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Mineralogy, Petrology and Whole-Rock Chemistry of Selected Mechanical Test Samples of Yucca Mountain Tuffs

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ABSTRACT

Petrologic, bulk chemical and mineralogic data are presented for 19 samples of tuffaceous rocks from core holes UE-25a#1, USW G-1, USW GU-3, and USW G-4 at Yucca Mountain, Nevada. The suite of samples contains a wide variety of petrologic types, including zeolitized, glassy, and devitrified tuffs. Data include hand sample and thin section descriptions (with modal analyses for which uncertainties are estimated), and major element analyses with uncertainty estimates. No uncertainties were estimated for qualitative mineral identifications by X-ray diffraction.

The work contained in this report was done within WBS Element 1.2.4.2.1.3.S (later changed to WBS 1.2.3.2.7.1.3)

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1.0 INTRODUCTION

This document reports the results of petrologic, chemical and mineralogic analyses of rock samples from several deep coreholes at Yucca Mountain, Nevada (Figure 1), performed in the Department of Geology and Institute of Meteoritics at the University of New Mexico (UNM). This work was completed in support of the Yucca Mountain Project, which is administered by the U.S. Department of Energy. The controlling document under which these data were gathered is EP-0007: "Characterization of the Mineralogy and Petrology of Mechanical Test Samples". The most current revision of this document is Revision C, Dated 4/19/90.

The data were obtained using procedures described in Technical Procedures (TPs) named in EP-0007, and listed in Table 1, over the course of more than two years from December, 1987 to March, 1990. The technical procedures have been revised during this time period. Without exception, the procedures current at the time of data collection were used.

The remainder of this report includes four sections. First, the objectives of the study are stated briefly. Second, a discussion of the analytical techniques used and the methods employed to estimate uncertainties is presented. The third section is a partly descriptive and partly interpretive summary of the characteristics of each of the samples which utilizes all analytical data. The last section is a series of appendices which presents the hand sample and thin section petrographic data, the whole-rock analyses, and the qualitative X-ray diffraction (XRD) data.

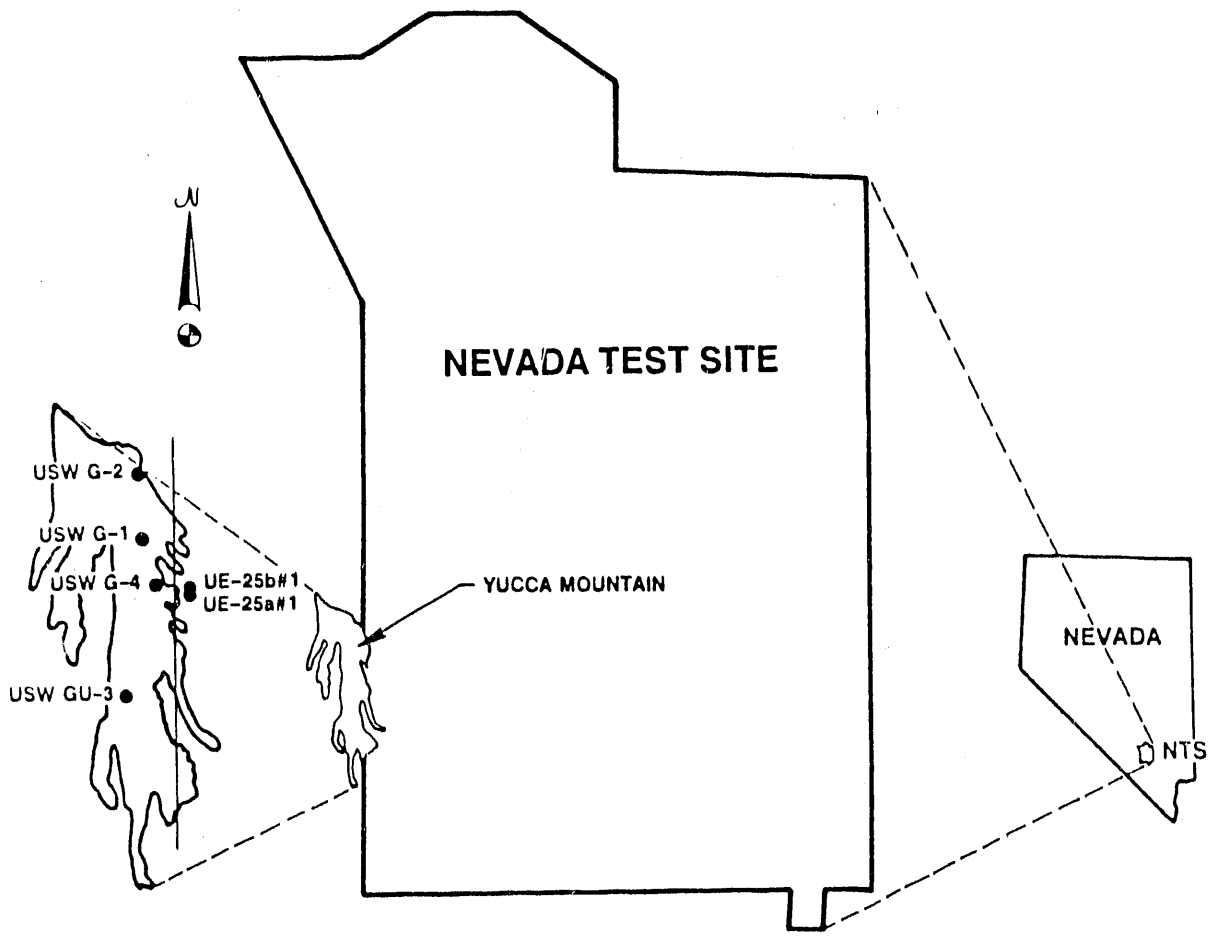

Figure 1: Location of the Nevada Test Site, Yucca Mountain, and Existing Deep Coreholes

Table 1

Technical Procedures Used for Data Gathering

Title	Number
Procedures for Laboratory Sample Petrology Determination	TP-59
Procedures for Preparation of Polished Thin Sections	TP-60
Procedures for Laboratory Sample Bulk Chemical Determination	TP-61
Laboratory Procedures for Mineralogic Analysis by X-Ray Powder Diffraction Part 1: Data Gathering	TP-62
Laboratory Procedures for Mineralogic Analysis by X-Ray Powder Diffraction Part 2: Data Analysis	TP-102

2.0 OBJECTIVE

The purpose of this report is to provide mineralogic, petrologic and chemical data on samples of tuff from Yucca Mountain for use in investigating potential correlations with existing mechanical-property data gathered on these samples. Data have been tabulated (Appendices A through D) in a manner designed to facilitate statistical analysis. The data are also available in digital form (IBM PC-Compatible) to facilitate direct input into statistical data-analysis programs.

Petrologic data include: color; texture; estimate of average, maximum, and minimum grain size for fragments and phenocrysts; type and estimation of the degree of welding; estimation of the type and amount of devitrification; modal estimates of constituents for hand samples and thin sections (with uncertainty estimates when done by point count); and descriptive or interpretive comments about hand samples and thin sections. Whole-rock chemical analyses of major elements include an estimate of uncertainty, CIPW normative mineral contents calculated from the analyses, and brief interpretive comments. Qualitative mineralogic data gathered by XRD include identification of mineral phases, an assessment of the quality of XRD peak matches with Joint Committee on Powder Diffraction Standards (JCPDS) powder diffraction file standards, quality criteria for the data, and brief interpretive comments about the analysis. The JCPDS reference file includes thousands of mineral analyses. It is maintained by the International Center for Diffraction Data (1601 Park Lane, Swarthmore, Pennsylvania) and is distributed by subscription in various forms, including microfiche cards (with search manuals in book form) and digital form for use with automated diffractometer systems. Although no quantitative estimates of mineral abundances by XRD were attempted, a rough estimate of the amount of each identified phase was made by classifying each identified mineral present as a major, minor, or trace constituent, based on peak intensities. Quantitative estimates of mineral proportions (with uncertainty estimates) are planned for a future report.

The data in the appendices are presented by analytical techniques used. Section 4 presents the author's synthesis of these data and presents conclusions which may be drawn about each sample by

combining the results of the analyses. When interpretations of analytical results were made, an effort was made to present the reasoning behind those interpretations.

3.0 ANALYTICAL TECHNIQUES AND ASSOCIATED UNCERTAINTIES

3.1 Petrography

3.1.1 Methods

Descriptive petrographic data for the samples were obtained by the author in the Institute of Meteoritics (IM) using procedures detailed in TP-59. Descriptive petrographic data for hand samples and polished thin sections made from those samples are presented in Appendices A and B, respectively.

Hand samples were received in various forms. Most samples were 1 in. (2.54 cm) by 2 in. (3.08 cm) cylindrical core which had been compressed to failure by mechanical testing. In most cases, samples were still in the cylindrical polyolefin sleeves used to encase them during testing. Exceptions included: A1-212.7 which was a 2-3/8 in. (6.03 cm) by 5 in. (12.7 cm) core wrapped in a rubber sleeve, and G1-2276-SF which had no jacket and was broken into about 10 irregular pieces. Point counts were made on most hand samples by counting along a series of traverse lines (usually 8 per sample) along a millimeter-scale ruler (at 1 mm intervals) using a binocular microscope. The number of points counted per sample range between 273 and 409. Point counts on the hand samples were done primarily to allow estimation of constituents visible on that scale (because boundaries are commonly obscured in thin sections) and to evaluate the proportions of large fragments which might be over- or under-represented in thin sections. Several of the samples came in clear jackets, allowing point counting before removal of the jackets, and many samples in opaque jackets remained sufficiently intact when the jackets were removed to permit point counting. For samples which were too fragmented to allow point counts, a visual estimate of the mode was made. The exceptions are those samples in which the matrices are fine-grained and homogeneous so that thin section modal analyses would be most accurate. In addition, severe oil staining of A1-212.7 inhibited clast identification in hand sample.

Two polished thin sections were made from each sample, following procedures detailed in TP-60. In cutting core pieces for thin section preparation, an effort was made to select pieces from different locations in the core to provide representative sampling. The thin sections were described following procedures detailed in TP-59. Objectives of the descriptions include determination of the type and extent of devitrification, presence (and degree) or absence of welding, and the presence (and type) or absence of pore filling materials. Point counts were made using an automated point counting stage by counting on a 1 mm by 1 mm grid on both thin sections. The number of points counted range between 426 and 764. The low numbers of points were counted on samples of limited size, or on those in which areas were skipped because of excessive plucking (loss of material during polishing) in some areas of the section.

3.1.2 Uncertainties

Descriptive petrographic data are, by their nature, subjective and dependent on the expertise of the petrographer; they are not subject to any estimation of errors. The uncertainties for hand sample or thin section point counts were calculated using the method of Van der Plas and Tobi (1965); the uncertainties shown in Appendices A and B are $\pm 2\sigma$ standard deviations, calculated using the equation shown below, giving 95% confidence that the actual amount is within the range of uncertainty given.

$$\sigma = (p(100-p)/n)^{0.5} \qquad (1)$$

where p = calculated content of a mineral in volume percent, and
n = the total number of points counted.

In those cases in which the uncertainty exceeds the amount present, the amount should be considered too low for accurate estimation. It must be emphasized that the estimated uncertainties are for the particular thin sections counted. Tuffaceous volcanic rocks are commonly inhomogeneous, however, and it is difficult to confirm that two sections can accurately represent the modal proportions of constituents in the sample as a whole. No uncertainty estimates could be made for visually estimated modes.

3.2 Whole-Rock Analyses

3.2.1 Methods

The whole-rock analyses presented in Appendix C were obtained in the Geochemistry Laboratory in the Department of Geology at UNM. Various techniques were used, including X-ray fluorescence spectroscopy (XRF), gravimetric and volumetric analysis. The analyses were made on rock powders which were prepared in accordance with procedures detailed in TP-59 by powdering in a ball mill, grinding the coarse residual with a mortar and pestle, and sieving through a 100-mesh (149-μm) screen. The analytical techniques used are described in detail in TP-61, and the technique used for determining the concentration of each element (conventionally presented in oxide form) is identified in the tables in Appendix C.

Quality evaluation of the analyses specified in EP-0007 and TP-61 required that analytical totals for each analysis fall between 99.0% and 100.5% by weight. This criterion was met for all but one of the samples. This sample, A1-212.7, was saturated with oil because of a leak in the jacket during mechanical testing and required special analytical techniques (described in TP-61) developed for analysis of samples with high organic contents. Although it yielded an analytical total of 101.4% (0.9% higher than the upper limit for a "quality" analysis), repeating the analysis did not improve results. This suggests that the high totals are attributable to the high organic content. Because this was the only sample of its type (glassy, with extremely high porosity) and because the cumulative uncertainty for all of the elements analyzed (Section 3.2.2) is considerably larger than 0.9%, it was decided to include the data in the compilation.

3.2.2 Uncertainties

The estimated errors given as measures of the uncertainties involved in the whole-rock analyses are based on generally accepted analytical errors for the techniques used. In general, a smaller percentage deviation is expected for greater absolute amounts (wt. percents) of an element present in a given sample. As specified in TP-61 and EP-0007, estimated errors are: ±3% of the determined amount for amounts >1 wt%; ±10% for amounts ≤1 wt% and ≥0.1 wt%; and ±20% for amounts <0.1 wt% and ≥0.01 wt%.

Amounts less than 0.01 wt% are considered below limits of detection. Accurate estimates of actual uncertainties are extremely difficult for the composite techniques used because of many contributing factors, including interferences and slight inhomogeneities in the fused disks prepared for XRF, small random errors in weighing (for all techniques), possible slight rehydration of samples between determination of $H_2O(-)$ and $H_2O(+)$ (only significant for samples with high total H_2O content), and slight measurement errors in preparation of solutions and pipetting.

Prior to analysis of the samples, five replicate analyses were made on a well known standard (NIST SRM-688 Basalt) to experimentally assess the variation to be expected from the analytical techniques used. Table 2 summarizes these data. It also includes the consensus values and uncertainties for the standard given by the National Institute of Standards and Technology (NIST - formerly called the National Bureau of Standards or NBS), the results of the analyses using XRF and gravimetric determination of FeO, standard deviations (n-1) calculated for the replicates, and the percent deviation of the average values from the standard values. All of the percent deviation values are well within the limits specified in EP-0007, including those not certified by NIST. NIST does not report a value for Fe_2O_3. In order to produce an analytical total for the whole rock, Fe_2O_3 was calculated by subtracting the weight equivalent of FeO (FeO x 1.1113) from the reported total Fe (as Fe_2O_3).

Total iron as Fe_2O_3 is determined by XRF, and determination of FeO is done by a volumetric procedure. To estimate actual uncertainties in this procedure, five replicate analyses were made of the Mount Royal Gabbro standard, MRG-1; the results are presented in Table 3. Volatile content of MRG-1 (including water and other volatiles) was also determined gravimetrically by weight loss in heating to 110°C (reported as $H_2O(-)$) and on ignition at 1000°C (L.O.I.).

The data from MRG-1 show that the volumetric determination of FeO is well within the analytical requirements of ±3% of the amount present. It should also be noted that the determination of total Fe as Fe_2O_3 for this standard shows a high degree of accuracy supporting the accuracy of the XRF determination.

Table 2

Calibration Check Results for Multiple Analyses of SRM-688 Basalt

	NIST SRM-688 Reference Values (wt %)		5 Replicate Analyses (wt%)		Deviation from NIST (%)	Allowable Deviation (%)
	Value	Uncertainty	Average Value	Std. Dev. (n-1)		
Element:						
SiO_2	48.4	±0.1	48.40	0.49	None	±3.0
TiO_2	1.17	±0.01	1.157	0.010	-1.11	±3.0
Al_2O_3	17.36	±0.09	17.30	0.18	-0.35	±3.0
Fe_2O_3	1.86 @	**	1.99	0.08	**	**
FeO	7.64	±0.03	7.618	0.01	-0.42	±3.0
MnO	0.167	±0.002	0.156	0.002	-6.59	±10.0
MgO	8.4	**	8.53	0.09	1.55	±3.0
CaO	12.17	**	12.11	0.14	-0.46	±3.0
Na_2O	2.15	±0.03	2.18	0.02	1.40	±3.0
K_2O	0.187	±0.008	0.189	0.008	1.07	±10.0
P_2O_5	0.134	±0.003	0.135	0.004	0.75	±10.0
Total:	99.638		99.765		0.119	
Total Fe as Fe_2O_3	10.35	±0.04	10.45	0.09	0.93	±3.0

** NOTE: NBS does not certify values for Fe_2O_3, MgO and CaO.
@ Amount of Fe_2O_3 is calculated based on reported values as discussed in the text.

Table 3

Calibration Check Results for Multiple Analyses of Mount Royal Gabbro Standard (MRG-1) for Fe_2O_3, FeO and L.O.I.

	Consensus Values for MRG-1	5 Replicate Analyses (wt%)		Deviation from Consensus (%)
		Average Value	Std. Dev. (n-1)	
Element:				
Fe_2O_3	8.36	8.25	0.04	-1.32
FeO	8.66	8.66	0.03	None
L.O.I.	2.10	1.99	0.02	-5.24
$H_2O(-)$	0.13	0.14	0.02	7.69
Total all Volatiles	2.23	2.13	0.02	-4.48
Total Fe as Fe_2O_3 (XRF)*	17.93	17.88	0.08	-0.28

* Total Fe as Fe_2O_3 is average of 3 replicates by XRF (17.97%, 17.84%, 17.84%)
L.O.I. includes $H_2O(+)$, CO_2 and any other volatiles present in the sample.

MRG-1 is not a certified standard for water and other volatile content, however it is noted that the deviation from the consensus values of somewhat more than 5% exceeds the requirements for other elements. The large deviation from the consensus values for these volatiles, however, suggest that repeatability of $H_2O(+)$ and $H_2O(-)$ determinations are probably not be as good as that for other elements. As suggested in a previous report (Connolly and Nimick, 1990) a better estimate of the accuracy for H_2O determination would probably be ±10% of the amount present for amounts ≥1%, and ±30% of the amount present for amounts <1%. For zeolitic materials, an additional unquantifiable uncertainty is introduced by the rapidity with which zeolites tend to exchange water with their surroundings, especially in low humidity environments.

3.3 X-ray Diffraction

3.3.1 Methods

The XRD data used to identify mineral phases were obtained in the X-Ray Diffraction Laboratory in the Department of Geology at UNM using the Scintag Pad V XRD system, following procedures detailed in TP-62. 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 mineral phases present were identified following procedures detailed in TP-102. The mineral identifications are summarized in Appendix D.

Some of the minerals present in these samples may be uniquely identified by comparison of peak positions with peaks in the JCPDS powder diffraction file. Of the minerals identified in the samples studied here, quartz, cristobalite, mordenite, and various clay minerals may be uniquely identified. While feldspars may be identified based on several characteristic peaks, extensive solid solution and exsolution typical of feldspars found in volcanic rocks make the identification of specific phases tentative. Almost all of the samples contain feldspar, but the "Probable" designation in the data sheets is common because it is rare that a precise match for a single JCPDS card is found. The zeolites clinoptilolite and heulandite possess extremely similar XRD patterns; in most samples the relative intensities of the peaks most closely match the data for clinoptilolite and, in general, it was listed as the positively identified phase while

heulandite was listed as probable or possible. Clinoptilolite and heulandite can only be reliably differentiated by heating to 450°C (the temperature at which heulandite becomes amorphous) and re-running the sample (Mumpton, 1960); this test was not done with these samples. The tridymite present in Yucca Mountain samples does not match that of any of the JCPDS standards; this was noted by the author in previous studies and confirmed by David Bish of Los Alamos National Laboratory. Tridymite peaks also can show significant peak overlaps with feldspar and cristobalite peaks, making unique identification difficult. Tridymite, when identified (Appendix D), was confirmed by petrographic observations of thin sections. Clay minerals also can present problems in identification, particularly when low abundances make the XRD pattern weak. Typically the basal (001) reflection is all that is seen, and this reflection will not always produce a unique match with a JCPDS card because of interlayer stacking which can vary considerably in mixed layer clays. In Appendix D, it is common to list a number of possible card matches, none of which may represent the actual clay mineral in the sample.

This report was to include semi-quantitative estimates of the proportions of mineral phases utilizing a modification of the method of Pawloski (1985). This method requires that XRD patterns for samples have repeatable peak intensities. However, replicate analyses of several samples at the operating conditions used to gather the basic qualitative data failed to meet the repeatability criteria, and attempts to apply this method were therefore abandoned. The data presented in Appendix D include a qualitative assessment of the amounts of each mineral present. In the data compilation sheets, "Major" indicates a phase with a strong XRD pattern, "Minor" indicates a recognizable pattern of significantly lower intensity than a major phase, and "Trace" indicates a very low intensity, commonly incomplete pattern for the phase identified. These designations are subjective and dependent on the experience of the interpreter. They are tempered by petrographic observations, whole-rock chemical data and the concentration factor (K-constant) data presented by Pawloski (1985) and reproduced in Table 4. These factors are, to some extent, machine dependent and to a great extent dependent on sample preparation procedures, but as a general guideline the minerals with larger factors produce weaker patterns for a given amount of the mineral present. Glass may be identified by the

presence of a broad "swell" in the raw data pattern between 20° and 30° 2θ, but identification is complicated by the presence of more intense mineral peaks; whenever identified (Appendix D), the presence of glass is confirmed by petrographic observations. It should be noted that comparison of experimental XRD data for devitrified samples with normative mineral abundances calculated by the CIPW procedure from the whole-rock analyses suggest that the K-constants for feldspar should be two to three times the values given in Table 4.

Table 4

K Constants for Minerals Commonly Found in Nevada Test Site Samples (from Pawloski, 1985)

Mineral	K-Constant	Mineral	K-Constant
Quartz	1.0000	Dolomite	0.3528
Montmorillonite	22.0412	Glass	36.8405
Illite	30.2904	Hornblende	2.7698
Clinoptilolite	9.7432	Kaolinite	10.5970
Feldspars	1.2774	Biotite	0.4304
Calcite	0.6544		

3.3.2 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 peaks characteristic for the phase (which varies for different phases); (2) the scan speed (slower scans result in higher signal-to-noise ratios allowing detection of smaller amounts of a phase); (3) the intensity of the incident X-rays, and (4) the sensitivity of the detector and electronics used to process the signal. Although not rigorously tested, the estimated minimum detection limit for minerals with low-intensity characteristic 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 1 to 3%.

No uncertainties can be estimated for the qualitative estimates of abundance presented in Appendix D.

4.0 SUMMARY OF SAMPLE CHARACTERISTICS

The following sections are brief descriptions of each sample analyzed for this study. The descriptions are interpretive in that there is an attempt to integrate the petrographic, whole-rock chemical, and XRD data to deduce information which one analytical technique alone cannot provide.

All of the samples have some properties in common. First, all samples are extremely low in total iron, and almost all of that is in the ferric state (Fe_2O_3 in the whole-rock analyses); these are all highly oxidized rocks. Second, all of the rocks are rhyolitic in composition. The devitrified samples (indicated by total H_2O under 1% in the chemical analyses and calculated differentiation indices ≥95) are typically high silica rhyolites with SiO_2 content ≥75%. The process of zeolitization results in the addition of CaO to the rock and, sometimes, removal of SiO_2, resulting in lowering of the differentiation index, with concomitant addition of H_2O to the sample. An extensively zeolitized sample typically contains at least 7 to 9 wt% total H_2O (H_2O+ and H_2O- combined).

4.1 A1-212.7

The sample is a glassy, non-welded, shard-rich, well sorted air-fall tuff with extremely high porosity. Visible porosity in thin section (>30 μm) was counted as 9% of the mode. Only clays (montmorillonite, saponite) were definitely identified by XRD, with some opal-CT (or cristobalite) possible. No zeolites are present in this sample. The sample is significantly contaminated by hydraulic oil added during mechanical testing. The H_2O content listed in the whole-rock analysis is very high (11% $H_2O(+)$ and 3% $H_2O(-)$), but this includes an unknown contribution from organics (oil) not removed by pre-analysis treatment. (Oil was dissolved by mixing the powdered sample in acetone and decanting the solution in three stages.) Corundum in the CIPW norm (4.6%) is indicative of high clay content. The sample has relatively high MnO content (0.12%); possible Fe-Mn oxides were noted in the hand sample but were not noted in thin section, although their presence may be masked by dark oil contaminated areas in the

matrix. This sample probably originated as a primary fall deposit, as indicated by the random orientation of shards and depletion of fines; it is unlikely that the delicate shard shapes present could have survived significant reworking. The absence of zeolites suggests there has been no long term interaction with groundwater. An estimated 15 to 25% of the sample is clays and opal-CT, with the remainder being glass.

4.2 G1-1487.4-SLA1

The sample is a zeolitized, non-welded, matrix-supported, pumice- or lithic-rich ash-flow tuff. All of the matrix and most of the lithic fragments (interpreted to be large former pumice fragments and minor perlite) are zeolitized and texturally altered. The high total H_2O content is indicative of extensively zeolitized tuff. Visible porosity (>30 μm) is about 5% of the mode. Zeolites dominate the XRD pattern, and no glass is evident in thin section. The sample probably originated as a thin ash-flow which was altered by prolonged contact with groundwater, resulting in pervasive zeolitization. The sample is very similar to G1-1550.4-SLA28 and G1-1551.1-SLA29.

4.3 G1-1550.4-SLA28

The sample is a zeolitized, non-welded, matrix supported, pumice- or lithic-rich ash-flow tuff. All matrix and most lithics (interpreted to be large former pumice fragments and minor perlite) are texturally altered by zeolitization. Visible (>30 μm) porosity is about 4% of the mode. Matrix/clast contacts are usually sharply defined. Zeolitized lithics exceed fine matrix in abundance. The high total-H_2O content is typical of extensively zeolitized tuff. Zeolites dominate the XRD pattern, and no glass is evident in thin sections. The sample probably originated as a thin ash-flow which was altered by prolonged contact with groundwater, resulting in pervasive zeolitization. The sample probably is non-welded, but the orientation of elongate fragments perpendicular to the core axis suggests some flow orientation or slight welding. The sample is very similar to G1-1487.4-SLA1 and G1-1551.1-SLA29, except for slight variations in feldspar peak positions in XRD (suggesting slightly that different feldspar phases are present) and a greater abundance of zeolitized (pumice?) fragments.

4.4 G1-1551.1-SLA29

The sample is a zeolitized, non-welded, matrix-supported, pumice- or lithic-rich tuff. All matrix and most lithics (interpreted to be large former pumice fragments and minor perlite) are texturally altered by zeolitization. The high total-H_2O content is typical for extensively zeolitized tuff, but $H_2O(-)$ is lower than that in G1-1487.4-SLA1 and G1-1550.4-SLA28. Matrix/clast contacts are generally sharp, but not as sharp as in G1-1550.4-SLA28. Zeolites dominate the XRD pattern, and glass is not evident in thin sections. The sample probably originated as a thin ash-flow which was altered by prolonged contact with groundwater, resulting in pervasive zeolitization. The sample is very similar to G1-1487.4-SLA1 and G1-1550.4-SLA28, except for slight variations in feldspar peak positions (compared to G1-1487.4-SLA1), a greater abundance of zeolitized (pumice?) fragments, and the presence of more devitrified lithic fragments. The latter probably account for the stronger feldspar peaks in the XRD pattern.

4.5 G1-1784.8-SLA19

The sample is a zeolitized, crystal-rich, somewhat lithic-rich, non-welded air-fall tuff or well-sorted volcaniclastic. The sample has abundant, very fine interclast matrix, but textures observed in thin section suggest that this originated by in situ breakdown of coarser glassy lithic fragments and pumice during zeolitization. Concentration of resistant fragments (phenocrysts and devitrified lithic fragments) suggests that reworking may have occurred. Visible porosity (>30 μm) in thin section is about 3% of the mode. The low bulk zeolite content (indicated by H_2O content in whole rock analysis and XRD pattern) is deceptive in this sample because phenocrysts comprise 23% of the mode and devitrified lithic fragments comprise 10.4%. The XRD pattern is dominated by phases occurring as phenocrysts and in lithic fragments, and zeolite peak intensities are about 50 to 60% less that those obtained from shallower samples which are zeolite-dominated. The H_2O content in the chemical analysis suggests that this sample contains less than half of the total quantity of zeolites in G1-1487.4-SLA1 and shallower samples, and some of the fragments appear glassy in thin section. Partly colloform Fe-Mn(?) oxides rim some of the Fe-Ti oxides, suggesting interaction with groundwaters, possibly contemporaneous with zeolitization.

4.6 G1-1785.6-SLA20

The sample is virtually identical to G1-1784.8-SLA19. It is a zeolitized, crystal-rich (20% total phenocrysts), somewhat lithic-rich (11% devitrified lithics), non-welded air-fall tuff or well-sorted volcaniclastic with very fine interclast matrix. Visible porosity (>30 μm) in thin section is about 3% of the mode. The zeolite content in this sample appears higher than in the previous sample because of lower intensity of the feldspar and quartz peaks relative to the zeolites, but absolute intensities of zeolite peaks are only slightly greater than those of G1-1784.8. The fine matrix appears to be zeolitized, formerly glassy, lithic fragments, and in thin section it appears that prior to zeolitization the rock was depleted in fines. The H_2O content in the chemical analysis suggests that this sample contains less than half of the total amount of zeolites found in G1-1487.4-SLA1 and other zeolitized samples from shallower levels in the USW G-1 drill hole. Some fragments and matrix appear isotropic in thin section and may be partly glassy.

4.7 G1-2276-SF

The sample is zeolitized, somewhat crystal-rich (16% total phenocrysts), lithic-poor, non-welded tuff. Visible porosity (>30 μm) in thin section is about 5% of the mode. The rock appears to have been originally depleted in fines, with much of the present fine matrix having originated by alteration of pumice and shards during zeolitization. Locally isotropic matrix suggests some material may still be glass. Mordenite appears to be the dominant zeolite together with clinoptilolite (or heulandite). XRD peaks for feldspars and quartz probably result from phenocrysts. Relatively high H_2O content in the whole-rock analysis is indicative of zeolitization. Fe-Ti oxides are marginally altered, and colloform secondary opaque oxides are present; the relatively high MnO content (0.13%) in the whole-rock analysis supports the identification of these as Fe-Mn oxides.

4.8 G1-2589-SD

The sample is a partially welded, zeolitized ash-flow tuff. Visible porosity (>30 μm) is about 2% of the mode, and birefringence of the matrix suggests that clays are present. Welding is indicated by strong preferred orientation of largely undeformed

shards. Quartz and feldspar XRD intensities are low, in agreement with the low total phenocryst content (8.6%). Clinoptilolite is the dominant zeolite, with subordinate mordenite. Illite (or some mixed layer illite-rich clay) is present. The high total-H_2O content in the whole-rock analysis implies extensive zeolitization. No glass is evident in thin section.

4.9 G1-2699.1-SLB

The sample is a partially welded, zeolitized ash-flow tuff. A small amount (0.2%) of isotropic (glassy?) fragments is present in thin section. Zeolites are present, replacing matrix and filling pores. The sample is somewhat crystal-rich (13%), with feldspars dominating. Most lithic fragments and shards are zeolitized; devitrified lithics are rare. The total H_2O content in whole rock analysis implies zeolitization, but is lower than in many other zeolitized samples. Feldspar peaks (from phenocrysts) dominate the XRD pattern, followed by quartz (also presumably from phenocrysts). Illite peaks are very strong (with minor peaks present also) and clinoptilolite/heulandite is the dominant zeolite. Fe/Mn oxides may be present, and 0.09% MnO in the analysis is higher than in most samples. Visible (>30 μm) porosity is low (1.5%).

4.10 G1-2996.9-SLB

The sample is a moderately welded, devitrified (silica-feldspar), pumice-rich ash-flow tuff. Large lithic fragments are unevenly distributed in the sample. Phenocrysts are small and highly broken. The total H_2O content is <1%, typical for devitrified samples. Quartz peaks dominate the XRD pattern, with feldspar peaks subordinate; a small illite peak (8.8° 2θ) is present. CIPW normative minerals calculated from the whole-rock analysis indicate 35% quartz and 63% feldspar, and yet the XRD pattern for quartz is much stronger than that for feldspars. This indicates that the XRD peak intensity for quartz is much stronger than peak intensities from equivalent or greater amounts of feldspar.

4.11 G1-3102.3-SLD

The sample is a partially devitrified and partially zeolitized, lithic-rich, non-welded ash-flow tuff. In the thin section description, it was assumed that the fine grained matrix is zeo-

lite-dominated although it was noted that the birefringence was higher than normal for zeolites. The dominance of quartz and feldspars in the XRD pattern, and relatively low total H_2O content (under 5%) in the whole-rock analysis suggest that some devitrification of the matrix occurred during primary cooling at high temperature. Visible porosity (>30 μm) is relatively high (about 6%). Zeolite occludes many pores and occurs in the matrix. The strong XRD peaks for quartz and feldspar may result in part from the high total of devitrified lithics plus phenocrysts (9% + 15% = 24% total), but the H_2O content is still anomalously low. Illite is present, but XRD peak intensity is very low; another very fine-grained clay yields a broad peak centered at 7.5° 2θ. Clinoptilolite (and/or heulandite) is the dominant zeolite, but analcime may also be present. This is the first sample in which the apparent mixing of high-temperature devitrification and low-temperature zeolitization has been observed by the author.

4.12 G1-3498.4-SLB

This sample was consumed during testing at Sandia after preparation of thin sections, therefore no whole-rock chemical or XRD data were obtained. It is a non-welded, zeolitized, lithic-rich, clay-rich, volcaniclastic sandy siltstone. No recognizable shards are present, and rock is composed of very fine grained matrix (46%) with highly birefringent clay (illite?) common. Most clasts are devitrified lithic fragments (39%) 0.2 mm to 1 cm in size, plus 11% felsic phenocrysts. Clay appears to be the dominant authigenic mineral; zeolites are not immediately apparent but may be too fine-grained to be recognizable in thin section. This appears to be a clastic rock with volcanic components, not an ignimbrite, and is the first of its type from Yucca Mountain seen by the author.

4.13 GU3-760.9/4A

The sample is a partially (to moderately?) welded, devitrified (silica-feldspar) ash-flow tuff. Welding is indicated by preferred orientation of shards, but deformation of shards is minimal. Finely crystalline axiolitic and spherulitic devitrification is prominent, with coarsely crystalline tridymite (2.5%) filling pores. No visible (>30 μm) porosity was counted in thin section. The sample is extremely crystal-poor (<1% total phe-

nocrysts) and no quartz was counted. XRD analysis shows that cristobalite is dominant, with subordinate tridymite. Sanidine and a plagioclase of intermediate composition also show strong XRD peaks and, presumably, are devitrification products. Quartz, if present, is very minor. Some Fe-Mn oxides are present on fracture surfaces. Chemically, this is a high-silica rhyolite.

4.14 G4-742.75-E

The sample is a moderately to densely welded, devitrified (silica-feldspar) ash-flow tuff. All fragments show a strong preferred orientation, with deformation and flattening of shards. All of the matrix, as well as pumice fiamme, are completely devitrified, with fine axiolitic and spherulitic textures dominant. Tridymite fills all pores so that no porosity was counted in thin section. The sample is crystal-poor (1% total). Chemically, this is a high-silica rhyolite. Cristobalite dominates the XRD pattern, with subordinate anorthoclase (K-rich albite) and sanidine; all presumably are devitrification products. Quartz is present but minor, and tridymite is present but (as is common for this phase) peaks do not precisely match any of the JCPDS cards for the mineral. Some Fe-Mn oxides appear to have developed as alteration products of Fe-Ti oxides. This sample is virtually identical to G4-742.75-G.

4.15 G4-742.75-G

See G4-742.75-E; samples are virtually identical.

4.16 G4-965.2-D

The sample is a densely welded, devitrified (silica-feldspar) ash-flow tuff. All elongate fragments show preferred orientation, with extreme deformation of shards and matrix. Tridymite and quartz both occur replacing shards, and tridymite is abundant, filling pores. Coarsely crystalline quartz and feldspar "mosaic" areas partly replace areas which were formerly dominated by finely crystalline cristobalite and feldspar. Crystallization of shards and matrix is complete, and crosses the now relict fragmental boundaries. Visible porosity is very low and total phenocryst content is under 2%. The total-H_2O content is under 1%, and chemically the sample is a high-silica rhyolite. The XRD pattern reflects the appearance of quartz as a dominant phase and

the decrease in cristobalite with depth. Textures indicate that replacement of cristobalite is accompanied by recrystallization of feldspars. The feldspar XRD pattern, however, is very similar to that in G4-742.75 (E and G), suggesting all crystallization occurred at high-temperature conditions as part of the primary devitrification process. These data all suggest that kinetic factors (perhaps related to silica saturation) are responsible for determining whether quartz or cristobalite is developed during devitrification.

4.17 G4-1001.9-A

The sample is a densely welded, devitrified (silica-feldspar) ash-flow tuff. Shards have been texturally destroyed by pervasive devitrification, but the welding fabric is extremely strong. Spherulitic and axiolitic devitrification overprints relict fragmental textures. The phenocryst content is under 2%, and visible porosity (>30 μm) is extremely low. As with G4-965.2-D, coarsely crystalline mosaics of quartz and feldspar replace finer cristobalite-dominated spherulitic and axiolitic areas, and coarsely crystalline tridymite occurs as pore filling material. Whole-rock chemistry indicates that the rock is a high-silica rhyolite with a very low H_2O content. Mineral phases identified by XRD are the same as for G4-965.2-D and G4-742.75(E and G), but relative peak heights suggest that quartz is more abundant.

4.18 G4-1369.1-E

The sample is a glassy, non-welded air-fall tuff. The dominance of grain support suggests origin as a fall deposit, in which fines are removed, rather than by ash-flow, in which most fines are retained. This interpretation is not unequivocal, however, because about 35% fine matrix is present in the thin sections. Glass appears very fresh in thin-section, with most fragments being pale brown in plane-polarized light and dark (isotropic) with polarizers crossed. Some very fine matrix shows some weak optical dispersion and possible incipient crystallization (possibly very fine clays). The XRD pattern indicates minimal crystallization but with a broad, weak clay peak at about 7.5° 2θ. Some secondary clear pore filling material is isotropic to very weakly birefringent and may be opal-CT. One sharp peak at about 27.9° 2θ is attributable to feldspar, probably from within lithic fragments or as present phenocrysts. Pumice shows both

ovoid and tubular bubble textures, with gradation between the two types within single fragments. Visible porosity (>30 μm) is relatively high, with 7% counted. Numerous minor phases are present in small amounts including sphene(?), apatite, zircon and possibly chevkinite or allanite. Chemically, this sample is a high silica rhyolite with about 4% (total) H_2O, typical for hydrated perlitic glass.

4.19 G4-1400.6-H

The sample is a glassy, non-welded ash-flow tuff. Abundant fine matrix (58%) and matrix support indicate ash-flow origin. Shards appear water-clear and isotropic in thin section, but the matrix shows development of fine, birefringent crystallites, and some pumice and glassy fragments show perlitic textures with some associated crystallization. The XRD pattern, while weak and showing a sizeable glass "hump" in the 20° to 30° 2θ range, indicates the presence of zeolite (clinoptilolite, with possible mordenite and heulandite), cristobalite as opal-CT, and relatively weak quartz and feldspar peaks. The H_2O content is quite high (total about 8%), and supports the interpretation that the sample contains perhaps 40% zeolite. Visible porosity (>30 μm) is about 4%. Chemically this sample is NOT a high-silica rhyolite, probably because of the removal of SiO_2 and addition of CaO during zeolitization.

5.0 REFERENCES

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APPENDIX A

DATA COMPILATION FORMS FOR HAND SAMPLE ANALYSES

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: A1-212.7 Sample Origin: Drill Hole UE-25a#1

Location: Depth 212.7 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Yellowish to golden brown

Texture: Tuffaceous to sandy volcaniclastic, nonwelded

Grain Size(mm)--> Average*: 1 Minimum: 0.1 Maximum: 2
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Not Estimated

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	0.0	
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	0.0	
Devitrified Lithics:	0.0	
Felsic Phenocrysts:	0.0	
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.0	
Total:	0.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Textures not easily recognized because of wash-out of material on surface and oil saturation. Well sorted. No count performed on hand sample due to even distribution of constituents.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA- YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1487.4-SLA1 Sample Origin: Drill Hole USW G-1

Location: Depth 1487.4 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Pinkish buff plus light and dark lithics

Texture: Tuffaceous, nonwelded, matrix-supported

Grain Size(mm)--> Average*: 0.2 Minimum: 0.01 Maximum: 10
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 357

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	73.7	+/- 4.7
Zeolitized Lithics:	17.1	+/- 4.1
Glassy Lithics:	0.0	
Altered Perlite:	3.9	+/- 2.1
Pumice:	0.0	
Devitrified Lithics:	3.9	+/- 2.0
Felsic Phenocrysts:	1.4	+/- 1.2
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.0	
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Perlite commonly altered to white zeolite. Lithic fragments are typically larger than all others. Dark lithic fragments counted as devitrified; this is confirmed by thin section examination.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1550.4-SLA28 Sample Origin: Drill Hole USW G-1

Location: Depth 1550.4 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Pinkish buff, lithics white to dark reddish brown

Texture: Tuffaceous, nonwelded, matrix-supported

Grain Size(mm)--> Average*: 0.1 Minimum: 0.01 Maximum: 10
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 391

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	59.1	+/- 5.0
Zeolitized Lithics:	33.8	+/- 4.8
Glassy Lithics:	0.0	
Altered Perlite:	3.1	+/- 1.8
Pumice:	0.0	
Devitrified Lithics:	3.3	+/- 1.8
Felsic Phenocrysts:	0.8	+/- 0.9
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.0	
Total:	100.1	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Matrix is very-fine-grained. Zeolitized lithics are finely crystalline internally. Dark, devitrified lithics are elongate perpendicular to core axis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1551.1-SLA29 Sample Origin: Drill Hole USW G-1

Location: Depth 1551.1 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Pinkish buff matrix, lithics white to dark reddish brown

Texture: Tuffaceous, nonwelded, matrix-supported

Grain Size(mm)--> Average*: 0.2 Minimum: 0.01 Maximum: 13
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 409

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	57.9	+/- 4.9
Zeolitized Lithics:	32.5	+/- 4.6
Glassy Lithics:	0.0	
Altered Perlite:	4.4	+/- 2.0
Pumice:	0.0	
Devitrified Lithics:	5.1	+/- 2.2
Felsic Phenocrysts:	0.0	
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.0	
Total:	99.9	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Very similar to G1-1550.4 but with a wider variety of devitrified lithics. Slight tendency for elongate clasts to lie perpendicular to core axis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1784.8-SLA19 Sample Origin: Drill Hole USW G-1

Location: Depth 1784.8 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Gray to purplish gray; varicolored clasts in light matrix

Texture: Tuffaceous to volcaniclastic, sandy

Grain Size(mm)--> Average*: 0.3 Minimum: 0.1 Maximum: 5
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Not Estimated

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	0.0	
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	0.0	
Devitrified Lithics:	0.0	
Felsic Phenocrysts:	0.0	
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.0	
Total:	0.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Hand sample mode estimate unnecessary because of fine grain size. Clast sorting is generally good, with very fine inter-clast matrix. Sample is crystal-rich.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1785.6-SLA20 Sample Origin: Drill Hole USW G-1

Location: Depth 1785.6 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Gray to purplish gray; varicolored clasts in light matrix

Texture: Tuffaceous, volcaniclastic

Grain Size(mm)--> Average*: 0.3 Minimum: 0.1 Maximum: 5
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Not Estimated

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	0.0	
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	0.0	
Devitrified Lithics:	0.0	
Felsic Phenocrysts:	0.0	
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.0	
Total:	0.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Fine grain size makes hand sample mode estimation unnecessary. Matrix appears to be finely crystalline zeolite. Identical to G1-1784.8 except for a few large white zeolitic lithics.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-2276-SF Sample Origin: Drill Hole USW G-1

Location: Depth 2276 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Yellowish to golden brown

Texture: Tuffaceous, nonwelded, grain supported

Grain Size(mm)--> Average*: 0.5 Minimum: 0.1 Maximum: 2
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Visual Estimate

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	40.0	
Zeolitized Lithics:	40.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	0.0	
Devitrified Lithics:	0.0	
Felsic Phenocrysts:	15.0	
Mafic Phenocrysts:	5.0	
Porosity (Visible):	0.0	
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Zeolitization obscures primary textures and fragment boundaries. Grain supported. Some diagenetic matrix from altered lithics. Extensively zeolitized. Fe-Ti oxides marginally altered.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-2589-SD Sample Origin: Drill Hole USW G-1

Location: Depth 2589 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Pinkish buff

Texture: Tuffaceous, partially welded

Grain Size(mm)--> Average*: 0.3 Minimum: 0.1 Maximum: 10
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 294

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	69.4	+/- 5.4
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	21.1	+/- 4.8
Devitrified Lithics:	5.8	+/- 2.7
Felsic Phenocrysts:	2.4	+/- 1.8
Mafic Phenocrysts:	1.4	+/- 1.4
Porosity (Visible):	0.0	
Total:	100.1	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Matrix has sugary texture. Some high-T devitrification may be present. Notable extension fractures present in core are very jagged in appearance.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-2699.1-SLB Sample Origin: Drill Hole USW G-1

Location: Depth 2699.1 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Pale reddish brown, light and dark speckled

Texture: Tuffaceous, partially welded

Grain Size(mm)--> Average*: 0.5 Minimum: 0.2 Maximum: 30
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 351

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	71.2	+/- 4.8
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	19.9	+/- 4.3
Devitrified Lithics:	5.1	+/- 2.3
Felsic Phenocrysts:	2.3	+/- 1.6
Mafic Phenocrysts:	1.4	+/- 1.3
Porosity (Visible):	0.0	
Total:	99.9	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
One large pumice(?) fragment is about 5% of sample. Matrix sugary textured, and appears to be crystalline. Looks devitrified, but pumice fragments appear to be zeolitized.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-2996.9-SLB Sample Origin: Drill Hole USW G-1

Location: Depth 2996.9 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Light to medium gray, light & dark speckled

Texture: Tuffaceous, moderately welded

Grain Size(mm)--> Average*: 0.5 Minimum: 0.2 Maximum: 30
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 388

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	77.6	+/- 4.2
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	10.1	+/- 3.1
Devitrified Lithics:	8.2	+/- 2.8
Felsic Phenocrysts:	2.3	+/- 1.5
Mafic Phenocrysts:	1.8	+/- 1.3
Porosity (Visible):	0.0	
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Large lithics unevenly distributed in sample. Strong preferred orientation of elongate pumice fiamme. Overall is pumice-rich with many small phenocryst fragments.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-3102.3-SLD Sample Origin: Drill Hole USW G-1

Location: Depth 3102.3 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Yellowish to brownish gray, light speckled

Texture: Tuffaceous, nonwelded

Grain Size(mm)--> Average*: 0.5 Minimum: 0.2 Maximum: 10
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 402

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	68.7	+/- 4.6
Zeolitized Lithics:	13.4	+/- 3.4
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	0.0	
Devitrified Lithics:	12.7	+/- 3.3
Felsic Phenocrysts:	1.5	+/- 1.2
Mafic Phenocrysts:	1.0	+/- 1.0
Porosity (Visible):	2.7	+/- 1.6
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Zeolitic lithics are probably altered pumice, and some 3 mm-1.5 cm holes appear to be washed out altered pumice. Lithic rich sample includes both devitrified and zeolitic fragments.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.P. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-3498.4-SLB Sample Origin: Drill Hole USW G-1

Location: Depth 3498.4 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Yellowish brown matrix with varicolored clasts

Texture: Tuffaceous, volcaniclastic, silty to sandy texture

Grain Size(mm)--> Average*: 0.5 Minimum: 0.1 Maximum: 10
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 273

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	67.4	+/- 5.7
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	0.0	
Devitrified Lithics:	31.9	+/- 5.6
Felsic Phenocrysts:	0.0	
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.7	+/- 1.0
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Matrix VERY crumbly, soft. Some zeolite(?) and botryoidal silica fill in pores. Some gypsum had grown from evaporated pore water around polyolefin jacket on core.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: GU3-760.9/4A Sample Origin: Drill Hole USW GU-3

Location: Depth 760.9 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Pinkish buff to very light brown, some lithics dark gray

Texture: Tuffaceous, nonwelded(?)

Grain Size(mm)--> Average*: 0.5 Minimum: 0.3 Maximum: 10
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Visual Estimate

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	93.0	
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	0.0	
Devitrified Lithics:	5.0	
Felsic Phenocrysts:	1.0	
Mafic Phenocrysts:	1.0	
Porosity (Visible):	0.0	
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Large lithics could be undercounted in thin section. Matrix includes visibly crystalline shards. Mn-Fe oxides present on fractures. Appears to be devitrified, not zeolitized.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-742.75-E Sample Origin: Drill Hole USW G-4

Location: Depth 742.75 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Very light gray to pinkish-gray or pinkish-buff

Texture: Tuffaceous, partially to moderately welded

Grain Size(mm)--> Average*: 0.8 Minimum: 0.5 Maximum: 15
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 399

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	88.0	+/- 3.3
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	6.8	+/- 2.5
Devitrified Lithics:	3.0	+/- 1.7
Felsic Phenocrysts:	1.3	+/- 1.1
Mafic Phenocrysts:	1.0	+/- 1.0
Porosity (Visible):	0.0	
Total:	100.1	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
0.5% Fe-Mn oxides included in "Mafic phenocrysts". Many lithics grade into matrix. Almost all fragments show a notable preferred orientation perpendicular to core axis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-53 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-742.75-G Sample Origin: Drill Hole USW G-4

Location: Depth 742.75 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Very light gray to pinkish-gray or pinkish-buff

Texture: Tuffaceous, moderately to partially welded

Grain Size(mm)--> Average*: 1 Minimum: 0.1 Maximum: 20
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 383

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	88.3	+/- 3.3
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	9.4	+/- 3.0
Devitrified Lithics:	0.5	+/- 0.7
Felsic Phenocrysts:	0.8	+/- 0.9
Mafic Phenocrysts:	1.0	+/- 1.0
Porosity (Visible):	0.0	
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Strong preferred orientation of crystalline pumice fiamme and smaller crystallized areas. Some Fe-Mn oxides noted in point count (1 count = 0.3% of mode).

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-965.2-D Sample Origin: Drill Hole USW G-4

Location: Depth 965.2 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Pale reddish brown to gray, light gray (fiamme).

Texture: Tuffaceous, welded

Grain Size(mm)--> Average*: 1 Minimum: 0.5 Maximum: 25
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 393

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	82.2	+/- 3.9
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	13.7	+/- 3.5
Devitrified Lithics:	3.3	+/- 1.8
Felsic Phenocrysts:	0.5	+/- 0.7
Mafic Phenocrysts:	0.3	+/- 0.6
Porosity (Visible):	0.0	
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Rare pink, fine-grain lithics appear to be a type of pumice and are included in count with pumice. Matrix-pumice boundaries are often poorly defined. Coarser matrix tends to be lighter color.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-1001.9-A Sample Origin: Drill Hole USW G-4

Location: Depth 1001.9 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Pale reddish brown, pink, light gray (fiamme)

Texture: Tuffaceous, densely to moderately welded

Grain Size(mm)--> Average*: 1 Minimum: 0.5 Maximum: 25
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 400

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	87.0	+/- 3.4
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	0.0	
Pumice:	5.0	+/- 2.2
Devitrified Lithics:	8.0	+/- 2.7
Felsic Phenocrysts:	0.0	
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.0	
Total:	100.0	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Devitrified lithics include dark gray, pink, and very light gray types. Pumice is elongate gray crystalline fiamme. Pumice and m show gradational contacts.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-1369.1-E Sample Origin: Drill Hole USW G-4

Location: Depth 1369.1 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: Black to red-brown matrix; gray, red, white, and buff fragment

Texture: Tuffaceous, nonwelded, glassy

Grain Size(mm)--> Average*: 1 Minimum: 0.5 Maximum: 15
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 400

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	82.8	+/- 3.8
Zeolitized Lithics:	0.0	
Glassy Lithics:	7.5	+/- 2.6
Altered Perlite:	0.0	
Pumice:	8.0	+/- 2.7
Devitrified Lithics:	0.3	+/- 0.5
Felsic Phenocrysts:	1.5	+/- 1.2
Mafic Phenocrysts:	0.0	
Porosity (Visible):	0.0	
Total:	100.1	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
34% of matrix is black, glassy; rest is pale buff, very fine.
Pumice includes ovoid and "stretched" tubular textured types.
All fragments look very fresh and texturally distinct.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Hand Sample Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-1400.6-H Sample Origin: Drill Hole USW G-4

Location: Depth 1400.6 ft Test #: 1

Part 2. PARAMETERS

Hand Sample Description

Color: White to buff matrix, gray to reddish brown fragments

Texture: Tuffaceous, nonwelded, zeolitized, glassy

Grain Size(mm)--> Average*: 1 Minimum: 0.5 Maximum: 8
* Average is estimate based on range of fragment sizes observed.

Hand Sample Mode estimated by: Point Count--#Points: 400

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	79.5	+/- 4.0
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Altered Perlite:	1.8	+/- 1.3
Pumice:	12.8	+/- 3.3
Devitrified Lithics:	5.5	+/- 2.3
Felsic Phenocrysts:	0.3	+/- 0.5
Mafic Phenocrysts:	0.3	+/- 0.5
Porosity (Visible):	0.0	
Total:	100.2	

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates errors at a 95% confidence level. Visual estimates are aided by the diagram of Lof (1982); no errors are estimated.

Hand Sample Comments:
Sample mixes glassy fragments with buff colored ones which appear zeolitized. Matrix appears zeolitized. Extreme porosity in pumice and texture of pores implies some material washed out.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

APPENDIX B

DATA COMPILATION FORMS FOR THIN SECTION ANALYSES

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: A1-212.7 Sample Origin: Drill Hole UE-25a#1
Location: Depth 212.7 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS1-A1 & EP7-TS1-A2

Welding: Nonwelded
Est. % Cryst: 15 Lithologic Type: Glassy
Type of Pore Filling Material: None

Thin Section Mode Estimated by: Point Count--#Points: 668

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	44.2	+/- 3.8
Shards:	37.6	+/- 3.7
Pumice:	2.5	+/- 1.2
Altered Perlite:	0.0	
Devitrified Lithics:	0.1	+/- 0.2
Zeolitized Lithics:	0.0	
Glassy Lithics:	4.3	+/- 1.6
Alkali Feldspar:	1.2	+/- 0.8
Plagioclase Feldspar:	0.3	+/- 0.4
Quartz:	0.3	+/- 0.4
Biotite:	0.0	
Fe-Ti Oxides:	0.1	+/- 0.2
Others (See below):	0.0	
Porosity (Visible):	9.3	+/- 2.2
Total:	99.9	

Included
in "Others": N/A

Note: Error calculation uses method of Van der Plas and Tobi (1965)
and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Glassy, pale yellow shards are undeformed, randomly oriented, and depleted in fine (<20 micron) fragments. Many large and small pores in fragments and matrix.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA- YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1487.4-SLA1 Sample Origin: Drill Hole USW G-1
Location: Depth 1487.4 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS2-A1 & EP7-TS2-A2

Welding: Nonwelded
Est. % Cryst: 95 Lithologic Type: Zeolitized
Type of Pore Filling Material: Zeolite

Thin Section Mode Estimated by: Point Count--#Points: 567

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	57.1	+/- 4.2
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	1.9	+/- 1.1
Devitrified Lithics:	2.3	+/- 1.3
Zeolitized Lithics:	31.9	+/- 3.9
Glassy Lithics:	0.0	
Alkali Feldspar:	0.9	+/- 0.8
Plagioclase Feldspar:	0.7	+/- 0.7
Quartz:	0.4	+/- 0.5
Biotite:	0.2	+/- 0.4
Fe-Ti Oxides:	0.0	
Others (See below):	0.0	
Porosity (Visible):	4.6	+/- 1.8
Total:	100.0	

Included
in "Others": N/A

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
Fragments and matrix are texturally distinct, with minimal "gradational" contacts. Zeolite very fine execpt when filling pores. Zeolitic lithics and pumice can't be differentiated.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1550.4-SLA28 Sample Origin: Drill Hole USW G-1
Location: Depth 1550.4 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS3-A1 & EP7-TS3-A2

Welding: Nonwelded
Est. % Cryst: 95 Lithologic Type: Zeolitized
Type of Pore Filling Material: Zeolite

Thin Section Mode Estimated by: Point Count--#Points: 626

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	42.5	+/- 4.0
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	2.2	+/- 1.2
Devitrified Lithics:	1.4	+/- 0.9
Zeolitized Lithics:	46.8	+/- 4.0
Glassy Lithics:	0.0	
Alkali Feldspar:	1.4	+/- 0.9
Plagioclase Feldspar:	0.3	+/- 0.4
Quartz:	1.0	+/- 0.8
Biotite:	0.5	+/- 0.6
Fe-Ti Oxides:	0.0	
Others (See below):	0.0	
Porosity (Visible):	3.8	+/- 1.5
Total:	99.9	

Included in "Others": Possible minor clay minerals (noted, not counted)

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
"Original" matrix textures destroyed by zeolitization. Very fine zeolites dominant. Many different lithic fragment types are present, and fragment matrix boundaries are well-defined.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA- YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1551.1-SLA29 Sample Origin: Drill Hole USW G-1
Location: Depth 1551.1 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS4-A1 & EP7-TS4-A2

Welding: Nonwelded
Est. % Cryst: 95 Lithologic Type: Zeolitized
Type of Pore Filling Material: Zeolite

Thin Section Mode Estimated by: Point Count--#Points: 632

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	50.9	+/- 4.0
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	4.3	+/- 1.6
Devitrified Lithics:	5.4	+/- 1.8
Zeolitized Lithics:	33.9	+/- 3.8
Glassy Lithics:	0.0	
Alkali Feldspar:	0.9	+/- 0.8
Plagioclase Feldspar:	0.3	+/- 0.4
Quartz:	1.4	+/- 0.9
Biotite:	0.0	
Fe-Ti Oxides:	0.2	+/- 0.4
Others (See below):	0.0	
Porosity (Visible):	2.7	+/- 1.3
Total:	100.0	

Included
in "Others": Possible minor clay minerals (noted, not counted)

Note: Error calculation uses method of Van der Plas and Tobi (1965)
and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Matrix texture altered by zeolitization. Zeolitic lithics, pumice and perlite show local gradational textures. Some possible clay minerals noted in minor amounts.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1784.8-SLA19 Sample Origin: Drill Hole USW G-1
Location: Depth 1784.8 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS5-A1 & EP7-TS5-A2

Welding: Nonwelded
Est. % Cryst: 85 Lithologic Type: Zeolitized
Type of Pore Filling Material: Zeolite

Thin Section Mode Estimated by: Point Count--#Points: 589

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	47.2	+/- 4.1
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	10.4	+/- 2.5
Zeolitized Lithics:	16.6	+/- 3.1
Glassy Lithics:	0.0	
Alkali Feldspar:	5.8	+/- 1.9
Plagioclase Feldspar:	8.3	+/- 2.3
Quartz:	6.5	+/- 2.0
Biotite:	0.7	+/- 0.7
Fe-Ti Oxides:	1.7	+/- 1.1
Others (See below):	0.0	
Porosity (Visible):	2.9	+/- 1.4
Total:	100.1	

Included in "Others": Minor amphibole & pyroxene noted (not counted)

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
Zeolitized very fine matrix may be partly glassy. Much matrix appears to have originiated by in-situ alteration of glassy fragments. Fe-Ti oxides partly colloform, probably and Mn-rich.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-1785.6-SLA20 Sample Origin: Drill Hole USW G-1
Location: Depth 1785.6 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS6-A1 & EP7-TS6-A2

Welding: Nonwelded
Est. % Cryst: 85 Lithologic Type: Zeolitized
Type of Pore Filling Material: Zeolite

Thin Section Mode Estimated by: Point Count--#Points: 461

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	52.3	+/- 4.7
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	10.8	+/- 2.9
Zeolitized Lithics:	13.7	+/- 3.2
Glassy Lithics:	0.0	
Alkali Feldspar:	5.9	+/- 2.2
Plagioclase Feldspar:	7.8	+/- 2.5
Quartz:	3.9	+/- 1.8
Biotite:	0.4	+/- 0.6
Fe-Ti Oxides:	1.5	+/- 1.1
Others (See below):	0.7	+/- 0.8
Porosity (Visible):	3.0	+/- 1.6
Total:	100.0	

Included
in "Others": Sphene, amphibole

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Most matrix appears to be altered glassy lithic fragments. Matrix- and Grain-support appear evident in different areas of sections. Minor glass may be present in clast and matrix.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-2276-SF Sample Origin: Drill Hole USW G-1
Location: Depth 2276 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS7-A1 & EP7-TS7-A2

Welding: Nonwelded
Est. % Cryst: 85 Lithologic Type: Zeolitized, Glassy?
Type of Pore Filling Material: Zeolite

Thin Section Mode Estimated by: Point Count--#Points: 611

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	70.5	+/- 3.7
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	0.0	
Zeolitized Lithics:	8.3	+/- 2.2
Glassy Lithics:	0.0	
Alkali Feldspar:	6.4	+/- 2.0
Plagioclase Feldspar:	5.1	+/- 1.8
Quartz:	3.6	+/- 1.5
Biotite:	0.2	+/- 0.4
Fe-Ti Oxides:	0.2	+/- 0.4
Others (See below):	0.3	+/- 0.4
Porosity (Visible):	5.4	+/- 1.8
Total:	100.0	

Included
in "Others": Colloform Mn-Fe oxides

Note: Error calculation uses method of Van der Plas and Tobi (1965)
and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Some matrix is from altered lithics, some primary. Matrix is locally isotropic, possibly partly glassy. Local tabular zeolite (in pores). Phenocrysts relatively large (to 2mm).

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-2589-SD Sample Origin: Drill Hole USW G-1
Location: Depth 2589 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS8-A1 & EP7-TS8-A2

Welding: Partial
Est. % Cryst: 95 Lithologic Type: Zeolitized, Possible Clays
Type of Pore Filling Material: Zeolite

Thin Section Mode Estimated by: Point Count--#Points: 616

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	51.5	+/- 4.0
Shards:	13.3	+/- 2.7
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	1.3	+/- 0.9
Zeolitized Lithics:	23.2	+/- 3.4
Glassy Lithics:	0.0	
Alkali Feldspar:	2.3	+/- 1.2
Plagioclase Feldspar:	2.8	+/- 1.3
Quartz:	2.9	+/- 1.4
Biotite:	0.5	+/- 0.6
Fe-Ti Oxides:	0.2	+/- 0.4
Others (See below):	0.0	
Porosity (Visible):	2.1	+/- 1.2
Total:	100.1	

Included
in "Others": Colloform Mn-Fe oxides (present, not counted)

Note: Error calculation uses method of Van der Plas and Tobi (1965)
and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Although zeolitized, shard textures are well preserved.
Prominent zeolites locally line pores. Matrix birefringence
suggests clays. Shards well defined, largely undeformed.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 3315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-2699.1-SLB Sample Origin: Drill Hole USW G-1
Location: Depth 2699.1 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS9-A1 & EP7-TS9-A2

Welding: Partial to moderate
Est. % Cryst: 90 Lithologic Type: Zeolitized, glassy
Type of Pore Filling Material: Zeolite (partial)

Thin Section Mode Estimated by: Point Count--#Points: 607

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	60.6	+/- 4.0
Shards:	5.1	+/- 1.8
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	1.0	+/- 0.8
Zeolitized Lithics:	18.5	+/- 3.2
Glassy Lithics:	0.2	+/- 0.4
Alkali Feldspar:	3.6	+/- 1.5
Plagioclase Feldspar:	5.4	+/- 1.8
Quartz:	3.3	+/- 1.5
Biotite:	0.5	+/- 0.6
Fe-Ti Oxides:	0.3	+/- 0.4
Others (See below):	0.0	
Porosity (Visible):	1.5	+/- 1.0
Total:	100.0	

Included
in "Others": N/A

Note: Error calculation uses method of Van der Plas and Tobi (1965)
and estimates counting errors at a 95% confidence level.

Thin Section Comments:
High-T devitrification is not evident in thin section. Matrix appears partly glassy, and zeolites are present in pores. Matrix is very fine-grained, with some glass fragments noted.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly Div: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-2996.9-SLB Sample Origin: Drill Hole USW G-1
Location: Depth 2996.9 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS10-A1 & EP7-TS10-A2

Welding: Moderate to dense
Est. % Cryst: 99 Lithologic Type: Silica-feldspar
Type of Pore Filling Material: Silica-feldspar

Thin Section Mode Estimated by: Point Count--#Points: 493

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	63.1	+/- 4.3
Shards:	0.0	
Pumice:	16.2	+/- 3.3
Altered Perlite:	0.0	
Devitrified Lithics:	7.1	+/- 2.3
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Alkali Feldspar:	6.1	+/- 2.2
Plagioclase Feldspar:	3.4	+/- 1.6
Quartz:	2.0	+/- 1.3
Biotite:	0.6	+/- 0.7
Fe-Ti Oxides:	0.2	+/- 0.4
Others (See below):	0.2	+/- 0.4
Porosity (Visible):	1.0	+/- 0.9
Total:	99.9	

Included
in "Others": Zircon (1 point counted)

Note: Error calculation uses method of Van der Plas and Tobi (1965)
and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Elongate area of spherulitic matrix counted as pumice fiamme.
Primary shard/matrix textures obscured by welding. High-T
devitrified with axiolitic & spherulitic textures prominent.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-3102.3-SLD Sample Origin: Drill Hole USW G-1
Location: Depth 3102.3 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS11-A1 & EP7-TS11-A2

Welding: Nonwelded
Est. % Cryst: 95 Lithologic Type: Zeolitized
Type of Pore Filling Material: Zeolite (abundant)

Thin Section Mode Estimated by: Point Count--#Points: 590

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	65.4	+/- 3.9
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	8.8	+/- 2.3
Zeolitized Lithics:	5.1	+/- 1.8
Glassy Lithics:	0.0	
Alkali Feldspar:	4.9	+/- 1.8
Plagioclase Feldspar:	4.6	+/- 1.7
Quartz:	4.4	+/- 1.7
Biotite:	0.5	+/- 0.6
Fe-Ti Oxides:	0.2	+/- 0.4
Others (See below):	0.0	
Porosity (Visible):	6.1	+/- 2.0
Total:	100.0	

Included in "Others": Trace of pyroxene, spinel noted (not counted)

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
Contains a very diverse assemblage of devitrified lithics. Matrix is thoroughly crystallized; may be zeolitized but birefringence higher than normal for clinoptilolite alone.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G1-3498.4-SLB Sample Origin: Drill Hole USW G-1
Location: Depth 3498.4 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS12-A1 & EP7-TS12-A2

Welding: Volcaniclastic
Est. % Cryst: 75 Lithologic Type: Zeolite(?), mica/clay(?)
Type of Pore Filling Material: None noted

Thin Section Mode Estimated by: Point Count--#Points: 426

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	45.5	+/- 4.8
Shards:	0.2	+/- 0.4
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	39.0	+/- 4.7
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Alkali Feldspar:	4.5	+/- 2.0
Plagioclase Feldspar:	4.9	+/- 2.1
Quartz:	1.9	+/- 1.3
Biotite:	0.7	+/- 0.8
Fe-Ti Oxides:	0.7	+/- 0.8
Others (See below):	0.2	+/- 0.4
Porosity (Visible):	2.3	+/- 1.5
Total:	99.9	

Included
in "Others": Altered pyroxene; matrix is 2.3% muscovite/kaolinite

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
Rock is volcaniclastic with unusual fragmental texture. Wide variety of devitrified lithics. Birefringent clay(?) prominent in matrix. Coarse zeolites not evident. Some glassy shards.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: GU3-760.9/4A Sample Origin: Drill Hole USW GU-3
Location: Depth 760.9 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS13-A1 & EP7-TS13-A2

Welding: Partial to moderate(?)
Est. % Cryst: 99 Lithologic Type: Silica-feldspar
Type of Pore Filling Material: Tridymite

Thin Section Mode Estimated by: Point Count--#Points: 603

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	68.7	+/- 3.8
Shards:	5.5	+/- 1.9
Pumice:	21.1	+/- 3.3
Altered Perlite:	0.0	
Devitrified Lithics:	1.5	+/- 1.0
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Alkali Feldspar:	0.2	+/- 0.4
Plagioclase Feldspar:	0.5	+/- 0.6
Quartz:	0.0	
Biotite:	0.0	
Fe-Ti Oxides:	0.0	
Others (See below):	2.7	+/- 1.3
Porosity (Visible):	0.0	
Total:	100.2	

Included
in "Others": Mn-Fe oxides 0.2%; pore filling tridymite 2.5%

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
Devitrification shows axolitic, spherulitic and coarse mosiaic textures. Much tridymite-dominated pore filling. Devitrification crystallization commonly crosses fragment boundaries.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-742.75-E Sample Origin: Drill Hole USW G-4
Location: Depth 742.75 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS14-A1 & EP7-TS14-A2

Welding: Moderate to dense(?)
Est. % Cryst: 99 Lithologic Type: Silica-feldspar
Type of Pore Filling Material: Tridymite

Thin Section Mode Estimated by: Point Count--#Points: 663

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	92.3	+/- 2.1
Shards:	0.0	
Pumice:	4.7	+/- 1.6
Altered Perlite:	0.0	
Devitrified Lithics:	0.2	+/- 0.3
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Alkali Feldspar:	0.2	+/- 0.3
Plagioclase Feldspar:	0.2	+/- 0.3
Quartz:	0.3	+/- 0.4
Biotite:	0.0	
Fe-Ti Oxides:	0.3	+/- 0.4
Others (See below):	2.0	+/- 1.1
Porosity (Visible):	0.0	
Total:	100.2	

Included in "Others": 2% Pore filling tridymite.

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
Matrix contains highly flattend relict shards. Coarsely crystalline elongate zones probably altered pumice fiamme. Fe-Ti oxides are marginally altered to Mn-Fe oxides.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA- YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-742.75-G Sample Origin: Drill Hole USW G-4
Location: Depth 742.75 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS15-A1 & EP7-TS15-A2

Welding: Moderate to dense
Est. % Cryst: 99 Lithologic Type: Silica-feldspar
Type of Pore Filling Material: Tridymite

Thin Section Mode Estimated by: Point Count--#Points: 633

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	92.3	+/- 2.1
Shards:	0.0	
Pumice:	4.3	+/- 1.6
Altered Perlite:	0.0	
Devitrified Lithics:	0.8	+/- 0.7
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Alkali Feldspar:	0.3	+/- 0.4
Plagioclase Feldspar:	0.3	+/- 0.4
Quartz:	0.3	+/- 0.4
Biotite:	0.0	
Fe-Ti Oxides:	0.0	
Others (See below):	1.7	+/- 1.0
Porosity (Visible):	0.0	
Total:	100.0	

Included in "Others": 1.7% tridymite filling pores

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
Matrix contains highly flattend relict shards. Coarsely crystalline elongate zones are probably altered pumice fiamme which show gradational contacts with matrix.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA- YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-965.2-D Sample Origin: Drill Hole USW G-4
Location: Depth 965.2 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS16-A1 & EP7-TS16-A2

Welding: Dense
Est. % Cryst: 99 Lithologic Type: Silica-feldspar
Type of Pore Filling Material: Tridymite, quartz + feldspar

Thin Section Mode Estimated by: Point Count--#Points: 764

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	81.2	+/- 2.8
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	2.4	+/- 1.1
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Alkali Feldspar:	0.7	+/- 0.6
Plagioclase Feldspar:	0.8	+/- 0.6
Quartz:	0.1	+/- 0.2
Biotite:	0.0	
Fe-Ti Oxides:	0.1	+/- 0.2
Others (See below):	14.7	+/- 2.6
Porosity (Visible):	0.1	+/- 0.2
Total:	100.1	

Included
in "Others": 12.3% coarse qz-feld; 2.4% pore-fill tridymite

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Matrix includes fine, axiolitic & spherulitic areas. Welding is very dense, with extreme deformation of shards & matrix. Quartz and tridymite both replace shards. Cryst. crosses boundaries.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III YMP DRMS DATA SET ID: 51/L04-2/21/86 SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-1001.9-A Sample Origin: Drill Hole USW G-4
Location: Depth 1001.9 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS17-A1 & EP7-TS17-A2

Welding: Dense(?)
Est. % Cryst: 99 Lithologic Type: Silica-feldspar
Type of Pore Filling Material: Tridymite, quartz + feldspar

Thin Section Mode Estimated by: Point Count--#Points: 729

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	84.4	+/- 2.7
Shards:	0.0	
Pumice:	0.0	
Altered Perlite:	0.0	
Devitrified Lithics:	1.1	+/- 0.8
Zeolitized Lithics:	0.0	
Glassy Lithics:	0.0	
Alkali Feldspar:	0.4	+/- 0.5
Plagioclase Feldspar:	1.0	+/- 0.7
Quartz:	0.0	
Biotite:	0.0	
Fe-Ti Oxides:	0.0	
Others (See below):	13.2	+/- 2.5
Porosity (Visible):	0.0	
Total:	100.1	

Included
in "Others": 10.8% coarse qz-feld; 2.3% pore-fill tridymite

Note: Error calculation uses method of Van der Plas and Tobi (1965)
and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Matrix includes fine and spherulitic/axiolitic areas. Shard form absent, but welding fabric is strong. Crystallization crosses fragment boundaries. Possible perrierite noted.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA- YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-1369.1-E Sample Origin: Drill Hole USW G-4
Location: Depth 1369.1 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS18-A1 & EP7-TS18-A2

Welding: Nonwelded
Est. % Cryst: 5 Lithologic Type: Glassy
Type of Pore Filling Material: Minor opal-CT(?)

Thin Section Mode Estimated by: Point Count--#Points: 725

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	35.3	+/- 3.5
Shards:	30.5	+/- 3.4
Pumice:	16.4	+/- 2.8
Altered Perlite:	0.0	
Devitrified Lithics:	0.8	+/- 0.7
Zeolitized Lithics:	0.0	
Glassy Lithics:	9.2	+/- 2.1
Alkali Feldspar:	0.3	+/- 0.4
Plagioclase Feldspar:	0.0	
Quartz:	0.1	+/- 0.2
Biotite:	0.0	
Fe-Ti Oxides:	0.0	
Others (See below):	0.0	
Porosity (Visible):	7.3	+/- 1.9
Total:	99.9	

Included
in "Others": Uncounted, minor: sphene, apatite, zircon, allanite(?)

Note: Error calculation uses method of Van der Plas and Tobi (1965)
and estimates counting errors at a 95% confidence level.
Thin Section Comments:
Pumice is 6.1% ovoid bubble, 10.3% tubular bubble types. Shard matrix is pale brown, isotropic; fine matrix clear and isotropic Some secondary pore-filling clear xn present.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Petrographic Data Compilation for the Yucca Mountain Project SEPDB
(Thin Section Data)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

Sample ID: G4-1400.6-H Sample Origin: Drill Hole USW G-4
Location: Depth 1400.6 ft Test #: 1

Part 2. PARAMETERS

Thin Section Description

Thin Section ID #s: EP7-TS19-A1 & EP7-TS19-A2

Welding: Nonwelded
Est. % Cryst: 15 Lithologic Type: Glassy, clay-zeolite(?)
Type of Pore Filling Material: Zeolite(?)

Thin Section Mode Estimated by: Point Count--#Points: 716

Constituents	Amount (%)	Est Error (95% Conf)
Matrix:	58.4	+/- 3.7
Shards:	15.5	+/- 2.7
Pumice:	2.1	+/- 1.1
Altered Perlite:	0.0	
Devitrified Lithics:	4.1	+/- 1.5
Zeolitized Lithics:	0.0	
Glassy Lithics:	13.5	+/- 2.6
Alkali Feldspar:	0.7	+/- 0.6
Plagioclase Feldspar:	0.7	+/- 0.6
Quartz:	0.4	+/- 0.5
Biotite:	0.1	+/- 0.2
Fe-Ti Oxides:	0.3	+/- 0.4
Others (See below):	0.0	
Porosity (Visible):	4.2	+/- 1.5
Total:	100.0	

Included in "Others": Not counted: minor altered hornblende, allanite(?)

Note: Error calculation uses method of Van der Plas and Tobi (1965) and estimates counting errors at a 95% confidence level.

Thin Section Comments:
Some <5 micron crystallites in fine matrix, are possible clay or zeolites. Shards are water-clear. Matrix-support suggests ash-flow origin. XRD suggests partial zeolitization.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-59 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA-GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

APPENDIX C

DATA COMPILATION FORMS FOR WHOLE-ROCK CHEMICAL ANALYSES

NOTE: No whole-rock analysis was performed for Sample G1-3498.4-SLB because the material returned from SNL after physical property measurements was not representative of the original whole-rock.

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: A1-212.7 SAMPLE ORIGIN: Drill Hole UE-25a#1
LOCATION: Depth 212.7 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: A1-212.7-B-2
Comments: Sample was oil saturated; clay/zeolite probably present.
ANALYSIS TOTAL IS OVER 101.5% LIMIT.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	64.1	+/- 1.9	XRF	Quartz:	36.35
TiO2:	0.170	+/- 0.017	XRF	Corundum:	4.60
Al2O3:	13.49	+/- 0.40	XRF	Orthoclase:	22.80
Fe2O3:	0.66	+/- 0.07	XRF,V	Albite:	23.04
FeO:	0.14	+/- 0.01	V	Anorthite:	5.79
MnO:	0.120	+/- 0.012	XRF	Hypersthene:	6.10
MgO:	2.14	+/- 0.06	XRF	Magnetite:	0.40
CaO:	1.06	+/- 0.03	XRF	Hematite:	0.48
Na2O:	2.39	+/- 0.07	XRF	Ilmenite:	0.37
K2O:	3.38	+/- 0.10	XRF	Rutile:	
P2O5:	0.029	+/- 0.006	XRF	Apatite:	0.08
H2O(+):	10.76	+/- 0.32	G	H2O:	
H2O(-):	3.02	+/- 0.09	G		
Total:	101.449			Norm Total:	100.01
				Differentiation index:	
Total Fe as Fe2O3:	0.82	+/- 0.08	XRF	Qtz+Orth+Alb=	82.19
Loss on Ignition:	10.76	+/- 0.32	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA
GATHERING ACTIVITY: III

YMP DRMS DATA SET ID: 51/L04-2/21/86

SNL DATA REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1487.4-SLA1 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1487.4 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-1487.4-SLA1-B-2
Comments: High H2O(+) and H2O(-) suggest zeolitization.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	69.5	+/- 2.1	XRF	Quartz:	35.74
TiO2:	0.084	+/- 0.017	XRF	Corundum:	0.50
Al2O3:	11.81	+/- 0.35	XRF	Orthoclase:	29.89
Fe2O3:	0.50	+/- 0.05	XRF,V	Albite:	28.88
FeO:	0.02	+/- 0.00	V	Anorthite:	3.97
MnO:	0.022	+/- 0.004	XRF	Hypersthene:	0.30
MgO:	0.11	+/- 0.01	XRF	Magnetite:	
CaO:	0.74	+/- 0.07	XRF	Hematite:	0.55
Na2O:	3.09	+/- 0.09	XRF	Ilmenite:	0.10
K2O:	4.57	+/- 0.14	XRF	Rutile:	0.04
P2O5:	0.013	+/- 0.003	XRF	Apatite:	0.03
H2O(+):	5.63	+/- 0.17	G	H2O:	
H2O(-):	4.32	+/- 0.13	G		
Total:	100.389			Norm Total:	100.00
				Differentiation index:	
Total Fe as Fe2O3:	0.52	+/- 0.05	XRF	Qtz+Orth+Alb=	94.51
Loss on Ignition:	5.63	+/- 0.17	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA
GATHERING ACTIVITY: III

YMP DRMS DATA SET
ID: 51/L04-2/21/86

SNL DATA
REP #: SAND90-7053

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1550.4-SLA28 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1550.4 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-1550.4-SLA28-B-2
Comments: High H2O(+) and H2O(-) suggest zeolitization.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	68.9	+/- 2.1	XRF	Quartz:	33.88
TiO2:	0.081	+/- 0.016	XRF	Corundum:	0.38
Al2O3:	11.98	+/- 0.36	XRF	Orthoclase:	32.24
Fe2O3:	0.64	+/- 0.06	XRF,V	Albite:	28.69
FeO:	0.02	+/- 0.00	V	Anorthite:	3.72
MnO:	0.014	+/- 0.003	XRF	Hypersthene:	0.22
MgO:	0.08	+/- 0.02	XRF	Magnetite:	
CaO:	0.70	+/- 0.07	XRF	Hematite:	0.71
Na2O:	3.07	+/- 0.09	XRF	Ilmenite:	0.08
K2O:	4.93	+/- 0.15	XRF	Rutile:	0.05
P2O5:	0.017	+/- 0.003	XRF	Apatite:	0.04
H2O(+):	5.84	+/- 0.18	G	H2O:	
H2O(-):	4.05	+/- 0.12	G		
Total:	100.340			Norm Total:	100.01
				Differentiation index:	
Total Fe as Fe2O3:	0.66	+/- 0.07	XRF	Qtz+Orth+Alb=	94.81
Loss on Ignition:	5.84	+/- 0.18	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1551.1-SLA29 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1551.1 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-1551.1-SLA29-B-2
Comments: High H2O(+) and H2O(-) suggest zeolitization.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	69.7	+/- 2.1	XRF	Quartz:	34.56
TiO2:	0.090	+/- 0.018	XRF	Corundum:	0.51
Al2O3:	12.04	+/- 0.36	XRF	Orthoclase:	31.48
Fe2O3:	0.60	+/- 0.06	XRF,V	Albite:	28.60
FeO:	0.05	+/- 0.01	V	Anorthite:	3.64
MnO:	0.023	+/- 0.005	XRF	Hypersthene:	0.33
MgO:	0.12	+/- 0.01	XRF	Magnetite:	
CaO:	0.69	+/- 0.07	XRF	Hematite:	0.66
Na2O:	3.09	+/- 0.09	XRF	Ilmenite:	0.17
K2O:	4.86	+/- 0.15	XRF	Rutile:	0.01
P2O5:	0.015	+/- 0.003	XRF	Apatite:	0.04
H2O(+):	5.21	+/- 0.16	G	H2O:	
H2O(-):	3.96	+/- 0.12	G		
Total:	100.478			Norm Total:	100.00
				Differentiation index:	
Total Fe as Fe2O3:	0.66	+/- 0.07	XRF	Qtz+Orth+Alb=	94.64
Loss on Ignition:	5.20	+/- 0.16	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1784.8-SLA19 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1784.8 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-1784.8-SLA19-B-2
Comments: H2O content typical of perlite, too low for extensive zeolite.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	65.6	+/- 2.0	XRF	Quartz:	25.34
TiO2:	0.440	+/- 0.044	XRF	Corundum:	1.13
Al2O3:	15.81	+/- 0.47	XRF	Orthoclase:	25.68
Fe2O3:	3.45	+/- 0.10	XRF,V	Albite:	27.23
FeO:	0.19	+/- 0.02	V	Anorthite:	14.27
MnO:	0.073	+/- 0.015	XRF	Hypersthene:	1.81
MgO:	0.70	+/- 0.07	XRF	Magnetite:	
CaO:	2.90	+/- 0.09	XRF	Hematite:	3.57
Na2O:	3.11	+/- 0.09	XRF	Ilmenite:	0.58
K2O:	4.19	+/- 0.13	XRF	Rutile:	0.15
P2O5:	0.096	+/- 0.019	XRF	Apatite:	0.24
H2O(+):	2.61	+/- 0.08	G	H2O:	
H2O(-):	0.81	+/- 0.08	G		
Total:	99.939			Norm Total:	100.00
				Differentiation index:	
Total Fe as Fe2O3:	3.66	+/- 0.11	XRF	Qtz+Orth+Alb=	78.25
Loss on Ignition:	2.59	+/- 0.08	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA GATHERING ACTIVITY: III
YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1785.6-SLA20 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1785.6 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-1785.6-SLA20-B-2
Comments: H2O content typical of perlite, too low for extensive zeolite.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	65.1	+/- 2.0	XRF	Quartz:	25.96
TiO2:	0.430	+/- 0.043	XRF	Corundum:	1.34
Al2O3:	15.70	+/- 0.47	XRF	Orthoclase:	25.37
Fe2O3:	3.32	+/- 0.10	XRF,V	Albite:	26.79
FeO:	0.23	+/- 0.02	V	Anorthite:	14.21
MnO:	0.044	+/- 0.009	XRF	Hypersthene:	1.88
MgO:	0.72	+/- 0.07	XRF	Magnetite:	
CaO:	2.86	+/- 0.09	XRF	Hematite:	3.47
Na2O:	3.03	+/- 0.09	XRF	Ilmenite:	0.61
K2O:	4.10	+/- 0.12	XRF	Rutile:	0.13
P2O5:	0.094	+/- 0.019	XRF	Apatite:	0.23
H2O(+):	2.30	+/- 0.07	G	H2O:	
H2O(-):	1.20	+/- 0.04	G		
				Norm Total:	99.99
Total:	99.078				
				Differentiation index:	
Total Fe as Fe2O3:	3.58	+/- 0.11	XRF	Qtz+Orth+Alb=	78.12
Loss on Ignition:	2.27	+/- 0.07	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-2276-SF SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 2276 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-2276-SF-B-2
Comments: H2O content implies extensive zeolitization; low Al2O3 implies minimal clay content.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	69.2	+/- 2.1	XRF	Quartz:	34.91
TiO2:	0.140	+/- 0.014	XRF	Corundum:	0.40
Al2O3:	12.89	+/- 0.39	XRF	Orthoclase:	22.94
Fe2O3:	1.02	+/- 0.03	XRF,V	Albite:	30.22
FeO:	0.04	+/- 0.01	V	Anorthite:	9.48
MnO:	0.125	+/- 0.013	XRF	Hypersthene:	0.57
MgO:	0.21	+/- 0.02	XRF	Magnetite:	0.14
CaO:	1.79	+/- 0.05	XRF	Hematite:	1.01
Na2O:	3.30	+/- 0.10	XRF	Ilmenite:	0.29
K2O:	3.58	+/- 0.11	XRF	Rutile:	
P2O5:	0.021	+/- 0.004	XRF	Apatite:	0.05
H2O(+):	4.54	+/- 0.14	G	H2O:	
H2O(-):	3.37	+/- 0.10	G		
Total:	100.216			Norm Total:	100.01
				Differentiation index:	
Total Fe as Fe2O3:	1.07	+/- 0.03	XRF	Qtz+Orth+Alb=	88.07
Loss on Ignition:	4.54	+/- 0.14	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-2589-SD SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 2589 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-2589-SD-B-2
Comments: H2O content implies extensive zeolitization; low Al2O3 implies minimal clay content.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method
SiO2:	69.0	+/- 2.1	XRF
TiO2:	0.130	+/- 0.013	XRF
Al2O3:	12.57	+/- 0.38	XRF
Fe2O3:	0.80	+/- 0.08	XRF,V
FeO:	0.09	+/- 0.02	V
MnO:	0.028	+/- 0.006	XRF
MgO:	0.19	+/- 0.02	XRF
CaO:	1.11	+/- 0.03	XRF
Na2O:	3.90	+/- 0.12	XRF
K2O:	3.35	+/- 0.10	XRF
P2O5:	0.026	+/- 0.005	XRF
H2O(+):	5.16	+/- 0.15	G
H2O(-):	3.52	+/- 0.11	G
Total:	99.834		
Total Fe as Fe2O3:	0.90	+/- 0.09	XRF
Loss on Ignition:	5.15	+/- 0.15	G

CIPW Normative Minerals	
Quartz:	33.89
Corundum:	0.61
Orthoclase:	21.74
Albite:	36.16
Anorthite:	5.86
Hypersthene:	0.52
Magnetite:	
Hematite:	0.87
Ilmenite:	0.27
Rutile:	
Apatite:	0.07
H2O:	
Norm Total:	99.99

Differentiation index:
Qtz+Orth+Alb= 91.79

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-2699.1-SLB SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 2699.1 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-2699.1-SLB-B-2
Comments: Intermediate H2O content implies some zeolitization.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	69.3	+/- 2.1	XRF	Quartz:	32.64
TiO2:	0.190	+/- 0.019	XRF	Corundum:	0.55
Al2O3:	12.91	+/- 0.39	XRF	Orthoclase:	26.74
Fe2O3:	1.05	+/- 0.03	XRF,V	Albite:	31.11
FeO:	0.14	+/- 0.01	V	Anorthite:	6.49
MnO:	0.092	+/- 0.018	XRF	Hypersthene:	0.81
MgO:	0.30	+/- 0.03	XRF	Magnetite:	0.22
CaO:	1.26	+/- 0.04	XRF	Hematite:	0.98
Na2O:	3.42	+/- 0.10	XRF	Ilmenite:	0.39
K2O:	4.20	+/- 0.13	XRF	Rutile:	
P2O5:	0.035	+/- 0.007	XRF	Apatite:	0.09
H2O(+):	4.12	+/- 0.12	G	H2O:	
H2O(-):	2.54	+/- 0.08	G		
Total:	99.577			Norm Total:	100.02
				Differentiation index:	
Total Fe as Fe2O3:	1.21	+/- 0.04	XRF	Qtz+Orth+Alb=	90.49
Loss on Ignition:	4.11	+/- 0.12	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-2996.9-SLB SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 2996.9 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-2996.9-SLB-B-2
Comments: Low H2O content typical for devitrified sample.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	75.6	+/- 2.3	XRF	Quartz:	34.95
TiO2:	0.160	+/- 0.016	XRF	Corundum:	0.44
Al2O3:	12.77	+/- 0.38	XRF	Orthoclase:	33.44
Fe2O3:	1.05	+/- 0.03	XRF,V	Albite:	25.68
FeO:	0.12	+/- 0.01	V	Anorthite:	3.48
MnO:	0.042	+/- 0.008	XRF	Hypersthene:	0.55
MgO:	0.22	+/- 0.02	XRF	Magnetite:	0.06
CaO:	0.74	+/- 0.07	XRF	Hematite:	1.01
Na2O:	3.02	+/- 0.09	XRF	Ilmenite:	0.31
K2O:	5.62	+/- 0.17	XRF	Rutile:	
P2O5:	0.033	+/- 0.007	XRF	Apatite:	0.08
H2O(+):	0.61	+/- 0.06	G	H2O:	
H2O(-):	0.14	+/- 0.01	G		
Total:	100.145			Norm Total:	100.00
				Differentiation index:	
Total Fe as Fe2O3:	1.18	+/- 0.04	XRF	Qtz+Orth+Alb=	94.07
Loss on Ignition:	0.60	+/- 0.06	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-3102.3-SLD SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 3102.3 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G1-3102.3-SLD-B-2
Comments: H2O (+)&(-) mix implies partial zeolitization; high Al2O3 suggests presence of clays.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	70.7	+/- 2.1	XRF	Quartz:	35.00
TiO2:	0.260	+/- 0.026	XRF	Corundum:	1.55
Al2O3:	13.18	+/- 0.40	XRF	Orthoclase:	26.79
Fe2O3:	1.54	+/- 0.05	XRF,V	Albite:	26.74
FeO:	0.12	+/- 0.01	V	Anorthite:	5.94
MnO:	0.039	+/- 0.008	XRF	Hypersthene:	1.79
MgO:	0.68	+/- 0.07	XRF	Magnetite:	
CaO:	1.21	+/- 0.04	XRF	Hematite:	1.62
Na2O:	3.01	+/- 0.09	XRF	Ilmenite:	0.35
K2O:	4.31	+/- 0.13	XRF	Rutile:	0.09
P2O5:	0.055	+/- 0.011	XRF	Apatite:	0.14
H2O(+):	2.78	+/- 0.08	G	H2O:	
H2O(-):	1.42	+/- 0.04	G		
Total:	99.344			Norm Total:	100.01
				Differentiation index:	
Total Fe as Fe2O3:	1.67	+/- 0.05	XRF	Qtz+Orth+Alb=	88.53
Loss on Ignition:	2.77	+/- 0.08	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: GU3-760.9/4A SAMPLE ORIGIN: Drill Hole USW GU-3
LOCATION: Depth 760.9 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: GU3-760.9/4A-B-2
Comments: Low H2O content typical for devitrified sample.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	76.1	+/- 2.3	XRF	Quartz:	34.50
TiO2:	0.110	+/- 0.011	XRF	Corundum:	0.30
Al2O3:	12.75	+/- 0.38	XRF	Orthoclase:	29.12
Fe2O3:	0.61	+/- 0.06	XRF,V	Albite:	32.06
FeO:	0.05	+/- 0.01	V	Anorthite:	2.67
MnO:	0.053	+/- 0.011	XRF	Hypersthene:	0.48
MgO:	0.19	+/- 0.02	XRF	Magnetite:	0.02
CaO:	0.55	+/- 0.06	XRF	Hematite:	0.60
Na2O:	3.76	+/- 0.11	XRF	Ilmenite:	0.21
K2O:	4.88	+/- 0.15	XRF	Rutile:	
P2O5:	0.013	+/- 0.003	XRF	Apatite:	0.03
H2O(+):	0.37	+/- 0.04	G	H2O:	
H2O(-):	0.16	+/- 0.02	G		
Total:	99.636			Norm Total:	99.99
				Differentiation index:	
Total Fe as Fe2O3:	0.67	+/- 0.07	XRF	Qtz+Orth+Alb=	95.68
Loss on Ignition:	0.37	+/- 0.04	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-742.75-E SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 742.75 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G4-742.75-E-B-2
Comments: Low H2O content typical for devitrified sample.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	77.0	+/- 2.3	XRF	Quartz:	36.41
TiO2:	0.102	+/- 0.010	XRF	Corundum:	0.47
Al2O3:	12.55	+/- 0.38	XRF	Orthoclase:	29.03
Fe2O3:	0.62	+/- 0.06	XRF,V	Albite:	30.03
FeO:	0.10	+/- 0.02	V	Anorthite:	2.61
MnO:	0.054	+/- 0.011	XRF	Hypersthene:	0.55
MgO:	0.22	+/- 0.02	XRF	Magnetite:	0.19
CaO:	0.54	+/- 0.05	XRF	Hematite:	0.49
Na2O:	3.54	+/- 0.11	XRF	Ilmenite:	0.19
K2O:	4.89	+/- 0.15	XRF	Rutile:	
P2O5:	0.012	+/- 0.002	XRF	Apatite:	0.03
H2O(+):	0.65	+/- 0.07	G	H2O:	
H2O(-):	0.19	+/- 0.02	G		
Total:	100.473			Norm Total:	100.00
				Differentiation index:	
Total Fe as Fe2O3:	0.73	+/- 0.07	XRF	Qtz+Orth+Alb=	95.47
Loss on Ignition:	0.64	+/- 0.06	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-742.75-G SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 742.75 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G4-742.75-G-B-2
Comments: Low H2O content typical for devitrified sample.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	76.9	+/- 2.3	XRF	Quartz:	37.05
TiO2:	0.105	+/- 0.011	XRF	Corundum:	0.77
Al2O3:	12.64	+/- 0.38	XRF	Orthoclase:	28.85
Fe2O3:	0.61	+/- 0.06	XRF,V	Albite:	29.24
FeO:	0.11	+/- 0.01	V	Anorthite:	2.60
MnO:	0.038	+/- 0.008	XRF	Hypersthene:	0.58
MgO:	0.23	+/- 0.02	XRF	Magnetite:	0.18
CaO:	0.54	+/- 0.05	XRF	Hematite:	0.49
Na2O:	3.44	+/- 0.10	XRF	Ilmenite:	0.20
K2O:	4.85	+/- 0.15	XRF	Rutile:	
P2O5:	0.014	+/- 0.003	XRF	Apatite:	0.03
H2O(+):	0.75	+/- 0.08	G	H2O:	
H2O(-):	0.18	+/- 0.02	G		
Total:	100.354			Norm Total:	99.99
				Differentiation index:	
Total Fe as Fe2O3:	0.73	+/- 0.07	XRF	Qtz+Orth+Alb=	95.14
Loss on Ignition:	0.74	+/- 0.07	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-965.2-D SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 965.2 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G4-965.2-D-B-2
Comments: Low H2O content typical for devitrified sample.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	76.0	+/- 2.3	XRF	Quartz:	36.41
TiO2:	0.100	+/- 0.010	XRF	Corundum:	0.56
Al2O3:	12.51	+/- 0.38	XRF	Orthoclase:	28.72
Fe2O3:	0.63	+/- 0.06	XRF,V	Albite:	30.22
FeO:	0.02	+/- 0.00	V	Anorthite:	2.72
MnO:	0.052	+/- 0.010	XRF	Hypersthene:	0.51
MgO:	0.20	+/- 0.02	XRF	Magnetite:	
CaO:	0.56	+/- 0.06	XRF	Hematite:	0.64
Na2O:	3.52	+/- 0.11	XRF	Ilmenite:	0.16
K2O:	4.78	+/- 0.14	XRF	Rutile:	0.02
P2O5:	0.015	+/- 0.003	XRF	Apatite:	0.04
H2O(+):	0.61	+/- 0.06	G	H2O:	
H2O(-):	0.16	+/- 0.02	G		
Total:	99.200			Norm Total:	100.00
				Differentiation index:	
Total Fe as Fe2O3:	0.66	+/- 0.07	XRF	Qtz+Orth+Alb=	95.35
Loss on Ignition:	0.61	+/- 0.06	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-1001.9-A SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 1001.9 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G4-1001.9-A-B-2
Comments: Low H2O content typical for devitrified sample.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	76.8	+/- 2.3	XRF	Quartz:	36.77
TiO2:	0.100	+/- 0.010	XRF	Corundum:	0.47
Al2O3:	12.46	+/- 0.37	XRF	Orthoclase:	28.17
Fe2O3:	0.62	+/- 0.06	XRF,V	Albite:	30.53
FeO:	0.02	+/- 0.00	V	Anorthite:	2.71
MnO:	0.055	+/- 0.011	XRF	Hypersthene:	0.50
MgO:	0.20	+/- 0.02	XRF	Magnetite:	
CaO:	0.56	+/- 0.06	XRF	Hematite:	0.63
Na2O:	3.58	+/- 0.11	XRF	Ilmenite:	0.16
K2O:	4.72	+/- 0.14	XRF	Rutile:	0.02
P2O5:	0.014	+/- 0.003	XRF	Apatite:	0.03
H2O(+):	0.62	+/- 0.06	G	H2O:	
H2O(-):	0.15	+/- 0.02	G		
				Norm Total:	99.99
Total:	99.859				
				Differentiation index:	
Total Fe as Fe2O3:	0.64	+/- 0.06	XRF	Qtz+Orth+Alb=	95.47
Loss on Ignition:	0.62	+/- 0.06	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7059

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-1369.1-E SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 1369.1 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G4-1369.1-E-B-2
Comments: H2O content implies perlitic glass and/or partial zeolitization. Normative corundum suggests possible clays.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method
SiO2:	73.6	+/- 2.2	XRF
TiO2:	0.110	+/- 0.011	XRF
Al2O3:	12.72	+/- 0.38	XRF
Fe2O3:	0.62	+/- 0.06	XRF,V
FeO:	0.10	+/- 0.02	V
MnO:	0.066	+/- 0.013	XRF
MgO:	0.13	+/- 0.01	XRF
CaO:	0.78	+/- 0.08	XRF
Na2O:	2.96	+/- 0.09	XRF
K2O:	4.92	+/- 0.15	XRF
P2O5:	0.014	+/- 0.003	XRF
H2O(+):	3.65	+/- 0.11	G
H2O(-):	0.50	+/- 0.05	G
Total:	100.155		
Total Fe as Fe2O3:	0.73	+/- 0.07	XRF
Loss on Ignition:	3.64	+/- 0.11	G

CIPW Normative Minerals	
Quartz:	37.22
Corundum:	1.17
Orthoclase:	30.31
Albite:	26.06
Anorthite:	3.94
Hypersthene:	0.34
Magnetite:	0.21
Hematite:	0.50
Ilmenite:	0.22
Rutile:	
Apatite:	0.03
H2O:	
Norm Total:	100.00
Differentiation index:	
Qtz+Orth+Alb=	93.59

Notes: 1. H2O(-) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

Bulk Chemistry Data Compilation for the Yucca Mountain Project SEPDB

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-1400.6-H SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 1400.6 ft TEST #: 1

Part 2. PARAMETERS

Whole-Rock Analysis Results

Whole-Rock Analysis IDs: G4-1400.6-H-B-2
Comments: H2O content suggests some zeolites present with glass.

Element/Oxide	Amount(%)	Estimated Error	Analysis Method	CIPW Normative Minerals	
SiO2:	70.9	+/- 2.1	XRF	Quartz:	38.75
TiO2:	0.100	+/- 0.010	XRF	Corundum:	0.39
Al2O3:	12.08	+/- 0.36	XRF	Orthoclase:	27.79
Fe2O3:	0.53	+/- 0.05	XRF,V	Albite:	23.79
FeO:	0.11	+/- 0.01	V	Anorthite:	8.05
MnO:	0.058	+/- 0.012	XRF	Hypersthene:	0.32
MgO:	0.12	+/- 0.01	XRF	Magnetite:	0.27
CaO:	1.52	+/- 0.05	XRF	Hematite:	0.38
Na2O:	2.60	+/- 0.08	XRF	Ilmenite:	0.21
K2O:	4.34	+/- 0.13	XRF	Rutile:	
P2O5:	0.016	+/- 0.003	XRF	Apatite:	0.04
H2O(+):	5.16	+/- 0.15	G	H2O:	
H2O(-):	2.86	+/- 0.09	G		
Total:	100.404			Norm Total:	99.99
				Differentiation index:	
Total Fe as Fe2O3:	0.65	+/- 0.07	XRF	Qtz+Orth+Alb=	90.33
Loss on Ignition:	5.15	+/- 0.15	G		

Notes: 1. H2O(+) includes H2O, CO2 & other volatiles.
2. Norms for samples are based on analyses normalized to 100% excluding all H2O from the norm. CIPW normative minerals are reported in weight percents.
3. Error values shown are based on acceptance criteria for whole-rock analyses specified in TP-61. Decimal places shown approximate the precision for that element.

Key to Analysis Method: XRF=X-ray fluorescence; V=volumetric analysis; AA=atomic absorption; G=gravimetric analysis; C=colorimetric analysis.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007 and TP-61 for details of procedures followed.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REP #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

APPENDIX D

DATA COMPILATION FORMS FOR QUALITATIVE X-RAY DIFFRACTION ANALYSES

NOTE: No XRD analysis was performed for Sample G1-3498.4-SLB because the material returned from SNL after physical property measurements was not representative of the original whole-rock.

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: A1-212.7 SAMPLE ORIGIN: Drill Hole UE-25a#1
LOCATION: Depth 212.7 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: A1-212.7-B-1-B
Initial data collected on 1/04/90 using filename: A1-212-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:			Montmorillonite:	Yes	Maj?
Cristobalite:	Poss		Illite:		
Tridymite:			Smectite:		
Opal-CT:	Prob	Min	Saponite:	Yes	Maj?
Feldspars----------			Chlorite:	Prob	Min
Plagioclase:			Other Clays:	Poss	Tr
Sanidine:			Other Phases---------		
Anorthoclase:			Glass:	Yes	Maj
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----- -------			All Others:		
Clinoptilolite:					
Mordenite:					
Phillipsite:					
Heulandite:					
Analcime:					

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Rectorite, Halloysite-7A
Other Phases: None Identified
Notes on XRD Analysis:
Clays are probably poorly crystalline. Broad 20-30 deg "hump" indicates glass present. Very low counts (max 180 cps clay peak) indicates poor crystallinity, and probable glass dominance. ID based on detailed JCPDS Card comparison with raw data. Opal-CT probable due to 20 and 35 deg peaks.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1487.4-SLA1 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1487.4 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-1487.4-SLA1-B-1-B
Initial data collected on 1/04/90 using filename: G1-1487-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Min	Montmorillonite:		
Cristobalite:			Illite:		
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Poss	Min	Other Clays:		
Sanidine:	Poss	Min	Other Phases---------		
Anorthoclase:	Prob	Min	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:	Poss	Tr
Clinoptilolite:	Yes	Maj			
Mordenite:			** ID Criteria:		
Phillipsite:			Yes = Positive ID		
Heulandite:	Poss	Maj?	Prob = Probably Present		
Analcime:			Poss = Possibly Present		
			Blank = Not identified		

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: Mn Oxides (pyrolusite, cryptomelane, or hollandite)
Notes on XRD Analysis:
Overall low counts (max 370 cps on zeolite peak).
Mineral ID based on extensive comparison of possible phases with net intensity file for sample. Mn-oxides not good match, but may account for broad peak at 37.2 deg.
G1-1487-1, G1-1550-1 and G1-1551-1 are all very similar.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1550.4-SLA28 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1550.4 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-1550.4-SLA28-B-1-B
Initial data collected on 1/04/90 using filename: G1-1550-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Min	Montmorillonite:		
Cristobalite:			Illite:		
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Yes	Min	Other Clays:		
Sanidine:			Other Phases---------		
Anorthoclase:	Poss	Min	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:	Poss	Tr
Clinoptilolite:	Yes	Maj			
Mordenite:					
Phillipsite:					
Heulandite:	Poss	Maj?			
Analcime:					

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: Mn Oxides (pyrolusite, cryptomelane, or hollandite)
Notes on XRD Analysis:
Overall low counts (max 350 cps on zeolite peak).
Mineral ID based on extensive comparison of possible phases with net intensity file for sample. Mn-oxides not good match, but may account for broad peak at 37.2 deg.
G1-1487-1, G1-1550-1 and G1-1551-1 are all very similar.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTINC INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1551.1-SLA29 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1551.1 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-1551.1-SLA29-B-1-B
Initial data collected on 1/04/90 using filename: G1-1551-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases			Clays		
Quartz:	Yes	Min	Montmorillonite:		
Cristobalite:			Illite:		
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars			Chlorite:		
Plagioclase:	Yes	Min	Other Clays:		
Sanidine:			Other Phases		
Anorthoclase:	Poss	Min?	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites			All Others:	Poss	Tr
Clinoptilolite:	Yes	Maj			
Mordenite:					
Phillipsite:					
Heulandite:	Poss	Maj?			
Analcime:					

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: Mn Oxides (pyrolusite, cryptomelane, or hollandite)
Notes on XRD Analysis:
Overall low counts (max 340 cps on zeolite peak).
Mineral ID based on extensive comparison of possible phases with net intensity file for sample. Mn-oxides not good match, but may account for broad peak at 37.2 deg.
G1-1551-1, G1-1550-1 and G1-1487-1 are all very similar.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1784.8-SLA19 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1784.8 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-1784.8-SLA19-B-1-B
Initial data collected on 1/04/90 using filename: G1-1784-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Maj?	Montmorillonite:		
Cristobalite:			Illite:		
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Yes	Maj	Other Clays:		
Sanidine:			Other Phases---------		
Anorthoclase:			Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:	Yes	Min?			
Mordenite:			** ID Criteria:		
Phillipsite:			Yes = Positive ID		
Heulandite:	Poss	Min?	Prob = Probably Present		
Analcime:			Poss = Possibly Present		
			Blank = Not identified		

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Moderate intensity pattern (max 1000 cps feldspar peak).
Feldspars dominate with quartz somewhat subordinate.
Clinoptilolite/heulandite is clearly present in minor amounts.
ID based on comparisons of sample raw data and net intensity with JCPDS card patterns.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-1785.6-SLA20 SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 1785.6 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-1785.6-SLA20-B-1-B
Initial data collected on 1/08/90 using filename: G1-1785-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases		
Quartz:	Yes	Maj
Cristobalite:	Poss	Min
Tridymite:	Poss	Tr?
Opal-CT:		
Feldspars		
Plagioclase:	Prob	Maj
Sanidine:		
Anorthoclase:		
Orthoclase:		
Microcline:		
Zeolites		
Clinoptilolite:	Prob	Min
Mordenite:		
Phillipsite:		
Heulandite:	Prob	Min?
Analcime:		
Clays		
Montmorillonite:		
Illite:		
Smectite:		
Saponite:		
Chlorite:		
Other Clays:	Poss	Tr?
Other Phases		
Glass:		
Calcite:		
Aragonite:		
All Others:		

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: QUALITATIVE ONLY
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: See comments.
Other Phases: None Identified
Notes on XRD Analysis:
Overall low counts (max 370 cps on feldspar peak). Mineral ID based on JCPDS card comparison with raw and net intenstiy data. Feldspar peak strongest, then quartz, then clinoptilolite. Possible clays due to small peaks in the 34-44 deg range.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-2276-SF SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 2276 ft TEST #: 1

Part 2. PARAMETERS
X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-2276-SF-B-1-B
Initial data collected on 1/08/90 using filename: G1-2276-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases---------			Clays----------		
Quartz:	Yes	Min	Montmorillonite:		
Cristobalite:			Illite:		
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Maj	Other Clays:		
Sanidine:			Other Phases---------		
Anorthoclase:	Poss	Maj?	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:	Prob	Maj			
Mordenite:	Yes	Maj			
Phillipsite:					
Heulandite:	Poss	Min?			
Analcime:					

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: QUALITATIVE ONLY
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Overall low counts (max 360 cps on feldspar peak). Mineral ID based on JCPDS card comparison with raw data file. Zeolites clearly dominate the pattern, with subordinate feldspar and quartz.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-2589-SD SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 2589 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-2589-SD-B-1
Initial data collected on 1/08/90 using filename: G1-2589-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Tr	Montmorillonite:		
Cristobalite:	Poss	Tr?	Illite:	Yes	Min
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Maj	Other Clays:	Poss	Tr?
Sanidine:			Other Phases---------		
Anorthoclase:	Poss	Min?	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:	Yes	Maj			
Mordenite:	Yes	Maj			
Phillipsite:					
Heulandite:	Poss	Maj?			
Analcime:					

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: QUALITATIVE ONLY
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Possible clinochlore, saponite
Other Phases: None Identified
Notes on XRD Analysis:
Overall low counts (max 275 cps on feldspar peak). Mineral ID based on JCPDS card comparison with RD and NI files. Zeolites appear to be dominant, with feldspar peaks subordinate and minor quartz. Very similar to G1-2276-1 except for stronger mordenite peaks, sharp peak at 39.5 deg, and small illite peak (9 deg).

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-2699.1-SLB SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 2699.1 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-2699.1-SLB-B-1-B
Initial data collected on 1/08/90 using filename: G1-2699-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Min	Montmorillonite:		
Cristobalite:	Poss	Min?	Illite:	Yes	Min
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Maj	Other Clays:		
Sanidine:	Poss	Min?	Other Phases---------		
Anorthoclase:	Poss	Min?	Glass:		
Orthoclase:	Poss	Min?	Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:	Poss	Tr?
Clinoptilolite:	Yes	Maj			
Mordenite:			** ID Criteria:		
Phillipsite:			Yes = Positive ID		
Heulandite:	Poss	Maj?	Prob = Probably Present		
Analcime:			Poss = Possibly Present		
			Blank = Not identified		

XRD Data Restrictions: QUALITATIVE ONLY
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: Fe-Mn oxide jacobsite is possible.
Notes on XRD Analysis:
Overall low counts (max 400 cps on feldspar peak). Mineral ID based on JCPDS card comparison with RD and NI data files. Strong feldspar peaks around 27.8 deg., zeolites dominant, quartz is minor but present. Strong illite peak at 9 deg with minor peaks present also.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-2996.9-SLB SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 2996.9 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-2996.9-SLB-B-1-B
Initial data collected on 1/08/90 using filename: G1-2996-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Maj	Montmorillonite:		
Cristobalite:			Illite:	Poss	Tr
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:			Other Clays:		
Sanidine:	Prob	Maj	Other Phases---------		
Anorthoclase:	Prob	Maj	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:					
Mordenite:					
Phillipsite:					
Heulandite:					
Analcime:					

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: QUALITATIVE ONLY
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Overall strong pattern (max 1400 cps on quartz peak). Mineral ID based on JCPDS card comparison with net intensity data. Quartz clearly dominates pattern, with subordinate feldspars. Small peak at 8.8 deg best accounted for by small amount of illite; no other phases are apparent.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G1-3102.3-SLD SAMPLE ORIGIN: Drill Hole USW G-1
LOCATION: Depth 3102.3 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G1-3102.3-SLD-B-1-B
Initial data collected on 1/08/90 using filename: G1-3102-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Maj	Montmorillonite:		
Cristobalite:			Illite:	Prob	Tr
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Min	Other Clays:	Poss	Tr?
Sanidine:			Other Phases---------		
Anorthoclase:			Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:	Prob	Min			
Mordenite:			** ID Criteria:		
Phillipsite:			Yes = Positive ID		
Heulandite:	Poss	Min?	Prob = Probably Present		
Analcime:	Poss	Tr?	Poss = Possibly Present		
			Blank = Not identified		

XRD Data Restrictions: QUALITATIVE ONLY
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Possible rectorite
Other Phases: None Identified
Notes on XRD Analysis:
Moderately strong pattern (max 1000 cps quartz peak). Mineral ID by JCPDS card/raw data and net intensity comparison. Quartz peak dominates and minor peak relative intensities suggest no other components in main peak. Small but definite 8.8 deg illite peak.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: GU3-760.9/4A SAMPLE ORIGIN: Drill Hole USW GU-3
LOCATION: Depth 760.9 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: GU3-760.9/4A-B-1-B
Initial data collected on 1/08/90 using filename: GU3-760-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Tr?	Montmorillonite:		
Cristobalite:	Yes	Maj	Illite:		
Tridymite:	Prob	Tr	Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Maj?	Other Clays:		
Sanidine:	Prob	Min	Other Phases---------		
Anorthoclase:			Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:					
Mordenite:					
Phillipsite:					
Heulandite:					
Analcime:					

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: QUALITATIVE ONLY
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Moderately strong pattern (max 1000 cps on cristobalite peak).
Mineral ID by JCPDS card/raw data and net intensity comparison.
Cristobalite dominant, quartz present as very minor phase.
Tridymite probable with 20.7 and 21.1 deg peaks.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-742.75-E SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 742.75 ft TEST #: 1

Part 2. PARAMETERS
X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G4-742.75-E-B-1-B
Initial data collected on 1/09/90 using filename: G4-742E-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Min	Montmorillonite:		
Cristobalite:	Yes	Maj	Illite:		
Tridymite:	Prob	Min	Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Maj	Other Clays:		
Sanidine:	Yes	Min	Other Phases---------		
Anorthoclase:	Prob	Maj	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:					
Mordenite:			** ID Criteria:		
Phillipsite:			Yes = Positive ID		
Heulandite:			Prob = Probably Present		
Analcime:			Poss = Possibly Present		
			Blank = Not identified		

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Strong pattern (max 1250 cps on cristobalite peak). Most phases well accounted for by matched cards except for sanidine. Peak at 21 deg is unmatched, but is probably tridymite, since this positively identified in thin section. Virtually identical to G4-742G-1.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-742.75-G SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 742.75 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G4-742.75-G-B-1
Initial data collected on 1/09/90 using filename: G4-742G-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Min	Montmorillonite:		
Cristobalite:	Yes	Maj	Illite:		
Tridymite:	Prob	Min	Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Maj	Other Clays:		
Sanidine:	Yes	Min	Other Phases---------		
Anorthoclase:	Prob	Maj	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:					
Mordenite:			** ID Criteria:		
Phillipsite:			Yes = Positive ID		
Heulandite:			Prob = Probably Present		
Analcime:			Poss = Possibly Present		
			Blank = Not identified		

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Strong pattern (max 1205 cps on cristobalite peak). Most phases well accounted for by matched cards except for sanidine. Peak at 21 deg is unmatched, but is probably tridymite, since this positively identified in thin section. Virtually identical to G4-742E-1.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-965.2-D SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 965.2 ft TEST #: 1

Part 2. PARAMETERS

X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G4-965.2-D-B-1-B
Initial data collected on 1/09/90 using filename: G4-965-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Maj	Montmorillonite:		
Cristobalite:	Yes	Maj	Illite:		
Tridymite:	Poss	Tr	Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Min	Other Clays:		
Sanidine:	Prob	Min	Other Phases---------		
Anorthoclase:	Prob	Maj	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:					
Mordenite:			** ID Criteria:		
Phillipsite:			Yes = Positive ID		
Heulandite:			Prob = Probably Present		
Analcime:			Poss = Possibly Present		
			Blank = Not identified		

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Strong pattern (max 1255 cps on quartz peak). Most cards match well except plagioclase which overlaps cristobalite too strongly. 20.8 deg may be weak tridymite with quartz peak overlap. Series of samples (G4-742, 965 and 1001) show increase in quartz relative to cristobalite + tridymite with depth.

Part 3. EXPERIMENT CONDITIONS

Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA: III
GATHERING ACTIVITY: YMP DRMS DATA SET ID: 51/L04-2/21/86
SNL DATA REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-1001.9-A SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 1001.9 ft TEST #: 1

Part 2. PARAMETERS
X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G4-1001.9-A-B-1-B
Initial data collected on 1/09/90 using filename: G4-1001-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)	Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------			Clays----------		
Quartz:	Yes	Maj	Montmorillonite:		
Cristobalite:	Poss	Min	Illite:		
Tridymite:			Smectite:		
Opal-CT:			Saponite:		
Feldspars----------			Chlorite:		
Plagioclase:	Prob	Maj?	Other Clays:		
Sanidine:	Prob	Min?	Other Phases---------		
Anorthoclase:	Poss	Maj?	Glass:		
Orthoclase:			Calcite:		
Microcline:			Aragonite:		
Zeolites----------			All Others:		
Clinoptilolite:					
Mordenite:			** ID Criteria:		
Phillipsite:			Yes = Positive ID		
Heulandite:			Prob = Probably Present		
Analcime:			Poss = Possibly Present		
			Blank = Not identified		

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Strong pattern (max 1420 cps on quartz peak). No feldspar cards are perfect matches. Cristobalite peak notably weaker than in shallower samples, with quartz strongly dominant peak. Quartz, plagioclase, and sanidine can account for virtually all peaks.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-1369.1-E SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 1369.1 ft TEST #: 1

Part 2. PARAMETERS
X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G4-1369.1-E-B-1-B
Initial data collected on 1/09/90 using filename: G4-1369-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------		
Quartz:	Yes	Tr
Cristobalite:		
Tridymite:		
Opal-CT:	Yes	Min?
Feldspars----------		
Plagioclase:	Prob	Min
Sanidine:		
Anorthoclase:		
Orthoclase:		
Microcline:		
Zeolites----------		
Clinoptilolite:		
Mordenite:		
Phillipsite:		
Heulandite:		
Analcime:		

Mineral	Criteria for ID**	Amount Est.(@)
Clays----------		
Montmorillonite:		
Illite:		
Smectite:		
Saponite:		
Chlorite:		
Other Clays:	Poss	Tr
Other Phases---------		
Glass:	Yes	Maj
Calcite:		
Aragonite:		
All Others:		

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Poss 11.8 A clay, maybe Rectorite
Other Phases: None Identified
Notes on XRD Analysis:
Overall weak pattern (max 275 cps on Albite peak). Broad, low intensity "hump" in 20 to 30 deg range indicates glass dominant. Albite best match for sharp 28 deg peak. Opal-CT is positive ID, and a small quartz peak is present. Feldspar and quartz are probably phenocryst phases.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007. TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

X-Ray Diffraction Data Compilation, Yucca Mountain Project SEPDB
(Qualitative Results only)

Part 1. SAMPLE LOCATION AND IDENTIFICATION

SAMPLE ID: G4-1400.6-H SAMPLE ORIGIN: Drill Hole USW G-4
LOCATION: Depth 1400.6 ft TEST #: 1

Part 2. PARAMETERS
X-Ray Diffraction (XRD) Analysis Results

XRD Analysis IDs: G4-1400.6-H-B-1-B
Initial data collected on 1/09/90 using filename: G4-1400-1

Mineral and Glass Identification by X-Ray Diffraction

Mineral	Criteria for ID**	Amount Est.(@)
Silica Phases--------		
Quartz:	Yes	Min
Cristobalite:		
Tridymite:		
Opal-CT:	Prob	Min
Feldspars----------		
Plagioclase:	Poss	Min
Sanidine:		
Anorthoclase:		
Orthoclase:		
Microcline:		
Zeolites----------		
Clinoptilolite:	Yes	Min
Mordenite:	Poss	Min?
Phillipsite:		
Heulandite:	Poss	Min
Analcime:		

Mineral	Criteria for ID**	Amount Est.(@)
Clays----------		
Montmorillonite:		
Illite:		
Smectite:		
Saponite:		
Chlorite:		
Other Clays:		
Other Phases---------		
Glass:	Yes	Maj
Calcite:		
Aragonite:		
All Others:		

** ID Criteria:
Yes = Positive ID
Prob = Probably Present
Poss = Possibly Present
Blank = Not identified

XRD Data Restrictions: None
Note @: Qualitative Estimate. Maj=Major Phase; Min=Minor; Tr=Trace
Other Clays: Not Identified
Other Phases: None Identified
Notes on XRD Analysis:
Overall weak pattern (max 250 cps on zeolite peak). Broad, low intensity "hump" in 20 to 30 deg range indicates glass dominant. Clinoptilolite best zeolite match; hard to positively ID others. Small quartz peak evident, and weak feldspar at 27.8. Opal-CT is probable, and no clay peaks are evident.

Part 3. EXPERIMENT CONDITIONS
Standard. See EP-0007, TP-62 & TP-102 for conditions and procedures.

Part 4. REFERENCE AND SUPPORTING INFORMATION

QA LEVEL OF DATA YMP DRMS DATA SET SNL DATA
GATHERING ACTIVITY: III ID: 51/L04-2/21/86 REPT #: SAND90-7058

DCF COMPILED BY: J.R. Connolly DIV: 6315 (UNM) Date: 7/06/90

APPENDIX E

APPLICABILITY TO REFERENCE INFORMATION BASE AND SITE AND ENGINEERING PROPERTY DATABASE

All data presented on the data compilation forms in Appendix C are intended for entry in the Site and Engineering Properties Data Base (SEPDB).

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