U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MODAL ANALYSES OF SELECTED TERTIARY VOLCANIC ROCKS FROM NYE AND LINCOLN COUNTIES, NEVADA

By

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Open-File Report 94-151

1994

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ABSTRACT

Results of modal analyses of more than three hundred samples of middle Tertiary ash-flow tuff units common to eastern Nevada are presented in this report. Such analyses play an important role in defining, correlating, and identifying sources of ash-flow tuffs. The purpose of this report is to provide information for current and future stratigraphic investigations and correlations of selected volcanic outflow cooling units in the eastern Nevada portion of the Basin and Range Province.

The original modal data from thin section analyses were recorded onto five by eight inch index cards. The major objective of this report was to transfer the data from these cards to computer format. This task was preformed for the following reasons: 1) for accessibility of the data to other workers involved in stratigraphic and structural studies in the region; and 2) to duplicate the modal cards, as they are the sole copy of this database, compiled over a thirty year period.

INTRODUCTION

This report consists of petrographic modal data determined for middle Tertiary tuff samples collected from thirteen selected stratigraphic sections in eastern Nevada. Sampling efforts were conducted in the 1960's and 70's by members of the USGS Central Nevada Project, whose primary objective included regional investigations of ash-flow sheets and their sources in Nye and Lincoln Counties, Nevada. This objective was carried out by establishing a petrographic data set, based on modal phenocryst composition, that could be used to correlate ash-flow tuffs units of the region. As stated by Best, Christiansen, and others (1989), "stratigraphic sequence combined with modal phenocryst composition serves as primary correlation criteria".

USGS Project members sampled stratigraphic sections of Cook (1965), who in addition to J. Hoover Mackin and students, pioneered stratigraphic studies of the voluminous ash-flow sheets that blanket the eastern Great Basin. Sections of Cook in this report include: Forest Home, located on the east side of the Grant Range; Golden Gate Range; North Seaman Range; southwest and southern Egan Range, and Shingle Spring in the Egan Range; Ely Range (Schell Creek Range in this report); Condor Canyon; and Hiko West (Hancock Summit section in this report) in the Pahranagat Range. Other sections of the report include the Hubbard and Sherwood sections of Scott (1965) in the Grant Range, Crested Wheat section of Dixon and others (1972), and the Sandy Summit section of Snyder, Ekren, and Dixon (1972). All sampled section locations are shown in plate 1.

Sampling focused on documenting the occurrence and collecting representative sample suites for stratigraphic units exposed at each section; therefore, these stratigraphic sections are referred to as "sampled" sections, rather than "measured" sections.

After the samples were collected, thin sections were prepared and analyzed. Modal phenocryst data was recorded onto index cards as each thin section was analyzed. The index cards (shown in figure 1) were designed to define each sample based on a modal classification scheme. Point counts were tallied; phenocryst, groundmass, and lithic percentages were calculated; and notes were recorded on characteristics and morphology of phenocrysts, texture, lithic fragments, and crystallinity. The index cards included color-coded bar graphs that represented volume

percentages of the different rock forming minerals in each sample. The varicolored bar graphs could be laid out on a table or mounted on a bulletin board to correlate ash-flow tuff units from one section to another.

STRATIGRAPHY

This part of the report reviews modal phenocryst and other petrographic data that distinguish stratigraphic units from one another at the selected sampled sections. For greater stratigraphic detail of these rocks, such as paleomagnetic, geochemical, and geochronological analyses, the reader is referred to other reports, many of which are referenced below.

When reviewing this database, the reader should entertain the concept of modal variability within some volcanic stratigraphic units, especially zoned ash-flow sheets. The best example from this report is the Monotony Tuff at the Sandy Summit section (appendix), where a relatively complete section of Monotony was sampled. Modal analyses suggest that the Monotony Tuff is compositionally zoned at this location (see below for further details).

Although not demonstrated in this report, the Windous Butte formation is an example of a zoned ash-flow sheet that grades upward from a crystal-poor rhyolitic lower part, to a quartz latitic top (Best, Christiansen, and others, 1989); in this case, the top of the unit could be mistaken for the Monotony Tuff or units of the Needles Range Group. Scott and others (in press) also noted modal variability in the Hiko Tuff and suggested the Hiko may be compositionally zoned.

The Windous Butte Formation, named by Cook (1965), is a crystal-rich, low-silica rhyolitic ash-flow tuff that is 31.3 Ma (Best, Christiansen, and others, 1989). The formation is reported to be an outflow sheet of the Williams Ridge caldera of the central Nevada caldera complex (Best, Christiansen, and others, 1989; Best and others, 1993). The formation is exposed at the Crested Wheat, Hubbard, Forest Home, southern Egan Range, and Shingle Spring sections (appendix). Samples from these sections consist of dominant plagioclase (45 to 64 percent), a relative abundance of quartz (15 to 36 percent), lesser amounts of alkali feldspar (2 to 14 percent), biotite (3 to 12 percent), and hornblende (0 to 5 percent).

The Needles Range Formation was originally named by Mackin (1960), but was subsequently raised to group rank by Best and Grant (1987). Formations of the Needles Range Group presented in this report are the Cottonwood Wash, Wah Wah Springs and Lund Formations of Best and Grant (1987); all three are crystal-rich dacite ash-flow sheets that are petrographically distinct, and are associated with the Indian Peak caldera complex (Best and Grant, 1987; Best, Christiansen, and Blank, 1989; and Best and others, 1993).

The Cottonwood Wash Formation contains a wide range in values of total percent phenocrysts (from 17 to 46 percent), abundant plagioclase (49 to 65 percent) and lesser amounts of quartz (7 to 22 percent) and alkali feldspar (0 to 7 percent), and is distinguished from other units by the presence of large books of biotite (Best and Grant, 1987; Scott and others, in press). The Wah Wah Springs Formation generally has greater amounts of hornblende than biotite, and the Lund Formation is characterized by a relative abundance of quartz, and trace amounts of sphene (Best and Grant, 1987; in this report, see appendix). Average K-Ar ages of the Cottonwood Wash, Wah Wah Springs, and Lund Formations are respectively: 30.6 Ma; 29.5 Ma;

and 27.9 Ma (Best and Grant, 1987); however, more recent $^{40}Ar/^{39}Ar$ dating of constraining stratigraphic units indicate average ages for the two older units are too young by as much as one million years (Best, written commun., 1994).

The Monotony Tuff was defined by Ekren and others (1971) who identified a source area for the unit in the Pancake Range (pl. 1) of eastern Nevada (Ekren and others, 1972). The Monotony Tuff is lithologically similar to the Needles Range Group, however, the distinctive phenocryst compositions of the three formations in the Needles Range Group differentiate the units. In addition, samples of the Monotony in this report tend to show greater amounts of pyroxene than formations of the Needles Range Group (appendix). A relatively complete suite of samples for the Monotony was analyzed from the Sandy Summit section; this section is unique because modal data indicate the Monotony is compositionally zoned at this location. The data display an upward increase in total percent phenocrysts (from 22 percent at the base of the section to almost 50 percent at the top) and quartz phenocrysts (from 7 percent at the base, to 32 percent at the top), and a steady upward decrease in plagioclase and mafic phenocrysts (appendix). The Monotony is subdivided into lower, middle, and upper parts to illustrate this compositional variability. Best, Christiansen and others (1989) listed one $^{40}Ar/^{39}Ar$ age of 27.3 Ma for the Monotony Tuff.

The Isom Formation was originally defined by Mackin (1960), but was later redefined by Anderson and Rowley (1975) to include three members; in ascending order they are the Blue Meadows, Baldhills, and Hole-in-the-Wall Tuff Members. The source of the younger two members is believed to be just southeast of the Indian Peak caldera complex (Anderson and Rowley, 1975; Best, Christiansen and others, 1989). The average age of the Isom Formation is 27 Ma (Best, Christiansen and Blank, 1989). No attempt was made to correlate samples of the Isom in this report with the members of Anderson and Rowley (1975) because of the small sample number; therefore, these samples are referred to as ash-flow tuffs of the Isom compositional type. The term "compositional type" was used by Best, Christiansen, and others (1989) to designate stratigraphic units so compositionally similar, that stratigraphic correlations among the units are difficult. Samples of the Isom were analyzed from the North Seaman Range, Southwest Egan Range, Southern Egan Range, and Hancock Summit sections (appendix). At every section, the Isom-type ash-flow tuffs directly underlie the olivine-bearing lower Shingle Pass cooling unit, and overlie either the Lund Formation or Monotony Tuff. Samples of the Isom of this report consisted of 1 to 9 percent total phenocrysts, 68 to 89 percent plagioclase, 0 to 7 percent quartz, 1 to 10 percent pyroxene (both clinopyroxene and orthopyroxene), and trace amounts of hornblende and biotite (appendix).

The Shingle Pass Tuff was named by Cook (1965). The type section for the unit is Shingle Spring in the Egan Range, a stratigraphic section included within this report (appendix). The Shingle Pass Tuff is reported to consist of three cooling units (Ekren and others, 1971). In this report, the lower and upper units were identified in the Hubbard, North Seaman Range, Southwest Egan Range, Shingle Spring, and Hancock Summit sections (appendix). In addition, the lower cooling unit is present in the Golden Gate Range and Southern Egan Range sections, and the upper unit is present in the Crested Wheat section.

The lower Shingle Pass cooling unit is most often characterized by having a two-pyroxene phenocryst assemblage and Fe-rich olivine. Analyses of samples from three of seven sections showed more alkali feldspar than plagioclase, two sections showed greater plagioclase than alkali feldspar, and the remaining two sections showed subequal amounts of plagioclase and alkali feldspar. In contrast, the upper cooling unit

consisted of dominant plagioclase, small amounts alkali feldspar, biotite, and no olivine. The source area of the Shingle Pass Tuff is believed to be in the Quinn Canyon Range (Sargent and Houser, 1970) (pl. 1); the age of the lower cooling unit is 26.0 Ma, and the upper is 26.7 Ma (Best, Christiansen, and others, 1989).

At several sections in this report (Hubbard, North Seaman Range, Southwest Egan Range, and Hancock Summit), another ash-flow tuff unit is present between the lower and upper Shingle Pass cooling units. This unit is here informally named the tuff of Murphy Gap, for its well exposed location at the southern end of the Golden Gate Range (pl. 1). The tuff of Murphy Gap is petrographically distinct from the Shingle Pass cooling units because it is more crystal-rich (10-30 percent phenocrysts), and has greater amounts of quartz phenocrysts (20-40 percent) (appendix).

The Leach Canyon Formation, named by Mackin (1960), and later subdivided into members known as the Narrows Tuff Member and overlying Table Butte Tuff Member (Anderson and Rowley, 1975). The Leach Canyon is present in the North Seaman Range and Condor Canyon sections where it is characterized as containing about 12-25 percent phenocrysts dominated by plagioclase, a relative abundance of quartz (20-40 percent), and lesser amounts of alkali feldspar, biotite, hornblende, and pyroxene (appendix). Trace amounts of sphene also characterize the Leach Canyon. The age of the Leach Canyon Formation is 23.8 Ma (Armstrong, 1970; Best and others, 1993).

The Condor Canyon Formation was named by Cook (1965) and subdivided into two units known as the Swett Tuff Member, and the Bauers Tuff Member (Anderson and Rowley, 1975). The source of these units is believed to be the Caliente caldera complex (Best, Christiansen, and others, 1989; Rowley and Siders, 1988). Both members are present in the Condor Canyon section; only the Bauers Tuff Member was present in the North Seaman Range section. The members of the Condor Canyon Formation are distinctive because neither member contains quartz phenocrysts, and the Swett Tuff Member lacks alkali feldspar (appendix). The average K-Ar age of the Swett Tuff Member is 23.7 Ma (Armstrong, 1970), and 22.7 Ma for the Bauers Tuff Member (Armstrong, 1970; Noble and McKee, 1972).

The Pahranagat Formation was originally named the Pahranagat Lakes tuff by Williams (1967), but was redefined as the Pahranagat Formation by Scott and others (in press). Five samples of the Pahranagat Formation were analyzed from the Shingle Spring section, and one from the North Seaman Range section. Analyzed samples showed about 15-30 percent total phenocrysts composed dominantly of plagioclase, subequal amounts of quartz and alkali feldspar, lesser biotite, and trace amounts of hornblende and pyroxene (appendix). The average age of the formation is 22.6 Ma (Deino and Best, 1988).

The Harmony Hills Tuff is one of the most distinctive ash-flow tuff units in the Great Basin because of the high amount of phenocrysts present in the rock. The unit was originally defined by Mackin (1960) as the youngest member of the Quichapa Group, but was later raised to formational rank by Cook (1965). Only three samples were analyzed in this report from the Condor Canyon section; samples displayed 47-50 percent phenocrysts, composed of 60-70 percent plagioclase, 15-20 percent biotite, from 1-10 percent quartz, hornblende, and pyroxene, and insignificant amounts of alkali feldspar. The source area for the Harmony Hills has been postulated to be either in the Bull Valley Mountains of Utah (Blank, 1959; Williams, 1967) or the southern Caliente caldera complex (Rowley and others, 1979; Ekren and others, 1977). The average K-Ar age for the Harmony Hills is 21.0 Ma (Armstrong, 1970; Noble and

McKee, 1972), but a better age is thought to be between 21.7 and 22.6 Ma based on additional age data from Rowley and others (1989).

The Hiko Tuff was named by Dolgoff (1963). The outflow facies of the unit is distinctive in outcrop because it weathers as large boulders that form massive, granite-like knobby cliffs. Three samples were analyzed from the Condor Canyon section that ranged from 28 to 34 percent total phenocrysts, 48 to 62 percent plagioclase, 13 to 28 percent alkali feldspar, 10 to 12 percent biotite, 8 to 9 percent quartz, 3 to 6 percent hornblende, and trace amounts of pyroxene and sphene. Rowley and Siders (1988) identified the source area for the Hiko Tuff as the Delamar caldera, part of the Caliente caldera complex. The age of the Hiko Tuff is 18.6 Ma (Taylor and others, 1989).

The Crested Wheat section contains several units not present at any other section. These units include the tuff of Crested Wheat Ridge, the D unit of the Bates Mountain Tuff, and the tuff of Clipper Gap. The tuff of Crested Wheat Ridge was named by Dixon and others (1972) for its type section in the Pritchards station quadrangle, Nye County, Nevada. The samples in this report correlate with Unit A (oldest) and Unit B (youngest) of Dixon and others (1972). Samples CW-8 through CW-11 correlate with Unit A, and showed 27 to 31 percent total phenocrysts, 22 to 27 percent quartz, 32 to 39 percent alkali feldspar, 33 to 37 percent plagioclase, 4 to 7 percent biotite, and trace amounts of hornblende (appendix). This unit has is also referred to as the "rib former" because of its resistant character in outcrop (Dixon and others, 1972). An age of 28.6 Ma was reported for this unit (Dixon and others, 1972).

Samples CW-13 through CW-17 correlate with map Unit B of Dixon and others (1972), and showed 37 to 42 percent total phenocrysts, 20 to 32 percent quartz, 17 to 27 percent alkali feldspar, 33 to 51 percent plagioclase, 6 to 8 percent biotite, 0 to 3 percent hornblende, and trace amounts of orthopyroxene (appendix).

Overlying the upper Shingle Pass cooling unit at the Crested Wheat section is the Bates Mountain Tuff, named by Stewart and McKee (1968) from studies in Lander County, Nevada, and described in detail by Gromme' and others (1972), McKee (1976), and Sargent and McKee (1969). Three samples were analyzed from the Crested Wheat section and are correlated with the Bates Mountain D unit of Gromme' and others (1972). Analyzed samples ranged from 2 to 5 percent total phenocrysts, 3 to 4 percent quartz, 45 to 85 percent alkali feldspar, 6 to 20 percent plagioclase, 0 to 4 percent biotite, about 1 percent pyroxene (clinopyroxene), and trace amounts of hornblende (appendix). K-Ar ages for the Bates Mountain D unit are 22.8 Ma (Sargent and McKee, 1969), 23.1 Ma (Gromme' and others, 1972), and 23.3 Ma (McKee and Stewart, 1971), but Deino (1989) gives a $^{40}Ar/^{39}Ar$ age of 25.1 Ma.

Overlying the Bates Mountain Tuff at the Crested Wheat section is the tuff of Clipper Gap. Named by Gromme' and others (1972), the unit is a crystal-poor rhyolite similar to the underlying Bates Mountain Tuff. Only one sample was analyzed that displayed about 7 percent total phenocrysts, 15 percent quartz, 52 percent alkali feldspar, 24 percent plagioclase, 4 percent biotite, and 2 percent hornblende (appendix). The K-Ar age for the tuff of Clipper Gap is 22.1 Ma (Gromme' and others, 1972).

At the Schell Creek section, underlying the Cottonwood Wash Formation, is the tuff of Pritchards Station. This unit was named by Dixon and others (1972) for its type locality in the Pritchards Station quadrangle, Nye County, Nevada. Only two samples were analyzed from the section. Analyses showed 25 to 46 percent phenocrysts, about

26 percent quartz, 17 to 30 percent alkali feldspar, 34 to 44 percent plagioclase, 4 to 6 percent biotite, about 6 percent hornblende, and traces of pyroxene (appendix).

DATABASE FORMAT

The database in this report was designed to display all pertinent data recorded on the original modal cards. Each sampled section presented in the appendix includes a spreadsheet of data, graphs of that data, and additional sample data.

Spreadsheet

The sampled section name and location (in latitude and longitude) are given in the upper left-hand of the spreadsheet. From left to right across the spreadsheet, the first column records the sample designation. Samples are listed in normal stratigraphic sequence in which they occur in outcrop; oldest at the base to youngest at the top.

The second column records the unit name, discussed in greater detail in the "Stratigraphy" section of the report. Unit names that are queried indicate that the stratigraphic pick is questionable.

The third column records the number of points counted per thin section, and the fourth column shows volume percent phenocrysts of total points counted from thin section. The next three columns are under the heading "Felsic Phenocrysts", and subheadings include volume percent of total phenocrysts of quartz (Qtz), alkali feldspar (Kspar), and plagioclase (Plag). The following six columns are under the heading "Mafic Phenocrysts", and include volume percent of total phenocrysts of biotite (Bi), hornblende (Hb), clinopyroxene (Cpx), orthopyroxene (Opx), pyroxene (Px), and altered mafics (Alt maf). The next column, "Other", records volume percent of other phenocrysts not listed in the previous columns, such as olivine (Ol). The symbol "tr" was recorded when trace amounts (less than 1 percent) of the phenocrysts were observed from the point count.

The next six columns are under the heading of "Phenocryst occurrences"; subheadings include sphene (Sp), allanite (Al), apatite (Ap), zircon (Zr), pyroxene (Px), and hornblende (Hb). The numbers in these columns were obtained by scanning the thin section and recording the number of phenocrysts present that were not part of the point count.

The final column records the petrographer that analyzed the thin section. Codes and names are listed below:

(FMB) F.M. Byers
(WJB) W.J. Barnes
(GLD) G.L. Dixon
(FNH) F.N. Houser
(ELM) E.L. Marcantel
(BQ) W.D. Quinlivan
(KAS) K.A. Sargent

Graphs

Graphs were prepared for each unit of the sampled stratigraphic sections. The graphs show normalized volume percent of the total number of phenocrysts counted on the y axis, versus phenocryst type on the x axis. From left to right on the x axis, the phenocryst type includes quartz (QTZ), alkali feldspar (KSPAR), plagioclase (PLAG), biotite (BIO), hornblende (HRNB), pyroxene (PYROX), and total volume percent of phenocrysts (PHEN) from the point count. This modal classification scheme is commonly used in correlation of ash-flow tuff units.

The name of the sampled section, unit, and number of samples (n) are shown in the upper right hand corner of the graphs. The vertical lines on the graphs show the range in volume percent of each phenocryst, and the horizontal dashes show average volume percent.

Additional Sample Data

These data, originally recorded in the lower right-hand corner of the index cards (fig. 1), describe basic rock characteristics including: degree of welding, crystallinity, and texture; lithic type; plagioclase extinction angles (degrees); and any other relevant information obtained from the point count.

SUMMARY

This report presents modal data of samples from middle Tertiary ash-flow tuff units collected from thirteen selected stratigraphic sections in eastern Nevada. The data were collected in the 1960's and 70's, and were originally recorded on modal index cards. The modal data were transferred from the index cards to computer format for accessibility to others. We hope these data will contribute to stratigraphic investigations of the Tertiary volcanic rocks of the eastern Great Basin.

ACKNOWLEDGMENTS

We would like to recognize the following U.S. Geological Survey geologists who created this database; E.B. Ekren, R.E. Anderson, E.L. Marcantel, K.A. Sargent, F.M. Byers, F.N. Houser, W.J. Barnes, W.D. Quinlivan, W.J. Carr, and R.P. Smith. Much of the earlier petrographic work, for which a large portion of this data set is based, was completed by the late William D. Quinlivan. Special thanks to Myron Best who greatly contributed to this report.

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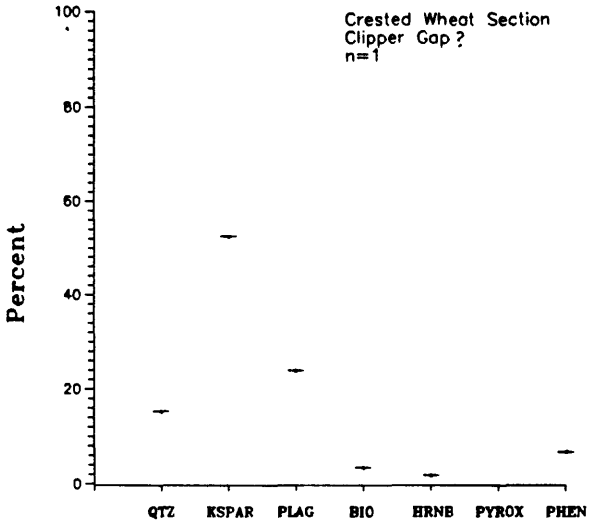
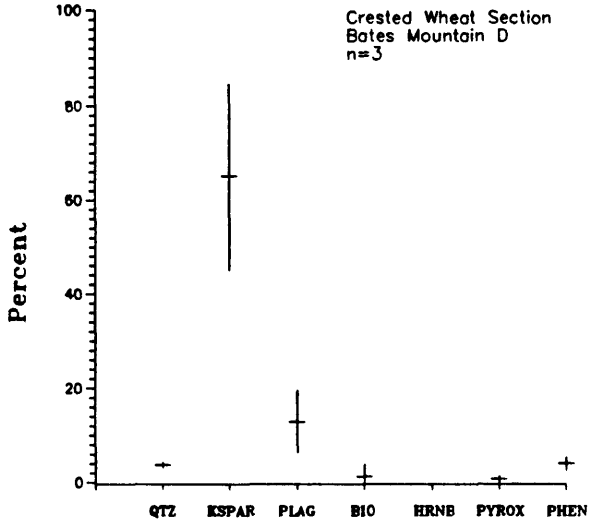
Appendix
CRESTED WHEAT SECTION
38°56'20", 116°11'30"

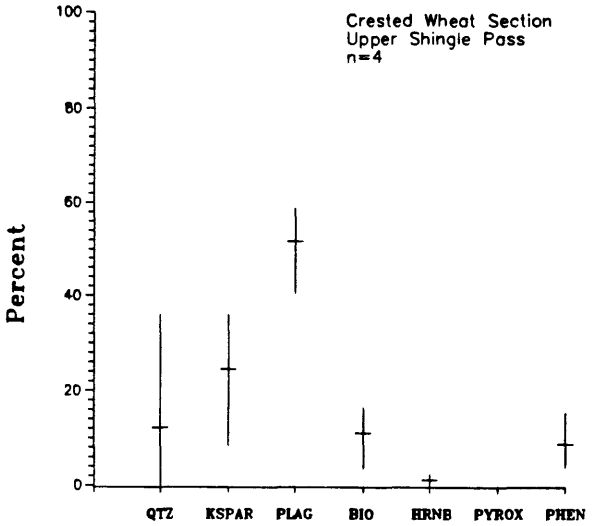
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences Sp	Al	Ap	Zr	Px	Petrographer
CW-30	Clipper Gap?	3236	6.8	15.4	52.5	24.0	3.6	1.8							2				BQ
CW-29	Bates Mtn.	3663	4.4	3.1	84.5	6.2	tr	tr	1.2			1.9							BQ
CW-28	Bates Mtn.	3403	5.4	4.3	45.0	13.1	3.8					2.2						1	BQ
CW-27	Bates Mtn.	3124	2.5	3.9	66.2	19.5	tr		1.3			1.3							BQ
CW-25	U. Shingle Pass	1588	15.4	9.9	8.3	50.7	14.5	2.4							1				BQ
CW-24	U. Shingle Pass	10453	3.8	tr	21.7	58.7	10	1				3.3	13						GLD
CW-23	U. Shingle Pass	3119	10.8	2.9	32.5	56.8	3.6					2.3	9						BQ
CW-22	U. Shingle Pass	3062	5.2	36.0	36.0	40.5	16.5	1.3							3				BQ
CW-20	Isom type?	2023	15.0	2.0	10.0	82.0	tr					4							GLD
CW-19	Isom type?	834	19.2	4.0	5.0	86.0	0					tr	1-01						GLD
CW-17	U. Crested Wheat	1372	42.3	20.2	20.2	43.4	7.1	1.7							1				BQ
CW-16	U. Crested Wheat	1360	37.0	28.3	21.4	37.9	4.6	2.8		tr					1				BQ
CW-15	U. Crested Wheat	1349	40.1	27.4	17.5	36.8	8.3	1.8		tr					1				GLD
CW-14	U. Crested Wheat	1097	40.5	25.9	13.1	50.7	6	2				1	6		2	30	1		GLD
CW-13	U. Crested Wheat	1643	38.0	31.7	27.5	33.3	6.9					tr	4		5		5		GLD
CW-11	L. Crested Wheat	693	27.4	22.6	35.3	34.7	6.8	tr							2		9		GLD
CW-10	L. Crested Wheat	735	29.1	22.4	38.8	33.6	6.8					tr			3	10	3		GLD
CW-9a	L. Crested Wheat	672	29.2	22.5	36.2	36.7	4.6								2		1		GLD
CW-8	L. Crested Wheat	1380	31.3	27.3	32.0	32.9	4.4								5				BQ
CW-6	Unnamed	11680	6.6	0.8	53.4	38.4						3.9				12	2		GLD
CW-5b	Unnamed	6094	5.2	0.0	13.9	77.0	tr					7.6	24			17	4		GLD
CW-5a	Unnamed	8760	7.4		55.1	30.8						8.6				4	1		GLD
CW-4	Windous Butte	1302	40.4	18.2	4.6	57.9	10.2					9.1				58	2		GLD
CW-1	Windous Butte	936	32.8	26.0	8.8	47.3	11					6.8			1	26	1		GLD

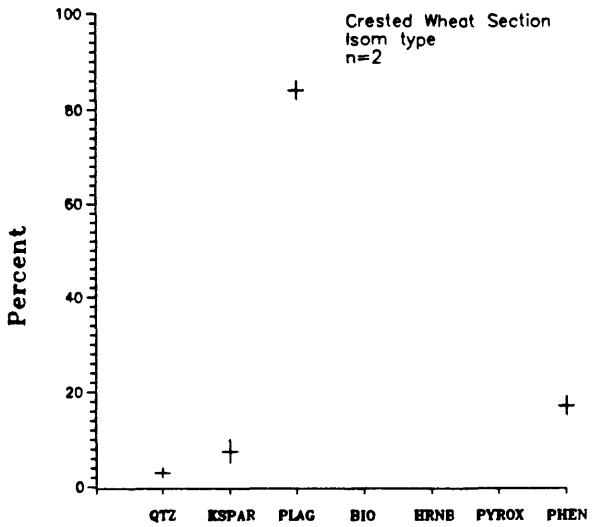
Appendix--continued

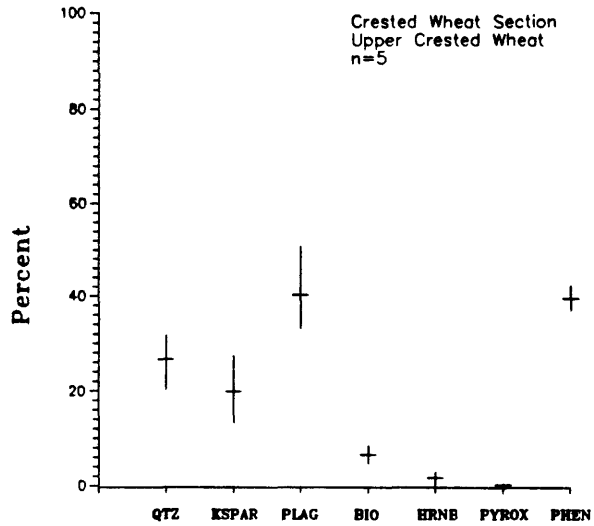
Crested Wheat Section

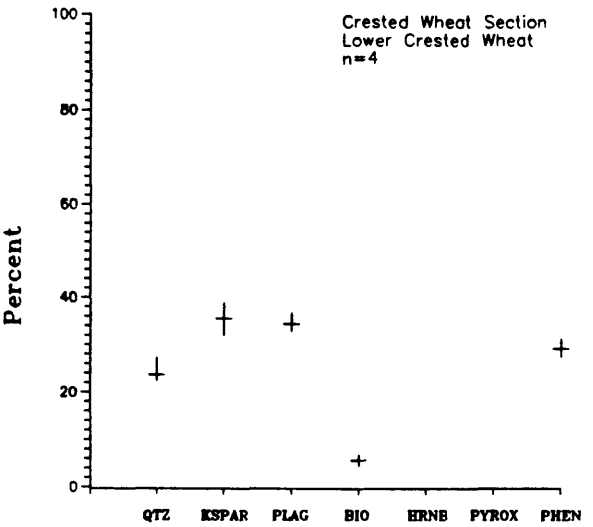






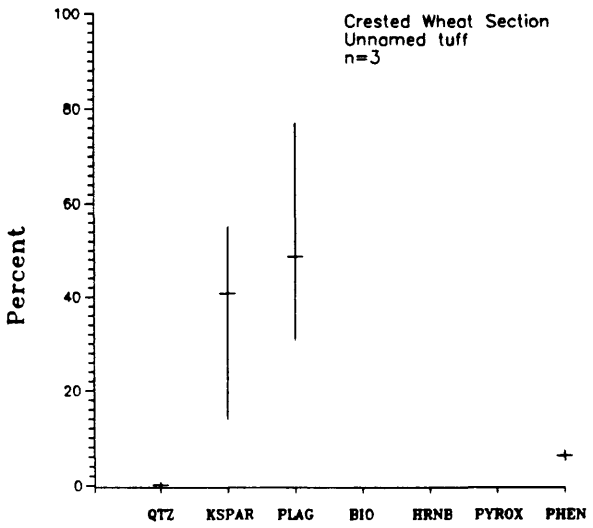


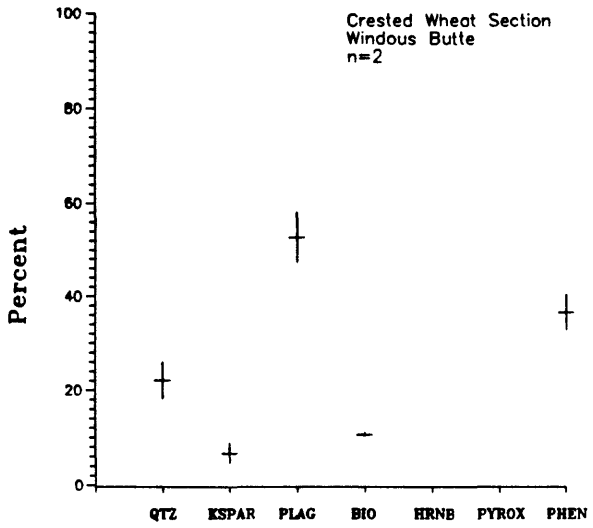




Appendix--continued

Crested Wheat Section





Appendix--continued

CRESTED WHEAT SECTION; ADDITIONAL SAMPLE DATA

CW-30 Non-welded tuff. Greater than 70% shards. Microcrystalline groundmass. A little tridymite in cavities. Allanite to 0.5 mm. A 2 mm hornblende-biotite-plagioclase-apatite clot, counted as lithic, may be source of hornblende and biotite in rock. Potassium feldspar: a little probably anorthoclase, but most is clear; complex, and simple twins; moderate schiller. Plagioclase: much has indices less than balsam; a few small glomerophenocrysts. Quartz embayed. Lithics: some basic volcanics, many with fibrous crystal growths of probable sedimentary or igneous origin.

CW-29 Altered mafics probably clinopyroxene. Alkali feldspar as in CW-28. All low negative relief material is anorthoclase, with grid twinning visable in some; much embayed to subhedral. Two potassium feldspar rock. Plagioclase count if anything is high. Clinopyroxene partly to completely altered. Euhedral gem-like zircon as in CW-27. A few potassium feldspar twins and glomerophenocrysts. A little vapor phase in cavities. 50% pumice to 1/2".

CW-28 Densely welded, devitrified tuff. Altered mafics probably clinopyroxene. Brown hornblende with inclined extinction. 30% potassium feldspar very strongly embayed; 10-15% grid-twinned anorthoclase; some strongly embayed; Some indices not sharply negative; no twins; good schiller. Plagioclase: some embayed, but less than potassium feldspar; oscillatory-progressive zoning; glomerophenocrysts (few). 50% pumice to > 1/2". A few small basic lithics.

CW-27 Moderately to densely welded vitrophyre (incipient vitrophyre). Altered mafics possibly clinopyroxene. Unusually euhedral, gem-like zircon. Approximate mode because of low crystal points. Potassium feldspar: euhedral to slightly embayed, slightly resorbed; simple twins; 3 grains of grid-twinned anorthoclase. Plagioclase: resorbed and wormy; no sharp zoning. 30% pumice. Volcanic lithics, mostly intermediate to basic.

CW-25 Partially welded shard tuff. Holes believed to have contained phenocrysts, many may have been quartz, so crystal percent may also be low. Potassium feldspar: some twins; moderate schiller. Plagioclase: some wormy; prominent oscillatory-progressive zoning. Less than 10% pumice. Intermediate to basic lithics.

CW-24 Moderately welded tuff. Altered mafics may include some biotite. Problem in counting mafics because of common scattered semiopaque, irregular blobs, some of which may have been mafics. Vapor phase slight. Embayed biotite. Potassium feldspar: moderate schiller; simple twins. Plagioclase: a few worms; inclusions of biotite; prominent oscillatory-progressive zoning. Seven holes counted from point count (1.7% of total phenocrysts). Siltstone lithics.

Appendix--continued

CRESTED WHEAT SECTION (continued)

CW-23	Moderately welded, devitrified, shardy tuff. 10-15% large pumice. Potassium feldspar: some zoned; some plagioclase inclusions; complex twins; moderate schiller. Plagioclase: pronounced ocscillatory-progressive zoning; little embayment. Biotite oxidized. Quartz much embayed. Some of altered mafics are biotite? Saw no other psuedomorphs. Volcanic lithics.
CW-22	Vitric, moderately welded, 20-40% pumice to greater than 15 mm. No quartz. Potassium feldspar: poor schiller; common simple twins; slightly embayed. Volcanic and siltstone lithics.
CW-20	Densely to moderately welded, and devitrified. Crystals relatively small with the exception of one plagioclase. Altered mafic possiblly olivine. No lithics.
CW-19	Densely welded tuff, highly devitrified, radial pumice. Granite-weathering. Olivine to iddingsite (?) common. Pumice is in elongated blobs. One welded tuff lithic.
CW-18	Groundmass microcrystalline and contains abundant tridymite. Small crystals are obscured by groundmass. A very uncertain mode, but rock is very low in plagioclase and mafics. Rhyolitic volcanic and siltstone lithics.
CW-17	Partly welded, devitrified tuff. Hornblende is partly altered, but H/B ratio is good. No apparent pyroxene. Sedimentary lithics.
CW-16	Partially welded, vitric, common pumice. Siltstone, sandstone, and intermediate lava lithics.
CW-15	Vitric pumice, moderately welded; groundmass incipiently devitrified. Orthopyroxene enclosed in hornblende. A few small lithics, nothing distinctive.
CW-14	Moderately welded, partly vapor phase, plagioclase resorbed. Altered mafics are hornblende? Lithics of siltstone, welded tuff, and lava. Hornblende is quite altered.
CW-12	Lithics of intermediate lava.
CW-10	Densely welded, devitrified tuff. Rib-former at the base of tuff of Crested Wheat. Rock is very fresh. Altered mafics are possiblly hornblende. Fresh allanite grains.
CW-9b	Densely welded tuff, devitrified. Resorbed plagioclase. Does not agree with other rib-former modes.
CW-8	Vitric, shardy, and partly welded; no lithics.

Appendix--continued

CRESTED WHEAT SECTION (continued)

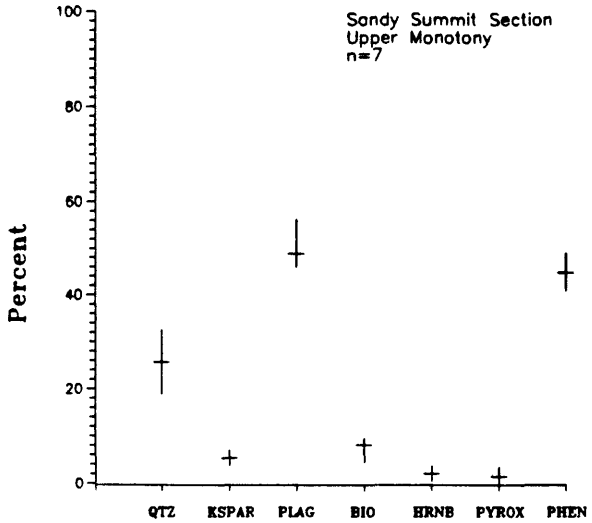
CW-6	Moderately welded shard tuff. Same as CW-5 without the glass, however, two large shards present in thin section. Plagioclase is slightly resorbed.
CW-5b	Densely welded shard tuff. Small crystals, no quartz, one biotite crystal. Questionable mode because of uncetain altered mafics.
CW-5a	Vitric shard tuff. Plagioclase is partially resorbed, potassium feldspar is relatively fresh. Altered mafics of biotite and hornblende? Lithics of siltstone and sandstone.
CW-4	Plagioclase partly altered. Altered mafics are hornblende? and biotite. Lava lithics. Strong vapor-phase, many crystals chloritized.
CW-1	Moderately welded, and devitried--typical Windous Butte "E" unit.

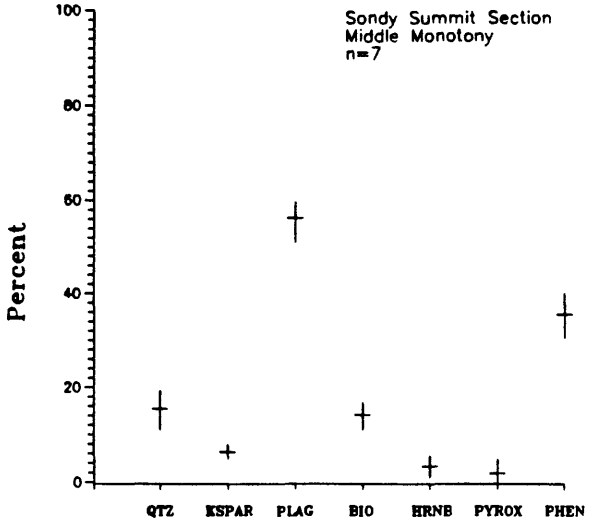
Appendix (continued)
SANDY SUMMIT SECTION
38° 26', 116° 07'30"

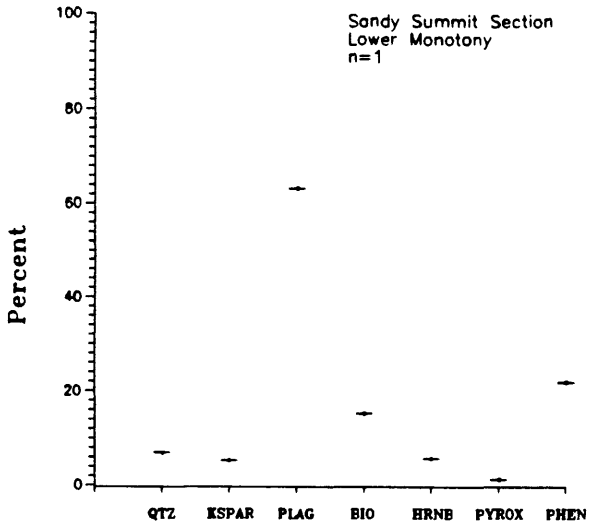
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences Sp	Al	Ap	Zr	Px	Petrographer
S-17	U. Monotony	851	48.8	32.3	3.6	46.5	4.3	tr	1.9			8				19	2	30	GLD
S-15	U. Monotony	806	45.8	20.9	4.3	56.1	8.9	1.4	2.7			4.9				31	5	46	GLD
S-14	U. Monotony	935	45.0	28.0	4.4	47.8	9.5	1.1	2.5			5.6				32	5	48	GLD
S-13	U. Monotony	889	40.7	18.8	5.5	54.0	8.9	3.3	3.3			5				34	9	47	GLD
S-12	U. Monotony	872	46.0	22.1	6.2	46.0	9.2	3.7			5	6.7				52	8	58	GLD
S-11	U. Monotony	780	42.1	25.2	6.9	46.0	9.5	3.4			4	4.6				45	3	63	GLD
S-10	U. Monotony	1051	44.4	32.5	6.2	45.8	6.6	1.9			3.9	2.6			1	30	3	40	GLD
S-8	M. Monotony	896	40.0	10.9	7.5	59.5	15.6	1.7			2.2	2				17	1	30	GLD
S-7	M. Monotony	1026	36.6	15.4	6.6	56.0	14.1	1			4.8					35	10	63	GLD
S-6	M. Monotony	1235	38.6	14.4	7.9	56.0	11.9	4.9			4					47	12	70	GLD
S-5	M. Monotony	1045	33.9	19.2	6.7	57.3	11	2			2.2				3	17	5	41	GLD
S-4	M. Monotony	1112	30.6	14.7	5.9	57.4	16.8	3.2	tr							22	3	7	GLD
S-3	M. Monotony	1160	36.0	16.3	4.8	55.6	14.9	4.8	1.4							33	12		GLD
S-2	M. Monotony	1181	33.6	17.4	5.2	51.0	15.1	5.5	2.8						1	30	11		GLD
S-1	L. Monotony	1104	21.9	7.0	5.4	63.2	15.3	5.8	1.2						2	30	4	24	GLD

Appendix--continued

Sandy Summit Section







Appendix--continued

SANDY SUMMIT SECTION; ADDITIONAL SAMPLE DATA

S-17	Moderately welded, strongly devitrified tuff. Quartz is higher because of several large grains. Altered mafics of biotite and hornblende.
S-15	Same as S-14.
S-14	Moderately welded, devitrified, and altered tuff. Most plagioclase is resorbed. Altered mafics of biotite and hornblende. Lithics look like sandstone. Some plagioclase is chloritized. Quartz is overemphasized.
S-13	Moderately welded, devitrified, and altered tuff. Magnetite surrounds altered mafics of biotite. Pyroxene is all clinopyroxene.
S-12	Moderately welded, devitrified, and altered tuff. Lava lithic ? Altered mafics are biotite and hornblende. Plagioclase is resorbed.
S-11	Moderately welded, devitrified tuff. Lithics of lava. Altered mafics are possibly biotite with magnetite scattered throughout. Some plagioclase is chloritized and highly resorbed.
S-10	Moderately welded, devitrified tuff. Mafic psuedomorphs are mostly biotite. Spherulitic pumice.
S-8	Moderately welded, devitrified tuff, spherulitic pumice, well altered--most of the altered mafics are probably biotite with some hornblende and pyroxene.
S-7	Moderately welded, slightly vapor-phase. Altered hornblende and pyroxene.
S-6	Moderately welded, devitrified tuff. Abundant pyroxene. Pyroxene and hornblende are altered, but not as much as S-5.
S-5	Moderately to densely welded, devitrified tuff. Hornblende and pyroxene altered.
S-4	Densely welded, devitrified tuff. Hornblende and pyroxene highly altered (chloritized).
S-3	Densely welded, devitrified tuff. Some alteration in hornblende and pyroxene.
S-2	Densely welded, devitrified tuff.
S-1	Densely welded, slightly vitric tuff; possibly crystal-poor base of Monotony. Hornblende slightly altered; phenocrysts are generally small.

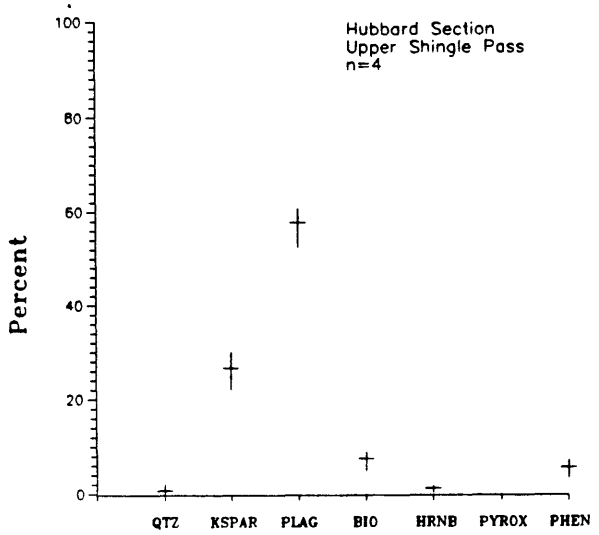
Appendix (continued)
HUBBARD SECTION
38° 26', 115° 20'

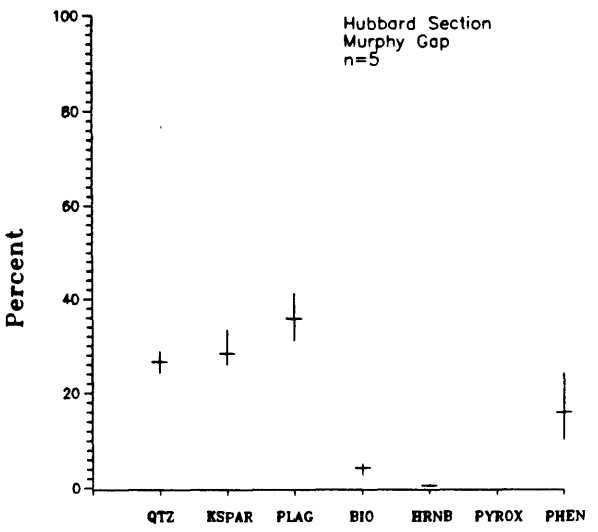
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences Sp	Al	Ap	Zr	Px	Petrographer
E-26	U. Shingle Pass	6076	6.5	0.0	26.0	60.5	7.6	tr				tr			2		5		KAS
E-25	U. Shingle Pass	5192	7.0	0.8	29.9	58.2	4.7	1.1				tr	2		1		2		KAS
E-24	U. Shingle Pass	6500	5.7	1.9	28.6	52.3	8.7	1.6				tr			2		11		KAS
E-23	U. Shingle Pass	6678	3.2		21.9	59.5	8.8	1.4				2.3			1		5		KAS
E-22	Murphy Gap	2331	24.3	26.8	26.3	39.7	5	tr		tr					1		8		KAS
E-21	Murphy Gap	1771	22.0	27.7	26.0	41.3	2.7	tr			tr	1.8							FNH
E-20	Murphy Gap	3234	12.7	28.8	30.2	31.2	5.1	tr							1		2		KAS
E-19	Murphy Gap	3960	11.0	25.7	33.5	32.6	4.4	tr									10		KAS
E-18	Murphy Gap	4000	10.2	24.3	26.5	35.1	4.4										2		KAS
E-16	L. Shingle Pass	8918	2.7	11.0	28.3	46.5	2.5	tr			tr	4.7							FNH
E-14	L. Shingle Pass	2516	13.7	10.0	31.0	51.6	tr				tr	7							FNH
E-13	L. Shingle Pass	4440	5.4	17.7	46.2	26.9				2.1			2-01		1		13		KAS
E-12	L. Shingle Pass	3280	3.1	5.8	51.5	35.0	0				2		tr-01		1		2		KAS
* E-11	Fault breccia	2034	7.3	7.1		46.4	5.3	24.1			2.3	4.7		2					KAS
E-10	Monotony	1168	27.1	6.6	4.4	54.1	26	3.2			1.3				1	30	5	10	GLD
E-9	Monotony	1944	16.5	5.0	3.0	63.3	21.5	2			tr	2							GLD
E-8	Monotony	1068	28.7	2.0	5.5	57.0	24.4	6.8							1	20	3	3	GLD
E-7	Monotony	1201	20.9	8.4	4.4	57.4	19.1	3.2							1	5	3		GLD
E-6	Wah Wah Springs	972	32.4	4.8	0.6	57.8	10.8	20.6				1.6			1	15	3		GLD
E-5	Wah Wah Springs	828	40.6	8.3	0.6	61.9	7.7	15.2				3.1				17	5		GLD
E-4	Wah Wah Springs	1396	41.8	3.3	0.0	63.8	8.8	21.2			tr								GLD
E-3	Wah Wah Springs	907	37.2	0.4		58.8	5	30.6								27	3	3	GLD
E-2	Wah Wah Springs	1164	25.9	0.3		57.1	8.6	27.2								31	2	2	GLD
E-1	Cottonwood Wash	597	46.0	20.8	4.1	64.3	6.4	2.6				1.5							WJB

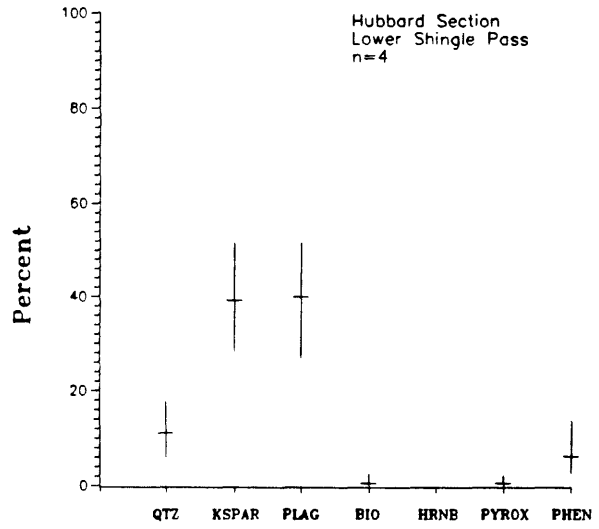
* Fault breccia of Lund Formation composition

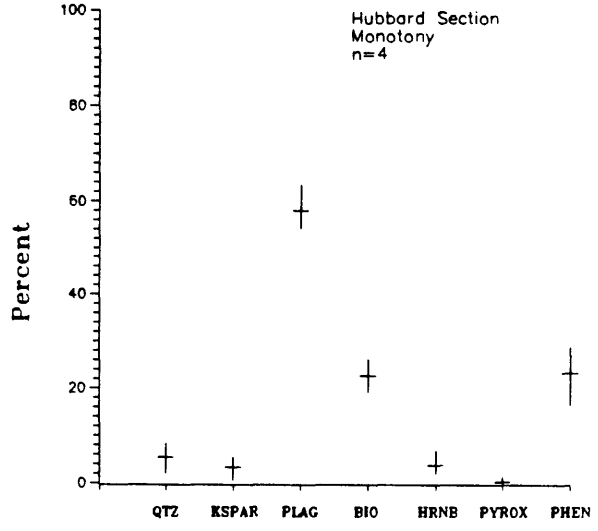
Appendix--continued

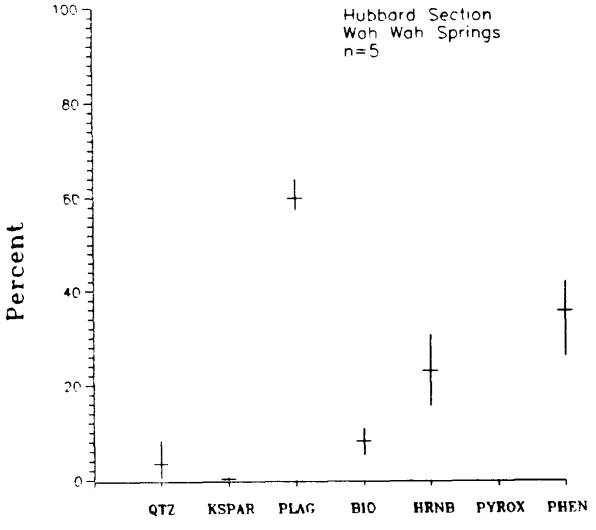
Hubbard Section, Grant Range

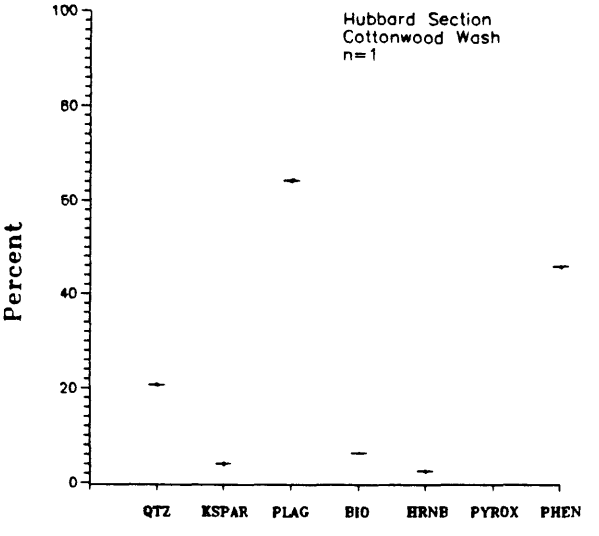












Appendix--continued

HUBBARD SECTION; ADDITIONAL SAMPLE DATA

E-26 Plagioclase: 22^{o}, (+) and (-). Allanite has heavy alteration rim. Lithics of pyroxene and basic lava.

E-25 Hornblende, yellow green to medium green. Biotite is altered, iron rich rims. Shard tuff.

E-24 Hornblende, (very altered on one) pale to medium green pleochroism. Plagioclase: 10^{o}.

E-23 Hornblende, yellow brown to red brown, has iron oxide rim. Plagioclase: 27^{o}, faint zoning.

E-22 Hornblende, yellow brown to brown, has iron oxide rim. Plagioclase: 15^{o}, (-), 25^{o}. Potassium feldspar, many with small plagioclase inclusions. Lots of sericite in groundmass. Orthopyroxene with alteration rims. Lithics of sandstone.

E-21 Duplicate cards. Pyroxene is (-), 40% altered.

E-20 Allanite with alteration rim of iron oxide? Pleochroism red brown to yellow.

E-19 Hornblende edges altered to iron oxide. No calcite. About 10% of potassium feldspar and plagioclase are very difficult to tell which is which. Mode not exact.

E-18 Calcite in groundmass. Plagioclase: 18^{o}.

E-17 Duplicate cards. Hornblende as crystal (euhedral) void. Potassium feldspar is anhedral-subhedral. Quartz subhedral-euhedral.

E-16 Duplicate cards. Plagioclase is (+). Pyroxene is altered. Shard base. Phenocryst holes = 8 of the total point count.

E-14 Duplicate cards. Potassium feldspar large and well zoned. Trace of onion skin quartz. Pumice rich.

E-12 Groundmass partly spherulitic. Clinopyroxene very light green with half orthopyroxene. Lithics of siltstone.

E-11 Some Plagioclase is highly altered, some fresh. Pyroxene, hornblende, and biotite all altered.

E-10 Slightly to moderately welded, vapor-phase, vitric shards throughout thin section. Plagioclase is quite fragmented. Quartz is slightly resorbed and also fragmented. Pyroxene and hornblende are altered, biotite is slightly altered. Lithics of siltstone and welded tuff.

Appendix--continued

HUBBARD SECTION (continued)

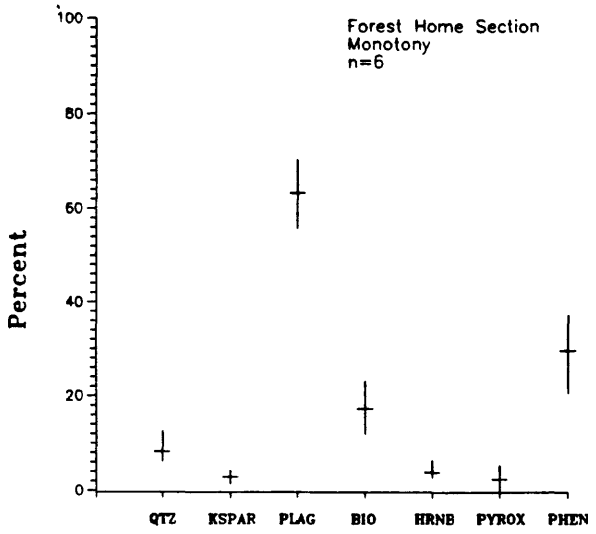
E-8	Moderately to densely welded, and devitrified. Sample is fresh. Plagioclase is slightly resorbed, potassium feldspar is fresh. Pyroxene is present and altered, and hornblende and biotite are relatively fresh. Lithics of welded tuff.
E-7	Moderately welded, partly devitrified, vapor-phase. Sample is very similar to E-6. Plagioclase is partly resorbed, quartz and potassium feldspar are fresh. Altered mafics are hornblende.
E-6	Moderately welded, and devitrified. Unit is altered with hornblende almost gone. Hornblende and biotite are the oxidized variety. Plagioclase slightly resorbed. Quartz fresh. Potassium feldspar fresh. Altered mafics are hornblende. No sphene.
E-5	Moderately to densely welded, and devitrified. This section is strongly devitrified and slightly to moderately altered. Plagioclase is slightly resorbed. Quartz is embayed. Questionable potassium feldspar. Altered mafic is hornblende. Hornblende is quite altered. No sphene.
E-4	Pyroxene is clinopyroxene. Hornblende is embayed in small part. No sphene.
E-3	Same as E-2. No sphene.
E-2	Moderately to densely welded, vitric, shardy tuff. Only two to three grains of quartz present. Plagioclase mostly fresh with some resorbed. Hornblende slightly altered (most fresh). Biotite fresh. Pyroxene (two grains) almost completely gone. Glomerophenocrysts of Plagioclase. Plagioclase phenocrysts are 1.5 mm. No sphene.
E-1	Plagioclase is (+)(yel NW). No sphene. 17 phenocryst holes.

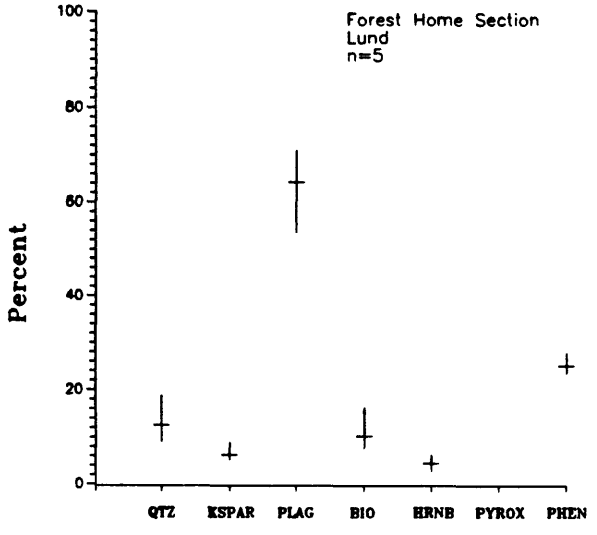
Appendix (continued)
FOREST HOME SECTION
38°21', 115°22'

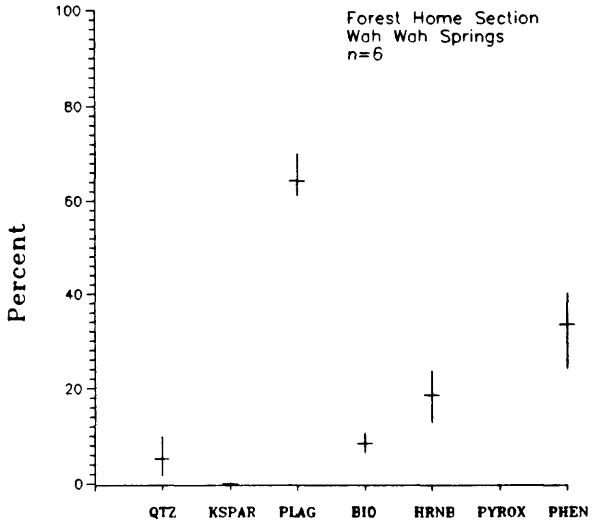
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences Sp	Al	Ap	Zr	Px	Petrographer
E-49	Monotony	1403	30.1	6.1	2.8	63.3	19.4	5	1.7							42	23		WJB
E-48	Monotony	761	37.3	9.2	4.2	55.6	20.8	3			5.3					17	3		GLD
E-47	Monotony	1428	28.2	12.6	3.2	60.8	14.9	3	3.5						1	73	25		WJB
E-46	Monotony	882	36.6	7.7	2.2	60	23.2	3.1			2.2					25	1	12	GLD
E-45	Monotony	2449	25.5	7.1	1.3	70.2	13.9	2.7	2.2							37	11		WJB
E-43	Monotony	2543	20.7	7	4	68.9	11.9	6.5						4		38	18		WJB
E-42	Lund	1125	27.6	15.4	5.1	53.4	16.1	6.1			tr	2.3				8	4		GLD
E-41	Lund	1721	23.9	9.2	6.6	69.8	9.7	2.7						2	1	58	13		WJB
E-40	Lund	1605	25.4	10.8	5.2	70.8	7.6	4.4						5		49	13		WJB
E-39	Lund	2122	24.2	9	8.8	67.6	8.6	4.1						6	1	47	21		WJB
E-38	Lund	2485	23.3	18.7	5.7	59.5	9.5	4.8						3	3	36	15		WJB
E-37	Wah Wah Springs	1292	32.6	7.8	0	65.4	10.7	12.8								80	14		WJB
E-36	Wah Wah Springs	2014	24.1	9.9	0	63.1	9.3	13.2						3		65	10		WJB
E-35	Wah Wah Springs	1361	31	5	0.2	70	6.4	17.5						4		64	7		WJB
E-34	Wah Wah Springs	2729	40.3	5		61	7	23.7	tr							58	9		WJB
E-33	Wah Wah Springs	2499	38.5	2.3		63.8	8.4	21.7	tr							57	14		WJB
E-32	Wah Wah Springs	2520	35.4	1.6	0	62.6	9.3	23	tr					4		51	13		WJB
E-29	Cottonwood Wash?	2342	17.2	14.4	6.7	65.5	11.7									16	13		WJB
E-28	Cottonwood Wash?	1550	19.7	15.1	3.9	65.6	12.5	tr							3	5	1		GLD

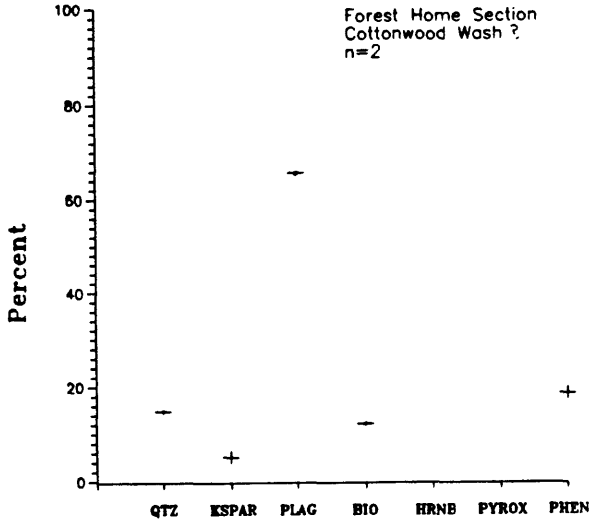
Appendix--continued

Forest Home Section, Grant Range









Appendix--continued

FOREST HOME SECTION; ADDITIONAL SAMPLE DATA

E-49 Plagioclase: 31^{o} maximum. No sphene.

E-48 Same as section E-46 with the exception of more pyroxene.

E-47 Plagioclase: 30^{o} maximum.

E-46 Moderately to densely welded, vitrophyre. Well zoned plagioclase (partly resorbed). Quartz is fresh. Only two grains of potassium feldspar. Hornblende, biotite and pyroxene is relatively fresh. Pyroxene is clinopyroxene variety.

E-45 Plagioclase: 28^{o} maximum.

E-43 Plagioclase: 27^{o} maximum.

E-42 Moderately welded, devitrified. Plagioclase slightly resorbed. Quartz and potassium feldspar fresh. One grain of altered pyroxene. Other altered mafics are hornblende and biotite. Six blank spots tabulated in point count.

E-40 Plagioclase: 27^{o} maximum. Sphene very fine grained.

E-39 Plagioclase: 29^{o} maximum. Sphene present in form of very small crystals. Identification made on basis of very high dispersion.

E-38 Plagioclase: 30^{o} maximum. Sphene crystals very small. Identification based on very high dispersion.

E-37 Plagioclase: 30^{o} maximum.

E-36 Plagioclase: 30^{o} maximum. Only two grains of potassium feldspar observed. Large plucked areas of thin section ignored in counts.

E-35 Plagioclase: 31^{o} maximum. Only one phenocryst of potassium feldspar observed. Sphene does not show characteristic wedge shape.

E-34 Plagioclase: 32^{o}.

E-33 Plagioclase: 30^{o}.

E-32 Plagioclase: 31^{o}.

E-29 Plagioclase: 29^{o}. Possible single occurrence of allanite.

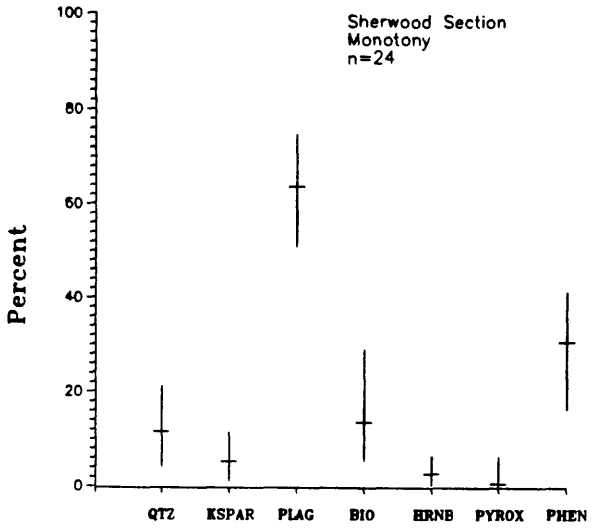
E-28 Densely welded, vitrophyre. Plagioclase is partly resorbed. Potassium feldspar fresh. Quartz is fresh and embayed. Hornblende is almost all gone. Biotite fresh. Large glass shards. Lithics of welded tuff, siltstone, and sandstone.

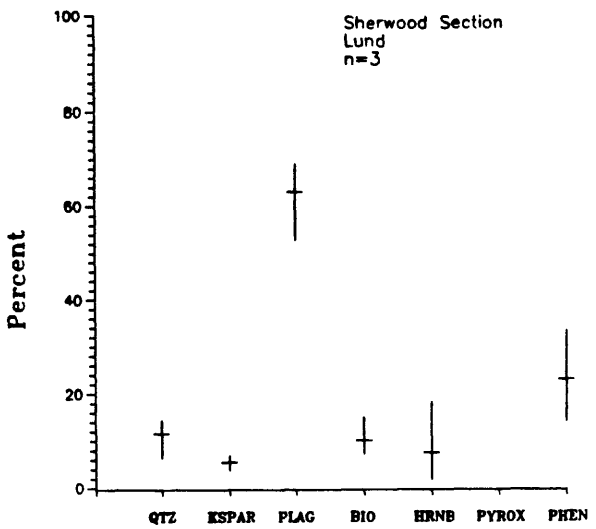
Appendix (continued)
SHERWOOD SECTION
38°19', 115°23'

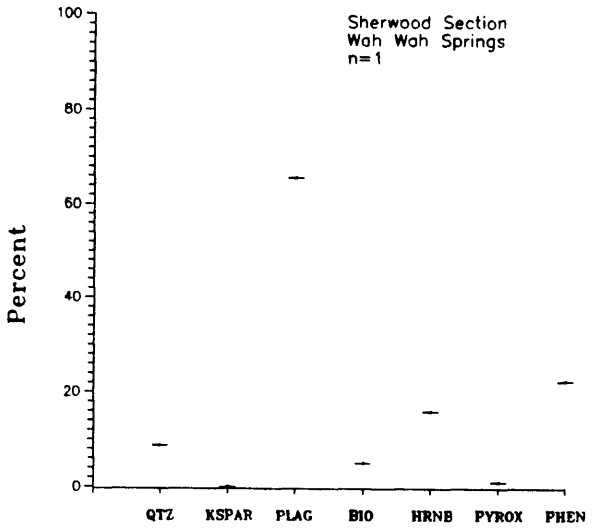
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen: Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen: Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences: Sp	Al	Ap	Zr	Px	Petrographer
F-29	Monotony	1410	23.3	15.5	6.7	61.7	8.2	tr				6.1				2	5		GLD
F-28	Monotony	2553	18.0	13.3	5.4	72.4	6.3	tr							1	39	18		GLD
F-27	Monotony	816	40.9	21.0	7.2	52.1	13.5	2.7				1				5	2		GLD
F-26	Monotony	1321	32.2	10.1	3.3	74.0	8.2	2.8	tr						1	45	20		GLD
F-25	Monotony	1088	29.0	12.7	8.9	57.6	13	1.9			1.3	3.2			1	10	1	4	GLD
F-24	Monotony	2402	26.0	10.7	1.8	74.6	10.2	1							4	51	30		GLD
F-23	Monotony	1088	26.3	5.9	5.6	65.0	17.1	2.8				1.7				6	6		GLD
F-22	Monotony	2270	35.0	13.8	3.0	73.2	7.2	1.1	tr							42	25		GLD
F-21	Monotony	813	41.3	11.0	6.3	65.2	11.6	1.8			1.2	1.2	4			7	2		GLD
F-20	Monotony	1321	35.6	20.6	2.8	61.7	10.6	2.8	tr						3	54	16		GLD
F-19	Monotony	931	34.9	12.6	7.4	52.0	19.1	4.9				2.1	7		1	15	1		GLD
F-18	Monotony	2585	16.3	9.5	3.6	72.4	12.3	1.7							2	28	14		GLD
F-17	Monotony	1068	20.3	11.5	9.2	56.2	17.1	2.3				1				11	3		GLD
F-15	Monotony	1358	32.5	11.3	3.9	72.3	9.3	1.4							3	47	14		GLD
F-14	Monotony	880	35.5	7.1	5.8	61.9	16.3	2.9			2.2					17	2		GLD
F-13	Monotony	1351	35.8	8.5	1.9	68.2	12.4	5.2	2.1							45	14		GLD
F-12	Monotony	907	35.5	4.0	5.0	54.3	23.9	4.4			6.2					20	4		GLD
F-11	Monotony	1300	32.3	8.6	1.0	68.6	16	2.9	1.4							29	20		GLD
F-10	Monotony	912	36.2	8.2	4.8	59.1	19.7	4.2			2.7					15		9	GLD
F-9	Monotony	1949	21.6	5.2	1.9	61.0	28.9	2.1					tr-Al		1	25	5		WJB
F-8	Monotony	960	32.6	18.2	11.4	50.8	12.7	4.6								7	3		GLD
F-7	Monotony	1351	30.2	17.1	5.4	68.7	5.4	1.7					tr-Al		2	37	13		WJB
F-6	Monotony	939	34.1	12.8	8.4	58.8	12.5	3.3				3.1			1	20	2		GLD
F-5	Monotony	1392	29.9	10.1	4.1	64.5	13.5	6.5					tr-Ap			32	12		WJB
F-4	Lund?	989	33.1	6.4	3.7	52.6	15	18.3						6		30	4		WJB
F-3	Lund?	2603	21.6	14.5	6.9	67.5	7.1	2.7					tr-Ap	1	2	36	22		WJB
F-2	Lund?	3191	14.0	14.1	6.0	68.9	8.3	1.8							1	24	9		WJB
F-1	Wah Wah Springs	2484	22.4	8.8	0.0	65.5	5	15.9	1				tr-Ap	1		53	11		WJB

Appendix--continued

Sherwood Section, Grant Range







Appendix--continued

SHERWOOD SECTION; ADDITIONAL SAMPLE DATA

F-29 Partially welded and slightly vitric. Looks to be same cooling unit as F-27 with fewer crystals. Plagioclase is resorbed. Quartz (one large crystal of 3.8 mm) is partially resorbed and embayed. Altered mafics possibly hornblende.

F-28 Plagioclase: 31^{o}.

F-27 Moderately welded, and devitrified. Unit is much more altered than other "F" samples. Possibly a cooling break between F-25 and F-27.

F-26 Plagioclase: 27^{o} maximum.

F-25 Densely to moderately welded, and devitrified. Several cognates interspersed in thin section. Plagioclase is moderately resorbed. Quartz and potassium feldspar fresh. Very similar to other "F" series sections. Altered mafics are hornblende or biotite replaced by magnetite.

F-24 Plagioclase: 33^{o} maximum.

F-23 Densely welded, and devitrified; same as F-19.

F-22 Plagioclase: 30^{o} maximum.

F-21 Same as F-17 with exception of alteration. The section seems to be more altered. Pyroxene is barely distinguishable.

F-20 Plagioclase: 30^{o} maximum.

F-19 Moderately welded, completely devitrified. Sample seems quite fresh, especially hornblende. Both quartz and potassium feldspar embayed. Plagioclase is slightly resorbed. Altered mafics of pyroxene or hornblende.

F-18 Plagioclase: 29^{o} maximum.

F-17 Densely welded, and devitrified. Sample is relatively fresh. Plagioclase is slightly resorbed. Quartz and potassium feldspar are fresh. Probably within same cooling unit as F-10, F-12, F-14. Altered mafic is hornblende.

F-15 Plagioclase: 31^{o} maximum.

F-14 Densely welded, and devitrified. Same unit as F-10, F-12, however, this unit is devitrified. Altered mafics are pyroxene (or whats left of it).

F-13 Plagioclase: 31^{o} maximum.

F-12 Same as F-10. This sample seems more fragmented?

Appendix--continued

SHERWOOD SECTION (continued)

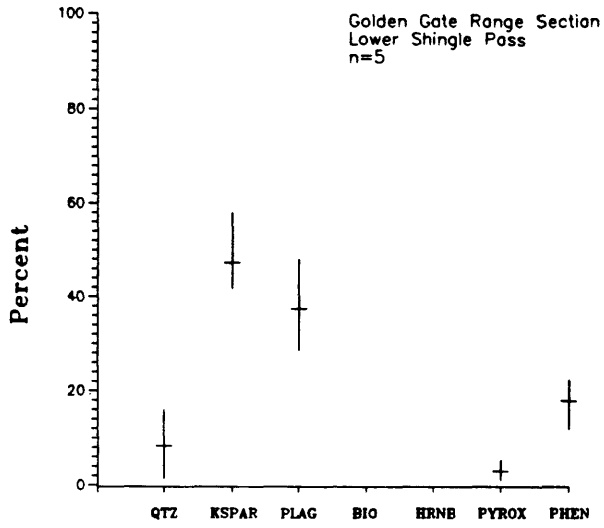
F-11	Plagioclase: 32° maximum.
F-10	Moderately welded, slightly vitric groundmass. Plagioclase is slightly resorbed. Calcite replacement around fringe of some crystals. Quartz, potassium feldspar, and biotite relatively fresh. fresh. Pyroxene is almost gone. Lithics of siltstone or sandstone.
F-9	Plagioclase: 28° maximum. Slide badly plucked and beveled.
F-7	Plagioclase: 29° maximum.
F-6	Moderately welded, and devitrified. More altered than F-4. Plagioclase is resorbed. Quartz embayed. Potassium feldspar relatively fresh. Biotite and hornblende partially replaced by magnetite. Altered mafics are both biotite and hornblende. No sphene.
F-5	Plagioclase: 30° maximum.
F-4	Moderately to densely welded, and devitrified. Fresh, well zoned plagioclase, slightly resorbed. Quartz, potassium feldspar, and biotite are fresh. Hornblende slightly altered. is quite fresh. Lithics of welded tuff.
F-3	Plagioclase: 30° maximum.
F-2	Plagioclase: 27° maximum.
F-1	Plagioclase: 31° maximum.

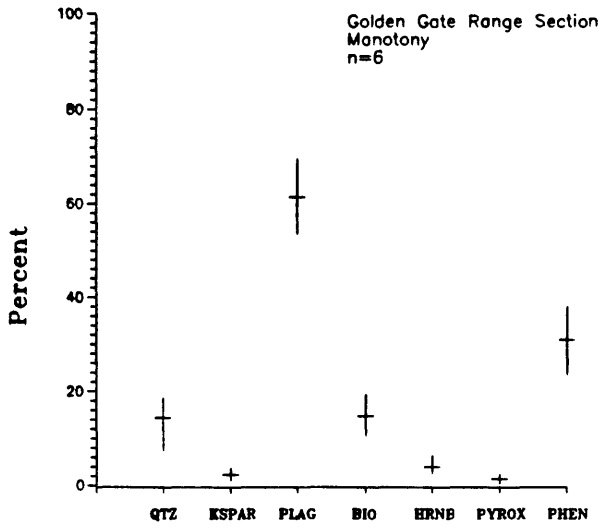
Appendix (continued)
GOLDEN GATE RANGE SECTION
38°03'40", 115°23'

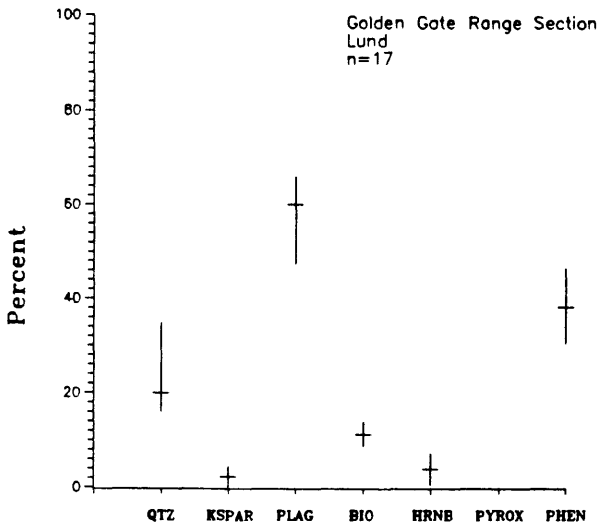
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences Sp	Al	Ap	Zr	Px	Petrographer
G-35	L. Shingle Pass	2340	11.9	1.4	44.1	43.4		tr		5.4		tr	tr-Ol		2		12		KAS
G-34	L. Shingle Pass	2520	16.0	12.9	49.4	32.5	tr	tr			1	tr	1-Ol	1	4		23		KAS
G-33	L. Shingle Pass	2400	18.4	15.9	43.5	34.9		tr			3	tr	1.4-Ol		1		16		KAS
G-32b	L. Shingle Pass	1155	20.8	3.3	41.7	47.9			4.2								10		ELM
G-32a	L. Shingle Pass	2352	22.2	8.1	57.8	28.6	tr	tr			1.2	tr	2-Ol	1	4		9		KAS
G-30	Monotony	1276	23.6	18.4	2.0	61.1	10.6	3.7	1.7								9		ELM
G-29	Monotony	1056	31.3	16.9	2.1	60.4	15.7	3.3	1								6		ELM
G-28	Monotony	1386	31.6	11.9	3.7	56.9	19	6.4	tr								17		ELM
G-27	Monotony	1260	30.2	18.6	1.1	53.5	19.2	2.6	2.4								9		ELM
G-26	Monotony	1302	30.7	7.5	3.0	69.5	13	3.2	1.5								9		ELM
G-25	Monotony	1452	37.9	13.3	2.5	66.9	11	4.8	1.5					1			5		ELM
G-24	Lund	1386	30.5	20.4	2.6	55.7	13.7	4.5					tr-Sp	24		1	9		ELM
G-1	Lund	986	42.0	21.8	1.4	60.3	10.8	3.4						20		5	5		ELM
G-2	Lund	1197	37.6	22.9	3.6	56.9	10.7	3.6					tr-Sp	26			10		ELM
G-3	Lund	1044	36.7	15.9	3.9	62.1	9.7	5.7					tr-Sp	25			11		ELM
G-4	Lund	1176	38.8	17.1	1.8	61.8	11.8	4.8						38			22		ELM
G-5	Lund	1260	40.1	20.6	1.4	60.2	11.7	3.2					tr-Sp	38			19		ELM
G6b	Lund	974	46.4	20.0	3.3	62.0	11.7	tr					tr-Sp	17		15	3		WJB
G6a	Lund	1155	40.4	18.5	1.3	62.5	10.9	3					1.2-Sp	32			23		ELM
G-7	Lund	1132	37.4	17.3	1.9	62.2	13	3.1					tr-Sp	33			20		ELM
G-8	Lund	1344	43.2	17.9	2.1	62.8	10.2	3.1					1-Sp	36			18		ELM
G-9	Lund	1564	34.5	18.2	4.3	60.4	10.9	3.5					tr-Sp	32			21		ELM
G-10	Lund	1260	39.9	16.7	3.0	60.4	13.9	3.6						29			22		ELM
G-11	Lund	1344	35.5	22.2	2.3	56.8	13.6	2.3						31			18		ELM
G-12	Lund	1200	40.8	20.5	1.4	60.3	10.4	4.5						32			25		ELM
G-13	Lund	1320	34.6	17.7	0.9	65.9	8.8	4.8						23			17		ELM
G-14	Lund	950	36.7	34.7	2.9	47.3	8.6	4.9						11		2	13		ELM
G-15	Lund	1180	34.8	16.6	0.0	62.5	11.2	7.1						11			7		ELM
G-16	Wah Wah Springs	1302	31.3	11.8	0.0	63.4	6.1	13.8	tr					8		10	2		ELM
G-17	Wah Wah Springs	1495	26.5	2.8	0.0	61.0	1.5	24.7	2					4		5	19		ELM
G-18	Wah Wah Springs	2368	11.2	3.0	1.9	74.0	11.3	2.7				2					13		ELM
G-19	Wah Wah Springs	1711	29.5	9.1	1.2	59.5	9	16.8	1.6							4	4		ELM
G-20b	Wah Wah Springs	1172	38.3	4.7	0.0	57.5	6.5	23.4	1.3							7	4		WJB
G-20a	Wah Wah Springs	1800	39.7	7.4	1.3	54.4	9.1	22.6	1.4							12	5		ELM
G-21	Wah Wah Springs	1620	41.2	6.0	1.2	61.8	7.7	19.3	tr							15	5		ELM
G-22	Wah Wah Springs	1357	45.5	4.9	0.8	63.0	7.5	19.8	tr							20	4		ELM
G-23	Wah Wah Springs	1767	43.5	2.4	0.4	59.0	10.4	24.8	tr							75	1		ELM

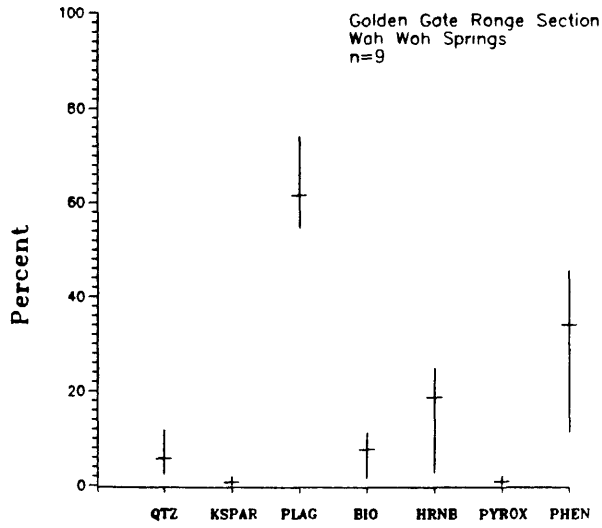
Appendix--continued

Golden Gate Range Section









Appendix--continued

GOLDEN GATE RANGE SECTION; ADDITIONAL SAMPLE DATA

G-35	Orthopyroxene has parallel extinstion. Plagioclase: 21.5°.
G-34	Some calcite alteration.
G-33	Clinopyroxene (+), nearly clear. Plagioclase (-), 15°. Hornblende is light to medium green. Lithic of reworked tuff.
G-32b	Slightly welded vitrophyre. Plagioclase: 12-21°. Clinopyroxene altered to opaques.
G-32a	Some potassium feldspar well zoned. Plagioclase (-), 20°, has small inclusions of pyroxene, and hornblende. Pyroxene (+). Olivine (-), iddingsite in part. Lithic of intermediate lava.
G-30	Devitrified, partly welded tuff. Plagioclase: 18-34°.
G-29	Devitrified, partly welded tuff. Plagioclase: 30-34°. Quartz and feldspar badly fractured.
G-28	Devitrified, partly welded tuff. Plagioclase: 24-25°. Ken Sargent noted possible flow break below.
G-27	Lithics are reddish, altered tuff, containing plagioclase and quartz. Mostly vitric matrix with abdundant pumice. Plagioclase: 21-18°.
G-26	Plagioclase: 22-22°. 3 mm quartz present.
G-25	Plagioclase: 22-28°.
G-24	Plagioclase: 16-23°.
G-1	Hornblende replaces plagioclase. Plagioclase: 16-24°. Almost all potassium feldspars and quartz badly fractured. Apatite and sphene replace mafics.
G-2	Plagioclase: 18-20°.
G-3	Plagioclase: 17-24°. Entire slide, matrix and phenocrysts, badly fractured.
G-4	Plagioclase: 18-20°.
G-5	Plagioclase: 20-22°.
G-6a	Plagioclase: 20-22°.
G-6b	Plagioclase: 30°. Groundmass contains much fibrous chalcedony.

Appendix--continued

GOLDEN GATE RANGE SECTION (continued)

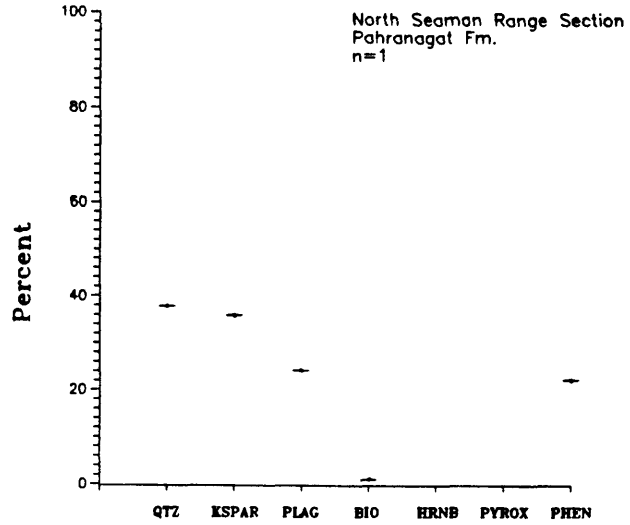
G-7	Quartz badly strained, often shows biaxial interference figure with (+) sign. Plagioclase: 20-22°. Lithics include altered lava and tuff fragments.
G-8	Plagioclase: 20-22°.
G-9	Plagioclase: 17-20°.
G-10	Plagioclase: 18-20°.
G-11	Plagioclase: 10-20°.
G-12	Plagioclase: 19-25°. Quartz fractured and plucked. Sphene and zircon associated with opaques.
G-13	Quartz fractured. Plagioclase: 18-20°. Lithics of altered lava.
G-14	Plagioclase: 21-23°. Quartz fractured. Plagioclase and hornblende arealtered. Devitrified groundmass. Lithics of altered tuff.
G-15	Plagioclase: 27-29°. Lithics of reworked tuff.
G-16	Plagioclase: 19-26°. Vapor phase zone of cooling unit below welded into base of this cooling unit? Sphene would also suggest mixing. Lithics of siltstone and reworked tuff.
G-17	Agglomerates and stringers of quartz and plagioclase. Plagioclase: 21-24°.
G-18	Agglomerate of 0.2 mm quartz grains. Lava lithics with plagioclase and biotite; also devitrified glass. Zircon associated with opaques. Plagioclase: 17-25°.
G-19	Plagioclase: 25-30°.
G-20a	Clinopyroxene altered to hornblende. Plagioclase: 26-28°. Abundant secondary carbonate mineralization.
G-20b	Plagioclase: 31°. Relict shards abundant in glass.
G-21	Carbonate replacement of phenocrysts and groundmass. Clinopyroxene altered to hornblende. Lithics contain many 0.1-0.2 mm plagioclase phenocrysts. Plagioclase: 18-25°.
G-22	Plagioclase growing in biotite and some hornblende. Plagioclase: 21-15°. Some alteration of hornblende and biotite.
G-23	Hornblende replaces clinopyroxene. Plagioclase 17-30°. Apatite replaces hornblende and occasionally biotite.

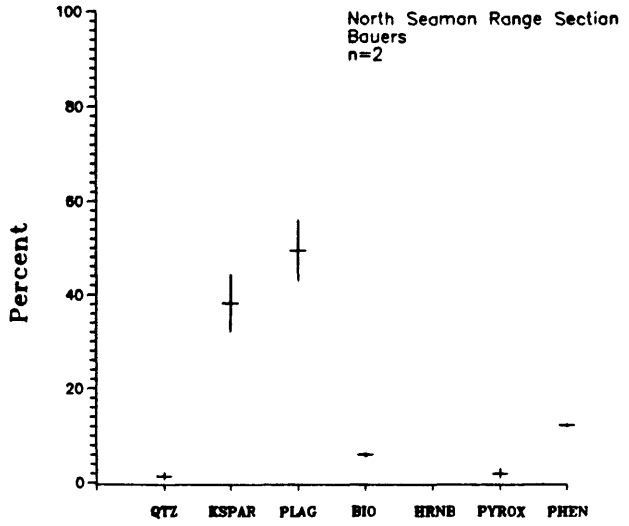
Appendix (continued)
NORTH SEAMAN RANGE SECTION
38°18'50", 115°16'

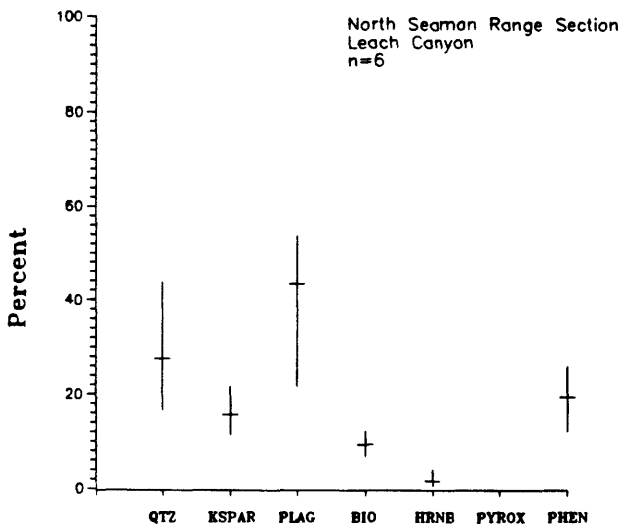
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences Sp.	Al	Ap	Zr	Px	Petrographer
ND-24	Pahranagat	3264	22.1	37.8	35.9	24.2	1					tr	1				9		ELM
ND-23	Bauers	3071	11.9	0.8	44.3	42.9	6		3								9		ELM
ND-22	Bauers	4264	12.6	2.2	32.2	55.8	6.1	tr	1								27		ELM
ND-20	Leach Canyon	3420	12.1	43.7	21.6	21.6	10.1	tr						15			3		ELM
ND-19	Leach Canyon	2736	14.3	31.6	16.2	42.4	7.2	tr						6			3		ELM
ND-18	Leach Canyon	1750	19.4	22.4	15.3	45.4	10	3.5									12		ELM
ND-17	Leach Canyon	1760	21.6	16.5	11.3	53.6	12.1	4									12		ELM
MD-16	Leach Canyon	893	23.5	23.8	18.1	50.0	6.7	tr									8		ELM
ND-15A	Leach Canyon	1914	25.9	27.8	11.5	47.2	10.3	1.4									3		ELM
ND-14	U. Shingle Pass	4250	6.0		43.2	40.1	15.3	tr									7		ELM
ND-13	U. Shingle Pass	5859	6.0		29.9	60.4	7.3										5		ELM
ND-12	U. Shingle Pass	6510	6.5	0.7	43.7	43.9	5.6	1.6	tr			1					13		ELM
ND-11	U. Shingle Pass	11390	7.8	1.1	28.1	61.7	6.4	1	tr								3		ELM
ND-10	U. Shingle Pass	4539	5.5	4.0	28.9	54.2	7.2	tr	2							1	10		ELM
ND-9	Murphy gap	1995	18.0	18.6	39.5	28.6	8.1	1.9				tr	2			1	9		ELM
ND-8	Murphy Gap	3560	31.0	34.0	33.0	28.0	4.1	tr								2	14		ELM
ND-7	Murphy Gap	3441	12.9	43.9	33.8	18.9	2.9										7		ELM
ND-6	L. Shingle Pass	5612	13.0	9.6	49.4	35.8	tr					2.2	16	2			23		ELM
ND-5	L. Shingle Pass	5246	12.3	9.6	43.8	40.1	1					4	26				12		ELM
ND-4	L. Shingle Pass	2058	14.8	6.2	34.2	49.9	tr	tr				4.9	15				9		ELM
ND-3	Isom type	5520	4.6	0.8		71.7	tr		5.5	1.2	3	5.1	13				4		ELM
ND-2	Isom type	5162	5.7	1.7		79.0			1.4	8.5						2	2		ELM
ND-1	Lund	2262	42.0	36.5	4.4	48.3	6.3	1.7					tr-8p	17		12	24		ELM

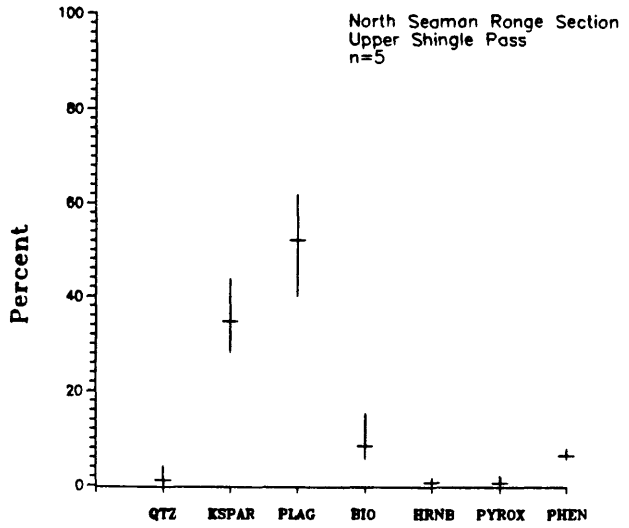
Appendix--continued

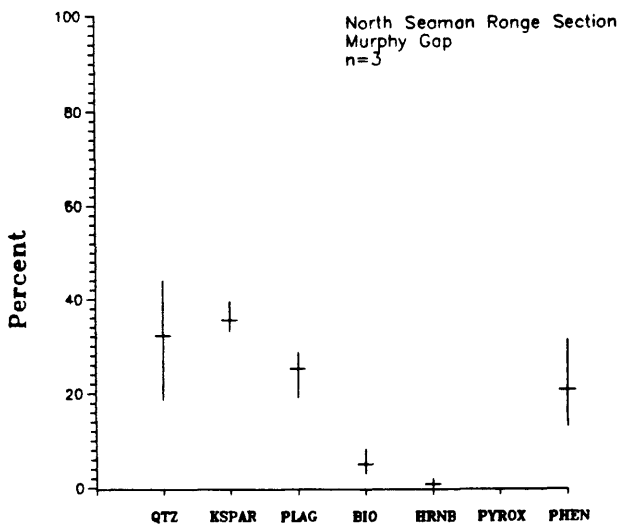
North Seaman Range Section

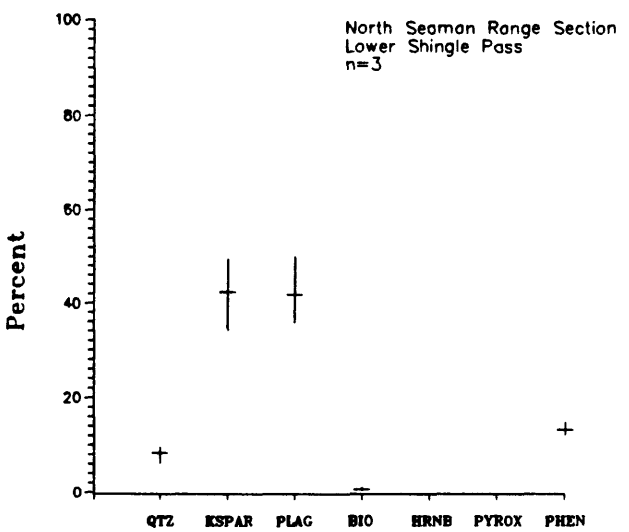






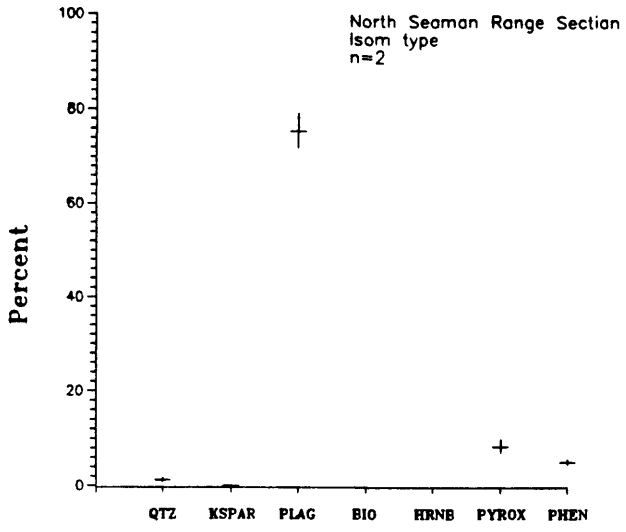


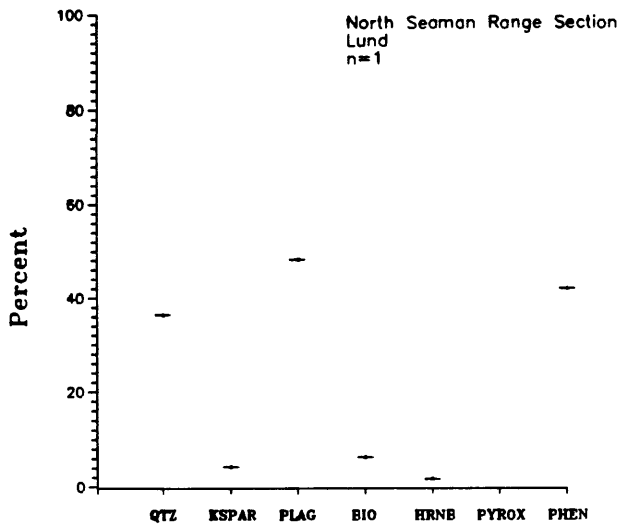




Appendix--continued

North Seaman Range Section





Appendix--continued

NORTH SEAMAN RANGE SECTION; ADDITIONAL SAMPLE DATA

ND-24 Devitrified, moderately welded tuff. Shards replaced by fibrous feldspar and quartz. Large embayed quartz crystals.

ND-23 Devitrified, moderately welded tuff. Abundant calcite in matrix, large plagioclase crystals contain holes in center.

ND-22 Devitrified, densely welded tuff. Many plagioclase crystals are broken and partially lost. Zircons with opaques on plagioclase.

ND-21 Devitrified, moderately to densely welded tuff. Altered pumice in matrix; cavities in matrix indicate former presence of large feldspar crystals.

ND-20 Partially devitrified, moderately welded tuff. Some feldspars entirely removed except for rims. Lithics are chloritized, granular material with fragments of plagioclase and other oxidized dacite lithics.

ND-19 Partially devitrified, non-welded tuff.

ND-18 Partially devitrified, non-welded tuff. Lithics are oxidized dacite with plagioclase and quartz. Some flow structure.

ND-17 Slightly devitrified, non-welded, shardy tuff. Abundant calcite in matrix. Zircon in matrix associated with mafics.

ND-16 Partially devitrified, non-welded to partially welded tuff. Lithics are shardy dacite with plagioclase and hornblende.

ND-15a Slightly devitrified, shardy, non-welded tuff. Abundant calcite alteration. Rare lithics.

ND-14 Devitrified, moderately welded tuff. Plagioclase: 13, 20, 21.5^{o}. Abundant calcite in matrix. Zircon in matrix.

ND-13 Devitrified, moderately welded tuff. Plagioclase: 18.5, 23, 26.5, 30.5^{o}. Matrix contains abundant voids lined with plagioclase, quartz, and potassium feldspar--voids may have originially been crystals. Spherulitic.

ND-12 Devitrified, spherulitic tuff. Plagioclase: 13.5, 20, 27^{o}. Matrix contains abundant voids lined with plagioclase, quartz, and potassium feldspar--voids may have originally been crystals.

ND-11 Vitric, shardy, non-welded to partially welded tuff. Plagioclase: 16.5, 23.5, 30^{o}. Scattered pumice in matrix. Spherulites of potassium feldspar and quartz in matrix and in veins which cut matrix.

ND-10 Slightly devitrified, shardy, non-welded to partially welded tuff. Plagioclase: 15.5-21.5^{o}. Pumice fragments abundant.

Appendix--continued

NORTH SEAMAN RANGE SECTION (continued)

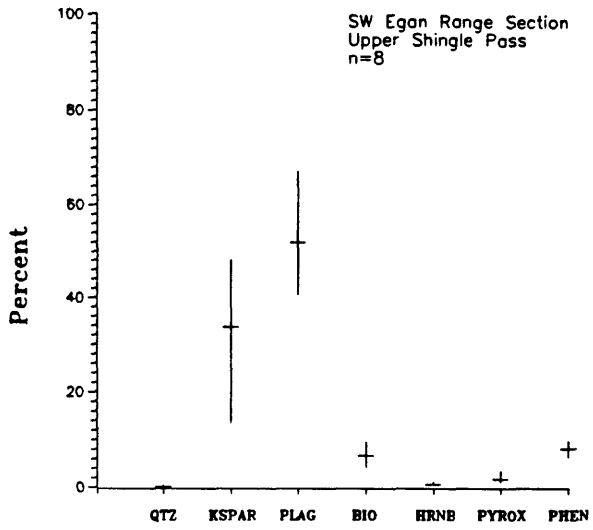
ND-9	Partially devitrified, moderately welded tuff. Plagioclase: 10.5, 12, 18.5, 19°. Altered mafics are probably hornblende or pyroxene. Centers of many plagioclase crystals missing. Zircon in matrix.
ND-8	Partially devitrified, moderately welded tuff. Plagioclase: 12, 19, 22.5°. Shardy ghosts still visible under plain light. Zircon in matrix near plagioclase and biotite. Oriented inclusions in some sanidine.
ND-7	Partially devitrified, moderately welded tuff. Plagioclase: 11-18°. Zircon in matrix. Oriented inclusions of plagioclase? or quartz? in sanidine. Secondary veins of quartz and potassium feldspar cut other grains.
ND-6	Devitrified, moderately welded tuff. Plagioclase: 11, 12, 17.5, 18.5, 21°. Remnants of biotite or hornblende, surrounded by oxidation rims. Embayed quartz distinctive. Some sanidine contains oriented inclusions of plagioclase? or quartz?
ND-5	Partially devitrified, moderately welded tuff. Plagioclase: 8, 14.5, 15.5, 18°. Altered mafics may have been olivine, but are completely oxidized now. Zircon in matrix.
ND-4	Devitrified tuff. Plagioclase: 11, 11.5, 12, 16°. Secondary quartz and potassium feldspar in matrix, some fibrous and spherulitic material. Altered mafics completely oxidized and unrecognizable.
ND-3	Devitrified tuff. Plagioclase: 9, 11.5, 21.5, 24.5°. Plagioclase altered, many voids, veins filled with alteration products. Altered mafics may have been olivine.
ND-2	Vitric, non-shardy tuff. Plagioclase: 8.5, 8.5, 9, 12.5°. Lithics of dacite containing plagioclase and pyroxene.
ND-1	Devitrified tuff. Sphene in matrix. Quartz moderately embayed.

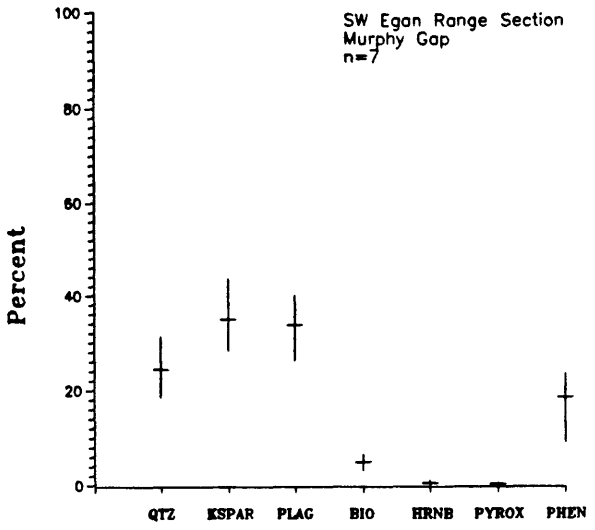
Appendix (continued)
SOUTHWEST EGAN RANGE SECTION
38°16'50", 115°05'30"

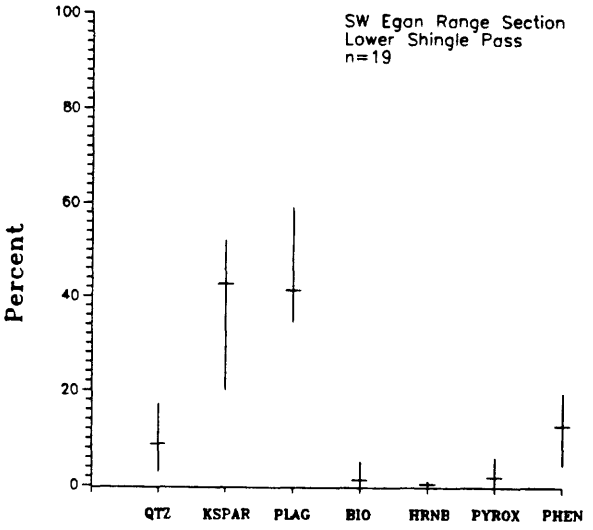
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen			Mafic Phen						Other (%)	Phenocryst occurrences					Petrographer
				Qtz (%)	Kspar (%)	Plag (%)	Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)		Sp	Al	Ap	Zr	Px	
I-36	U. Shingle Pass	5695	9.0	0.0	32.9	55.3	7.2	tr	1.4	tr		1					9		ELM
I-35b	U. Shingle Pass	2465	8.7	0.0	13.5	67.0	5.7	tr	3.4			8	17						ELM
I-35a	U. Shingle Pass	6448	7.5	0.4	41.5	47.1	6.8	tr	1.5			tr	1				8		ELM
I-34	U. Shingle Pass	5504	8.7		35.8	54.3	6.2	tr	1.2							1	6		ELM
I-33	U. Shingle Pass	4636	6.5		38.6	47.1	9.4	1	1.7			tr	2				8		ELM
I-32	U. Shingle Pass	5673	9.7		48.0	44.5	4.4	tr	1			tr	1				10		ELM
I-31	U. Shingle Pass	5238	6.4		38.6	40.7	9.5	1	1.5								11		ELM
I-30	U. Shingle Pass	15190	8.6	0.1	31.1	60.0	4.1	tr	1.6	tr		tr	3			1	21		ELM
I-29	Murphy Gap	2795	20.2	22.9	28.4	40.2	6.2	1		tr		tr	1				21		ELM
I-28	Murphy Gap	2170	20.8	18.6	32.8	39.5	6.6	1			tr						10		ELM
I-27	Murphy Gap	4387	23.5	23.0	34.0	36.8	4.3	tr			tr	tr				4	27		ELM
I-26	Murphy gap	3496	23.2	28.9	30.5	32.8	5.7	tr	tr			tr					20		ELM
I-25	Murphy Gap	3348	18.0	25.7	43.7	26.5	3.1					tr	2				14		ELM
I-24	Murphy Gap	4752	15.3	31.4	37.4	26.3	3.6										7		ELM
I-23	Murphy Gap	4692	9.0	20.6	38.6	34.5	5.2										10		ELM
I-22b	L. Shingle Pass	2535	8.0	10.0	31.0	47.0	4	tr	tr			7			1				ELM
I-22a	L. Shingle Pass	4141	8.2	9.6	43.7	40.4	3.6										7		ELM
I-21	L. Shingle Pass	7820	5.8	17.1	40.0	37.4	3.9					tr					3		ELM
I-20	L. Shingle Pass	7308	4.3	13.3	42.9	35.7	5.1	tr				1					3		ELM
I-19	L. Shingle Pass	3800	13.6	11.4	44.6	39.6	1	tr				tr					4		ELM
I-17	L. Shingle Pass	4160	13.7	7.4	46.1	42.1	1			1.2		1.4					13		ELM
I-16	L. Shingle Pass	4896	13.7	8.7	43.3	41.6	tr	tr	1.9	tr		tr					5		ELM
I-15	L. Shingle Pass	6052	13.7	8.3	46.0	40.2	0	1		1.3							10		ELM
I-14	L. Shingle Pass	3560	12.7	2.9	44.5	43.3	tr	1	2.4	2		1					8		ELM
I-13	L. Shingle Pass	2800	14.6	6.1	45.2	41.0	tr	tr	1.2	2.2		1					8		ELM
I-12	L. Shingle Pass	3744	16.6	7.4	45.6	42.1	tr		tr	1.1		1.8				2	7		ELM
I-11	L. Shingle Pass	3588	16.1	11.6	42.3	41.4	tr	tr	1.6	tr		1					4		ELM
I-10	L. Shingle Pass	3942	12.4	7.2	51.9	34.6	tr	tr	1.6	tr		2.7					5		ELM
I-9	L. Shingle Pass	4240	19.5	5.1	42.7	46.6	tr	tr	2.5	tr		tr				3	8		ELM
I-8b	L. Shingle Pass	2017	16.7	7.7	47.5	36.6			4.1			2.7							ELM
I-8a	L. Shingle Pass	3320	16.9	6.3	48.8	38.6	0	tr	2.3	1.8		tr				1	6		ELM
I-7	L. Shingle Pass	6510	16.2	9.5	43.6	41.2	tr	tr	1.2	1		1.5					16		ELM
I-6b	L. Shingle Pass	2396	10.6	7.0	20.0	59.0	2	tr	6			2			2				ELM
I-6a	L. Shingle Pass	6936	11.0	11.2	42.6	38.9	tr	tr	tr	1		3.4					27		ELM
I-5b	Isom type	42440	1.0			66.0	tr	1	13			11							ELM
I-5a	Isom type	6272	5.2	1.9	0.0	77.0	tr	tr	3.4	7.8		tr					1		ELM
I-4a	Isom type	7065	3.7	2.8		83.5	1.2	tr	2	1.2							8		ELM
I-3b	Isom type	50200	0.7	0.0	0.0	89.0	tr		2.5			tr							ELM
I-3a	Isom type	5959	4.7	4.3	0.7	80.0	1.1	tr	2.9			3.9					3		ELM
I-2	Monotony	1100	31.9	13.8	0.6	64.3	11.4	5.1		1.2				7			13		ELM
I-1	Monotony	1360	23.2	12.6	2.5	61.9	11.4	7.3				1.9		7		4	7		ELM

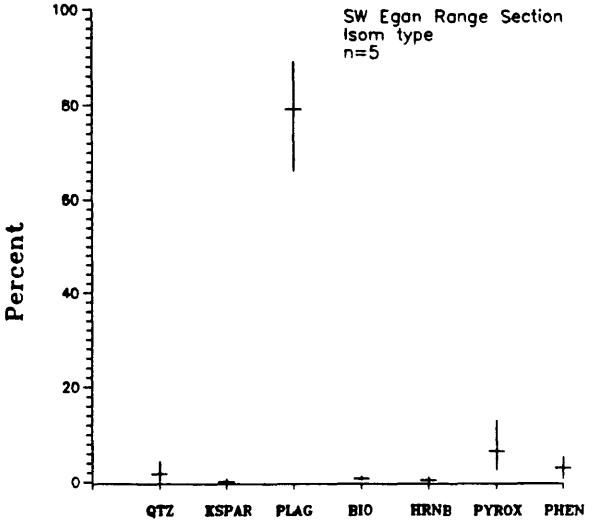
Appendix--continued

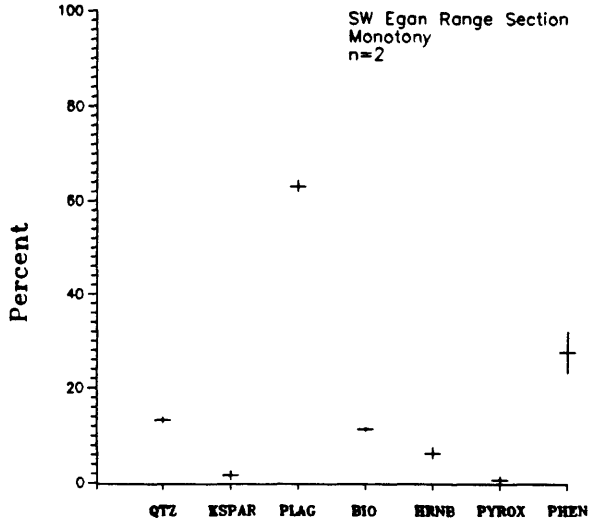
Southwest Egan Range Section











Appendix--continued

SOUTHWEST EGAN RANGE SECTION; ADDITIONAL SAMPLE DATA

I-36 Devitrified moderately welded tuff. Cooling unit 5. Plagioclase: 10, 15, 15.5, 20, 20, 20, 23.5°. Lithics include one large recrystallized dacite with plagioclase and biotite, several smaller fragments. Spherulites in matrix.

I-35b Cooling unit 5. Olivine?

I-35a Devitrified, moderately welded tuff. Lithics of dacite with pyroxene, plagioclase and sanidine. Cooling unit 5. Plagioclase: 14.5, 15, 16.5, 23°. Spherulites of quartz and feldspar in matrix.

I-34 Devitrified, moderately welded tuff. Cooling unit 5. Plagioclase: 11.5, 19.5, 20, 22.5°. Spherulites of quartz and feldspar in matrix, also quartz and feldspar crystal agglomerates. Zircon in matrix. Lithics are oxidized dacite.

I-33 Devitrified, moderately welded tuff. Cooling unit 5. Plagioclase: 10.5, 18. Zircons in matrix associated with mafics and opaques.

I-32 Partially devitrified, moderately welded, shardy tuff. Cooling unit 5. Plagioclase: 13, 14.5, 23.5, 25, 27°. Lithophysal voids filled with spherulitic material. Zircon in matrix with opaques and mafics. Lithics are oxidized dacite.

I-31 Vitric, moderately welded, shardy tuff. Cooling unit 5. Plagioclase: 12.5, 13.5, 19.5, 20°. Large spherulites in matrix, may fill lithophysal voids. Zircon in matrix associated with mafics and opaques. Lithics are oxidized dacite.

I-30 Vitric, moderately welded, shardy tuff. Cooling unit 5. Plagioclase: 13, 13.5, 16, 23°. Zircon in matrix associated with opaques and mafics. All feldspars have very shiny, satiny luster. Large pumices in matrix. Lithics of oxidized dacite.

I-29 Completely devitrified tuff. Cooling unit 4. Plagioclase: 24, 25, 26.5, 29°. Zircon mostly in matrix near opaques. Spherulites of quartz and feldspar in matrix. Lithics of dacite.

I-28 Devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 9, 15, 15.5, 19.5°. Some spherulites of quartz and feldspar in matrix. Lithics of oxidized dacite with tiny crystal laths.

I-27 Partially devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 11, 11, 18.5, 20.5°. Spherulites and fibrous masses of quartz and feldspar in matrix. Zircon in matrix. Pyroxene altered, not possible to determine type.

Appendix--continued

SOUTHWEST EGAN RANGE SECTION (continued)

I-26	Partially devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 12, 13, 23, 23.5, 25°. Matrix includes spherulites of feldspar and quartz feldspar agglomerates. Lithics are pyroxene, biotite, rich dacite, in large crystals.
I-25	Partially devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 9.5, 9.5, 12, 12, 21, 24°. Scattered agglomerates of plagioclase or sanidine. Zircon associated with opaques and plagioclase.
I-24	Partially devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 6, 6, 6, 14, 15, 24.5°. Quartz embaymment consists of holes in middle of crystal. Aggregates of plagioclase or sanidine. Possibly two plagioclase types. Lithics of crystal-rich dacite.
I-23	Partially devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 9.5, 16, 16.5°. Quartz embayment consists of holes in middle of crystals. Aggregates of plagioclase. Lithics are dacite with tiny crystal laths.
I-22b	Cooling unit 4.
I-22a	Partially devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 18.5, 20.5, 23.5, 24.5°. Zircon associated with opaques and plagioclase. Biotite not altered like those lower in section.
I-21	Devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 14, 19, 24°. Lithics are oxidized dacite. Altered mafics are one half pyroxene and one half biotite. Syntaxial overgrowths on a few sanidines. Matrix partially recrystallized with some carbonate. Lithics of oxidized dacite.
I-20	Devitrified, moderately welded tuff. Cooling unit 4 (shard base). Plagioclase: 8, 9, 13°. Altered mafics are probably biotite; no pyroxene apparent. Matrix partially recrystallized, some carbonate. Syntaxial overgrowths on sanidine. Lithics of oxidized dacite.
I-19	Devitrified, recrystallized tuff. Cooling unit 3. Plagioclase: 7.5, 10.5, 25, 26°. Sanidine shows syntaxial overgrowths. Agglomerates of plagioclase and altered mafics. Lithics are oxidized dacite. Mafics are pyroxene?
I-17	Devitrified, moderately welded? tuff. Cooling unit 3. Plagioclase: 15, 18, 19, 21.5, 23°. Lithics oxidized. Mafics mostly oxidized and altered. Aggregates of plagioclase, mafics, opaques, and zircon. Matrix completely recrystallized to quartz, potassium feldspar, and some carbonate. Shard texture nearly gone. Lithics of oxidized dacite.

Appendix--continued

SOUTHWEST EGAN RANGE SECTION (continued)

I-16	Devitrified, moderately welded tuff. Cooling unit 3. Plagioclase: 19, 19.5, 20, 23°. Matrix almost completely recrystallized; abundant carbonate replacement. Altered mafics are pyroxene. Some quartz. Lithics of dacite of andesite.
I-15	Devitrified, moderately welded tuff. Cooling unit 3. Plagioclase: 10, 10, 14, 14, 18°. Mafics oxidized and altered. Agglomerates of mafics, opaques, plagioclase, and zircon. Less quartz embayed than lower portions of CU-3. Central one third of slide completely devitrified, spherulitic.
I-14	Devitrified, moderately welded tuff. Cooling unit 3. Plagioclase: 9.5, 10.5, 12, 16, 23°. Abundant spherulites and fibrous secondary quartz and potassium feldspar. Aggregates of plagioclase, pyroxene, opaques, and zircon. All mafics oxidized and otherwise altered. Altered mafics are pyroxene.
I-13	Devitrified, moderately welded tuff. Cooling unit 3. Plagioclase: 9.5, 12, 21°. Altered mafics are pyroxene. Agglomerates of plagioclase, and opaques. Quartz not as deeply embayed as previous slides. Lithics of dacite.
I-12	Devitrified, moderately welded tuff. Cooling unit 3. Plagioclase: 16, 18.5, 19.5, 23.5°. Altered mafics are pyroxene; some pyroxene altered to hornblende. Distinctive embayed quartz. Accessory minerals associated with opaques.
I-11	Devitrified, moderately to densely welded tuff. Cooling unit 3. Plagioclase: 14.5, 17.5, 20, 20.5°. Agglomerates of quartz, sanidine, plagioclase, and pyroxene. Altered mafics are pyroxene. Distinctive embayed quartz. Zircon in opaques.
I-10	Devitrified, moderately to densely welded tuff. Cooling unit 3. Plagioclase: 9.5, 12.5, 16°. Distinctive embayed quartz. Spherulites and agglomerates of sanidine and quartz. Agglomerates of mafics and plagioclase. Altered mafics are pyroxene.
I-9	Devitrified, moderately to densely welded tuff. Cooling unit 3. Plagioclase: 5.5, 6.5, 8.5, 11, 12.5, 23°. Lithics of dacite and andesite (plagioclase, altered mafics, orthopyroxene). Pyroxene altered to hornblende. Agglomerates of plagioclase, mafics, opaques, zircon, and apatite. Distinctive embayed quartz.
I-8b	Cooling unit 3. Outlines of altered mafic crystals suggest biotite in a few cases.

Appendix--continued

SOUTHWEST EGAN RANGE SECTION (continued)

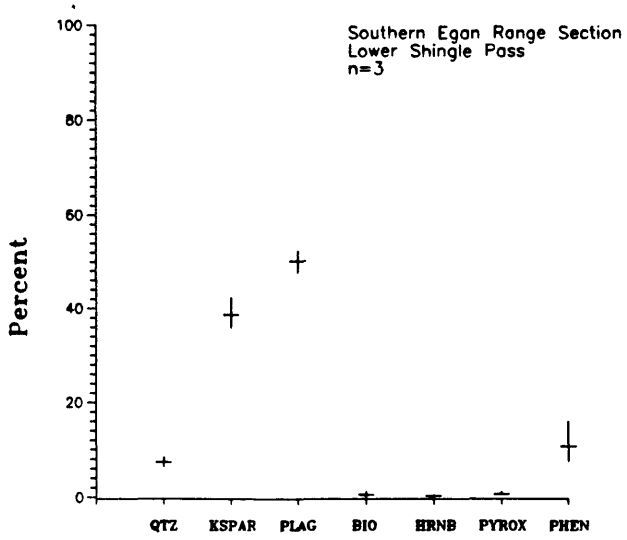
I-8a	Vitric, shardy, moderately welded tuff. Cooling unit 2. Plagioclase: 8.5, 16.5, 18, 22.5, 27.5°. Lithics of devitrified dacite and andesite, abundant crystals that range from tiny laths to 0.8 mm. Quartz distinctive, highly embayed. Agglomerates of potassium feldspar, mafics, and opaques.
I-7	Vitric, shardy, moderately welded tuff. Plagioclase: 8, 8.5, 10, 17°. Lithics of oxidized tuff with plagioclase, quartz, and mafics with rounded edges. Altered mafics all pyroxene. Zircon associated with opaques and pyroxene.
I-6b	Cooling unit 3 (shard tuff). Some hornblende is brown. Quartz very embayed. Most altered mafic is biotite. Probably needs recount for better potassium feldspar to plagioclase ratio.
I-6a	Vitric, shardy, moderately welded tuff. Cooling unit 3. Plagioclase: 9.5, 15, 16°. Altered mafics all pyroxene. Lithics of tuff with quartz, plagioclase, hornblende, and pyroxene. Some oxidized, dacite or andesite. Embayed quartz, very distinctive.
I-5b	Cooling unit 2.
I-5a	Vitric, moderately welded tuff. Cooling unit 2. Plagioclase, both (+) and (-): 19, 21, 27, 31, 34°. Lithics of crystal-rich tuff with hornblende and plagioclase. Orthopyroxene probably hypersthene.
I-4a	Partially devitrified, densely welded, shardy tuff. Plagioclase: 20, 22.5, 25°. Abundant cavities, some lined with potassium feldspar and quartz crystals. Possibly vapor phase phenomena. Lithics of dacite.
I-3b	Cooling unit 1. Plagioclase clear, unaltered, zoning uncommmon. Altered mafics are opaque pseudomorphs after biotite. Pyroxene has ragged edges.
I-3a	Partially devitrified, moderately welded tuff. Cooling unit 1. Plagioclase: 17-20°. Many chert aggregates alone and surrounding other minerals. Altered mafics and opaques in close association, sometimes difficult to tell apart. Lithics with plagioclase, altered mafics, and quartz.
I-2	Partially devitrified, partly welded, oxidized tuff. Plagioclase: 13-14, 25-28°. Pyroxene altered to hornblende. Hornblende also badly oxidized and completely destroyed in many cases.
I-1	Devitrified oxidized tuff. Plagioclase: 20-32°. Quartz agglomerates. Lithics with plagioclase laths; biotite and plagioclase intergrown.

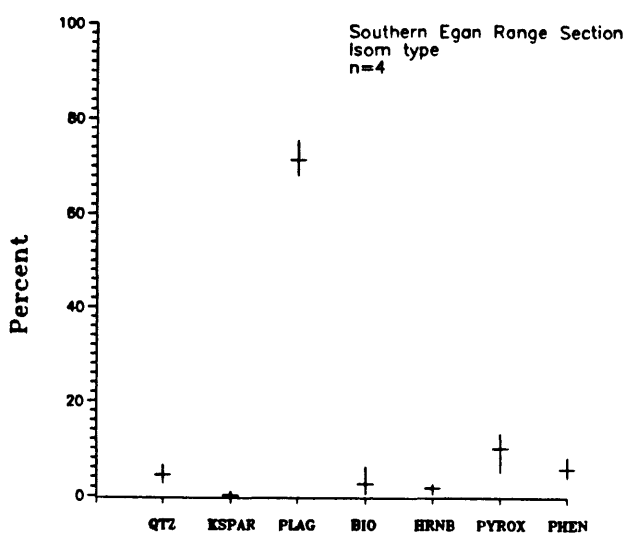
Appendix (continued)
SOUTHERN EGAN RANGE SECTION
38° 20', 114° 58'

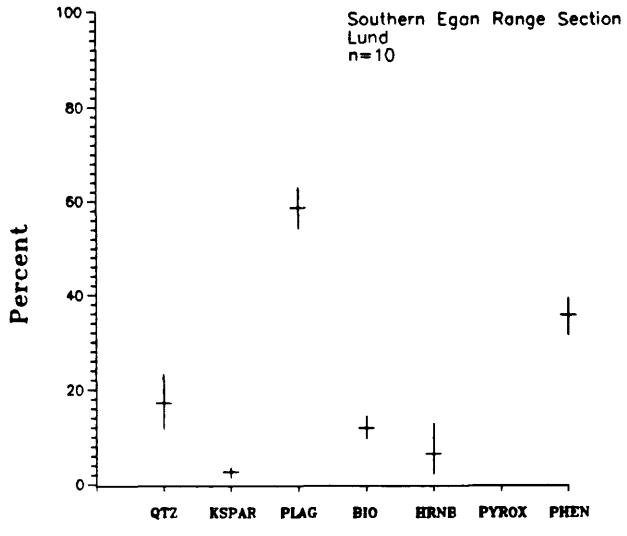
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences Sp	Al	Ap	Zr	Px	Petrographer
H-21	L. Shingle Pass	1562	15.9	6.4	37.8	50.6	1.2	tr	1.2	tr			1.2-01				5		ELM
H-20	L. Shingle Pass	4100	7.5	8.4	42.4	47.6			tr								13		ELM
H-19	L. Shingle Pass	2478	8.8	7.3	35.8	52.3	tr	tr	tr	tr			2.3-01				12		ELM
H-18	Isom type	2680	8.0	6.6	0.0	69.8	3.7	tr	8.8	4.2									ELM
H-17	Isom type	7128	6.8	3.1	0.0	68.0	6.2	2.3	9.4	2.7				1			17		ELM
H-16	Isom type	7524	3.9	2.7	1.0	75.3	tr	2	10	tr							3		ELM
H-15	Isom type	4264	3.8	5.6	0.0	72.1	4.4	2.5	5					1			3		ELM
H-14	Lund	1281	35.7	16.6	3.1	54.9	9.6	12.9					tr-Sp	12			7		ELM
H-13	Lund	1008	31.5	11.7	1.6	60.3	14.5	8.8						12			6		ELM
H-11b	Lund	1151	38.6	13.5	3.6	54.2	12.6	12.6						39		26	26		WJB
H-11a	Lund	1120	36.3	14.5	3.2	59.0	9.8	9.1					1-Sp	30			17		ELM
H-10	Lund	1386	35.6	17.4	2.4	62.8	9.7	6.1						22			16		ELM
H-9	Lund	1056	33.1	15.8	3.4	60.7	13.2	4					1.2-Sp	29			11		ELM
H-8b	Lund	1126	39.4	15.8	3.4	61.9	12.9	2.7					1.1-Sp	25		35	14		WJB
H-8a	Lund	1092	34.3	23.3	1.3	57.5	11.8	2.1					1.3-Sp	20			8		ELM
H-7	Lund	1176	34.5	20.7	1.5	57.6	14.3	4.4					tr-Sp	37			12		ELM
H-6	Lund	1239	38.7	22.9	3.1	57.1	12.3	3.5					tr-Sp	15			1		ELM
H-5	Wah Wah Springs	1220	36.1	5.7	0.0	65.7	7.7	15.5	2.1								8		ELM
H-4	Wah Wah Springs	1218	38.8	6.8	0.2	64.9	6.6	16.3	3							2	9		ELM
H-3	Wah Wah Springs	1386	38.7	7.5	0.0	66.0	8.8	13.4	tr								10		ELM
H-2b	Wah Wah Springs	1344	31.6	4.7	0.0	64.6	8.7	16	1.2								10		ELM
H-2a	Wah Wah Springs	1410	37.0	3.5	0.0	65.9	8.2	15.5	1.1				tr-Ap			37	13		ELM
H-24	Wah Wah Springs	1276	42.9	4.4	0.0	64.0	8.2	19.4	1.8				tr-Zr				4		ELM
H-25	Wah Wah Springs	1365	40.3	6.6	0.0	58.0	8.7	23.5	1.1								6		ELM
H-26	Wah Wah Springs	1344	45.8	2.6	0.0	59.6	9.4	25.5	tr								9		ELM
H-27	Wah Wah Springs	1218	37.3	4.9	0.0	59.5	7.1	24	1.1							6	12		ELM
H-28	Cottonwood Wash?	1408	44.3	14.9	0.0	63.9	7.5	10.6	tr								7		ELM
H-29	Cottonwood Wash?	1280	42.5	9.0	0.0	59.2	13.6	14.7	1.3								7		ELM
H-30	Cottonwood Wash?	1210	42.2	6.7	0.0	60.1	10.8	18.6	tr								5		ELM
H-31	Windous Butte	1071	36.5	27.1	2.1	57.0	8.2	4.1									10		ELM
H-32a	Windous Butte	1364	35.9	27.4	6.3	48.9	11.5	4.1					tr-Zr				11		ELM
H-32b	Windous Butte	1107	36.5	31.2	6.7	45.3	12	4.5					tr-Zr			42	29		WJB

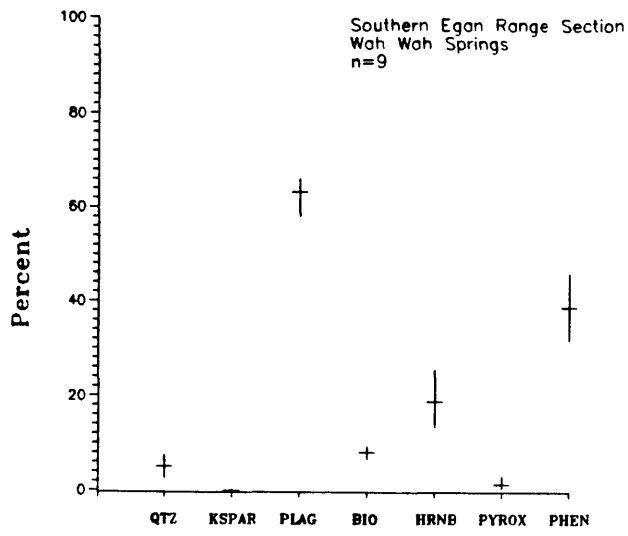
Appendix--continued

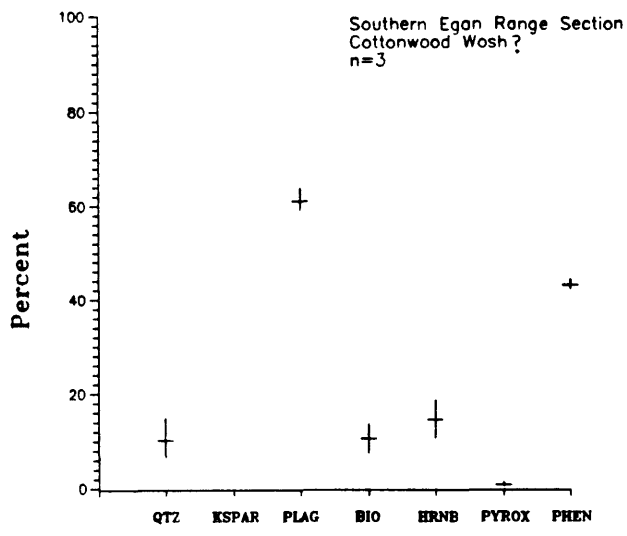
Southern Egan Range Section

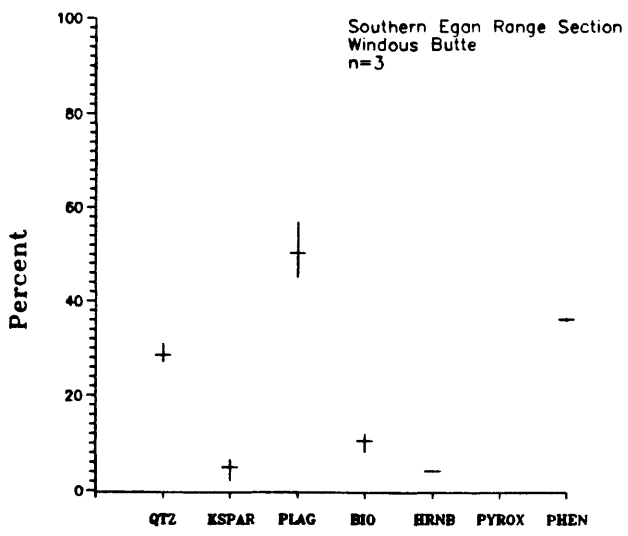












Appendix--continued

SOUTHERN EGAN RANGE SECTION; ADDITIONAL SAMPLE DATA

H-21	Partially devitrified, moderately welded tuff. Plagioclase: 16-18°. Agglomerates of plagioclase and mafics.
H-20	Slightly devitrified, partly welded tuff. Plagioclase: 22-26°. Lithics of oxidized, plagioclase-rich lava.
H-19	Partially devitrified, moderately welded tuff. Plagioclase: 10-18.5°.
H-18	Devitrified, partly welded tuff. Plagioclase: 22-29°. Agglomerates of plagioclase,pyroxene, and opaques. Lithics of reworked tuff.
H-17	Slightly devitrified, partly welded tuff. Plagioclase: 23-27°. Lithics containing plagioclase, hornblende, pyroxene, biotite, and plagioclase-rich lava. Some agglomerates of crystals.
H-16	Vitric, non-welded tuff. Plagioclase: 21-24°.
H-15	Vitric, non-welded tuff. Cooling unit 6. Plagioclase: 24-28°.
H-14	Devitrified, moderately welded tuff. Cooling unit 5. Plagioclase: 18-24°. Biotite and hornblende intergrown. Biotite and plagioclase intergrown. Minor oxidation of mafic minerals.
H-13	Devitrified, moderately welded tuff. Plagioclase: 24-28°. Biotite and hornblende intergrown. Biotite and plagioclase intergrown.
H-11b	Plagioclase: 26°.
H-11a	Partially devitrified, moderately welded tuff. Plagioclase: 24-28°.
H-10	Slightly devitrified, partly welded tuff. Plagioclase: 23-30°.
H-9	Slightly devitrified, partly welded tuff. Plagioclase: 19, 20-27°.
H-8b	Plagioclase: 26°.
H-8a	Slightly devitrified, moderately welded tuff. Plagioclase: 20-26°.
H-7	Slightly devitrified, moderately welded tuff. Plagioclase: 20-23°.
H-6	Partially devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 14, 17-30°. Abundant pumice fragments.
H-5	Devitrified tuff. Plagioclase: 24-28°. Lithics with plagioclase, quartz, and opaques.
H-4	Devitrified tuff. Plagioclase: 18-30°. Lithics of reworked tuff, and andesitic lava.

Appendix--continued

SOUTHERN EGAN RANGE SECTION (continued)

H-3	Devitrified tuff. Plagioclase: 28-30°. Lithics with plagioclase, clinopyroxene, and opaques.
H-2b	Devitrified, partly welded tuff. Plagioclase: 28-29°. Plagioclase crystals form aggregates.
H-2a	Plagioclase: 31°. Fibrous chalcedony abundant in glass.
H-24	Devitrified, partly welded tuff. Plagioclase: 25-31°.
H-25	Devitrified, partly welded tuff. Plagioclase: 20-28°.
H-26	Vitric, slightly welded tuff. South Egan cooling unit 3. Plagioclase: 21-30°. Lithics of altered tuff.
H-27	Vitric, slightly welded tuff. Plagioclase: 21-29°. Average crystal size-0.2 mm. Lithics of tuffs containing plagioclase, hornblende, and biotite.
H-28	Devitrified tuff. Plagioclase: 25-30°. Some plagioclase crystals fractured near edge. Mafics oxidized around rim.
H-29	Plagioclase: 25-29°. Mafics oxidized around rim. Lithics of reworked tuff.
H-30	Cooling unit 2. Plagioclase: 16, 29, 32°. Lithics of plagioclase-bearing altered tuff.
H-31	Lithics of intermediate lava.
H-32a	Devitrified, partly welded tuff.
H-32b	Plagioclase: 30°.

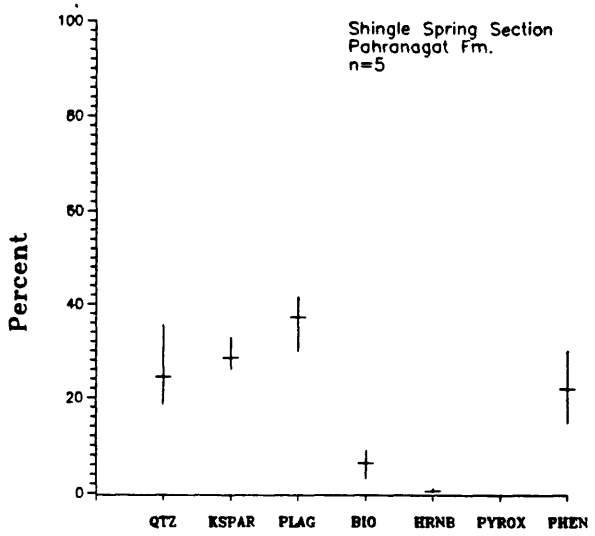
Appendix (continued)
SHINGLE SPRING SECTION
38° 33', 114° 56'

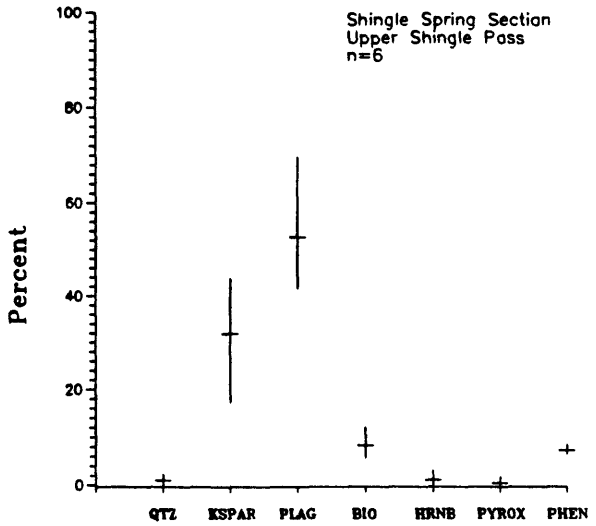
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen: Qtz (%)	Kspar (%)	Plag (%)	Mafic Phen: Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)	Other (%)	Phenocryst occurrences: Sp	Al	Ap	Zr	Px	Petrographer
H-101	Pahranagat	2520	30.1	18.5	32.9	40.2	5.8	tr									12		KAS
H-100	Pahranagat	2340	27.6	19.2	27.3	41.7	8.2	1.1									12		KAS
H-99	Pahranagat	3120	21.7	25.4	27.5	37.5	6.1	tr			tr				1		12		KAS
H-98	Pahranagat	3240	16.1	23.9	26.2	37.7	9	tr							1		6		KAS
H-97	Pahranagat	3120	14.7	35.6	29.0	29.9	3.1	tr	tr								7		KAS
Samples of Bauers Tuff (H-95 to H-96) missing																			
H-94	U. Shingle Pass	3198	7.3	2.2	41.8	43.5	10.3										19		KAS
H-93	U. Shingle Pass	3354	7.1	1.7	43.7	41.6	7.1	tr	1.7							1	10		KAS
H-92	U. Shingle Pass	3315	8.1	1.9	38.2	48.2	8.9	tr									14		KAS
H-90	U. Shingle Pass	3078	8.6		23.3	54.5	12	tr		tr					2	2	2		KAS
H-89	U. Shingle Pass	3159	6.7	0.5	17.1	69.5	5.7	2.4							3		6		KAS
H-88	U. Shingle Pass	1530	6.5		27.3	58.6	6.1	3	tr						1		4		KAS
H-87	L. Shingle Pass	3219	14.0	14.6	46.7	28.5	tr			1.1			1.5-01		1		15		KAS
H-86b	L. Shingle Pass	3000	14.0	14.8	50.5	29.7							2.4-01		2	4	17		FMB
H-86a	L. Shingle Pass	2590	13.8	15.1	48.0	28.8				2.2			3.4-01		1		14		KAS
H-85	L. Shingle Pass	5508	10.3	15.8	49.0	37.6		tr		1.4		1.8	2.5-01		1	1	1		KAS
H-84	L. Shingle Pass	6392	8.2	7.7	44.0	38.8				3.8	20		3.1-01		4		12		KAS
H-83	L. Shingle Pass	6820	7.7	17.3	40.0	36.1	tr	tr			1.7		1.7-01		4		10		KAS
H-81	L. Shingle Pass	9973	5.3	8.6	43.5	38.3		tr			4.3		1.9-01		1		2		KAS
* H-79	Wah Wah Springs	1387	31.1	3.2	0.0	65.0	24.1	5.3								38	10		WJB
* H-76	Wah Wah Springs	1179	42.3	4.6	0.0	59.3	27.1	5.4	tr							48			WJB
* H-74	Wah Wah Springs	1182	50.4	3.7	0.0	64.6	22.3	5.2	tr							53	7		WJB
* H-73	Wah Wah Springs	1545	47.4	5.5	0.0	59.6	23.9	6.8	tr							64	12		WJB
* H-71	Wah Wah Springs	1255	42.4	2.4	0.2	62.6	23.9	6.6	tr							71	9		WJB
* H-70	Wah Wah Springs	1337	31.6	9.9	0.2	57.4	22	3.1	2.8							8	2		WJB
* H-68	Wah Wah Springs	1266	55.1	9.2	0.0	57.1	28.7	2	1.4							27	13		WJB
* H-67	Wah Wah Springs	1325	51.6	5.3	0.0	64.2	25.7	1	tr							35	10		WJB
* H-65	Wah Wah Springs	1286	49.5	4.7	0.0	63.0	26.2	3.9	tr							30	19		WJB
* H-64	Wah Wah Springs	1203	47.2	6.5	0.0	62.9	23.9	3.5	tr							4	8		WJB
* H-62	Wah Wah Springs	1386	47.4	7.8	0.3	64.5	20.5	1.8	tr							24	12		WJB
* H-60	Wah Wah Springs	1846	22.0	2.7	0.5	57.6	27.6	7.9	tr							18	7		WJB
Samples of Cottonwood Wash Tuff (H-57 to H-59) missing																			
H-56	Windous Butte	1302	25.0	29.2	3.4	53.9	9.9	3.4									6		ELM
H-55	Windous Butte	1044	23.9	32.9	2.0	53.4	8.4	2.4									2		ELM
H-54	Windous Butte	1160	33.1	24.7	5.2	63.5	3.9	1.8									3		ELM
H-53	Windous Butte	1218	32.3	29.0	6.9	58.3	4.3	1.3									2		ELM
H-52	Windous Butte	1368	30.0	29.3	6.6	57.3	4.4	2									2		ELM
H-51	Windous Butte	1000	40.3	29.8	13.9	50.1	3.7	2.2									2		ELM
H-50	Windous Butte	900	46.1	25.3	8.9	58.8	3.9	3.1									2		ELM
H-49	Windous Butte	1887	29.5	24.1	11.9	52.4	8.1	2									5		ELM
H-48	Windous Butte	1218	32.0	36.4	9.7	49.5	2.6	3.1									2		ELM
H-47	Windous Butte	1180	36.2	15.0	11.5	64.2	5.6	3.5									9		ELM

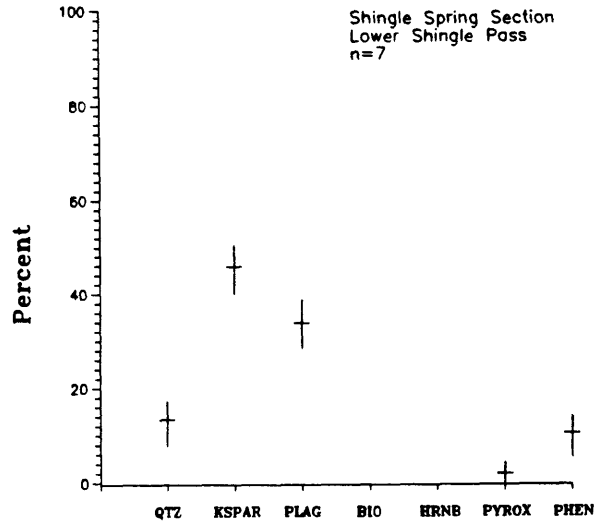
* Hornblende and biotite percentages miscalulated; sample recounts showed Hb/Bi ratios of 3:1

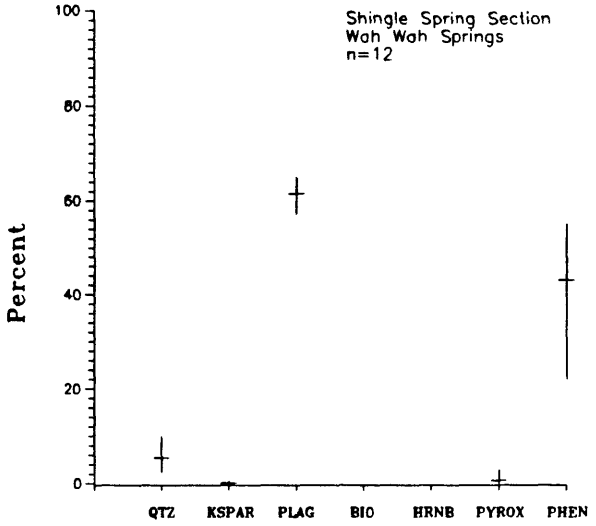
Appendix--continued

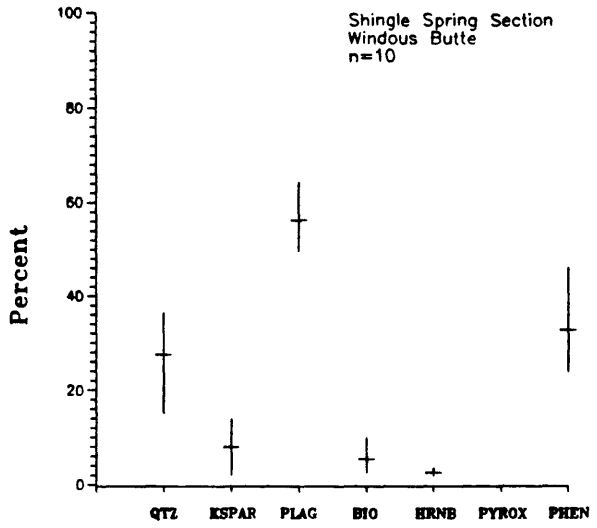
Shingle Spring Section, Egan Range











Appendix--continued

SHINGLE SPRING SECTION; ADDITIONAL SAMPLE DATA

H-101	Cooling unit 4. Plagioclase atered to calcite. Plagioclase: 9, 31°.
H-100	Cooling unit 4. Lithics of tuffaceous sandstone or shale.
H-99	Cooling unit 4. Plagioclase: 20°, zoned. Pyroxene pseudomorphs.
H-98	Cooling unit 4.
H-97	Cooling unit 4. Plagioclase: 6°. Had a hard time distinguishing potassium feldspar from plagioclase.
H-94	Cooling unit 3. Plagioclase: 25, 15°.
H-93	Cooling unit 3. Plagioclase: zoned 14, 11°. Much fine-grained calcite.
H-92	Cooling unit 3. Plagioclase: 12°, (+).
H-90	Cooling unit 2. Plagioclase: 18, 8°. Shard tuff, devitrified, vapor phase.
H-89	Cooling unit 2. Plagioclase 11°, altered to sericite. Hornblende yellow brown to black, some very nice ones. Lithics of very fine lava.
H-88	Cooling unit 2. Plagioclase: 23, 13°. Lithics of fine-grained basic lava.
H-87	Cooling unit 1.
H-86b	Shard-pumice tuff. Sericite(?) halo around hypersthene. Plagioclase An30, may be xenocryst from lithic. Glomerophenocrysts An30 and opaque, An20 and opaque and zircon. Iddingsite after olivine.
H-86a	Cooling unit 1. Plagioclase: 7, 8, 10, 19°.
H-85	Cooling unit 1. Plagioclase: 16, 19°, 1 grain (-). Recounted all potassium feldspar: 147 potassium feldspar (56.7%), 113 plagioclase (43.3%).
H-84	Cooling unit 1. Plagioclase: 11°. Pyroxene (+).
H-83	Plagioclase: 9, 17, 15, 16°. Plagioclase zoned. Pyroxene clear. Allanite: one is 0.9mm. Quartz is very embayed.
H-81	Potassium feldspar has grid texture. Plagioclase zoned. Pyroxene clear to very pale green.
H-79	Completely devitrified. Mafics, and to a lesser extent, plagioclase extensively altered. No clinopyroxene. Spherulitic and axiolitic textures common. Top of section.

Appendix--continued

SHINGLE SPRING SECTION (continued)

H-76	Completely devitrified. Spherulitic texture. Mafics partly altered. Sample taken 65 m above H-70.
H-74	Completely devitrified, partly welded. Biotite and hornblende replace clinopyroxene. Spherulitic texture. Sample taken 45 m above H-70.
H-73	Completely devitrified partly welded. Axiolitic texture rare. Sample taken 30 m above H-70.
H-71	Spherulitic and axiolitic textures abundant. Mafics are quite fresh, rock is completely devitrified and partly welded. Sample taken 2 m above H-70.
H-70	Completely devitrified. Axiolitic texture common. Mafics fairly fresh.
H-68	Completely devitrified, and partly welded. Spherulitic texture common. Biotite, clinopyroxene, and hornblende altered to clay and opaques.
H-67	Biotite and hornblende extensively altered to clay and opaques. Spherulitic texture common. Amount of alteration of plagioclase and mafics increases upward in the section. Clinopyroxene partly altered to hornblende. Some replacement of plagioclase by iron oxides along fractures and cleavage.
H-65	Completely devitrified, and partly welded. Hornblende and biotite rimmed by alteration products (opaques). Quartz and plagioclase phenocrysts commonly fractured. Abundant spherulitic texture.
H-64	Devitrified. Biotite and hornblende partly altered to opaques and clay? but some grains fresh. Clinopyroxene altered.
H-62	Completely devitrified, partly welded; spherulitic textures common. Shards compacted and bent around phenocrysts. Clinopyroxene partly altered to hornblende. Opaques largely magnetite?; partly altered to biotite, hornblende and clinopyroxene.
H-60	Non-welded, vitric-shard base. Little pumice.
H-56	Devitrified, moderately welded tuff. Lithics of altered intermediate tuff and siltstone.
H-55	Devitrified, moderately welded tuff. Lithics of siltstone.
H-54	Devitrified, moderately to densely welded tuff.
H-53	Devitrified, moderately to densely welded tuff.
H-52	Devitrified, moderately to densely welded tuff.

Appendix--continued

SHINGLE SPRING SECTION (continued)

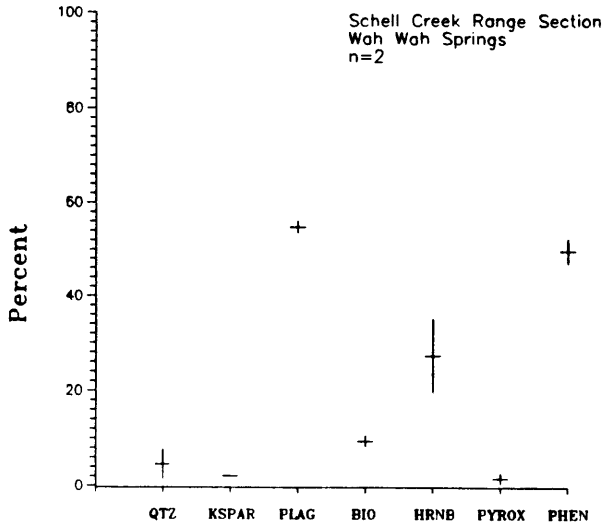
H-51	Devitrified, moderately welded tuff. Contains black alteration product in matrix.
H-50	Devitrified, densely welded tuff.
H-49	Devitrified, partly welded tuff. Biotite and hornblende are highly altered, especially along rims.
H-48	Devitrified, partly welded tuff.
H-47	Partially devitrified, partly welded tuff.

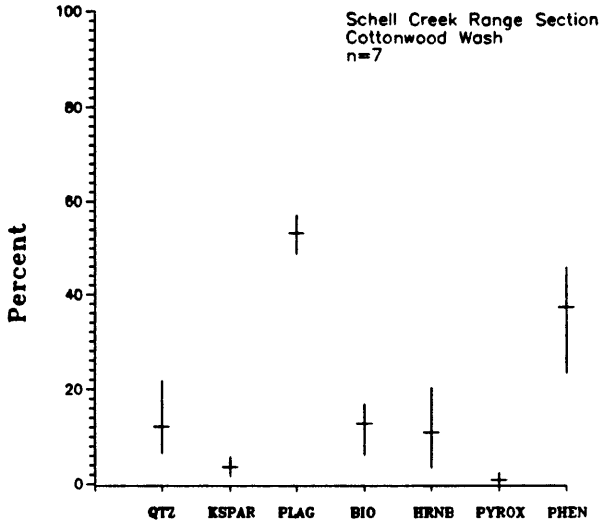
Appendix (continued)
SCHELL CREEK RANGE SECTION
38° 28', 114° 45'

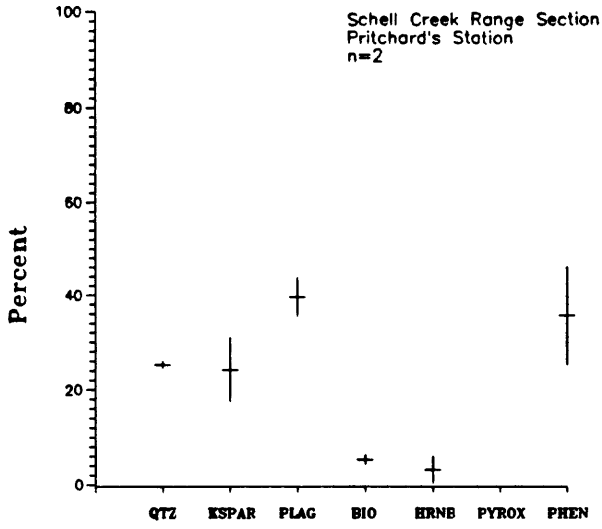
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen			Mafic Phen						Other (%)	Phenocryst occurrences					Petrographer
				Qtz (%)	Kspar (%)	Plag (%)	Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)		Sp	Al	Ap	Zr	Px	
ER-14	Wah Wah Springs	798	47.1	7.7	2.1	56.1	10.6	19.7			2.7					55	8	35	GLD
ER-13	Wah Wah Springs	899	52.3	1.4	2.1	53.4	8.3	35.1			tr					23	2	12	GLD
ER-12	Cottonwood Wash	918	45.8	10.2	5.5	50.5	13.3	8.1			2.4	7.6				22	7	11	GLD
ER-11	Cottonwood Wash	798	44.6	14.3	1.7	57.3	6.1	3.4			1.1	14				21	2		GLD
ER-10	Cottonwood Wash	852	43.1	21.8	1.6	50.7	13.6	8.4			1.6	tr				15		3	GLD
ER-9	Cottonwood Wash	1007	33.5	6.5	3.5	48.7	16.9	20.4			1.1					17	2	9	GLD
ER-8	Cottonwood Wash	924	35.0	12.4	3.4	54.8	12	13.3	tr						35		4	3	GLD
ER-6	Cottonwood Wash	965	36.1	11.2	4.0	54.0	14.7	12.3							3	42	9		GLD
ER-5	Cottonwood Wash	1113	23.4	9.1	5.8	57.1	13.8	11						4	5	77	14		GLD
ER-2	Pritchards St.	938	46.1	25.9	17.6	43.8	4.4	6			tr	1.1				10	3	4	GLD
ER-1	Pritchards St.	1045	25.3	24.6	31.0	35.6	6.4	tr											GLD

Appendix--continued

Schell Creek Range Section







Appendix--continued

SCHELL CREEK RANGE SECTION; ADDITIONAL SAMPLE DATA

ER-14 Densely welded, devitrified tuff. Crystal-rich. Plagioclase is resorbed and zoned (most are twinned). Similar to ER-13.

ER-13 Moderately welded tuff. Crystal-rich. Plagioclase is partly resorbed, however, well zoned and twinned. Abundant hornblende. Pyroxene is altered. Vitric shards throughout the thin section. No sphene.

ER-12 Moderately welded, devitrified tuff. Coarse-grained, large crystals. Many of the minerals are fragmented. Plagioclase is well zoned (50% of plagioclase). Quartz is large (up to 3.0 mm). Magnetite is replacing biotite and hornblende as in ER-11. First thin section with good pyroxene (42^{o} extinction angle).

ER-11 Moderately welded, strongly devitrified tuff. Intensely altered, most crystals are almost gone. Plagioclase is quite resorbed, as is quartz. Up to 10 mm cognates in section. Mafics (hornblende and biotite) are almost completely replaced by magnetite. Altered mafics are replaced hornblende and biotite. One grain of altered pyroxene? Only one grain of plagioclase is unaltered.

ER-10 Densely welded, devitrified tuff. Plagioclase is resorbed and chloritized. Large phenocrysts of quartz (5 mm maximum). Nondescript potassium feldspar. Mafics are altered. Magnetite inclusions in all the biotite and hornblende. Pyroxene is almost gone.

ER-9 Densely welded vitrophyre. Looks like the same cooling unit as ER-6 to 8. Plagioclase is partly resorbed. Quartz in good shape. Mafics of altered hornblende, biotite, and completely altered pyroxene. Glomerophenocrysts of hornblende with plagioclase.

ER-8 Moderately welded, partly devitrified. Plagioclase is resorbed. Very similar to ER-6 and possibly ER-7. Lithic fragments of lava origin. Granophyric texture in the lithics and some parts of groundmass.

ER-6 Densely welded, devitrified tuff. Crystals are relatively small. Pumice is welded together. Plagioclase is resorbed. Potassium feldspar in good shape. Quartz heavily resorbed. Mafic minerals are small. Hornblende is quite altered, biotite is fresh. No lithics.

ER-5 Densely welded, devitrified tuff. Phenocrysts are relatively small (1.5 mm average). Quartz fresh (embayed). Plagioclase is well zoned and resorbed. Potassium feldspar very fresh. Mafics include altered hornblende, fresh biotite, and possiblly sphene. Glomerophenocrysts of plagioclase. One lithic of basaltic origin.

Appendix--continued

SCHELL CREEK RANGE SECTION (continued)

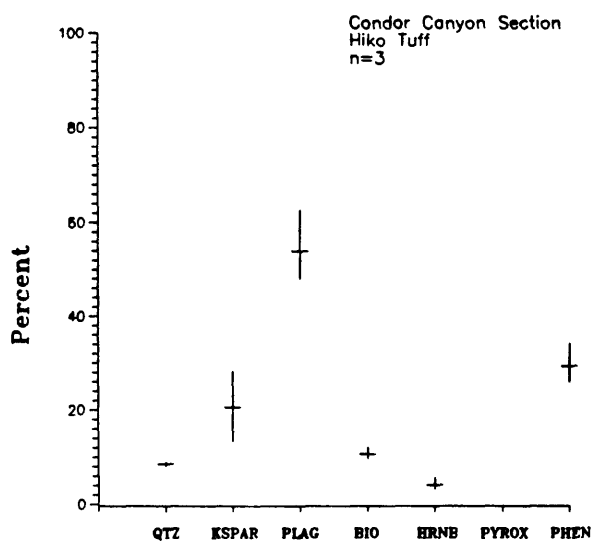
ER-2	Moderately welded, devitrified (or partly devitrified) tuff. Quartz in fresh crystals (some altered). Potassium feldspar fresh, plagioclase quite resorbed. Glomerophenocrysts of plagioclase. Mafics are altered. Green altered hornblende. Biotite slightly altered. One grain of altered pyroxene. Black magnetite.
ER-1	Non to partly welded, vitric tuff. Fresh quartz. Some well zoned potassium feldspar and plagioclase. Less than 1 mm glass shards throughout thin section. Biotite in laths (fresh). Altered mafics possibly hornblende. No lithics. Hornblende in most crystals is partially altered.

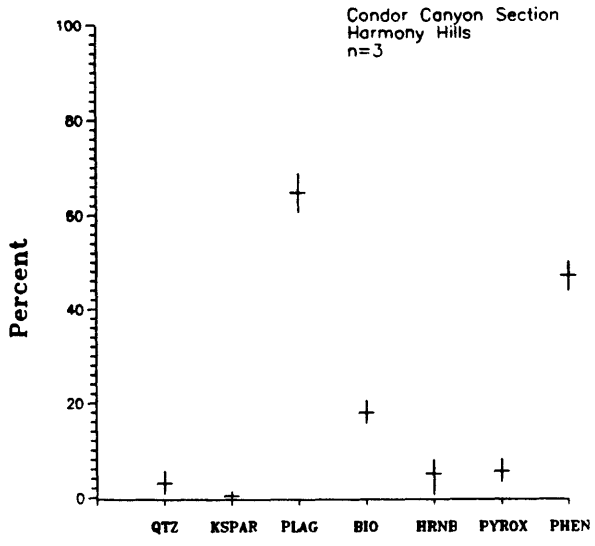
Appendix (continued)
CONDOR CANYON SECTION
37°51', 114°20'

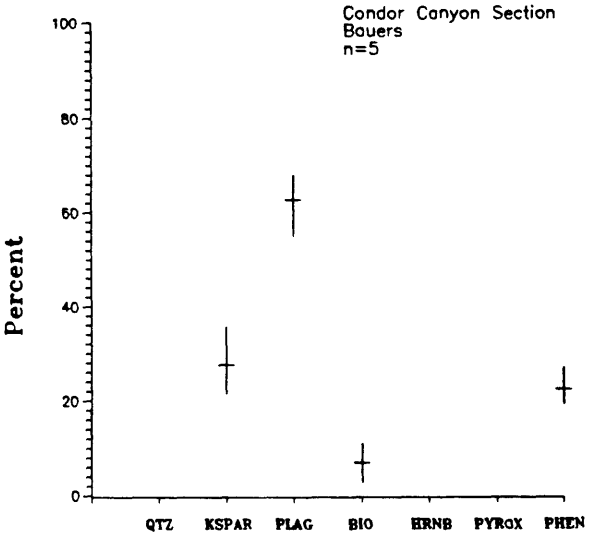
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen			Mafic Phen						Other (%)	Phenocryst occurrences					Petrographer
				Qtz (%)	Kspar (%)	Plag (%)	Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)		Sp	Al	Ap	Zr	Px	
UC-30	Hiko	931	34.1	8.8	28.3	47.9	10.4	3.4						3		12		1	GLD
UC-29	Hiko	1155	25.9	8.0	20.1	51.0	12	5.7						4		15	4		GLD
UC-28	Hiko	1109	28.2	8.9	13.4	62.1	9.6	3.2			tr		tr-Zr	10	2	9			GLD
UC-27	Harmony Hills	800	47.3	5.8	0.0	60.5	15.6	7.9			7.9					19	4	15	GLD
UC-26	Harmony Hills	867	43.7	3.4	0.0	68.7	17.7	6.3			3.1					12	3	8	GLD
UC-25	Harmony Hills	712	50.0	0.8	1.4	65.0	20.5	6.7			5.3					14	4		GLD
UC-24	Bauers	1141	22.4	0.0	28.8	61.4	7.1										2		GLD
UC-23	Bauers	1164	27.2	0.0	27.5	68.0	2.8				tr						2	3	GLD
UC-22	Bauers	1284	23.8	0.0	35.7	55.0	6.8				1.1						2		GLD
UC-21	Bauers	1392	20.3	0.0	21.5	63.9	11		tr							2	3		GLD
UC-20	Bauers	1380	19.4	0.0	24.8	65.4	7.8				tr					4	3		GLD
UC-19	Swett	1752	15.3	0.0	0.0	82.2	13.3									1	2		GLD
UC-18	Swett	1190	11.6	0.7	0.0	79.7	15.9									12	4		GLD
UC-17	Swett	1190	13.0	0.0	0.0	77.9	19.5									12	2		GLD
UC-16	Swett	1400	12.9	0.0	0.0	83.9	12.2									9	3		GLD
UC-15	Swett	1190	15.1	0.0	0.0	85.6	10.6									7	2	1	GLD
UC-14	Swett	1260	12.5	0.0	0.0	79.1	15.8	1		tr	4				2	4		4	GLD
UC-13A	Swett	1400	10.9	0.0	0.0	67.1	25									6	3		GLD
UC-13	Swett	1330	12.5	0.0	0.0	80.7	13.9									4			GLD
UC-9	Leach Canyon	630	24.0	37.1	19.2	35.1	7.9	tr			2			4	2	5	2	2	GLD
UC-8	Leach Canyon	1190	16.9	36.3	24.4	30.3	4	1.5			2		tr-Sp	11	3		2	2	GLD
UC-7	Leach Canyon	980	16.2	35.8	20.8	36.5	5.7				2			7	2	4		2	GLD
UC-6	Leach Canyon	1120	17.4	28.7	31.2	29.2	8.2	tr			2			10		3	3	2	GLD
UC-5	Leach Canyon	980	12.3	27.0	28.5	31.4	11							10	1	4	1		GLD

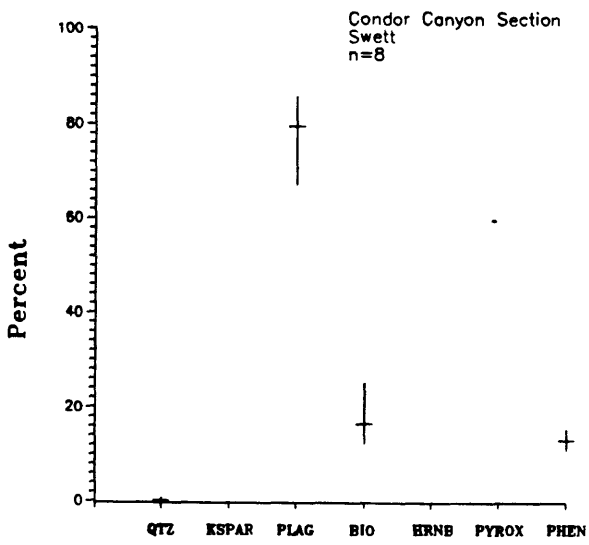
Appendix--continued

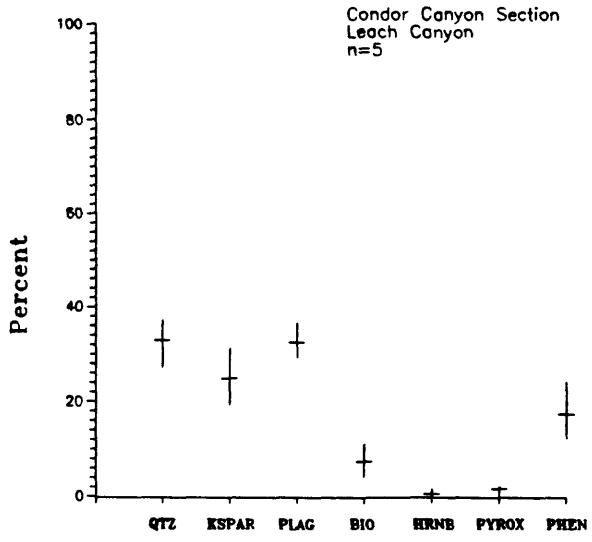
Condor Canyon Section











Appendix--continued

CONDOR CANYON SECTION; ADDITIONAL SAMPLE DATA

UC-30 Moderately to densely welded, devitrified tuff. Plagioclase is partly zoned and resorbed. Potassium feldspar is abundant and fresh. Quartz is fresh and embayed. Mafics are altered. Sphene is present.

UC-29 Moderately welded, devitrified tuff. Shperical pumice. Plagioclase is slightly resorbed, potassium feldspar is fresh, and quartz is embayed. Unit is slightly altered. Sphene in thin section. One lithic of clayey composition.

UC-28 Moderately to densely welded, devitrified tuff. Spherical pumice. Plagioclase slightly resorbed, quartz and potassium feldspar relatively fresh. Pyroxene almost gone. Several grains of sphene.

UC-27 Moderately to densely welded, devitrified tuff. Similar to UC-26 without lithics. Plagioclase well zoned and slightly resorbed. No potassium feldspar; quartz is embayed and altered.

UC-26 Moderately welded, devitrified tuff. Plagioclase is fresh and well zoned. Quartz is embayed. Fresh pyroxene, hornblende and biotite.

UC-25 Moderately welded, devitrified tuff. Well zoned plagioclase. Lithics of welded tuff and clayey-sand.

UC-24 Moderately welded, vitric tuff. Same as UC-23. Biotite is well oxidized, plagioclase is well resorbed.

UC-23 Moderately welded, vitric tuff. Unit is more altered than UC-20 to UC-22, but still is same tuff (up section). Pyroxene is well altered.

UC-22 Moderately to densely welded shard tuff. Same unit as UC-20 and UC-21.

UC-21 Densely welded vitrophyre. Same as UC-20.

UC-20 Densely welded vitrophyre. Plagioclase and potassium feldspar are fresh. Lithic of silt or clay.

UC-19 Densely welded shard tuff. Plagioclase is slightly resorbed. Lithics of clayey silt.

UC-18 Same as UC-15,16, and 17. Lithics of siltstone, lava, and welded tuff.

UC-17 Same as UC-15, and 16. Biotite well oxidized.

UC-16 Same as UC-15. Mafic psuedomorphs are probably pyroxene. Biotite quite oxidized.

UC-15 Moderately welded, devitrified tuff. Shards with vapor-phase crystals. One large lithic of basaltic composition.

Appendix--continued

CONDOR CANYON SECTION (continued)

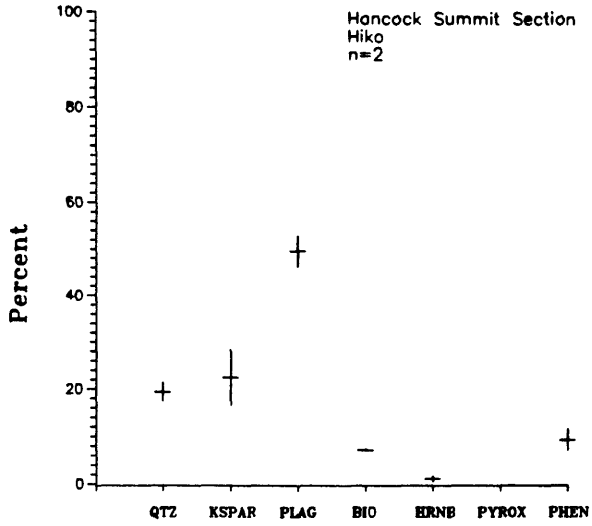
UC-14	Same as UC-13.
UC-13a	Same as UC-13. Lithics of siltstone.
UC-13	Very densely welded, devitrified tuff. Biotite very fresh.
UC-9	Same as UC-8. One large lithic of welded tuff.
UC-8	Partly welded, partly vitric tuff.
UC-7	Moderately welded, partly vitric tuff. Related to UC-5 and UC-6. Lithics of lava, welded tuff, and siltstone.
UC-6	Vitric shard tuff. Plagioclase partly resorbed, quartz resorbed and embayed, potassium feldspar in euhedral crystals. Lithics of lava, and welded tuff.
UC-5	Partly welded vitric tuff. Embayed quartz; plagioclase only partially resorbed. Abundant sphene. Lithics of siltstone and lava.

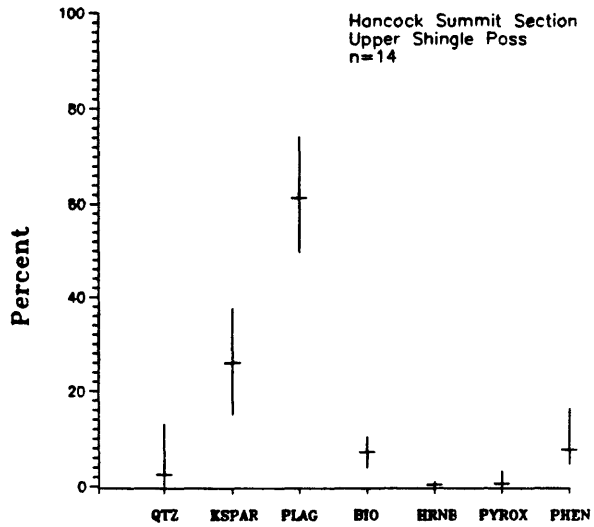
Appendix (continued)
HANCOCK SUMMIT SECTION
37°25', 115°22'

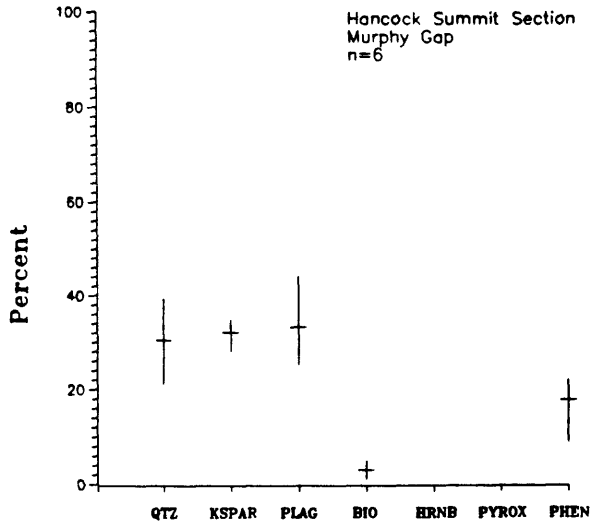
Sample number	Unit	Pts ctd	Phen (%)	Felsic Phen			Mafic Phen						Other (%)	Phenocryst occurrences					Petrographer
				Qtz (%)	Kspar (%)	Plag (%)	Bi (%)	Hb (%)	Cpx (%)	Opx (%)	Px (%)	Alt maf (%)		Sp	Al	Ap	Zr	Px	
NE-29	Hiko	4536	11.5	21.4	16.5	52.6	7	1.7						tr			tr		ELM
NE-28	Hiko	5520	7.0	17.4	28.4	46.1	7.3	tr						5		1	1		ELM
Fault?																			
NE-27	U. Shingle Pass	6890	5.7	0.8	37.6	51.0	6.5	tr									10		ELM
NE-25	U. Shingle Pass	6111	8.1	0.6	24.7	66.2	5.1	tr	1							2	10		ELM
NE-24	U. Shingle Pass	6120	7.8	0.4	15.0	74.1	9.2		tr								4		ELM
NE-24c	U. Shingle Pass	1116	8.9	1.0	22.2	68.6	6	1											ELM
NE-24b	U. Shingle Pass	6324	7.4	1.0	22.2	68.9	7.9	tr	tr								7		ELM
NE-24a	U. Shingle Pass	6656	8.0	0.0	31.5	58.8	4.5	tr		3.2						1	4		ELM
NE-23	U. Shingle Pass	6120	5.7	0.3	31.9	60.4	4.8	1									9		ELM
NE-22	U. Shingle Pass	5724	7.2	0.7	33.6	57.5	3.9	1		1						2	3		ELM
NE-21	U. Shingle Pass	6072	4.7		31.6	55.3	10.4	tr		1							6		ELM
NE-20	U. Shingle Pass	4459	4.7	3.3	19.1	63.3	9.1		1.4								5		ELM
NE-19	U. Shingle Pass	4692	8.5	7.6	21.2	59.7	7.9					tr					17		ELM
NE-18	U. Shingle Pass	4343	8.2	2.8	26.9	58.6	8.4					tr				3	13		ELM
NE-17	U. Shingle Pass	4800	7.8	3.7	20.8	65.8	7	tr			tr					2	10		ELM
NE-16	U. Shingle Pass	3520	16.4	13.0	26.8	49.6	9.6									3	17		ELM
NE-15	Murphy Gap	3510	21.9	21.1	28.1	44.0	4.8	tr								5	14		ELM
NE-14	Murphy Gap	3900	20.4	24.9	33.9	34.4	4.9	tr									10		ELM
NE-13	Murphy Gap	2975	20.8	34.4	31.8	30.7	2.4										2		ELM
NE-12	Murphy Gap	3480	19.8	32.9	31.5	32.2	2.9					tr					3		ELM
NE-11	Murphy Gap	5487	15.3	39.3	32.9	25.2	1.9										2		ELM
NE-10	Murphy Gap	4365	8.9	30.1	34.7	33.2	1	tr				tr					1		ELM
NE-9	L. Shingle Pass	4185	11.7	13.3	38.7	39.3	0				2.7	1.2					11		ELM
NE-8	L. Shingle Pass	4600	12.7	3.3	47.5	33.9	tr		4.5	1.4		tr	2				11		ELM
NE-7	L. Shingle Pass	3822	7.2	30.5	50.7	12.3	0			tr		4					10		ELM
NE-6	L. Shingle Pass	3995	14.6	7.5	53.7	36.0	0		tr			1.2				1	4		ELM
NE-5	L. Shingle Pass	4692	10.7	11.9	51.5	30.8	1.2	tr				1.4					12		ELM
NE-4	L. Shingle Pass	4876	10.4	11.5	55.7	26.4	tr	tr				2.6			3		6		ELM
NE-3	L. Shingle Pass	4606	16.5	11.1	46.6	38.3	tr		tr	1.5							9		ELM
NE-2	Isom type	5148	8.5	3.6	0.9	76.3	tr	tr	3.4	7.8						7			ELM
NE-1	Monotony	972	36.9	12.6	3.6	62.0	12.9	6.7	tr						4		2		ELM

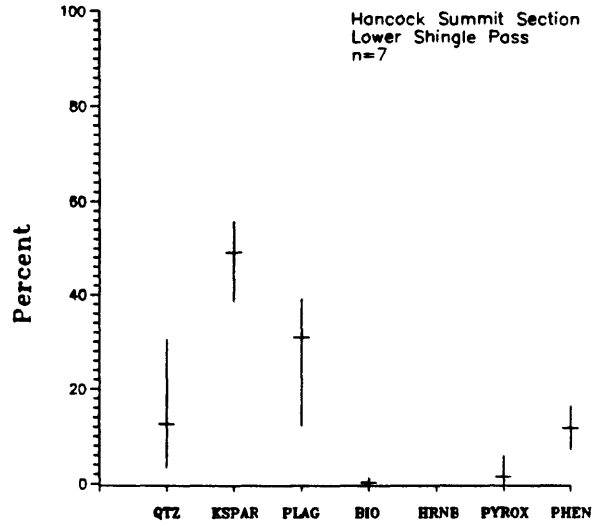
Appendix--continued

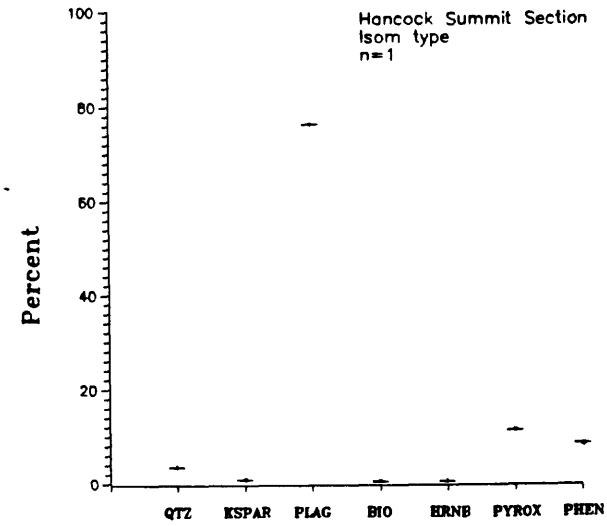
Hancock Summit Section, Pahranagat Range

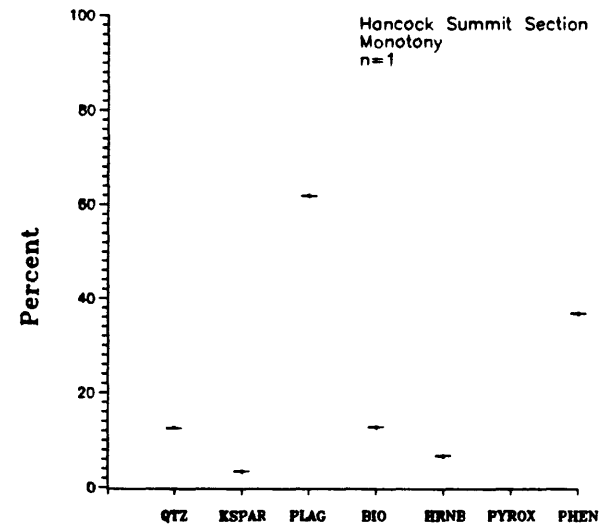












Appendix--continued

HANCOCK SUMMIT SECTION; ADDITIONAL SAMPLE DATA

NE-29 Partially devitrified, slightly welded tuff. Plagioclase: 13, 20.5, 27.5°. Several aggregates of biotite, opaques and plagioclase. Lithics oxidized fragments with a few tiny crystal laths (0.3-0.5 mm).

NE-28 Devitrified tuff. Cooling unit 7. Plagioclase: 8.5, 18.5, 20°. Matrix with abundant carbonate. Most biotite surrounded by oxidized alteration haloes. Lithics oxidized, tiny crystal laths, one with altered mafics.

NE-27 Devitrified tuff. Plagioclase: 8.5, 11, 18.5°. Lithics are small (0.3 mm), oxidized fragments with tiny crystal laths; one large (2 cm) lithic completely recrystallized with a few plagioclase and opaque phenocrysts. Zircons associated with opaques.

NE-25 Devitrified, moderately welded tuff. Plagioclase: 20.5, 28, 28.5, 31.5°. Lithics are many small oxidized fragments with tiny crystal laths; several large (2 mm-1 cm) lithics with plagioclase, clinopyroxene, and opaques. Zircons associated with opaques, apatites in plagioclase.

NE-24 Devitrified, moderately welded tuff. Plagioclase: 18-30°. Scattered aggregates of plagioclase and opaques. Lithics are mostly small, oxidized fragments with tiny crystal laths. One large completely recrystallized area may be a lithic. It contains no phenocrysts except for a plagioclase core of two or three crystals. The total point count of this one lithic is 500 points. If it turns out not to be a lithic, just add the 500 points onto the groundmass. The few plagioclase points won't significantly alter the phenocryst percentages.

NE-24c Jon's quickie cross check of this NE-24 slide.

NE-24b Plagioclase: 18-30°.

NE-24a Devitrified, moderately welded tuff. Plagioclase: 15.5, 16.5, 24, 28.5°. Pyroxenes are mostly altered hornblendes and have dark altered rims. Lithics are completely recrystallized, contain carbonates, a few plagioclase, and one potassium feldspar. They may be odd diagenetic portions of the matrix, but I think they are seperate lithics. I have circled 2 of them on NE-24 slide. If they are not true lithics just add the 636 points to the groundmass. The total phenocryst content of the lithics is not more than 20 points and most of that is plagiocalase. There are a few tiny lithics (oxidized and altered) that are definitely lithics. They add up to about 10 points of the total 636 points.

NE-23 Devitrified, moderately welded tuff. Plagioclase: 14.5, 15.5, 22°. Zircons associated with opaques.

Appendix--continued

HANCOCK SUMMIT SECTION (continued)

NE-22 Vitric, shardy, non-welded tuff. Plagioclase: 17.5, 20, 21, 23°. Apatite in plagioclase. Zircon associated with opaques. Lithics are mostly reddish-oxidized material, a few with tiny crystal laths.

NE-21 Vitric, shardy, non-welded tuff. Cooling unit 6. Plagioclase: 16.5, 21, 24, 29°. Zircons associated with opaques. Lithics are oxidized fragments.

NE-20 Partially devitrified, non-welded tuff. Plagioclase: 15.5, 20, 25, 28°. Matrix about one third to one half carbonate. Zircons associated with opaques and mafics. Lithics are oxidized and light gray.

NE-19 Devitrified, non to partly welded tuff. Plagioclase: 12, 17.5, 20, 25.5°. Mafics mostly oxidized with tiny crystal laths. About one third to one half of matrix replaced by carbonate. Altered mafics are pyroxene or hornblende. Zircon associated with opaques and mafics.

NE-18 Slightly devitrified, moderately welded tuff. Plagioclase: 11.5, 13.5, 24.5°. Altered mafics either pyroxene or hornblende. Apatite in plagioclase. Zircon in plagioclase, mafics, and opaques. Lithics are oxidized fragments containing tiny crystal laths.

NE-17 Partially devitrified, partly welded tuff. Cooling unit 5. Plagioclase: 12.5, 25.5, 26°. Large pumices in matrix. Agglomerates of plagioclase and mafics. Lithics are reddish to dark brown.

NE-16 Partially devitrified, partly welded tuff. Plagioclase: 14.5, 17.5, 19°. Some alkali feldspars have plagioclase crystals incorporated in them. Apatite inclusions in feldspars. Zircons associated with opaques, biotite, and feldspars.

NE-15 Partially devitrified tuff. Plagioclase: 16.5-28.5°. Most phenocrysts rimed by secondary crystals and overgrowths--some syntaxial, some not.

NE-14 Partially devitrified, moderately welded tuff. Plagioclase: 11.5, 13, 22.5, 31°. Some alkali feldspars are zoned and some show microperthitic texture.

NE-13 Mostly devitrified, moderately to densely welded tuff. Plagioclase: 12, 21, 22°. Several agglomerates of plagioclase, opaque, and biotite.

NE-12 Mostly devitrified, moderately welded tuff. Cooling unit 4. Plagioclase: 11.5, 14, 15.5, 26.5°. Several alkali feldspars have plagioclase cores or inclusions. Zircons associated with opaques. Carbonate fracture fill. Altered mafics probably biotite.

Appendix--continued

HANCOCK SUMMIT SECTION (continued)

NE-11 Completely devitrified tuff. Plagioclase: 12, 18, 19°. Syntaxial overgrowths on all sialic crystals. Altered material in voids could be vapor phase crystallization.

NE-10 Partially devitrified tuff. Cooling unit 3. Plagioclase: 15-24°. Several alkali feldspars have plagioclase cores. Altered mafics may be some type of vapor phase mineral.

NE-9 Devitrified tuff. Plagioclase: 9.5, 9.5, 18°. Abundant carbonate in matrix and embayed portion of crystals. Microperthitic texture in some alkali feldspars. Agglomerates of plagioclase, pyroxene and opaques. Pyroxenes altered to hornblende? Alteration of pyroxenes makes it possible to tell if most are clinopyroxene or orthopyroxene.

NE-8 Devitrified tuff. Plagioclase: 11.5, 14, 18.5, 23°. Pyroxenes are highly altered with thick rims and broad areas of hematite? and other alteration minerals. Zircons in matrix or with opaques.

NE-7 Completely devitrified tuff. Plagioclase: 10-19°. Several alkali feldspars have plagioclase cores. Potassium feldspars and quartz have optically continuous overgrowths extending into matrix.

NE-6 Devitrified, moderately to densely welded tuff. Plagioclase: 12-20.5°. Distinctive embayed quartz. Altered mafics probably formerly pyroxenes.

NE-5 Devitrified, moderately to densely welded tuff. Plagioclase: 10.5, 13, 13.5, 20, 20.5°. Embayed quartz distinctive. Zircons with opaques.

NE-4 Partially devitrified, moderately welded tuff. Plagioclase: 13.5, 16, 16.5, 20.5°. Distinctive embayed quartz crystals.

NE-3 Vitric, shardy, moderately to densely welded tuff. Cooling unit 2. Plagioclase: 18, 19.5, 19.5, 26.5°. Zircon associated with opaques. 4 or 5 zoned potassium feldspars may be anorthoclase. Abundant pumice in matrix.

NE-2 Vitric, shardy, moderately welded tuff. Cooling unit 1a. Plagioclase: 9.5, 12, 15, 15.5, and 28°. Agglomerates of plagioclase, pyroxene, and opaques. Apatite in orthopyroxene. Abundant pumice in matrix.

NE-1 Slightly devitrified, partly welded tuff. Cooling unit 1. Plagioclase: 12.5, 14, 15.5, 23.5, and 25°.

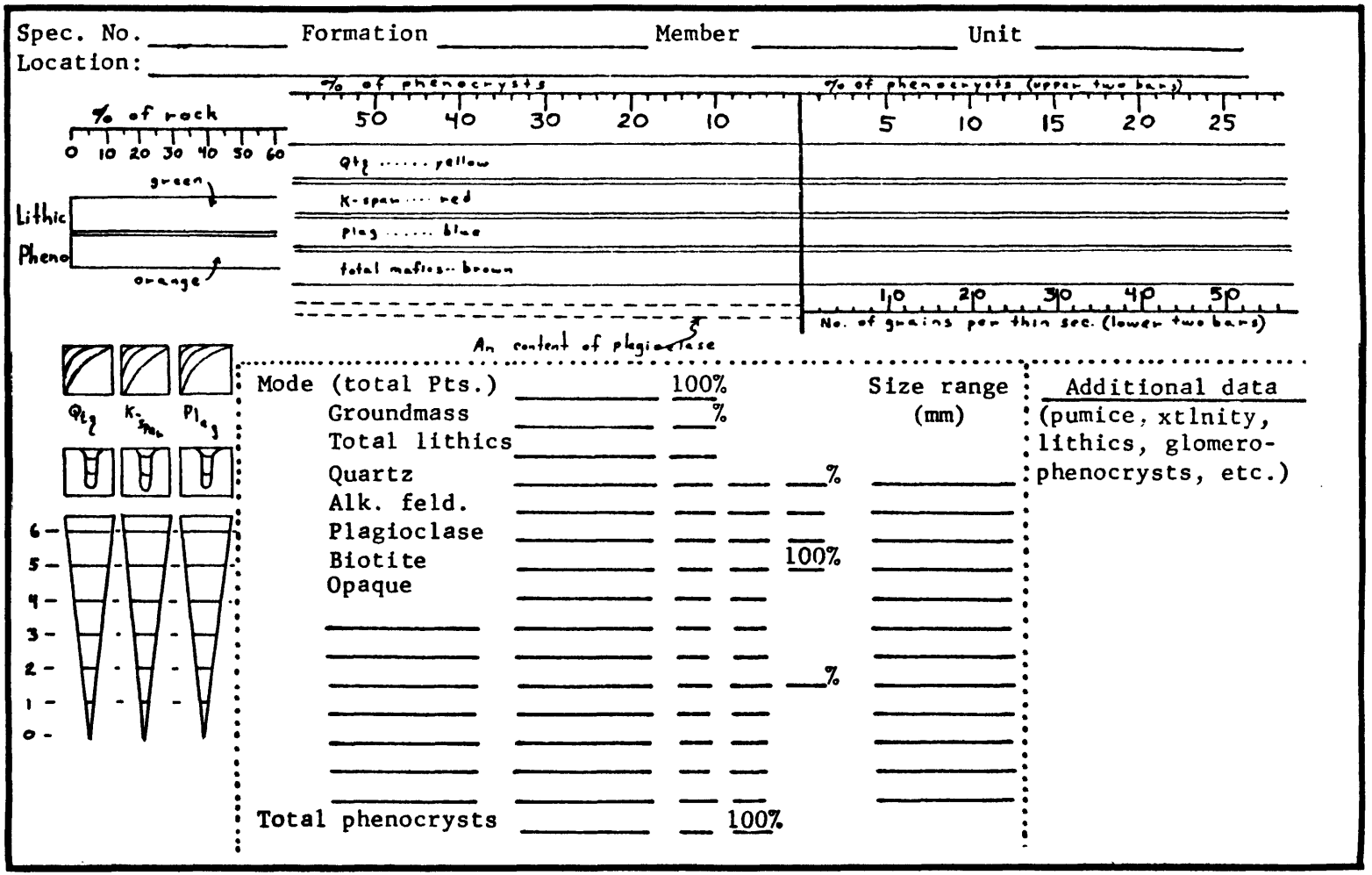


Figure 1. Index card used to record original modal data