to be correct within ±10% of the amount present if the amount is over 1%, and ±30% of the amount present if the amount is under 1%. Similar uncertainties are estimated for $H_2O^-$. These estimates are uncertainties associated with the measurement itself. For zeolitic materials, an additional uncertainty is introduced by the hygroscopic nature of the material. During determination of $H_2O^-$ and $H_2O^+$, the powders are exposed to environments of varying humidity, which may add (or subtract) water to

the powder. This potential effect has not been quantified but is likely to have caused the analytic total for Sample G4-1444.7 (100.58 wt%) to fail the criterion stated at the beginning of Section 2.1.1.

## 2.2 X-Ray Diffraction

### 2.2.1 Method

The XRD data used to identify mineral phases present in the samples were obtained by the X-Ray Diffraction Laboratory in the Department of Geology at UNM by using the Scintag Pad V XRD system (Procedure 4). The resulting data are presented in Table 2. Although the data were gathered before the completion of Procedure 4, the equipment and procedures used were substantially the same as those described in this document.

Based on the presence of unique diffraction peaks, XRD can uniquely identify minerals in any given crystalline sample. All of the samples for which data are presented here were scanned over an angular interval of 4 to 54° 2-theta (2θ), at a rate of 1° 2θ/min. The Scintag Pad V software was used to convert the raw peak position and intensity data to a peak data file consisting of a list of all 2θ values and associated relative intensities (normalized to a value of 100 for the strongest peak) corrected for the background intensity. Individual mineral phases are identified by comparison with data from mineral standards contained in the Joint Committee on Powder Diffraction Standards (JCPDS) powder diffraction file. This comparison was performed visually on a Tektronix graphics terminal, which allows comparison of sample data with peak data for JCPDS standards. This method allows very reliable determination of the presence of quartz, cristobalite, tridymite, and various feldspars. The presence of up to five different feldspar phases in many of these samples makes the identification of all the different feldspars difficult because of peak overlap. Zeolites and clay minerals may be detected reliably if present in substantial amounts, typically greater than 5 wt%.

Table 2

SEMI-QUANTITATIVE X-RAY DIFFRACTION RESULTS

| | Mineral Amounts (wt%) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Sample ID | Feldspar | Quartz | Cristobalite | Tridymite | Glass | Clinoptilolite | Clay | Other[a] |
| UE-25a#1 1518.9 | 5 | 6 | 4[b] | - | - | 70 | 15 | - |
| USW G-1 504.6 | 62 | 3 | 17 | 14 | - | - | - | 4 |
| USW G-1 1151.1 | 58 | 10 | 20 | 8 | - | - | - | 4 |
| USW G-1 1288.9 | 10-15 | 1-3 | 5[b] | - | 70-75 | - | - | - |
| USW G-1 1796.4 | 10 | 7 | 5 | - | - | 53 | 25 | - |
| USW G-2 1646.8 | - | - | 2[b] | - | 90-95 | - | - | - |
| USW G-2 1659.2 | 4-8 | 3 | 3[b] | - | 54-58 | 12 | 10 | - |
| USW G-2 1748.0 | 6 | 11 | 6[b] | - | - | 77 | - | - |
| USW GU-3 542.7 | 64 | - | 20 | 13 | - | - | - | 3 |
| USW GU-3 857.1 | 61 | 23 | 10 | 3 | - | - | - | 3 |
| USW G-4 329.4 | 77 | - | 14 | 4 | - | - | - | 5 |
| USW G-4 493.2 | 60 | - | 31 | 5 | - | - | - | 4 |
| USW G-4 965.2 | 59 | 20 | 12 | 5 | - | - | - | 4 |
| USW G-4 1171.8 | 59 | 24 | 12 | - | - | - | - | 5 |
| USW G-4 1220.9 | 60 | 20 | 13 | 4 | - | - | - | 3 |
| USW G-4 1294 | 61±12 | 17±3 | 12±2 | 6±1 | - | - | - | 4 |
| USW G-4 1307.2A | 61±12 | 7±1 | 20±4 | 9±2 | - | - | - | 3 |
| USW G-4 1307.2F | 61±12 | 17±3 | 15±3 | 4±1 | - | - | - | 3 |
| USW G-4 1444.7 | - | - | - | - | - | 100 | - | - |
| USW G-4 1649.5 | - | 4 | 3[b] | - | - | 93 | - | - |

a. Includes all unidentified phases.
b. Probably opal-CT.

Estimation of amounts of the mineral phases present cannot be reliably accomplished using only XRD because special sample preparation and standardization techniques are required, which were not available at the time these data were gathered. For this reason, the proportions of mineral phases present were estimated using the XRD data, petrographic observations, and the whole-rock analysis data. These estimates were performed as described below.

The mineral phases present were identified by XRD. Samples were classed as either devitrified, zeolitized, or glassy, based on petrographic observation of thin sections, chemical characteristics determined by analyses of whole rock, and XRD data. Devitrified samples are characterized by a high degree of visible crystallinity in thin section and the presence of abundant feldspar and silica phases shown in the XRD results. Zeolitized samples are characterized by low-birefringence crystallinity in thin section, elevated water content (total $H_2O$ above 10%) as shown by chemical analysis, and the presence of clinoptilolite as detected by XRD. Glassy samples are nearly isotropic in thin section, have $H_2O^+$ contents of about 3% (or less), and have very-low-intensity XRD traces with a broad, poorly defined background "hump" in the range between 20 and 30° 2θ.

For devitrified samples, CIPW-normative minerals were calculated by using whole rock chemical data and by including $H_2O^+$ as a normative component. The XRD and petrographic data indicated that the CIPW norms represented a reasonable approximation of the actual mineral content, particularly in regard to silica phases and feldspar, which compose over 96% of the norms. Proportions of the silica phases were estimated by comparing intensities for quartz, tridymite, and cristobalite peaks (if present in the XRD trace) using the K-factors calculated by Pawloski (1985) and by then distributing the normative silica among the phases in those calculated proportions.

For the glassy samples, CIPW norms were calculated by including $H_2O^+$ as a normative component. XRD data indicated that a small fraction of

opaline material (opal-CT) was present in all samples, in addition to some quartz and feldspar probably present as phenocrysts in the glass. One sample included a detectable amount of zeolite and clay. Because direct determination of the amount of glass is not possible, the amounts of the crystalline constituents were estimated by comparing ratios of integrated peak intensities in glassy samples with those in devitrified and zeolitized samples for feldspar, quartz, cristobalite (for opal-CT), and clay minerals. The amounts shown in the data tables were calculated by comparing the intensities of the peaks for these minerals in glassy rocks to intensities for the same minerals in devitrified or zeolitized rocks and by multiplying this number by the mineral fractions calculated for the more crystalline samples. The remainder, minus modal amounts of devitrified rock fragments and phenocrysts (determined by petrographic examination of thin sections), was assumed to be glass.

For the zeolitized samples, the CIPW norms are not representative of the actual mineralogy of the samples. Mineral proportions were estimated using the method and K-factors of Pawloski (1985). This method requires that all phases be identified. It was impossible to determine whether any glass was present in the samples in addition to the crystalline phases; thus, any glass that may be present has not been included in the estimated proportions.

### 2.2.2 Uncertainties

XRD is a very reliable method of identifying crystalline phases in rocks. The lower limit of detectability for an individual phase depends on (1) the intensity of the diffracted peak (which varies for different phases), (2) the speed of the scan (slower scans result in higher signal-to-noise ratios and therefore provide the ability to detect smaller amounts of mineral), and (3) the sensitivity of the detector and the electronics used to amplify and process the detector signal. Although not rigorously tested, the estimated minimum detection limit for minerals with low-intensity XRD peaks (clays and zeolites) is about 5% at the operating

conditions used in this study. Minerals with strong XRD signatures (e.g., quartz) would probably be detectable in amounts of 2 to 3%.

All of the estimates of the amounts of the identified mineral phases are subject to significant errors. Directly applying the K-ratios used by Pawloski (1985) in her "quantitative" method produced unacceptable results for the devitrified samples. Pawloski's K-ratios for feldspars are not applicable because the feldspars in her samples were of different composition from those in the samples analyzed for this study. For this reason, normative calculations were used in this study to estimate feldspar amounts, and Pawloski's approach was applied only to the different silica phases. Errors in K-ratios for quartz, cristobalite, and tridymite would have resulted in systematic errors in the calculated proportions of these mineral phases. A quantitative evaluation of all these potential sources of error cannot be made.

For the glassy samples, more sources of error are present than those mentioned for the devitrified samples. The counts for mineral phases in the glassy samples were compared with counts obtained for more crystalline samples under the same instrumental operating conditions but at a different time. This procedure introduced two sources of error. One error is uncorrected instrumental drift, which may occur between the two times of measurement. The second error is a systematic one that is related to the differences between the mineral compositions (and dependent x-ray peak intensities) in these samples and those in the standards used by Pawloski. A quantitative evaluation of all these potential sources of error cannot be made.

Pawloski's method and K-factors were used to estimate the proportions of mineral phases in the zeolitized samples. Potential sources of error include the lack of standard calibration for the Scintag XRD unit, the questionable feldspar K-factors, and the validity of application of the cristobalite K-factor to opal-CT in the zeolitized samples. Because of the difficulty in identifying glass in an otherwise crystalline sample, a significant amount of glass (possibly up to 50%) would not be detectable if present. The background counts for the zeolitized samples are very similar

to those for the devitrified samples, which argues against the presence of significant amounts of glass. A quantitative evaluation of all these potential sources of error cannot be made.

## 2.3 Petrography

### 2.3.1 Methods

Descriptive petrographic data for the samples were obtained by the Institute of Meteoritics (IOM), Department of Geology, UNM, where a binocular microscope was used for hand sample descriptions, and one of two Zeiss research petrographic microscopes was used for thin section descriptions. Descriptive data are presented in Appendix B.

The hand samples were in the form of sections of 6.35-cm-diameter pieces of core of variable length (generally 7.6 to 15.2 cm.) and were described on tuff sample description forms designed for NNWSI samples by the IOM. Because the samples were to be powdered for measuring chemical, x-ray, physical property, and experimental heat capacity after description and removal of subsamples for thin sections, very complete hand sample descriptions were made by Connolly.

It was thought that a high percentage of phenocrysts and crystalline lithic fragments relative to fine-grained matrix could have a significant effect on the heat capacity of the samples, and efforts were made to accurately estimate the percent of phenocrysts, matrix, and lithics in the hand samples. For each sample, an estimate of volume percentages of different components was made, either by making point counts along axial traverse lines on the core or, where sample conditions made this approach impractical, by making visual estimates. For the samples counted, 6 to 9 evenly spaced lines were marked along the length of the core, a millimeter scale was attached to the sample by rubber bands along these lines, and points were counted at 0.5-cm intervals along the scale on each line. The number of points counted per sample ranged between 98 and 207. Lof (1982)

published visual estimation diagrams that were used as a guide for making visual estimates of component percentages for selected samples. Standard procedures used in the IOM for hand sample descriptions of YMP samples are described in Procedure 2. Although these data were gathered before the completion of this document, the equipment and procedures used in data gathering were substantially the same as those described in Procedure 2.

Polished thin sections were made from each sample. For most samples (including all samples for which hand-sample examination showed significant small-scale compositional variation), two polished thin sections were prepared following relevant portions of Procedure 3. Although these sections were made before the completion of this procedure, the equipment and procedures used to gather these data were substantially the same as those described in Procedure 3. The polished sections were examined and described by Connolly (Appendix B). The main objective of the petrographic observations was to determine whether the samples were devitrified, glassy, or zeolitized and to obtain descriptive data on matrix textures. Point counts of the thin sections were not performed.

### 2.3.2 Uncertainties

Descriptive petrographic data are, by their nature, subjective and dependent on the expertise of the petrographer and are not subject to any estimation of errors. The uncertainty given for samples in which hand-sample point counts were made used the method of Van der Plas and Tobi (1965); the uncertainties are $\pm 2\sigma$ standard deviations, giving 95% confidence that the actual amount is within the range of uncertainty given. Where the $2\sigma$ value equaled or exceeded the amount counted, no uncertainty was estimated and a value of "not applicable" (NA) was entered on the data sheets. No quantitative uncertainty estimates could be made using the visual mode.

## 2.4 Assessment of Limitations of the Data

The preceding sections describe the estimated uncertainties associated with the data in this report. In addition to these estimates, use of the data in the calculation of heat capacity has two limitations, the most important of which is the absence of measured data with which to verify the usefulness of the information. This limitation is a special problem for chemical analysis of $H_2O$. Without measurements to confirm the assumption that $H_2O^-$ is pore or absorbed water and $H_2O^+$ is "structural" water in minerals, it cannot be verified that the water in the analyses has been apportioned properly or that normalization of analyses to exclude all $H_2O^-$ is appropriate.

The other limitation is the semiquantitative nature of the XRD analyses. For devitrified samples, XRD analyses can provide relatively accurate estimates of the feldspar-to-silica-phase ratio when combined with the chemical analyses. However, obtaining accurate estimates of the relative proportions of the three different silica phases (quartz, tridymite, and cristobalite) is more difficult. This limitation is relevant because both tridymite and cristobalite undergo polymorphic transformations in the temperature range expected near a repository (~25 to 250°C). Accounting for the heat involved in these transformations is not possible unless the amount of the relevant phases can be determined accurately.

## 3.0 CONCLUSIONS

This report describes the analytical techniques, the uncertainties associated with those techniques, and some of the limitations of the resulting data. Two conclusions have been reached:

- in terms of relevance to heat capacity calculations, the major uncertainty associated with bulk chemical analyses is related to determination and apportioning of the $H_2O$ content; and

- if mineralogic data are to be used in the calculation of heat capacity, a quantitative x-ray diffraction technique needs to be developed to reduce the uncertainties inherent in the semiquantitative technique currently in use.

## 4.0 REFERENCES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# APPENDIX A

## DATA COMPILATION FORMS FOR CHEMICAL ANALYSES

## BULK CHEMISTRY DATA COMPILATION FORM FOR THE NNWSI PROJECT SEPDB

**PART 1. SAMPLE LOCATION AND IDENTIFICATION**

SAMPLE ID UE25 A-1 1518.9 SAMPLE ORIGIN UE-25a#1

SAMPLE INTERVAL (ft) 1518.9-1519.5 TEST # 1

**PART 2. PARAMETERS**

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 69.30 | 0.08 | 11.88 | 0.85 | < 0.01 | 0.06 | 0.04 |
| EXPERIMENT UNCERTAINTY | ±2.08 | ±0.02 | ±0.36 | ±0.04 | BDL[a] | ±0.02 | ±0.01 |
| TEST TYPE(S)[b] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 2.12 | 1.27 | 4.22 | 0.01 | 6.46 | 4.11 | 100.40 |
| EXPERIMENT UNCERTAINTY | ±0.06 | ±0.04 | ±0.13 | ±0.003 | ±0.65 | ±0.41 | ±0.65 |
| TEST TYPE(S)[b] | X | X | X | X | G | G | |

a. BDL = Below Detection Limit.

b. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

**PART 3. EXPERIMENT CONDITIONS**

Standard; see Section 2.1 of SAND88-0882.

**PART 4. REFERENCE AND SUPPORTING INFORMATION**

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-1 504.6 SAMPLE ORIGIN USW G-1

SAMPLE INTERVAL (ft) 504.6 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 74.16 | 0.18 | 13.64 | 1.12 | < 0.01 | 0.09 | 0.24 |
| EXPERIMENT UNCERTAINTY | ±2.22 | ±0.01 | ±0.41 | ±0.03 | BDL[a] | ±0.03 | ±0.01 |
| TEST TYPE(S)[b] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.62 | 3.38 | 5.10 | 0.02 | 0.82 | 0.32 | 99.68 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.10 | ±0.15 | ±0.01 | ±0.25 | ±0.10 | ±0.66 |
| TEST TYPE(S)[b] | X | X | X | X | G | G | |

a. BDL = Below Detection Limit.

b. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-1 1151.1 SAMPLE ORIGIN USW G-1

SAMPLE INTERVAL (ft) 1151.1 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 75.64 | 0.12 | 13.06 | 0.70 | <0.01 | 0.08 | 0.19 |
| EXPERIMENT UNCERTAINTY | ±2.27 | ±0.01 | ±0.39 | ±0.04 | BDL[a] | ±0.02 | ±0.01 |
| TEST TYPE(S)[b] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.54 | 3.14 | 4.80 | 0.01 | 0.89 | 0.58 | 99.75 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.09 | ±0.14 | ±0.003 | ±0.27 | ±0.17 | ±0.67 |
| TEST TYPE(S)[b] | X | X | X | X | G | G | |

a. BDL = Below Detection Limit.

b. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-1 1288.9 SAMPLE ORIGIN USW G-1

SAMPLE INTERVAL (ft) 1288.9 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 74.17 | 0.11 | 12.76 | 0.60 | 0.34 | 0.08 | 0.06 |
| EXPERIMENT UNCERTAINTY | ±2.23 | ±0.01 | ±0.38 | ±0.03 | ±0.02 | ±0.02 | ±0.02 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.60 | 4.11 | 3.66 | 0.01 | 3.28 | 0.18 | 99.96 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.12 | ±0.11 | ±0.003 | ±0.33 | ±0.05 | ±0.64 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-1 1796.4 SAMPLE ORIGIN USW G-1

SAMPLE INTERVAL (ft) 1796.4-1797.5 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 64.87 | 0.33 | 13.96 | 2.86 | < 0.01 | 0.25 | 0.90 |
| EXPERIMENT UNCERTAINTY | ±1.95 | ±0.02 | ±0.42 | ±0.09 | BDL[a] | ±0.01 | ±0.05 |
| TEST TYPE(S)[b] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 1.81 | 2.75 | 3.59 | 0.05 | 5.13 | 3.96 | 100.47 |
| EXPERIMENT UNCERTAINTY | ±0.05 | ±0.08 | ±0.11 | ±0.02 | ±0.51 | ±0.40 | ±0.61 |
| TEST TYPE(S)[b] | X | X | X | X | G | G | |

a. BDL = Below Detection Limit.

b. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-2 1646.8 SAMPLE ORIGIN USW G-2

SAMPLE INTERVAL (ft) 1646.8-1647.4 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 73.44 | 0.11 | 12.70 | 0.63 | 0.24 | 0.08 | 0.05 |
| EXPERIMENT UNCERTAINTY | ±2.20 | ±0.01 | ±0.38 | ±0.03 | ±0.01 | ±0.02 | ±0.01 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.59 | 3.28 | 4.60 | 0.01 | 3.93 | 0.19 | 99.84 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.10 | ±0.14 | BDL[b] | 0.39 | ±0.06 | ±0.66 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

b. BDL = Below Detection Limit.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-2 1659.2 SAMPLE ORIGIN USW G-2

SAMPLE INTERVAL (ft) 1659.2-1659.7 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 72.33 | 0.11 | 12.76 | 0.69 | 0.16 | 0.08 | 0.06 |
| EXPERIMENT UNCERTAINTY | ±2.17 | ±0.01 | ±0.38 | ±0.04 | ±0.01 | ±0.02 | ±0.02 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.88 | 2.77 | 4.77 | 0.01 | 4.58 | 0.70 | 99.89 |
| EXPERIMENT UNCERTAINTY | ±0.04 | ±0.08 | ±0.14 | ±0.003 | ±0.46 | ±0.21 | ±0.63 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

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COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-2 1748.0 SAMPLE ORIGIN USW G-2

SAMPLE INTERVAL (ft) 1748.0-1748.7 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 72.02 | 0.08 | 10.72 | 0.65 | 0.03 | 0.07 | 0.07 |
| EXPERIMENT UNCERTAINTY | ±2.16 | ±0.02 | ±0.32 | ±0.03 | ±0.01 | ±0.02 | ±0.02 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 1.60 | 1.75 | 3.84 | 0.01 | 6.05 | 3.00 | 99.89 |
| EXPERIMENT UNCERTAINTY | ±0.05 | ±0.05 | ±0.12 | ±0.003 | ±0.61 | ±0.30 | ±0.64 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

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COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW GU-3 542.7 SAMPLE ORIGIN USW GU-3

SAMPLE INTERVAL (ft) 542.7 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 74.57 | 0.15 | 13.38 | 1.19 | < 0.01 | 0.09 | 0.11 |
| EXPERIMENT UNCERTAINTY | ±2.24 | ±0.01 | ±0.40 | ±0.06 | BDL[a] | ±0.03 | ±0.01 |
| TEST TYPE(S)[b] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.53 | 3.63 | 5.07 | 0.02 | 0.52 | 0.12 | 99.37 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.11 | ±0.15 | ±0.01 | ±0.16 | ±0.04 | ±0.66 |
| TEST TYPE(S)[b] | X | X | X | X | G | G | |

a. BDL = Below Detection Limit.

b. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW GU-3 857.1 SAMPLE ORIGIN USW GU-3

SAMPLE INTERVAL (ft) 857.1 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 75.36 | 0.11 | 12.94 | 1.06 | 0.08 | 0.08 | 0.11 |
| EXPERIMENT UNCERTAINTY | ±2.26 | ±0.01 | ±0.65 | ±0.05 | ±0.02 | ±0.02 | ±0.01 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.53 | 3.54 | 4.70 | 0.01 | 0.55 | 0.14 | 99.20 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.11 | ±0.14 | ±0.003 | ±0.03 | ±0.01 | ±0.65 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 329.4 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 329.4-330.0 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 68.29 | 0.43 | 16.10 | 2.04 | < 0.01 | 0.10 | 0.28 |
| EXPERIMENT UNCERTAINTY | ±2.05 | ±0.03 | ±0.48 | ±0.07 | BDL[a] | ±0.01 | ±0.01 |
| TEST TYPE(S)[b] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 1.06 | 4.40 | 5.84 | 0.07 | 0.46 | 0.00 | 99.06 |
| EXPERIMENT UNCERTAINTY | ±0.04 | ±0.13 | ±0.18 | ±0.03 | ±0.02 | BDL[a] | ±0.64 |
| TEST TYPE(S)[b] | X | X | X | X | G | G | |

a. BDL = Below Detection Limit.

b. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Anaylsis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 493.2 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 493.2-493.4 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 75.47 | 0.12 | 12.98 | 1.07 | < 0.01 | 0.08 | 0.17 |
| EXPERIMENT UNCERTAINTY | ±2.26 | ±0.01 | ±0.39 | ±0.05 | BDL[a] | ±0.02 | ±0.01 |
| TEST TYPE(S)[b] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.55 | 3.40 | 4.84 | 0.01 | 0.65 | 0.46 | 99.80 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.10 | ±0.15 | ±0.003 | ±0.20 | ±0.14 | ±0.67 |
| TEST TYPE(S)[b] | X | X | X | X | G | G | |

a. BDL = Below Detection Limit.

b. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 965.2 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 965.2 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 75.62 | 0.11 | 12.84 | 0.99 | < 0.01 | 0.08 | 0.13 |
| EXPERIMENT UNCERTAINTY | ±2.27 | ±0.01 | ±0.39 | ±0.05 | BDL[a] | ±0.02 | ±0.01 |
| TEST TYPE(S)[b] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.54 | 3.30 | 4.74 | 0.01 | 0.64 | 0.48 | 99.48 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.10 | ±0.14 | BDL[a] | ±0.19 | ±0.14 | ±0.70 |
| TEST TYPE(S)[b] | X | X | X | X | G | G | |

a. BDL = Below Detection Limit.

b. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1171.8 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1171.8-1172.4 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 75.16 | 0.11 | 12.89 | 0.92 | 0.06 | 0.78 | 0.14 |
| EXPERIMENT UNCERTAINTY | ±2.26 | ±0.01 | ±0.39 | ±0.05 | ±0.02 | ±0.04 | ±0.01 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.54 | 3.35 | 4.70 | 0.01 | 0.68 | 0.42 | 99.76 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.10 | ±0.14 | BDL[b] | ±0.20 | ±0.13 | ±0.67 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

b. BDL = Below Detection Limit.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1220.9 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1220.9-1222.0 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 75.32 | 0.11 | 12.96 | 0.87 | 0.08 | 0.08 | 0.15 |
| EXPERIMENT UNCERTAINTY | ±2.26 | ±0.01 | ±0.40 | ±0.04 | ±0.02 | ±0.02 | ±0.01 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.56 | 3.34 | 4.80 | 0.01 | 0.61 | 0.44 | 99.33 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.10 | ±0.14 | ±0.003 | ±0.18 | ±0.13 | ±0.64 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1294 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1294 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 75.39 | 0.12 | 12.74 | 0.69 | 0.24 | 0.08 | 0.10 |
| EXPERIMENT UNCERTAINTY | ±2.26 | ±0.01 | ±0.38 | ±0.04 | ±0.01 | ±0.03 | ±0.01 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.56 | 3.60 | 4.64 | 0.02 | 0.98 | 0.39 | 99.55 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.11 | ±0.14 | ±0.01 | ±0.29 | ±0.12 | ±0.64 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1307.2A SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1307.2 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 75.78 | 0.11 | 12.86 | 0.80 | 0.14 | 0.08 | 0.10 |
| EXPERIMENT UNCERTAINTY | ±2.27 | ±0.01 | ±0.39 | ±0.04 | ±0.01 | ±0.02 | ±0.03 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.55 | 3.50 | 4.80 | 0.01 | 0.60 | 0.39 | 99.72 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.11 | ±0.14 | BDL[b] | ±0.18 | ±0.12 | ±0.67 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

b. BDL = Below Detection Limit.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1307.2F SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1307.2 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 76.20 | 0.11 | 12.85 | 0.75 | 0.14 | 0.08 | 0.08 |
| EXPERIMENT UNCERTAINTY | ±2.29 | ±0.01 | ±0.39 | ±0.04 | ±0.01 | ±0.02 | ±0.03 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.56 | 3.62 | 4.66 | 0.01 | 0.40 | 0.21 | 99.68 |
| EXPERIMENT UNCERTAINTY | ±0.03 | ±0.11 | ±0.14 | ±0.004 | ±0.12 | ±0.06 | ±0.65 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1444.7 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1444.7-1445.8 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 65.43 | 0.11 | 11.93 | 1.02 | 0.02 | 0.08 | 0.04 |
| EXPERIMENT UNCERTAINTY | ±1.96 | ±0.01 | ±0.36 | ±0.03 | ±0.01 | ±0.02 | ±0.01 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 1.23 | 2.44 | 4.36 | 0.01 | 8.21 | 5.71 | 100.58* |
| EXPERIMENT UNCERTAINTY | ±0.04 | ±0.07 | ±0.13 | BDL[b] | 0.82 | ±0.57 | ±0.65 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

b. BDL = Below Detection Limit.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

*This total violates the acceptance criterion of 99.0-100.5%. However, because the magnitude of the violation (0.08%) is much less than the experiment uncertainty for many oxides, the analysis is considered to be usable.

BULK CHEMISTRY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1649.5 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1649.5-1650.6 TEST # 1

PART 2. PARAMETERS

CONSTITUENTS IDENTIFIED, AMOUNTS, AND EXPERIMENT UNCERTAINTY (WEIGHT PERCENT)

| CONSTITUENT | $SiO_2$ | $TiO_2$ | $Al_2O_3$ | $Fe_2O_3$ | FeO | MnO | MgO |
|---|---|---|---|---|---|---|---|
| AMOUNT | 68.20 | 0.08 | 11.54 | 0.75 | 0.02 | 0.05 | 0.03 |
| EXPERIMENT UNCERTAINTY | ±2.05 | ±0.03 | ±0.35 | ±0.04 | ±0.01 | ±0.01 | ±0.01 |
| TEST TYPE(S)[a] | G | X | X | X & V | V | X | X |

| CONSTITUENT | CaO | $Na_2O$ | $K_2O$ | $P_2O_5$ | $H_2O^+$ | $H_2O^-$ | Total |
|---|---|---|---|---|---|---|---|
| AMOUNT | 0.75 | 2.68 | 4.44 | 0.01 | 6.82 | 4.74 | 100.12 |
| EXPERIMENT UNCERTAINTY | ±0.04 | ±0.08 | ±0.13 | BDL[b] | ±0.68 | ±0.47 | ±0.65 |
| TEST TYPE(S)[a] | X | X | X | X | G | G | |

a. X = X-ray Fluorescence, AA = Atomic Absorption, V = Volumetric Analysis, G = Gravimetric Analysis.

b. BDL = Below Detection Limit.

NAME OF TRACE CONSTITUENT(S) AND AMOUNTS (IN PPM)

None

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.1 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: F. B. NIMICK (Name) 6313 (SNL Div.) 3/23/88 (Date)

COMMENTS

# APPENDIX B

## DATA COMPILATION FORMS FOR PETROGRAPHIC INFORMATION

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID UE-25 A-1 1518.9 SAMPLE ORIGIN UE-25a#1

SAMPLE INTERVAL (ft) 1518.9-1519.5 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Pale brownish to pinkish buff with varicolored lithic fragments.

TEXTURE: Tuffaceous, volcaniclastic .

CLAST TYPE & SIZES: Pale buff zeolitic lithics, 1-30 mm; dark gray to black lithics 1-15 mm; rare brick-red porous fragments.

OTHER: Notable preferred orientation of elongate lithics defines bedding.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two sections (A and B) cut parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 55% | ±8% | Any fragments <0.5 mm | Variable |
| Zeolitized Lithics (pumice?) | 36% | ±8% | 1-30 mm, probably replaced | Angular |
| Zeolitized perlite | 3% | NA[c] | 0.5-10 mm, average 1 mm | NC[d] |
| Devitrified tuff fragments | 3% | NA[c] | 0.1-1.2 mm | Subangular to subrounded |
| Phenocrysts (quartz, feldspar) | 2% | NA[c] | NC[d] | NC[d] |
| Red porous lithics | 1% | NA[c] | average 1 mm | Subrounded, zeolitized |

NO. OF POINTS COUNTED: 153; point count done on hand sample, not in thin section.

ESTIMATED VOLUME % VOID SPACE: Pores not counted but are common in pumice. Total porosity probably ≥30%.

WELDING: Not welded; sample is essentially cemented by zeolites.

DEVITRIFICATION: No high-temperature devitrification; all formerly glassy pumice, shards, and matrix are now zeolitized.

MISC. TEXTURES-FABRIC: Fragment size averages 0.5-2 mm and shows fair sorting.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NA = Uncertainty larger than amount present.
d. NC = Not compiled.

COMMENTS

FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-1 504.6 SAMPLE ORIGIN USW G-1

SAMPLE INTERVAL (ft) 504.6 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Matrix: pale brown to reddish brown; lithophysae: light gray.

TEXTURE: Tuffaceous, welded, lithophysal.

CLAST TYPE & SIZES: Alkali feldspar, minor.

OTHER: Abundant lithophysal cavities.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION NUMBERS, ETC.): Two polished thin sections (A and B) approximately perpendicular to layering.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix (devitrified) | 35% | ±9% | Most <2 μm | NC[c] |
| Altered matrix | 43% | ±9% | Most <10 μm | NC[c] |
| Lithophysal cavity | 18% | ±7% | Up to 1 cm | NC[c] |
| Phenocrysts (alkali feldspar, plagioclase, quartz) | 3% | NA[d] | 0.2-3.0 mm, average 1.5 mm | Subhedral, broken |
| Fiamme | 2% | NA[d] | Slightly coarser than devitrified matrix | |

NO. OF POINTS COUNTED: 124; points counted on hand sample, not in thin section.

ESTIMATED VOLUME % VOID SPACE: 18% in lithophysal cavities, probably about 3-5% in matrix.

WELDING: Moderate.

DEVITRIFICATION: Complete; both fine-scale in matrix and coarser (with vapor phase) in altered areas.

MISC. TEXTURES OR FABRIC: Sample is very phenocryst-poor; tridymite prominent as pore filling, probably 2-3%.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated with chart of Van der Plas and Tobi (1965).
c. NC = Not compiled.
d. NA = Uncertainty larger than amount present.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-1 1151.1 SAMPLE ORIGIN USW G-1

SAMPLE INTERVAL (ft) 1151.1 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Reddish brown with elongate areas of gray crystalline matrix.

TEXTURE: Tuffaceous, densely welded; includes rare small lithophysae.

CLAST TYPE & SIZES: Volcanic lithics, 0.2 mm-1 cm; feldspar subhedral, <1 mm.

OTHER: Sample contains one partly filled longitudinal microfault with 1-4 mm displacement.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two polished thin section (A and B) cut parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 60% red, 16% gray; | ±7% red, ±5% gray; | red <3μm, gray <10μm | NC[c] |
| Lithic fragments | 5% | ±3% | Average 3 mm, range 0.1-1 cm | Subrounded |
| Phenocrysts (feldspar, quartz) | 3% | NA[d] | Average 0.4 mm, 0.02-2.0 mm | Subhedral |
| Fiamme | 2% | NA[d] | Up to 1-2 cm long; most less | Elongate |
| Lithophysae (cavities) | 1% | NA[d] | NC[c] | NC[c] |

NO. OF POINTS COUNTED: 177 (Points counted on hand sample, not in thin section).

ESTIMATED VOLUME % VOID SPACE: 3% counted, probably about 5% total.

WELDING: Dense; extreme flattening and deformation of matrix.

DEVITRIFICATION: Complete; fine pseudomorphic replacement of shards in red matrix; coarser crystals in gray altered matrix.

MISC. TEXTURES-FABRIC: Some secondary "revesiculation" bubbles in fiamme locally.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NC = Not compiled.
d. NA = Uncertainty larger than amount present.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-1 1288.9 SAMPLE ORIGIN USW G-1

SAMPLE INTERVAL (ft) 1288.9 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Dark gray to black.

TEXTURE: Vitroclastic, tuffaceous, welded.

CLAST TYPE & SIZES: Volcanic lithics 2-8 mm; sanidine ≤1 mm; flattened fiamme 1 mm to a few cm.

OTHER: Perlitic structure noted locally with hand lens; sample is fairly friable.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two sections (A and B) cut approximately parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 83% | ±5% | 0.2 mm-1.0 mm shards | Elongate, angular |
| Lithic fragments | 8% | ±4% | Up to 1 cm | Angular |
| Phenocrysts (feldspar, minor quartz) | 5% | ±4% | 0.1-0.8 mm | Subhedral to anhedral |
| Fiamme | 4% | NA[c] | 1 mm to few cm long | Flattened, elongate |

NO. OF POINTS COUNTED: 207 points counted on hand sample, not in thin section.

ESTIMATED VOLUME % VOID SPACE: No pores counted; overall porosity probably ≤3%.

WELDING: Moderate; shards strongly compressed and fused into vitrophyre.

DEVITRIFICATION: Slight; sample is mostly glassy, but perlitic cracks are present, crossing fragment boundaries.

MISC. TEXTURES-FABRIC: Oxides show no exsolution; biotite is brown and fresh.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NA = Uncertainty larger than amount present.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-1 1796.4 SAMPLE ORIGIN USW G-1

SAMPLE INTERVAL (ft) 1796.4-1797.5 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Brown with dark gray lithics and white zeolitized areas.

TEXTURE: Tuffaceous, volcaniclastic.

CLAST TYPE & SIZES: Gray to black fine-grain lithics, 1-8 mm; zeolitized white "patches" (pumice?) 2-15 mm.

OTHER: Sample received saturated with J-13 well water--white areas very soft and gummy.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two sections (A and B) cut approximately parallel to core axis. Sections are workable but somewhat thick.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 71% | NA[b] | Crystals <10 μm | Altered shards |
| Soft white zeolite | 15% | NA[b] | Very fine crystals in areas up to 2-15 mm across | NC[c] |
| Zeolitized lithics | 5% | NA[b] | Most <0.5 mm | Variable |
| Devitrified (non-zeol) lithics | 5% | NA[b] | 0.5-4.0 mm | Rounded to subrounded |
| Phenocrysts (qtz, feldspar) | 4% | NA[b] | Up to 2 mm, average 0.1 mm | Subhedral to anhedral |

NO. OF POINTS COUNTED: None; modes estimated visually on hand sample.

ESTIMATED VOLUME % VOID SPACE: Pores present in thin section; overall porosity probably ≥30%.

WELDING: Nonwelded; sample is cemented by zeolite.

DEVITRIFICATION: No high-temperature devitrification; thoroughly zeolitized.

MISC. TEXTURES-FABRIC: Soft white zeolite appears to replace perlite or pumice fragments.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimated for modal estimation by visual examination.
c. NC = Not compiled.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-2 1646.8 SAMPLE ORIGIN USW G-2

SAMPLE INTERVAL (ft) 1646.8-1647.4 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Dark gray to black.

TEXTURE: Vitroclastic, tuffaceous, welded.

CLAST TYPE & SIZES: Dark reddish brown lithics up to 1 mm; some fiamme 3 to 6 mm long.

OTHER: Quartz(?) coating present on fracture surface; poorly developed perlitic structure.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two thin sections (A and B) cut parallel to core axis.

Both sections are somewhat thick (≈ 60 μm)

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix (glassy) | 85% | NA[b] | 0.1-3 mm shards | NC[c] |
| Fiamme | 10% | NA[b] | 1 mm to a few cm | Elongate |
| Lithic fragments | 3% | NA[b] | Up to 1 mm | Angular |
| Phenocrysts (plagioclase, alkali feldspar, biotite, and quartz) | 2% | NA[b] | 0.4-1.2 mm | Subhedral |

NO. OF POINTS COUNTED: None; modes estimated visually on hand sample.

ESTIMATED VOLUME % VOID SPACE: Some pores visible in pumice fragments; total porosity probably 3-5%.

WELDING: Moderate, deformation of shards and fiamme is extensive, but some pumice retains pores.

DEVITRIFICATION: Minor; mostly glassy with some perlitic cracks and sparse crystallites in glass locally.

MISC. TEXTURES-FABRIC: Lots of perlitic cracks, possibly with some clays; shards are brown in plane light.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD

SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85

SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimated for modal estimation by visual examination.
c. NC = Not compiled.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-2 1659.2 SAMPLE ORIGIN USW G-2

SAMPLE INTERVAL (ft) 1659.2-1659.7 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Dark gray to black.

TEXTURE: Vitroclastic, tuffaceous, welded, perlitic.

CLAST TYPE & SIZES: Volcanic lithics 1-7 mm across.

OTHER: Abundant thin perlitic cracks with white material.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two thin sections (A and B) oriented approximately parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix (glassy) | 88% | NA[b] | 0.1-1.0 mm shards | Elongate |
| Lithic fragments | 7% | NA[b] | 0.2 mm to few cm | Angular to rounded |
| Phenocrysts (feldspar qtz, biotite) | 3% | NA[b] | Up to 1.5 mm | Subhedral |
| Filled pelitic fractures | 2% | NA[b] | Very fine fill material | NC[c] |

NO. OF POINTS COUNTED: None; modes estimated visually on hand sample.

ESTIMATED VOLUME % VOID SPACE: None counted; estimate approximately 3%, including micropores.

WELDING: Moderate; most shards show some preferred orientation and alignment. Flattening ratio for fiamme ≈3:1.

DEVITRIFICATION: Slight (sample mostly glassy) but very prominent in abundant perlitic fractures.

MISC. TEXTURES-FABRIC: Perlitic fractures cross fragment boundaries.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimated for modal estimation by visual examination.
c. NC = Not compiled.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-2 1748.0 SAMPLE ORIGIN USW G-2

SAMPLE INTERVAL (ft) 1748.0-1748.7 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Pale pinkish buff with dark gray, reddish brown, and pale pink clasts.

TEXTURE: Tuffaceous, volcaniclastic, nonwelded.

CLAST TYPE & SIZES: Dark welded tuff lithics 1 mm-1.5 cm; light zeolitic lithics 1 mm-1.2 cm; zeolitized perlite, ≤5 mm.

OTHER: Few longitudinal fractures in core; no obvious planar fabric in sample.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two thin sections (A and B) cut perpendicular to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 51% | NA[b] | Includes all fragments ≤0.5 mm | NC[c] |
| Zeolitized lithics | 25% | NA[b] | 0.5-5 mm | Subangular |
| Devitrified lithics | 20% | NA[b] | 1.0-10 mm | NC[c] |
| Zeolitized perlite | 3% | NA[b] | 0.5-3 mm | Subrounded |
| Phenocrysts (qtz, feldspar) | 1% | NA[b] | <0.5-1.0 mm | Subhedral, some broken |

NO. OF POINTS COUNTED: None; modes estimated visually on hand samples.

ESTIMATED VOLUME % VOID SPACE: Pores are present in varying sizes but not counted; porosity probably ≈ 30%.

WELDING: Nonwelded; sample cemented by zeolites.

DEVITRIFICATION: No high-temperature devitrification; zeolitization is very thorough in all but devitrified lithics.

MISC. TEXTURES-FABRIC: Contains significant ~20% nonzeolitized devitrified rock fragments.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD

SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85

SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimated for modal estimation by visual examination.
c. NC = Not compiled.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW GU-3 542.7 SAMPLE ORIGIN USW GU-3

SAMPLE INTERVAL (ft) 542.7 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Light gray to medium gray with reddish brown streaks.

TEXTURE: Tuffaceous, welded; rare lithophysae with gray altered areas.

CLAST TYPE & SIZES: Elongate reddish brown fiamme (to 1.4 mm); frothy devitrified pumice (up to 2-4 cm).

OTHER:

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two polished thin sections (A and B) made; oriented approximately parallel with core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | | EXPECTED UNCERTAINTY[b] | | SIZE | SHAPE |
|---|---|---|---|---|---|---|
| Matrix | gray 75% | reddish brown 7% | gray ±9% | red ±5% | <0.05 mm, variable | NC[c] |
| Gray fiamme (pumice) | 7% | | ±5% | | NC[c] | NC[c] |
| Phenocrysts (quartz all feldspar and rare biotite) | 4% | | NA[d] | | 0.2-2.0 mm | NC[c] |
| Lithophysal alteration (cavities) | 4%(1%) | | NA[d] | | Slightly coarser than gray matrix | NC[c] |
| Volcanic lithic fragments | 2% | | NA[d] | | 1-5 mm | NC[c] |

NO. OF POINTS COUNTED: 98 (Points counted on hand sample, not in thin section).

ESTIMATED VOLUME % VOID SPACE: One percent counted; probably 3-5%, including microscopic porosity.

WELDING: Moderate? (Difficult to assess because of extensive vapor phase crystallization.)

DEVITRIFICATION: Total; destroys shard forms. Tridymite abundant, probably 10-15% of mode.

MISC. TEXTURES-FABRIC: Most feldspar phenocrysts fractured and altered.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NC = Not compiled.
d. NA = Uncertainty larger than amount present.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW GU-3 857.1 SAMPLE ORIGIN USW GU-3

SAMPLE INTERVAL (ft) 857.1 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Reddish gray to gray.

TEXTURE: Tuffaceous, welded, sparsely lithophysal.

CLAST TYPE & SIZES: Rare microporphyritic and fine-grain lithic <2 mm.

OTHER: Single 5 x 40 mm lithophysa noted with quartz lining cavity; small gray altered areas present.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two polished thin sections (A and B) cut parallel to core axis

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix (altered) | 88% (2%) | NA[b] | <2 μm to 20 μm | Variable |
| Lithic fragments | 3% | NA[b] | Average 1 mm | Subrounded |
| Phenocrysts (plagioclase alkali feldspar quartz, biotite). | 3% | NA[b] | 0.2-2.5 mm | NC[c] |
| Fiamme | 3% | NA[b] | Up to few mm | Elongate, reddish brown |

NO. OF POINTS COUNTED: None. Modes estimated by visual examination on hand sample.

ESTIMATED VOLUME % VOID SPACE: One percent counted in lithophysae; probably ~5% total porosity.

WELDING: Moderate; much of original texture modified by coarse vapor-related crystallization.

DEVITRIFICATION: Complete with two styles--shard replacement <2 μm, vapor-phase-related 5-20 μm. Abundant (5-10%?), tridymite in vapor phase areas.

MISC. TEXTURES-FABRIC: Fe-Ti oxides are exsolved with marginal alteration; feldspar phenocrysts highly fractured.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/18/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimate for modal estimation by visual examination.
c. NC = Not compiled.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 329.4 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 329.4-330.0 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Dark reddish brown with gray fiamme.

TEXTURE: Tuffaceous, welded, sparsely lithophysal.

CLAST TYPE & SIZES: Abundant quartz, feldspar phenocrysts, copper-colored biotite; rare lithics.

OTHER: Very high flattening ratios for fiamme; average length to height = 6.5:1.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two polished thin sections (A and B) made. Orientation perpendicular to layering

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 72% | ±7% | ≤20 μm | NC[c] |
| Phenocrysts (quartz, biotite, feldspar, etc.) | 14% | ±5% | 0.3 mm - 2.0 mm | NC[c] |
| Fiamme | 6% | ±3% | NC[c] | NC[c] |
| Lithophysal altered areas (cavities) | 5% (3%) | ±3%(NA[d]) | 20-50 μm altered areas | NC[c] |

NO. OF POINTS COUNTED: 175 points counted on hand sample, not in thin section.

ESTIMATED VOLUME % VOID SPACE: 3% counted; total, including micropores, probably 5-7%.

WELDING: Moderate to dense.

DEVITRIFICATION: Complete, coarsest in fiamme. Includes considerable 40-150 μm tridymite.

MISC. TEXTURES-FABRIC: This sample is phenocryst-rich, with minor hornblende, pyroxene, Fe-Ti oxides, zircon, and chevkinite.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NC = Not compiled.
d. NA = Uncertainty larger than amount present.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 493.2 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 493.2-493.4 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Gray to reddish gray.

TEXTURE: Tuffaceous, welded, vapor phase crystallized, lithophysal.

CLAST TYPE & SIZES: Rare phenocrysts and fine-grain lithics with porous fiamme.

OTHER: Lithophysae strongly (~1:3) elongate.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Plane of flattening is parallel to core axis and core appears to have rotated in barrel; 2 polished thin sections (A and B) are perpendicular to plane of flattening.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 62% | NA[b] | <20 μm | Variable |
| Lithophysal altered regions (cavities) | 25% (5%) | NA[b] | >20 μm, up to 0.5 mm | Variable |
| Phenocrysts (feldspar, qtz, biotite) | 3% | NA[b] | 0.2-1.5 mm | Subhedral to anhedral |
| Fiamme? (elongate zones reddish brown) | 3% | NA[b] | Maximum few mm long | Elongate, |
| Lithic fragments | 2% | NA[b] | Average 1 mm | Subrounded |

NO. OF POINTS COUNTED: None. Visual mode estimate done on hand sample.

ESTIMATED VOLUME % VOID SPACE: 5% counted; probably 10-15%, including micropores.

WELDING: Probably moderate but hard to estimate because of vapor phase crystallization.

DEVITRIFICATION: Complete, commonly coarse, obscuring original textures; abundant pore-filling tridymite.

MISC. TEXTURES-FABRIC: Some yellowish brown material associated with tridymite may be clay (<1%).

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimate for modal estimation by visual examination.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 965.2 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 965.2 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Pale reddish brown.

TEXTURE: Tuffaceous, welded, sparsely lithophysal.

CLAST TYPE & SIZES: Crystal-rich tuff, subrounded to 3 mm, phenocrysts ~1 mm; both rare.

OTHER: Elongate light-colored areas appear to be flattened pumice fiamme.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Sample is scrap from 2-3/8" core after 1" mechanical test samples removed; 2 thin sections made (A and B) cut parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 84% | ±6% | Very fine replacement of shards, etc. | NC[c] |
| Fiamme | 8% | ±4% | 1 mm to several cm long. Elongate | NC[c] |
| Phenocrysts (feldspar, quartz) | 3% | NA[d] | 0.2-1.3 mm | Subhedral, broken |
| Volcanic lithic fragments | 4% | ±3% | 2-7 mm | Subangular to Subrounded |
| Vapor phase alteration | 1% | NA[d] | Crystals to 10 μm | NC[c] |

NO. OF POINTS COUNTED: 170 counted on hand sample, not in thin section.

ESTIMATED VOLUME % VOID SPACE: None counted; probably 3-5%, including micropores.

WELDING: Dense to moderate with extreme deformation in matrix.

DEVITRIFICATION: Complete, dominated by very fine crystillization replacing shards, etc.; tridymite present but rare.

MISC. TEXTURES-FABRIC: Some colloform Mn-oxides(?) associated with fractures; quartz fill in fractures.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NC = Not compiled.
d. NA = Uncertainty larger than amount present.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1171.8 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1171.8-1172.4 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Pale reddish brown matrix with light and dark volcanic lithic fragments.

TEXTURE: Welded, tuffaceous, very sparsely lithophysal.

CLAST TYPE & SIZES: Gray lithics 1-10 mm; elongate gray fiamme up to 2.5 cm; feldspar phenocrysts <1 mm.

OTHER:

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Sample very fragmented; two polished thin sections (A and B) made approximately parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 83% | ±5% | Very fine (<<5 μm) | Variable |
| Volcanic lithics | 7% | ±4% | 1-7 mm | Subangular |
| Fiamme | 6% | ±4% | Up to 25 mm long | Elongate |
| Phenocrysts (feldspar, quartz) | 2% | NA[c] | 0.2-0.8 mm | Subhedral, broken |
| Lithophysal cavity | 2% | NA[c] | To 1 cm | NC[d] |

NO. OF POINTS COUNTED: 176 points counted on hand sample, not in thin section.

ESTIMATED VOLUME % VOID SPACE: 2% counted in cavity, probably 5-7% total, including micropores.

WELDING: Moderate with strong preferred orientation of shards where not obscured by crystallization.

DEVITRIFICATION: Complete as fine shard replacement, coarse "granophyric" and vapor phase with very rare tridymite.

MISC. TEXTURES-FABRIC: Fractures show quartz mosaic fill.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NA = Uncertainty larger than amount present.
d. NC = Not compiled.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1220.9 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1220.9-1222.0 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Pale brownish buff to reddish brown.

TEXTURE: Tuffaceous, welded.

CLAST TYPE & SIZES: Gray lithics average 2-10 mm, one 5 cm across; quartz-feldspar phenocrysts <0.5 mm.

OTHER: The large lithic fragment is very porous.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): One polished thin section made, cut parallel to core axis

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 78% | ±7% | <5 μm crystals | Variable |
| Lithic fragments | 11% | ±5% | Most <1 cm; one 5 cm | Subrounded |
| Phenocrysts (quartz, feldspar, biotite) | 5% | ±4% | 0.4-1.5 mm | Subhedral |
| Fiamme | 5% | ±4% | Up to a few cm long | Elongate |
| Vapor phase alteration | 1% | NA[c] | Up to a few mm long | Lenticular crystal aggregates |

NO. OF POINTS COUNTED: 134 counted on hand sample, not in thin section.

ESTIMATED VOLUME % VOID SPACE: No pores counted; total porosity with micropores probably 3-5%.

WELDING: Dense to moderate based on matrix deformation.

DEVITRIFICATION: Complete; includes fine-scale matrix replacement and coarser crystallization.

MISC. TEXTURES-FABRIC: Tridymite very locally present in pores, maybe 1-2%.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NA = Uncertainty larger than amount present.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1294 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1294 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Dark brownish gray.

TEXTURE: Tuffaceous, welded, at least partially devitrified.

CLAST TYPE & SIZES: Dark gray fiamme 1 mm to several cm; rare phenocrysts up to 1 mm.

OTHER: Brown color and crystallinity when magnified suggest devitrification.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Supplied by SNL as a glassy sample. Two polished thin sections (A and B) made, cut parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix (dark gray) | 85% | NA[b] | Crystals <20 μm | Variable |
| Lithic fragments | 8% | NA[b] | Up to 5 mm | Subangular |
| Fiamme | 5% | NA[b] | 1 mm to several cm | Elongate |
| Phenocrysts (mostly feldspar) | 2% | NA[b] | <0.2 mm to 1.0 mm | Subhedral to anhedral |

NO. OF POINTS COUNTED: None (too small for point count); modes estimated visually on hand sample.

ESTIMATED VOLUME % VOID SPACE: Large pores rare; including micropores, probably 3-5% porosity.

WELDING: Moderate; flattening ratios for fiamme average 4.3:1 (length:height).

DEVITRIFICATION: Appears complete. Rock is not vitric, rather finely crystalline devitrified shards.

MISC. TEXTURES-FABRIC: Plagioclase is dominant phenocryst.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimated for modal estimation by visual examination.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1307.2A SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1307.2 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Reddish brown and dark gray.

TEXTURE: Tuffaceous, vitroclastic, welded.

CLAST TYPE & SIZES: Brown fine grain lithics up to few cm; many <1-3 mm.

OTHER: Some quartz(?) on exposed fracture surface; some holes and cracks include brownish buff material, possibly clay?

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Single polished thin section made parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 88% | NA[b] | <20 μm to 0.1 mm (crystals) | Variable, includes some fiamme |
| Lithic fragments | 6% | NA[b] | Average 1-3 mm, some more | Subangular |
| Phenocrysts | 4% | NA[b] | 0.2-2.0 mm | Subhedral |

NO. OF POINTS COUNTED: None (sample too small for point count); modes estimated visually on hand sample.

ESTIMATED VOLUME % VOID SPACE: 2% estimated; partly filled with clay(?) and zeolites(?); probably 5% total pores.

WELDING: Moderate: notable shard alignment, notable (not extreme) shard deformation.

DEVITRIFICATION: Complete; rock is not vitric; no zeolites evident; some possible clays.

MISC. TEXTURES-FABRIC: Flattening ratios for fiamme 3.3:1 (length:height); not prominent in hand sample.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimated for modal estimation by visual examination.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1307.2F SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1307.2 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Dark reddish brown and dark gray.

TEXTURE: Tuffaceous, vitroclastic, welded.

CLAST TYPE & SIZES: Red to gray volcanic lithics up to a few mm.

OTHER: Pale brown material in matrix may be clay.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Core broken in mechanical testing; one section cut as close to core axis as possible.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix | 90% | NA[b] | ≤20-μm crystals | Variable |
| Lithic fragments | 7% | NA[b] | Up to 2 mm | Subrounded |
| Phenocrysts (quartz, feldspar, biotite) | 3% | NA[b] | 0.2-1.2 mm | Subhedral |

NO. OF POINTS COUNTED: None (too small for point count); modes estimated visually on hand sample.

ESTIMATED VOLUME % VOID SPACE: None counted; total porosity probably 3-5%.

WELDING: Moderate. Strong preferred orientation of shards, but shard deformation is not extreme.

DEVITRIFICATION: Complete; this rock is not vitric; spherulitic axiolitic fine crystallization is dominant.

MISC. TEXTURES-FABRIC: Flattening ratio for fiamme = 4.0:1

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. NA = No uncertainty estimated for modal estimation by visual examination.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1444.7 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1444.7-1445.8 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Pale pinkish buff with darker and lighter lithic fragments and altered areas.

TEXTURE: Tuffaceous, volcaniclastic. Zeolitization prominent in some fragments.

CLAST TYPE & SIZES: Pinkish buff volcanic lithics 5-30 mm; altered greenish perlite 2-20 mm; gray to reddish brown tuff, 1-20 mm.

OTHER: There is weak preferred orientation of elongate rock fragments.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two polished thin sections (A and B) cut parallel to core axis.

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix (zeolitic) | 52% | ±7% | Arbitrarily defined as fragments <0.5 mm | NC[c] |
| Zeolitized tuff fragments | 40% | ±7% | Arbitrarily defined as fragments ≥0.5 mm | NC[c] |
| Zeolitized perlite | 4% | ±3% | 0.5-1.0 mm | Rounded |
| Devitrified (non-zeol.) tuff | 3% | NA[d] | 0.5-2.0 mm | Subrounded |
| Phenocrysts (felsic and biotite) | 1% | NA[d] | 0.5-3.0 mm | Subhedral |

NO. OF POINTS COUNTED: 180 on hand sample; not in thin section.

ESTIMATED VOLUME % VOID SPACE: Not estimated, but pores are obvious in thin section; total porosity probably ≈30%.

WELDING: Nonwelded; sample cemented by zeolite.

DEVITRIFICATION: No high-temperature devitrification; all fragments except devitrified tuff and phenocrysts are zeolitized.

MISC. TEXTURES-FABRIC: Much late oxidation evident; some possible geopetal fill structures present.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NC = Not compiled.
d. NA = Uncertainty larger than amount present.

COMMENTS

PETROGRAPHY DATA COMPILATION FORM
FOR THE NNWSI PROJECT SEPDB

PART 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID USW G-4 1649.5 SAMPLE ORIGIN USW G-4

SAMPLE INTERVAL (ft) 1649.5-1650.6 TEST # 1

PART 2. PARAMETERS

HAND SAMPLE DESCRIPTION

COLOR: Pale pinkish buff to pinkish brown.

TEXTURE: Tuffaceous, volcaniclastic.

CLAST TYPE & SIZES: Soft zeolitized pumice(?) 2-15 mm; dark gray to reddish brown tuff <5 mm.

OTHER: Extensively zeolitized.

THIN SECTION DESCRIPTION

NOTES (ORIENTATION, SECTION #'S, ETC.): Two polished thin sections (A and B) made parallel to core axis

CONSTITUENTS

| NAME | AMOUNT[a] | EXPECTED UNCERTAINTY[b] | SIZE | SHAPE |
|---|---|---|---|---|
| Matrix (zeolitic) | 62% | ±9% | Arbitrarily defined as ≤0.5 mm | NC[c] |
| Zeolitized tuff fragments | 30% | ±8% | Arbitrarily defined as >0. 5 mm | Subangular |
| Devitrified (non-zeol.) tuff | 5% | ±4% | 0.5-2.0 mm | Subangular to subrounded |
| Phenocrysts (felsic) | 2% | NA[d] | 0.2-2.0 mm | Subhedral to broken |
| Porous zeolitized perlite | 1% | NA[d] | Up to 2 mm | Subrounded |

NO. OF POINTS COUNTED: 123 counted on hand sample, not in thin section.

ESTIMATED VOLUME % VOID SPACE: Not estimated, but pores obvious in thin section; total porosity probably ≈30%.

WELDING: Nonwelded; sample cemented by zeolite.

DEVITRIFICATION: No high-temperature devitrification; all fragments except devitrified tuff and phenocrysts are zeolitized.

MISC. TEXTURES-FABRIC: Pumice and fragmented pumice dominate sample; oxides are exsolved and biotites are altered.

PART 3. EXPERIMENT CONDITIONS

Standard; see Section 2.3 of SAND88-0882.

PART 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY TBD SNL NNWSI PROJECT DATA SET ID 51/L04-1/10/85 SNL DATA REPORT NUMBER SAND88-0882

THIS DCF COMPLETED BY: J. R. Connolly (Name) 6313 (UNM) (SNL Div.) 4/19/88 (Date)

a. Modal percent, assumed to be equivalent to volume percent.
b. Estimated by graphical method of Van der Plas and Tobi (1965).
c. NC = Not compiled.
d. NA = Uncertainty larger than amount present.

COMMENTS

## APPENDIX C

## APPLICABILITY TO REFERENCE INFORMATION BASE AND SITE AND ENGINEERING PROPERTY DATA BASE

All data presented on the data compilation forms in Appendix A are intended for entry in the Site and Engineering Property Data Base.

Figure 2 of this report is the same as the figure presented in the RIB Version 4, Revision 0 of Item 1.1.1 (DOE, 1989). An earlier draft of this report is cited in the RIB Version 4, Revision 0 of Item 1.2.2; some of the numbers in Table 29 have been revised since that draft.

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