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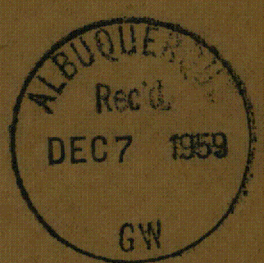
TEM-836

"GRANITE" EXPLORATION HOLE, AREA 15, NEVADA TEST SITE, NYE COUNTY, NEVADA--INTERIM REPORT, PART A, STRUCTURAL, PETROGRAPHIC, AND CHEMICAL DATA

By F. N. Houser and F. G. Poole



Trace Elements Memorandum Report 836

UNITED STATES DEPARTMENT OF THE INTERIOR
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PART A, STRUCTURAL, PETROGRAPHIC, AND CHEMICAL DATA

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F. N. Houser and F. G. Poole

July 1959

Trace Elements Memorandum Report 836

This report is preliminary and has not been edited for conformity with Geological Survey format and nomenclature.

*This report concerns work done on behalf of Albuquerque Operations Office, U. S. Atomic Energy Commission.

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PART A, STRUCTURAL, PETROGRAPHIC, AND CHEMICAL DATA

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INTRODUCTION

The "Granite" exploration hole was core drilled to determine the character of the igneous rocks from the surface to a depth of 1,200 feet and the degree of structural anisotropism of the rock within 200 feet of a point 950 feet below the surface. This report summarizes the data on the structure, chemistry, petrology and alteration of the rocks exposed at the surface in the immediate vicinity of the drill site and in the core. No attempt has been made to interpret the data because much pertinent data remain to be obtained concerning the mineralogy and petrography of the rocks. The work reported herein was done on behalf of the Albuquerque Operations Office, U.S. Atomic Energy Commission.

The drill hole is in the southwestern part of the Climax stock in the north-central part of the Nevada Test Site (fig. 1). The Nevada State coordinates of the drill hole are N. 901,906.97 and E. 676,827.21; the collar elevation is about 5,113 feet. A graded dirt road passable by heavy equipment, such as truck-mounted drill rigs, connects the drill site with a gravel road leading from the Mercury Highway to Groom Lake. The drill hole is on one of several low southeast-trending ridges which

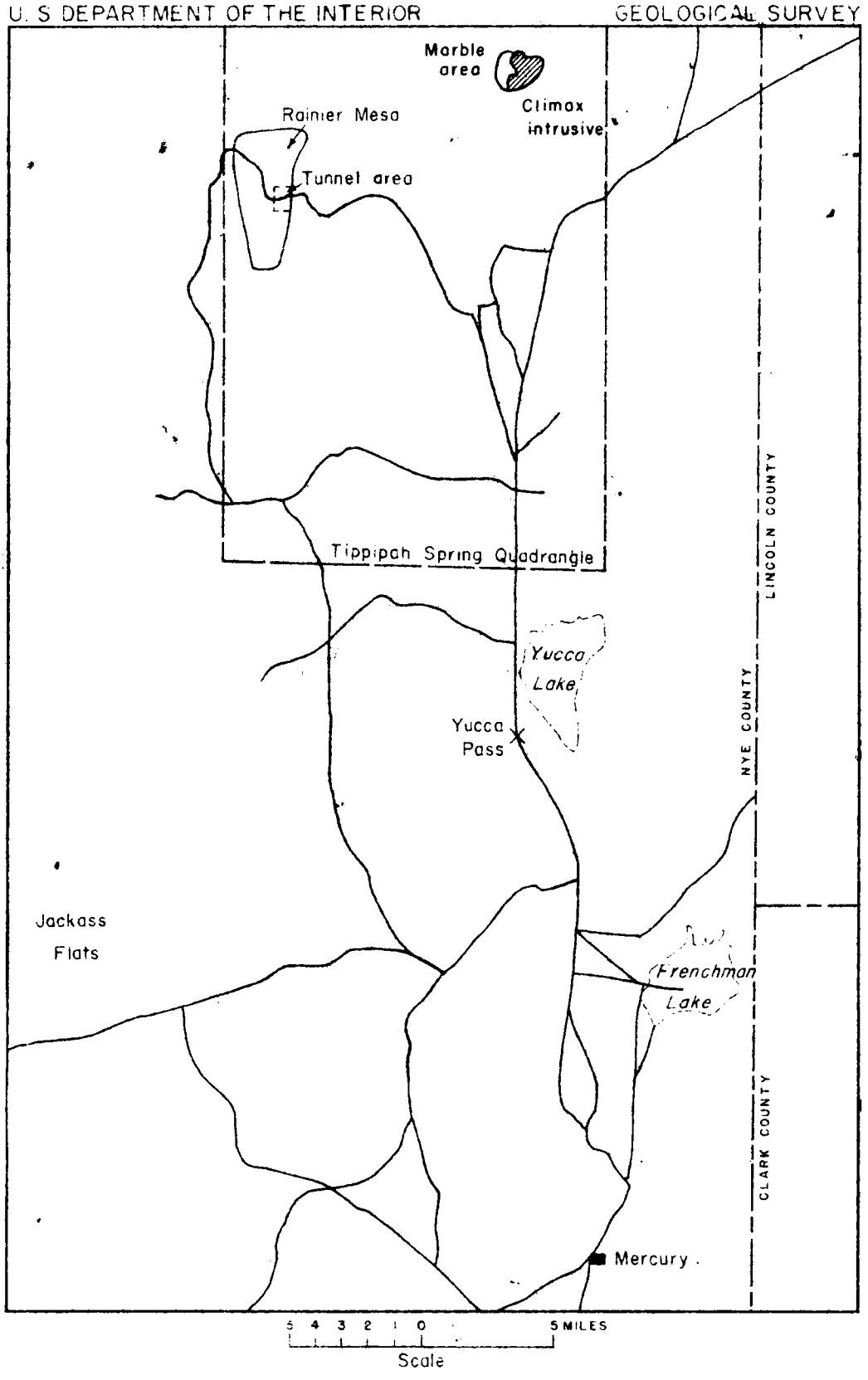


FIGURE 1–INDEX MAP SHOWING LOCATION OF TUNNEL AREA, RAINIER MESA, MARBLE AREA AND CLIMAX INTRUSIVE NEVADA TEST SITE, NYE COUNTY, NEVADA

have 40 to 60 feet of relief. The intervening valleys contain intermittent streams and are partly filled with rock debris derived by weathering of the Climax intrusive mass.

The detailed information on the drilling operation, condition of the hole, and unit price schedule are included to facilitate future use of this hole, and to aid future planning and cost estimating for other holes in this type of terrane.

The "Granite" exploration hole was cored vertically to a depth of 1,200 feet by the Boyles Bros. Drilling Company, Salt Lake City, Utah. The hole was reamed to a diameter of 6 inches to 951 feet by the same company. Detailed drilling information is contained in table 1.

The unit drilling costs are presented in table 2. One detailed cost not listed in table 2, and perhaps of some significance, is the relative cost of diamond bits per foot cored when using the wire-line versus conventional coring equipment. According to Mr. Willden, field representative for the Boyles Bros. Company, the cost of diamond bits for this hole was about three times greater when using NX conventional coring equipment compared to the NC wire-line equipment.

The courtesy and cooperation extended the U.S. Geological Survey by Mr. Gerald Willden of Boyles Bros. Drilling Company, and by Mr. Seymour Myers and Mr. Walter Johnson of Holmes and Narver Inc., as well as many other personnel of both organizations, has been fully appreciated. Holmes and Narver, Inc., was the architect-engineering and contracting firm.

Table 1.--Drilling data, "Granite" hole, Area 15, Nevada Test Site, Nye County, Nevada

Item	Description	Date	Depth (feet)
Coring:			
Started		3-27-59	0 to 1,200
Completed		5-12-59	
Reaming:	8 and 6 inch		0 to 951
Started		5-14-59	
Completed		6-?-59	
Diameter of drill bits	3.565 inches 3 inches 8 inches 6 inches		20 to 1,090 1,090 to 1,200 0 to 12 12 to 951
Equipment:			
Drills	Coring and drilling: Longyear Master Straitline Diamond core; (capacity 3,000 feet-NX)		0 to 1,200
	Reaming: Joy 22HD Diamond Core (capacity 1,500 feet-NWX)		0 to 951
Coring tools	NC wire-line (coring) NX-conventional (coring)		20 to 1,090 1,090 to 1,200

Table 1.--Drilling data, "Granite" hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Item	Description	Date	Depth (feet)
Reaming tools	8- and 6-inch diamond bits (drilling)		0 to 951
Cemented intervals	To fix surface casing		0 to 13
	To prevent fluid loss and cave-in		12 to 20
	do		13 to 87.5
	do		320 to 355
	do		307 to 360
	do		324 to 374
	do		330 to 374
	do		926 to 1,053
	do		900 to 1,090
	do		1,073 to 1,133
Drilling fluid	Water or small amounts of bentonite-type mud		0 to 480
	Bentonite-type mud 1/		480 to 1,200
Casing	8 inch		0 to 12.8
	3 inch (ID)		953 to 1,041 2/

Table 1.--Drilling data, "Granite" hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Item	Description	Date	Depth (feet)
Logging	McCullough Tool Co., gamma radiation	5-18-59	0 to 1,000
	McCullough Tool Co., neutron radiation	5-18-59	0 to 1,009
	Eastman Oil Well Survey Co., magnetic directional survey	5-21-59	0 to 1,150 3/
	Eastmen Oil Well Survey Co., spontaneous potential and resistivity	5-21-59	0 to 1,141
	Eastman Oil Well Survey Co., temperature	5-21-59	72 to 1,159
	Dames and Moore seismic, velocity	5-17-59 to 5-18-59	
	U. S. Geological Survey seismic, velocity	6-3-59 to 6-4-59	
Core recovery 4/ (percent)	89.3 average, entire hole 5/		20 to 1,200
	92.4 average, NC wire-line coring		20 to 1,090
	59.8 average, NX conventional coring		1,090 to 1,200
Costs	See table 2, Cost schedule		

Table 1.--Drilling data, "Granite" hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

1/ Mud was supplemented in the interval 1,170 to 1,188 feet with cotton packing, cotton seed, thick mud wrapped in paper sacks, and one rubber ball.

2/ Includes 76 feet of drill pipe, 12 feet plus of core barrel and diamond core bit-- total 88 feet of coring tools lost by mishap during cementing.

3/ At increments of 50 feet.

4/ For percent recovery by interval cored see Graphic log, figure 2.

5/ Based on 1,153.5 feet for which recovery data are available.

Table 2.--Drilling cost, "Granite" hole, Area 15, Nevada Test Site, Nye County, Nevada

Description	Quantity	Unit	Unit price (dollars)
Mobilization for coring and drilling	1	Job	$1,750.00
Coring and drilling (minimum diameter hole) surface to 1,000 feet	1,000	LF 1/	15.20
Coring and drilling (6-inch hole) surface to 1,000 feet	1,000	LF	11.60
Coring and drilling (minimum hole) 1,000 feet to 1,200 feet	200	LF	17.90
Mobilization and demobilization for logging with crew		Hour	22.50
Mobilization and demobilization for logging without crew		Hour	14.50
Continuous bore hole survey (0 to 1,000 feet)	1	Each	325.00
Sonic or velocity log (1,000 feet)	1	Each	--
Induction log (1,000 feet)	1	Each	--
Neutron-gamma ray log (0 to 1,000 feet)	1	Each	275.00
Electrical log (0 to 1,000 feet)	1	Each	450.00
Temperature log (0 to 1,000 feet)	1	Each	400.00
Surface casing	10	LF 1/	9.50
Bailing equipment-furnishing	1	Job	350.00
Bailing equipment-operating	6	Hour	25.00
Water injection equipment-furnishing	1	Job	250.00
Water injection equipment-operating	12	Hour	25.00

Table 2.--Drilling cost, "Granite" hole, Area 15, Nevada Test Site, Nye County, Nevada.--Continued

Description	Quantity	Unit	Unit price (dollars)
Pumping equipment-furnishing	1	Job	$1,900.00
Pumping equipment-operating	40	Hour	25.00
Seismic survey	1	Job	
Logging and surveying mileage service	1	Each	1,300.00
Standby time	6	Hour	22.50
Demobilization and moveout	1	Job	500.00
Additional set-up	1	Job	650.00

1/ LF = linear foot.

GEOLOGY

The igneous rocks of the Climax stock that crop out in the vicinity of the exploratory hole are an equigranular granodiorite and a porphyritic fine- to medium-grained quartz monzonite. The contact between the two rocks is irregular, sharp, strikes west to northwest, and dips steeply to the south and southwest(?). The hole was collared in the porphyritic quartz monzonite about 50 feet south of the contact with the granodiorite.

Structure

The igneous rocks at the surface and penetrated by the exploration hole are well jointed and faulted. The most prominent joint set in the core dips 15° to 35° NE. and throughout the hole was assumed to have an average strike of N. 32° W., the same as that of the prominent northeast-dipping joint set mapped at the surface. In each 100 feet of hole, a 10-foot interval of core was oriented by using the strike (N. 32° W.) of the low-angle joints. The strike and dip of each joint were recorded on rosette diagrams (figs. 3 through 5). Because the method of orienting the core is inaccurate, the measured strikes of all other joints were plotted in the centers of the 45° quadrants and therefore reflect only their general trend. Each figure shows the joints observed in the four 10-foot intervals in each of the upper, middle, and lower 400-foot intervals of the hole. The rosette diagrams show the frequency of the fractures of various attitudes with depth, the distribution of the high-angle (> 45°) joints, and the changes in dip of the set that strike N. 32° W. (See also table 3.) Joints that strike

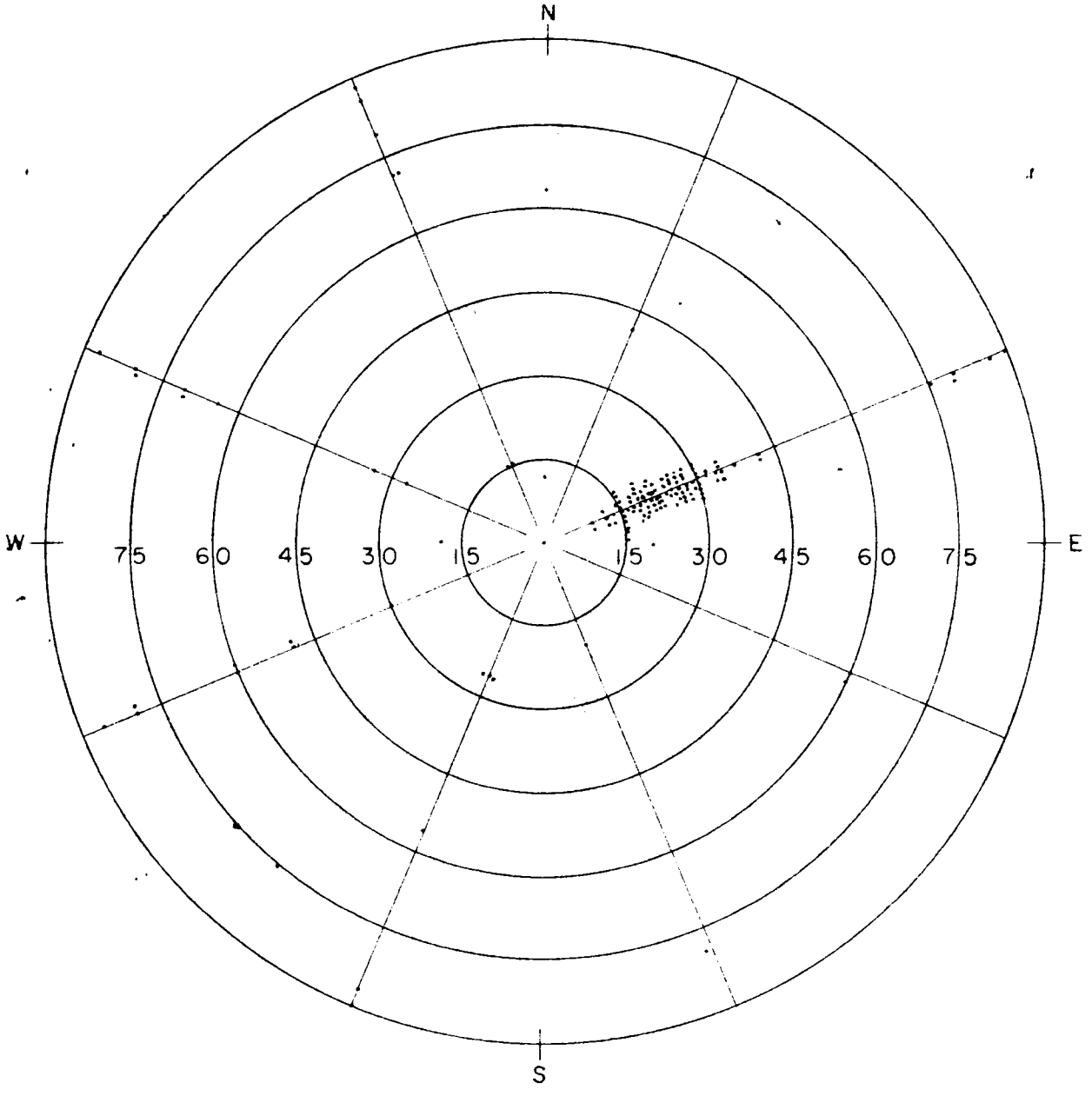


FIGURE 3-ROSETTE DIAGRAM SHOWING AMOUNT AND APPROXIMATE DIRECTION OF DIP OF 142 JOINTS MEASURED AT SELECTED INTERVALS FROM 0 TO 400 FEET IN GRANITE EXPLORATION HOLE, U15 AREA, NEVADA TEST SITE, NYE COUNTY, NEVADA

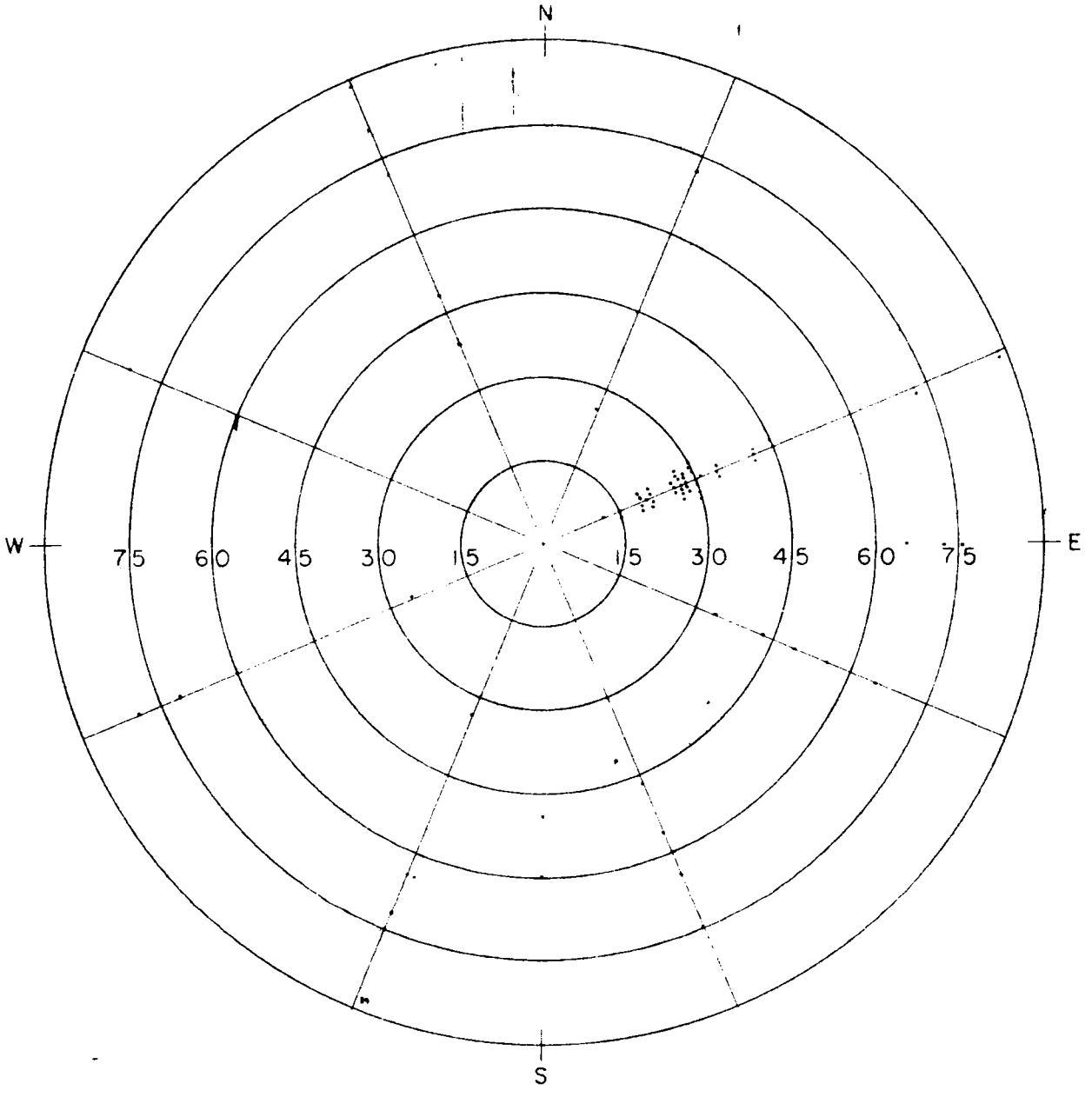


FIGURE 4-ROSETTE DIAGRAM SHOWING AMOUNT AND APPROXIMATE DIRECTION OF DIP OF 81 JOINTS MEASURED AT SELECTED INTERVALS FROM 400 TO 800 FEET IN GRANITE EXPLORATION HOLE, U15 AREA, NEVADA TEST SITE, NYE COUNTY, NEVADA

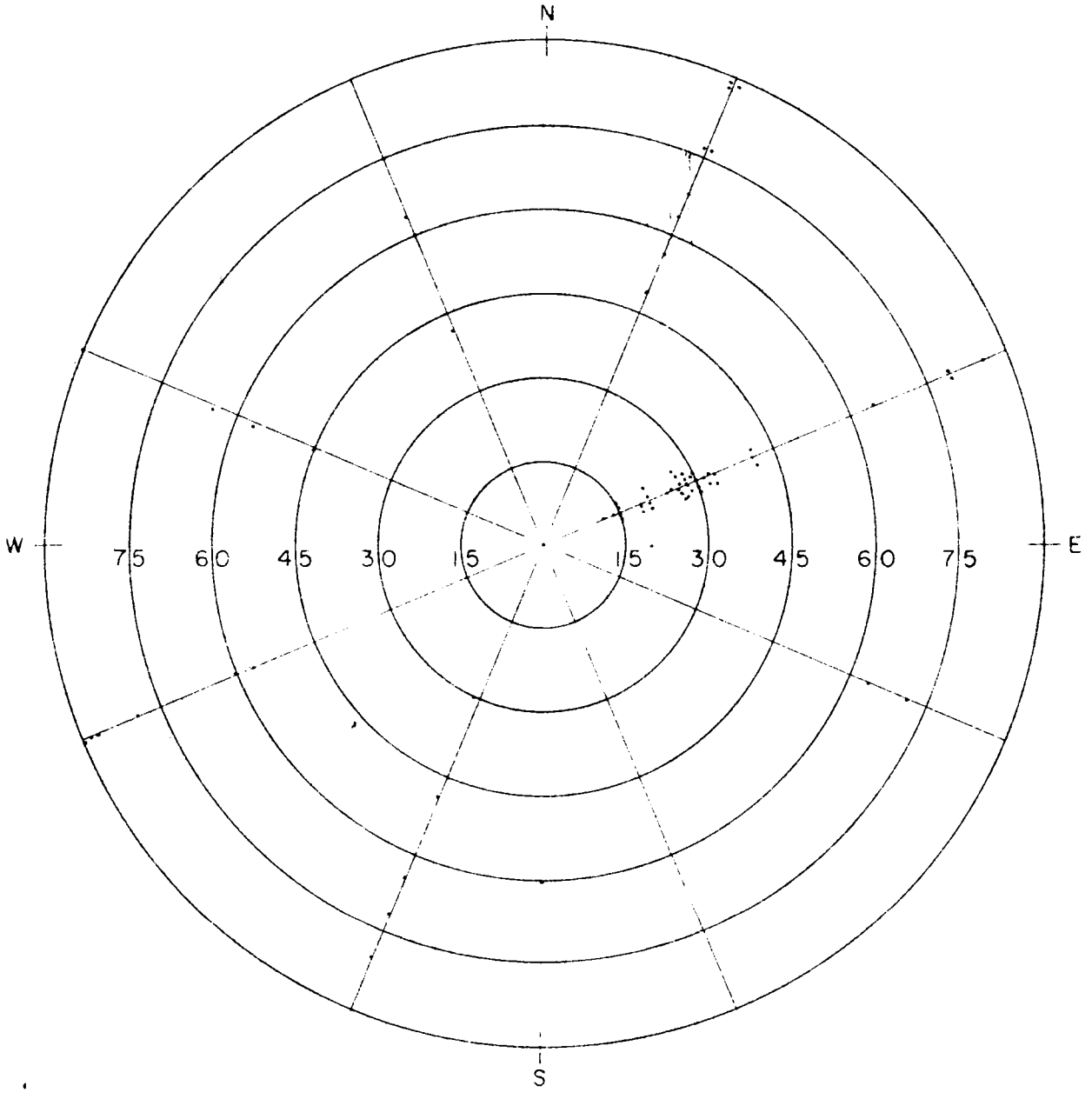


FIGURE 5-ROSETTE DIAGRAM SHOWING AMOUNT AND APPROXIMATE DIRECTION OF DIP OF 75 JOINTS MEASURED AT SELECTED INTERVALS FROM 800 TO 1200 FEET IN GRANITE EXPLORATION HOLE, U15 AREA, NEVADA TEST SITE, NYE COUNTY, NEVADA

Table 3.--Summary of data on joint frequency, "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada

Depth (feet)	Length of core examined in selected intervals (feet)	Number of joints measured			Average joints per foot		
		Total	Low angle joints of N. 32° W. set	High angle (> 45°)	All joints	Low angle joints of N. 32° W. set	High angle (> 45°)
0-400	35.9	142	98	31	4.0	2.7	0.9
400-800	37.2	81	43	31	2.2	1.2	0.8
800-1,200	38.5	75	38	32	1.9	1.0	0.8
Entire hole	111.6	298	179	94	2.7	1.6	0.8

Table 4.--Results of compression tests conducted by Nevada Testing Laboratories, Ltd., Las Vegas, Nevada

Lab. No.	Holmes and Narver No. 1/	Core size (inches) Diameter	Length	Rock type	Depth of sample	Dip of pre-test natural fractures present in specimen 2/ (degrees)	Total load (pounds)	Core area (square inches)	Pounds per square inch	Type of fracture developed by test
6	HNG-1	2.375	2.375	Quartz monzonite	46.0-46.5	35	40,350	4.43	9,110	Tension
7	HNG-2	2.375	2.375	do	121.5-122.0	25	35,800	4.43	8,080	
7A	HNG-2	2.375	2.125	do	122.0	25	39,100	4.43	8,830	Do
8	HNG-3	2.375	2.3125	Granodiorite	244.0-244.5	35	49,400	4.43	11,510	Do
9	HNG-4	2.375	2.375	do	343.5-344.0	None	29,800	4.43	6,720	Tension, few shear
10	HNG-5	2.375	2.375	do	447.0-447.5	None	53,500	4.43	12,070	Tension
1	HNG-6	2.375	2.375	do	844.4-845.1	Approx. 30	105,500	4.43	23,800	Tension, few shear
2	HNG-7	2.375	2.375	do	855.5-856.0	None	71,650	4.43	16,500	Tension

Table 4.--Results of compression tests conducted by Nevada Testing Laboratories, Ltd., Las Vegas, Nevada.--Continued

1/ Samples HNG-1 through HNG-5 were reported 4-24-59 (Ref. P. O. LV-68718, Lab. No. P-107). Specimens were cut and capped with standard mineral lead compound. Tests were performed with a Baldwin-Limi-Hamilton Universal Testing Machine, Model No. 120-H, and Baldwin Microformer Stress-Strain Recorder. Samples HNG-6 and HNG-7 were reported 5-9-59 (Ref. P. O. LV-68718, Lab. No. P-107). Specimens capped with plastic steel containing 80 percent steel (PSI 18,000 pounds).

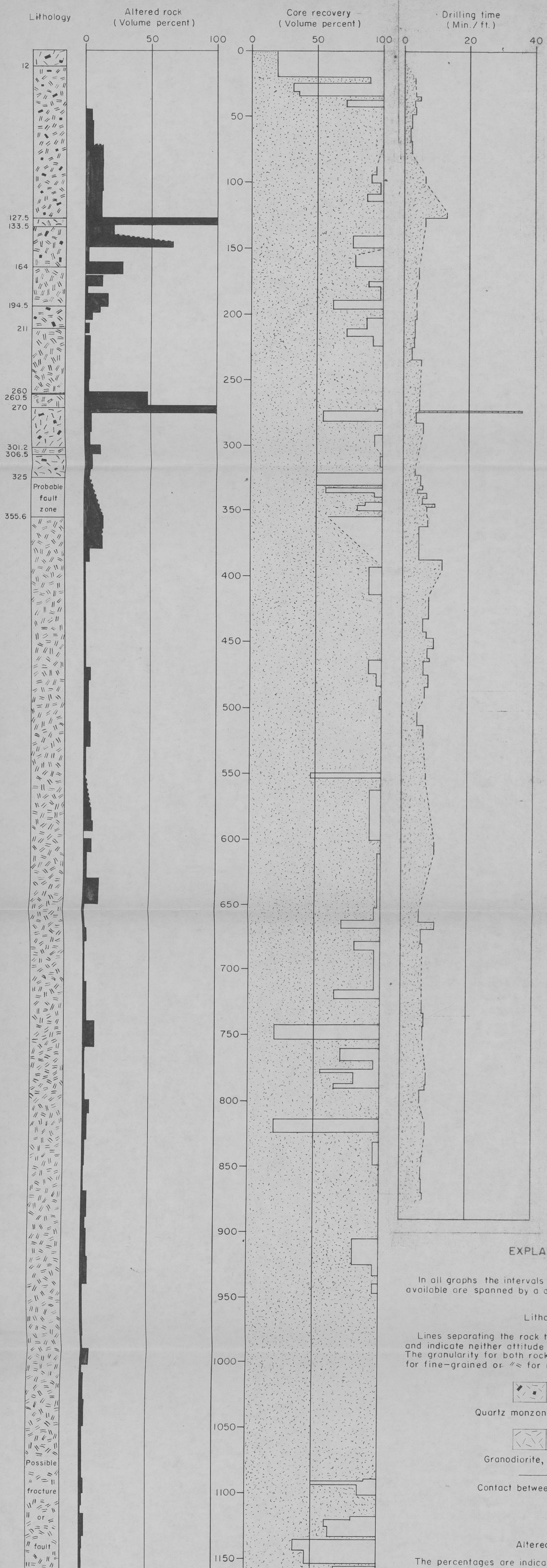
2/ Assumed strike of joint represented in specimen is N. 32° W. (see text for details regarding this joint set). Only one joint was observed in each of the four specimens noted in this column.

Faults are difficult to recognize on the surface because of poor exposures and lack of lithologic markers. They are indicated in the core by much broken rock, clayey gouge, slickensides on fractures and by increased water loss. The only fault recognized in the core was between 325 and 355 feet, though the highly permeable rocks from 1,090 to 1,170 feet may represent a fault zone. The attitude of these faults is unknown; however, in the marble west of the Climax stock, post-intrusion faults strike W. to N. 45° W., and dip steeply north or south. Thus, the faults intersected in the hole probably strike northwest to west, and dip steeply to the north.

Petrography

Both rock types--granodiorite and quartz monzonite--mapped on the surface were penetrated by the "Granite" exploration hole. Quartz monzonite was encountered through six intervals from 0 to 127.5, 133.5 to 164.0, 194.5 to 211.0, 260 to 260.5, 270.0 to 301.2, and 306.7 to 325 feet; granodiorite is present in the remainder of the hole (fig. 2 and table 11).

In the core the granodiorite is light gray to greenish gray, equigranular and medium grained whereas the quartz monzonite is medium gray to light gray and contains phenocrysts in a fine- to medium-grained groundmass. The average mineralogic compositions of the quartz monzonite and granodiorite as determined by a few modal analysis are given in table 5. These averages have not been adjusted for the amounts of the different facies of quartz monzonite that are represented in the core and crop out at the drill site. These results



EXPLANATION

In all graphs the intervals for which no information is available are spanned by a dotted line

Lithology

Lines separating the rock types are diagrammatic only and indicate neither attitude nor degree of irregularity. The granularity for both rock types is indicated by: /= for fine-grained or //= for medium-grained

Quartz monzonite, porphyritic

Granodiorite, equigranular

Contact between rock types

Altered rock

The percentages are indicated for all hydrothermal alteration and mineralization products along or in veins for the interval plotted. No percentages are shown for widely disseminated chlorite or clay minerals, nor for the products of weathering

Note: Elevation of collar 5113 feet (estimated)

FIGURE 2—GRAPHIC LOG OF THE GRANITE EXPLORATION HOLE SHOWING ROCK TYPE, AMOUNT OF ALTERED ROCK, CORE RECOVERY, AND DRILLING TIME

Table 5.--Average of modal analyses in volume percent, of granodiorite and quartz monzonite of the Climax stock, Nevada Test Site, Nye County, Nevada

Rock	Granodiorite	Quartz monzonite
No. of modal analyses	4	4
Essential minerals:		
Quartz	28.6	27.3
Potassium feldspar		
Orthoclase	22.5	35.5
Microcline	0	Trace
Plagioclase	37.4	29.3
Type 1/	(calcic andesine)	(sodic andesine)
Biotite	6.5	4.2
Hornblende	0.1	Trace
Accessory minerals:		
Iron ore	0.8	0.9
Sphene	0.4	0.1
Apatite	0.1	0.05
Alteration minerals:		
Chlorite (excl. of penninite)	0.7	0.7
Penninite	0.6	0.8
Sericite	1.4	1.2
Kaolinite	0.8	0
Epidote	0.08	0.05
Sum	100	100

1/ Provisional estimates based upon flat-stage extinction angles.

show that the porphyritic quartz monzonite contains more potassium feldspar, mainly orthoclase but less plagioclase, quartz, and biotite than the granodiorite. The plagioclase of the fine- to medium-grained part of the quartz monzonite appears to be slightly more sodic than the plagioclase of the granodiorite.

The normative mineral composition (norms) of the rocks (table 6) was calculated from the chemical analyses and reflect many of the chemical variations of the rocks in terms of theoretical minerals present. As shown in table 6 the quartz monzonite generally contains more orthoclase and quartz and less anorthite than the granodiorite. More or less equal amounts of albite merely reflect the rather constant Na_2O content of the rocks. The ratio of orthoclase to total feldspar for quartz monzonite, however, is somewhat higher, though more erratic, than for granodiorite.

Hydrothermal alteration

Evidence of hydrothermal alteration of the quartz monzonite and granodiorite was found in much of the core from the exploration hole. The alteration products include clay minerals, chlorite, secondary feldspar, sericite, quartz, epidote and sulfide minerals, mainly iron sulfide. The clay minerals and chlorite occur in zones throughout the rocks and are concentrated with the other alteration products along the gently northeast-dipping joints.

Table 6.--Normative mineral compositions 1/ for igneous rocks from the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent.

Column		1	2	3	4	5	6	7	8	9
Rock	Type 2/	Granodiorite					Quartz monzonite			
	Facies 3/	m	m 4/	m	m	sill 5/	m	m	m	f
Sample no. 6/		HG-7	FP-65	FP-62	G-800-0	HT-8	G-70	FP-63	HG-10	G-277-0
Calculated from analysis in table 5, column:		1	2	3	11	25	31	32	33	37
Orthoclase (or)		19.5	21.3	20.1	23.1	16.0	20.1	30.1	23.6	33.1
Albite (ab)		26.2	28.7	27.0	25.4	33.0	28.7	25.3	25.4	22.8
Anorthite (an)		16.7	14.8	18.2	16.2	20.5	17.4	8.1	13.5	13.6
Ilmenite (il)		.7	.6	.9	.7	.9	.7	.4	.6	.7
Magnetite (mg)		2.5	2.3	2.8	2.5	2.5	1.9	.5	2.2	1.6
Hematite (hm)								.3		
Quartz (q)		29.3	28.6	26.6	27.2	20.7	25.6	30.2	31.0	22.7
Corundum (c)		.8	.6	.6	1.0	.2	.4	2.5	.7	1.0
Hypersthene (hy)		2.7	2.1	2.5	2.9	4.4	3.6	.4	2.1	2.6
Apatite (ap)		.2	.2	.2	.2	.3	.2	.2	.2	.3
Sum 8/		98.6	99.2	98.9	99.2	98.5	98.6	98.0	99.3	98.4
or/ab + an + or		31	33	31	36	23	30	47	38	48
an/ab + an		39	34	40	39	38	38	24	35	37
Rock type as determined from norm 9/		g	g	g	q	g	g	q	q	q

Table 6.--Normative mineral compositions 1/for igneous rocks from the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent--Continued

Column		10	11	12
Rock	Type 2/	Quartz monzonite		Granite
	Facies 3/	f	f 7/	a
Sample no. 6/		HG-8	HG-19	H-367-1
Calculated from analysis in table 5, column:		38	39	40
Orthoclase (or)		20.7	72.7	46.1
Albite (ab)		26.2	4.6	16.9
Anorthite (an)		15.2	.8	2.8
Ilmenite (il)		.8	.8	.1
Magnetite (mg)		2.5	.8	.2
Hematite (hm)			.1	
Quartz (q)		29.1	16.6	31.3
Corundum (c)		1.6	2.1	1.1
Hypersthene (hy)		2.0	.3	.1
Apatite (ap)		.2	.2	.1
Sum 8/		98.3	99.0	98.7
or/ab + an + or		38	93	70
an/ab + an		37	15	14
Rock type as determined from norm 9/		g-q	gr	gr

Table 6.--Normative mineral compositions 1/ for igneous rocks from the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent--Continued

1/ Weight percent. Theoretical mineral composition based on chemical analysis. CIPW system used in computations.

2/ Name assigned to original unaltered rock on the basis of megascopic petrology, chemical analyses and norms.

3/ Determined megascopically for granodiorite or quartz monzonite: f = fine-grained facies, m = medium-grained facies; for granite dikes: a = aplitic (fine grained), g = medium grained, p = pegmatitic (coarse to very coarse grained).

4/ Hydrothermally(?) altered.

5/ No facies designated but rock is medium grained.

6/ All samples with prefix "G" are from exploration hole and number indicates depth. Zero following depth number distinguishes specific series of samples. All other samples are from the surface.

7/ Hydrothermally altered--predominant product is secondary K-feldspar.

8/ Sum of normative minerals in rock are less than 100 percent as H_2O, MnO, and CO_2 determined in chemical analysis were not used in these CIPW norm calculations.

9/ g = granodiorite, q = quartz monzonite, and gr = granite.

The clay minerals are predominantly montmorillonite though kaolinite was detected in a few samples. They make up relatively a small part of the total rock but are common in zones 1 to 15 feet thick, many of which appear to be associated closely with high-angle fractures.

The vertical distribution in the core of the minerals (other than the clay and chlorite) formed by hydrothermal alteration was determined by measuring to the nearest 0.01 foot the thickness of each altered zone. The average amount of altered rock is plotted on the bar graph (fig. 2) for given intervals of core. In general the altered igneous rocks are most abundant from the surface to depth of about 360 feet. In this interval both the granodiorite and quartz monzonite contain zones in which the altered rock is extensive.

Chemistry

The results of chemical analyses of 31 samples from core of the exploration hole and 8 samples from the surface are given in table 7. The average chemical composition of the medium-grained granodiorite (table 8) was computed from 13 analyses and it is thought to be representative of the granodiorite from 356 feet to bottom of the drill hole. For the quartz monzonite, the average composition (table 8) was not weighted for relative amounts of the fine- and medium-grained rocks and does not necessarily represent the bulk composition of the quartz monzonite mass.

Table 7.--Chemical analyses for igneous rocks of the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent

Rock	Type 1/	Granodiorite							
	Facies 2/	m	m 3/	m	m	m	m	m	m
Column		1	2	3	4	5	6	7	8
Sample	Number	HG-7	FP-65	FP-62	G-165-0	G-236-0	G-255	G-400-0	G-500-0
	Type 4/	G	G	G	G	G	G	G	G
	Report no. IRC-	354	354	354	393	393	382	393	393
	Lab. no.	153994	154000	153998	154558	154559	154466	154567	154561
	Analysts 5/	1,2,3,4	1,2,3,4	1,2,3,4	1,2,4	1,2,4	1,4,2	1,2,4	1,2,4
Location 6/		S	S	S	E	E	E	E	E
SiO_2		68.6	69.6	67.5	65.5	68.2	66.2	70.8	68.7
Al_2O_3		15.6	15.5	16.2	16.1	15.3	16.4	14.9	15.4
Fe_2O_3		1.7	1.6	1.9	2.5	1.8	1.5	1.6	2.0
FeO		1.7	1.5	1.7	1.2	1.6	2.3	1.2	1.2
MgO		.64	.48	.70	.83	.68	1.2	.39	.53
CaO		3.6	3.2	3.9	4.5	3.9	4.1	3.0	3.4
Na_2O		3.1	3.4	3.2	3.4	3.0	3.2	2.9	3.0
K_2O		3.3	3.6	3.4	2.4	3.0	3.0	4.0	3.4
H_2O		.70	.54	.83	1.4	1.1	1.0	.80	1.5
TiO_2		.38	.34	.46	.43	.38	.48	.26	.34
P_2O_5		.18	.16	.18	.25	.22	.18	.14	.18
MnO		.06	.06	.07	.06	.05	.10	.06	.07
CO_2		.08	.10	.08	.39	.13	.10	.18	.10
Sum		100	100	100	99	99	100	100	100

Table 7.--Chemical analyses for igneous rocks of the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent--Continued

Rock	Type 1/	Granodorite						
	Facies 2/	m	m	m	m	m	m	m
Column		9	10	11	12	13	14	15
Sample	Number	G-600-0	G-700-0	G-800-0	G-900-0	G-1000-0	G-1100-0	G-1200-0
	Type 4/	G	G	G	G	G	G	G
	Report no. IRC-	393	393	393	393	393	402	402
	Lab. no.	154562	154563	154564	154565	154566	273776	273778
	Analysts 5/	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4	1,2,4
Location 6/		E	E	E	E	E	E	E
SiO_2		68.1	68.2	68.1	67.3	67.4	65.3	66.1
Al_2O_3		16.2	15.3	16.1	15.7	15.9	16.4	16.3
Fe_2O_3		1.7	1.8	1.7	2.0	1.8	1.8	1.8
FeO		1.5	1.4	1.5	1.6	1.6	2.1	2.0
MgO		.67	.54	.60	.67	.76	1.3	1.2
CaO		3.5	3.9	3.5	4.1	4.0	3.9	3.8
Na_2O		3.2	3.0	3.0	3.1	3.3	3.2	3.2
K_2O		3.5	3.7	3.9	3.2	3.3	3.6	3.4
H_2O		.88	.82	1.0	.80	.76	.93	.84
TiO_2		.35	.36	.37	.40	.40	.48	.47
P_2O_5		.18	.20	.19	.27	.22	.18	.18
MnO		.08	.08	.08	.09	.08	.10	.10
CO_2		.06	.38	.07	.13	.10	.14	.09
Sum		100	100	100	99	100	99	99

Table 7.--Chemical analyses for igneous rocks of the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent--Continued

Rock	Type 1/	Granodiorite							
	Facies 2/	m	m	m	m	m	m	m	m
Column		16	17	18	19	20	21	22	23
Sample	Number	G400	G500	G600	G700	G800	G900	G1000	G1100
	Type 4/	C	C	C	C	C	C	C	C
	Report no. IRC-	397	397	397	397	397	397	397	402
	Lab. no.	154629	154630	154631	154632	154633	154634	154635	273777
	Analysts 5/	1,4,2	1,4,2	1,4,2	1,4,2	1,4,2	1,4,2	1,4,2	1,2,4
Location 6/		E	E	E	E	E	E	E	E
SiO_2		67.9	66.8	67.4	67.7	67.5	67.6	67.4	65.8
Al_2O_3		15.6	15.6	15.6	15.8	15.6	16.0	16.0	16.4
Fe_2O_3		1.5	1.8	1.6	1.8	1.9	1.7	1.8	2.0
FeO		1.6	1.6	1.6	1.4	1.5	1.6	1.6	2.0
MgO		.89	1.0	.89	.79	.94	.88	.89	1.2
CaO		3.5	3.7	3.7	3.7	3.6	4.2	3.9	3.9
Na_2O		2.8	2.8	2.8	3.0	2.9	3.1	3.1	3.2
K_2O		3.7	3.6	3.6	3.5	3.6	3.3	3.6	3.4
H_2O		1.2	1.7	1.5	1.3	1.4	.82	.94	.91
TiO_2		.36	.40	.40	.36	.38	.40	.41	.48
P_2O_5		.14	.16	.16	.16	.16	.19	.21	.19
MnO		.04	.06	.04	.04	.04	.06	.04	.10
CO_2		.18	.44	.44	.28	.29	.14	.17	.10
Sum		99	100	100	100	100	100	100	100

Table 7.--Chemical analyses for igneous rocks of the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent--Continued

Rock	Type 1/	Grano-diorite	Granodiorite and quartz monzonite			Quartz monzonite		
	Facies 2/	m	gm 65% qf 35%	gm 50% qf 50%	gm 40% qm 60%	m	m 100%	m
Column		24	25	26	27	28	29	30
Sample	Number	G930-0	G-300	G-200	G-100	G-118	G-50-90	G-70
	Type 4/	G	C	C	C	G	C	G
	Report no. IRC-	402	397	382	382	382	382	382
	Lab. no.	273775	154628	154463	154462	154465	154461	154464
	Analysts 5/	1,2,4	1,4,2	1,4,2	1,4,2	1,4,2	1,4,2	1,4,2
Location 6/		E	E	E	E	E	E	E
SiO_2		63.5	67.2	65.9	64.2	67.2	69.6	67.8
Al_2O_3		16.4	15.9	16.1	16.2	15.9	15.8	16.1
Fe_2O_3		1.8	1.7	1.9	2.0	1.6	1.0	1.3
FeO		1.6	1.5	1.7	1.6	1.6	1.2	1.7
MgO		1.4	.86	1.1	1.0	.86	.61	.88
CaO		3.1	3.5	3.4	3.7	3.5	2.7	3.5
Na_2O		3.4	2.9	2.8	2.8	3.0	2.9	3.4
K_2O		4.5	3.9	4.0	3.9	3.7	4.8	3.4
H_2O		1.8	1.3	1.4	2.2	1.0	.96	.83
TiO_2		.49	.38	.44	.44	.40	.33	.38
P_2O_5		.19	.17	.18	.19	.16	.12	.15
MnO		.10	.04	.08	.08	.08	.08	.08
CO_2		1.1	.39	.26	1.0	.09	<.05	.06
Sum		99	100	99	99	99	100	100

Table 7.--Chemical analyses for igneous rocks of the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent--Continued

Rock	Type 1/	Quartz monzonite								Granite
	Facies 2/	m	m	m	m	m 60% f 40%	f	f	f 7/	a
Column		31	32	33	34	35	36	37	38	39
Sample	Number	FP-63	HG-10	G-63-0	G-144-0	G-0-40	G-277-0	HG-8	HG-19	H-367-1
	Type 4/	G	G	G	G	C	G	G	G	G
	Report no. IRC-	354	354	393	393	382	393	354	354	382
	Lab. no.	153999	153996	154556	154557	154460	154560	153995	153997	154467
	Analysts 5/	1,2,3,4	1,2,3,4	1,2,4	1,2,4	1,4,2	1,2,4	1,2,3,4	1,2,3,4	1,4,2
Location 6/		S	S	E	E	E	E	S	S	S
SiO_2		70.8	70.7	69.3	66.2	67.3	67.1	68.2	67.3	74.0
Al_2O_3		15.9	14.9	15.6	17.3	16.4	16.5	16.1	16.6	13.9
Fe_2O_3		.6	1.5	1.4	1.7	1.5	1.1	1.7	.6	.15
FeO		.34	1.5	1.3	.83	1.6	1.4	1.5	.61	.16
MgO		.16	.47	.49	.59	1.0	.63	.52	.10	.02
CaO		1.8	2.9	3.3	3.4	3.6	3.0	3.3	.38	.70
Na_2O		3.0	3.0	3.0	3.1	3.3	2.7	3.1	.54	2.0
K_2O		5.1	4.0	4.0	3.2	3.4	5.6	3.5	12.3	7.8
H_2O		1.1	.57	.66	2.6	1.3	.96	.80	.63	.64
TiO_2		.22	.34	.36	.42	.44	.37	.40	.40	.06
P_2O_5		.13	.14	.18	.24	.19	.20	.18	.17	.12
MnO		.02	.04	.06	.04	.08	.06	.04	.02	.02
CO_2		.04	.10	.08	.34	.06	.20	.06	.15	<.05
Sum		99	100	100	100	100	100	99	100	100

Table 7.--Chemical analyses for igneous rocks of the Climax intrusive mass, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent--Continued

1/ Name assigned to original unaltered rock on the basis of megascopic petrology, chemical analyses and norms.

2/ Determined megascopically for granodiorite or quartz monzonite: f = fine-grained facies, m = medium-grained facies; for granite dikes: a = aplitic (fine grained), g = medium grained, p = pegmatitic (coarse to very coarse grained).

For the column showing composite samples, the facies line is used to indicate the relative proportions of the two rock types or two facies of one rock type in the composite sample.

3/ Hydrothermally(?) altered.

4/ G = grab, C = composite. Composite samples consist of equal amounts of rock taken at even 10-foot intervals beginning at the footage indicated by the sample number.

5/ Analysts indicated by numbers: 1 - P. L. D. Elmore, 2 - E. H. Barlow, 3 - M. D. Mack, and 4 - S. D. Botts.

6/ S = surface sample, E = sample from granite exploration hole, sample number indicates depth; zero following depth number distinguishes specific series of samples.

7/ Hydrothermally altered--predominant product is secondary K-feldspar.

Table 8.--Average chemical composition in weight percent for granodiorite and quartz monzonite in the Climax stock, Nevada Test Site, Nye County, Nevada

	Granodiorite (medium grained)	Quartz monzonite (fine to medium grained)
No. of analyses	13	10
SiO_2	68.01	68.42
Al_2O_3	15.74	16.05
Fe_2O_3	1.81	1.34
FeO	1.54	1.30
MgO	0.64	0.62
CaO	3.74	3.10
Na_2O	3.14	3.05
K_2O	3.36	4.07
H_2O	0.93	1.08
TiO_2	0.38	0.37
P_2O_5	0.20	0.17
MnO	0.07	0.06
CO_2	0.15	0.11
Sum	100	100

The differences between the chemical analyses of the two major rock types are not great. The quartz monzonite in respect to the granodiorite contains: 1) more K_2O, 2) slightly more SiO_2 and Al_2O_3, 3) less total FeO ($FeO+Fe_2O_3$ recomputed to FeO) and CaO, and 4) very slightly less Na_2O.

In table 9 are given some of the data from spectrographic and radiometric analysis of samples from the exploration hole. The samples are listed in the same order as in table 6. There are few analytically significant differences in the elemental composition of altered and unaltered rocks. The altered quartz monzonite represented by sample HG19 (column 38), however, shows a slightly higher amount of eU, B, Ba, Pb, and Sr. The granite dike material of sample H367-1 (column 39) appears to be low in Cu but high in Pb.

Chemical analyses for Cu, Zn, Pb, and S were made on samples of granodiorite and quartz monzonite (table 10). For some of these analyses the theoretical sulfide minerals were computed. The total of sulfide minerals present ranges from about 0.1 to 0.7 percent by volume.

Table 9.--Semiquantitative spectrographic and equivalent uranium analyses of granodiorite and quartz monzonite from the Climax ~~stock~~, Nevada Test Site, Nye County, Nevada. Amounts shown are weight percent.1/ Note: To read line captions, fold out bottom of page 43.

1	2	3	4	5	6	7	8	9	10
HG7	FP65	FP62	G165-0	G236-0	G255	G400-0	G500-0	G600-0	G700-0
1	1	1	3	3	2	3	3	3	3
270549	270567	270563	272303	272304	271844	272312	272306	272307	272308
4,2	4,2	4,2	3	3	2	3	3	3	3
0.002	0.004	0.001							
0	0	0	0	0	0	0	0	0	0
.07	.07	.07	.03	.07	.07	.07	.07	.07	.07
.0003	.0003	.0003	.0003	.0003	.00015	.0003	.0003	.0003	.00015
0	0	0	0	0	0	0	0	0	0
.015	0.	.015	0	0	0	0	0	0	0
.0007	0.	.0007	.0007	.0007	.0007	0	0	0	.0007
.0007	.00015	.0007	.0007	.0007	.0007	.0003	.0007	.0003	.0003
.0007	.003	.0015	.015	.007	.003	.0007	.0007	.0007	.0003
.0015	.0015	.0015	.0015	.003	.0015	.0015	.003	.0015	.0015
.007	0.	.003	.003	0	.003	0	0	.003	0
0	0	0	0	0	0	0	0	0	0
0	.0015	0	.0007	0	0	0	0	0	0
0	0	0	.0015	.0015	d	d	d	d	d
d	0	0	0	0	0	0	0	0	0
0	0	0	0	.0003	0	0	0	0	0
.0015	.003	.0007	d	.0015	.0015	.0015	.0015	.0015	.0015
.0007	.0003	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007
.07	.03	.07	.07	.07	.07	.07	.07	.07	.07
.007	.003	.007	.007	.007	.007	.007	.007	.007	.007
.0015	.0015	.0015	.0015	.0015	.0015	d	.0015	.0015	d
.00015	d	.00015	.00015	.00015	.00015	.00015	.00015	.00015	.00015
0	0	0	0	0	0	0	0	0	0
.015	.007	.015	.015	.015	.015	.007	.007	.007	.007

Table 9.--Semiquantitative spectrographic and equivalent uranium analyses of granodiorite and quartz monzonite from the Climax stock, Nevada Test Site, Nye County, Nevada.--Continued
Amounts shown are weight percent. 1/

11	12	13	14	15	16	17	18	19	20
G800-0	G900-0	G1000-0	G1100-0	G1200-0	G400	G500	G600	G700	G800
3	3	3	5	5	4	4	4	4	4
272309	272310	272311	273776	273778	272783	272784	272785	272786	272787
3	3	3	4,1	4,1	4,3	4,3	4,3	4,3	4,3
			0.003	0.002	0.003	0.002	0.002	<0.001	<0.001
0	0	0	0	0	0	0	0	0	0
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003	.0003
0	0	0	.0015	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
.0007	0	.0007	.0007	.0007	.0007	.0007	.0007	d	d
.0003	.0007	.0007	.0003	.0003	.0003	.0003	.0007	.0003	.0003
.0007	.003	.003	.0003	.0003	.0003	.0015	.003	.007	.0015
.0015	.0015	.003	.007	.0015	.0015	.0015	.003	.0015	.0015
0	0	0	.007	0	.003	0	0	0	.003
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	.0007	.0007
d	d	d	d	d	0	d	0	d	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
.0015	.0015	.0015	.0015	d	.0015	.003	.003	.0015	.0015
.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0007
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.007	.007	.007	.007	.007	.007	.007	.007	.007	.007
d	.0015	d	.0015	.0015	d	d	.0015	d	d
.00015	.00015	.00015	.00015	.00015	.00015	.00015	.00015	.00015	.00015
0	0	0	0	0	0	0	0	0	0
.007	.007	.007	.007	.015	.015	.015	.015	.015	.015

Table 9.--Semiquantitative spectrographic and equivalent uranium analyses of granodiorite and quartz monzonite from the Climax stock, Nevada Test Site, Nye County, Nevada.--Continued
Amounts shown are weight percent. 1/

21	22	23	24	25	26	27	28	29	30
G900	G1000	G1100	G930-0 6/	G300	G200	G100	G118	G50-90	G70
4	4	5	5	4	2	2	2	2	2
272788	272789	273777	273775	272782	271841	271840	271843	271839	271842
4,3	4,3	4,1	4,1	4,3	2	2	2	2	2
0.001	0.002	0.003	0.003	0.003					
0	0	0	0	0	0	0	0	0	0
.07	.07	.07	.07	.07	.07	.07	.07	.15	.07
.0003	.0003	.0003	.00015	.0003	.00015	.00015	.00015	.00015	.00015
0	0	0	0	0	0	0	0	0	0
.03	0	0	0	0	0	0	0	0	0
.0007	d	d	.0007	.0007	.0003	.0003	.0007	.0003	.0003
.0003	.0003	.0003	.0007	.0003	.0003	.0003	.00015	.00015	.00015
.0007	.0007	.0003	.0007	.007	.003	.003	.003	.0015	.0003
.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015	.0015
.007	0	.003	.003	0	.003	.003	.003	.003	.003
0	0	0	.03	0	0	0	0	0	0
0	0	0	0	0	.0015	0	0	0	0
d	d	d	0	d	d	d	d	d	d
.015	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
.0015	.0015	d	d	.0015	.0015	.0015	.0015	.0015	.0015
.0007	.0007	.0007	.0007	.0007	.0007	.0007	.0003	.0003	.0003
.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
.007	.007	.007	.007	.007	.007	.007	.007	.003	.007
d	d	.0015	.0015	d	.0015	.0007	.0007	.0007	.0007
.00015	.00015	.00015	.00015	d	.00015	d	0	d	0
0	0	0	0	0	0	0	0	0	0
.015	.015	.015	.015	.015	.007	.015	.015	.015	.015

Table 9.--Semiquantitative spectrographic and equivalent uranium analyses of granodiorite and quartz monzonite from the Climax stock, Nevada Test Site, Nye County, Nevada.--Continued
Amounts shown are weight percent. 1/

31	32	33	34	35	36	37	38	39
FT63	HG10	G63-0	G144-0	G0-40	G277-0	HG8	HG19 6/	G367-1
1	1	3	3	2	3	1	1	2
270564	270552	272301	272302	271838	272305	270550	270559	271845
4,2	2	3	3	2	3	4,2	4,2	2
0.002	<0.001					<0.001	0.007	0
0	0	0	0	0	0	0	0	0
.07	.07	.07	.07	.07	.15	.07	.15	.07
.0003	.00015	.00015	.00015	.00015	.0003	.0003	0	.0003
0	0	0	0	0	0	0	0	0
.015	0	0	0	0	0	.015	0	0
.0003	.0003	0	0	.0003	0	.0003	0	0
.0003	.0003	.0003	.00015	.0003	.0003	.0003	.00015	d
0	.0003	.0007	.0007	.0015	.007	.0007	.0007	.00015
.0015	.0007	.0015	.003	.0015	.0015	.0015	.0015	.0015
.003	.003	.003	.003	.003	0	.007	.003	0
0	0	0	0	0	0	0	0	0
0	0	.0007	0	0	0	0	.0007	0
0	0	.0015	.0015	d	d	0	0	d
0	0	0	0	0	0	.007	0	0
0	0	0	0	0	0	0	0	0
.007	.0015	.0015	d	.0007	.0015	.0007	.007	.003
.0003	.0003	d	d	.0007	d	.0007	.0003	0
.07	.07	.07	.07	.07	.07	.07	.03	.03
.007	.007	.007	.007	.007	.003	.007	.007	.0015
.0007	.0007	d	d	.0007	d	.0015	.0007	.0007
d	d	0	0	d	0	d	0	0
0	0	0	0	.03	0	0	0	0
.015	.015	.015	.015	.015	.007	.015	.015	.003

Table 9.--Semiquantitative spectrographic and equivalent uranium analyses of granodiorite and quartz monzonite from the Climax stock, Nevada Test Site, Nye County, Nevada--Continued
Amounts shown are weight percent.

ıre reported to the nearest number in the series 7, 3, 1.5, 0.7, 0.3, 0.15, etc., in percent. ıbers represent midpoints of group data on a geometric scale. Comparisons of this type of :itative result with data obtained by quantitative methods, either chemical or spectrographic, : about 60 percent of the quantitative values fall within the assigned semiquantitative groups.

of sample, type of rock and location, see table 7.

r semiquantitative spectrographic analyses indicated by number: 1 - TDS-9797; 2 - TDS-9921; 952; 4 - TDS-9975; 5 - TDS-10041. No report number is indicated for eU analyses.

ndicated by number: 1 - N. M. Conklin, 2 - R. G. Havens, 3 - J. C. Hamilton, and 4 - L. M. Lee nt U analyses).

te visual detection limits are shown in parentheses. These values are approximate and for some concentrations lower than these values may be detected; for other elements the detection limit e attained. The letter "d" indicates the element was detected, but no value was assigned. ɔn to elements listed the following were looked for but not found: As, Au, B, Cd, Dy, Er, Eu, f, Hg, Ho, In, Ir, Lu, Os, Pd, Pr, Pt, Re, Rh, Ru, Sb, Sm, Sn, Ta, Tb, Te, Th, Tl, Tm, U, and W. ents for which chemical analyses are given in table 3 are not listed.

ɔn to elements shown, sample HG-19 contains 0.003 B and B was detected but not determined in

Table10.--Chemical analyses for Cu, Pb, Zn, and S for igneous rocks from the "Granite" exploration hole, Nevada Test Site, Nye County, Nevada

Column		1	2	3	4	5	6	7	8
Rock	Type 1/	Granodiorite							
	Facies 2/	m	m	m	m	m	m	m	m
Sample	No. 4/	G-255	G1100-0	G1200-0	G400	G500	G600	G700	G800
	Type 5/	G	G	G	C	C	C	C	C
	Rept. no. TDC-	9921	10041	10041	9975	9975	9975	9975	9975
	Serial no.	271844	273776	273778	272783	272784	272785	272786	272787
	Analysts 6/	1,2	2,1	2,1	3,1,2	3,1,2	3,1,2	3,1,2	3,1,2
Cu (ppm)		55	<5	<5	16	18	77	39	15
Pb (ppm)		<5	15	15	21	31	49	23	26
Zn (ppm)		435	90	70	50	80	100	70	60
S (percent)		0.47	0.14	<0.02	0.26	0.22	0.21	0.19	0.33
Computed maximum theoretical sulfides	Chalcopyrite	.0166							
	Galena	.0002							
	Sphalerite	.0650							
	Pyrite	.0510							
	Sum	.1328							

Table 10.--Chemical analyses for Cu, Pb, Zn, and S for igneous rocks from the "Granite" exploration hole, Nevada Test Site, Nye County, Nevada--Continued

Column		9	10	11	12	13	14	15	16
Rock	Type 1/	Granodiorite				Granodiorite and quartz monzonite			Quartz monzonite
	Facies 2/	m	m	m	m 3/	gm 65% qf 35%	gm 50% qf 50%	gm 40% qm 60%	m
Sample	No. 4/	G900	G1000	G1100	G930-0	G300	G200	G100	G118
	Type 5/	C	C	C	G	C	C	C	G
	Rept. no. TDC-	9975	9975	10041	10041	9975	9921	9921	9921
	Serial no.	272788	272789	273777	273775	272782	271841	271840	271843
	Analysts 6/	3,1,2	3,1,2	2,1	2,1	3,1,2	1,2	1,2	1,2
Cu (ppm)		5	19	<5	13	35	45	55	25
Pb (ppm)		18	13	15	15	35	20	<5	<5
Zn (ppm)		60	80	90	95	60	<30	375	<30
S (percent)		0.02	0.23	0.07	0.45	0.38	0.85	0.90	0.39
Computed maximum theoretical sulfides	Chalcopyrite								.0072
	Galena								.0002
	Sphalerite								.0030
	Pyrite								.7246
	Sum								.7350

Table 10--Chemical analyses for Cu, Pb, Zn, and S for igneous rocks from the "Granite" exploration hole, Nevada Test Site, Nye County, Nevada--Continued

Column		17	18	19	
Rock	Type 1/	Quartz monzonite			
	Facies 2/	m	m	m 60% f 40%	
Sample	No. 4/	G50-90	G70	G0-40	
	Type 5/	C	G	C	
	Rept. No. TDC-	9921	9921	9921	
	Serial no.	271839	271842	271838	
	Analysts 6/	1,2	1,2	1,2	
Cu (ppm)		20	5	45	
Pb (ppm)		30	< 5	90	
Zn (ppm)		< 30	< 30	45	
S (percent)		0.14	0.06	0.06	
Computed maximum theoretical sulfides	Chalcopyrite	.	.0015		
	Galena	.	.0002		
	Sphalerite	.	.0030		
	Pyrite	.	.1092		
	Sum	.	.1139		

Table 10.--Chemical analyses for Cu, Pb, Zn, and S for igneous rocks from the "Granite exploration hole, Nevada Test Site, Nye County, Nevada--Continued

1/ Name assigned to original unaltered rock on the basis of megascopic petrology, chemical analyses and norms.

2/ Determined megascopically for granodiorite or quartz monzonite: f = fine-grained facies, m = medium-grained facies.

3/ Hydrothermally altered-predominant product is secondary K-feldspar.

4/ All samples with prefix "G" are from exploration hole and number indicates depth. Zero following depth figure distinguishes specific series of samples. All other samples are from the surface.

5/ G = grab, C = composite. Composite samples consist of equal amounts of rock taken at even 10-foot intervals beginning at the footage indicated by the sample number.

6/ Analysts indicated by numbers: 1 - W. D. Goss, 2 - H. H. Lipp, and 3 - Claude Huffman.

Table 11.--Lithologic log of the "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada
Logged by F. N. Houser, F. G. Poole, G. A. Izett, and C. E. Price

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
0.0-20.0	20.0	2/			30		Granodiorite, porphyritic,
20.0-25.0	5.0	17	3.4		90	1.9	fine-grained (0-12 ft)
25.0-30.5	5.5				32	4.2	medium (12-37.5 ft), iron-
30.5-34.5	4.0	15	3.8		36		stained fractures common to
34.5-37.5	3.0	15	5.0		100		27.5 ft slightly argillized, biotite not bleached.
37.5-42.5	5.0	17	3.4		72	1.9	Granodiorite, porphyritic,
42.5-48.7	6.2	22	3.5		100		medium-grained, little iron
48.7-58.4	9.7	26	2.7		100		stain, common pyrite dis-
58.4-68.7	10.3	21	2.0		100	4.3	seminated through rock and
68.7-78.3	9.6	24	2.5				along tight fractures that
78.3-87.5	9.2						are bordered by argillized
87.5-94.5	7.0				95		rock with and without bleached
94.5-100.3	5.8	34	6.8		91	1.4	biotite. Galena noted from
100.3-109.0	8.7				98		88-89 ft. Some fractures
109.0-114.9	5.9				88		coated with yellow iron(?)
114.9-122.0	7.1				100		hydroxide. Rock very solid
122.0-125.5	3.5	45	13.0		100		for drilling and coring from 42 to 58.4 ft.
125.5-133.5	8.0	53	6.6		100	6.5	From 127.5 ft granodiorite, equigranular, fine-grained, greenish-gray; disseminated pyrite.

Table 11.--Lithologic log of the "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
133.5-140.8	7.3				100	3.3	Granodiorite, porphyritic, medium-grained, argillized in part, and feldspathized(?) in part; biotite altered from 151-161 ft, common pyrite.
140.8-149.9	9.1	79	8.7		77	2.1	
149.9-151.0	1.1				100		
151.0-155.0	4.0						
155.0-164.0	9.0				79		
164.0-173.0	9.0	41	4.6	9.0	100	2.7	Granodiorite, equigranular, medium-grained, feldspathized, sericitized, and argillized (intensely from 174 to 189.5) in part; pyrite common in veins and disseminated through rock; trace galena from 175 to 179.5 ft.
173.0-175.0	2.0			2.0	100		
175.0-179.5	4.5			4.0	89		
179.5-189.5	10.0	40	4.0	9.0	98	2.6	
189.5-196.0	6.5			4.0	62		From 194.5 granodiorite, porphyritic, medium-grained, partly argillized and feldspathized; carbonate lining fractures (192.5-193).
196.0-203.0	7.0	29	4.1	7.0	100	2.3	
203.0-211.0	8.0	29	3.6	7.0	88	1.8	
211.0-216.5	5.5	20	3.6	4.0	73	2.2	Granodiorite, equigranular, medium-grained, partly argillized and feldspathized; traces of epidote; abundant pyrite. Intensely argillized and crumbly from 214 to 217. Core partly granodiorite, porphyritic, fine-grained, from 260 to 260.5 ft.
216.5-224.0	7.5	25	3.3	7.0+	93+	1.5	
224.0-233.5	9.5	27	2.8	9.5	100		
233.5-237.7	4.2	23	5.5	4.5	100		
237.7-263.6	25.9			25.9	100		

Table 11.--Lithologic log of the "Granite" exploration hole, Area15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
263.6-272.3	8.7	47	4.8	8.9	100	1.2	From about 270, granodiorite, porphyritic, fine to medium grained, green gray possibly from argillic alteration to montmorillonite; some feldspathic alteration; pyrite abundant in veinlets and irregular masses, trace galena.
272.3-272.9	0.6	18	36.0	0.5	96		
272.9-281.5	8.6	34	4.0	4.7	55	1.2	
281.5-290.8	9.3	57	6.1	9.3	100	1.4	
290.8-301.2	10.4				94	1.0	
301.2-304.7	3.5					0.7	Granodiorite, equigranular, medium-grained; pyrite common.
304.7-307.8	3.1				100		
307.8-317.7	9.9	43		9.8	98		From 306.7 granodiorite, porphyritic, fine- to medium-grained, partly feldspathized and biotite bleached; pyrite common along fracture; some fractures partly argillized; carbonate along some fractures.
317.7-322.3	4.6	17	3.7	4.7	100		Interval 325-355.6 broken rock fragments and clay with some slickensides--probably steeply dipping faulted zone; clay is probably product of argillic alteration; pyrite on fractures.
322.3-330.5	8.2	43	5.2	4.2	50	1.8	
330.5-333.0	2.5	15	6.0	2.5	100		
333.0-336.5	3.5	16	4.6	2.0	57	2.0	
336.5-340.0	3.5	25	7.1	3.3	94		
340.0-344.0	4.0	24	6.0	4.0	100	2.2	

Table 11.--Lithologic log of the "Granite" exploration hole, Area15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
344.0-346.3	2.3	22	9.6	2.0	87	1.9	
346.3-350.0	3.7	27	7.3	3.0	81		
350.0-355.3	5.3			5.3	100		Cemented twice from about 310 - 360.7 and once from about 310 - 374 to prevent caving.
355.3-355.6	0.3			0.2	60		
355.6-360.7	5.1	40	7.8				From about 356 granodiorite, equigranular, medium-grained, partly argillized and feldspathized.
360.7-386.5	25.8		5.0	25.8	100	4.3	Granodiorite, light-gray to medium-gray, medium-grained, equigranular; biotite is dominant dark mineral; alteration products are clay, chlorite, calcite, feldspar, epidote, and hematite; alteration minerals are commonly associated with fractures that are low angle (25°-30°) and high angle (55°-75°); pyrite is present along the low-angle fractures, but pyrite is less than 1 percent of rock. Core is competent, except 368 ft - 369 ft, and 382 ft - 384 ft owing to fracturing and argillic alteration.

Table 11.--Lithologic log of the "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
386.5-393.5	7.0		12.0	7.0	100		Granodiorite, light-gray to medium-gray, medium-grained, equigranular; biotite is common and occurs in books; argillic alteration along low- and high-angle fractures, but most intense along high-angle fractures; biotite is altered to chlorite in fracture zones and shows incipient alteration to chlorite away from some fractures; calcite, epidote, and hematite along some fractures. Low-angle fractures occur about 2 per foot and high-angle fractures about 1 per foot. Pyrite occurs most commonly along low-angle fractures, but some high-angle fractures are coated with pyrite; however, pyrite is less than 1 percent of rock. Core is generally competent except from 391.6-392.5 ft; 396-397 ft; 418-419 ft; and 436 ft.
393.5-413.9	20.4			19.5	90		
413.9-431	17.1		8.0	17.1	100		
431-441.2	10.2		6.2	10.2	100	0.7	
441.2-446.2	5.0		7.0	5.0	100	1.1	
446.2-454	7.8		9.6	7.8	100		

Table 11.--Lithologic log of the "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
454-461	7.0		7.7	7.0	100		Granodiorite, light-gray to medium-gray, medium-grained, equigranular, biotite in books, a few phenocrysts of potash feldspar, argillic and chloritic alteration along low- and high-angle fractures; other alteration products are feldspar, calcite, and epidote; at 478 ft a ½-in. quartz-filled fracture. Pyrite occurs as disseminations along low-angle fractures, and is less than 1 percent of rock. Average fracture intensity is about 1.5 low angle and 1.0 high angle per foot. Core is generally competent except 464 ft - 465 ft; 474 ft - 476 ft; and 507 ft.
461-464	3.0		8.3	3.0	100		
464-474	10.0		6.2	9.0	90	2.9	
474-483	9.0		8.0	8.7	96	1.5	
483-491.5	8.5		6.8	8.5	100	1.4	
491.5-501.5	10.0			9.8	98		
501.5-511.2	9.7		4.6	9.7	100	1.9	

Table 11.--Lithologic log of the "Granite" exploration hole, Area 5, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
511.2-521.4	10.2		6.3	10.2	100	1.1	Granodiorite, light-gray to medium-gray, medium-grained, equigranular; biotite is mostly fresh and occurs in books; alteration products are clay, chlorite, calcite, epidote, and hematite. Pyrite occurs along low-angle (25°-32°) fractures and is less than 1 percent of rock. Average fracture intensity is about 2 per foot (low angle) 1 per foot (high angle). Core is generally competent except at 597 ft, 553 ft, and 575 ft.
521.4-548.9	27.5			27.5	100		
548.9-553	4.1		7.3	1.9	46		
	Depth to water in hole April 13, 107.9 ft and hole depth 553 ft.						
553-561.6	8.6			8.6	100		
561.6-600	38.4			35.5	92		
600-601	1.0			1.0	100		Granodiorite, light-gray to medium-gray, medium-grained, equigranular, biotite is fresh and occurs in books; alteration products are clay, chlorite and epidote. Chloritic alteration is mostly associated with fractures, argillic alteration is most intense along high-angle fractures; hydrous iron oxides and alteration feldspars not
601-610	9.0		10.0	9.0	100	1.5	
610-652	42			41.0	97		

Table 11.--Lithologic log of the "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
							conspicuous. Pyrite occurs almost exclusively along low-angle fractures, but the pyrite is less than 1 percent of rock. Fracture intensity is about 2 per foot (low angle), 1 per foot (high angle). Core is mostly competent except at 623 to 624 ft and 648 to 649 ft.
652-663.3	11.3		5.3	10.7	95	0.8	Granodiorite, light-gray to medium-gray, medium-grained, equigranular, biotite is commonly fresh and occurs in books; alteration minerals as above; low-angle (25°-32°) and high-angle (55°-75°) fractures occur at the rate of 1 per foot; argillic alteration most common along high-angle fractures; pyrite is restricted to low-angle fractures and forms less than 1 percent of rock; rock is usually competent except altered zones at 665 ft to 667 ft, 670 ft, and 712 ft to 713 ft.
663.3-669.3	6.0		10.0	4.2	70		
669.3-679.3	10.0		6.0	10.0	100	0.8	
679.3-685.6	6.3		6.3	5.0	80	2.3	
685.6-716	30.4			28.9	95		

Table 11.--Lithologic log of the "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/	Lithologic description and remarks
		Min	Min/ft	Feet	Percent	gal/min	
716-722	6.0			3.9	65		Granodiorite, light-gray to medium-gray, medium-grained, equigranular, biotite is common mafic mineral and occurs in books; alteration including argillation and chloritization are common along fractures. Other alteration products are calcite, epidote and sericite. Low-angle and high-angle fracture intensity is about 2 and 1 per foot, respectively. Iron sulfide occurs as disseminations along low-angle fractures but sulfide content is less than 1 percent. In the main, the core is competent except at 723 ft to 724 ft and 744 ft to 753 ft.
722-732	10.0		6.5	10.0	100	.4	
732-742	10.0		7.0	10.0	100	.4-	
742-753	11.0		6.8	2.2	20	.4 -	
753-760	7.0			7.0	100		Granodiorite, light-gray to medium-gray, medium-grained, equigranular, biotite is common and occurs in books; alteration along fractures consists of clay, chlorite, and epidote. Fracture intensity and competence, as above but more common from 762 ft to 769 ft, 775.5 ft to 778.3 ft and 786 ft to 790 ft. Pyrite is common along low-angle fractures, but content is less than 1 percent of rock.
760-769	9.0			6.3	70		
769-775.5	6.5			6.2	95		
775.5-778.3	2.8			1.5	55		
778.3-786	7.7		7.8	6.2	80		
786-790	4.0		7.5	2.6	65		
790-800	10.0		6.0	10.0	100		

Table 11.--Lithologic log of the "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
800-809	9.0						Granodiorite, light-gray to medium-gray, equigranular, medium-grained, common low-angle joints, and sparse to common steeply dipping joints; alteration products: common clay, chlorite, carbonate; sparse to common potassium feldspar and quartz; and sparse pyrite (< 1 percent).
809-814	5.0			5.0	100	3.1	
814-824	10.0		7.5	2.0	20		
824-830.9	6.9			6.9	100		
830.9-848.6	17.7			16.8	95		
848.6-858.3	9.7		6.2	9.7	100	1.1	
858.3-868.4	10.1		6.5				
868.4-871.5	3.1		6.6	3.1	100		
871.5-905	33.5			33.5	100		
905-914	9.0			7.2	80		
914-924	10.0			8.0	80		
924-932.5	8.5			8.1	95		
932.5-939.7	7.2			7.2	100		
939.7-946.2	6.5			6.2	95	3.6	
946.2-955.6	9.4			9.4	100		
955.6-964.0	8.4			8.4	100		
964.0-1089.3	125.3			125.3	100		
1089.3-1090.3	1.0			0.9	90		
1090.3-1093	2.8			1.4	50		
1093-1101	8.0			6.8	85		
1101-1117	16.0			16.0	100		
1117-1120	3.0			2.4	80		
1120-1125	5.0			3.0	60		

Table 11.--Lithologic log of the "Granite" exploration hole, Area 15, Nevada Test Site, Nye County, Nevada--Continued

Interval (feet)	Footage	Drilling time		Core recovery		Water loss 1/ gal/min	Lithologic description and remarks
		Min	Min/ft	Feet	Percent		
1125-1133	8.0			5.0	63		
1133-1135	2.0			2.0	100		
1135-1143	8.0			3.0	37		
1143-1153	10.0			4.5	45		
1153-1155	2.0			2.0	100		
1155-1163	8.0			5.4	67		
1163-1173	10.0			1.0	10		
1173-1183	10.0			2.5	25		
1183-1185	2.0			0.8	40		
1185-1188.5	3.5			1.5	43		
1188.5-1200	11.5			8.3	72		
Total	1200						

1/ Average loss for interval cored. Computed by C. E. Price and Alfred Clebsch, Jr., USGS.

2/ Blank spaces indicate no data available.