

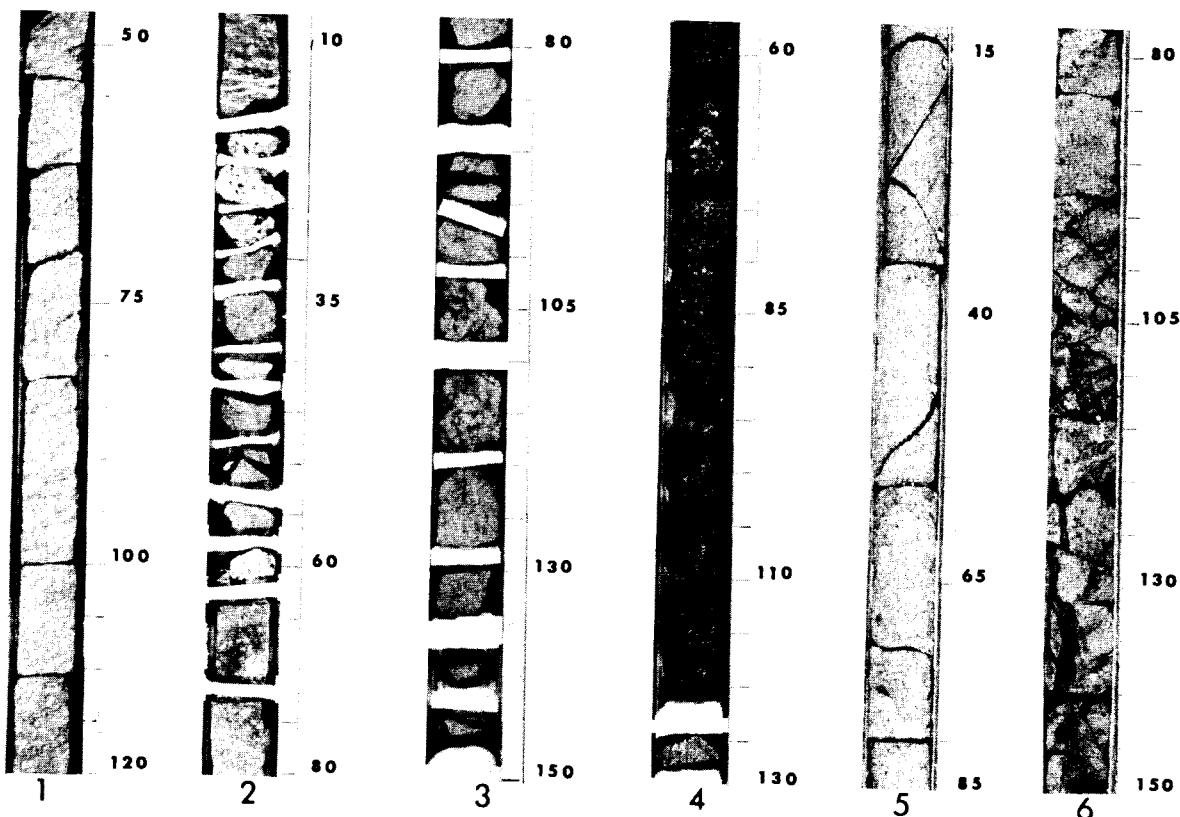
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INITIAL CORE DESCRIPTIONS

DEEP SEA DRILLING PROJECT

LEG 45

MID- ATLANTIC RIDGE



Prepared for the
NATIONAL SCIENCE FOUNDATION
National Ocean Sediment Coring Program
Under Contract C-482
By the
UNIVERSITY OF CALIFORNIA
Scripps Institution of Oceanography
Prime Contractor for the Project

Captions to Cover Photos

1. 395-18-1, 45-120 cm:
Serpentinized lherzolite. Augen are enstatite, and are aligned roughly parallel to foliation. Serpentinization increases downward, heightening contrast of augen.
2. 395-18-2, 5-80 cm:
Serpentinized lherzolite (topmost piece) separated from serpentinized harzburgite (lowest two pieces) by carbonate cemented breccias (light gray with dark fragments). The breccia fragments are pieces of serpentinite, gabbro and basalt. Between the breccia pieces are pieces of plagioclase-, olivine- and clinopyroxene-phyric fine-grained basalt. The serpentinized lherzolite and harzburgite are intensely altered to reddish iron oxides at their edges, where they are laced with calcite veins.
3. 395A-8-1, 75-150 cm:
Fine-grained aphyric basalt. The fifth piece from the bottom has unusual very large (up to 1 cm) spherulites, mats of skeletal acicular plagioclase, skeletal titanomagnetite, and skeletal olivine. These are set in a darker, nearly opaque, mesostasis, and grew near the edge of a pillow or flow.
4. 395A-58-2, 55-130 cm:
Hyaloclastites containing angular fragments of fresh glass set in a partially palagonitized crushed-glass matrix.
5. 395A-63-3, 10-85 cm:
A portion of a 15 m thick intrusive plagioclase-olivine phyric dolerite, cored over 500 meters below the sediment-basement interface.
6. 395A-66-2, 75-150 cm:
Altered, highly fractured fine-grained aphyric basalt cored near the bottom of Hole 395A, over 550 meters below the sediment-basement interface. The intense fracturing is probably the result of compressional failure under the weight of so much overburden. Secondary minerals are concentrated near cracks and include calcite, clays, and zeolites.

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Dear Colleague:

This document has been printed and distributed by the Deep Sea Drilling Project for the purpose of sample selection by interested earth scientists. Sample requests are honored after one year following completion of the cruise on which the samples were collected. It is an interim and informal document consisting of site data and sedimentologic and paleontologic data and interpretations as known six (6) months post-cruise. These data, while adequate for most sample selection needs, are subject to slight revision by the time of issue of the corresponding volume of the Initial Reports of the Deep Sea Drilling Project.

The information contained herein is preliminary and privileged, consequently this document is not to be cited or used as the basis of other publications. Data cited or used in a manuscript will be considered a breach of professional ethics.

Thank you for your interest in the Deep Sea Drilling Project.

Sincerely,

A handwritten signature in cursive script that appears to read "David G. Moore".

David G. Moore
Chief Scientist
Deep Sea Drilling Project

INITIAL CORE DESCRIPTIONS

DEEP SEA DRILLING PROJECT

LEG 45

November 30, 1975 – January 20, 1976

A Project Planned by and Carried Out With the Advice of the
JOINT OCEANOGRAPHIC INSTITUTIONS FOR DEEP EARTH SAMPLING (JOIDES)

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LEG 45
Initial Core Description

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Initial Core Descriptions

Leg 45

by

The Shipboard Scientific Party

Introduction

The following contains the basic descriptive and analytic data obtained on DSDP Leg 45 which recovered mainly ocean ridge volcanic rocks from the Mid-Atlantic Ridge. The data is presented in preliminary form as an aid to sampling. The volcanic and plutonic rock descriptions are considerably more detailed than those of previous DSDP legs. This is because each piece of rock requires specific information on its composition, orientation, magnetic properties, physical properties, and degree of alteration in order to provide an intelligent basis for sampling. We of the scientific party of Leg 45 feel that our preliminary integration, assessment, and interpretation of the data is also vital to intelligent sampling, especially to those who might wish to disprove our conclusions! Most of the interpretations were summarized in Geotimes (May, 1976) which is the appropriate article to reference. The report which follows is based on the Preliminary Report of Leg 45 which was distributed as an information circular to many scientists and institutions. We wish specifically to emphasize that Leg 45 results at this time are preliminary and we ask those critical of or confused by our interpretations to direct queries to the shipboard party for our consideration for the *Initial Report* volume. We offer this Initial Core Description compilation as no more than a guide to sampling, and will be glad to reply to comments in an appropriate format.

Leg 45 Summary

The primary scientific objective of DSDP Leg 45, the inaugural cruise of the International Phase of Ocean Drilling (IPOD), was to develop an understanding of the composition, structure and origin of the oceanic crust by drilling as deeply into it as technology would permit. The deep drilling accomplished during Leg 45 is part of a long range program to determine the petrologic, geochemical, magnetic, physical and structural properties of the crust beneath the ocean floor, to obtain an understanding of the processes which produce these properties, and to outline the evolution of oceanic crust through time. The drilling is part of an ambitious integrated program of geophysical site surveying, surface sampling and drilling which share the same basic scientific objectives.

D/V *Glomar Challenger* departed San Juan on 30 November 1975 and completed its voyage 52 days later in San Juan on 20 January 1976. Three holes were drilled in two different site survey areas (Figures 1 to 3). These areas, which were surveyed by R/V *Atlantic II* (WHOI), R/V *Kana Keoki* (HIG) and R/V *Akademik Kurchatov* (USSR), are located on crust of middle to late Miocene age located about 90 miles on either side of the Mid-Atlantic Ridge axis (Site 395, west of ridge axis, latitude 22°45.35'N, longitude 46°04.90'W; Site 396, east of ridge axis, latitude 22°58.88'N, longitude 43°30.95'W). The surveyed regions were generated between 6 and 13 million years ago at approximately the same latitude at the ridge crest and have since been separated by sea-floor spreading.

The first hole drilled in survey area AT-5, was a single-bit pilot hole (395) aimed at confirming whether the basement rocks were suitable for deep

drilling. Ninety three meters of sediment and ninety two meters of basement rocks were continuously cored in 4484 meters of water before the bit was completely worn. With this the hole conditions were deemed satisfactory, and we decided to attempt a very deep hole on this site. A re-entry cone was set onto the sea floor, and casing was cemented below the cone approximately 120 meters through sediments into basement. After 576 meters of basement rocks were drilled in Hole 395A (664 meters sub-bottom) involving nine re-entries into the cone, unstable hole conditions forced us to leave. At this time, we went to Site Survey Area AT-6 and drilled a single bit hole through 125 meters of sediment and 96 meters of basalt (Site 396). This concluded the drilling on Leg 45. Holes 396A and B were drilled in area AT-6 during Leg 46, and will be described in the Leg 46 Initial Core Descriptions.

Below are the summaries of these sites revised to include shore-based biostratigraphic determinations by Ansis Kaneps [DSDP] and David Bukry [U.S. G.S.]. These are followed by more comprehensive interpretations of the magnetic and chemical determinations on the rocks.

Summary Site 395, Hole 395

Site 395 was drilled at $22^{\circ}45.35'N$, $46^{\circ}04.90'W$ in 4484 meters water on the eastern edge of Target Pond A, IPOD Survey Area AT-5, within normal-polarity magnetic anomaly 4 (Figure 2). The site was carefully chosen to avoid fracture zones. Target Pond A is bounded by north to northeast trending ridges. A lithologic column of primarily basement rocks is given in Figure 4. In this column units are designated as phryic (Units P₁- P₅) or aphyric

(Units A₁- A₅) depending on the presence or absence of phenocrysts. Hole 395 penetrated 89 meters Neogene of foraminifer-nannofossil ooze and 4 meters of calcareous brown manganese-micronodule-bearing clays. The basalt-sediment contact was not recovered in undisturbed form. The lowest sediments are assigned to the *Discoaster quinqueramus* zone (upper Miocene) in close agreement with the age of anomaly 4. Basalt and serpentinite sand and cobbles were frequently encountered in the sediments. A serpentinite-gabbro rubble zone apparently immediately overlies basement. It may be talus. Recovery in the sediments was 73 per cent.

We drilling 95 meters into basement, with 22 per cent recovery including drill cuttings, 10.8 per cent without cuttings. The drill penetrated 57 meters of aphyric basalt pillow lavas before encountering a gabbro-serpentinized peridotite complex. The contact with the overlying pillow lavas was not recovered. A small piece of gabbro separates basalt from peridotites. The gabbro-peridotite contact was not recovered. The peridotite is 20-40 per cent serpentинized and preserves many primary minerals, including olivine, but has no plagioclase. It is among the freshest so far obtained from the Atlantic Ocean floor. The peridotite includes a 1.4 meter section of continuously-recovered tectonized harzburgite with large elongate enstatite augen inclined 40° to the vertical. Tectonic foliation predates serpentini-ation. The harzburgite is separated from a one-meter section of continuously-recovered non-foliated serpentinized lherzolite by a carbonate-cemented serpentinite breccia zone with a probable basalt dike in the middle. Traces of microfossils are preserved in the carbonate breccia matrix. The basalt is

plagioclase-olivine-clinopyroxene phric. The lower lherzolite is separated from massive plagioclase-olivine phric basalt by another carbonate-cemented breccia zone. There is no evidence for pillow lava features in this basalt, where the hole terminated. We infer that the gabbro-ultramafic complex was emplaced away from fracture zones in this structurally complex region which may be typical of much of Central Atlantic.

Basalts analyzed are fresh to moderately-altered mid-ocean-ridge basalts with K₂O of 0.09-0.30 per cent and TiO₂ of 1.0-1.7 per cent. Four distinct types were analyzed but are not readily relatable by shallow crystal fractionation or accumulation: 1) high Ca-Al aphyric basalt (Unit A₁, Figure 4); 2) lower Ca-Al aphyric basalt (Unit A₂); 3) plagioclase-olivine-clinopyroxene-phric basalt (Unit P₁); 4) plagioclase-olivine phric basalt (Unit P₂). Units P₁ and P₂ are exclusively found in the gabbro-ultramafic complex and are quite different from Units A₁ and A₂.

Unit A₂ is normally polarized with a mean inclination of 28° decreasing with depth. Units P₁ and P₂ in the plutonic complex are normally polarized, with a mean inclination of 8°. The average intensity of basalt magnetization is 0.003 emu/cc. Peridotites show no stable remanence because of magnetization induced by the magnetic steel collar used during drilling.

Summary Site 395, Hole 395A

Five hundred seventy-six meters of igneous basement were drilled at Hole 395A (22°45'N, 46°04'W) on magnetic anomaly 4 (upper Miocene) on the western flank of the Mid-Atlantic Ridge. Basement begins at about 93 meters

sub-bottom. The sequence cored (see Figure 4) includes three massive chemically uniform aphyric basalt units with many glassy zones (Unit A₂, 111-172 meters, Unit A₃, 361-365 meters, and Unit A₄, 565-665 meters sub-bottom). The upper two aphyric units are separated by at least two cycles (one, cored in Hole 395 only) of porphyritic basalts (plagioclase phenocrysts 15-30 per cent; olivine phenocrysts 2-10 per cent; clinopyroxene phenocrysts 0-5 per cent) which proceed from most fractionated to least fractionated upward (174-361 meters sub-bottom). These are Units P₅-P₃, and P₂-P₁ respectively. Units P₂ and A₂ correspond stratigraphically and chemically with basalts cored in Hole 395 (see Figure 4). All basalts are somewhat fractionated but high MgO picritic basalts and low-MgO high-Fe-Ti basalts are absent. A porphyritic basalt intrusion, Unit P₄ occurs within the third massive aphyric basalt (608-630 meters sub-bottom). It is chemically similar to phryic basalt type P₄ higher in the section. The final core (67) contained yet another chemically distinct aphyric basalt (Unit A₅). Alteration and fracturing increase generally but erratically downward. A breccia with clay-carbonate matrix occurs between 344 and 354 meters sub-bottom that has been reheated sufficiently by hydrothermal fluids to change the magnetic polarity of the breccia clasts. Hyaloclastites and other breccias occur elsewhere. Unit A₂ overlies serpentinite cobbles which correlate with the gabbro-serpentinized peridotite-basalt-calcareous sediment breccia zone of Hole 395. Both are perhaps talus from surrounding exposures. Basalt extrusion and formation of these peridotite-bearing breccias are inferred to have occurred in an axial rift setting.

The top 150 meters sub-basement basalts (Units A₂, P₂ and P₃) have a positive magnetic inclination of +40°. The first magnetic reversal (average inclination of -40°) occurs at 243 meters sub-bottom in phryic basalts. Only a minor lithological change, that between Units P₃ and P₄ is associated with this reversal. This magnetically reversed section is present for 330 meters and includes Units P₃, P₄, P₅ and A₃. Beginning at 573 meters sub-bottom is a 40-meter section of normally magnetized (inclination +55°) aphyric pillow basalt (Unit A₄). Underlying this, beginning at 520 meters sub-basement, is a 22-meter reversely magnetized (inclination -38°) dolerite intrusion (Unit P₄). The deepest magnetic unit sampled, 635-664 meters sub-basement, is coherently magnetized from 635-645 meters sub-bottom, with inclinations very close to -40°; the bottom 19 meters have widely scattered magnetic directions due to hydrothermal alteration. Average intensity of magnetization for the total drilled column of igneous crust is 0.004 emu/cc. The intensity of magnetization is very uniform within the various lithological units and no systematic variation in intensity with depth is observed. This data is consistent with the occurrence of several field reversals within the time span of magnetic anomaly 4. The inclinations scatters only slightly around the 40° inclination of an axial-geocentered dipole at this latitude.

The basalts comprise eleven distinct chemical types, five aphyric (Units A₄-A₅), the rest plagioclase, olivine, and clinopyroxene phryic (Units P₁- P₅, plus P₄). Each basalt type is compositionally homogeneous, consisting of between 30 to 250 meters of thin flows, pillow sequences, and possibly intrusives (see Figure 4). All have the chemical characteristics

of mid-ocean ridge tholeiites. They have low Mg/(Mg + Fe) values (0.51-0.66), low Ni (85-180 ppm) and Cr (200-370 ppm) abundances, and relatively high TiO₂ (1.0-1.7 per cent), Zr (67-130 ppm) and Sr (117-172 ppm) concentrations. These parameters, together with the presence of multiple phenocryst phases including pyroxene in some of the phric units, are indicative of the evolved nature of these basalts. They are unlikely candidates for unfractionated, primary, mantle-derived melts. Several stratigraphically separated units are closely comparable in composition, differing only in minor detail (Table 2). Such similarities imply cyclical magmatic processes, repeatedly generating magmas that are remarkably similar in composition.

Site 396, Hole 396

Site 396 was drilled at latitude 22°58.88'N, longitude 43°30.95'W in a water depth of 4450 meters. The site is located about 1.4 km from the western edge of a sediment pond, Survey Site AT-6, and was picked to be within normal polarity magnetic anomaly 5 (8.7-10 m.y.). It is at the approximate conjugate position on the opposite side of the ridge axis to Site 395. The regional bathymetry as well as the magnetic anomalies are well lineated and no evidence of fracture zones are observed in the vicinity of the sediment pond. One hundred twenty-five meters of sediment were continuously cored with the basalt-sediment contact recovered in undisturbed form. Surprisingly, the oldest sediments recovered are much older than expected - middle Miocene (*Discoaster exilis* zone, about 13 million years). This indicates that the basalts were erupted between magnetic anomalies 5A and 5B, not within anomaly 5 as first expected. Obviously there is a discrepancy

between the crustal age as picked from the regional magnetic anomalies, and the results of drilling at Site 396. Lithologically, the sediments can be divided into two units. The first, from 0 to 117 meters sub-bottom is a nannofossil ooze interbedded with lesser foraminifer-nannofossil ooze and foraminiferal sands. The second, from 117 to 125 meters, is brown calcareous basal clay interbedded with marly nannofossil ooze. Recovery in the sediments was 80.7 per cent.

We drilled 96 meters into basement until the bit was worn. Basement recovery was 33 per cent. The cored rocks consist of fairly uniform phryic basalt pillows with a multitude of glass zones, lithified sediment veins, and contact zones. The lava is plagioclase (5 to 15 per cent) and olivine (1-3 per cent) phryic. Clinopyroxene is not seen as a phenocryst phase and occurs primarily in skeletal form even in the groundmass. The groundmass of all the rocks is fine-grained, often variolitic with feldspar laths around 0.1 mm long. No basis exists for discrimination of lithologic units from hand specimen appearance. Two varieties of carbonate veins cross many of the samples. The first is a lithified (baked?) sedimentary carbonate, observed only in the upper three cores; the second is the re-crystallized white vein carbonate. The presence of the sedimentary carbonate in the basalts suggests that the upper part of the sequence was intruded into or extruded onto a carbonate ooze.

Despite the uniform hand specimen appearance of the basalts, a significant compositional variation is observed, particularly in $Mg/(Mg + Fe)$ values (0.58-0.66) and Ni concentrations (111-189 ppm), and in Sr. These

variations do not simply reflect varying proportions of modal phenocryst content since Al₂O₃ and CaO concentrations are approximately constant (16.7 and 12.0 per cent, respectively). Most of this variation can be attributed to fractional crystallization involving olivine and subordinate plagioclase. Significant differences in Sr abundances, coupled with lithologic breaks and contrasting magnetic properties, suggest that this is not a single co-magmatic series but that several separate but closely comparable series have been sampled.

The magnetic inclinations fall into three separate groups. The upper group, identified by only two samples from near the top of basement, is reversed and at a shallow angle of -20°. The middle group, which extends to about 70 meters sub-basement, is scattered around an average inclination of +35°. The lower magnetic group has an average inclination of -5°. The average intensity of the entire 96 meters of sub-basement is 1.53 ±0.15 × 10⁻³ emu/cc. This value is less than one-half the value obtained on Hole 395A. These data are consistent with extrusion of this section during a magnetic transition. The inclinations observed suggest that the magma was extruded when the earth's magnetic field was largely of a non-dipolar nature and consistent with extrusion of the pillow basalts at three different time intervals all within the same magnetic transition.

Preliminary Interpretation of Paleomagnetic Determinations, Leg 45

In order to determine the magnetic properties of the basement rocks

samples during DSDP Leg 45, a Schönstedt digital spinner magnetometer and demagnetizing unit were loaned by J. M. Hall of Dalhousie University to DSDP for use on board the *Glomar Challenger*. Approximately 200 samples (2.5 cm by 2.5 cm minicores) were taken from three holes (395, 395A, and 396) for shipboard magnetic analysis. Samples were routinely demagnetized at intervals of 50, 100, 200, 300, 400, 500, 600, 800 and 1000 oersteds in order to identify the stable magnetic direction of each sample. The relevant magnetic parameters measured were stable magnetic inclination, NRM intensity, and median demagnetizing field (MDF).

In almost all samples from all three holes (the finest grained, oxidized pillow basalts being the only exceptions) there was observed a vertical component of magnetization that was acquired during drilling. This "drilling remanence" was almost exactly parallel to the axis of the drill core (with a normal polarity) and was probably a VRM component that was acquired during the several hours required to drill 9.5 meters of igneous basement. The drilling remanence could usually be removed from both the fine- and coarse-grained rocks by partial AF demagnetization of the order of 100 oersteds. The serpentinized peridotite in Hole 395 were the only samples which were apparently sufficiently magnetically unstable that the vertical drilling remanence completely dominated any initial remanence and no stable directions could be obtained. This drilling remanence provided a useful check on the possible misorientation of rock cores during subsequent handling on shipboard.

The axial-centered dipole value of inclination for the latitude of the

Sites 395 and 396 is $\pm 40^\circ$. Values in inclination for the Hole 395 are of normal polarity and near the theoretical value at the top of the hole but show a definite trend towards shallower inclinations until they approach 0° inclination near the bottom. The single piece of gabbro, which is certainly tectonically misoriented showed a steeper value of inclination of $+45^\circ$. The single piece of oriented basalt lying below the gabbro and above the serpentized peridotite had a reversed inclination of -45° . No convincing stable directions were obtained from the peridotite samples. The four oriented basalt samples lying below the peridotite sections showed shallow inclinations which ranged from -6° to $+11^\circ$. This shallowing of inclinations with depth may be related to either progressive chemical change and subsequent CRM addition or due to tectonic movement during the period of eruption of this column of basalts. The range of more than 40° in inclinations seems too large to be caused by the secular variation of the non-dipole field. Subsequent shore-based studies are necessary to resolve this problem. In any case, there seems to be only a single (normal) polarity unit represented by the pillow basalts that make up most of this unit. The peridotite and gabbro units are presumed to be of tectonic origin.

The inclination values of Hole 395A are shown in Figures 4 and 5. The upper aphyric (presumably pillow) basalt, Unit A₂, is of normal polarity with little scatter around an average inclination value of about $+36^\circ$. This lack of scattering in stable inclination values indicates that the entire 65-meter section was erupted in less than 10^2 years and perhaps simultaneously. The plagioclase-olivine phryic units P₂ and P₃ (76 meters

thick) have a much larger scatter in positive inclination values and also a trend toward steeper inclination values. Although not shown there is also a corresponding increase in magnetic intensity with depth for this unit. Again, shore-based studies will be necessary to determine if this is recording a tectonic event or progressive low temperature oxidation. Unlike Hole 395, the scatter around the ideal dipole value is possible due to a rapid series of flows sampling different portions of a secular variation cycle.

The first magnetic reversal occurs in the phryic basalt at a sub-basement depth of 150 meters (uppermost Unit P₄). The samples from the upper part of the reversed section seem more weathered than those in the upper normal sections and it seems logical to attribute this to a time break of at least longer than that of a magnetic transition ($\sim 10^3$ years). The negative inclinations continue, with very little scatter around the dipole value of -40°, for the next 280 meters of basement rock, and include several different lithological units.

The second magnetic reversal occurs 482 meters sub-basement. Unit A₄ has an average inclination uniformly close to +60°. This deviation from the ideal value is probably due to the secular variation of the nondipole field. At 519 meters sub-basement, a dolerite intrusion (Unit P₄) appears with inclinations very uniformly close to -40°. The upper contact between the normal aphyric and the reversed dolerite was not recovered. Within the 21-meter thick dolerite unit there is a thin (0.5 meter) aphyric unit

that may be a type of inclusion. Shore-based studies will be needed to confirm that this unit was remagnetized by the dolerite, but the magnetic inclination of the thin aphyric unit is identical to that of the dolerite. Below the dolerite unit is a short 34 meter section of aphyric basalt with the top 10 meters having a reversed polarity (which may or may not be related to the dolerite intrusion) and the bottom 20 meters having been extensively hydrothermally altered. It is possible to speculate that if hydrothermal alteration continues with increasing depth down to seismic layer 3, then the boundary between the lower unaltered and hydrothermally altered aphyric units may represent the bottom of the coherently magnetized crust that contributes to the overlying magnetic anomaly.

Integrated over the entire drilled column of 395A basement igneous rocks, approximately 1/3 of the column is normally magnetized and 2/3 of the column is reversed. Although Site 395 is situated within a broad positive magnetic anomaly, this result is consistent with the presence of several reversed events being present within an anomaly of a single polarity. The small scatter in inclinations around the dipole value and the presence of several polarity units within the column indicate that the upper 600 meters of oceanic igneous crust formation is episodic with periods of rapid (10^2 years or less) extrusion followed by periods of quiescence (10^3 to 10^4 years).

The inclinations of the samples of Hole 396 show three separate groups. The upper few meters are reversed with a shallow angle of -20° . The middle group, which consists of most of the core, is scattered around an average

inclinaton of +35°. The lower magnetic unit consists of 30 meters of phryic pillow basalt with inclinations close to -5°. One possible interpretation of these results is that the upper and lower reversed sections of this column of basalt were extruded when the earth's magnetic field was transitional between normal and reversed dipolar states and is largely of non-dipolar nature. Since it is improbable that the upper and lower sections sampled two different magnetic transitions, it seems likely that the entire 100 meters of phryic pillow basalt was erupted at three different time intervals, all within the same magnetic transition. The near agreement of the middle sections with the axial centered dipole value of ±40° is then fortuitous.

The average intensity of magnetization is $2.93 \pm 46 \times 10^{-3}$ emu/cc in Hole 395, $3.78 \pm .65 \times 10^{-3}$ emu/cc in Hole 395A and $1.54 \pm .15 \times 10^{-3}$ emu/cc in Hole 396. The intensities have been integrated over the entire presumed composition of the column. The intensities for 395 and 395A are comparable to that found in the FAMOUS area and during DSDP Leg 37. The average intensity of Hole 396 is less than one-half these values and this may be due to either more extensive low temperature oxidation of the magnetic minerals at this site or it may be reflecting the lower field intensity that occurs during a magnetic transition. The hydrothermally altered zone at the very bottom of 395A showed, with two exceptions, a drastically reduced intensity of magnetization of less than 1×10^{-3} emu/cc. With the exception of the hydrothermal zone, there did not seem to be any significant trends in intensity with depth and intensity instead seemed to depend more on lithology and grain size.

The presence of two zones of breccia (carbonate matrix at 260 meters

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sub-basement and altered glass matrix at 410 meters sub-basement) in Hole 395A, and the recovery of oriented pieces of these sections, allowed a magnetic test to be performed to determine if the breccias were emplaced hot or cold. Cold emplacement would result in completely scattered magnetic directions within the breccia zones while hot emplacement or later reheating above the Curie temperature of the magnetic minerals would yield coherent magnetic directions. Measurement of five samples from the upper breccia unit gave a spread of inclinations of from +31° to +63° and three samples from the lower unit varied from -32° to -47°. This general uniformity of directions within each unit would result if the breccias were either emplaced hot or later reheated at intermediate temperatures somewhat below the Curie temperature. This would impose a rough coherence on the initially random magnetization of the breccia clasts. The intensity of magnetization of the breccia samples, both clasts and cement, are roughly the same and this adds credibility to the zones having been reheated. If the reheating hypothesis stands up to further shore-based rock magnetic studies, then it is possible to speculate that these breccia zones might have been conduits for hydrothermal circulation.

PRELIMINARY INTERPETATION OF CHEMISTRY, Leg 45

Introduction

Shipboard X-ray fluorescence analysis has been used to obtain selected major (SiO_2 , Al_2O_3 , Fe_2O_3 , MgO , CaO , K_2O , TiO_2) and trace element (Cr, Ni,

Sr, Zr) data for 86 basalt samples and 8 gabbroic and ultramafic rocks, cored from Holes 395, 395A and 396. The main objective of shipboard analyses is to use chemical parameters to recognize the major magmatic units encountered during drilling, and to establish chemical stratigraphies for the holes. Secondary aims are 1) more complete characterization of the rocks, 2) assessment of genetic relationships, and 3) to aid in more systematic and intelligent sampling for additional shore-based studies.

Gabbroic and Ultramafic Rocks

Coarse-grained gabbros and serpentinized peridotites were sampled in a rubble layer, immediately above basement in both Holes 395 and 395A, and also from a breccia zone at a sub-basement depth of 65-84 meters in Hole 395 and 75-83 meters in 395A. All of the ultramafic rocks are serpentinized and have Mg/(Mg + Fe) values typical of peridotites (e.g., about 0.90), but vary with respect to other constituents, such as CaO and Al₂O₃, reflecting derivation from a variety of materials including harzburgite, lherzolite, and feldspathic peridotite prior to serpentinization. The peridotites from the breccia zone have low loss on ignition values (7.6-9.1 per cent) and are perhaps some of the freshest analyzed peridotite samples from the Atlantic Ocean.

The gabbroic rocks are compositionally distinct from any of the basalts sampled, and cannot be considered to be slowly-cooled variants of the basalts. The low TiO₂ (0.04-0.8 per cent) and Zr (8-36 ppm) abundances in these rocks coupled with high Al₂O₃ (17.7-24.4 per cent) and variable MgO (5.5-13.9 per cent) concentrations imply cumulate origins, ranging from

plagioclase-pyroxene cumulate to troctolite. None of these gabbros have Mg/(Mg + Fe) values compatible with derivation from the basalts sampled at Site 395. At least one gabbro has a recrystallized (metamorphic) texture.

Basaltic Rocks

All of the basalts recovered from Holes 395, 395A and 396 (see Table 2) have the overall chemical characteristics of low-K mid-ocean ridge tholeiites, with uniform SiO₂ concentrations of about 49 percent, Al₂O₃ content varying between 14.5 and 18.9 percent, and MgO concentrations between 6.1 and 8.7 per cent. The K₂O content is low, but erratic in abundance, ranging from as little as 0.06 per cent in relatively fresh material to 0.36 per cent in more altered samples. All the basalts have low molecular Mg/(Mg + Fe) values (0.51-0.66), within the range prevalent for most mid-ocean tholeiites, but too low for these rocks to be considered as suitable candidates for primary, mantle-derived melts. They have all undergone a substantial fractionation history, as is also evident from the presence of multiple phenocryst phases, mainly plagioclase and olivine, but including clinopyroxene, in some units. The trace and minor element (Ti, Zr, Sr, Cr, Ni) abundances are also within the range commonly observed in evolved ocean ridge tholeiites.

A feature common to all the basalts from Holes 395, 395A and 396 is the uniformity of the Ti/Zr ratio. Similar ratios are found in basalts recovered from the FAMOUS area and on Leg 37. Such a linear relationship

implies similar distribution coefficients for both Ti and Zr, as well as a constant Ti/Zr ratio in the mantle source of these basalts. Products of off-ridge volcanism, such as alkaline and transitional tholeiitic basalts are conspicuously absent and it is presumed that the cored basalts were extruded along the axial zone of the nearby Mid-Atlantic Ridge. On the basis of the chemical data, it is possible to recognize discrete compositional units at Site 395. With increasing depth below the sediment-basement interface (Figure 4) these are: A₁, A₂, P₁, P₂, P₃, P₄, P₅, A₃, A₄, P_{4'}, A₄ again, and A₅. Units A₂, P₂ and P₃ were encountered in both holes (395 and 395A), whereas Units A₁ (the shallowest unit) and P₁ (basalts cored within the plutonic complex in Hole 395) were not identified in Hole 395A. Hole 395 did not penetrate units deeper than P₃. Average chemical compositions for the units, together with the inferred depth within basement are given in Table 2. The boundaries between these chemically defined units are broadly consistent with observed petrographic boundaries and with inferred time intervals based on changes in magnetic polarity and inclination. There are, however, some exceptions; for example, the compositional change between aphyric Units A₃ and A₄, corresponding to a magnetic reversal, is not observed petrographically. Conversely, shifts in polarity between upper Units A₄ and lower Unit A₄ and within Unit P₄ are not accompanied by substantial changes in chemistry or petrography.

Some of the units, which are separated stratigraphically, are closely similar in composition, differing only in minor details (e.g., A₂-A₄; A₅-A₅; P₄-P_{4'}). The similarity between P₄ and P_{4'} is readily explained since

P_4' is an intrusive unit, presumably co-magmatic with Unit P_4 . Other similarities are less easily explained since they are between aphyric units made up of extrusive flows and pillows. It follows, then, that since these compositionally similar units (Table 2) are separated by substantial time intervals, as deduced from magnetic data, ocean ridge magmatic processes can repeatedly generate magmas that are remarkably similar in composition. This is all the more unexpected when one considers that these magmas are thought to be evolved magmas that have undergone a substantial history of fractionation.

Petrographically, two broad basalt types have been sampled at Site 395; these are the aphyric and phryic basalts. The aphyric basalts (A_1-A_5) comprise about 59 per cent of the cored interval, and the phryic basalts (P_1-P_5, P_4') about 31 per cent. These two types are compositionally, as well as texturally, distinct. The phryic basalts are substantially higher than the aphyric basalts in Al_2O_3 and CaO content, reflecting high plagioclase phenocryst content (10-25 per cent); they have higher $Mg/(Mg + Fe)$ values (0.59-0.66 versus 0.51-0.59), but lower TiO_2 and Zr concentrations. These differences, in particular the $Mg/(Mg + Fe)$ values, preclude the possibility that the phryic and aphyric basalts are comagmatic, simply related by fractionation and accumulation of varying amounts of plagioclase phenocrysts. It seems reasonably certain that they are derived from different partial melting events.

Compositional variation of each magmatic unit is not large and it is difficult to assess the role of fractional crystallization within any single

unit. Although the existing data are consistent with a model in which all of the aphyric basalts may be derived by partial melting of a common source, it is not evident that they are co-magmatic, with A₁-, A₃-, and A₅-type basalts reflecting greater fractionation from a common (or similar) parental magma than A₃- and A₄-type basalts. In view of the contrasting magnetic properties, and inferred time intervals, co-magmatic relationships are not to be expected.

The relationships between the phryic units are more enigmatic, being complicated by the high abundance of plagioclase phenocrysts and the uncertainty as to whether the bulk chemistry reflects magmatic compositions or unsampled magma compositions plus widely varying amounts of accumulated plagioclase phenocrysts. Ti, Zr, Ni, Cr data suggest that the three units (P₃, P₄, P₅) and by extension, the more evolved Unit P₂, may belong to a single co-magmatic fractionation series. Sr data are, however, inconsistent with such an interpretation. Thus, if the variation in Sr is a primary feature, and not a consequence of alteration or mobilization, then it is necessary to conclude that the various phryic units are independently derived by partial melting of a source that was inhomogeneous with respect to Sr, subsequently modified by crystal fractionation.

Although the plagioclase-olivine phryic basalts cored from Hole 396 are broadly comparable compositionally with the basalts from Site 395, none are identical with any specific type, but tend to be intermediate with respect to many parameters between the phryic and aphyric basalts. In contrast with the Site 395 basalts, however, thick homogeneous chemical units

are not recognized. Consequently, all analyses from this hole are combined in Table 2. There is instead a significant range in compositions, particularly in molecular Mg/(Mg + Fe) values (0.59-0.66) and Ni concentrations (111-189). These variations, characterized by increasing TiO₂, Fe₂O₃ and Zr content with decreasing MgO, Mg/(Mg + Fe), Ni and Cr can be attributed to fractional crystallization involving olivine and subordinate plagioclase, the observed phenocryst phases. Variations in the Sr data are not consistent with a single co-magmatic fractionation series, but imply instead that several separate, but broadly similar, series have been sampled. Support for this interpretation is provided by changes in magnetic inclination and by interlayered sediments.

Table 1a. Leg 45 Site Summary

Hole	Dates (1975, 1976)	Latitude	Longitude	Water Depth (m)	Penetration (meters)	No. of Cores	Meters Cored	Meters Recovered	Percent of Recovery
395	6-9 December	22°45.35'N	46°04.90'W	4484	184.65	20	184.65	88.36	48
395A	9 December- 10 January	22°45.35'N	46°04.90'W	4484	664.09	68*	587.94	105.97	18
396	11-14 January	22°58.88'N	43°30.95'W	4450	221.49	25	221.49	133.28	60
						113	994.08	327.61	33

*Core #68 contained cuttings obtained while attempting to clean hole. The amount recovered was not added in total core recovery.

Table 1b. Core Summary

Page 1 of 4

Site 395, Hole 395, PDR 4484 meters Latitude 22°45.35'N, Longitude 46°04.90'W									
Core Number	Date (December 1975)	Time	Depth from Sea Surface (* m)		Depth below Sea Floor (* m)		Length Cored (m)	Length Recovered (m)	Percent Recovery
			Top	Bottom	Top	Bottom			
1	6	1907	4517.7-4525.2		0.00- 7.50		7.50	7.50	100
2	6	2035	4525.2-4534.7		7.50- 17.03		9.53	8.55	90
3	6	2215	4534.7-4544.3		17.03- 26.57		9.54	9.40	99
4	6	2338	4544.3-4553.8		26.57- 36.10		9.53	6.97	73
5	7	0135	4553.8-4563.3		36.10- 45.63		9.53	9.30	98
6	7	0321	4563.3-4572.8		45.63- 55.15		9.52	4.09	43
7	7	0510	4572.8-4582.3		55.15- 64.65		9.50	5.02	53
8	7	0645	4582.3-4591.9		64.65- 74.19		9.54	6.40	67
9	7	0832	4591.9-4601.4		74.18- 83.70		9.51	9.10	
10	7	1043	4601.4-4610.9		83.70- 93.23		9.53	1.90	20
11	7	1430	4610.9-4620.4		93.23-102.75		9.52	2.10	22
12	7	2015	4620.4-4629.9		102.75-112.25		9.50	1.92	20
13	8	0055	4629.9-4639.5		112.25-121.76		9.51	6.20	65
14	8	0400	4639.5-4649.0		121.76-131.27		9.51	0.62	7
15	8	0710	4649.0-4658.3		131.27-140.57		9.30	2.35	25
16	8	1010	4658.3-4667.8		140.57-150.08		9.51	2.25	24
17	8	1440	4667.8-4677.3		150.08-159.62		9.54	0.55	6
18	8	1828	4677.3-4686.8		159.62-169.15		9.53	2.57	27
19	8	2330	4686.8-4696.3		169.15-178.65		9.50	1.27	13
20	9	0510	4696.3-4702.3		178.65-184.65		6.00	0.30	5
			Totals		184.65		88.36		48

*Using pipe lengths supplied by driller. See operations text for possible explanations of discrepancy between PDR and drill string measurements to sea floor.

Table 1b. Core Summary (continued)

Site 395, Hole 395A, PDR 4484 meters Latitude 22°45.35'N, Longitude 46°04.90'W									
Core Number	Date (December 1975)	Time	Depth from Sea Surface (m)		Depth below Sea Floor (m)		Length Cored (m)	Length Recovered (m)	Percent Recovery
			Top	Bottom	Top	Bottom			
1	10	2030			2.67- 12.20		9.53	2.35	25
2	10	2200	4475.75-4477.67		0.75- 2.62		1.92	1.92	100
3	11	0700	4562.60-4571.84		87.60- 96.84		9.24	0.62	7
4	11	0915	4571.84-4581.16		96.84-106.16		9.32	2.24	24
5	11	1550	4581.16-4500.42		106.16-115.42		9.26	1.50	16
5a*	12	0850	Cleaning hole					Chips	--
Bit changed									
6	20	0400	4590.42-4591.00		115.42-116.00		0.58	0.12	21
7	20	0600	4591.00-4600.09		116.00-125.09		9.09	0.45	5
8	20	0810	4600.09-4609.62		125.09-134.62		9.53	0.98	10
9	20	1035	4609.62-4619.02		134.62-144.02		9.40	1.50	16
10	20	1415	4619.02-4628.53		144.02-153.53		9.51	0.27	3
11	20	1713	4628.53-4638.06		153.53-163.06		9.53	0.65	7
12	20	1945	4638.06-4647.44		163.06-172.44		9.38	0.04	0
13	20	2202	4647.44-4656.98		172.44-181.98		9.54	0.65	7
14	21	0129	4656.98-4666.49		181.98-191.49		9.51	3.65	38
15	21	0521	4666.49-4675.99		191.49-200.99		9.50	6.00	63
16	21	0800	4675.99-4685.52		200.99-210.52		9.53	0.70	7
17	21	1000	4685.52-4694.79		210.52-219.79		9.27	1.34	14
18	21	1249	4694.79-4904.34		219.79-229.34		9.55	0.82	9
Bit changed									
19	25	0920	4704.34-4706.70		229.30-231.90		2.56	0.15	6
20	25	1200	4706.90-4716.44		231.90-241.44		9.54	0.66	7
21	25	1530	4716.44-4725.97		241.44-250.97		9.53	0.35	4
22	25	1940	4725.97-4735.37		250.97-260.37		9.40	2.33	25
23	25	2215	4735.37-4744.88		260.37-269.88		9.51	0.76	8
24	26	0032	4744.88-4754.61		269.88-279.41		9.53	1.40	15
25	26	0247	4754.61-4763.79		279.41-288.79		9.38	1.25	13
26	26	0640	4763.79-4773.33		288.79-298.33		9.54	2.30	24
27	26	1100	4773.33-4782.84		298.33-307.84		9.51	1.40	15
28	26	1350	4782.84-4792.34		307.84-317.34		9.50	0.71	7
29	26	1630	4792.34-4801.87		317.34-326.87		9.53	0.30	3
30	26	1950	4801.87-4811.06		326.87-336.06		9.19	1.00	11
Bit changed (#4)									
31	28	0337	4811.06-4819.46		336.06-344.46		8.40	0.75	9
32	28	0650	4819.46-4829.00		344.46-354.00		9.54	2.30	24
33	28	0905	4829.00-4838.53		354.00-363.53		9.53	2.15	23
34	28	1152	4838.53-4847.93		363.53-372.93		9.40	0.35	4
35	28	1430	4847.93-4857.44		372.93-382.44		9.51	0.92	10
36	28	1810	4857.44-4866.97		382.44-391.97		9.53	1.00	10
37	28	2130	4866.97-4876.35		391.97-401.35		9.38	0.84	9
38	29	0050	4876.35-4885.89		401.35-410.89		9.54	0.50	5
39	29	0435	4885.89-4895.40		410.89-420.40		9.51	0.44	
Bit changed (#5)									

*After drilling Core 5, drill became stuck, and core barrel became full of cuttings. These have been retained and labeled 5a, and total material is 6 meters of mafic and ultramafic plutonic rocks and basalt, including basaltic glass.

Table 1b. Core Summary (continued)

Site 395, Hole 395A, PDR 4484 meters Latitude 22°45.35'N, Longitude 46°04.90'W									
Core Number	Date (December 1975)	Time	Depth from Sea Surface *		Depth below Sea Floor *		Length Cored (m)	Length Recovered (m)	Percent Recovery
			Top	Bottom	Top	Bottom			
40	30	1450	4895.40-4903.05		420.40-428.05		7.65	0.07	1
41	30	1946	4903.05-4912.56		428.05-437.56		9.51	0.48	5
42	30	2300	4912.56-4922.09		437.56-447.09		9.53	0.52	5
43	31	0215	4922.09-4931.62		447.09-456.62		9.53	0.20	2
44	31	0505	4931.62-4941.01		456.62-466.01		9.39	0.00	0
45	31	0740	4941.01-4950.53		466.01-475.53		9.52	0.22	2
46	31	0950	4950.53-4960.07		475.53-485.07		9.54	0.70	7
47	31	1245	4960.07-4969.44		485.07-494.44		9.37	1.98	21
48	31	1610	4969.44-4978.96		494.44-503.96		9.52	1.08	11
49	31	2050	4978.96-4988.47		503.96-513.47		9.51	2.07	22
January 1976									
50	1	0020	4988.47-4997.97		513.47-522.97		9.50	1.70	18
51	1	0349	4997.97-5007.24		522.97-532.24		9.27	2.30	25
52	1	0630	5007.24-5016.51		532.24-541.51		9.27	1.60	17
53	1	1930	5016.51-5019.51		541.51-544.51		3.00	1.60	53
Changed bit (#6)									
54	3	1201	5019.51-5026.02		544.51-551.02		6.51	2.09	32
55	3	1640	5026.02-5035.55		551.02-560.55		9.53	1.86	20
56	3	2325	5035.55-5045.08		560.55-570.08		9.53	4.18	44
57	4	0305	5045.08-5054.57		570.08-579.47		9.39	1.50	16
58	4	0607	5054.47-5063.99		579.47-588.99		9.52	2.30	24
59	4	0910	5063.99-5073.53		588.99-598.53		9.54	2.45	26
60	4	1310	5073.53-5082.90		598.53-607.90		9.37	3.40	36
61	4	1708	5082.90-5092.42		607.90-617.42		9.52	3.82	40
62	5	0450	5092.42-5093.63		617.42-618.63		1.21	1.21	100
Changed bit (#7)									
63	6	0900	5093.63-5101.13		618.63-626.13		7.50	6.05	81
64	6	1615	5101.13-5110.64		626.13-635.64		9.51	5.85	62
65	6	2208	5110.64-5120.17		635.64-645.17		9.53	2.55	27
66	7	0225	5120.17-5129.70		645.17-654.70		9.53	3.93	41
67	7	0845	5129.70-5139.09		654.70-664.09		9.39	2.60	28
Changed bit (#8)									
68*	9	1000	5078.0 -5124.0		603.0- 649.0		--	5.0**	--
Totals							587.94	105.97	18

*Cuttings obtained when cleaning hole.

**Not counted in Hole 395A total recovery.

Table 1b. Core Summary (continued)

Site 396, PDR 4450 meters Latitude 22°58.88'N, Longitude 43°30.95'W									
Core Number	Date (January 1976)	Time	Depth from Sea Surface * (m)		Depth below Sea Floor * (m)		Length Cored (m)	Length Recovered (m)	Percent Recovery
			Top	Bottom	Top	Bottom			
1	11	1525	4450.00-4455.00		0.00- 5.00	5.00	5.00	100	
2	11	1712	4455.00-4464.28		5.00- 14.28	9.28	7.30	79	
3	11	1830	4464.28-4473.84		14.28- 23.84	9.56	5.54	58	
4	11	1950	4473.84-4483.10		23.84- 33.10	9.26	0.00	0	
5	11	2110	4483.10-4492.37		33.10- 42.37	9.27	9.00	97	
6	11	2210	4492.37-4501.92		42.37- 51.92	9.55	8.00	84	
7	11	2320	4501.92-4511.47		51.92- 61.16	9.24	9.15	99	
8	12	0102	4511.47-4520.72		61.16- 70.41	9.25	8.10	88	
9	12	0200	4520.72-4529.95		70.41- 79.64	9.23	6.65	72	
10	12	0310	4529.95-4539.18		79.64- 89.18	9.54	8.27	87	
11	12	0412	4539.18-4548.41		89.19- 98.41	9.23	8.60	93	
12	12	0525	4548.41-4557.96		98.41-107.96	9.55	8.20	86	
13	12	0640	4557.96-4567.20		107.96-117.20	9.25	9.24	100	
14	12	0825	4567.20-4576.74		117.20-126.74	9.54	9.54	100	
15	12	1315	4576.74-4586.05		126.74-136.05	9.31	4.95	53	
16	12	1800	4586.05-4595.30		136.05-145.30	9.25	5.83	63	
17	12	2240	4595.30-4604.55		145.30-154.55	9.25	0.00	0	
18	13	0530	4604.55-4613.56		154.55-163.56	9.01	4.78	53	
19	13	1005	4613.56-4622.82		163.56-172.80	9.26	3.00	32	
20	13	1215	4622.82-4632.06		172.80-182.06	9.24	0.00	0	
21	13	1340	4632.06-4641.33		182.06-191.33	9.27	1.03	11	
22	13	1730	4641.33-4650.59		191.33-200.59	9.26	5.70	62	
23	13	2030	4650.59-4660.24		200.59-210.24	9.65	0.70	7	
24	13	2310	4660.24-4669.49		210.24-219.49	9.25	3.60	39	
25	14	0310	4669.49-4671.49		219.49-221.49	2.00	1.10	55	
			Totals		221.49	133.28	60		

Table 2. Average Compositions of Chemically Defined Basalt Types, Leg 45

Chemical Type	A ₁	A ₂	P ₂	P ₃	P ₄	P ₅	A ₃	Upper A ₄	P ₄	Lower A ₄	A ₅	Samples
Hole	395	395	395A	395A	395A	395A	395A	395A	395A	395A	395A	396
Sub-basement depth	0-7	14-76	84-113	113-163	162-211	211-265	266-473	473-519	519-536	536-556	556-574	0-96
No. samples	1	12	8	6	6	6	16	4	4	4	1	10
SiO ₂	48.90	49.31	49.71	49.47	49.82	49.54	49.73	49.37	49.47	48.90	49.90	49.47
Al ₂ O ₃	15.93	14.97	18.04	17.69	17.15	18.29	15.14	15.00	16.90	15.17	15.10	16.73
Fe ₂ O ₃ *	12.83	12.18	9.33	8.77	8.82	8.73	11.20	11.17	8.87	11.46	10.56	9.42
MgO	6.80	8.56	6.84	7.63	7.78	7.24	7.61	8.20	8.35	8.40	7.30	7.81
CaO	11.01	10.57	12.13	12.75	12.25	12.26	11.29	10.97	12.03	11.09	11.40	11.98
K ₂ O	0.22	0.12	0.13	0.12	0.14	0.16	0.21	0.20	0.09	0.23	0.29	0.23
TiO ₂	1.70	1.63	1.37	1.05	1.12	1.18	1.72	1.59	1.13	1.62	1.69	1.29
Loss on ignition	0.90	0.96	1.84	1.20	1.30	1.88	1.34	1.90	1.85	2.87	2.60	2.45
Mg/(Mg + Fe)	0.51	0.59	0.59	0.59	0.63	0.65	0.62	0.57	0.59	0.65	0.59	0.58
Cr	352	317	199	374	345	301	297	369	324	355	306	341
Ni	161	177	101	142	135	136	117	171	131	172	129	132
Sr	127	120	162	117	135	164	131	127	132	129	132	145
Zr	121	113	97	67	70	78	126	111	73	111	124	89

*Total Fe expressed as Fe₂O₃

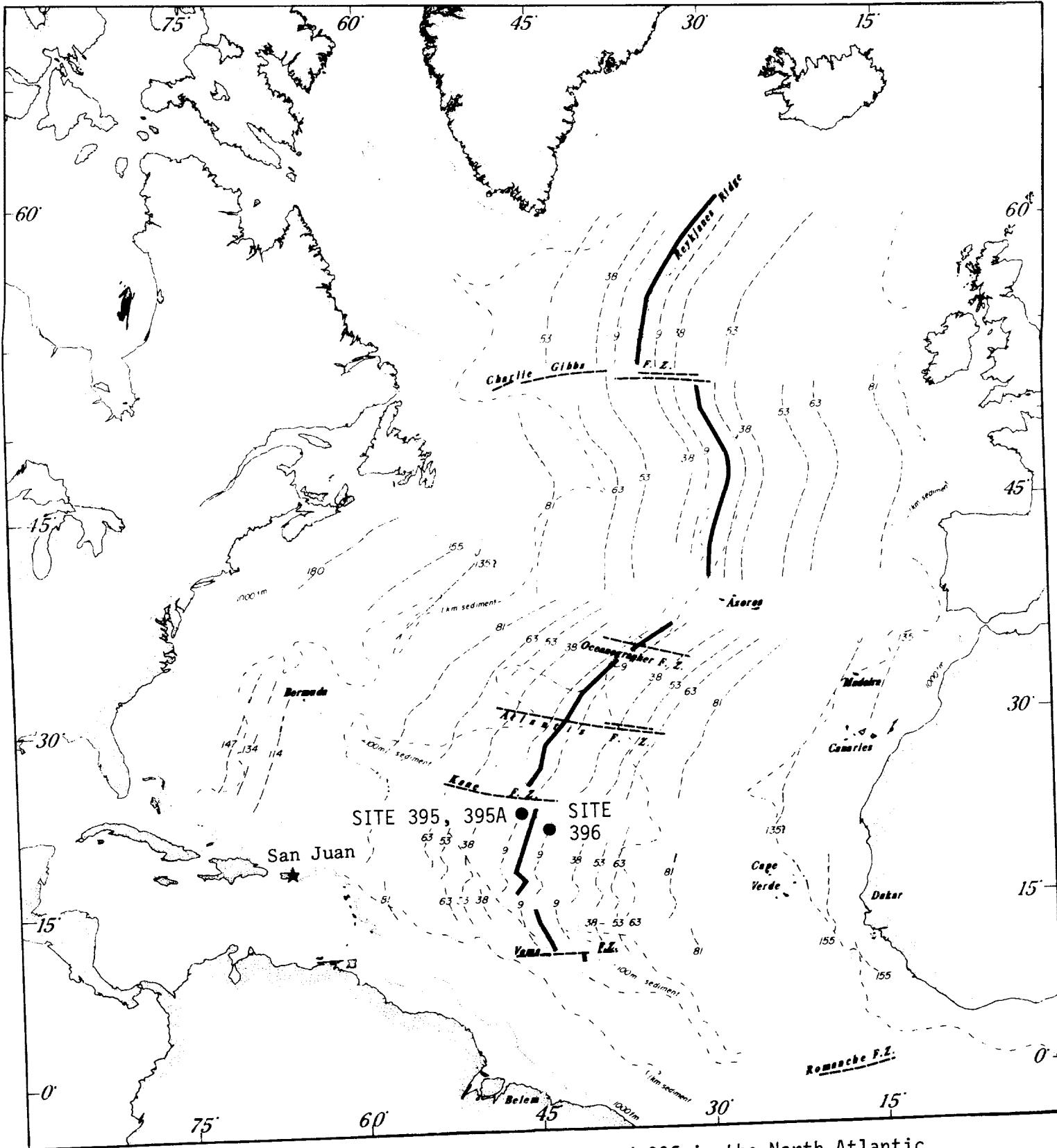


Figure 1. Location of Sites 395, 395A and 396 in the North Atlantic.

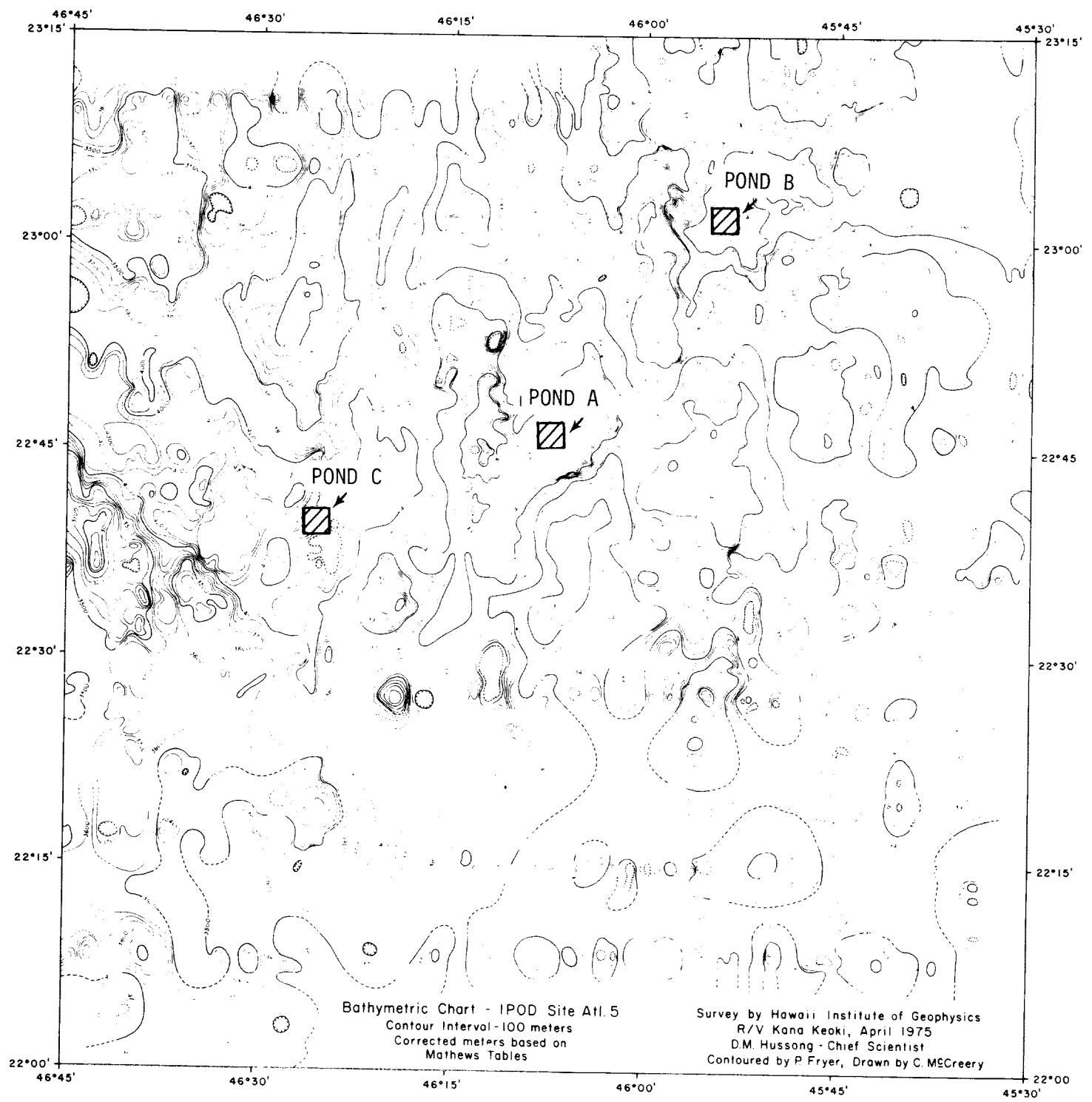


Figure 2. Survey Area AT-5 showing location of target Ponds A, B, and C.

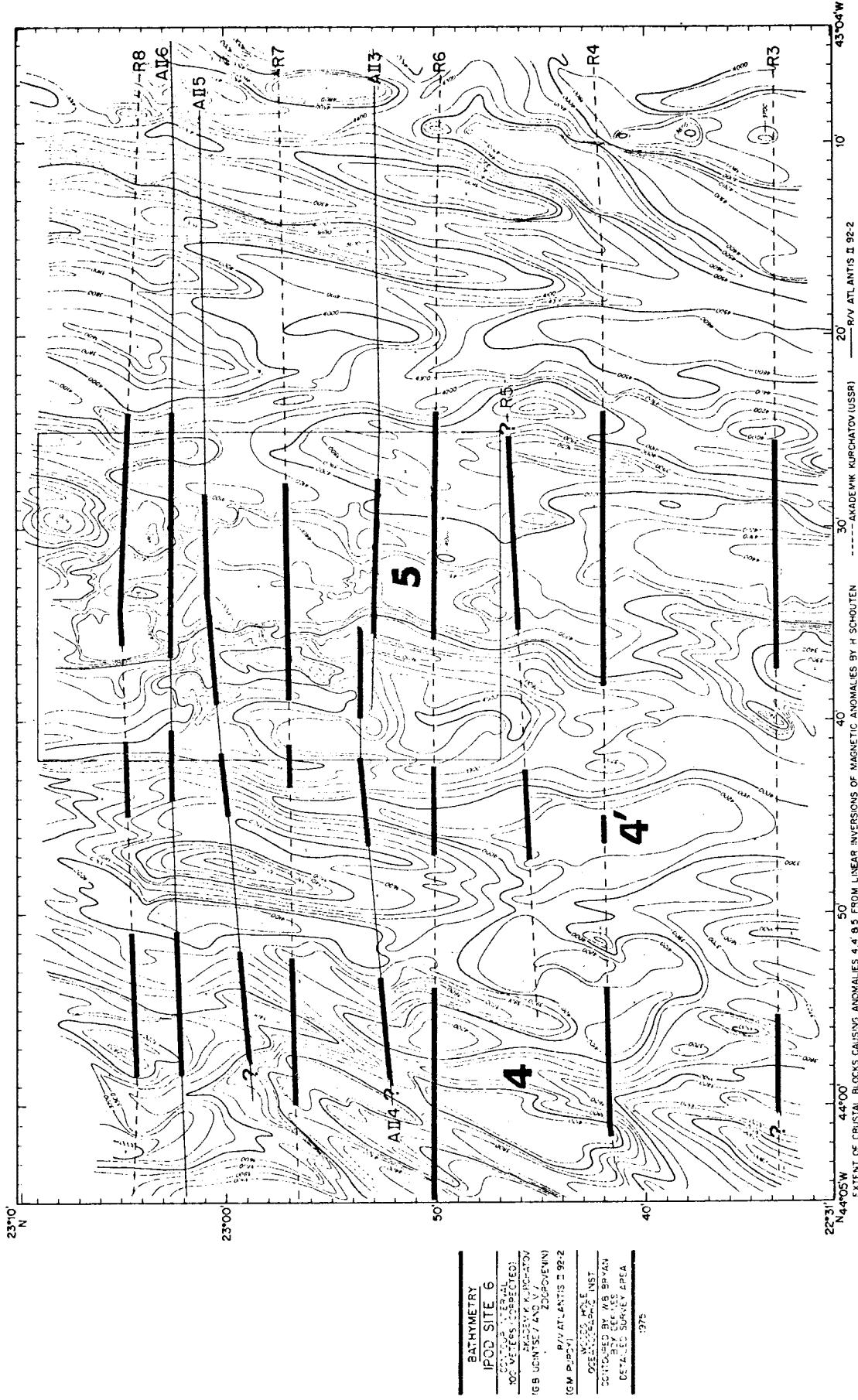


Figure 3. Survey Area AT-6 with superposed magnetic anomaly bands along survey ship tracks. Site 396 is shown.

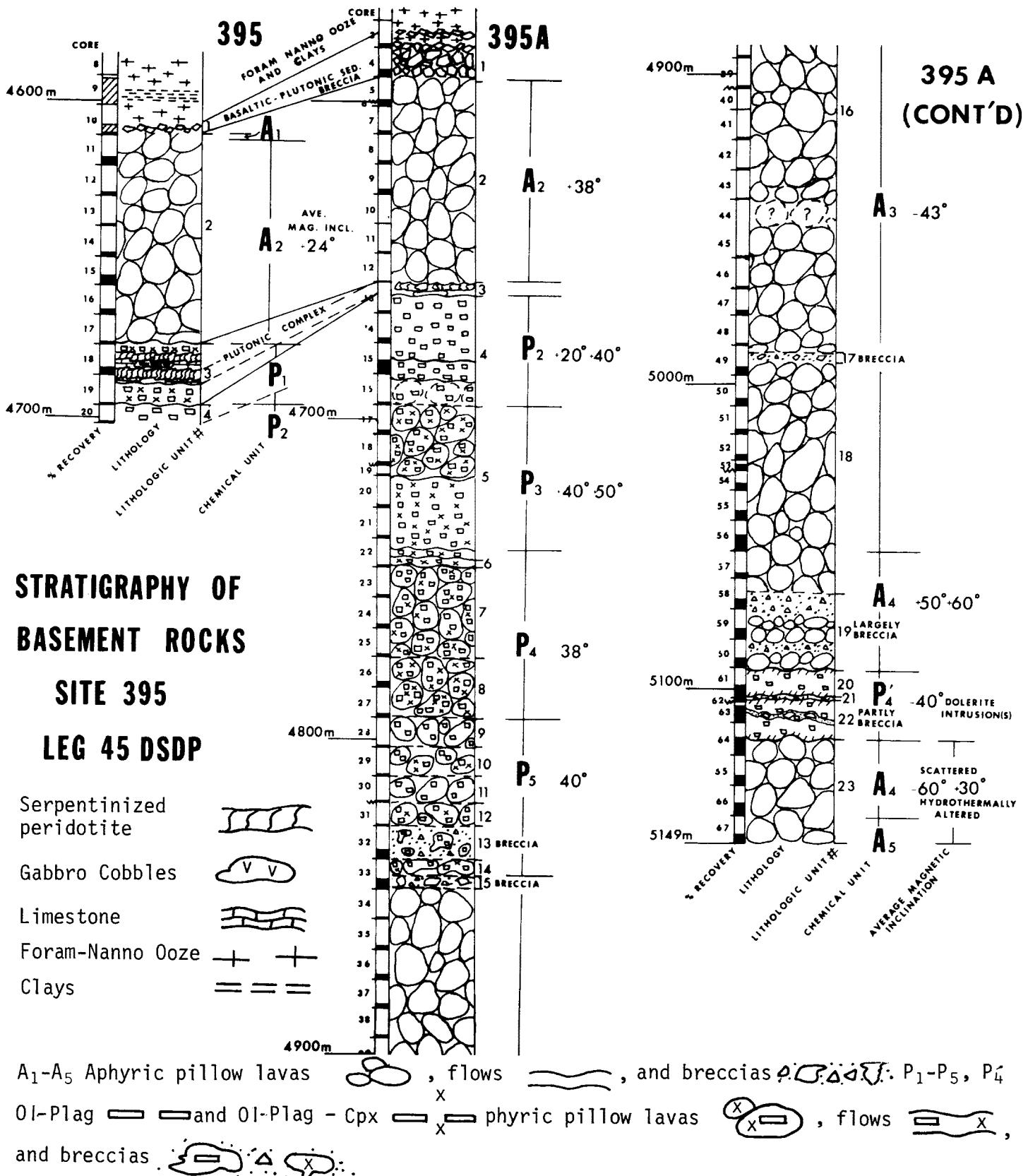


Figure 4. Lithologic columns for Holes 395 and 395A showing correlation of units, amounts recovered, and mean or range of magnetic inclinations in each unit.

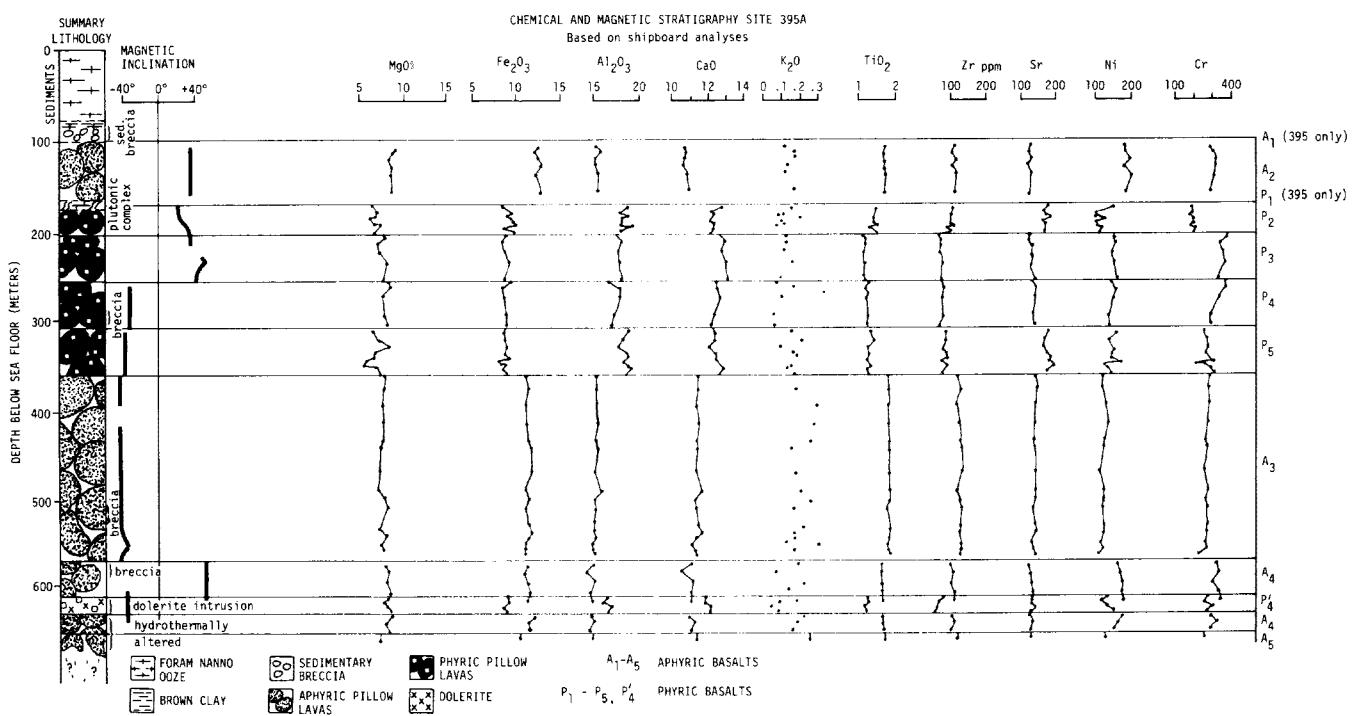


Figure 5. Chemical and magnetic stratigraphy Site 395 and 395A.

EXPLANATORY NOTES

Introduction

Persons wishing to obtain samples are directed to the DSDP-NSF sample distribution policy (reproduced herein, p.49). Sample requests must be submitted on standard DSDP request forms which may be obtained from:

The Curator
Deep Sea Drilling Project A-031
University of California, San Diego
La Jolla, California 92093

The following material is intended as an aid in understanding:

- (1) the terminology, labeling, and numbering conventions used by the Deep Sea Drilling Project;
- (2) the sedimentary, igneous, and metamorphic classification used on Leg 45; and
- (3) the presentation of the lithologic and paleontologic data on the core forms which make up much of this publication.

Numbering of Sites, Holes, Cores, Samples

Drill site numbers run consecutively from the first site drilled by *Glomar Challenger* in 1968; the site number is thus unique. Sites are drilled in site survey areas, designated by a mnemonic letter code and a number. On Leg 45, Atlantic Transect Areas AT-5 and AT-6 were drilled. Specific targets within these areas are designated by an additional letter. Target Pond A in Area AT-5 is therefore AT-5A.

The first (or only) hole drilled at a site takes the site number. Additional holes at the same site are further distinguished by a letter

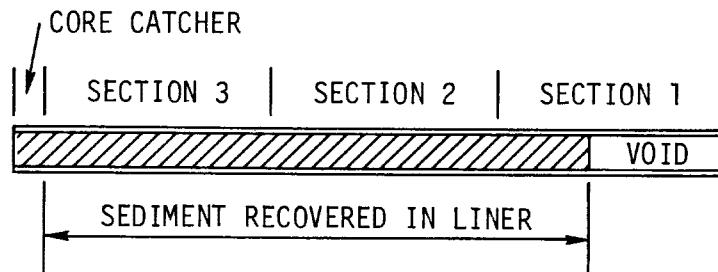
suffix. The first hole has only the site number; the second has the site number with suffix A; the third has the site number with suffix B; and so forth. It is important, for sampling purposes, to distinguish the holes drilled at a site, since recovered sediments or rocks usually do not come from equivalent positions in the stratigraphic column at different holes.

Cores are numbered sequentially from the top down. In the ideal case, they consist of 9 meters of sediment or rock in a plastic liner of 6.6 cm diameter. In addition, a short sample is obtained from the core catcher (a multi-fingered device at the bottom of the core barrel which prevents cored materials from sliding out during core-barrel recovery). This usually amounts to about 20 cm of sediment or rock. During Leg 45 the core catcher sample was split, described, and stored along with the rest of the core, if at all possible, taking care to maintain its proper vertical orientation. This sample represents the lowest stratum recovered in a particular cored interval. The core catcher sample is designated by CC (e.g., 395-4, CC is the core catcher sample of the fourth core taken at Site 395).

The cored interval is the interval in meters below the sea floor measured from the point at which coring for a particular core was started to the point at which it was terminated. This interval is generally about 9.5 meters (nominal length of a core barrel) but may be shorter if conditions dictate. Each core was measured on Leg 45. All coring was continuous (no intervals were uncored).

When a core is brought aboard the *Glomar Challenger* it is labeled and

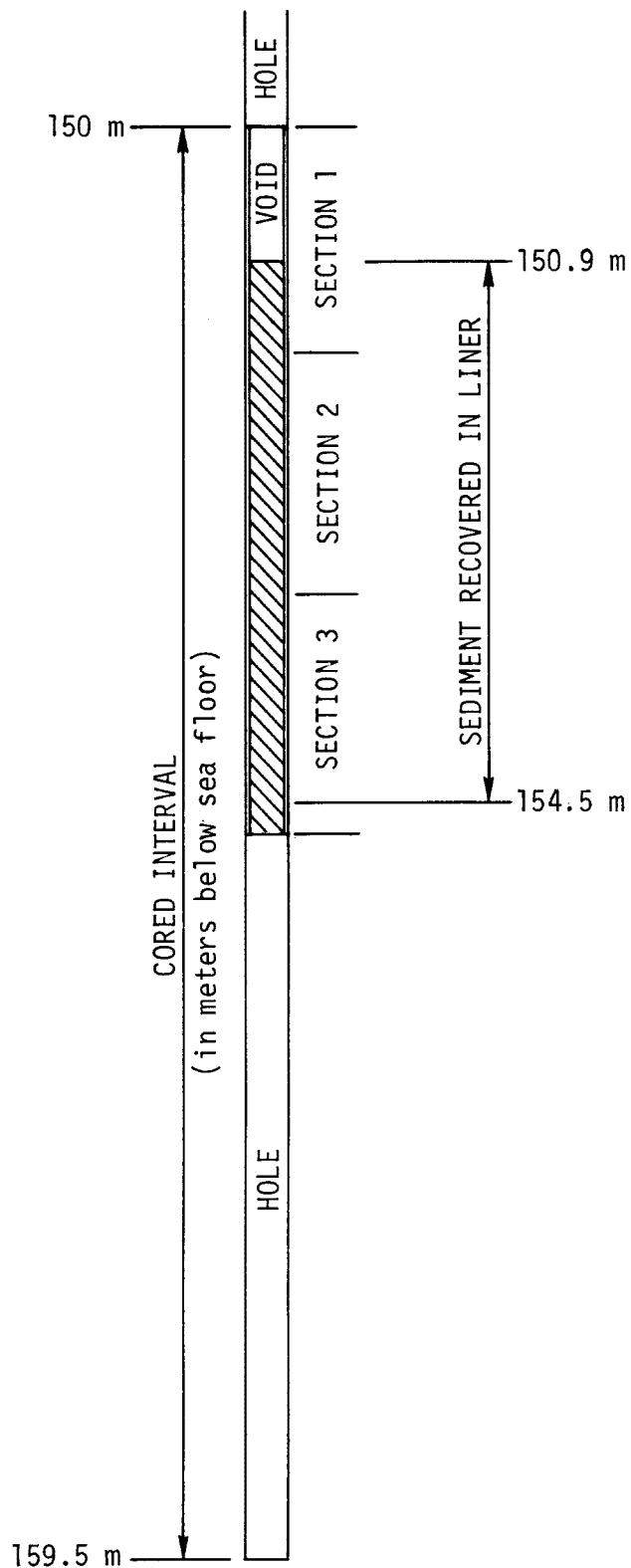
the plastic liner and core cut into 1.5-meter sections. A full, 9-meter core would thus consist of six sections, numbered from the top down, 1 to 6. (The discrepancy between the 9-meter core and 9.5-meter cored interval is discussed below.) Generally, something less than 9 meters is recovered. In this case, the sections are still numbered starting with one at the top, but the number of sections is the number of 1.5-meter intervals needed to accommodate the length of core recovered; this is illustrated below:



Thus, as shown, recovery of 3.6 meters would result in a core with 3 sections, with a void of 0.9 meters at the top of the first section. By convention, and for convenience in routine data handling at the Deep Sea Drilling Project, if a core contains a length of material less than the length of the cored interval, the recovered material is measured from the bottom of the core catcher sample, with the top of Section 1, rather than the top of the sediment, equal to the top of the cored interval. This is shown on the next page for the core in the above example. Thus, the depth below the sea floor of the top of the sediment or volcanic rock

of this hypothetical core would lie at 150.9 meters (not 150.0 m) and the bottom at 154.5 meters.

It was noted above that a discrepancy exists between the usual coring interval of 9.5 meters and the 9-meter length of core recovered. The core liners used are actually 9.28 meters in length, and the core catcher accounts for another 0.2 meters. In cases where the core liner is recovered full to the top, the core is still cut into six 1.5-meter sections, measured from the bottom of the liner, and the extra 0.28-meter section at the top is designated Section 0, or the "Zero



Section". One Leg 45 all zero sections were split and described. In the case of cores with zero sections, depth below sea floor is calculated by placing the top of Section 0 at the top of the cored interval.

In the core laboratory on the *Glomar Challenger*, after routine processing, the 1.5-meter sections of cored material and liner are split in half lengthwise. One half is designated the "archive" half, which is photographed; and the other is the "working" half, which is sampled by the shipboard scientists for further shipboard and shore-based analysis.

Samples taken from core sections are designated by the interval in centimeters from the top of the core section from which the sample was extracted; the sample size, in cc, is also given. Thus, a full sample designation would consist of the following information:

Leg (Optional)
Site (Hole, if other than first hole)
Core Number
Section Number
Interval in centimeters from top of section

Site 395A-1-3, 122-124 cm (10cc) designates a 10cc sample taken from Section 2 of Core 1 from the second hole drilled at Site 395, Hole A (mud-line core). The depth below the sea floor for this sample would then be the depth to the top of the cored interval (0 meters for a mud-line core) plus 3 meters for Sections 1 and 2, plus 122 cm (depth below the top of Section 3), or 3.2 meters. Note, however, that subsequent sample requests should refer to a specific interval within a core section (in centimeters) rather than depth in meters below the sea floor.

SEDIMENT DESCRIPTION CONVENTIONS

Core Disturbance

Sediment descriptions are given on sediment core description sheets (an example is Figure 6) conventions and symbols for descriptions are discussed below.

Unconsolidated sediments are often quite disturbed by the rotary drilling/coring technique, and there is a complete gradation of disturbance style with increasing sediment induration. An assessment of degree and style of drilling deformation is made on board ship for all cored material, and shown graphically on the core description sheets. The following symbols are used:

---- Slightly deformed; bedding contacts slight bent.

- - - Moderately deformed; bedding contacts have undergone extreme bowing.

----- Highly deformed; bedding completely disturbed, often showing symmetrical diapir-like structures.

○○○ Soupy, or drilling breccia; water-saturated intervals that have lost all aspects of original bedding and sediment cohesiveness.

Consolidated sediments and rocks seldom show much internal deformation, but are usually broken by drilling into cylindrical pieces of varying length. There is frequently no indication if adjacent pieces in the core liner are actually contiguous or if intervening sediment has been lost during drilling. The symbol (-o-o-o-) was used for cylindrical pieces of core separated by intervals of drilling breccia or injected (remolded) softer sediment.

Smear Slides

The lithologic classification of sediments is based on visual estimates of texture and composition in smear slides made on board ship. These estimates are of areal abundances on the slide and may differ somewhat from the more accurate laboratory analyses of grain size, carbonate content, and mineralogy. Experience has shown that distinctive minor components can be accurately estimated (± 1 or 2%), but that an accuracy of ± 10 per cent for major constituents is rarely attained. Carbonate content is especially difficult to estimate in smear slides, as is the amount of clay present. Smear slide analyses at selected levels as well as averaged analyses for intervals of uniform lithology are given on the core description sheets. For carbonate content, reference should be made to shipboard carbonate bomb analyses and shore-based analyses (also shown).

Carbonate and Grain Size Data

During Leg 45, use was made of the carbonate bomb device as an aid in sediment classification. This device is basically a cylindrical vessel with pressure gauge in which a sediment sample of known weight is reacted with acid. The pressure of CO_2 generated is measured and converted to per cent carbonate. Accuracy to within ± 5 per cent total carbonate has been quoted for the device. Shipboard carbonate bomb data are listed in a separate column on the core description sheet.

Samples were taken for DSDP shore-based carbon-carbonate analysis using the Leco 70-second Analyser. These are also listed on the core

description sheet in the sequence total carbon, organic carbon and CaCO_3 .

Grain size data are listed in the sequence sand, silt, and clay.

Sediment Induration

The determination of induration is highly subjective, but field geologists have successfully made similar distinctions for many years. The criteria of Moberly and Heath (1971) are used for calcareous deposits; subjective estimate or behavior in core cutting is used for others.

a). Calcareous sediments

Soft: Oozes have little strength and are readily deformed under the finer or the broad blade of a spatula.

Firm: Chalks are partly indurated oozes; they are friable limestones that are readily deformed under the fingernail or the edge of a spatula blade.

Hard: Cemented rocks are termed limestones.

b). The following criteria are used for other sediments:

If the material is soft enough that the core can be split with a wire cutter, the sediment name only is used (e.g. silty clay; sand).

If the core must be cut on the band saw or diamond saw, the suffix 'stone' is used (e.g. silty claystone; sandstone).

Sediment Classification

The sediment classification scheme used on Leg 45 is basically that devised by the JOIDES Panel on Sedimentary Petrology and Physical Properties and adopted for use by the JOIDES Planning Committee in

March, 1974, with minor modifications. The classification is outlined below. Only those portions pertinent to Leg 45 are listed. A compilation of symbols is given in Figure 7.

I. General rules for class limits and order of components in a sediment name.

- A. Sediment assumes the names of those components present only in quantities greater than 15 per cent.
- B. Where more than one component is present, the component in greatest abundance is listed farthest to the right, and other components are listed progressively to the left in order of decreasing abundance.
- C. The class limits are based on percentage intervals given below for various sediment types.

II. Pelagic Biogenic Calcareous Sediments

>30% CaCO₃
<30% terrigenous components
<30% siliceous microfossils

Principal components are nannofossils and foraminifera; qualifiers are used as follows:

<u>Foram %</u>	<u>Name</u>
<10	nannofossil ooze (chalk, limestone)
10-25	foraminiferal-nannofossil ooze
25-50	nannofossil-foraminiferal ooze
>50	foraminiferal ooze

Calcareous sediment containing 10-30 per cent siliceous fossils carry the qualifier radiolarian, diatomaceous or siliceous depending upon the identification.

III. Transitional Biogenic Calcareous Sediments

>30% CaCO₃
>30% terrigenous components or pelagic clay
<30% siliceous microfossils

If CaCO₃ 30-60%: marly is used as a qualifier:

soft: marly calcareous (or nannofossil, etc.) ooze
firm: marly chalk (or marly nannofossil chalk, etc.)
hard: marly limestone (or marly nannofossil limestone, etc.)

If $\text{CaCO}_3 > 60\%$:

soft: calcareous (or nannofossil, etc.) ooze
firm: chalk (or nannofossil chalk, etc.)
hard: limestone (or nannofossil limestone, etc.)

NOTE: Sediments containing 10-30 per cent CaCO_3 fall in other classes where they are denoted with the adjective "calcareous", "nannofossil", etc.

IV. Special Rock Types

- A. At Sites 395 and 396, brown to yellow-brown clays were recovered near volcanic basement. These appear similar to iron and manganese-rich clays near basement at other DSDP sites which are not normal pelagic clays. Rather they may relate to basement hydrothermal activity. These clays are therefore modified by color only. The term "pelagic" is avoided.

Biostratigraphy

At the time of this compilation biostratigraphic studies of Leg 45 sediments are still in progress. Age boundaries are shown based on foraminifera studies by A. Kaneps (DSDP) and nannofossil studies by D. Bukry (USGS). At their request, detail of zonations is not included, but will appear in the Initial Report.

BASEMENT DESCRIPTION CONVENTIONS

LEG 45

Core Forms

Initial core description forms for igneous and metamorphic rocks are not the same as those used for sediments. The sediment barrel sheets are substantially those published in previous Initial Reports. Igneous rock representation on barrel sheets is too compressed to provide adequate information for potential sampling. Consequently Visual Core Description forms, modified from those used on board ship, were used for more complete graphic representation. All shipboard data per 1.5-meter section of core are listed on the modified forms as well as summary hand-specimen and thin section descriptions.

To provide a uniform basis for future descriptions, a series of symbols and a number of format conventions for igneous and metamorphic rocks have been adopted. The symbols are presented on Figure 8. It is expected that this list will increase and be amended on future legs.

All basalts on Leg 45 were split using a rock saw with a diamond blade into archive and working halves. The latter was described and sampled on board ship. On a typical basalt description form (Figure 9), the left column is a visual representation of the working half using the symbols of Figure 8. Two closely spaced horizontal lines in this column indicate the location of styrofoam spacers taped between basalt pieces inside the liner. Each piece is numbered sequentially from the top of each section, beginning with the number 1. Pieces are labeled on the rounded, not the sawed

surface. Pieces which were possible to fit together before splitting are given the same number, but are separately consecutively lettered, as 1A, 1B, 2C, etc. Spacers were placed between pieces with different numbers, but not between those with different letters and the same number. In general, addition of spacers represents a drilling gap (no recovery). However, in cores where recovery was high, it was impractical to use spacers. In these cases, drilling gaps are indicated only by a change in numbers. Basalt rocks in the deeper cores of Hole 395A are so highly fractured that no attempt was made to move them from the liners for numbering. They were split in the liner with a special diamond rock saw fitted to a movable track. Each section was allowed to dry, then intervals and core and section number were marked on the sawed surfaces of pieces at least every 10 cm, and at closer intervals for small pieces. All pieces greater in longest diameter than about 1 cm were marked. All pieces, whether labeled on the rounded drilled surfaces, or, in the case of shattered rock, on sawed surfaces, have orientation arrows pointing to the top of the section, both on archive and working halves, provided the original unsplit piece was cylindrical in the liner and of greater length than the diameter of the liner. Special procedures were adopted to ensure that orientation was preserved through every step of the sawing and labeling process. All pieces suitable for sampling requiring knowledge of top from bottom are indicated by upward-pointing arrows to the left of the piece numbers on the description forms. Since the pieces were rotated during drilling it is not possible to sample for declination studies.

Samples were taken for various measurements on board ship. The type of

measurement and approximate location are indicated in the column headed "Sample" using the following notation:

X = X-ray fluorescence analysis
M = magnetics measurements
S = sonic velocity measurements
T = thin section
D = density measurements
P = porosity measurements

Igneous and Metamorphic Rock Classification

Basalts, gabbros and serpentinites were recovered on Leg 45. Classification was based mainly on mineralogy of minerals visible in hand specimens, and secondarily on texture. Thin section work in general added no new information to the hand specimen classification.

Basalts were termed aphyric, sparsely phryic, moderately phryic, or phryic depending on the proportion of phenocrysts visible with the binocular microscope (~12x). Aphyric basalts were so called if phenocrysts were absent. In a practical vein, this meant that if one piece of basalt was found with a phenocryst or two in a section with all other pieces lacking phenocrysts, and no other criteria such as grain size or texture distinguished this basalt from the others, then it too was described as aphyric. A note of the rare phenocrysts, however, was included in the general description. This was done in order to restrict the number of lithologic units to those with clearly distinctive and persistent visual differences.

Sparsely phryic basalts are those with 1-2 per cent phenocrysts present in almost every piece of a given core or section. Clearly contiguous pieces without phenocrysts were included in this category, again with the lack of phenocrysts noted in the general description.

Moderately phryic basalts contain 2-10 per cent phenocrysts. Aphyric basalts within a group of moderately phryic basalts are separately termed aphyric basalts.

Phryic basalts contain more than 10 per cent phenocrysts. No separate designation is made for basalts with more than 20 per cent phenocrysts; the proportion indicated in the core forms should be sufficient to guide the reader.

The basalts are further classified by phenocryst type, preceding the terms phryic, sparsely phryic etc. A plagioclase-olivine moderately-phryic basalt contains 2-10 per cent phenocrysts, most of them plagioclase, but with some olivine.

In deference to our European and Japanese colleagues, intrusive basalts cored in Hole 395A are termed dolerite rather than diabase.

Plutonic rocks recovered on Leg 45 are also described by mineralogy, except where separate rock names based on the mineralogy are in common usage. Thus, lherzolite and harzburgite are olivine-orthopyroxene-clino-pyroxene peridotite and olivine-orthopyroxene peridotite respectively, following the classification of Jackson (1968). These rocks are 20-40 per cent serpentинized, and are therefore described as serpentинized lherzolite or harzburgite, respectively. Peridotites whose original mineralogy are substantially (\sim 70 per cent) obliterated are called serpentinites. Gabbros with metamorphic textures recovered on Leg 45 are called recrystallized gabbros, again with appropriate mineralogic modifiers, because their specific metamorphic association, e.g. hornfels versus granulite, was not possible to determine.

No petrochemical or normative classification schemes are used on the core forms. More complete data will allow this type of classification in the Initial Report. The reader is referred to the Site Summaries and the interpretive section on chemistry for information pertinent to this aspect of Leg 45 igneous rock classification.

References

- Jackson, E. D., 1968. The characteristics of the lower crust and upper mantle beneath the Hawaiian Islands: Int. Geol. Cong. 23rd, Prague 1968, Proc. v. 1, p. 135-150.
- Moberly, R., Jr., and Heath, G. R., 1971. Carbonate sedimentary rocks from the western Pacific: Leg 7, Deep Sea Drilling Project, in Winterer, E. L., Riedel, W. R., et al., 1971, Initial Reports of the Deep Sea Drilling Project, v. 7, Washington (U. S. Government Printing Office), p. 977-985.

sample-distribution policy

Distribution of Deep Sea Drilling samples will be undertaken in order to (1) provide supplementary data for inclusion in the appropriate Initial Report to support *Glomar Challenger* scientists in achieving the scientific objectives of their particular cruise, (2) provide individual investigators with material to conduct detailed studies beyond the scope of the Initial Reports, and (3) provide reference material for up to five reference centers where paleontologic materials are or will be available for reference/comparison purposes.

The National Science Foundation has established a Sample Distribution Panel to advise on distribution of core material. This panel is chosen in accordance with usual Foundation practices, in a manner that will assure advice in the various disciplines leading to a complete and adequate study of the core and related materials. Funding for the proposed research is handled separately by the investigator, not through the Deep Sea Drilling Project.

1. Distribution of Samples for Contributions to Initial Reports

Any investigator who wishes to contribute a paper to a given volume of the Initial Reports may write to the Chief Scientist, Deep Sea Drilling Project, Scripps Institution of Oceanography, University of California, San Diego, La Jolla, California 92093, requesting samples from a forthcoming cruise. The request should include the nature of the study, and type, size, number of samples, particular sampling techniques or equipment that might be required, and an estimate of the time required to complete the study. The requests will be reviewed by shipboard scientists, and, if they are deemed suitable and pertinent to the objectives of the leg, and shipboard workload permits, the requested samples will be taken during the cruise (provided, of course, material suitable to the investigation is obtained during the drilling). In case of multiple requests to perform the same investigation, selection of investigator will be made by the shipboard scientific party. Proposals should be of a scope appropriate to complete the sampling and study in time for publication in the Initial Reports. Studies deemed acceptable will be referred to the DSDP Chief Scientist who will authorize distribution of the samples. The Deep Sea Drilling Project and cruise Chief Scientists will strive to ensure that there is a reasonable degree of continuity in the investigations among the various cruises, that the studies are pertinent to goals of the cruise, and that they are consistent with the publication policy for the Initial Reports. Subject to these same provisions, the shipboard scientific party may elect to have special studies of selected core samples of its recently completed cruise made by other investigators.

Investigations not completed in time for inclusion in the Initial Report may not be published in other journals until publication of the Initial Report for which it was intended though it is expected that they will normally be published as an appendix in a later Initial Report volume.

2. Distribution of Samples for Publication Other Than in Initial Reports

(A) Researchers intending to request samples for studies beyond the scope of the Initial Reports should first obtain a sample request form from the Curator, Deep Sea Drilling Project, Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093. Requests should specify the quantities and intervals of the core required, a statement of the proposed research, the possibility of returning residue to the Curator, the estimated time required to complete and publish the results, and the availability or need of funding and availability of equipment and space foreseen for the research.

In order to ensure that requests for highly desirable but limited samples can all be considered, approval of requests and distribution of samples will not be made prior to 12 months after date of completion of the cruise that collected the cores. Prior to the publication of an Initial Report, requests for samples from a cruise can be based on the Initial Core Descriptions (ICDs). Copies of the ICDs will be kept on open file at Scripps Institution of Oceanography and other designated institutions. The only exceptions to this policy will be for specific instances involving requests for sands with ephemeral properties.

Requests for samples from researchers in industrial laboratories will be handled in the same manner as those from academic organizations, and there will be the same obligation to publish results promptly. Requests from foreign scientists or organizations will also be considered and handled in a like manner.

(B) The Deep Sea Drilling Project's Curator has the responsibility for distributing samples, controlling quality of samples, and preserving core material. He also has the responsibility for maintaining a record of requests for samples that have been processed and filed indicating the investigator and subjects to be studied. This record will be available to investigators.

The distribution of samples will be made directly from the two repositories at Lamont-Doherty Geological Observatory and Scripps Institution of Oceanography by the Curator or his designated representative.

(C) (i) Samples up to 50 cc/m of core length can be automatically distributed by the Curator, Deep Sea Drilling Project, or his authorized representative to any qualified investigator who requests them. The Curator will refrain from making automatic distribution of any parts of the cores which appear to be in particularly high demand or limited supply, and any requests for these parts of the cores will be referred to the Sample Distribution Panel for review. Requests for samples from thin layers or important stratigraphic boundaries will also generally require Panel review. (ii) All requests for samples in excess of (C) (i) above will be referred to the Sample Distribution Panel. (iii) If, in the opinion of scientific investigators, certain properties they wish to study may deteriorate prior to the normal availability of the samples, such investigators may request that the normal waiting period not apply. All such requests must be approved by the Sample Distribution Panel.

(D) Samples will not be provided prior to assurance that funding for sample studies either exists or is not needed. However, neither formal approval of sample requests nor distribution of samples will be made until the appropriate time (Item 1). If a sample request is dependent, either wholly or in part, on proposed funding, the Curator will provide to the organization to whom the funding proposal has been submitted any information on the availability (or potential availability) of samples that it may request.

(E) Investigators receiving samples are responsible for: (i) Promptly publishing significant results; (ii) Acknowledging, in publications, that samples were supplied through the assistance of the National Science Foundation; (iii) Submitting five (5) copies of all reprints of published results to the Curator, Deep Sea Drilling Project, Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093; (iv) Notifying the Curator of any work done on the samples that is additional to that stated in the original request for samples; (v) Returning, in good condition, the remainders of samples after termination of research, if requested by the Curator.

(F) Cores will be made available at repositories for investigators to examine and specify exact samples in such instances as this may be necessary for the scientific purposes of the sampling, subject to the limitations of (C) (i) (ii) (iii) and (E) above, and with the specific permission of the Curator or his delegate.

(G) Cores of igneous and metamorphic rocks will also remain at the repositories where they will be available for observation and description and where selected samples may be taken for thin-section preparation and other work.

(H) The Deep Sea Drilling Project routinely processes by computer most of the quantitative data presented in the Initial Reports. Space limitations in the Initial Reports preclude the detailed presentation of all such data. However, copies of the computer readout are available for those who wish the data for further analysis or as an aid in selecting samples.

3. Reference Centers

As a separate and special category, samples may be distributed for the purpose of establishing up to five reference centers where paleontologic materials are available for reference/comparison purposes. Such reference centers shall be approved by the National Science Foundation before sample distribution. Samples will be distributed to the institution managing the reference center. Therefore assurance of adequate long-term curatorial management is a requisite of the establishment of any such reference center.

4. Other Records

Magnetics, seismic reflection, and bathymetric data collected underway by *Glomar Challenger* will also be available for distribution 12 months after completion of the cruise.

Requests for these data may be made to Director, Science Services, Deep Sea Drilling Project, Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California 92093.

A charge may be made to recover the expenses of responding to individual requests. Estimated charges can be furnished before the request is processed, if required.

This policy has the approval of the National Science Foundation and is designed to help ensure that the greatest possible scientific benefit is gained from the materials obtained and that samples will be made widely available to interested geologists.

Site	Hole	Core	Cored Interval: (meters below the sea floor)	
AGE	ZONE	FOSSIL CHARACTER	LITHOLOGY	LITHOLOGIC DESCRIPTION
		FORAMS NANNOS	SECTION METERS	Munsell Color Designation
	Foraminifer Zone Nannofossil Zone	ABUNDANCE: A = Abundant, C = Common, F = Frequent, R = Rare, -- = absent PRESERVATION: G = Good, M = Moderate, P = Poor	0 0.5 1 1.0 2 3 4 5 6 Core Catcher	See key to graphic lithology symbols (Figure 7).
				<p>Description of MAJOR LITHOLOGY and minor lithologies.</p> <p>Carbonate bomb</p> <p><u>Carbon Carbonate</u></p> <p>Total Carbon, Organic Carbon, % CaCO_3</p> <p><u>Grain Size</u> Sand, Silt, Clay</p> <p>In sample column:</p> <ul style="list-style-type: none"> * = smear location CC = carbon carbonate sample location GZ = grain size sample location

Figure 6. Sample Core Form.

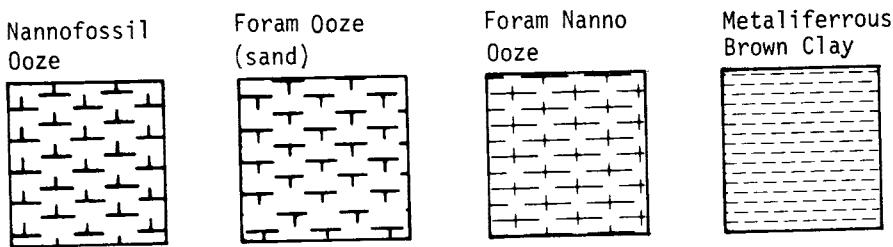


Figure 7. Symbols for Sediments

TEXTURE Used in graphic representation column	WEATHERING: ALTERATION Used in alteration column
Aphyric basalt	Very fresh
Variolitic basalt	
Porphyritic basalt Olivine and plagioclase phenocrysts	Moderately altered
Olivine plagioclase and clinopyroxene phenocrysts	
Vein with altered zone next to it	Badly altered
Gabbro	Almost completely altered
Dolerite (Diabase)	
Serpentinite (shear orientation approx. as in core; Augen shown toward bottom)	
Fractures	

Figure 8. List of Symbols, Igneous Rocks, Leg 45

LEG	SITE	L E	O H	CORE	SFC
45	395			15	2

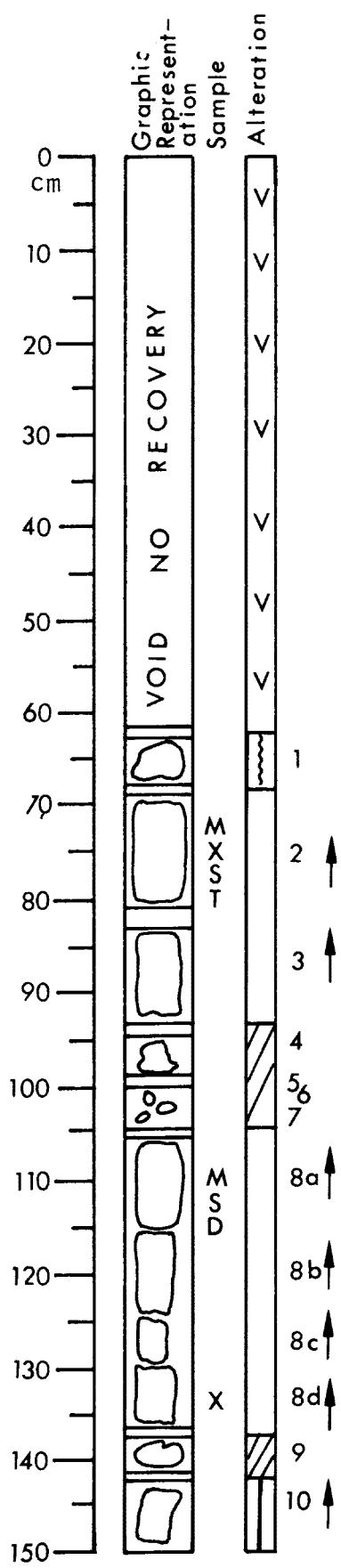


Figure 9. Visual Core Description

SITE SUMMARY SHEET

LEG 45

Site 395 Hole 395

Date Occupied 6 December 1975 (0000)
Date Departed 9 December 1975 (0600)
Time on Hole 3 days, 6 hrs.
Position: Latitude 22°45.35'N
Longitude 46°04.90'W
Water Depth (sea level) 4484 corrected meters, echo sounding
Water Depth (rig floor) 4494 corrected meters, echo sounding
Bottom Felt at (rig floor) 4528 meters, drill pipe
Penetration 184.65 meters
Number of Holes 1
Number of Cores 20
Total Length of Cored Section 184.65 meters
Total Core Recovered 88.36 meters
Percentage Core Recovery 47.9%

20

Oldest Sediment Cored

Depth Subbottom 93.0 meters
Nature calcareous brown clays
Age upper Miocene
Measured Velocity 1.6 km/sec

Basement

Depth Subbottom 9165 meters sub-basement
Nature basalt, serpentinized peridotite and gabbro
Velocity Range 4.30 km/sec for serpentinized peridotites to
5.30-6.10 km/sec for basalts and one gabbro

Principal Stratigraphic Units - Units are based on hand specimen mineral identification and chemistry. Where boundaries are within a core the depth to the boundary is determined by the proportion of the rock type in the core to the total recovery times the total penetration of the core (9.3 to 9.6 m).

Site 395 Hole 395 (continued)

<u>Cores</u>	<u>Depth Below Sea Surface (m)</u>	<u>Description</u>
1 to 9	4517.7-4601.4	Foraminifer-nannofossil ooze with minor basalt gabbro and serpentinite sand, gravel, or cobbles. Metaliferous calcareous clays in Core 9.
10	4601.4-4610.9	Basalt-serpentinized peridotite rubble zone.
11 to 17	4610.9-4674.2	Aphyric basalt Units A ₁ and A ₂ (A ₁ in Core 11 only).
17 to 19	4674.2-4688.0	Gabbro-peridotite complex.
19 to 20	4688.0-4702.3	Plagioclase-olivine-clinopyroxene-phyric basalt Unit P ₁ and plagioclase-olivine-phyric basalt Unit P ₂ .

Core 8		Cored Interval: 4382.3-4591.9 m (64.05-74.19 m subbottom)	
Hole	Site 395	LITHO. SAMPLE	DEFORMATION
METERS	SECTION	LITHOLOGY	FOLIATION
AGE	ZONE	FOLIATION	CHARACTER
FORAMS	NANOS	FORAMS	VOID
0			V
0.5			
1		Serpentinite chips	*
1.0	10YR 6/6	10YR 6/6	
2		ss	*
2	10YR 6/6	Foraminifera Nanofossils Fe-oxides Clay Volc. glass Heavy Minerals Opaques (Mn oxides?)	Tr-5% 95-99% Tr Tr Tr Tr Tr
3	10YR 6/6	Texture (range of ss)	
3	10YR 6/6	Sand 0, Silt 0-50%, Clay 0-50%	
		Note: Discosasters abundant (silt sized)	
		Carbonate Bomb (% CaCO ₃)	
		2-88-90 6-117-119	83% 73%
		Carbon Carbonate ^a	
		2-100 10.3 0.0 6-110 8.6 0.0 6-126 8.9 0.0	85 71 74
		Grain Size	
		4-50 0.9 16.2	82.9
5	10YR 6/6	VOID	V
6	10YR 6/6	VOID	V
		CORE CATCHER	*
		RG AG	

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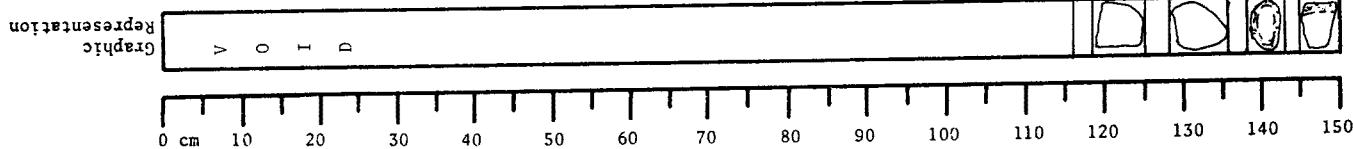
VISUAL CORE DESCRIPTION			ALTERATION		
LEG	SITE	CORE	LEG	SITE	CORE
4	5	3	V	V	V

This is a special section for basalts recovered in Section 10-2. The last 10 cm (140-150 cm) were removed by the Chemist. Two basalt cobbles were found within those sediments. (#'s 3 and 4 here). Two other basalt cobbles (#'s 1 and 2) were in highly deformed foram-nanofossil ooze. These four pieces of basalt represent initial contact with basaltic basement at Site 395. In order to store them with the rest of the igneous rocks of Site 395, all four pieces have been placed in this special section.

Serpentinite cobbles were recovered in the core catcher of this core, below the basalt cobbles. Either there is a serpentinite rubble zone (talus?) above basalt, or the serpentinite cobbles fell down the hole from above (note presence of serpentinite cobbles in previous cores). In either case, neither stratigraphy nor orientation has been preserved. The basalt-sediment contact was not recovered. Red clays in Core 9 were not in Core 10.

Macroscopic Description

Fine grained, aphyric, homogeneous basalt. Vesicles are less than 1%. Alteration is moderate in pieces 2-4. Brownish alteration rinds are present on those pieces. Vesicles and cracks are usually filled with green or very dark green clays, possibly celadonite.



45-395-10 cc

The core catcher of Core 10 contained several mafic and ultramafic cobbles for which thin sections and analyses were obtained. They were not photographed, however, and are stored in a freezer box.

#1 Serpentinized peridotite, 80% serpentinized, with about 20% relict orthopyroxene. Serpentinite includes about 10% magnetite, in "veins", and traces of chlorite.

#2 Feldspathic gabbro with cumulate texture. Rounded aggregates of plagioclase showing cumulate texture. Interstitial and also rounded areas of alteration products including principally chlorite and serpentine. Pyroxene is partially serpentinized. Plagioclase is about 80% of the rock (An₈₀ and 1-2 mm diam.)

#3 Serpentinized peridotite, not as serpentinized as #1 with some clinopyroxene in addition to orthopyroxene (has higher CaO and Al₂O₃ than #1, see analyses below).

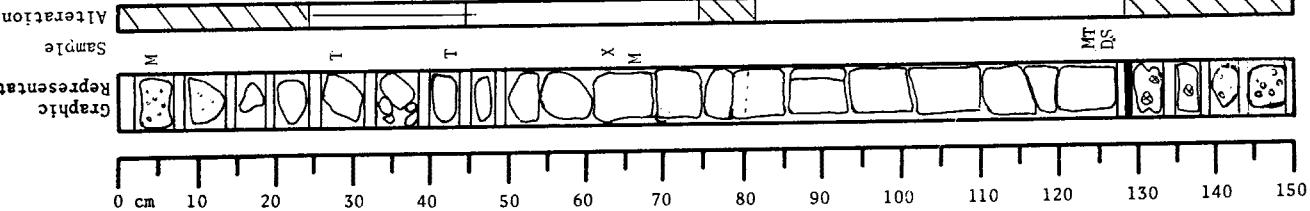
#4 Serpentinized peridotite, estimated original composition 55% opx, 40% ol, and 5% cpx. Ol is completely serpentinized, opx partially serpentinized. Magnetite is abundant (breakdown product of olivine, 5%). There are traces of sericitic (?), chlorite, and chrome spinel.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂	Ni	Cr	Sr	Zr
#1	43.56	1.26	9.95	43.73	0.03	0.02	0.03	2158	2104	6	3
#2	45.67	24.24	3.81	13.87	12.61	0.08	0.04	554	318	99	8
#3	44.77	6.27	10.66	35.31	1.85	0.02	0.09	1128	962	4	4
	IL										
	#1	13.79									
	#2	4.21									
	#3	11.56									

LEG	SITE	H O	L	CORE	SFC
4	5	3	9	5	11
4	5	3	9	5	11

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- BASALTMacroscopic Description

Generally fine-grained aphyric basalt, dark gray in color, variously moderately altered to gray brown. Alteration is most prominent in vesicular zones (pieces 1 and 14) and in spectacular variolitic zones (especially pieces 3, 9, and 11), where the variolites appear as dark gray circular patches set in a brownish altered matrix. Vesicles in 1 and 14 are sparse, and less than 1 mm in diameter. Vesicles are not present in the variolitic pieces. Throughout the section, plagioclase microphenocrysts are rare, and olivine very rare. Platy quench crystals of plagioclase are present in 2 and in the brownish matrix of the variolitic pieces. Piece 11 contains the freshest, and most clearly glassy zone of the section. A bit of glass is on one edge of 13. Cooling unit boundaries occur between 1 and 2, 11 and 12, and possibly 12 and 13.



LEG	SITE	H O	L	CORE	SEC
4	5	3	9	5	11
4	5	3	9	5	11

MAJOR ROCK TYPE -- BASALTMacroscopic Description

Fine-grained, generally aphyric, dark gray in color, locally altered to gray brown. Alteration is most prominent in vesicular pieces (1, 2, 15, and 16) and in variolitic pieces (13 and 14). Vesicles in 1, 15, and 16 are less than 1 mm in diameter, and about 1% of 1 and 5% of 15 and 16. Variolites in 13 and 14 are less well developed than those in section 11-1, but exhibit the typical relationship to vesicular basalts found in pillow lavas (variolites near quench glassy margins, vesicles further into the pillow). For this reason, a cooling unit boundary is shown above 13. Alteration in 6 and 7 highlights olivine microphenocrysts and interstitial glass by giving them a brown or reddish brown cast. Pieces 12a and 12L are almost certainly part of a single flow as they all appear uniformly moderately crystallized and fit together precisely. Platy quench crystals of plagioclase are prominent in 5. Plagioclase and olivine microphenocrysts occur in 6 and 7 (olivine highlighted by alteration).

Thin Section Descriptions

12d† 27-32 Piece 5: Basalt, coarse grained with well developed quench sheaths of plagioclase enclosing augite or glass, up to 3 mm. Plag. = 15%; cpx = 20%; Glass = 15%, now almost all as orange-yellow smectites. 40-43 Piece 9: Basalt, fine-grained, aphyric, sub-variolitic, with well developed, but small plagioclase quench crystals, very long and slender, sometimes with splay ends. Abundant plagioclase microlites in glass, partly altered to clays, locally yellow in color. Plag. = 50%; (An70-75); cpx = 10%; ol (microphenocrysts) = Tr; Glass = 30%; opaques = 10%.

120-126 Piece 12L: Fairly well crystallized basalt with subhedral to anhedral plagioclase (60%), clinopyroxene (40%) and olivine (Tr) with lesser magnetite (0.5%) and interstitial glass (Tr) altered to brown clays. Rare vesicles filled with clays. Plag is An70-75.

12k† SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂ Ni Cr Sr Zr

105-107 48.95 15.93 12.83 6.79 11.01 0.22 1.70 161 352 127 121

12L† 62-64 49.35 14.88 11.95 8.47 10.49 0.09 1.61 173 315 120 112

Inc. NRM MDF V_{eff} D P

15 3.5 +30° .455 350

14 62.64 +29° 3.94 75

12 120-122 +29° 3.37 <50 6.06 6.11 2.94-0.025

15

16†

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	1
5	3	9	5	1	2

VISUAL CORE DESCRIPTION

This section is entirely cuttings consisting of chips of basalt glass, lithic basalt, serpentinite, and foraminifera. Basalt glass and lithic basalt are 95% of the cuttings. Glass is so abundant that it is probable that cuttings represent thin, glassy flows too brittle to be cored.

Note: cuttings from 0-104 cm are similar to those in 12-1.

MAJOR ROCK TYPE -- BASALTMacroscopic Description

Slightly vesicular uniform aphyric fine-grained gray basalt variably altered to brownish-gray colors. Vesicles are 5-1 mm in diameter, and highlighted by alteration fillings of celadonite and calcite. Some vesicles in weathered parts of 2 have brown rims and white-gray cores. Feltly plagioclase laths are evident throughout, but no plagioclase microphenocrysts are present.

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	1
5	3	9	5	1	2

VISUAL CORE DESCRIPTION

C
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	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	1
5	3	9	5	1	2

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	1
5	3	9	5	1	2

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	1
5	3	9	5	1	2

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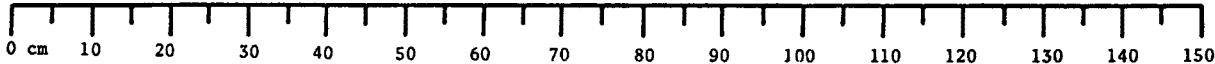
		H	O	L	CORE	S:FC
LEG	SITE	E		E		
4	5	3	9	5	1	
						2

VISUAL CORE DESCRIPTION

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest serpentinite-gabbro grains and a small fraction of foraminifera.

ALTERATION
SAMPLE

GRAPHIC
REPRESENTATION



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		H	O	L	CORE	S:FC
LEG	SITE	E		E		
4	5	3	9	5	1	
						1

VISUAL CORE DESCRIPTION

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest serpentinite-gabbro grains and a small fraction of foraminifera.

ALTERATION
SAMPLE

GRAPHIC
REPRESENTATION

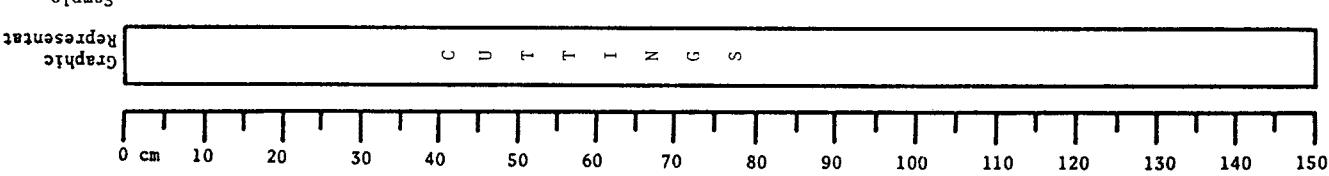


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LEG	SITE	H	O	L	CORE	SPC	SPC
4	5	3	9	5	1	5	5

VISUAL CORE DESCRIPTION

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest serpentinite-gabbro grains and a small fraction of foraminifera.

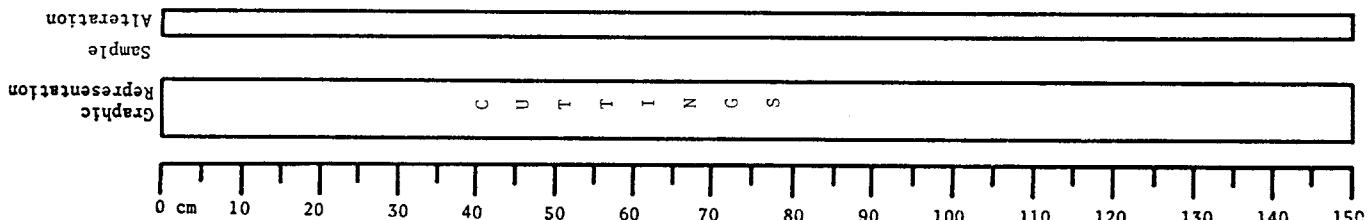


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LEG	SITE	H	O	L	CORE	SPC	SPC
4	5	3	9	5	1	5	5

VISUAL CORE DESCRIPTION

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest serpentinite-gabbro grains and a small fraction of foraminifera.

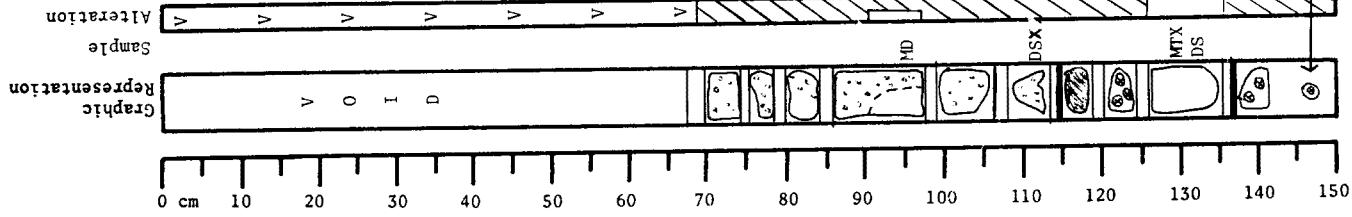


LEG	SITE	H O	L	CORE:	SEC
4	5	3	9	5	1
5	3	9	5	1	3

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- BASALTMacroscopic Description

1) Basalt - aphyric, moderately altered with tiny plagioclase laths visible using a hand lens, fairly uniformly distributed. The plagioclase is most apparent on the round side, where it appears as criss-crossed needles and laths. Groundmass intersertal glass stained dull orange by weathering. Manganese oxide (?) dendrites occur on the flat lower end. The oblique upper end is a crack surface with a thin layer of ferruginous clays produced by weathering.

2) Basalt - aphyric, slightly finer grained and more altered than 1; otherwise similar.



VISUAL CORE DESCRIPTION					
LEG	SITE	H O	L	CORE:	SEC
4	5	3	9	5	1
5	3	9	5	1	4

MAJOR ROCK TYPE -- BASALT

Macroscopic Description

At least three cooling units are represented by this core, with boundaries placed above 7 (fresh glass) and 10 (variolitic basalt). Rocks above 7 are moderately altered for the most part, with small vesicles a millimeter or less in diameter made more prominent by alteration fillings of calcite, ferruginous clays, and dark green clays (saponite?). Vesicles are less noticeable in the fresh portion of 4. Tiny needles and laths of plagioclase form radiating and cross-crossed patterns especially visible on the rounded surfaces of 1-4. Piece 9 is very fresh and very fine grained, and minor pahoehoe lining tiny fractures parallel to the exterior (upper?) surface. Variolites occur in 10 and 11, set in an oxidized brownish matrix. Piece 9 is very fresh and coarser grained than either 8 or 10.

Thin Section Description

131-132 Piece 9: Variolitic basalt, characterized by acicular quench crystals of olivine, with abundant double "swallow-tail" terminations, and tiny needles of plagioclase arrayed in typical variolitic swirls. There are 1-2% olivine microphenocrysts that crystallized before quenching. Quench crystals up to 0.5 mm.

Inc.	NRM	MDF	$V_F(\mu)$	$V_F(n)$	D	P
95-97	+23°	.853	200	2.94	.028	
130-132	+23°	.877	350	5.94	2.93	.030
112-114				4.37	4.46	2.61 .172

Inc.	NRM	MDF	$V_F(\mu)$	$V_F(n)$	D	P

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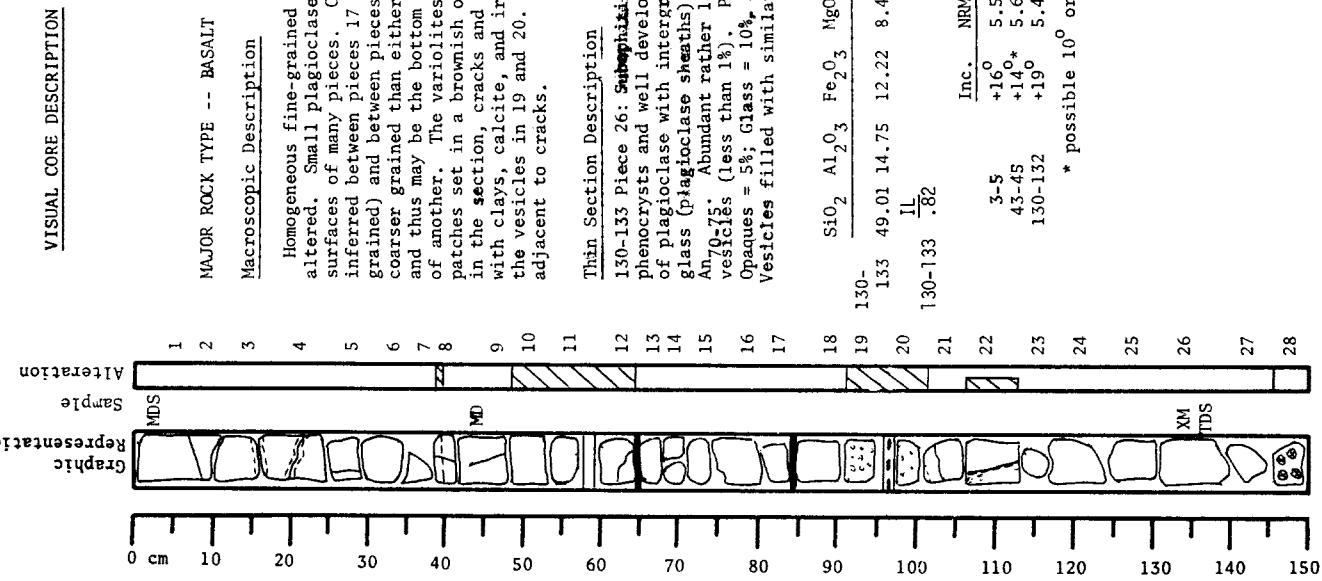
	H	O	L	CORE	SFC
LEG	SITE	E			
4	5	3	9	5	1

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- BASALTMacroscopic Description

This entire section may represent a single cooling unit. Piece 2 is volcanic glass with spherulitic fracture and plagioclase lining cracks in the glass. Piece 1 is vesicular and closely resembles 3 and 4. It may be out of sequence in the core because both it and 1 are very small and could have been interchanged during drilling. The top of the cooling unit, though, is placed between 1 and 2 because of this ambiguity. The proportion of vesicles decreases from 5% to less than 1% downward from 4 to 7. 7a-7e are a single piece fractured into several fragments. A prominent crack has fairly intensely altered basalt adjacent to it on either side for about 2 cm. through several of these fragments. Alteration is primarily oxidation to brownish gray colors. The crack is filled with calcite. The vesicles in 1, 3, 4, and 5 are usually filled with ferruginous clays and/or calcite, although some are empty.

The basalt is predominantly aphyric. An olivine phenocryst was found in 7e. Plagioclase needles and laths form radiating and criss-crossed patterns in 7, visible on the rounded side of the pieces with a hand lens.

Magnetic inclinations on 7a and 7e are about 10° apart, the largest difference between adjacent samples anywhere in cores 11-15. But since they are from the same rock, the difference cannot constitute a magnetic break. Rather, it reflects the accuracy of the magnetic data.



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LEG	SITE	H O L	CORE	SEC	LEG		SITE		H O L	CORE	SEC
					4	5	3	9	5	1	6

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- BASALT

Macroscopic Description

Very fine grained, aphyric basalt, locally fresh, but generally moderately altered. Small needles and laths of plagioclase ~~face~~ criss-crossed and radiating patterns visible on exterior surfaces of especially pieces 20-24. An 8 mm diameter rounded plagioclase phenocryst (xenocryst?) occurs in 12. Pieces 5-11 have circular gray variolites set in an oxidized brownish matrix. Cooling unit boundaries are placed between 4, an aphyric basalt, and 5, a variolitic basalt, and above 19, which has a glassy surface. Several cooling units may be represented by 5-11. There is a clay-filled crack with thin zones of altered basalt adjacent to it in 21. Pieces 3, 9, and 23 have similar magnetic inclinations.

Thin Section Description

109-111 Piece 20: Olivine basalt, moderately fine grained, showing parallel growth of acicular plagioclase and clinopyroxene and scattered radial aggregates of plagioclase sheathing clinopyroxene. The mesostasis is magnetite and clay minerals (devitrified glass?). Vesicles (0.2-1 mm less than 1%) are filled with clay minerals. Plag = 60% Cpx = 30%; O1 phenocrysts = 2-3%; Opacques = 5%; Glass and alteration products = 2-3%. Plag up to 0.5 mm.

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LEG	SITE	H O L	CORE	SEC	LEG		SITE		H O L	CORE	SEC
					4	5	3	9	5	1	6

VISUAL CORE DESCRIPTION

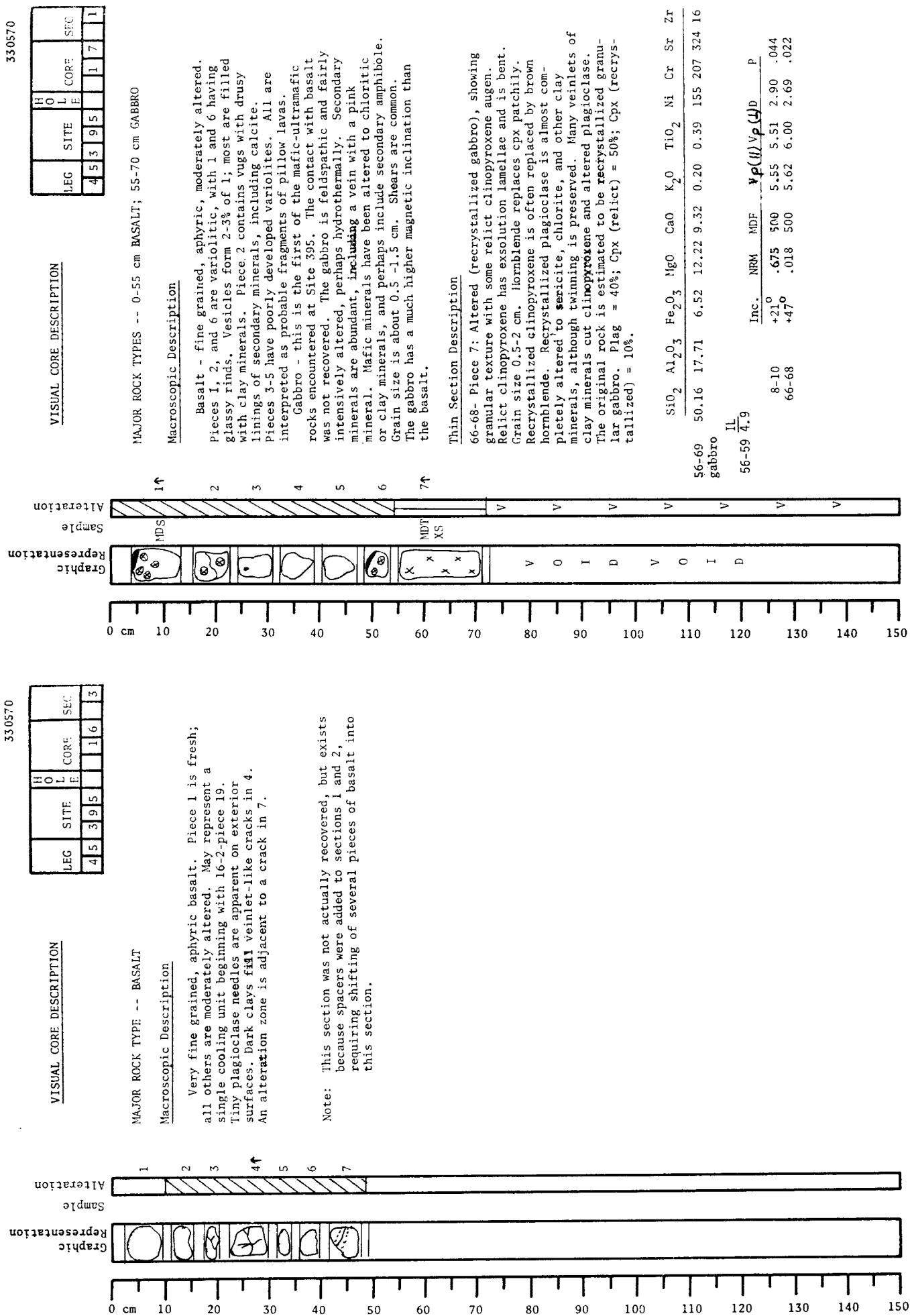
Cuttings: more than 95% basalt glass and lithic basalt chips; the rest- serpentinite-gabbro grains and a small fraction of foraminifera.

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LEG	SITE	H O L	CORE	SEC	LEG		SITE		H O L	CORE	SEC
					4	5	3	9	5	1	6

VISUAL CORE DESCRIPTION

Cuttings: more than 95% basalt glass and lithic basalt chips; the rest- serpentinite-gabbro grains and a small fraction of foraminifera.



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VISUAL CORE DESCRIPTION

LEG	SITE	H	O	L	CORE	SEC	
		4	5	3	9	5	1

MAJOR ROCK TYPES -- 33-42 cm BASALT; 42-150 cm SERPENTINIZED PERIDOTITE

Macroscopic Description

1 V Basalt - medium grained, plagioclase-olivine phryic, moderately altered near upper and lower edges.. There are about 15% plagioclase phenocrysts, and about 2% each of pyroxene and clinopyroxene. Olivine and olivine phenocrysts are about 1 mm; plagioclase up to 0.5 cm.

Serpentinized peridotite - moderately fresh (15-30% serpentinitized) peridotite, with large augen up to 10 mm long of enstatite defining a fabric inclined about 45° from the horizontal. The least serpentined pieces are uppermost (2a-d). Small (1-3 mm) green clinopyroxene grains and chromite are present. Enstatite is much more abundant than clinopyroxene. The matrix is predominantly serpentinitized olivine. Plagioclase is absent. The top-most piece of peridotite has about a 1 cm thick orangish (7.5R 6/6) weathered zone.

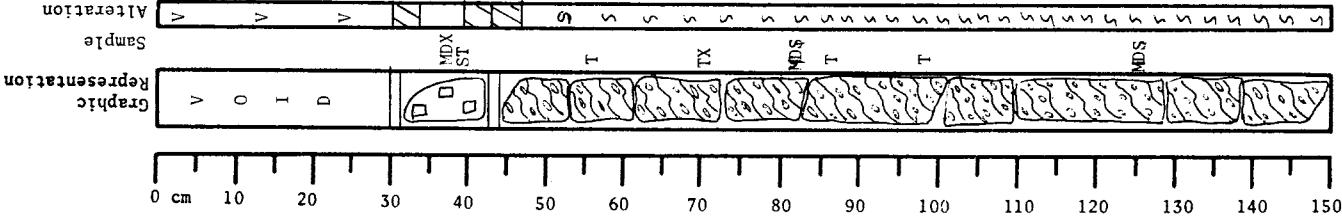
The basalt is the only rock from Site 395 for which a reversed polarity was determined. The peridotite has no stable remanence.

Thin Section Descriptions

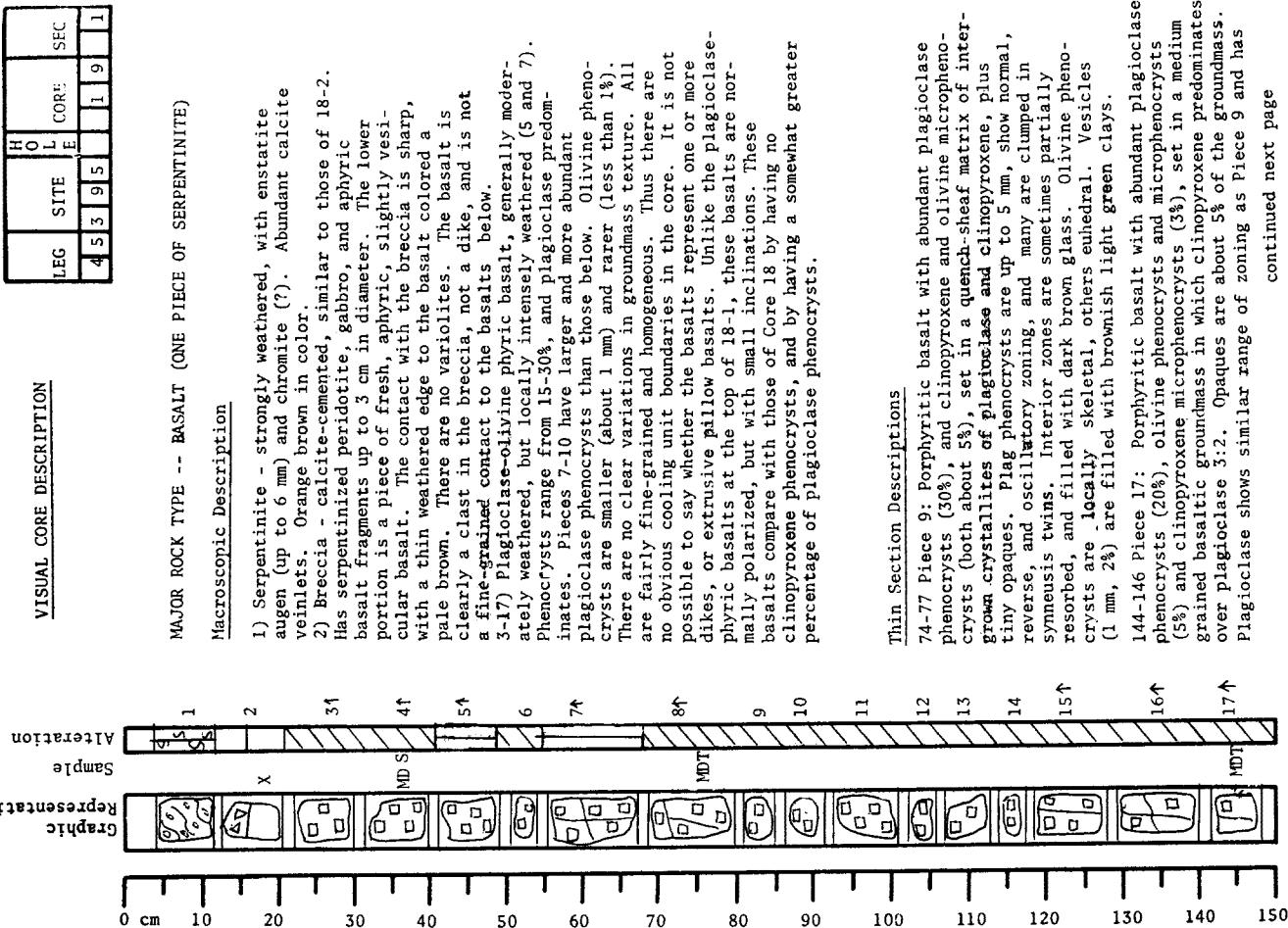
37-39 Piece 1: Plagioclase-olivine phryic basalt. The basalt has sub-ophtitic texture with 55% plagiophenocrysts (3-1.5 mm, An₈₀ core, An₇₀ rim), showing both normal and rare reverse zoning. Plagi forms clumps up to 10 mm. Large plagiophenocrysts often have partially resorbed (fretted) interior zones with blebs of brown glass or a fine-grained, low birefringent mineral, possibly clay, after glass. Olivine phenocrysts are usually less than 1 mm and are about 5% of the rock. Smaller olivine granules (0.2 mm) are present. Olivine cracks and margins are replaced by olive-green clays (about 10% of the olivine is altered in this way). Clinopyroxene (2V₊ = 55-60°) forms 30% of the rock, all in the groundmass.

54-56 Piece 2B, 56-58 Piece 2B, 68-70 Piece 2C, 83-85 Piece 2E, 980100 Piece 2E: Serpentinized harzburgite. Six thin sections cut in orientations parallel and perpendicular to foliation on various pieces. Thin sections show 30-50% enstatite augen (2V near 90°), and rare clinopyroxene (pale green, less than 2%) set in a variously serpentinized (15-30%) olivine matrix. Minor (2%) red-brown chrome spinel forms patches at the edges of olivine grains. Olivine is present as large crystals with granular smaller (1 mm) recrystallized olivine at the margins of the larger crystals, or forming bead-like strings through the larger crystals. Rock foliation is pre-serpentinitization. Opx shows Schiller texture and some cpx exsolution. It is locally bent. Plagioclase is absent. Serpentinite forms sogenetic webs in olivine.

(see next page for data)



Continued

VISUAL CORE DESCRIPTION

similar resorption blebs. One large megacryst has resorption cavities filled with fine-grained quench basalt, of an earlier generation than the groundmass surrounding the crystal. Syneusis clumps are moderately abundant, but there are one or two clumps of smaller plagioclase and olivine in about equal proportions. Olivine is now completely altered in these clumps, and is about 50% altered in the rest of the rock, to clays and Fe-hydroxides. Vesicles (0.5-1.5 mm, 1-2%) are mostly filled with brownish clay minerals, locally lined with fine grained glassy basalt with crystallites of cpx, plag, and magnetite.

74-77 Piece 9: Porphyritic basalt with abundant plagioclase phenocrysts (30%), and clinopyroxene and olivine microphenocrysts (both about 5%), set in a quench-sheaf matrix of intergrown crystallites of plagioclase and clinopyroxene, plus tiny opaques. Plag phenocrysts are up to 5 mm, show normal, reverse, and oscillatory zoning, and many are clumped in syneusis twins. Interior zones are sometimes partially resorbed, and filled with dark brown glass. Olivine phenocrysts are locally skeletal, others euhedral. Vesicles (1 mm, 2%) are filled with brownish light green clays.

144-146 Piece 17: Porphyritic basalt with abundant plagioclase phenocrysts (20%), olivine phenocrysts and microphenocrysts (5%) and clinopyroxene microphenocrysts (3%), set in a medium grained basaltic groundmass in which clinopyroxene predominates over plagioclase 3:2. Opaques are about 5% of the groundmass. Plagioclase shows similar range of zoning as Piece 9 and has

continued next page

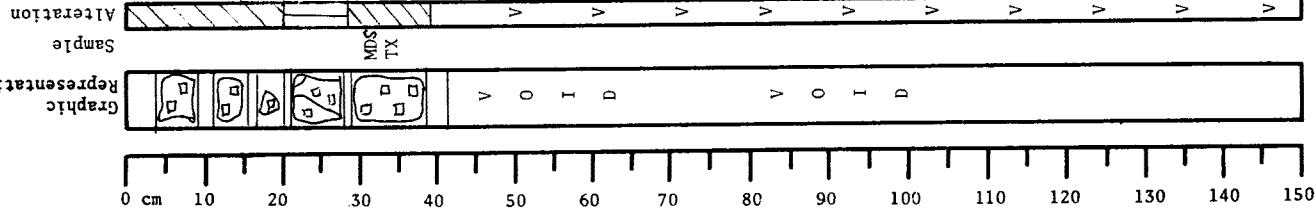
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VISUAL	CORE	DESCRIPTION	LEG	SITE	H	O	L	CORE	SEC		
			4	5	3	9	5		2	0	1

MAJOR ROCK TYPE -- BASALT

Macroscopic Description

Plagioclase-olivine-phryic basalt, fairly fresh, but one piece (4) moderately altered. Plagioclase phenocrysts are large (up to 0.5 cm in glomerophyric clumps), constituting as much as 15% of any piece. Vesicles are less than 1%, and tiny, less than 1 mm. They are often filled with a white interior lining. Vesicles in 4 are more noticeable because it is somewhat more altered than the other pieces. Olivine phenocrysts are fairly small (0.2-0.3 cm) and rare (less than 2%). Piece 5 has a small positive magnetic inclination. These basalts resemble those of Core 19, and differ from those of Core 18 by lacking clinopyroxene phenocrysts.



Thin Section Description

32-38 Piece 5: Porphyritic basalt with phenocrysts of plagioclase (20%), phenocrysts and microphenocrysts of olivine (10%) and microphenocrysts of clinopyroxene (2%) set in a medium grained basaltic groundmass which has plagioclase to cpx of 2:1. Plag phenocrysts are up to 2.5 mm separately, and rarely 1 cm in clumps or symensis twins. Groundmass plag is acicular, cpx is anhedral. Opacites are abundant (8%). Olivine is largely altered to brownish clays in some places, to iddingsite in others. Large olivines sometimes are replaced by carbonate as well as clays and Fe-hydroxides. In one instance, the carbonate is aragonite ($2V = 15^\circ$). Plag phenocrysts are typically rounded, zoned, corroded, or partially resorbed in interior zones.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂	Ni	Cr	Sr	Zr
32-36*	49.64	18.77	9.52	6.13	12.05	0.30	1.28	86	225	162	94

* Note: K₂O probably reflects alteration.

	Inc.	NRM	MDF	$V_p(V_n)$	$V_p(V_n)$	D	P
32-36	28-30	+8.6°	1.72	450	5.39	5.61	2.82 .045

SITE SUMMARY SHEET

LEG 45

Site 395 Hole 395A

Date Occupied	<u>9 December 1975 (0930)</u>
Date Departed	<u>10 January 1976 (0930)</u>
Time on Hole	<u>32 days, 0 hours</u>
Position: Latitude	<u>22°45.35'N</u>
Longitude	<u>46°04.90'W</u>
Water Depth (sea level)	<u>4484 corrected meters, echo sounding</u>
Water Depth (rig floor)	<u>4494 corrected meters, echo sounding</u>
Bottom Felt at (rig floor)	<u>4485 meters, drill pipe</u>
Penetration	<u>664.09 meters</u>
Number of Holes	<u>1</u>
Number of Cores	<u>68*</u>
Total Length of Cored Section	<u>487.94 meters</u>
Total Core Recovered	<u>105.97 meters</u>
Percentage Core Recovery	<u>18%</u>

Oldest Sediment Cored

Depth Subbottom	<u>see Hole 395 meters</u>
Nature	<u>--</u>
Age	<u>--</u>
Measured Velocity	<u>-- km/sec</u>

Basement

Depth Subbottom	<u>576.49 meters sub-basement</u>
Nature	<u>predominantly aphyric & phryic basalt units</u>
Velocity Range	<u>5.1 to 6.0 km/sec</u>

Principal Stratigraphic Units - Units are based on hand specimen mineral identification and chemistry. Where boundaries are within a core the depth to the boundary is determined by the proportion of the rock type in the core to the total recovery times the total penetration of the core (9.3 to 9.6 m).

*Core #68 contained cuttings obtained while attempting to clean hole.
The amount recovered was not added in total core recovery.

Site 395 Hole 395A (continued)

<u>Cores</u>	<u>Depth Below Sea Surface (m)</u>	<u>Description</u>
1 and 2	4475.75-4487.20	Foraminifer-nannofossil ooze. Mudline cores (taken to determine precise distance to sea floor). Core 2 is stratigraphically <u>above</u> Core 1.
3 to 5	4562.6-4582.4	Basalt-serpentinized peridotite rubble zone.
5 to 12	4582.4-4647.4	Aphyric basalt Unit A ₂ .
13	4647.4-4648.6	Gabbro peridotite complex.
13 to 16	4648.6-4679.0	Plagioclase-olivine phryic basalt Unit P ₂ .
16 to 22	4679.0-4741.5	Plagioclase-olivine-clinopyroxene phryic basalt Unit P ₃ .
22 to 27-2	4741.5-4778.9	Plagioclase-olivine-clinopyroxene phryic basalt Unit P ₄ .
27 to 33-2	4778.9-4836.0	Plagioclase-olivine-clinopyroxene phryic basalt Unit P ₅ . Breccia zones in Cores 32 and 33.
33-2 to 56 CC	4836.0-5045.1	Aphyric basalt Unit A ₃ . Breccia zone in Core 49.
57 to 66	5045.1-5129.7	Aphyric basalt unit A ₄ with breccias in Cores 58 and 60. In Cores 61-64 is a 15 meter thick olivine-plagioclase phryic dolerite sill or dike, Unit P ₄ !
67	5129.7-5149.1	Aphyric basalt Unit A ₅ . The boundary between A ₄ and A ₅ is between Section 66-2, 80 cm and Section 67-2 7 cm, but has not been precisely located.

Core 2		Cored Interval: 44.75-4477.67 m (0.75-2.62 m subbottom)	
Site 395	Hole A	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
	FOSIL CHARACTER	METER(S)	LITHOLOGY
		0	VOID V
		0.5	10YR 5/6
		1	*
		1.0	VOID V
		2	VOID V
			10YR 6/6
			Carbonate CC
			2-7/4
			9.0 0.1 74
			Core Catcher
			AG AG

330570

330570

LEG	SITE	H	O	CORE	SFC
4	5	3	9	5	A
4	5	3	9	5	A

MAJOR ROCK TYPES -- SERPENTINIZED PERIDOTITE AND FINE GRAINED APHYRIC BASALT

Rounded cobbles and short cored (cylindrical) pieces of serpentinitized peridotite and fine-grained, aphyric, generally variolitic basalt embedded in the upper part of the section in drilling cuttings composed of fine-grained aphyric basalt, serpentinitized peridotite, and minor foraminifera. Embedded in the lower part in cuttings mixed with pale yellowish brown foraminifera-nannofossil ooze.

Pieces 1, 2, 3, and 5 are variously serpentinitized peridotite with orthopyroxene augen up to 1 cm and talcose veinlets.

Pieces 4, 6, and 7 are portions of pillow lavas with large variolites (up to 1 cm) on 4 and 7, and altered margins on 4 and 6. Vescicles are rare and less than 1 mm in the variolitic pieces.

The pieces were removed from their matrix of cuttings and foram-nanno ooze for ease of description and handling.

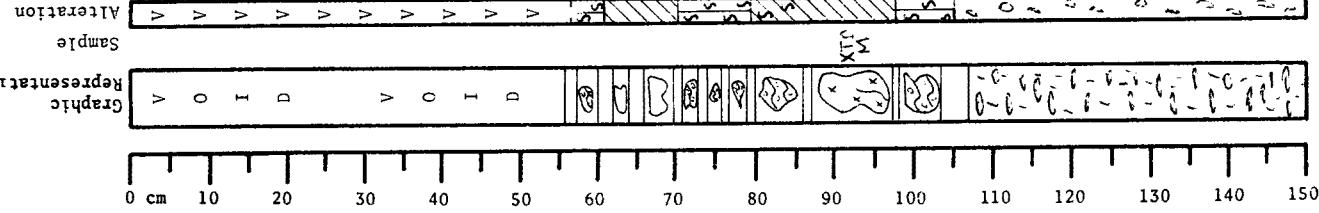
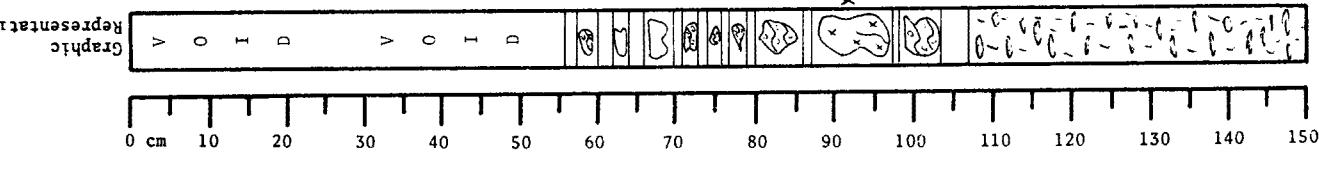
The variolitic basalts are similar to those of the aphyric basalt of Hole 395 and are inferred to represent first contact with basement in Hole 395A. The serpentinitized peridotite may represent a talus or gravel layer above basalt, especially since piece 2 appears to have been cored.

Thin Section Description

3-1-146-150 Near glassy variolitic basalt. Mats of plagioclase microllites and dust-like titanomagnetite with needles of quench olivine, now altered to iddingsite-like material. Non-variolitic portions of section are brown colored (oxidized) and have finer-grained plagioclase, no opaques. Minor vescicles either unfilled or partially filled with reddish Fe-stained alteration minerals.

Note: sequence of pieces in this core has no stratigraphic significance that we can infer.

INC.	NRM	MDF	V _p (u)	V _p (d)	D	P	
89-91	+12.2	1.02	125	3.80	4.14	2.48	8.8



LEG	SITE	H	O	CORE	SFC
4	5	3	9	5	A
4	5	3	9	5	A

MAJOR ROCK TYPES -- SERPENTINIZED PERIDOTITE, FINE-GRAINED APHYRIC BASALT, AND GABBRO

Macroscopic Description

Major rock types were embedded in drilling cuttings. The cuttings were removed from around the rocks for ease of description and handling.

The basalts (Pieces 2 and 3) are fine-grained, aphyric and moderately altered, similar to those of Core 3.

The peridotites (Pieces 1, 4-7, and 9) are moderately to intensely serpentinitized and, beyond that, altered by contact with sea water to some degree. Some enstatite augen are present. Piece 9, the most altered, has relic cataclastic texture cut by numerous magnetite, Fe-oxide and talc-bearing veinlets.

The gabbro (Piece 8) has 60-70% fresh to altered feldspar, with the remainder clinopyroxene & other mafics.

The cuttings are primarily aphyric basalt sand and chips with some volcanic glass, serpentinite, and individual mineral grains broken from ultramafic rocks -- orthopyroxene and talc, with minor foraminifera.

Thin Section Description

4-1-95-98 (Piece 8) Recrystallized gabro, granular texture, with some relic clinopyroxenes and feldspar.

Plag (= 60%) is An₅₀-Fs₄₅, about 10% relic and 20% mosaic.

Cpx has 2N+ = 55%, about 10% relic and 2-3% brown or green hornblende and magnetite. Relict cpx has abundant exsolution blebs and, with mosaic cpx, is arrayed in bands (foliation?). One or two crystals of altered olivine were found. One segment of plag is altered to a clear, high 2V- radiating mineral with low birefringence (a zeolite?).

Note: sequence of pieces in this section has no stratigraphic significance that we can infer.

INC.	NRM	MDF	V _p (u)	V _p (d)	D	P	
91-103 gabbro	51.6	18.86	7.11	5.5	12.42	0.10	0.81

INC.	NRM	MDF	V _p (u)	V _p (d)	D	P	
99-100 Piece No. 8	-10.0	2.47	800	--	--	2.87	--



LEG.	SITE	H O	L	CORE	SEC
4	5	3	9	5A	1

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPES -- FINE-GRAINED APHYRIC BASALT, SERPENTINIZED PERIDOTITE AND GABBRO.

Macroscopic Description

Major rock types were embedded in drilling cuttings. The cuttings were removed from around the rocks for ease of description and handling. Cuttings mostly basalt, some serp. and forams. The basalts (pieces 1, 5, and 6) are fine-grained, aphyric, and moderately to intensely altered. No glass-rinds or variolite zones are present. Piece 6 has a carbonate vein.

The serpentized peridotites have large talc grains (after opx augen) set in a matrix composed of serpentine and talc. Many talcose veinlets are present.

The gabbro (Piece 5) is primarily felsic but intensely altered (saussuritized?)...

Note: Drilling breccia has small pebbles between 125-150 cm.
1 Thin Section Description
4-2-58-61 Serpentized peridotite, with mesh texture of totally serpentized olivine with enstatite augen. Enstatite shows exsolution lamellae, and is about 40% of the rock.

Chrome spinel and chlorite are present in trace amounts.

Note: sequence of pieces in this section has no stratigraphic significance that we can infer.

56-58	Inc.	NRM	MDF	$V_{p(\perp)}$	$V_{p(\parallel)}$	D	P
Piece No. 3	-4.0	2.42	75	3.61	3.83	2.47	12.1

LEG.	SITE	H O	L	CORE	SEC
4	5	3	9	5A	2

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPES -- FINE GRAINED APIHYRIC BASALT WITH ONE PIECE OF SERPENTINIZED PERIDOTITE

Macroscopic Description

Serpentized Peridotite (Pieces 1 & 4) - similar to those of Cores 3 and 4; have enstatite augen. Lithologic Unit 1 ends at base of Piece 4. Enstatites in 4 are altered to talc.

Fine-grained aphyric basalt (Pieces 2, 3, and 5-21) - moderately to intensely altered for the most part, but fresh especially in pieces 16-18. Basalt is generally fine grained, but no glassy zones or variolitic zones are present. Piece 16 has long quench crystals of plagioclase in sub-radiating sheafs, and small crystals of olivine. It is unusually coarse-grained for this type of basalt. Vesicles are small (less than 1 mm) and minor (less than 1%) and are more evident in altered pieces where they are filled with greenish clays (Pieces 2, and 10-15). A carbonate vein occurs in Piece 16D. Vesicles in Piece 20 are filled with yellow brown to pale yellow brown materials, mostly clays.

Thin Section Description

5-1-100-103 Aphyric olivine basalt. Plag in radiating or sub-radiating array, sheathing cpx. Plag = 55%, Cpx = 30%, OI = 20%, titanomagnetite = 5%, glass = trace (visual estimate). Oliv microphenocrysts = 10%. Plag 0.8-2 mm long. Texture is intersectoral. Interstitial glass is altered to brown clay minerals. Trace vesicles are filled with clay minerals.

16a†	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
16b†	100-103						

16c†	aphyric basalt	49.4	14.87	12.20	8.8	10.53	0.10	1.62
16d†								

16e†								
16f†								

16g†	Inc.	NRM	MDF	$V_{p(\perp)}$	$V_{p(\parallel)}$	D	P
17	56-58						
Piece No. 12	--						

18							
Piece No. 16B +38.8	3.52						

19a†							
138-140							

19b†							
Piece No. 19B +27.3	2.42						

20

21

LEG.	SITE	H O	L	CORE	SEC
4	5	3	9	5A	5

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPES -- FINE GRAINED APIHYRIC BASALT WITH ONE PIECE OF SERPENTINIZED PERIDOTITE

Macroscopic Description

cores 3 and 4; have enstatite augen. Lithologic Unit 1 ends at base of Piece 4. Enstatites in 4 are altered to talc.

Fine-grained aphyric basalt (Pieces 2, 3, and 5-21) - moderately to intensely altered for the most part, but fresh especially in pieces 16-18. Basalt is generally fine grained, but no glassy zones or variolitic zones are present. Piece 16 has long quench crystals of plagioclase in sub-radiating sheafs, and small crystals of olivine. It is unusually coarse-grained for this type of basalt. Vesicles are small (less than 1 mm) and minor (less than 1%) and are more evident in altered pieces where they are filled with greenish clays (Pieces 2, and 10-15). A carbonate vein occurs in Piece 16D. Vesicles in Piece 20 are filled with yellow brown to pale yellow brown materials, mostly clays.

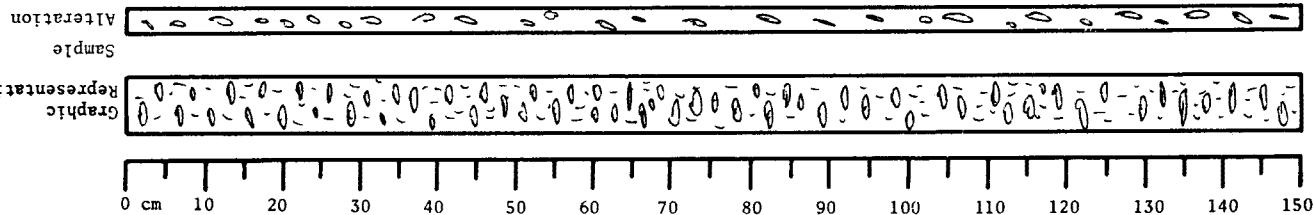
3†

4

	H	O	L	CORE	E	SITE	LEG
4	5	3	9	5	A	5	4

1-4

Sections 1-4 are drill cuttings obtained when bit and core barrel both became stuck in the hole for a time. They represent material cleared from the hole with the 14" diameter core bit prior to setting casing. They came from the same interval as Core 5, hence are called Core 5A. Cuttings consist mainly of angular grains and fragments of basalt, basalt glass, and minor foraminifera.

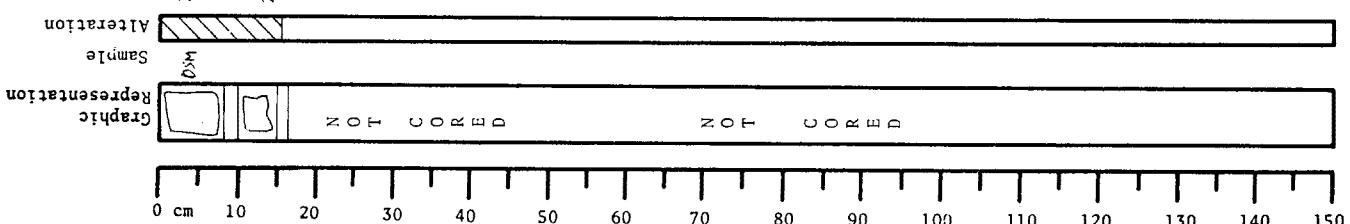
VISUAL CORE DESCRIPTION

	H	O	L	CORE	E	SITE	LEG
4	5	3	9	5	A	5	2

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Similar to those of Section 1. Moderately altered. Vesicles (about 2%) filled with dark green clays (?).

Note: this section exists because spacers were placed in section 1, forcing these two pieces into a separate liner. No core exists below 15 cm.

VISUAL CORE DESCRIPTION

LEG	SITE	H O L	CORE	SEC
4	5	3	9	5

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- BASALTMacroscopic Description

Medium grained aphyric basalt with elongate plagioclase laths interlocked with clinopyroxene (1-2 mm) and rare olivine microphenocrysts. Sub-variolitic texture. Piece 2 is coarser grained than 1. The upper half of 1 and all of 2 are moderately altered. Vesicles (rare, less than 1 mm) are filled with greenish gray clay minerals. Olivine microphenocrysts are altered to reddish-brown minerals.

Thin Section Description

16-1-130-134 Aphyric olivine basalt, interstitial, partly subvariolitic texture. Plag = 60%, cpx = 30%, ol = 12%, some as microphenocrysts. Plag is acicular, very slender and elongate, locally with splayed ends. Some glass present in trace amounts altered to orange clays similar to palagonite.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
130-134	V	V	V	V	V	V	V
aphyric basalt	49.6	15.19	12.03	8.5	10.60	0.16	1.64
	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr	

Alteration Sample

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- APHYRIC FINE-GRAINED BASALTMacroscopic Description

Fine-grained aphyric basalt containing small olivine microphenocrysts on coarser grained pieces. Elongate olivine crystallites visible in pieces 1 and 4. Piece 12 is variolitic. Vesicles are small (less than 1 mm) and between 1 and 5%. They are filled with clay and/or carbonate in 2,3,5,6,7,8,9, and 10. Piece 11 is glassy, and has minor palagonite. Pieces 1-10 appear to be a single cooling unit, finer grained toward the top and bottom. An important textural feature is that elongate quench olivine crystallites are visible in the finer grained (glassy to near glassy) pieces, but plagioclase is more prominent in the coarser grained pieces. It is acicular and sub-radiating, and associated with euhedral olivines without skeletal extensions.

Thin Section Descriptions

1 (Piece 3) Quench olivine with c-axis elongate skeletal extensions up to 0.4 mm. Plag present as much smaller acicular needles in sub-parallel sheafs or mats, with tiny titanomagnetite "dust". Vesicles (0-0.5 mm) are filled with pale green clay minerals. Groundmass form subvariolitic.
 7-1-27-30 (Piece 4) virtually identical to previous thin section. SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

7-6-82
 aphyric basalt
 94-96
 Piece No. 5
 Inc. NRM MDF V_{P(II)} V_{P(I)} D P
 6
 IL Mg/(Mg+Fe) Cr Ni Sr Zr

7
 113-116
 Piece No. 8
 -- -- -- 4.79 5.61 2.87 6.0
 11
 12

2†

Alteration Sample

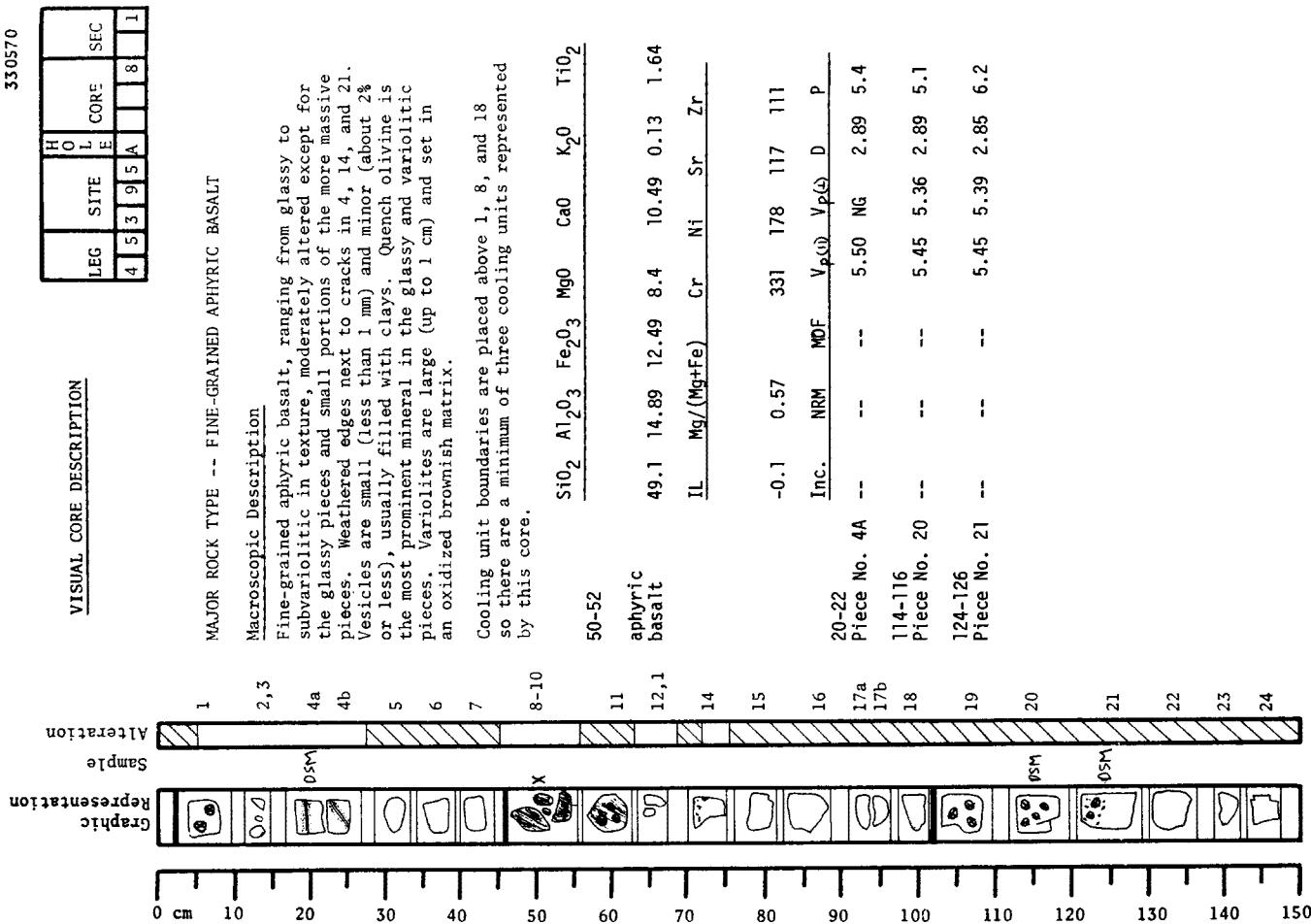
VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- APHYRIC FINE-GRAINED BASALTMacroscopic Description

Fine-grained aphyric basalt containing small olivine microphenocrysts on coarser grained pieces. Elongate olivine crystallites visible in pieces 1 and 4. Piece 12 is variolitic. Vesicles are small (less than 1 mm) and between 1 and 5%. They are filled with clay and/or carbonate in 2,3,5,6,7,8,9, and 10. Piece 11 is glassy, and has minor palagonite. Pieces 1-10 appear to be a single cooling unit, finer grained toward the top and bottom. An important textural feature is that elongate quench olivine crystallites are visible in the finer grained (glassy to near glassy) pieces, but plagioclase is more prominent in the coarser grained pieces. It is acicular and sub-radiating, and associated with euhedral olivines without skeletal extensions.

1 (Piece 3) Quench olivine with c-axis elongate skeletal extensions up to 0.4 mm. Plag present as much smaller acicular needles in sub-parallel sheafs or mats, with tiny titanomagnetite "dust". Vesicles (0-0.5 mm) are filled with pale green clay minerals. Groundmass form subvariolitic.
 7-1-27-30 (Piece 4) virtually identical to previous thin section. SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

7-6-82
 aphyric basalt
 94-96
 Piece No. 5
 Inc. NRM MDF V_{P(II)} V_{P(I)} D P
 6
 IL Mg/(Mg+Fe) Cr Ni Sr Zr

7
 113-116
 Piece No. 8
 -- -- -- 4.79 5.61 2.87 6.0
 11
 12



MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained aphyric basalt, ranging from glassy to subvariolitic in texture, moderately altered except for the glassy pieces and small portions of the more massive pieces. Weathered edges next to cracks in 4, 14, and 21. Vesicles are small (less than 1 mm) and minor (about 2% or less), usually filled with clays. Quench olivine is the most prominent mineral in the glassy and variolitic pieces. Variolites are large (up to 1 cm) and set in an oxidized brownish matrix.

Cooling unit boundaries are placed above 1, 8, and 18 so there are a minimum of three cooling units represented.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
49.1	14.89	12.49	8.4	10.49	0.13	1.64							

	-0.1	0.57	331	178	117	111	P
Inc.	NRM	MDF	V _{p(ψ)}	V _{p(ψ)}	D		
20-22 Piece No. 4A	--	--	--	5.50	NG	2.89	5.4
114-116 Piece No. 20	--	--	--	5.45	5.36	2.89	5.1
124-126 Piece No. 21	--	--	--	5.45	5.39	2.85	6.2

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LEG	SITE	H O	L E	CORE	SEC
4	5	3	9	5A	1
				9	2

VISUAL CORE DESCRIPTION

- 1 Described under 395A-9-1
 2 18-21

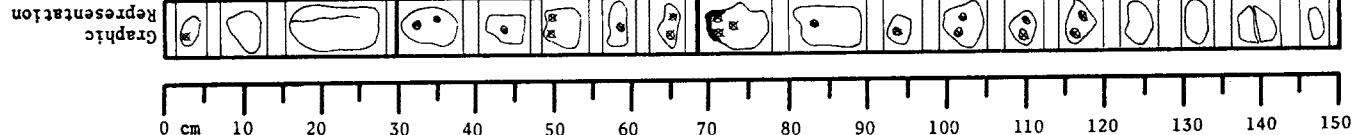
	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr		
49.4	15.14	12.20	8.5	10.65	0.11	1.64	

aphyric
basalt

	Inc.	NRM	MDF	V _p (i)	V _p (ii)	V _D	P
-0.7	0.58	328	193	120	112	D	

Piece No. 3 -- -- -- 5.49 5.87 2.94 2.4

Alteration Sample



330570

LEG	SITE	H O	L E	CORE	SEC
4	5	3	9	5A	1
				9	1

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

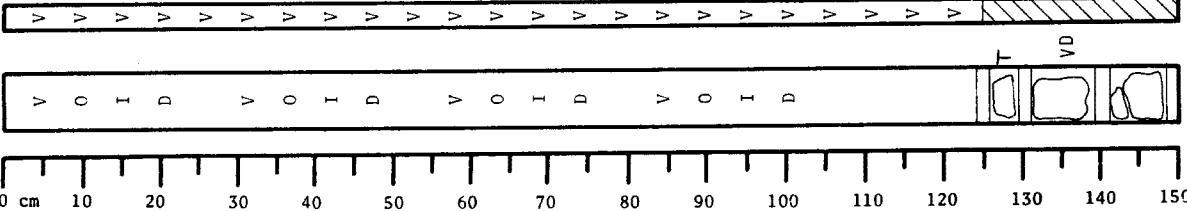
Very fine grained moderately weathered basalt with a few small vesicles. Elongate quench olivines visible on weathered edge of 1, not as prominent in other pieces. Vesicles have linings of green clays.

Thin Section Description

10-1-120-128 (Piece 1) - Subvariolitic texture; mats of fine acicular plagioclase and dustlike titanomagnetite. Plag often sheaths cpx. Quench olivines with skeletal extensions are abundant. Plag = 45%; cpx = 40%; ol = 10%; titanomagnetite = 2% (visual estimates)

Inc.	NRM	MDF	V	V	D	P
132-134	---	--	--	--	5.65	5.43 2.89 6.0

Alteration Sample



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VISUAL CORE DESCRIPTIONMacroscopic Description

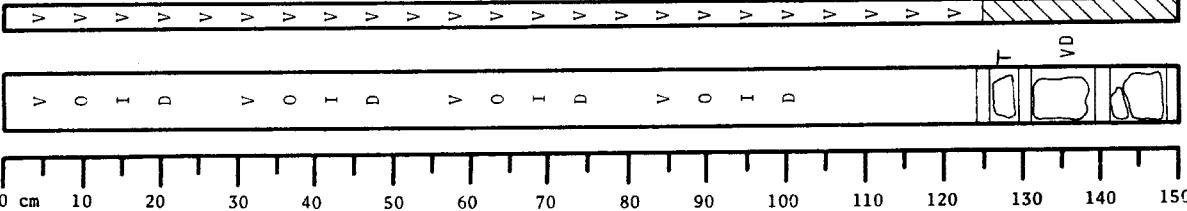
Very fine grained moderately weathered basalt with a few small vesicles. Elongate quench olivines visible on weathered edge of 1, not as prominent in other pieces. Vesicles have linings of green clays.

Thin Section Description

10-1-120-128 (Piece 1) - Subvariolitic texture; mats of fine acicular plagioclase and dustlike titanomagnetite. Plag often sheaths cpx. Quench olivines with skeletal extensions are abundant. Plag = 45%; cpx = 40%; ol = 10%; titanomagnetite = 2% (visual estimates)

Inc.	NRM	MDF	V	V	D	P
132-134	---	--	--	--	5.65	5.43 2.89 6.0

Alteration Sample



LEG	SITE	H L CORE			SEC
		4	5	3	
4	5	3	9	5	A
					1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained, aphyric, moderately altered basalt of fairly uniform texture, somewhat coarser grained than subvariolitic except for 3, which has small variolites (at least for this type of basalt). Piece 3 contains quench needles of olivine. All others have somewhat felty-textured fine acicular plagioclase (visible using a hand lens or binocular microscope). Vesicles are small (less than 1 mm) and minor (less than 1%) and are usually lined with yellow-brown or green clays. Most intense weathering follows cracks or edges of pieces.

Thin Section Descriptions

11.1-117-128 (Piece 8) Subvariolitic basalt with skeletal olivine microphenocrysts set in an acicular plagioclase-cpx "dustlike" titanomagnetite groundmass. Plag sheaths cpx and is arrayed in subparallel swaths or radial clusters. Clays present after glass between groundmass crystals.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
49.8	15.06	12.65	8.6	10.74	0.16	1.65

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
8	--	--	5.62	5.86	2.93

Inc.	NRM	MDF	V _P (μ)	V _P (μ)	D	P
5	129-131					

LEG	SITE	H L CORE			SEC
		4	5	3	
4	5	3	9	5	A
					1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained, aphyric, moderately altered basalt. Olivine alteration visible - brown specks. Mn-oxide specks visible on one surface. Sub-variolitic in part.

Note: lithologic Unit 2 ends at the bottom of this core.

LEG	SITE	H L CORE			SEC
		4	5	3	
4	5	3	9	5	A
					1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained, aphyric, moderately altered basalt. Olivine alteration visible - brown specks. Mn-oxide specks visible on one surface. Sub-variolitic in part.

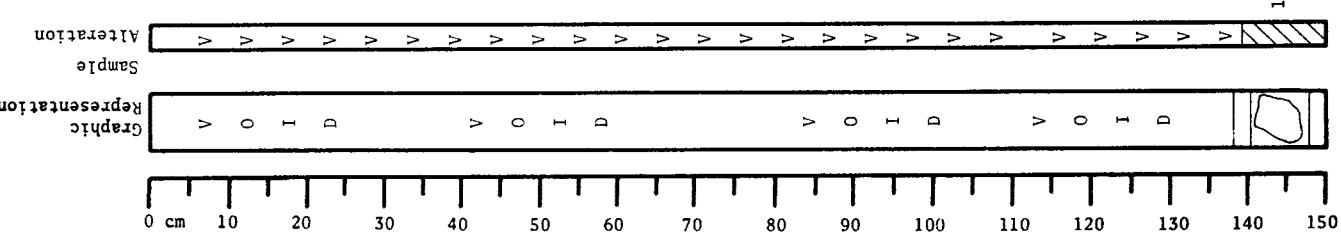
Note: lithologic Unit 2 ends at the bottom of this core.

LEG	SITE	H L CORE			SEC
		4	5	3	
4	5	3	9	5	A
					1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained, aphyric, moderately altered basalt. Olivine alteration visible - brown specks. Mn-oxide specks visible on one surface. Sub-variolitic in part.

Note: lithologic Unit 2 ends at the bottom of this core.

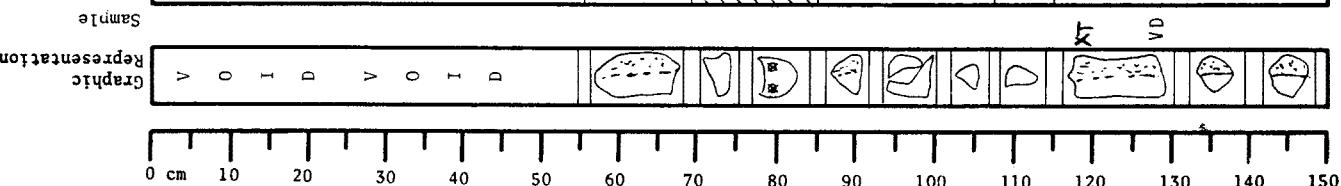


LEG	SITE	H L CORE			SEC
		4	5	3	
4	5	3	9	5	A
					1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained, aphyric, moderately altered basalt. Olivine alteration visible - brown specks. Mn-oxide specks visible on one surface. Sub-variolitic in part.

Note: lithologic Unit 2 ends at the bottom of this core.



	H	O	L	CORE	SEC
LEG	SITE	L	E		
4	5	3	9	5	A
				1	3

MAJOR ROCK TYPES -- SERPENTINIZED PERIDOTITE, FINE-GRAINED APHYRIC BASALT, AND PLAGIOLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Serpentinized Peridotite (Pieces 1 and 2) - 1 is green, about 80% serpentined and has partially altered enstatite augen. 2 is similar texturally to 1 but has been intensely oxidized and/or weathered to a yellow brown color (due to goethite after magnetite?)

Fine-grained aphyric basalt (Piece 3) - very dark gray, fresh basalt with no visible crystals. Small angular piece.

Note: this sequence is identical to the lowest part of the carbonate-cemented serpentinite breccia of Hole 395, except the carbonaceous breccia matrix is absent. This may be due to low recovery in this core. In both Holes 395 and 395A there is a serpentinite breccia or gravel zone between the upper aphyric basalts (Unit 2) and the plagioclase-olivine phyric basalts of Unit 4. The breccia is given a separate designation - Unit 3.

Plagioclase-olivine phyric basalt (Pieces 4-11) - has 15-30% phenocrysts of plagioclase up to 1 cm in size (mostly aggregates when that large) and 1-2% olivine phenocrysts up to 0.3 cm, set in a fine-grained basaltic groundmass. Rocks are fresh to moderately altered. Vesicles are less than 1% and rarely more than 1 mm in diameter, usually filled with pale green clays.

Thin Section Description 13-1-100-110 (Piece 7) Pl-ol phyric basalt, interstitial to subophitic groundmass. Abundant plagioclase phenocrysts with skeletal interiors, normal, reverse, and oscillatory zones. Skeletal interiors have finer grained (nearly sub-variolitic) blebs. Plagioclase phenocrysts = 10%, groundmass = 35%; Cpx, groundmass only = 40%; ol phenocrysts = trace, groundmass = 2%. "Mesostasis" consists of feathery cpx, plagioclase, and opaques. Vesicles are filled with glassy zones with cpx, plagioclase, and opaques. May be good orientation indicators.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Inc.	49.9	18.64	8.37	6.5	12.62	0.15	1.39
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr		

	-2.1	0.61	198	134	166	98	
Inc.	49.9	26.7	.855	500	5.54	5.46	2.86
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr		

MVD

	H	O	L	CORE	SEC
LEG	SITE	L	E		
4	5	3	9	5	A
				1	4

MAJOR ROCK TYPE -- PLAGIOLASE-OLIVINE PHYRIC BASALT

General Macroscopic Description of Cores 14 and 15

Beginning with 13-1-80 (Piece 4) is single, massive, fairly homogeneous cooling unit that encompasses all of Core 14 and most of Core 15. The basalt is gray, plagioclase and olivine phyric. It is fairly fresh, but with moderate alteration in patches, especially adjacent to cracks which often are the upper, lower, or side edges of pieces. There are up to 25% plagioclase phenocrysts and plagiocrocyts up to 1.5 cm. Phenocryst abundance varies, not progressively, but in irregular zones or patches. In addition to large plagioclase phenocrysts are finer acicular plagioclase crystals in the groundmass. Olivine is not as abundant (2-3%) but fresh crystals are evident, some in clusters up to 3 mm diameter. Small vesicles 1-2 mm in diameter are filled with pale green or orange colored clays and are scattered throughout. There are a few carbonate veinlets in pieces 6b and 6i of 14-5 but these are the only ones noted in Cores 14 and 15. Olivine is generally altered to red-stained clays in the more altered portions of the rocks, especially next to cracks.

Thin Section Description

14-1-90-100 (Piece 12) -- interstitial/subophitic porphyritic basalt. Plagioclase phenocrysts 15%, groundmass 55%; clinopyroxene phenocrysts - none, groundmass 40%; olivine phenocrysts - 10,11 trace, groundmass 3%; titanomagnetite 3%; "mesostasis" (consists of feathery cpx, acicular opaques and plagioclase laths) - 5%. Plagioclase megacrysts include some with skeletal interior zones (fine-grained, nearly glassy, included blebs), or have multiple zones. All usually have an outer zone. Crystallization sequence for this rock is plag + ol first, then cpx and plagioclase in the groundmass, and finally titanomagnetite (which is quite skeletal).

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Inc.	49.2	17.81	9.43	7.1	11.97	0.11	1.36
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr		

	-1.6	0.60		198	88	160	97
Inc.	4.42	150		5.55	5.57	2.87	3.6
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr		

MVD

	139-144	Piece No. 17B + 19.8	4.42	150	5.55	5.57	2.87	3.6
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr			

P

	H	O	L	CORE	SEC
LEG	SITE	L	E		
4	5	3	9	5	A
				1	1

MAJOR ROCK TYPES -- SERPENTINIZED PERIDOTITE, FINE-GRAINED APHYRIC BASALT, AND PLAGIOLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Serpentinized Peridotite (Pieces 1 and 2) - 1 is green, about 80% serpentined and has partially altered enstatite augen. 2 is similar texturally to 1 but has been intensely oxidized and/or weathered to a yellow brown color (due to goethite after magnetite?)

Fine-grained aphyric basalt (Piece 3) - very dark gray, fresh basalt with no visible crystals. Small angular piece.

Note: this sequence is identical to the lowest part of the carbonate-cemented serpentinite breccia of Hole 395, except the carbonaceous breccia matrix is absent. This may be due to low recovery in this core. In both Holes 395 and 395A there is a serpentinite breccia or gravel zone between the upper aphyric basalts (Unit 2) and the plagioclase-olivine phyric basalts of Unit 4. The breccia is given a separate designation - Unit 3.

Plagioclase-olivine phyric basalt (Pieces 4-11) - has 15-30% phenocrysts of plagioclase up to 1 cm in size (mostly aggregates when that large) and 1-2% olivine phenocrysts up to 0.3 cm, set in a fine-grained basaltic groundmass. Rocks are fresh to moderately altered. Vesicles are less than 1% and rarely more than 1 mm in diameter, usually filled with pale green clays.

Thin Section Description 13-1-100-110 (Piece 7) Pl-ol phyric basalt, interstitial to subophitic groundmass. Abundant plagioclase phenocrysts with skeletal interiors, normal, reverse, and oscillatory zones. Skeletal interiors have finer grained (nearly sub-variolitic) blebs. Plagioclase phenocrysts = 10%, groundmass = 35%; Cpx, groundmass only = 40%; ol phenocrysts = trace, groundmass = 2%. "Mesostasis" consists of feathery cpx, plagioclase, and opaques. Vesicles are filled with glassy zones with cpx, plagioclase, and opaques. May be good orientation indicators.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Inc.	49.9	18.64	8.37	6.5	12.62	0.15	1.39
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr		

MVD

P

	H	O	L	CORE	SEC
LEG	SITE	L	E		
4	5	3	9	5	A
				1	1

MAJOR ROCK TYPES -- SERPENTINIZED PERIDOTITE, FINE-GRAINED APHYRIC BASALT, AND PLAGIOLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Serpentinized Peridotite (Pieces 1 and 2) - 1 is green, about 80% serpentined and has partially altered enstatite augen. 2 is similar texturally to 1 but has been intensely oxidized and/or weathered to a yellow brown color (due to goethite after magnetite?)

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Note: this sequence is identical to the lowest part of the carbonate-cemented serpentinite breccia of Hole 395, except the carbonaceous breccia matrix is absent. This may be due to low recovery in this core. In both Holes 395 and 395A there is a serpentinite breccia or gravel zone between the upper aphyric basalts (Unit 2) and the plagioclase-olivine phyric basalts of Unit 4. The breccia is given a separate designation - Unit 3.

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Thin Section Description 13-1-100-110 (Piece 7) Pl-ol phyric basalt, interstitial to subophitic groundmass. Abundant plagioclase phenocrysts with skeletal interiors, normal, reverse, and oscillatory zones. Skeletal interiors have finer grained (nearly sub-variolitic) blebs. Plagioclase phenocrysts = 10%, groundmass = 35%; Cpx, groundmass only = 40%; ol phenocrysts = trace, groundmass = 2%. "Mesostasis" consists of feathery cpx, plagioclase, and opaques. Vesicles are filled with glassy zones with cpx, plagioclase, and opaques. May be good orientation indicators.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Inc.	49.9	18.64	8.37	6.5	12.62	0.15	1.39
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr		

MVD

P

	H	O	L	CORE	SEC
LEG	SITE	L	E		
4	5	3	9	5	A
				1	1

MAJOR ROCK TYPES -- SERPENTINIZED PERIDOTITE, FINE-GRAINED APHYRIC BASALT, AND PLAGIOLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

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	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Inc.	49.9	18.64	8.37	6.5	12.62	0.15	1.39
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr		

MVD

P

	H	O	L	CORE	SEC
LEG	SITE	L	E		
4	5	3	9	5	A
				1	1

MAJOR ROCK TYPES -- SERPENTINIZED PERIDOTITE, FINE-GRAINED APHYRIC BASALT, AND PLAGIOLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

Serpentinized Peridotite (Pieces 1 and 2) - 1 is green, about 80% serpentined and has partially altered enstatite augen. 2 is similar texturally to 1 but has been intensely oxidized and/or weathered to a yellow brown color (due to goethite after magnetite?)

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	SiO₂	Al₂O₃	Fe₂O₃	MgO	CaO	K₂O	TiO₂

330570

LEG	H			L	CORE	E	SEC			
	4	5	3					1	4	
										3

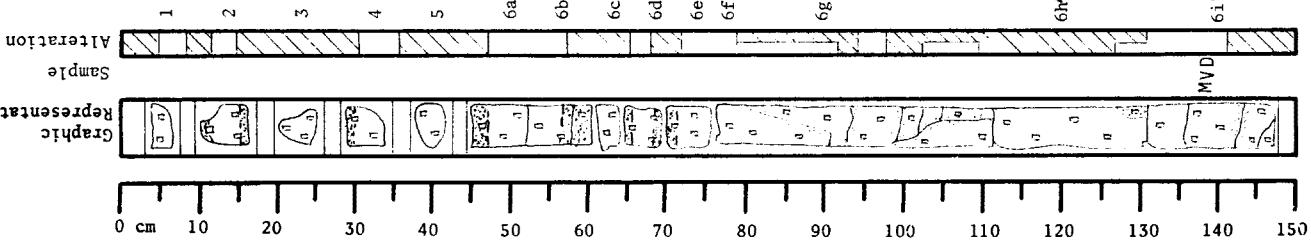
VISUAL CORE DESCRIPTION

1 MAJOR ROCK TYPE -- PLAGIOCLASE - OLIVINE PHYRIC BASALT

Macroscopic Description
Given in 14-1

Carbonate veinlets in 6b and 6i.

	Inc.	NRM	MDF	$V_p(\downarrow)$	$V_p(\downarrow \downarrow)$	D	P
138-140							
Piece No.	61	+21.8	4.59	90	5.52	5.61	2.91
							2.4



330570

LEG	H			L	CORE	E	SEC			
	4	5	3					1	4	
										2

VISUAL CORE DESCRIPTION

1 MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description
Given in 14-1

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
98-112							
							1.33

Plag-olivine

phyric basalt

49.5 18.28 8.94 6.9 12.10 0.08

	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
98-112						

plag-olivine

phyric basalt

-1.8 0.60 191 89 162 95

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
98-112 (altered)							

plag-olivine

phyric basalt

49.0 17.33 9.24 6.1 12.11 0.20

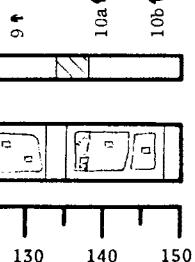
	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
98-112 (altered)						

plag-olivine

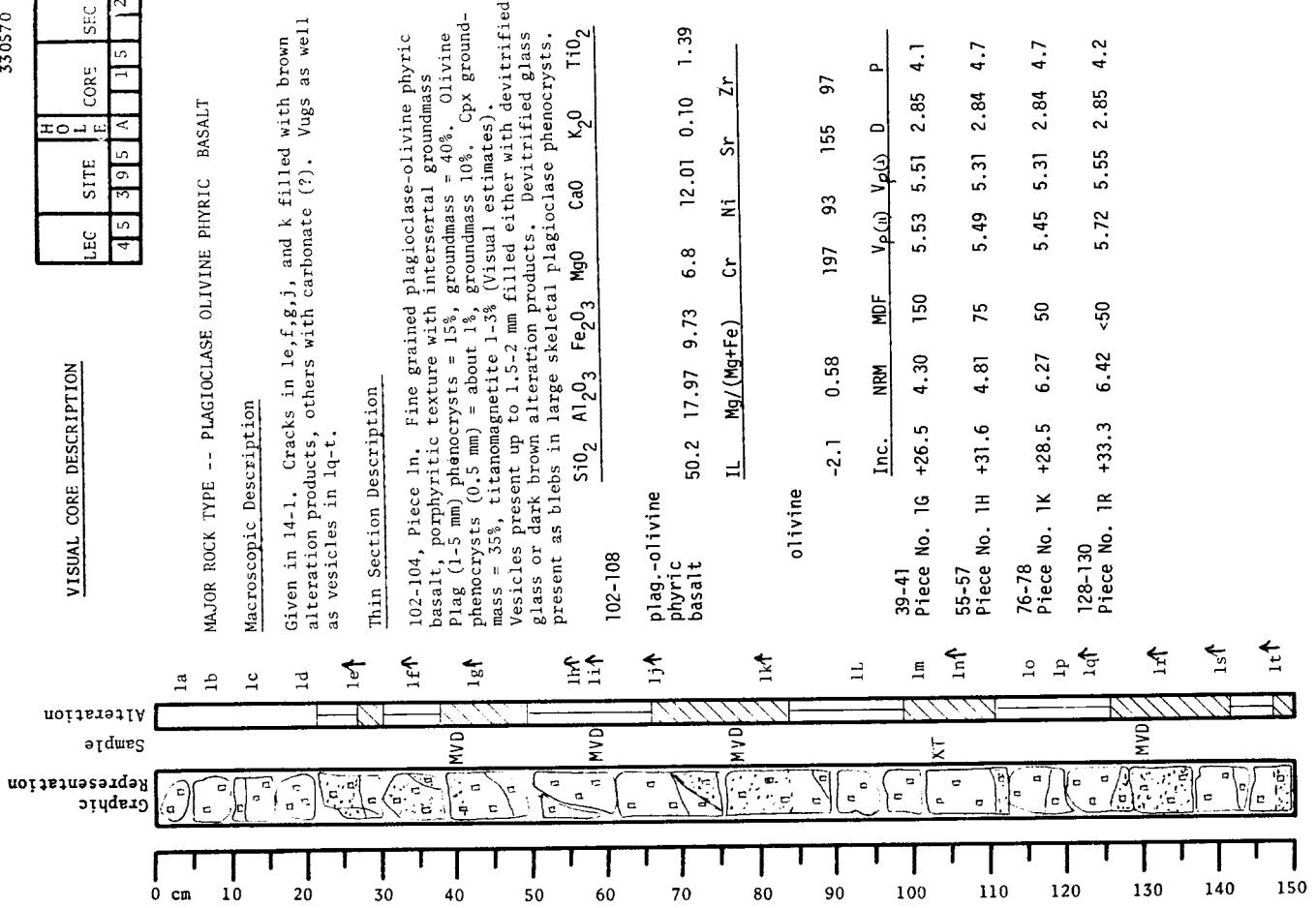
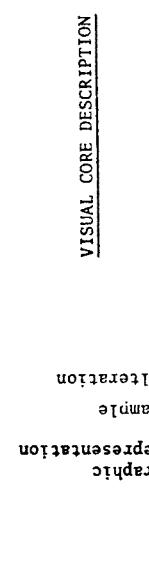
phyric basalt

-2.0 0.57 203 110 171 99

	Inc.	NRM	MDF	$V_p(\downarrow)$	$V_p(\downarrow \downarrow)$	D	P
116-118							
Piece No.	80	+17.7	1.87	110	5.65	5.37	4.3



		H	O	L	CORE	SEC
LEG	SITE	E	F	G	A	B
4	5	3	9	5	1	5
						12



330570

330570

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- PLAGIoclase-Olivine PHyric BASALT

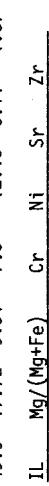
1a↑ Macroscopic Description
Given in 14-1.Thin Section Description

1c↑ 146-150 Piece 1p. Porphyritic interstitial fine-grained plagioclase-phryic basalt. Plag phenocrysts = 25%, olivine phenocrysts = less than 1%. Groundmass plag = 40%, cpx = 30% titanomagnetite = 5% (visual estimates) Plag = An₉₀-70° Vesicles form up to 2% of the rock. Some are partly filled with devitrified glass. Others are filled with yellow-gray clay minerals.



128-142

plag.-olivine phryic basalt
49.9 17.72 9.91 7.3 12.15 0.11 1.37



olivine

1H↑ -1.2 0.59 195 91 160 97

1i↑ 83-85 Piece No. 11 +39.0 6.48 <50 5.60 5.51 2.87 3.7

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

VISUAL CORE DESCRIPTION

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
					1 5 3 9 5 A 1 5 4

MAJOR ROCK TYPE -- PLAGIOCLASE-Olivine PHyric BASALT

1a↑ Macroscopic Description
Given in 14-1.

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
Piece No. 1M	+35.8	8.18	<50	5.61	5.59	2.87

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

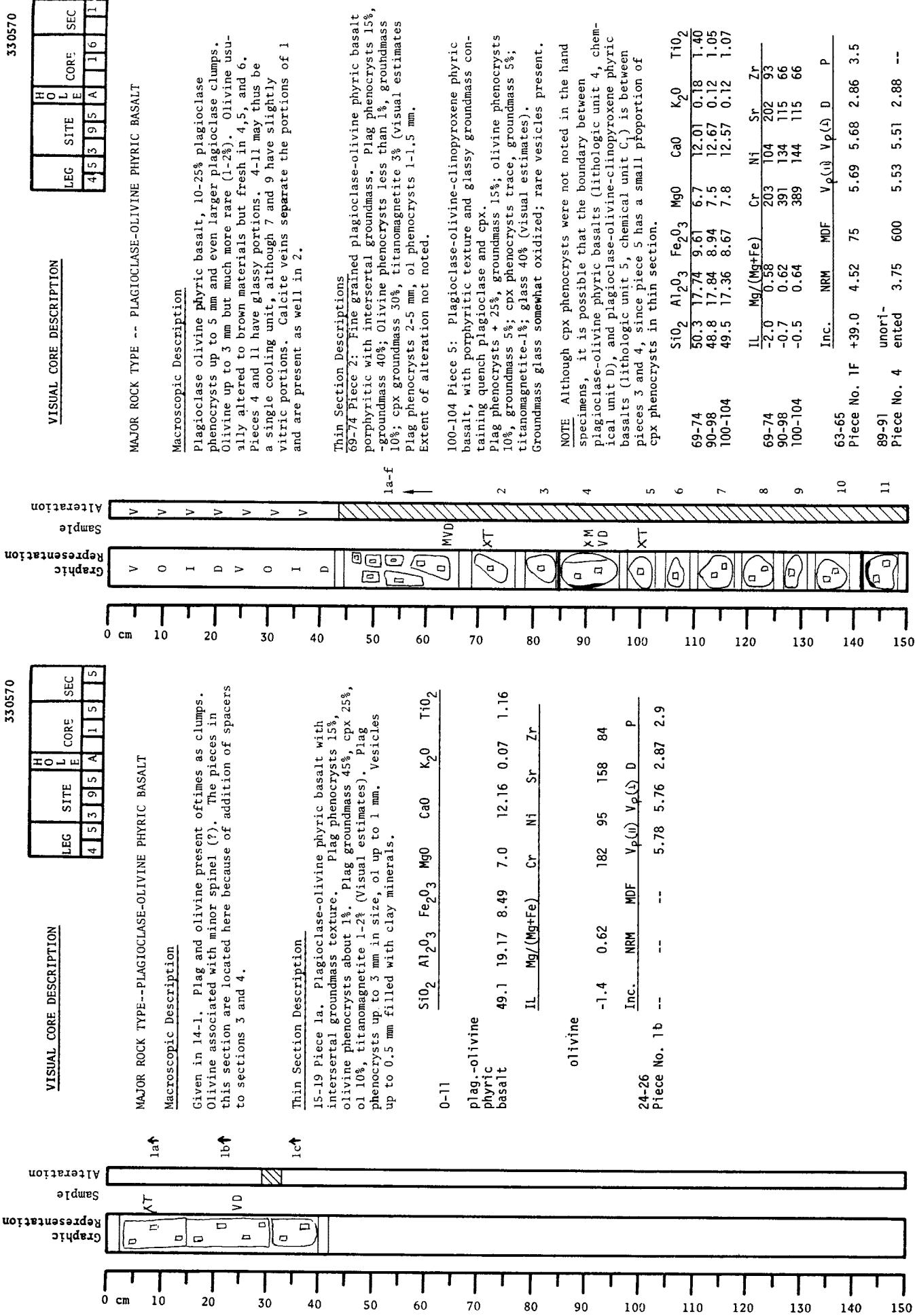
Given in 14-1

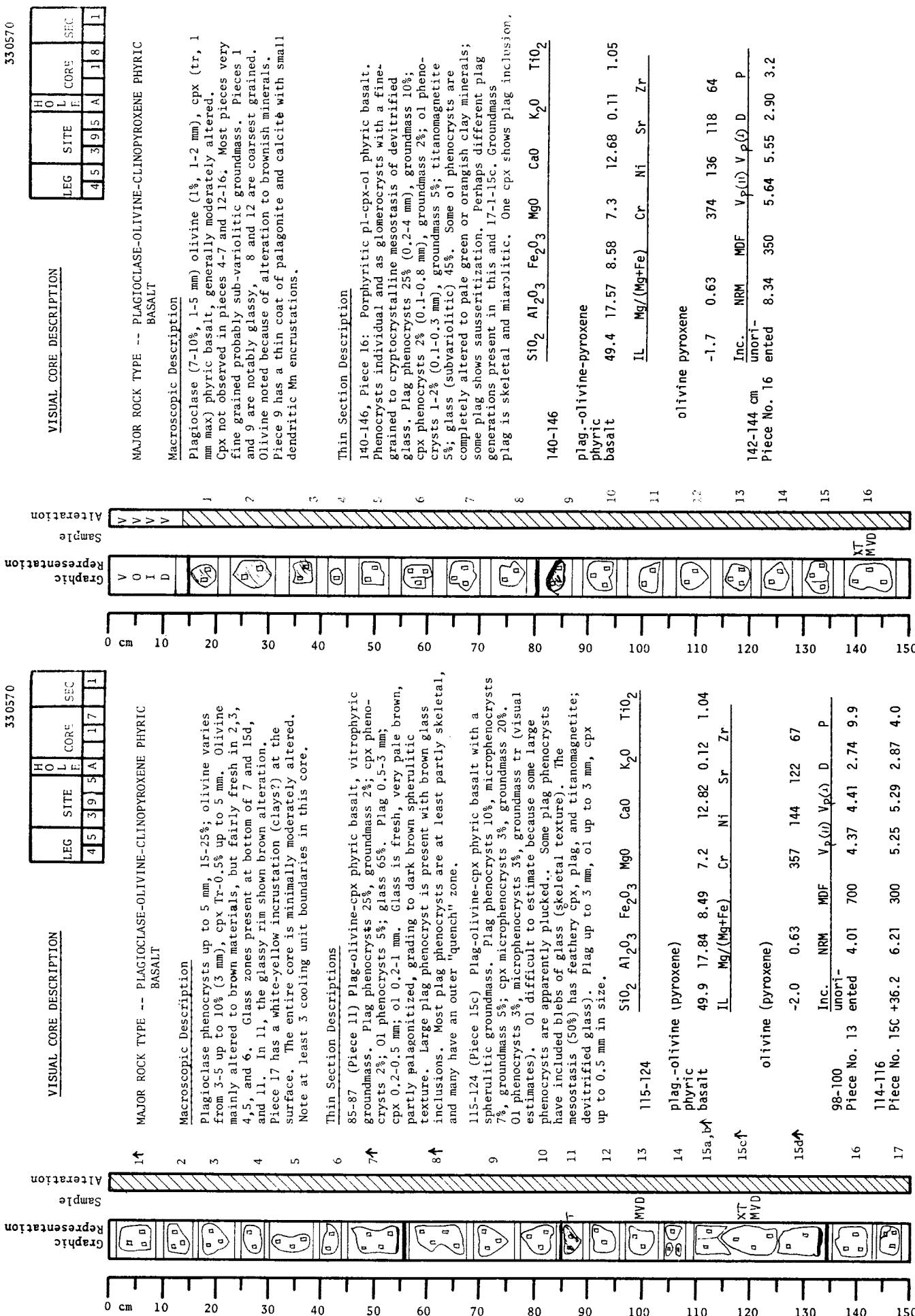
	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14-1

	Inc.	NRM	MDF	$V_p(\text{U})$	D	P
--	------	-----	-----	-----------------	---	---

Given in 14





LFG	SITE	H O	L	CORE	SEC
4	5	3	9	5	A
1	9	1	9	1	1

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPIROXENE PHRIC BASALT

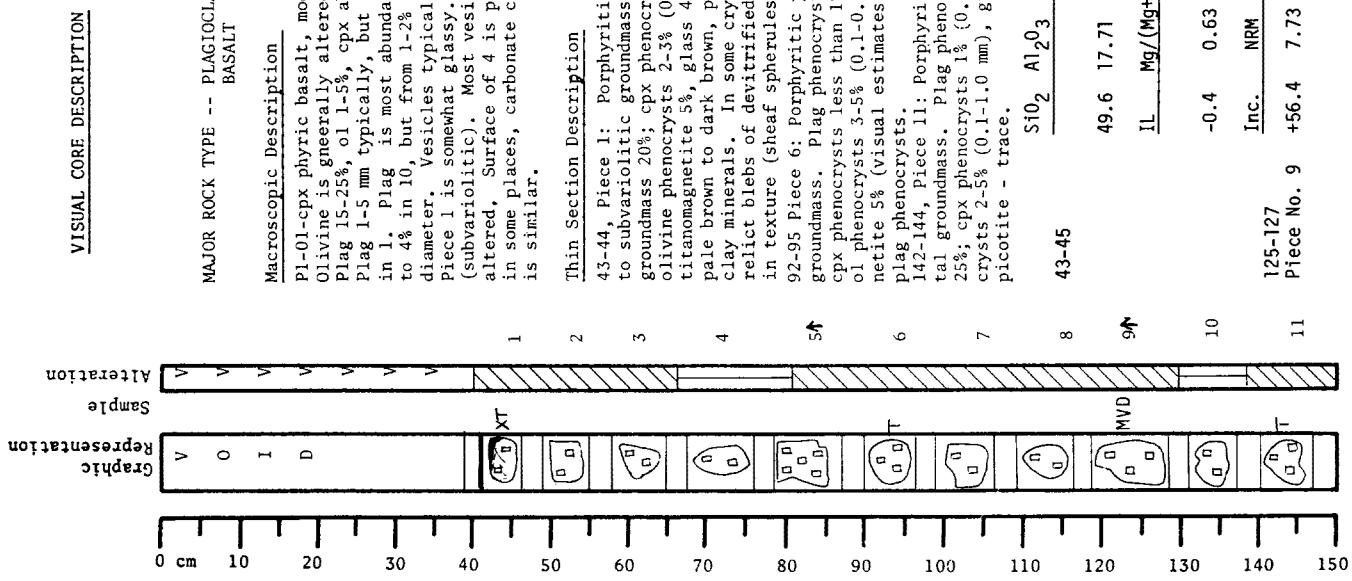
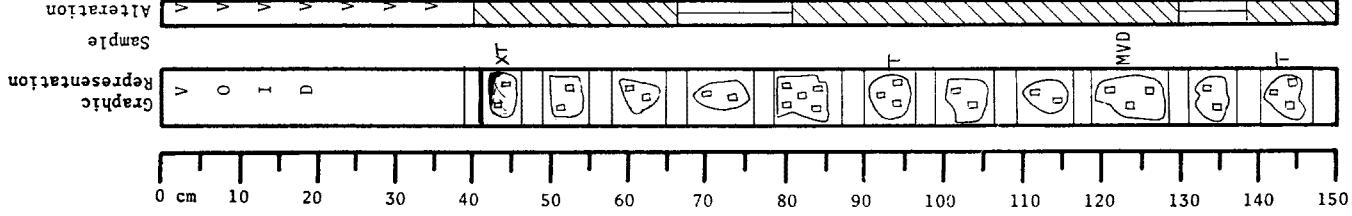
Macroscopic Description

Pl-ol-cpx phric basalt, moderately altered. Olivine is generally altered to brownish alteration minerals. Plag and ol phenocrysts from 1-5 mm. Plag:ol about 3:1 to 1:1 with cpx not as abundant in hand specimen. Piece 4 is not so porphyritic and somewhat coarser grained than 1-3 and 5. Important: weathered rinds on 1 and 3 indicate primary shapes. Imply rubble. Weathered surfaces darkened with Mn-oxides. Piece 2 has glassy edge. No orientation preserved.

	Plag	*	Ol	*	Cpx	*	Sum
1.	9%		9%		2%		20%
2	glass	21%		7%	2%	30%	inhomogeneous distribution
2 other	7%		7%	1%	15%		
3.	Too small to judge						
4.	7%		2%	1%	10%		
5.	7%		7%	1%	15%		
							*visual estimates

Thin Section Description

119-122 (Piece 2): Plag phenocrysts + microphenocrysts 35%, groundmass 10%; ol phenocrysts 2% (some plucked) groundmass Tr; cpx phenocrysts 1% groundmass 5%; titanomagnetite 2%; glass 45% (visual estimates). Plag 0.3 - 5 mm; ol 0.2-0.8 mm; cpx 0.1-0.7 mm). Some olivine altered to pale green to orange clays. Glassy groundmass is subvariolitic, and contains a vein partly filled with opaques and clays.



LEG	SITE	VISUAL CORE DESCRIPTION			CORE	SEC
		4	5	9		
		0	1	V		

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPIROXENE PHRIC BASALT

Macroscopic Description

Pl-01-cpx phric basalt, moderately to intensely altered. Olivine is generally altered to brownish alteration products. Plag 15-25%, ol 1-5%, cpx about 1% from piece to piece. Plag 1-5 mm typically, but there is a 1 cm plag phenocryst in 1. Plag is most abundant in 2 and 8. Vesicles are up to 4% in 10, but from 1-2% elsewhere, rarely more than 1 mm diameter. Vesicles typically have brown encrustation. Piece 1 is somewhat glassy. Others are very fine grained (subvariolitic). Most vesicular pieces (4 and 10) are most altered. Surface of 4 is partly covered with carbonate, and in some places, carbonate cover contains Mn spots. Piece 9 is similar.

Thin Section Description

43-44, Piece 1: Porphyritic plag-ol-cpx basalt, with glassy to subvariolitic groundmass. Plag phenocrysts 28% (2-4 mm), groundmass 20%; cpx phenocrysts less than 1% (0.1-0.3 mm), olivine phenocrysts 2-3% (0.1-0.2mm), groundmass trace; titanomagnetite 5%, glass 40% (visual estimates). Glass is pale brown to dark brown, partly altered to palagonite and clay minerals. In some crystals of plagioclase there are relic blebs of devitrified glass. Groundmass is spherulitic in texture (sheaf spherules), except where glassy, 92-95 Piece 6: Porphyritic plag-ol-cpx basalt, interstitial groundmass. Plag phenocrysts 30% (0.2-2.8 mm), groundmass 20%; cpx phenocrysts less than 1% (0.1-0.4 mm); groundmass 35%; ol phenocrysts 3-5% (0.1-0.5 mm), groundmass 5%; titanomagnetite 5% (visual estimates). Glass blebs in some larger plagioclase phenocrysts.

142-144, Piece 11: Porphyritic plag-ol-cpx basalt with interstitial groundmass. Plag phenocrysts 30% (0.2-6.0 mm), groundmass 25%; cpx phenocrysts 1% (0.1-1.2 mm), groundmass 35%; ol phenocrysts 2-3% (0.1-1.0 mm), groundmass trace; titanomagnetite 5%; picotite - trace.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
8	43-45						

Note circumferential weathered zones on 1 and 5. Back of 1 has possible glassy zone.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
9	49.6	17.71	9.20	8.0	12.85	0.16	1.07

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
10	-0.4	0.63	384	141	117	69	

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
11	125-127	In. Cr	NRM	MDF	V _P (u)	V _P (d)	D

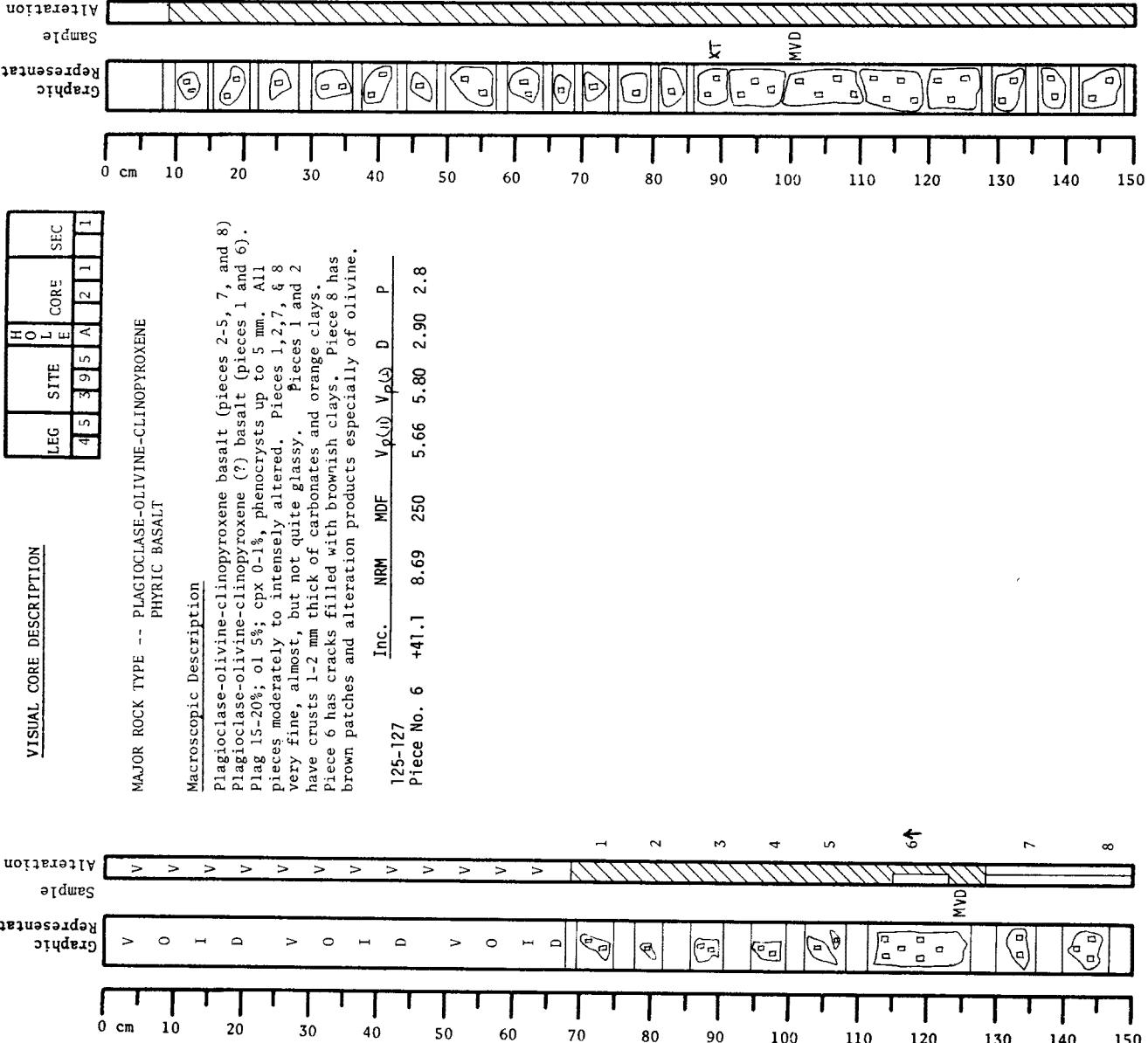
LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	1

MAJOR ROCK TYPE -- PLAGIoclase-OLIVINE-CLINOPYROXENE PHRYCIC BASALT

Macroscopic Description

Plagioclase-olivine-clinopyroxene basalt (pieces 2-5, 7, and 8). Plagioclase-olivine-clinopyroxene (?) basalt (pieces 1 and 6). Plag 15-20%; ol 5%; cpx 0-1%, phenocrysts up to 5 mm. All pieces moderately to intensely altered. Pieces 1,2,7, & 8 very fine, almost, but not quite glassy. Pieces 1 and 2 have crusts 1-2 mm thick of carbonates and orange clays. Piece 6 has cracks filled with brownish clays. Piece 8 has brown patches and alteration products especially of olivine.

Inc. NRM MDF V_P(V) V_P(D) D P
125-127
Piece No. 6 +41.1 8.69 250 5.66 5.80 2.90 2.80



LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	1

MAJOR ROCK TYPE--- PLAGIoclase-OLIVINE-CLINOPYROXENE PHRICIC BASALT

Macroscopic Description

Plag phenocrysts 15-20% - up to 10 mm long but most commonly about 1 mm, no apparent preferred orientation. Olivine phenocrysts 5-7%, mostly altered to brownish materials; up to 3 mm in diameter. Clinopyroxene less than 1% (few visible), pale emerald green in color not present in all pieces. Moderately to intensely altered, except for a few small (1 X 2 cm at surface) less altered portions in 13d. Calcite veins in 13c,d,e, 15,16, and 7. Groundmass fairly uniformly fine grained, with no glassy contacts.

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2

LEG	SITE	H O	L	CORE	SFC	SEC
4	5	3	9	5	A	2
</tbl_header

	V	H	O	L	CORE	SEC
LEG	V	V	V	V	V	V
	4	5	3	9	5	A
	2	4	1			

VISUAL CORE DESCRIPTION

CORE 24 SECTIONS 1 and 2; MAJOR ROCK TYPE -- PLAGIOLASE-OLIVINE CLINOPROXENE PHYLIC BASALT

Macroscopic Description

D V V V V V V
 Plagioclase 15-20% (1-10 mm, some larger giomeroocrysts), olivine 5-7% up to 3 mm, cpx tr-1%, rarely seen as large crystals 3-5 mm. Glass in section 1, piece 1, partly palagonitized) and piece 5; section 2, pieces 2, 14 (partly palagonitized) and 15). Vesicles generally 2-3%, 1-2 mm. Olivine is partially altered to brownish secondary minerals. Some calcite and zeolite (?) crack fillings. Some pieces are broken along cracks with a brownish (Mn^2+) coating. Section 1, piece 5 has a black "specular" mineral on its upper edge (probable crack filling).

Thin Section Description

T-125-T29#3 Plagioclase: plagioclase 20%; olivine 5%; cpx 1%. Groundmass: plagioclase 15%; olivine nil; cpx 15%; glass 40%; titanomagnetite 5%. Plag phenos contain glass blebs. Olivine locally altered to clays. Glass partially "devitrified".

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
125-129	V	V	V	V	V	V	V

plag-olivine-pyroxene

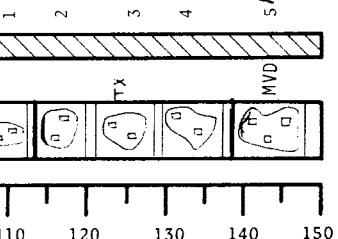
phylic basalt

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
-0.9	0.64	349	136	135	72

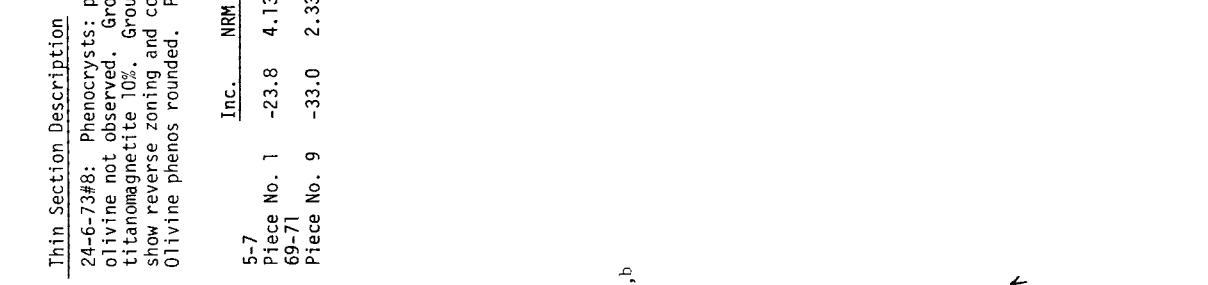
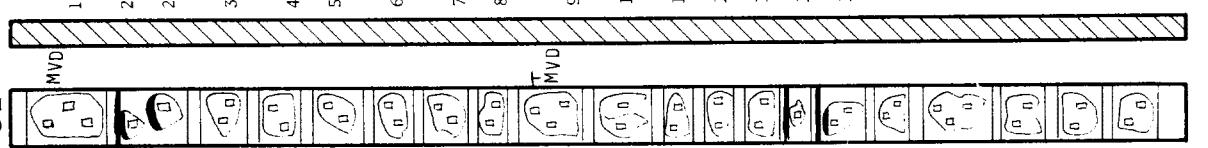
olivine-pyroxene

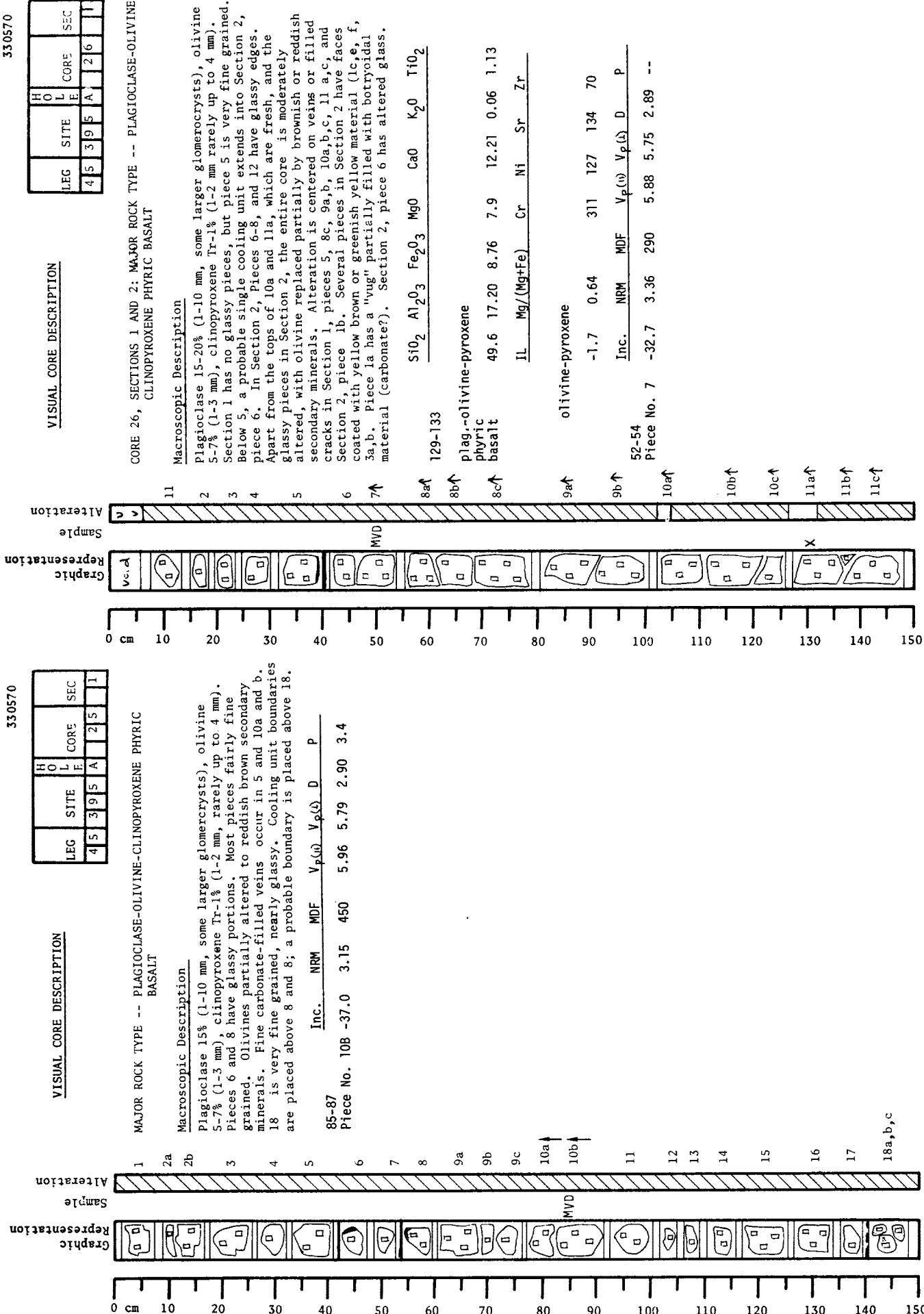
Inc. NRM MDF $V_{P(i)}$ $V_{P(j)}$ D P

Piece No.	5	-39.1	2.92	500	5.15	5.11	2.84	--
143-145								



Graphic Representation





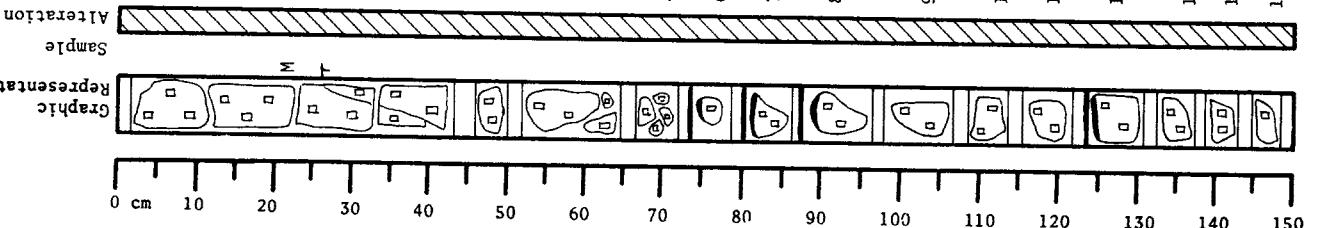
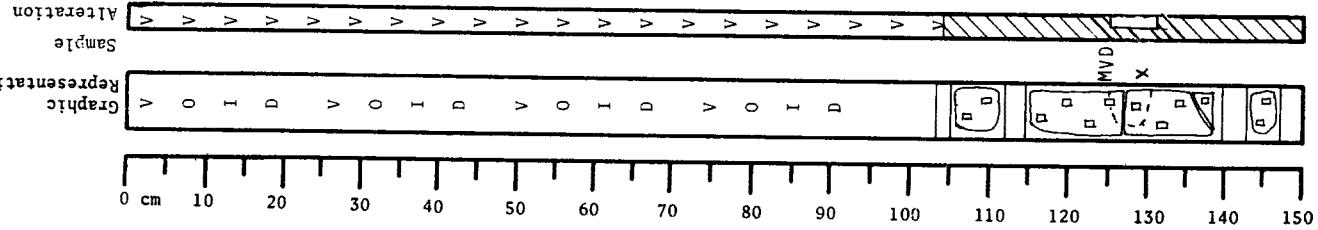
LEG	SITE	VISUAL CORE DESCRIPTION			CORE	SEC		
		H O	L E	SITE				
4	5	3	9	5	A	2	7	1

VISUAL CORE DESCRIPTIONThin Section Description

26-2-25-33 #1c
 Phenocrysts: plagioclase 35%; olivine 10%; cpx tr. Groundmass:
 Plagioclase 20%; cpx 20%; olivine 5%; titanomagnetite 10%.
 Plag An₇₅ Ab₂₅ ol approx Fo₈₅. Trace of picotite present. Plagioclase 254 mm. Cpx 2 mm. ol 3 mm. Ol phenos rounded. Groundmass texture subophitic. No alteration information given.

1c↑ 21-23 Inc. NRM MDF V_{P(i)} V_{P(ii)} D P
 1d↑ 21-23 -31.4 6.01 300 -- -- -- --

1e↑
 1f↑



LEG	SITE	VISUAL CORE DESCRIPTION			CORE	SEC		
		H O	L E	SITE				
4	5	3	9	5	A	2	7	1

VISUAL CORE DESCRIPTIONCORE 27 SECTIONS 1 AND 2: MAJOR ROCK TYPE -- PLAGIOLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALTMacroscopic Description

Plagioclase 10-20%, more typically 15-20% (1-10 mm, except for glomerocrysts, up to 2 cm), olivine 5-7% (1-3 mm), clinopyroxene Tr-1% (1-3 mm). Vesicles up to 3% (1-2 mm), locally filled with bluish-gray or yellowish material. Glass in Section 2, piece 4. Tiny, carbonate-filled veinlets in Section 1, Pieces 2a-c, Section 2, pieces 2a,b. Section 2, piece 4 has plagi megacrysts (up to 2 cm) with glassy inclusions. Largest clinopyroxene (8 mm) occurs in 2-4; cpx up to 3 mm is in 2-7. Entire core is generally moderately altered. Plag is least (around 10%) in 1-1.

LEG	SITE	VISUAL CORE DESCRIPTION			CORE	SEC		
		H O	L E	SITE				
4	5	3	9	5	A	2	7	1

LEG	SITE	VISUAL CORE DESCRIPTION			CORE	SEC		
		H O	L E	SITE				
4	5	3	9	5	A	2	7	1

Macroscopic Description

Plagioclase 10-20%, more typically 15-20% (1-10 mm, except for glomerocrysts, up to 2 cm), olivine 5-7% (1-3 mm), clinopyroxene Tr-1% (1-3 mm). Vesicles up to 3% (1-2 mm), locally filled with bluish-gray or yellowish material. Glass in Section 2, piece 4. Tiny, carbonate-filled veinlets in Section 1, Pieces 2a-c, Section 2, pieces 2a,b. Section 2, piece 4 has plagi megacrysts (up to 2 cm) with glassy inclusions. Largest clinopyroxene (8 mm) occurs in 2-4; cpx up to 3 mm is in 2-7. Entire core is generally moderately altered. Plag is least (around 10%) in 1-1.

LEG	SITE	VISUAL CORE DESCRIPTION			CORE	SEC		
		H O	L E	SITE				
4	5	3	9	5	A	2	7	1

plag.-olivine-pyroxene
 phyr. basalt

LEG	SITE	VISUAL CORE DESCRIPTION			CORE	SEC		
		H O	L E	SITE				
4	5	3	9	5	A	2	7	1

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

SiO₂ Al₂O₃ FeO₃ MgO CaO K₂O TiO₂

127-131

plag.-olivine-pyroxene

phyr. basalt

49.6 16.90 8.84 8.3 12.11 0.06 1.13

1L Mg/(Mg+Fe) Cr Ni Sr Zr

121-123 Piece No. 2A -30.2 3.78 200 5.67 5.73 2.89 --

33057.0

	H	O	L	CORE	SEC
LEG	SITE		E		
4	5	3	9	5	A
				2	8
				1	

VISUAL CORE DESCRIPTION

LEG	SITE	H	O	L	CORE	SEC
4	5	3	9	5	A	2

VISUAL CORE DESCRIPTION

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
23-25	-33.7	6.47	180	5.73	5.66	2.89	--
Piece No. 1C							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
145-147	-31.4	3.16	550	5.46	5.66	2.87	--
Piece No. 11							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
1d†							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
2a†							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
2b†							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
3							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
4							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
5							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
6							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
7							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
8							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
9							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
10							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
11							

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
12							

33057.0

	H	O	L	CORE	SEC
LEG	SITE		E		
4	5	3	9	5	A
				2	8
				1	

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE PHYRIC BASALT.Macroscopic Description

Beginning of lithologic unit 9 chemical unit C-3. Plagioclase 10-20%, olivine 3-5%. Clinopyroxene not noticed in any hand specimens. Olivine is generally partially altered to reddish-brown secondary minerals. Pieces are generally moderately altered, but 2 has some intensely altered portions. Vesicles are 1-3%, about 1 mm, oftentimes filled with secondary minerals, gray or dark green in color. Piece 1 has tiny black spots (Mn oxides?) on a weathered surface. Glass is present at the top of 9a. 9b and c have slightly coarser groundmass than 9a.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
1	51.0	14.0	1.0	10.0	1.0	0.0	0.0
2	51.0	14.0	1.0	10.0	1.0	0.0	0.0

plag.-olivine phyric basalt

	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
3	58-60	29.6	1.65	450	4.85	4.91
4	58-60	29.6	1.65	450	4.85	4.91

olivine

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
5							
6							

olivine

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
7							
8							

olivine

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
9							
10							

olivine

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
11							
12							

olivine

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
13							
14							

olivine

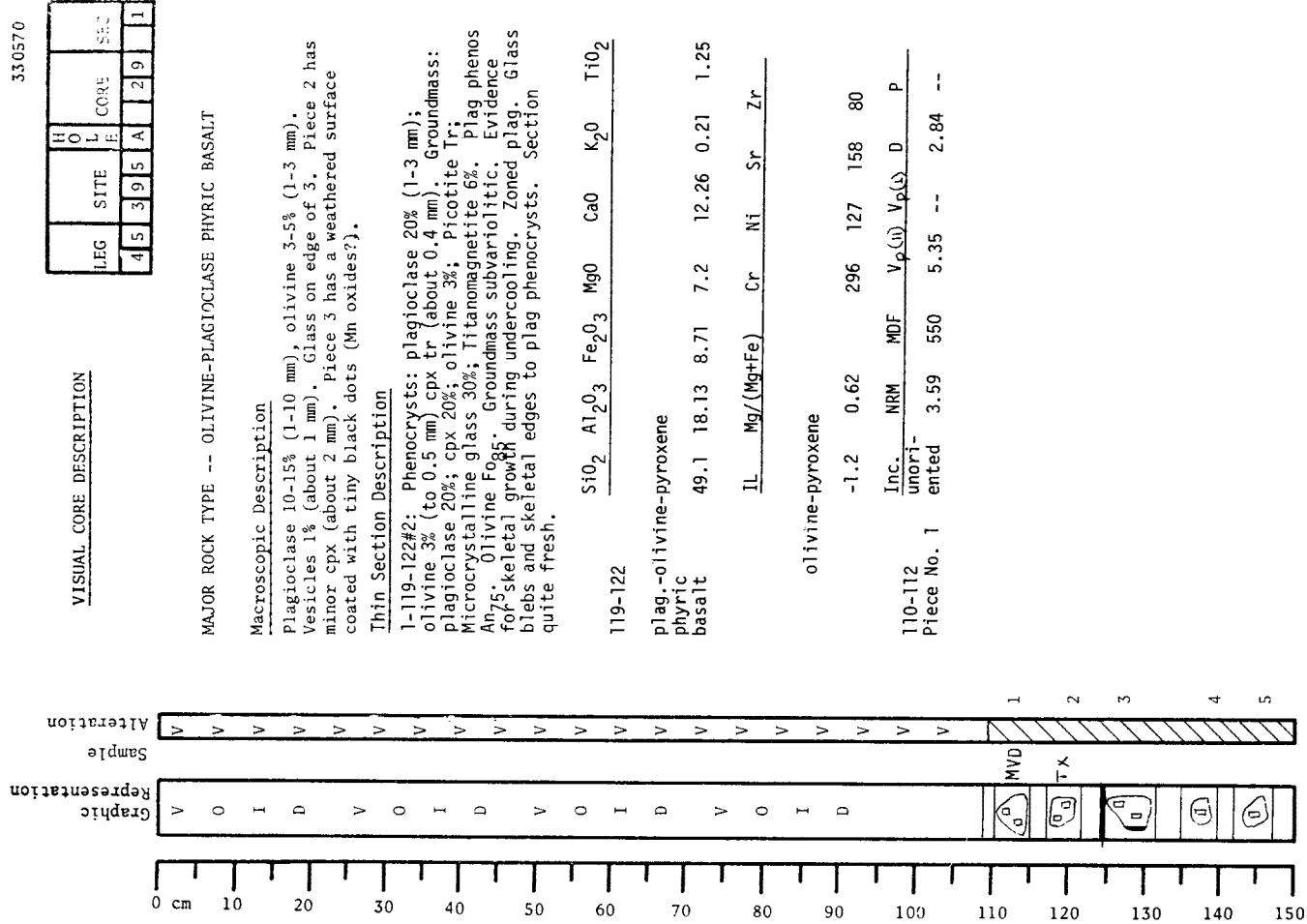
	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
15							
16							

olivine

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
17							
18							

olivine

	Inc.	NRM	MDF	$V_p(\omega)$	$V_p(\zeta)$	D	P
19							
20							



LEG	SITE	H E	L E	CORE:	SEC:
4	5	3	9	5	A
4	5	3	9	5	A

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -PLAGIoclase-Olivine PHyric BASALT AND PLAGIoclase-Olivine-CLINOPYROXENE PHyric BASALT

Macroscopic Description

1: cuttings in 3 cc bottle

2, 4-11, 13, and 14:

Plagioclase 25-30% (1-10 mm, with some large glomerocrysts), olivine 3-5%. Vesicles 1% (less than 1 mm.). Olivine partly altered to reddish brown secondary minerals, especially near cracks. No variation in groundmass texture or grain size. No glassy zones. Faint 0.5-1 cm weathered zones on #2, 3, and 9. 13 is 6 small pieces of basalt in a plastic bag.

3, 12: Plagioclase-20-25% (1-10 mm), olivine 3-5% (1-3 mm), clinopyroxene Tr (1-2 crystals per rock). In 12, cpx appears intergrown with plagioclase.

Thin Section Descriptions

1 1-63-67#3 and 1-70-16#4: Both very similar. Phenocrysts: plagioclase 20% (2-6 mm); olivine 3% (1-2 mm); cpx nil.

2 Groundmass: Plag 25-30%; ol 10%; cpx 20% (#4), nil (#3).

#3 has more groundmass glass than #4 (40% versus 10%). Glass microcrystalline - subvariolitic in #3. Trace of picotite present in both. Plag is An75. Olivine altering to clays.

1-83-87#6 is very similar to #4.

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

63-67

plag.-olivine-pyroxene

6 pyric basalt

7↓ IL Mg/(Mg+Fe) Cr Ni Sr Zr

5

4a↑

4d↑

4e↑

5↑

8↑

9↑

10

11

12

13

14

90-92

Piece No. 7

-37.2

1.67

550

5.90

5.91

2.86

4.4

P

Sample
Alteration

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- VOLCANIC BRECCIA WITH SUBDIABASIC OLIVINE-PLAGIoclase-PHYRIC BASALT FRAGMENTS IN CLAY AND/OR CARBONATE-CEMENTED MATRIX.

Macroscopic Description

Sections 1 and 2: The breccia contains basalt clasts 0.5-20 cm long, angular to rounded. The matrix contains sand-sized basalt and mineral grains (mostly plagioclase) and is yellowish to orange in color probably from clays and ferruginous secondary minerals after glass and olivine. There are tiny carbonate veins in the matrix and some of the clasts, as well as around some of the clasts. Basalt clasts have about 15% plagioclase phenocrysts, 5% olivine phenocrysts. Plag ranges from 0.1 to 4 cm. Olivine typically 1-3 mm.

Pieces 1-4e and 1-5 may have shear-oriented breccia matrix next to large clasts. The matrix of pieces 2-7b, c, and 2-8, b, c is partly hyaloclastite. Pieces 2-, 3, and 4 are isolated plagioclase-olivine phryic basalt, but probably were large cobbles in the breccia. The breccia in 2-5a-c appears to have two types of clasts - medium grained pl-ol phryic basalt, and fine grained (probably vitric) pl-ol phryic basalt.

Thin Section Description 1-115-118#fe. Clasts of basalt, medium grained, with plag phenos in a breccia of broken plag fragments. Olivine completely altered to clays. Cemented with about 10% calcite.

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

54-62
breccia matrix
IL Mg/(Mg+Fe) Cr Ni Sr Zr

54-62
approx. depth (m) 352
4e↑ breccia clast
IL Mg/(Mg+Fe) Cr Ni Sr Zr

-7.7 0.59 238 165 172 70
SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

49.6 18.79 8.73 5.5 13.90 0.15 1.19
IL Mg/(Mg+Fe) Cr Ni Sr Zr

-3.1 0.55 287 111 177 80
Inc. NRM MDF V_{p(w)} V_{f(w)} D P

6 54-56 Piece No. 3A +31.4 1.82 75 4.51 4.68 2.68 --

7↑ 117-119 +55.0 2.75 75 un- -- -- --

stable

P

	H	O	L	CORE	SFC
LEG	SITE	LEG	SITE	LEG	SITE
4	5	3	9	5	A
5	11	3	9	5	A

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE: PLAGIOCLASE-OLIVINE PHYRIC BASALT, LESSER PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT
 Macroscopic Description
 Plagioclase 15-20% (1-10 mm), olivine 3-5% (1-3 mm) in all but 2, which has less than 1% clinopyroxene in addition to plagioclase and olivine. The entire section is moderately to intensely altered. Pieces 4, 5a, 8, and 12 contain glass rinds which are partly altered to palagonite. These probably indicate the margins of pillow lavas. Pieces 5b, 8, 10, 11 and 14 have carbonate-coated surfaces. Large plagioclase megacrysts (1-2 cm) occur in 1, 4, 8, 9, 10, and 15.

	H	O	L	CORE	SFC
LEG	SITE	LEG	SITE	LEG	SITE
4	5	3	9	5	A
5	11	3	9	5	A

VISUAL CORE DESCRIPTION

- 1 ↑ 2-40-43#5c: Carbonate-cemented breccia; clastic texture. Clasts: plagioclase basalts with glassy groundmass (25%). Single plagioclase grains (25%). Olivine (about 1%) now clays and 80% carbonates. Matrix (45%) about 20% clays.
 2 2-56-58#7a: basalt clast in breccia. Phenocrysts: plagioclase 25% (1-2.5 mm); olivine 5% (.5-1.5 mm); cpx nil. Groundmass plagioclase 30%; cpx 30%; olivine 3%; titanomagnetite 3%. Olivine is partly replaced by carbonate and iddingsite. Plag phenos contain glass blebs (skeletal interiors). Plag is An 75.
 3 2-110-113#8c: Carbonate-cemented breccia: texture clastic-autoclastic. Clasts 40% (.5-3 cm). Matrix: carbonate 25%; clays 35%. Clasts are basaltic 80% (of clasts); vitreous 15%; crystals of plag 5%. Vitreous fragments and portions of matrix altered to palagonite. Plag in clastes partially replaced by carbonate.

Thin Section DescriptionsIL Mg/(Mg+Fe)Cr Ni Sr ZrInc. NRM MDF V_{P(1)} D P7a↑ 56-637b↑7c↑ 56-587d↓ Piece No. 7A133-135Piece No. 9B8a↑8b↓8c↑9a↑9b↓10↓111213141516VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE: PLAGIOCLASE-OLIVINE PHYRIC BASALT, LESSER PLAGIOCLASE-OLIVINE-CLINOPYROXENE PHYRIC BASALT
 Macroscopic Description
 Plagioclase 15-20% (1-10 mm), olivine 3-5% (1-3 mm) in all but 2, which has less than 1% clinopyroxene in addition to plagioclase and olivine. The entire section is moderately to intensely altered. Pieces 4, 5a, 8, and 12 contain glass rinds which are partly altered to palagonite. These probably indicate the margins of pillow lavas. Pieces 5b, 8, 10, 11 and 14 have carbonate-coated surfaces. Large plagioclase megacrysts (1-2 cm) occur in 1, 4, 8, 9, 10, and 15.

SampleRepresentationGraphiticMVD0 cm102030405060708090100110120130140150

	VISUAL CORE DESCRIPTION					
	LEG	SITE	H O	L	CORE	SEC
	4 5	3 9	5 A	3 3	3	2

MAJOR ROCK TYPES -- PIECES 1-8 PLAGIOCLASE-OLIVINE PYHRIC BASALT; PIECES 9-15 FINE GRAINED APHYRIC BASALT AND APHYRIC BASALT BRECCIA

Macroscopic Description

The upper part of the section (pieces 1-8) are a continuation of the lithologic unit described in 33-1, except there are no plagioclase-olivine-clinopyroxene pyritic basalts, only plagioclase-olivine pyritic basalts. Phenocryst abundances and sizes are similar. Olivine is partly altered to reddish brown secondary minerals. 1a contains carbonate veinlets associated with black spots (Mn?). 3 contains a cavity (1 cm diameter) filled with carbonate. 8, which is in a small plastic bottle, has a glassy rind (and thus could be the base of a flow). It is the deepest pyritic basalt recovered in 335A.

5 Pieces 9-15 include large angular cobbles (3-20 cm long) of fine-grained apphyric basalt set in a carbonate cemented matrix with fragments of basalt and basaltic glass, mostly altered to a yellowish brown. The larger clasts are very fine grained, nearly glassy. The proportion of vesicles varies (Piece 9, 2% (1/4 mm); 10, 5% (1/2-1 mm); 11, 1% (1/4 mm); Piece 9 also has one or two plagioclase phenocrysts. Pieces 15a and 15b have no coating of matrix material, but may be a large clast in the matrix.

Thin Section Description 2-107-109 #13: Autoclastic breccia. Apphyric basalt; dark brown to black, locally red (oxidized and partially carbonized). No carbonate cement. Much is fine grained to glassy. Matrix is mostly clays. Rest is sub-variolitic with elongate radiating plagioclase bundles.

Inc. NRM Mf. Vp(?) Vp(?) D P

8-10 Piece No. 1A -36.1 1.84 550 5.87 5.80 2.87 4.0

130-132 Piece No. 15B -47.8 6.43 650 5.79 5.86 2.87 --

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

9-13 plagioclase olivine

pyritic basalt 50.0 18.44 8.89 7.3 12.53 0.17 1.13

11. Mg/(Mg+Fe) Cr Ni Sr Zr

127-129 olivine

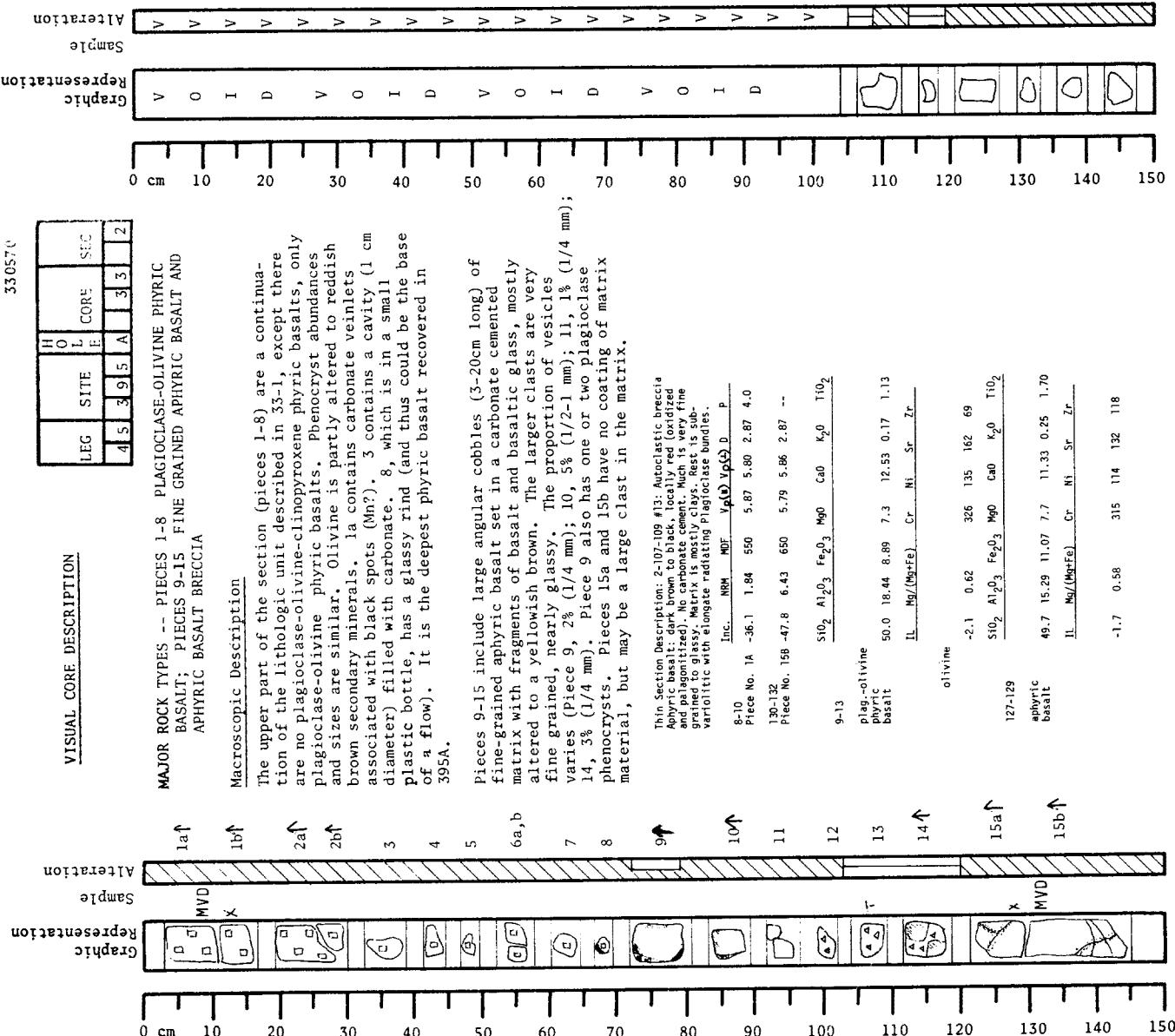
-2.1 0.62 326 135 162 69

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

15a apphyric basalt 49.7 15.29 11.07 7.7 11.33 0.25 1.70

11. Mg/(Mg+Fe) Cr Ni Sr Zr

15b apphyric basalt -1.7 0.58 315 114 132 118



VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- APIHYRIC BASALT

Macroscopic Description

Fine-grained apphyric basalt, with no more than 1 plagioclase phenocryst in 3-6, and none in 1 and 2. 1-3 have pale brownish gray altered rinds and thin carbonate incrustations. The rinds may indicate the original surface of the pieces. All pieces are moderately to intensely altered.

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- APIHYRIC BASALT

Macroscopic Description

Fine-grained apphyric basalt, with no more than 1 plagioclase phenocryst in 3-6, and none in 1 and 2. 1-3 have pale brownish gray altered rinds and thin carbonate incrustations. The rinds may indicate the original surface of the pieces. All pieces are moderately to intensely altered.

	LEG	SITE	H O	L	CORE	SEC
	4 5	3 9	5 A	3 3	3	1

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- APIHYRIC BASALT

Macroscopic Description

Fine-grained apphyric basalt, with no more than 1 plagioclase phenocryst in 3-6, and none in 1 and 2. 1-3 have pale brownish gray altered rinds and thin carbonate incrustations. The rinds may indicate the original surface of the pieces. All pieces are moderately to intensely altered.

	V	H	O	L	CORE	SITE	E		
LEG	4	5	3	9	5	A	3	5	1

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

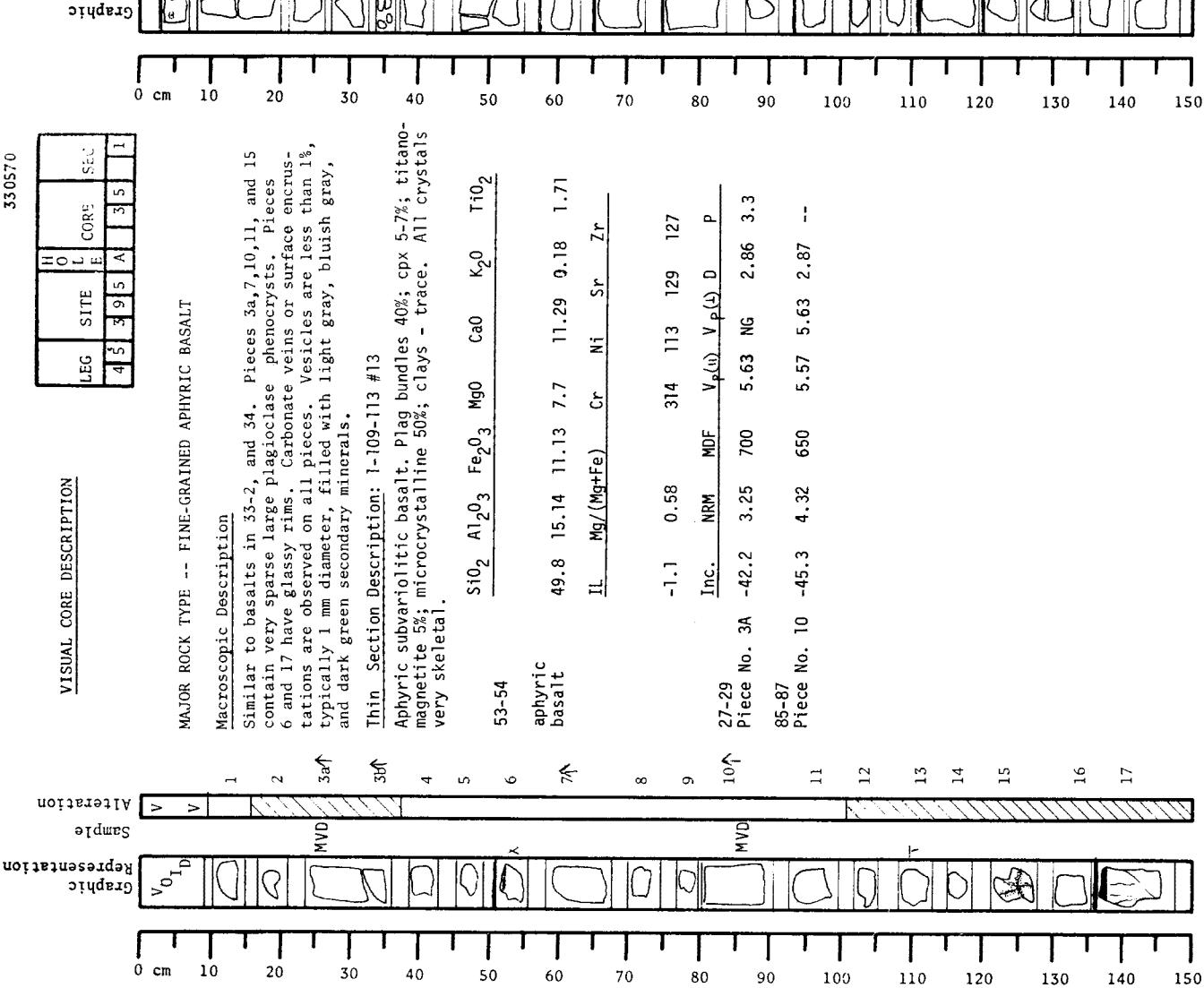
Similar to basalts in 33-2, and 34. Pieces 3a, 7, 10, 11, and 15 contain very sparse large plagioclase phenocrysts. Pieces 6 and 17 have glassy rims. Carbonate veins or surface encrustations are observed on all pieces. Vesicles are less than 1%, typically 1 mm diameter, filled with light gray, bluish gray, and dark green secondary minerals.

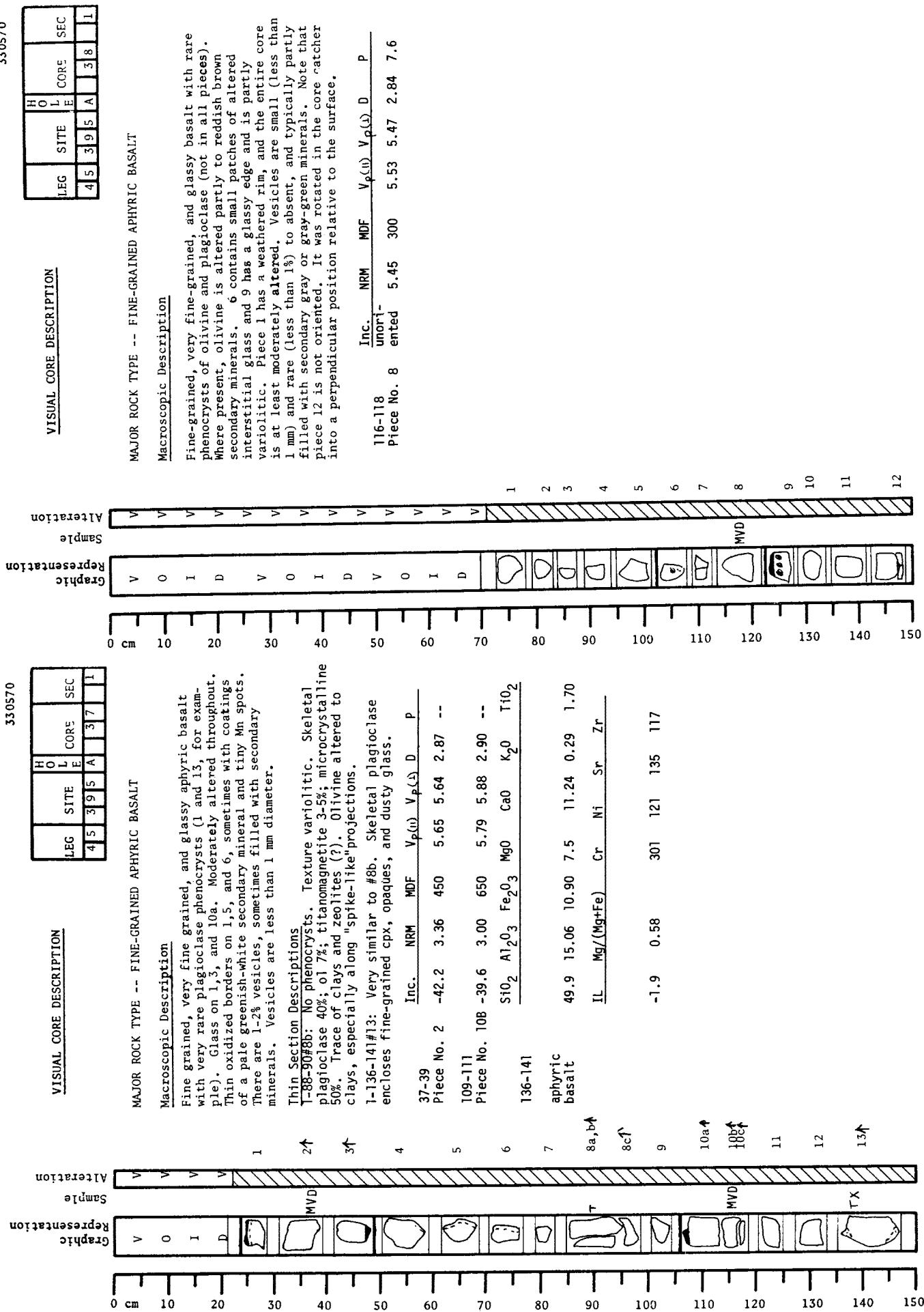
Thin Section Description: 1-109-113 #13

Aphyric subvariolitic basalt. Plag bundles 40%; cpx 5-7%; titanomagnetite 5%; microcrystalline 50%; clays - trace. All crystals very skeletal.

IL	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
	49.8	15.14	11.13	7.7	11.29	9.18	1.71

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr





330570

330570

	LEG	SITE	H O	L CORE	E	S.E.C.
	4 5	3 9	5	A	3 9	1

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt. Rare plagioclase phenocrysts in isolated pieces, and typical small vesicles less than 1 mm diameter and 1% in abundance filled with whitish or greenish secondary minerals. Piece 8 is partly glassy and variolitic. Where plagioclase is seen (2 and 8, for example) it can be fairly large, up to 5 mm. The entire core is moderately altered.

Thin Section Description

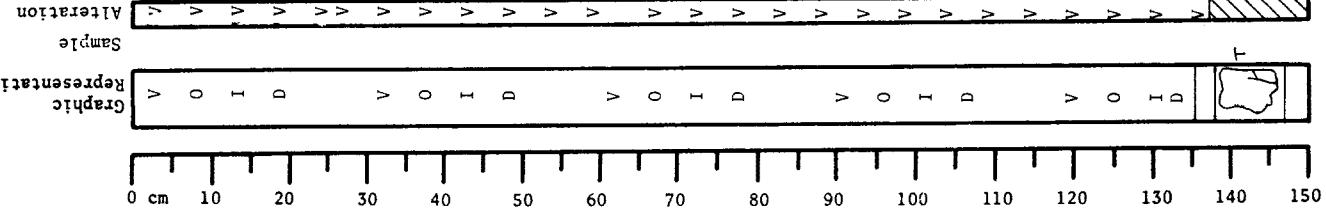
1-102-107#3: Aphyric variolitic olivine basalt: 40% skeletal plagioclase needles 0.01 x 0.6 mm enclosing cpx, opaques, and dustv glass. Matrix is 50% of rock, composed of feathery cpx, anhedral plag, and rare opaques and clay minerals. Olivine about 5%, skeletal micromphenocrysts 0.04 x 0.2 mm.

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

102-107

IL Mg/(Mg+Fe) Cr Ni Sr Zr

-1.9 0.58 306 128 129 122



1↑

T

	LEG	SITE	H O	L CORE	E	S.E.C.
	4 5	3 9	5	A	3 9	1

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

A single piece of fine-grained aphyric basalt, moderately altered, with very rare plagioclase phenocrysts. On the surface, subvariolitic textures formed by quench plagioclase laths can be seen. The piece is cut by carbonate veinlets. A weathered surface on the piece is coated by zeolite (?) with black spots (Mn?).

Thin Section Description

1-143-148#1: Olivine basalt with intersertal texture (locally looking nearly variolitic). Plag crystals 40% (.03 x .2 mm); olivine 5% (.04 mm anhedral, granular mostly, but locally -skeletal). Opaques 5%. Microcrystalline matrix 50% composed of feathery cpx, plag, opaque and clay mineral intergrowths.

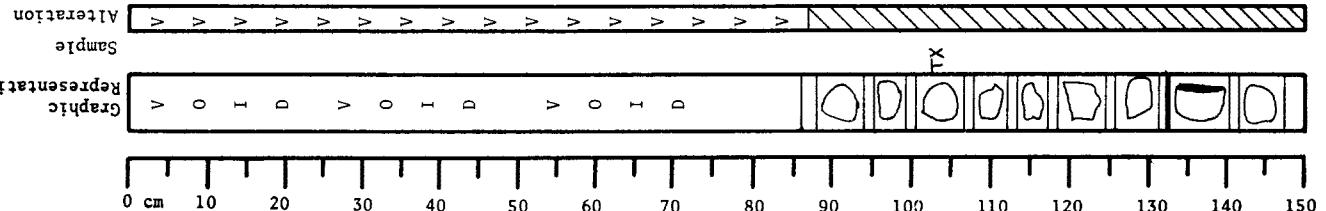
143-145
Piece No. 1 -46.2 5.03 500 5.78 -- 2.84 --

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

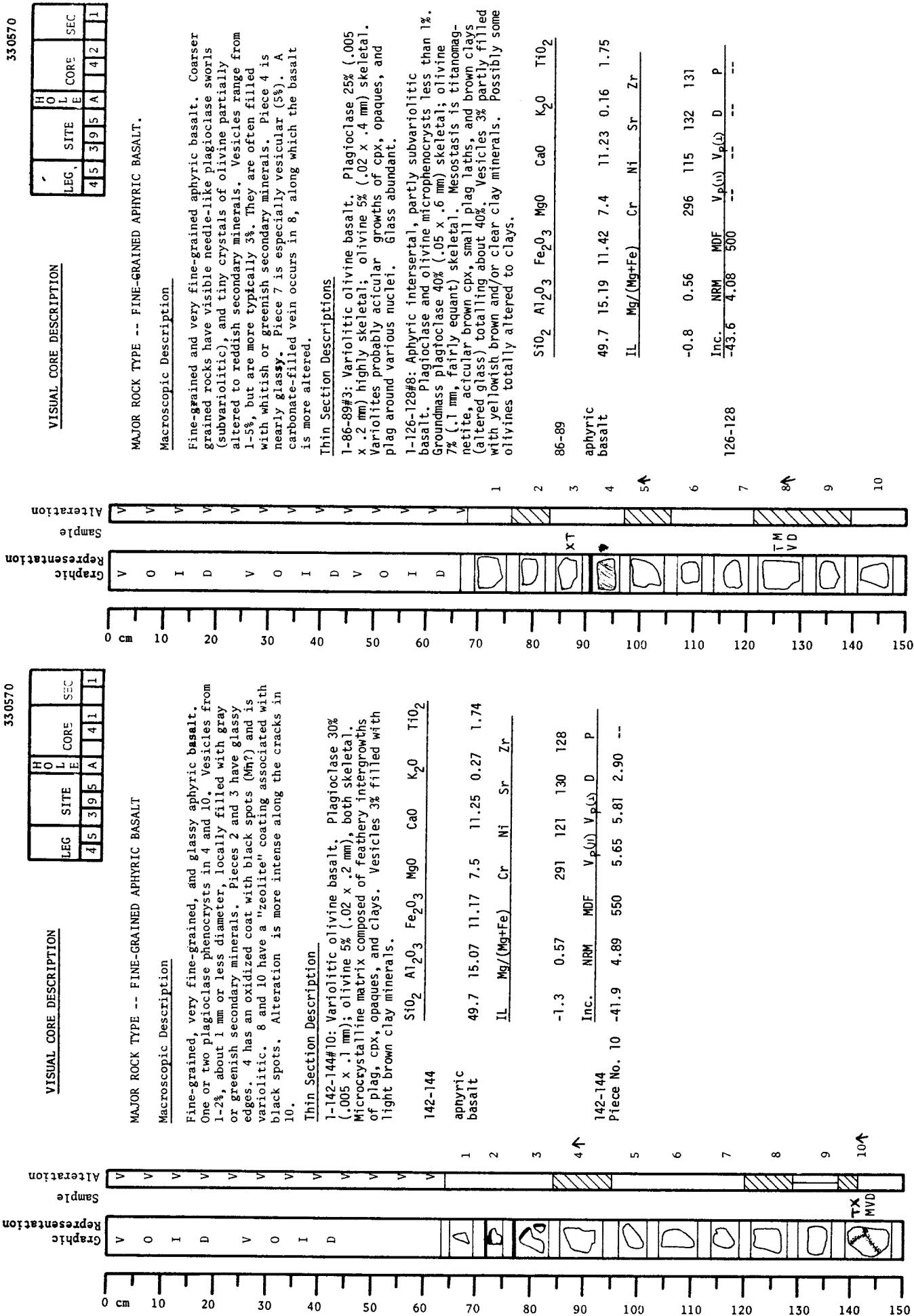
aphyric basalt

IL Mg/(Mg+Fe) Cr Ni Sr Zr

1.9 0.58 306 128 129 122



X



330570

VISUAL CORE DESCRIPTION		LEG	SITE	H O L E	CORE	SEC		
4	5	3	9	5	A	4	3	1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained vesicular (1-3%, 1 mm diam.) aphyric basalt. 5 is the most vesicular and the freshest. Pale brown alteration rims occur on 1-4.

Thin Section Description

1-132-134#3: Subvariolitic olivine basalt. Plagioclase 40% (.01- .5 mm) skeletal; cpx 30% (.005 mm long) skeletal; olivine 5% (.02 x .2 mm) skeletal. Titanomagnetite 5% (.003 mm equant or as chains) skeletal. Interstitial material 20% micromafic cpx, opaque, plagioclase, glass altered to brownish clays.

No Recovery 45-395A-44-1

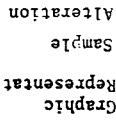
330570

VISUAL CORE DESCRIPTION		LEG	SITE	H O L E	CORE	SEC		
4	5	3	9	5	A	4	5	1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt. There are 1-3% vesicles (3% on 1, 2% on 2). Pieces 2 and 3 have glassy rims. Piece 1 is intensely altered. On its surface is a rust-colored coating with zeolites (?). A zeolite (?) encrustation is also found on 3.

SiO₂Al₂O₃Fe₂O₃MgOCaOK₂OTiO₂ILMg/(Mg+Fe)CrNiSrZr-1.10.56286111131131

Graphical Representation

Sample

0-150 cm alteration profile. Vesicular (V) throughout, except for sample 1 which is dolomitic (D).

124-127

aphyric basalt

1

2

3

4

5



Graphical Representation

Sample

0-150 cm representation profile. Vesicular (V) throughout, except for samples 1, 2, 3, 4, and 5 which are dolomitic (D).

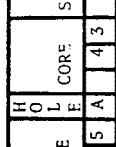
1

2

3

4

5



Graphical Representation

Sample

0-150 cm alteration profile. Vesicular (V) throughout, except for sample 1 which is dolomitic (D).

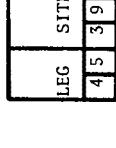
1

2

3

4

5



Graphical Representation

Sample

0-150 cm representation profile. Vesicular (V) throughout, except for samples 1, 2, 3, 4, and 5 which are dolomitic (D).

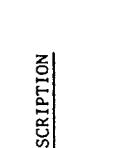
1

2

3

4

5



Graphical Representation

Sample

0-150 cm alteration profile. Vesicular (V) throughout, except for sample 1 which is dolomitic (D).

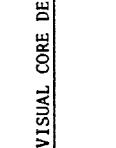
1

2

3

4

5



Graphical Representation

Sample

0-150 cm representation profile. Vesicular (V) throughout, except for samples 1, 2, 3, 4, and 5 which are dolomitic (D).

1

2

3

4

5



Graphical Representation

Sample

0-150 cm alteration profile. Vesicular (V) throughout, except for sample 1 which is dolomitic (D).

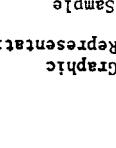
1

2

3

4

5



Graphical Representation

Sample

0-150 cm representation profile. Vesicular (V) throughout, except for samples 1, 2, 3, 4, and 5 which are dolomitic (D).

1

2

3

4

5

330570

LEG	SITE	H O L	CORE	L E	SEC
4	5	3	9	5	A
4	5	3	9	5	A

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine grained, very fine grained, and glassy aphyric basalt, fresh to moderately altered, with rare plagioclase phenocrysts in some pieces. Vesicles are 1-3% of the rocks, some filled with whitish or greenish secondary minerals. Pieces 8 and 9 have some glass. Piece 13 has more abundant plagioclase phenocrysts than usual. It also has carbonate-filled druses. Piece 1 has a crack along which alteration is most intense. It appears to be filled with zeolites (?). There is a carbonate encrustation on 14. Partial weathered rinds occur on 6 and 7.

Thin Section Description

54-60#3: "Aphyric" interstitial olivine basalt. Plagioclase 40% (.04 x .4 mm) skeletal; olivine 7% (.05 mm equant) skeletal; titanomagnetite 5% (.005 mm) skeletal. Rest is brown mesostasis composed of acicular cpx, opaques, and glass. Vesicles are filled partly with Fe-hydroxide, and very pale brown clay minerals.

VISUAL CORE DESCRIPTION

Macroscopic Description

V V V V V V

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, and very fine-grained aphyric basalt with rare "rounded" plagioclase phenocrysts (1-3 mm diam.). Vesicles are about 1% and filled with dark gray lay minerals. Variolitic texture is observed in some pieces. Pieces 1, 4, 14, 15, 16, and 17 contain carbonate veinlets, and 17 contains the most abundant carbonate veinlets among them. Some specimens have zeolite(?) coatings on weathered surfaces (1, 6, 7, 8, 9, 10, 11, 15, and 16). The entire core is moderately to intensely altered.

Thin Section Description

1-63-67#7: Variolitic olivine basalt, no phenocrysts. Plagioclase 30% (.005 x .2 mm) with rare larger (.02 x .3 mm); olivine 3-5% (.01 x .1 mm) skeletal; cpx rare up to .005 mm. Titanomagnetite .005 mm skeletal 5%. Matrix is microcrystalline plag, cpx, opaques, and brownish yellow clay minerals after glass. Plag is main mineral in variolites.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
63-67							
7							
8							
9							
10							
11							
12							
13a,b							
14							
15							
16							
17							

Sample

Alteration

Graphic

Representation

Section

Description



330570

LEG	SITE	H O L	CORE	L E	SEC
4	5	3	9	5	A
4	5	3	9	5	A

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

V V V V V V

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, with rare plagioclase phenocrysts (1-3 mm diam.). Vesicles are about 1% and filled with dark gray lay minerals. Variolitic texture is observed in some pieces. Pieces 1, 4, 14, 15, 16, and 17 contain carbonate veinlets, and 17 contains the most abundant carbonate veinlets among them. Some specimens have zeolite(?) coatings on weathered surfaces (1, 6, 7, 8, 9, 10, 11, 15, and 16). The entire core is moderately to intensely altered.

Thin Section Description

1-63-67#7: Variolitic olivine basalt, no phenocrysts. Plagioclase 30% (.005 x .2 mm) with rare larger (.02 x .3 mm); olivine 3-5% (.01 x .1 mm) skeletal; cpx rare up to .005 mm. Titanomagnetite .005 mm skeletal 5%. Matrix is microcrystalline plag, cpx, opaques, and brownish yellow clay minerals after glass. Plag is main mineral in variolites.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
63-67							
7							
8							
9							
10							
11							
12							
13a,b							
14							
15							
16							
17							

Sample

Alteration

Graphic

Representation

Section

Description



	H	O	L	CORE	E	SITE	LEG.
	4	5	3	9	5	A	4
	8	1	7	2	6	5	1

VISUAL CORE DESCRIPTION

Sample

Alteration

	H	O	L	CORE	E	SITE	LEG.
	4	5	3	9	5	A	4
	8	1	7	2	6	5	1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained and ve fine-grained aphyric basalt with some rare plagioclase and olivine phenocrysts in 8, 10, 12, and 14. Moderately to intensely altered, with 1-2% vesicles (1 mm diam) partially or completely filled with whitish or greenish secondary minerals. Pieces 6, 7, 10, 12, and 13 have carbonate veins.

	Inc.	NRM	MDF	$V_p(\text{U})$	$V_p(\text{G})$	D	P
5a-d	118-120	-47.2	2.17	900	--	--	--

6a-d↑

9↑

7a,b↑

8↑

9↑

10a↑

10b↑

11↑

12a↑

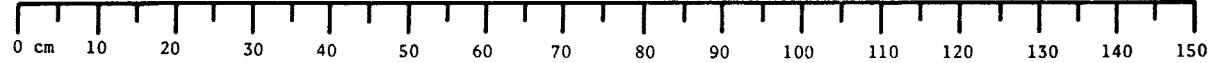
12b↑

(ext. r. f. r.)

12c↑

13

14

VISUAL CORE DESCRIPTION

Sample

Alteration

	H	O	L	CORE	E	SITE	LEG.
	4	5	3	9	5	A	4
	8	1	7	2	6	5	1

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained and ve fine-grained aphyric basalt with some rare plagioclase and olivine phenocrysts in 8, 10, 12, and 14. Moderately to intensely altered, with 1-2% vesicles (1 mm diam) partially or completely filled with whitish or greenish secondary minerals. Pieces 6, 7, 10, 12, and 13 have carbonate veins.

	Inc.	NRM	MDF	$V_p(\text{U})$	$V_p(\text{G})$	D	P
5a-d	118-120	-47.2	2.17	900	--	--	--

6a-d↑

9↑

10a↑

10b↑

11↑

12a↑

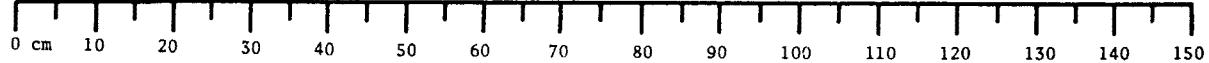
12b↑

(ext. r. f. r.)

12c↑

13

14



330570

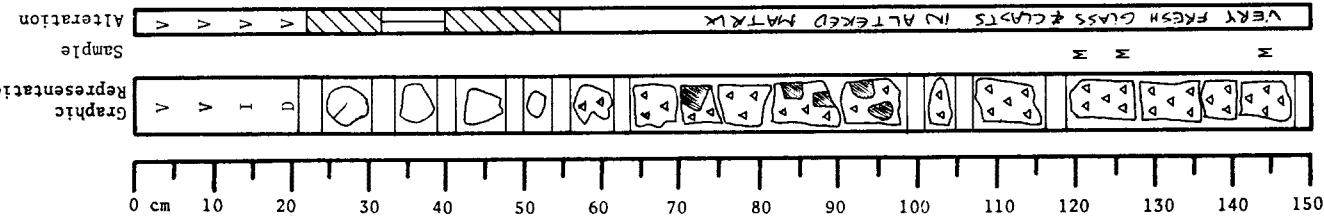
	LEG	SITE	H O	L	CORE	SEC
	4	5	3	9	5	A

MAJOR ROCK TYPES -- PIECES 1-4: FINE-GRAINED APHYRIC BASALT;
PIECES 5-9: GLASSY VOLCANIC BRECCIA

Macroscopic Description

Pieces 1-4: Fine-grained aphyric basalt, with rare plagioclase phenocrysts and veins filled with whitish secondary minerals. Piece 2 is pale brown due to alteration. Pieces 5-9d: Volcanic breccia. Angular fragments of aphyric basalt cemented together by an aggregate of small fragments of plagioclase and volcanic glass. There are thin veins of whitish material and patches in 6c, 8, 9a, 9b (zeolites?). In 5, one basalt fragment contains olivine phenocrysts. The breccia shows no fragment sorting or orientation. Alteration of basalt fragments in the breccia increases down-core. The matrix is ochre brown in 5, as are parts of the matrix of 6a-e. In 6, a darker brown matrix is also present. A dark brown matrix is the only matrix to 9a-d. 9a and 9b are more lithified than 6-8.

	Inc.	NRM	MDF	$V_p(l)$	D	P
5↑	119-121	-35.7	1.06	650	--	--
6a↑	122-124	-47.0	2.22	600	--	--
6b↑	145-147	-32.7	1.57	600	--	--



330570

	LEG	SITE	H O	L	CORE	SEC
	4	5	3	9	5	A

MAJOR ROCK TYPES -- PIECE 1: VOLCANIC BRECCIA; PIECES 2-18:
FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Piece 1: Volcanic breccia, with generally altered angular fine-grained basalt fragments. Largest fragment seen on cut surface has a few olivine and plagioclase phenocrysts. The matrix is dark brown, the same as that in the bottom of 49-1. One fragment has a glassy interior, but is altered to yellowish clays (?) along its edges.

Pieces 2-18: Fine-grained, very fine-grained, and glassy apophytic basalt. Very sparse phenocrysts of plagioclase and olivine are present in some pieces. Piece 2 has a glassy edge. Pieces 4-12 are cut by veins of carbonate about 0.05 mm across. Alteration of the basalt is concentrated next to these veins where the basalt is pale brown. Some relatively fresh areas of basalt remain but they are small. There are about 1% empty vesicles. Pieces 13-18 are fresher than 4-12, but their 1% of vesicles are filled with whitish secondary minerals. Veins of carbonate are also present.

Thin Section Description

2-13-17#2: Variolitic olivine basalt no phenocrysts. Plagioclase 35% (.01 x .2 mm), 1% (.1 x 1.5 mm). Olivine 5% (.2 mm) skeletal. Matrix is now pale brown feathery crystal aggregate (cpx, plag, opaques). No alteration information given.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
10							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
11↑							
12	49.6	15.08	11.14	8.1	11.32	0.17	1.72
13 a-d↑	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr	---
14	101-103	4.14	500	---	---	---	---

	Inc.	NRM	MDF	$V_p(l)$	D	P
15						
16						
17						
18						

LEG	SITE	H			O			L			CORE			SEC.	
		4.5	3.9	5.1	4.5	3.9	5.1	4.5	3.9	5.1	A	S	J	2	

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE (50-1, 2, & 3) -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained and very fine-grained aphyric basalt, generally moderately to intensely altered. Sparse plagioclase and olivine quench crystals observed in Section 1, pieces 1, 4, and 7-9. Section 2, pieces 1 and 2. In other pieces, crystals are too small to identify. Vesicles are 1-2%, less than 1 mm diameter, locally empty or filled with whitish or greenish alteration minerals. Olivine is partially altered to secondary reddish minerals. Many pieces have cracks less than 0.5 mm thick lined with carbonate or other whitish secondary minerals. Some fracture surfaces have an oxidized coating, possibly with Mn spots. Several pieces have partial alteration "rinds". Piece 2-15 has a glassy edge. The sequence represents low recovery in thin flows or pillow lavas.

Inc. NRM MDF $V_p(4)$ $V_p(5)$ D P

140-142

-45.8 3.41 500 -- -- --

92-94

-46.3 4.29 550 -- -- --

LEG	SITE	H			O			L			CORE			SEC.	
		4.5	3.9	5.1	4.5	3.9	5.1	4.5	3.9	5.1	A	S	J	2	

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE (50-1, 2, & 3) -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained and very fine-grained aphyric basalt, generally moderately to intensely altered. Sparse plagioclase and olivine quench crystals observed in Section 1, pieces 1, 4, and 7-9. Section 2, pieces 1 and 2. In other pieces, crystals are too small to identify. Vesicles are 1-2%, less than 1 mm diameter, locally empty or filled with whitish or greenish alteration minerals. Olivine is partially altered to secondary reddish minerals. Many pieces have cracks less than 0.5 mm thick lined with carbonate or other whitish secondary minerals. Some fracture surfaces have an oxidized coating, possibly with Mn spots. Several pieces have partial alteration "rinds". Piece 2-15 has a glassy edge. The sequence represents low recovery in thin flows or pillow lavas.

Inc. NRM MDF $V_p(4)$ $V_p(5)$ D P

140-142

-45.8 3.41 500 -- -- --

92-94

-46.3 4.29 550 -- -- --

LEG	SITE	H			O			L			CORE			SEC.	
		4.5	3.9	5.1	4.5	3.9	5.1	4.5	3.9	5.1	A	S	J	2	

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE (50-1, 2, & 3) -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained and very fine-grained aphyric basalt, generally moderately to intensely altered. Sparse plagioclase and olivine quench crystals observed in Section 1, pieces 1, 4, and 7-9. Section 2, pieces 1 and 2. In other pieces, crystals are too small to identify. Vesicles are 1-2%, less than 1 mm diameter, locally empty or filled with whitish or greenish alteration minerals. Olivine is partially altered to secondary reddish minerals. Many pieces have cracks less than 0.5 mm thick lined with carbonate or other whitish secondary minerals. Some fracture surfaces have an oxidized coating, possibly with Mn spots. Several pieces have partial alteration "rinds". Piece 2-15 has a glassy edge. The sequence represents low recovery in thin flows or pillow lavas.

Inc. NRM MDF $V_p(4)$ $V_p(5)$ D P

140-142

-45.8 3.41 500 -- -- --

92-94

-46.3 4.29 550 -- -- --

LEG	SITE	H	O	L	CORE	SIC		
4	5	3	9	5	A	5	1	11

VISUAL CORE DESCRIPTION**MAJOR ROCK TYPE (51-1, 2, & 3): FINE-GRAINED APHYRIC BASALT**Macroscopic Description

Fine grained and very fine-grained aphyric basalt with very sparse plagioclase phenocrysts in isolated pieces, moderately to intensely altered. Many pieces have subvariolitic texture, with quench plagioclase swards evident. Vesicles are 1-2% and less than 1 mm, locally empty or filled with whitish or greenish secondary minerals. Carbonate fillings occur in narrow cracks (less than 0.5 mm thick) and on fracture surfaces on many pieces. Glass is present on the edges of 2-6 and 2-16. Piece 1-2 has a three layer coating in places. The three layer coating consists of two layers of reddish oxidized material separated by a thin layer of carbonate. This was undoubtedly a crack filling which did not separate cleanly along a single layer. Glass is partially palagonitized in 2-6 and 2-16.

Section 3 is much like sections 2 and 1. Carbonate encrustations are common especially on 3-1 through 3-5, and 3-9. Very sparse "rounded" plagioclase phenocrysts are present in 3-7, 3-8, 3-19 and 3-21.

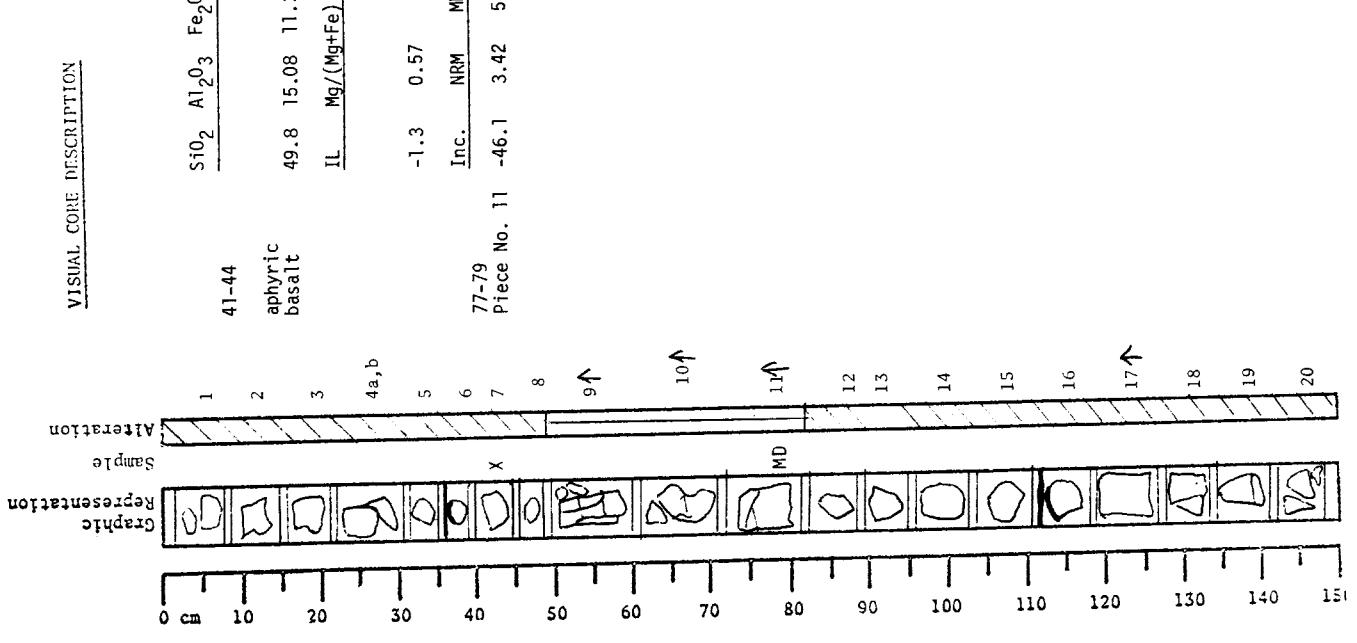
Inc.	NRM	MDF	$V_p(\perp)$	D	P
-41.8	4.87	550	--	--	--

VISUAL CORE DESCRIPTION**MAJOR ROCK TYPE (51-1, 2, & 3): FINE-GRAINED APHYRIC BASALT**Macroscopic Description

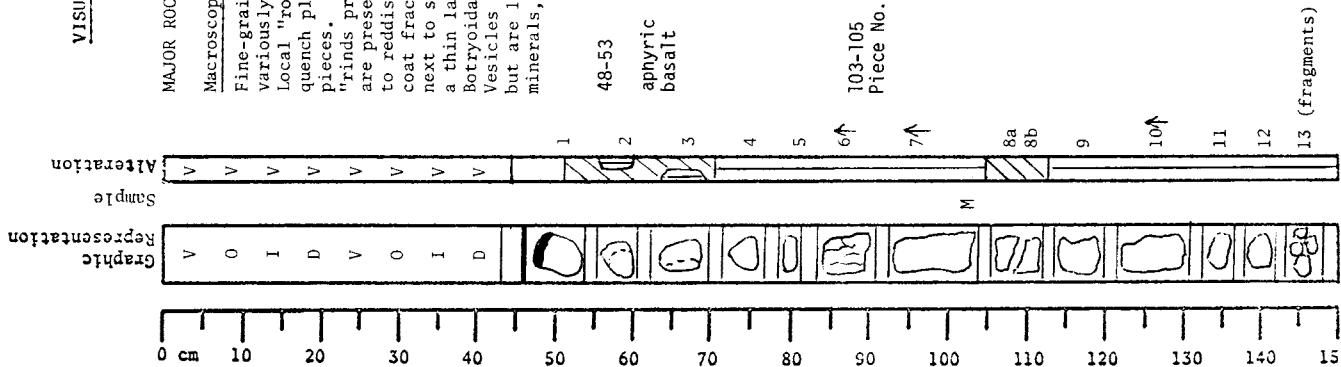
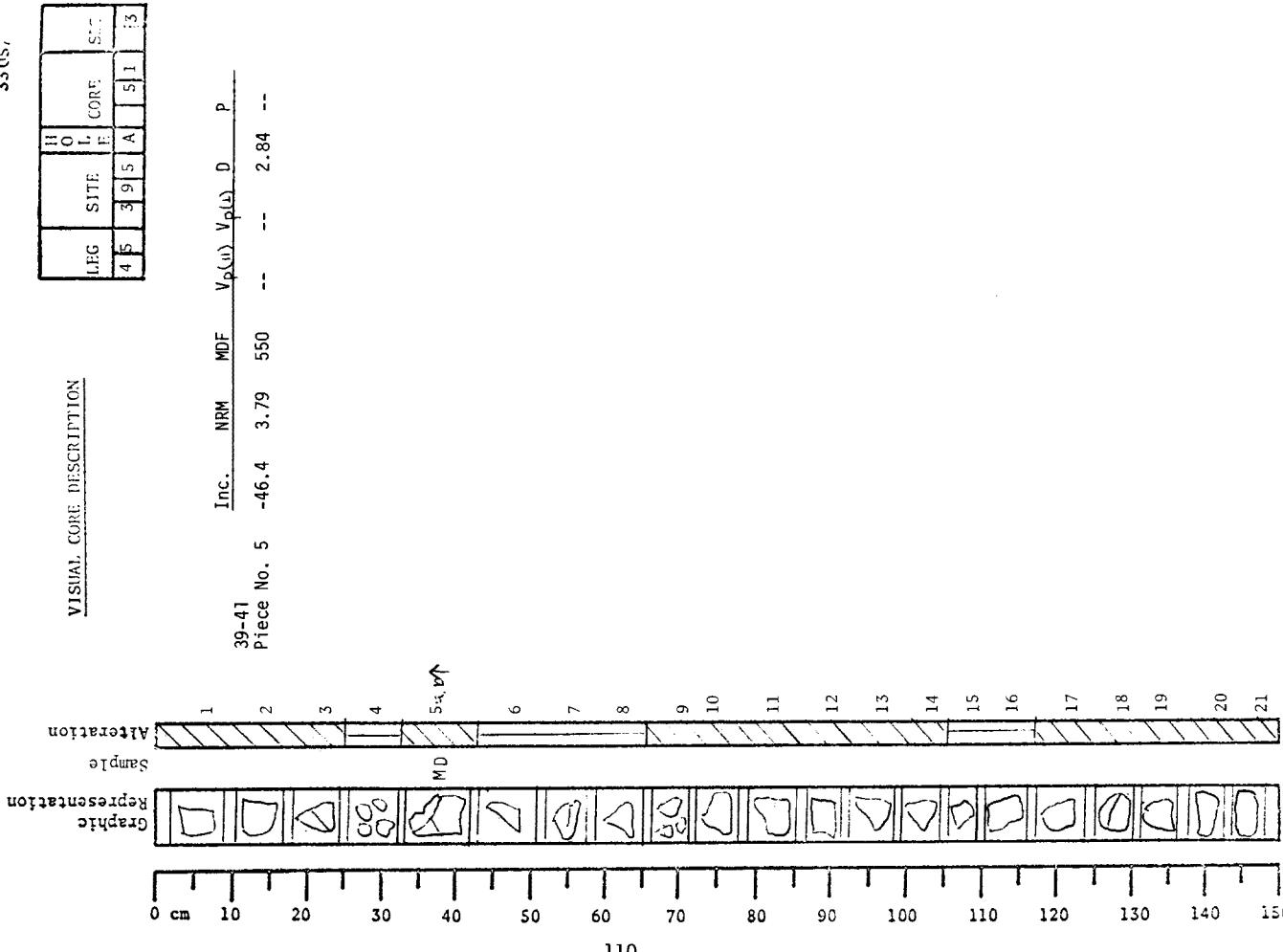
Fine grained and very fine-grained aphyric basalt with very sparse plagioclase phenocrysts in isolated pieces, moderately to intensely altered. Many pieces have subvariolitic texture, with quench plagioclase swards evident. Vesicles are 1-2% and less than 1 mm, locally empty or filled with whitish or greenish secondary minerals. Carbonate fillings occur in narrow cracks (less than 0.5 mm thick) and on fracture surfaces on many pieces. Glass is present on the edges of 2-6 and 2-16. Piece 1-2 has a three layer coating in places. The three layer coating consists of two layers of reddish oxidized material separated by a thin layer of carbonate. This was undoubtedly a crack filling which did not separate cleanly along a single layer. Glass is partially palagonitized in 2-6 and 2-16.

Section 3 is much like sections 2 and 1. Carbonate encrustations are common especially on 3-1 through 3-5, and 3-9. Very sparse "rounded" plagioclase phenocrysts are present in 3-7, 3-8, 3-19 and 3-21.

Inc.	NRM	MDF	$V_p(\perp)$	D	P
-41.8	4.87	550	--	--	--



33 Qs



LEG	SITE	H O	L CORE	SIT
4	5	3	9	5

Major Rock Type -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description (52-1 and 52-2)

Fine-grained, very fine-grained, and glassy aphyric basalt, variously fresh, moderately altered, and intensely altered. Local "rounded" very rare plagioclase phenocrysts. Usually quench plagioclase needles can be seen in the coarser grained pieces. Glass present on 1-1 and 2-9 and 2-10a. Alteration "rinds" present on 2-2 and 2-3. Tiny olivine crystals, which are present in the coarser-grained pieces, are partially altered to reddish secondary minerals. Carbonates line cracks and coat fracture surfaces. Alteration is somewhat more intense next to such cracks and surfaces. Often, the carbonate crusts a thin layer of reddish iron oxidation alteration products. Botryoidal crystals of zeolite (?) occur on one surface of 1-3. Vesicles are tiny (less than 1 mm) and rare (less than 1%) but are locally filled with whitish or greenish alteration minerals, probably clays.

LEG	SITE	H O	L CORE	SIT
4	5	3	9	5

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

Major Rock Type -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description (52-1 and 52-2)

Fine-grained, very fine-grained, and glassy aphyric basalt, variously fresh, moderately altered, and intensely altered. Local "rounded" very rare plagioclase phenocrysts. Usually quench plagioclase needles can be seen in the coarser grained pieces. Glass present on 1-1 and 2-9 and 2-10a. Alteration "rinds" present on 2-2 and 2-3. Tiny olivine crystals, which are present in the coarser-grained pieces, are partially altered to reddish secondary minerals. Carbonates line cracks and coat fracture surfaces. Alteration is somewhat more intense next to such cracks and surfaces. Often, the carbonate crusts a thin layer of reddish iron oxidation alteration products. Botryoidal crystals of zeolite (?) occur on one surface of 1-3. Vesicles are tiny (less than 1 mm) and rare (less than 1%) but are locally filled with whitish or greenish alteration minerals, probably clays.

13 (fragments)

11

12

10↑

9

8b

8a

7↑

6↑

5

4

3

2

1

7

6↑

5

4

3

2

1

7

6↑

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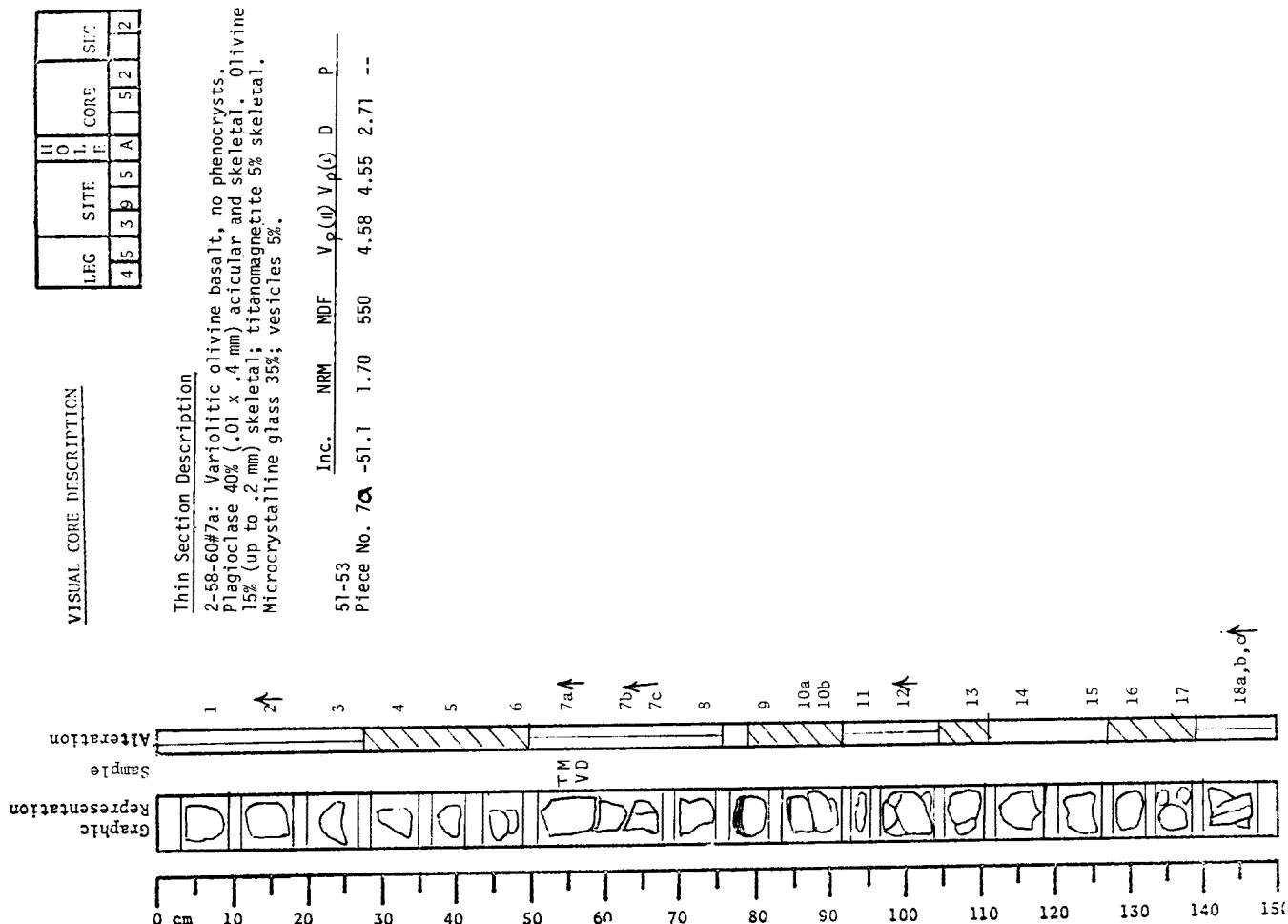
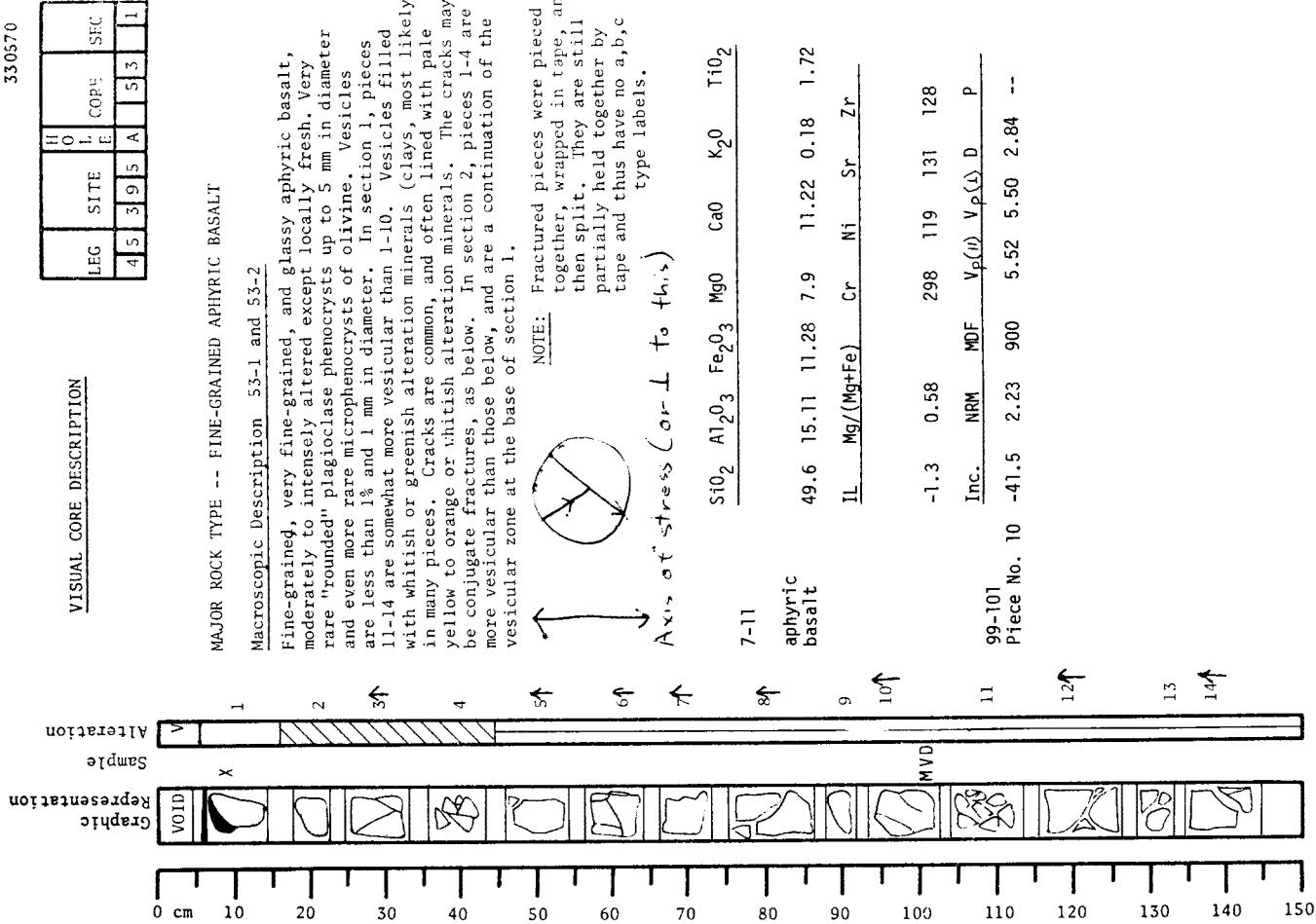
4

3

2

1

7</div



LEG	SITE	O	L	CORE	SEC
4	5	3	9	5	A
5	3	9	5	A	5

VISUAL CORE DESCRIPTION

1 62-64
2 Piece No. 7 -43.2 2.15 650 -- -- 2.89 3.4

3↑

4↑

5

6↑

7↑

8↑

9

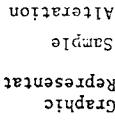
10

11

12

13↑

14↑



LEG	SITE	O	L	CORE	SEC
4	5	3	9	5	A
5	3	9	5	A	5

VISUAL CORE DESCRIPTION

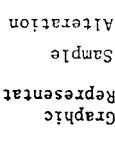
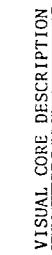
MAJOR ROCK TYPE -- FINE GRAINED APHYRIC BASALT

Macroscopic Description Sections 54-1 and 54-2

- 1 Fine-grained, very fine-grained, and glassy aphyric basalt ranging from fresh to intensely altered, locally highly fractured and containing very sparse plagioclase and/or olivine phenocrysts in some pieces. Alteration is primarily oxidation to various shades of pale brown. Olivine is partially altered to reddish secondary minerals. Many cracks are lined with thin veins of carbonate. Vesicles vary from 1-2% and are very tiny (less than 1 mm), locally filled with whitish, greenish, or orange secondary minerals. Glass rinds occur on 1-1, 2-6a, 2-8b, and 2-11. Fracture surfaces are along former cracks, and are coated with "chloritic" or carbonate minerals, and sometimes reddish alteration minerals.
- 2 Note that fractured pieces have been taped and split as in 53-1.
- 3
- 4
- 5
- 6

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
7	48-51						
8							
9	aphyric basalt	49.6	14.90	11.11	7.7	11.11	0.14
10a↑		IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zn
10b↑		-0.7	0.58		296	111	124
11	74-76	Inc.	NRM	MDF	V _D (D)	V _P (L)	D
12	Piece No. 10A	-43.9	4.67	900	5.81	5.77	2.89
13↑							
14↑							



Sample

Representation

Graphical

Sample

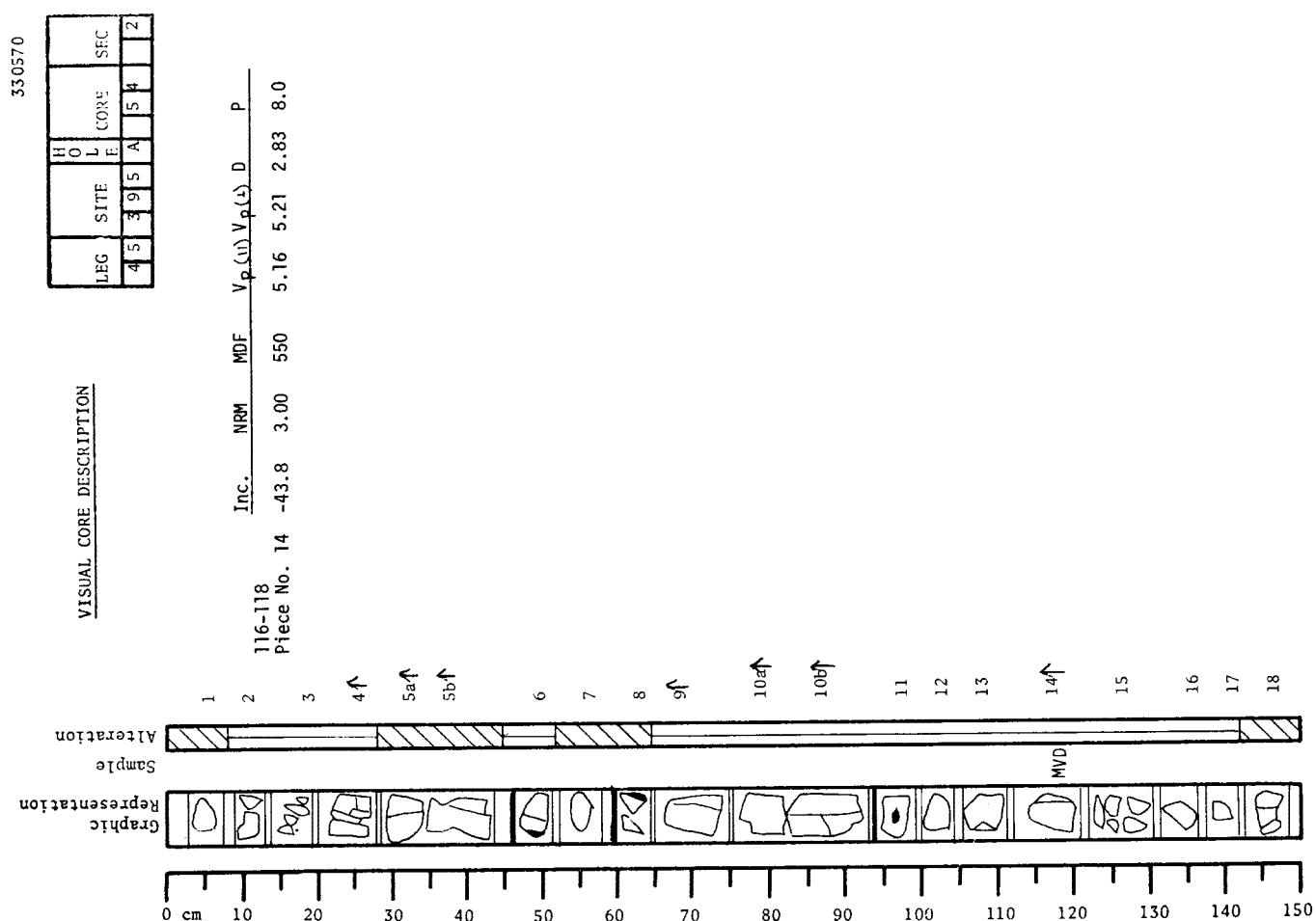
Representation

Graphical

Sample

Representation

Graphical



LEG	SITE	H O	L CORE ^E	SFC
4 5	3 9 5	A	5 4	1

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description Sections 55-1 and 55-2

The general features of this core are virtually identical to Core 54, described under 54-1. In 55, glass is found on 1-3 only. In the lower part of 1-8, large druses are developed, partially filled with white fine-grained, light greenish white spherical, and light brown and gray spherical secondary minerals. The former two are carbonates. In section 2, piece 8 may have glass, but it is highly altered.

Note: highly fractured pieces are taped together as in 53-1. Some pieces are too highly fractured to piece together and are clumped together as in 1-5 and 1-10.

Thin Section Descriptions

1-49-54#3: Subvariolitic olivine basalt, no phenocrysts. Plagioclase 10% (.05 x .1 mm) skeletal, acicular; olivine 5% (.02 x .2 mm) skeletal - acicular to anhedral, occasionally up to .5 mm. Microcrystalline groundmass 85%. No alteration information given.

1-104-10#7: Subvariolitic olivine basalt, no phenocrysts. Plagioclase 40% (.05 x .8 mm) acicular, skeletal laths. Olivine 15% (.1 mm) rounded; cpx 20% (about .3 mm) crystallized after plagioclase, and grew around it. Microcrystalline groundmass 20%, vesicles 5%, filled with olivine green clays. Olivines also slightly altered to clays.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
49-54							

5

aphyrpic basalt

	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
75-77	-1.6	0.59	303	116	131	126

7↑

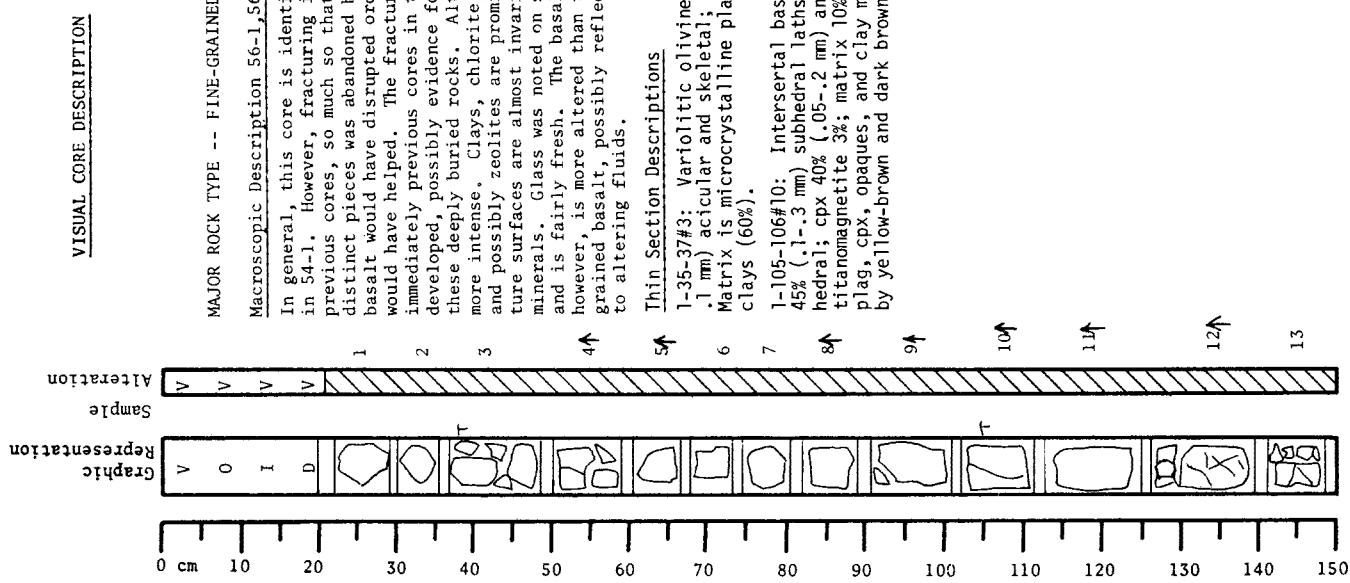
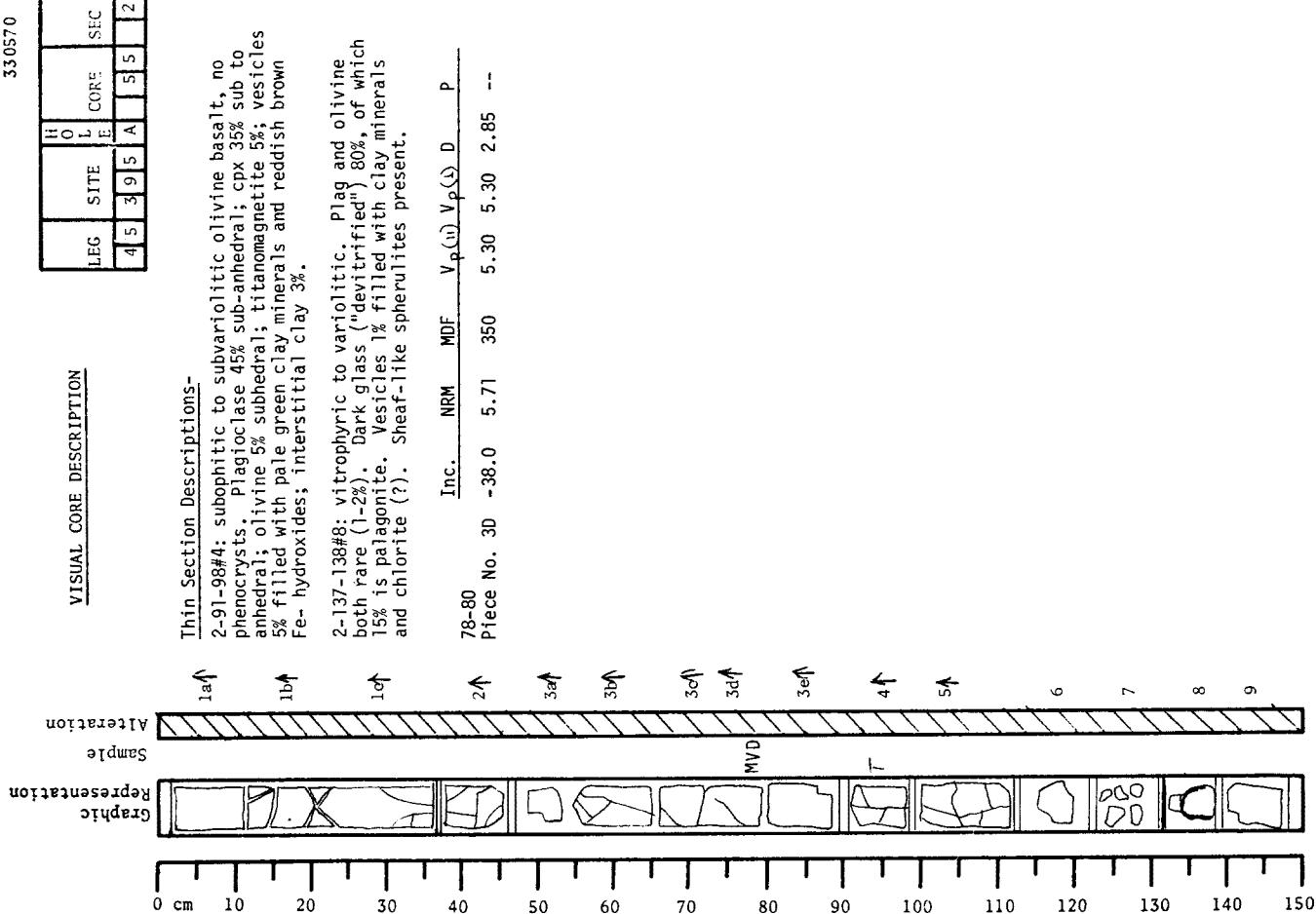
Piece No. 4B

	Inc.	NRM	MDF	$V_p(\text{H})$	$V_p(\text{L})$	D	P
8	-32.2	3.14	450	--	--	2.85	--

8

9↑

10



Thin Section Descriptions-

2-91-08#4: subophitic to subvariolitic olivine basalt, no phenocrysts. Plagioclase 45% sub-anhedral; cpx 35% sub-anhedral; olivine 5% subhedral; titanomagnetite 5%; vesicles 15% filled with pale green clay minerals and reddish brown Fe-hydroxides; interstitial clay 3%.

2-137-138#8: vitrophyric to variolitic. Plag and olivine both rare (1-2%). Dark glass ("devitrified") 80%, of which 15% is palagonite. Vesicles 1% filled with clay minerals and chlorite spherulites present. Sheaf-like spherulites present?

	Inc.	NRM	MDF	$V_p(\text{II})$	$V_p(\text{I})$	D	P
3-80	No	30	-38.0	5.7	350	5.30	2.85
3-80	ence	No					--

114

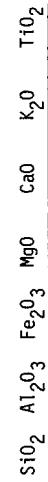
LEG	SITE	H	O	L	CORE	SFC.		
4	5	3	9	5	A	5	6	2

VISUAL CORE DESCRIPTION

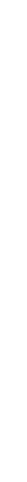
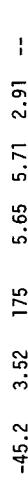
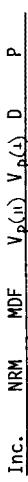
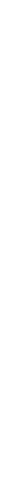
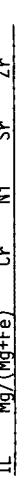
Thin Section Descriptions

1a 2-34-36#4a: Subophitic-subvariolitic olivine basalt, no phenocrysts. Plagioclase 30% subhedral (An₇₀); cpx 15% subhedral; olivine 5% subhedral, all .01-.5 mm. Plagioclase acicular, olivine more equant. Mesostasis 50% has 70% cpx, 20% plagioclase, 10% titanomagnetite. Vesicles are present and filled by red-brown and yellow-brown clays.

1b 2-89-91#4h: Intersertal olivine basalt. Plagioclase 45% (1-.3 mm), Tr up to 2.5 mm (An₆₅); cpx 45% (.1-.3 mm) anhedral; olivine 5% (.05-.2 mm) subhedral; titanomagnetite 2-3%, skeletal; vesicles 2-3% filled with greenish gray and yellowish brown clays (or chlorite?).



4b
aphyratic
basalt



LEG	SITE	H	O	L	CORE	SFC.		
4	5	3	9	5	A	5	6	3

Note: spacers were not placed between pieces in this section. Pieces are designated by interval only. Small drilling breaks probably occur between many pieces in this section. At least 5 and probably 6 capping unit boundaries were recovered in this section.

Thin Section Descriptions

3-8-10#1c: hyaloclastite. Yellow and black volcanic glass fragments with trace of skeletal olivine crystals. Pieces .1-.1 cm. Most fragments rimmed with palaonite. Cement is clays and zeolites (?). Glass = 90%. Cement = 10%.

3-94-96: Basalt glass, with about 1% each of skeletal, tiny plagioclase (.2-.4 mm) and ol (0.05 mm) crystals. Glass is brown to opaque. Glass grades from clear (quench) to dark colors by agglomeration of tiny variolites of dark incipient crystalline material (indeterminant mineralogy) which has either olivine crystallite or plagioclase crystallite cores. This represents a transition between truly quenched and highly undercooled but unquenched glassy material.

3-137-141: halophilic olivine basalt: Plagioclase 45% subhedral laths; cpx 15% anhedral; olivine 5% subhedral; titanomagnetite dust; vesicles 5% filled with greenish gray to brownish gray clays and perhaps chlorite. Microcrystalline mesostasis contains interbrown plag, cpx, opaque dust, and clays.

117-119 Inc. NRM MDF V_{p(1)} D P
-42.9 3.14 550 5.44 5.45 2.85 5.6

LEG	SITE	H	O	L	CORE	SFC.		
4	5	3	9	5	A	5	6	3

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-42.9 3.14 550 5.44 5.45 2.85 5.6

LEG	SITE	H	O	L	CORE	SFC.		
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-42.9 3.14 550 5.44 5.45 2.85 5.6

LEG	SITE	H	O	L	CORE	SFC.		
4	5	3	9	5	A	5	6	3

Note: spacers were not placed between pieces in this section. Pieces are designated by interval only. Small drilling breaks probably occur between many pieces in this section. At least 5 and probably 6 capping unit boundaries were recovered in this section.

Thin Section Descriptions</u

LEG	SITE	CORE			SEC
		H	O	L	
4	5	3	9	5	A
		6	c		

VISUAL CORE DESCRIPTION

LEG	SITE	CORE			SEC
		H	O	L	
4	5	3	9	5	A
		6	c		

Pieces recovered in the core catcher of Core 56 were placed in this section. However, they should have been placed at the top of the section as there is no major drilling break (unrecovered interval) between the base of 56-3 and the top of 56-cc. As the pieces were photographed in this position, however, this description is presented consistent with the photographs (a minor lapse in quality control).

At least two cooling unit boundaries were recovered in this section.

VISUAL CORE DESCRIPTION

LEG	SITE	CORE			SEC
		H	O	L	
4	5	3	9	5	A
		6	c		

1 MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT
 Macroscopic Description
 2a, b, c Fine-grained, very fine-grained, and glassy aphyric basalt.
 Many glassy rinds and zones as shown. Glass spectacular on
 3 17a-c which is nearly all glass, set in a clay matrix. 17a-c
 are breccias (see similar glass breccias in 58-2).
 Piece 4 shows vertical junction between basalt and basaltic
 glass breccia, choice Specimen. Piece 7 is the freshest in
 the core, and variolitic and glassy. Piece 8 is also variolitic.
 Cracks cross many pieces, particularly 10, 11, 13, 15, and 16a.
 They are usually with a white, non-carbonate material (zeolite?).
 4↑ 5-6-62#10: subvariolitic olivine basalt, no phenocrysts; plago-
 clase 15% as sheafs; olivine 5% highly skeletal. Vesicles 2%
 7 filled with clay minerals. Mesostasis 78% very fine grained
 8 micromass, dark brown sheaf like in places, indeterminant
 9 mineralogy.
 10↑ 10-125-13#16b: subvariolitic olivine basalt, no phenocrysts.
 Similar to #10, only slightly more crystalline (35% plаг).
 Vesicles 1-2% filled with clay minerals, zeolites (?), and
 possibly green celadonite.

SAMPLE ALTERATION11 125-131 SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

12 aphyric basalt 49.2 15.14 11.20 8.1 11.09 0.22 1.59

13↑ IL Mg/(Mg+Fe) Cr V_{p(1)} V_{p(4)} D Zr

14 -2.3 0.59 363 163 134 105

15 Inc. NRM MDF V_{p(1)} V_{p(4)} D P

16a↑ 110-112 Piece No. 16A +57.4 1.60 450 4.67 4.76 2.74 --

16b↑ 127-129 Piece No. 16B un-stable 1.12 700 5.63 5.70 2.89 --

17a 17b,c 18

GRAPHIC REPRESENTATIONGRAPHIC REPRESENTATION

330570

330570-C

LEG.	SITE	H	O	L	CORE	E	SEC
4	5	3	9	5	A	5	8

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, glass as marked. Variolites present adjacent to glass. Highly veined and fractured. Fractures filled with whitish secondary mineral (zeolites?). Generally moderately altered, except for glass which is fresh apart from minor palagonite. All veins are thin (less than 0.5 mm). No phenocrysts noted in any pieces.

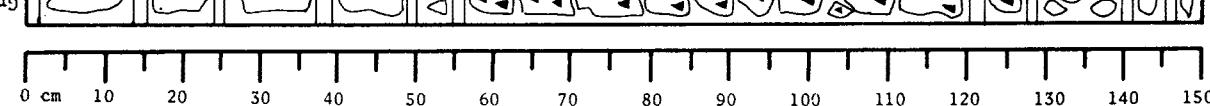
Thin Section Description

1-111-113#5: Subvariolitic olivine basalt, no phenocrysts: Plagioclase 40%, olivine 15%. Plag in radiating sheaflike aggregates. Vesicles 1% filled with clay minerals. Mesostasis is microcrystalline 45%, intergrown plag, cpx, opaques, and altered glass.

Inc.	NRM	MDF	$V_p(\text{U})$	$V_p(\text{D})$	D	P
56-58 Piece No. 1B	+60.5	1.65	500	5.13	5.24	2.81 8.4

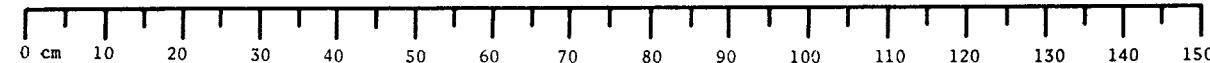
Graphic Representation

Sample Alteration



Graphic Representation

Sample Alteration



LEG.	SITE	H	O	L	CORE	E	SEC
4	5	3	9	5	A	5	8

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPES -- FINE-GRAINED APHYRIC BASALT AND FRESH HYALOCLASTITE BRECCIA.Macroscopic Description

Pieces 1-5 Very fine grained aphyric basalt with very rare phenocrysts of plagioclase. Piece 4 has vugs partially filled with pale yellow and pale white secondary minerals. Cracks cross 3 and 4.

Pieces 6a-7 Hyaloclastite. Basaltic glass fragments in matrix of altered glass fragments. Some glass fragments 4 cm across and rounded. A mixture of angular and rounded pieces. Piece 7 is partly very fine-grained basalt "grading into" hyaloclastite breccia. Glass in breccia is fresh. Matrix 20-50% of pieces. Pieces 8-10 are similar to 1-5.

Thin Section Descriptions

112-115#61 and 115-117#61: Hyaloclastite. Glass 90%. Trace of ornate skeletal tiny olivine crystals and chromite. Glass is partly "devitrified" and partly altered to pale green or brown clay minerals. Matrix around fragments is composed of pale green or brown clay minerals, and clear clay minerals.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
50.5	14.47	10.86	8.2	10.50	0.10	1.58

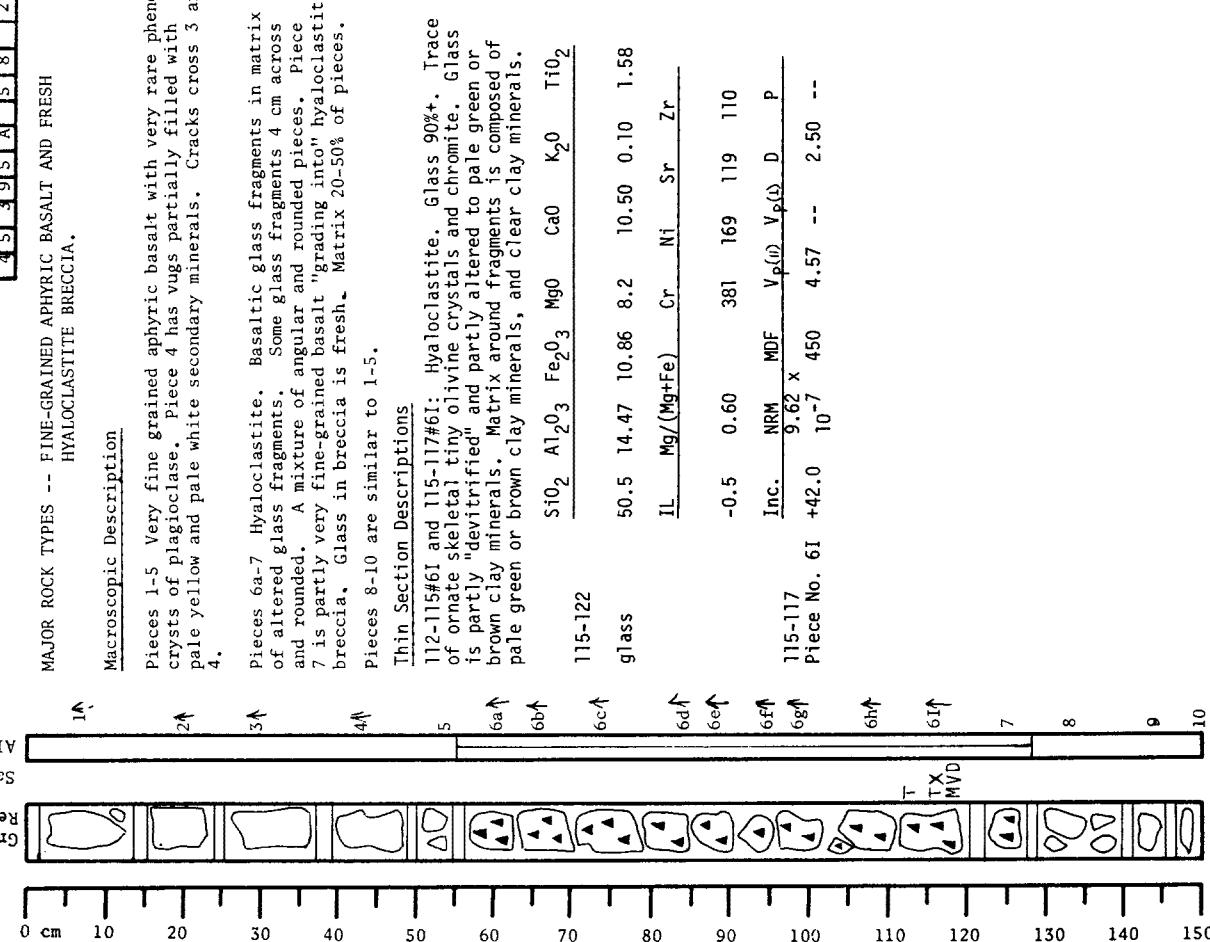
IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
-0.5	0.60	381	169	119	110

Inc.	NRM	MDF	$V_p(\text{U})$	$V_p(\text{D})$	D	P
115-117 Piece No. 61	+42.0	10 ⁻⁷	450	4.57	--	2.50 --



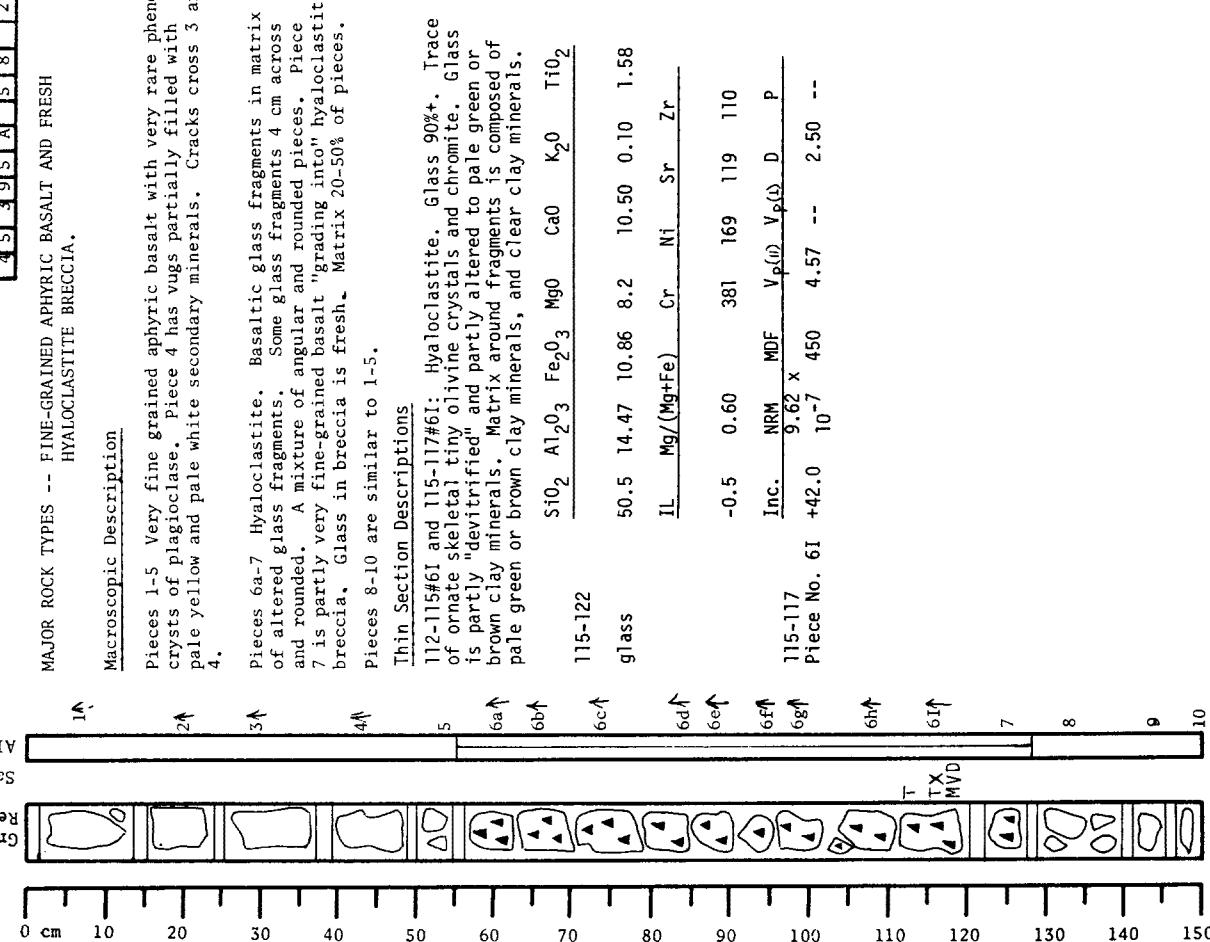
Graphic Representation

Sample Alteration



Graphic Representation

Sample Alteration



LEG.	SITE	H	O	L	CORE	E	SEC
4	5	3	9	5	A	5	8

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPES -- FINE-GRAINED APHYRIC BASALT AND FRESH HYALOCLASTITE BRECCIA.Macroscopic Description

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112-115#61 and 115-117#61: Hyaloclastite. Glass 90%. Trace of ornate skeletal tiny olivine crystals and chromite. Glass is partly "devitrified" and partly altered to pale green or brown clay minerals. Matrix around fragments is composed of pale green or brown clay minerals, and clear clay minerals.

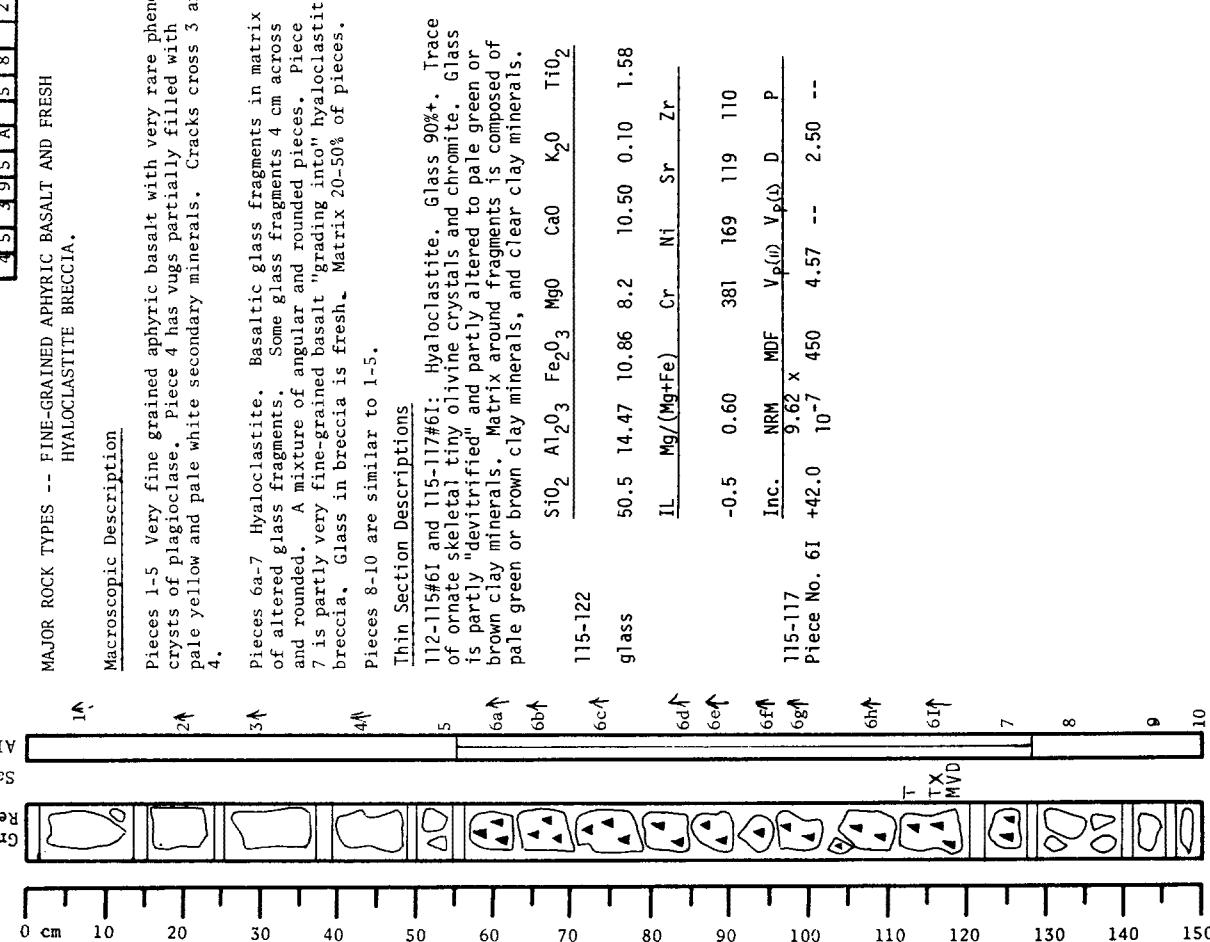
SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
50.5	14.47	10.86	8.2	10.50	0.10	1.58

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
-0.5	0.60	381	169	119	110

Inc.	NRM	MDF	$V_p(\text{U})$	$V_p(\text{D})$	D	P
115-117 Piece No. 61	+42.0	10 ⁻⁷	450	4.57	--	2.50 --

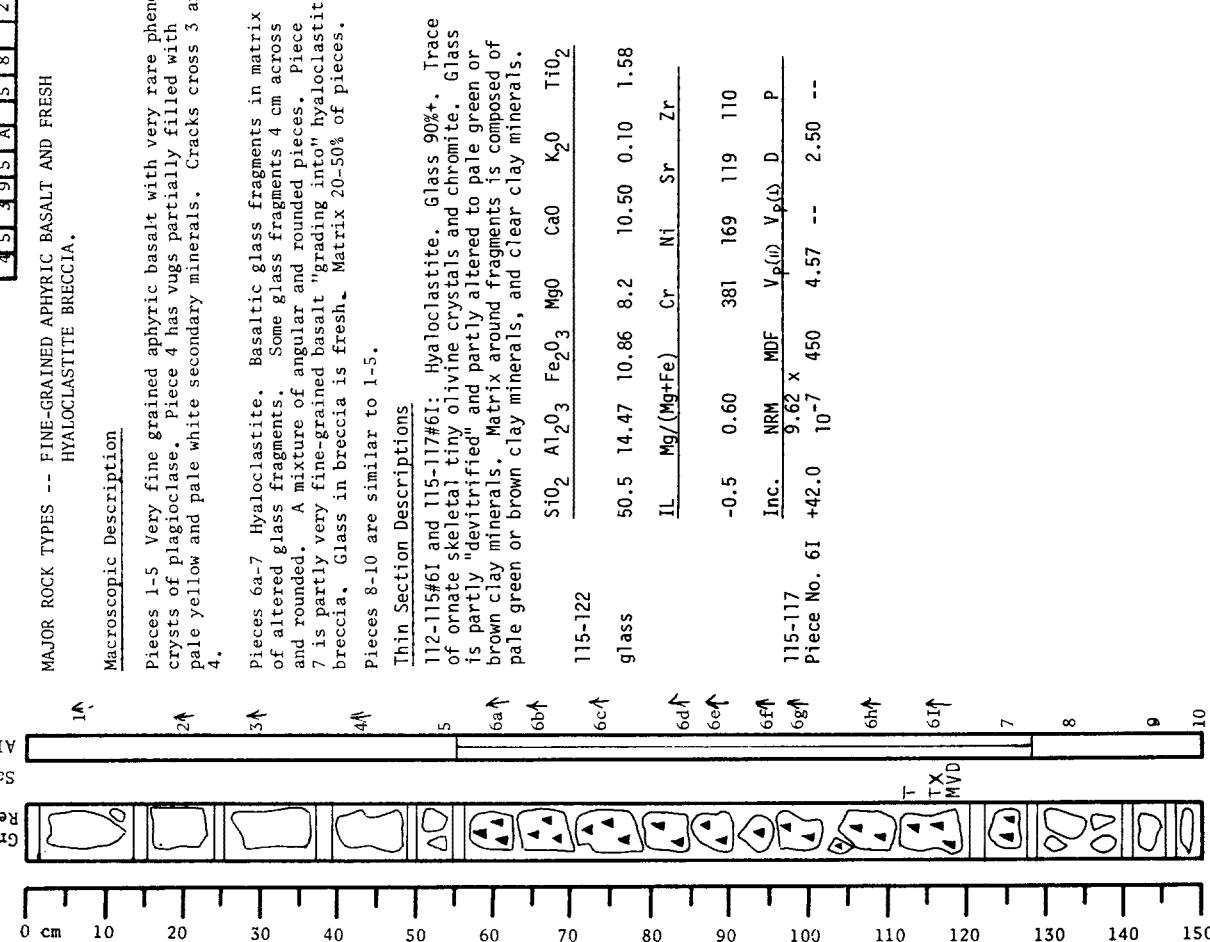
Graphic Representation

Sample Alteration



Graphic Representation

Sample Alteration



LEG.	SITE	H	O	L	CORE	E	SEC
4	5	3	9	5	A	5	8

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPES -- FINE-GRAINED APHYRIC BASALT AND FRESH HYALOCLASTITE BRECCIA.Macroscopic Description

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Thin Section Descriptions

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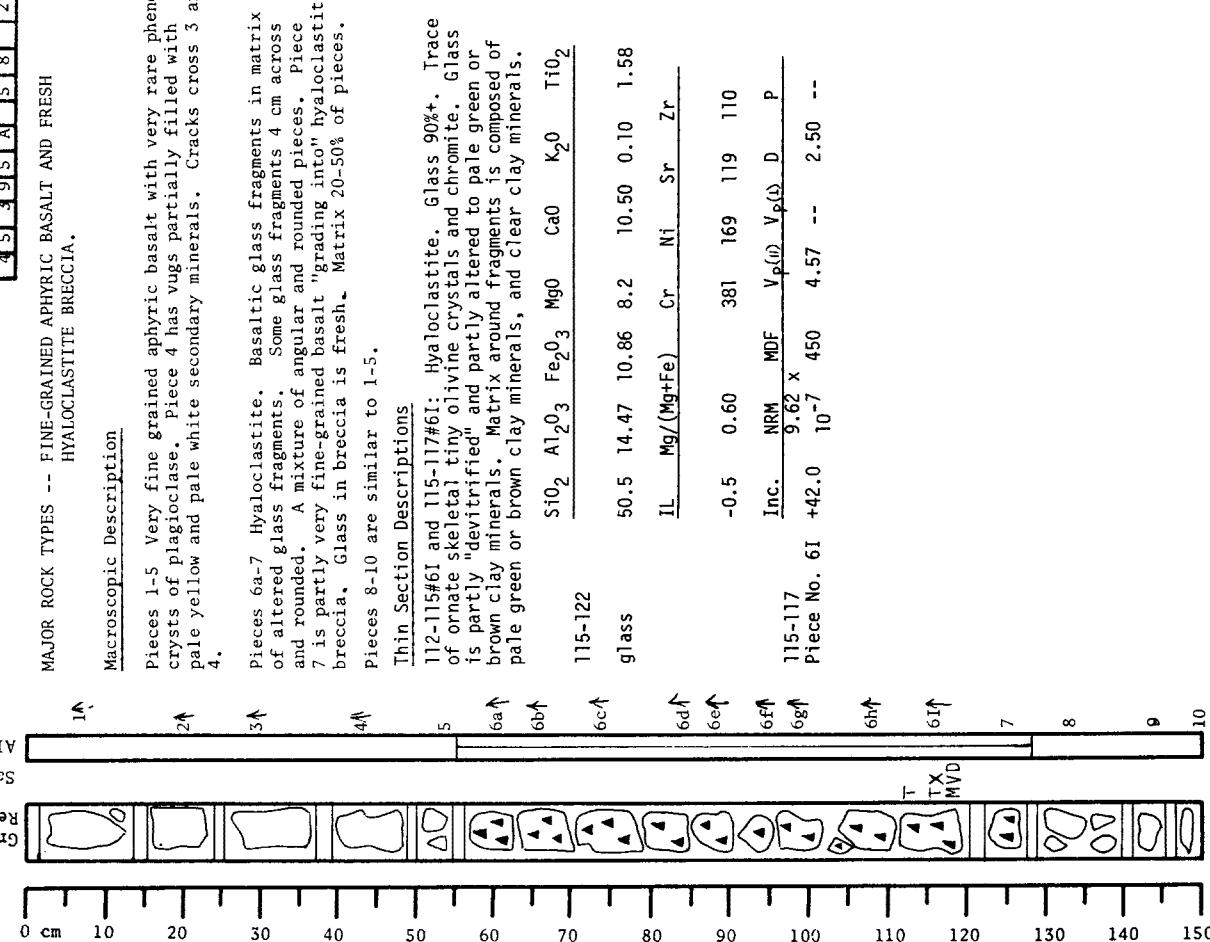
SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
50.5	14.47	10.86	8.2	10.50	0.10	1.58

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
-0.5	0.60	381	169	119	110

Inc.	NRM	MDF	$V_p(\text{U})$	$V_p(\text{D})$	D	P
115-117 Piece No. 61	+42.0	10 ⁻⁷	450	4.57	--	2.50 --

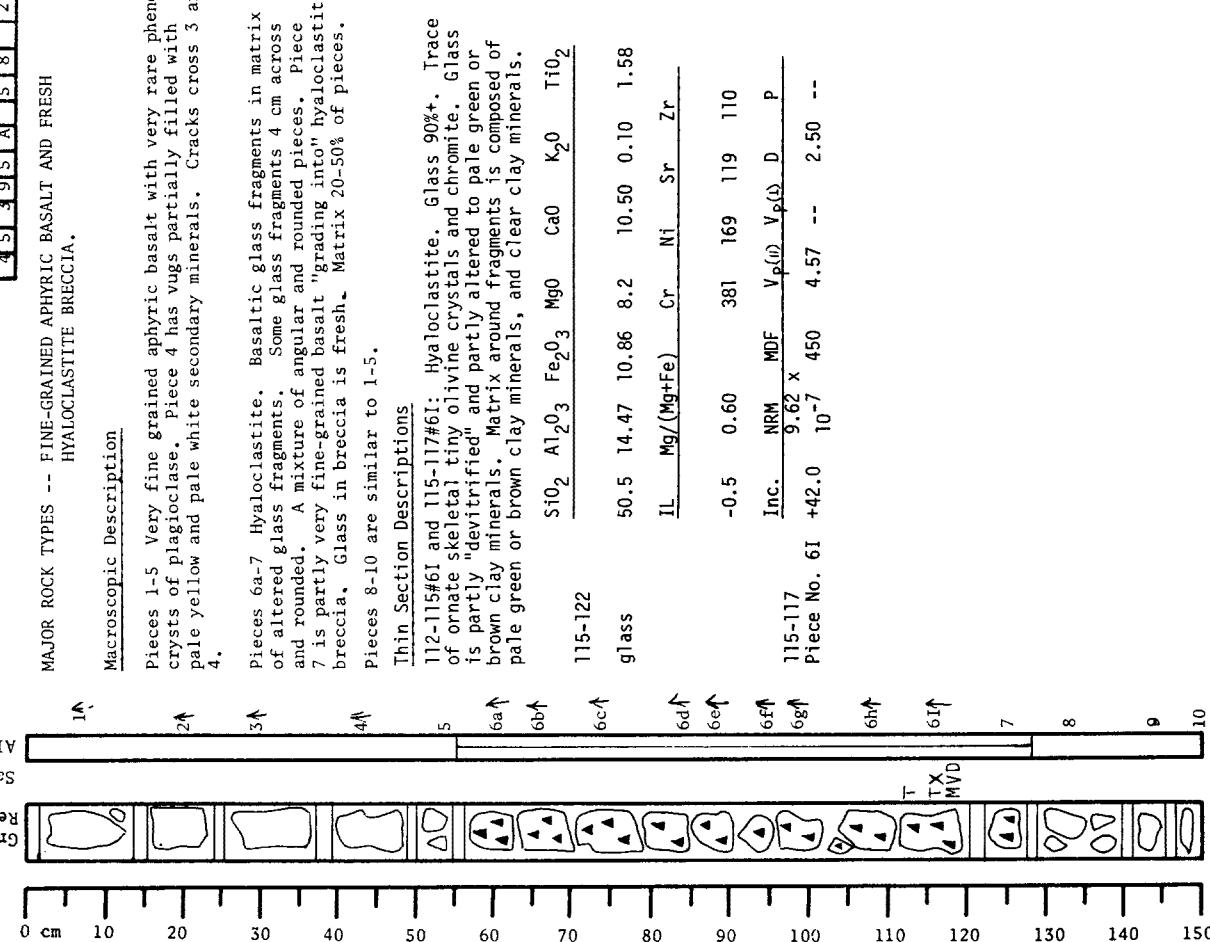
Graphic Representation

Sample Alteration



Graphic Representation

Sample Alteration



LEG.	SITE	H	O	L	CORE	E	SEC
4	5	3	9	5	A	5	8

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPES -- FINE-GRAINED APHYRIC BASALT AND FRESH HYALOCLASTITE BRECCIA.Macroscopic Description

Pieces 1-5 Very fine grained aphyric basalt with very rare phenocrysts of plagioclase. Piece 4 has vugs partially filled with pale yellow and pale white secondary minerals. Cracks cross 3 and 4.

Pieces 6a-7 Hyaloclastite. Basaltic glass fragments in matrix of altered glass fragments. Some glass fragments 4 cm across and rounded. A mixture of angular and rounded pieces. Piece 7 is partly very fine-grained basalt "grading into" hyaloclastite breccia. Glass in breccia is fresh. Matrix 20-50% of pieces. Pieces 8-10 are similar to 1-5.

Thin Section Descriptions

112-115#61 and 115-117#61: Hyaloclastite. Glass 90%. Trace of ornate skeletal tiny olivine crystals and chromite. Glass is partly "devitrified" and partly altered to pale green or brown clay minerals. Matrix around fragments is composed of pale green or brown clay minerals, and clear clay minerals.

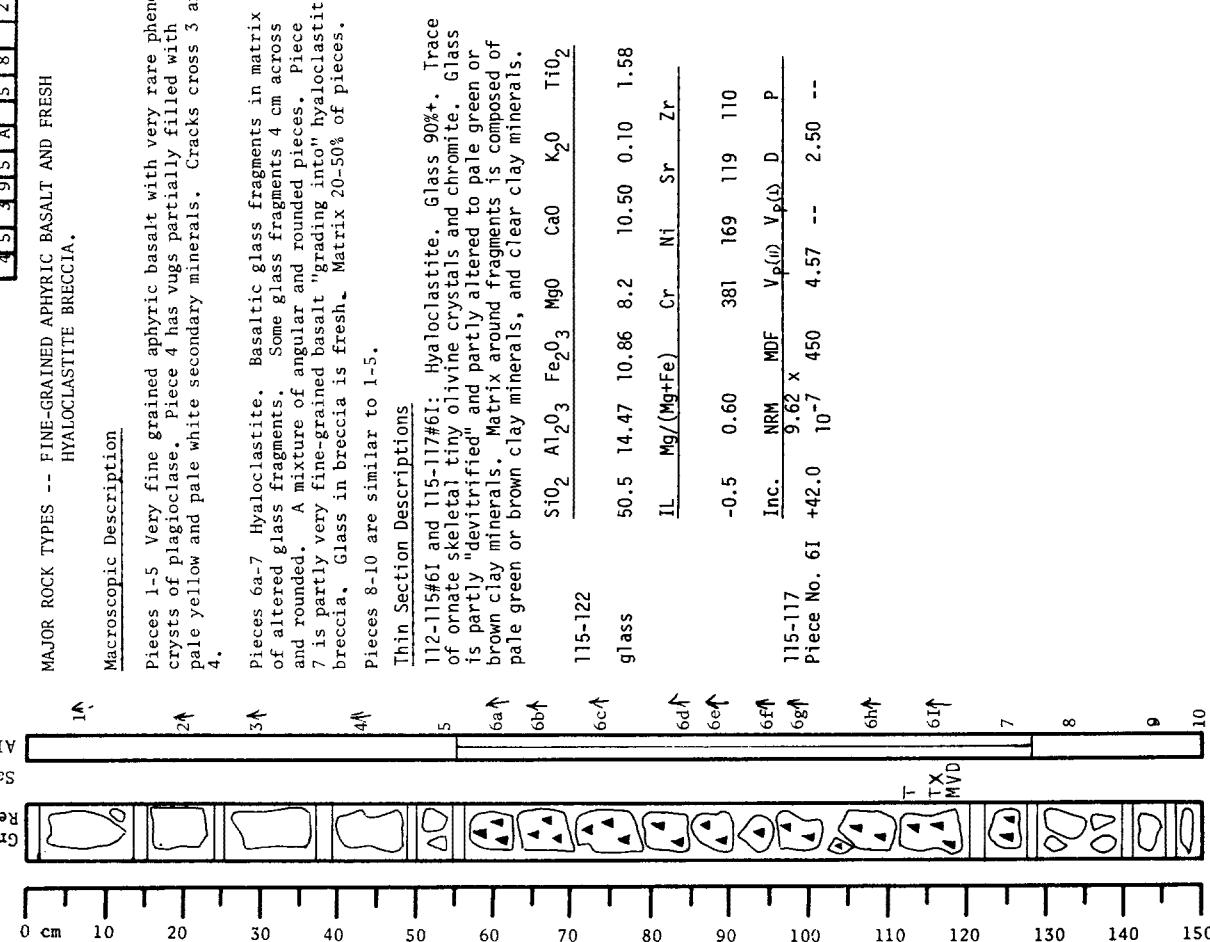
SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
50.5	14.47	10.86	8.2	10.50	0.10	1.58

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
-0.5	0.60	381	169	119	110

Inc.	NRM	MDF	$V_p(\text{U})$	$V_p(\text{D})$	D	P
115-117 Piece No. 61	+42.0	10 ⁻⁷	450	4.57	--	2.50 --

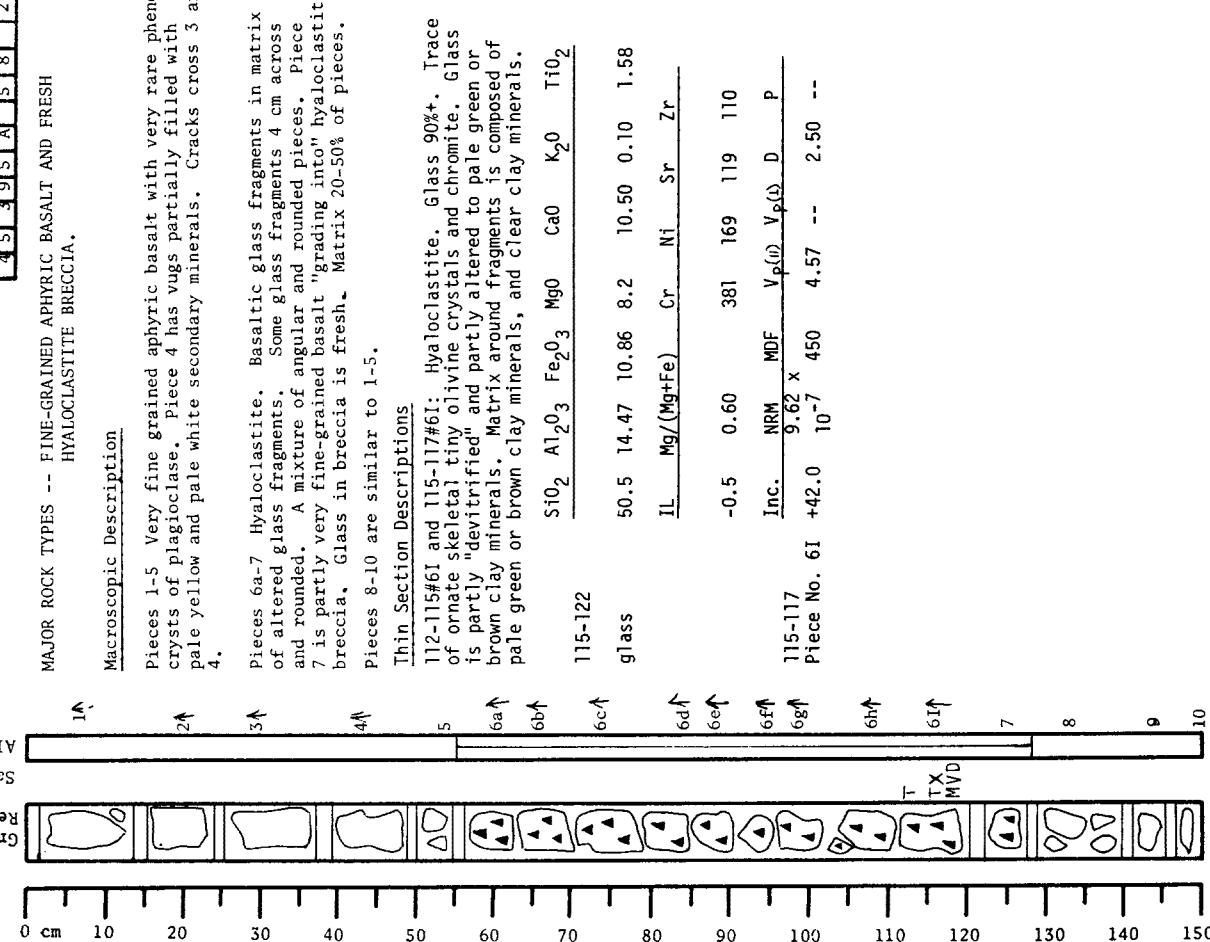
Graphic Representation

Sample Alteration



Graphic Representation

Sample Alteration



LEG.	SITE	H	O	L	CORE	E	SEC
4	5	3	9	5	A	5	8

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPES -- FINE-GRAINED APHYRIC BASALT AND FRESH HYALOCLASTITE BRECCIA.Macroscopic Description

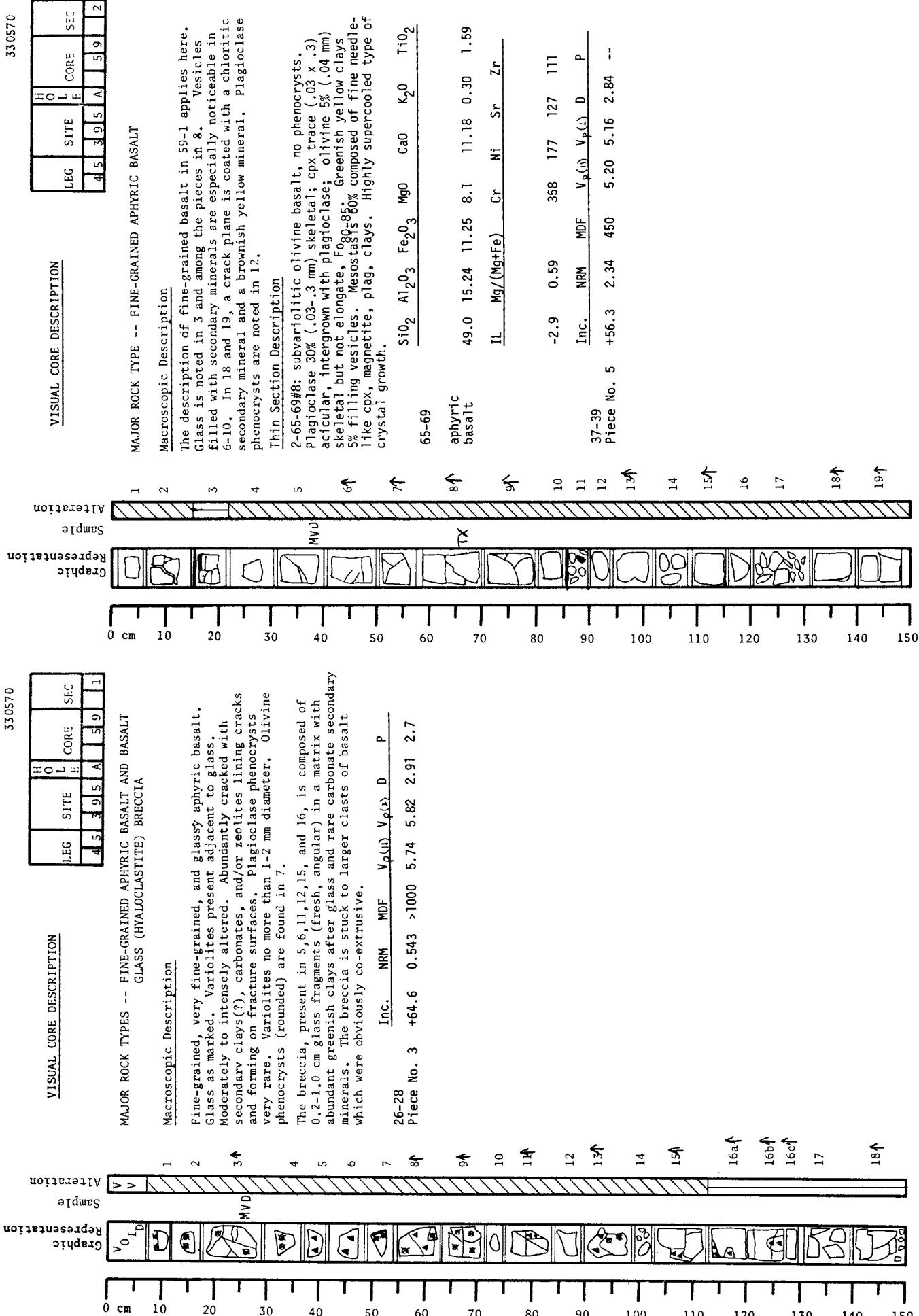
Pieces 1-5 Very fine grained aphyric basalt with very rare phenocrysts of plagioclase. Piece 4 has vugs partially filled with pale yellow and pale white secondary minerals. Cracks cross 3 and 4.

Pieces 6a-7 Hyaloclastite. Basaltic glass fragments in matrix of altered glass fragments. Some glass fragments 4 cm across and rounded. A mixture of angular and rounded pieces. Piece 7 is partly very fine-grained basalt "grading into" hyaloclastite breccia. Glass in breccia is fresh. Matrix 20-50% of pieces. Pieces 8-10 are similar to 1-5.

Thin Section Descriptions

112-115#61 and 115-117#61: Hyaloclastite. Glass 90%. Trace of ornate skeletal tiny olivine crystals and chromite. Glass is partly "devitrified" and partly altered to pale green or brown clay minerals. Matrix around fragments is composed of pale green or brown clay minerals, and clear clay minerals.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O
------------------	--------------------------------	--------------------------------	-----	-----	------------------



330570

	LEG	SITE	H	O	L	CORE	SFC		
	4	5	3	9	5	A	6	0	1

MAJOR ROCK TYPES -- FINE-GRAINED APHYRIC BASALT AND LESSER
BASALT GLASS BRECCIA

Macroscopic Description

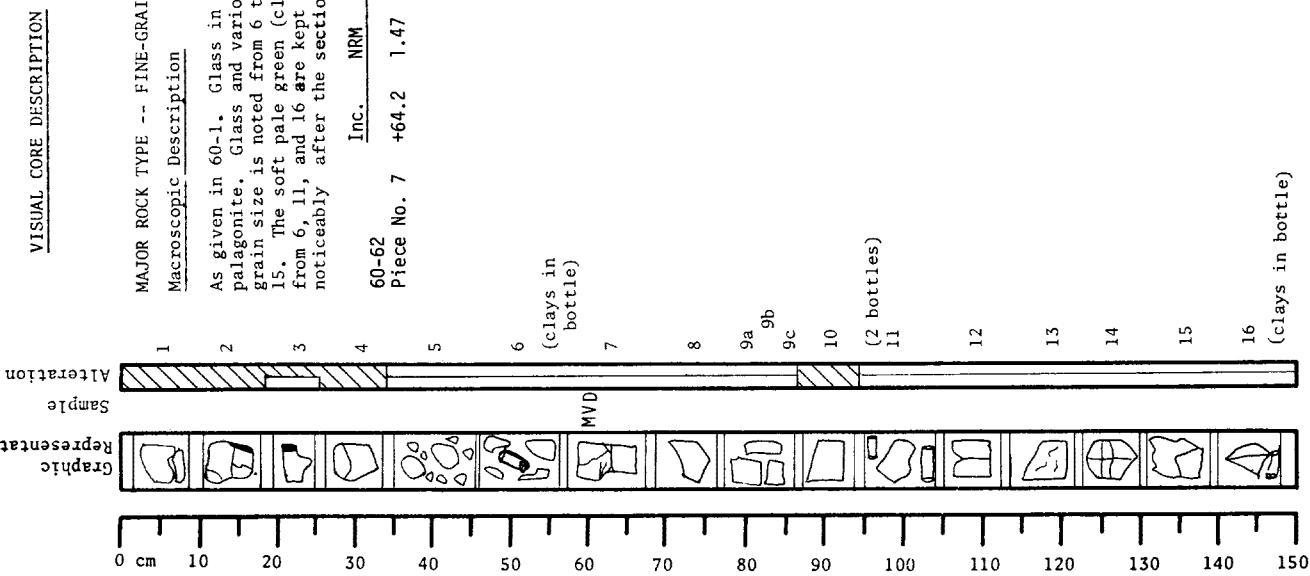
1 Fine-grained, very fine-grained, and glassy aphyric basalt. Glass as marked. Variolites present adjacent to glass and in some pieces without glass, no more than 1-2 mm in diameter. Moderately to intensely altered. Abundantly cracked with secondary clays (?), carbonates, and/or zeolites (?) lining cracks and forming on fracture surfaces. Plagioclase phenocrysts noted in 2, 9, and 10. Glass altered to palagonite in some pieces.

2 The breccia is again a basalt glass (haloclastite) breccia similar to that of 58-2 and 59-1. It occurs in 4, 5 and 6, and consists of angular glass fragments in a matrix of crushed and altered glass (mostly to clays and partly cemented by carbonates).

3 It is not extensively palagonitized. Palagonite was noted in 6 and 12, however.

4 Inc. NRM MDF $V_{p(\text{H})}$ $V_{p(\text{Q})}$ D P

Piece No. 2 +64.0 1.78 450 5.50 5.47 2.89 --



330570

	LEG	SITE	H	O	L	CORE	SFC		
	4	5	3	9	5	A	6	0	2

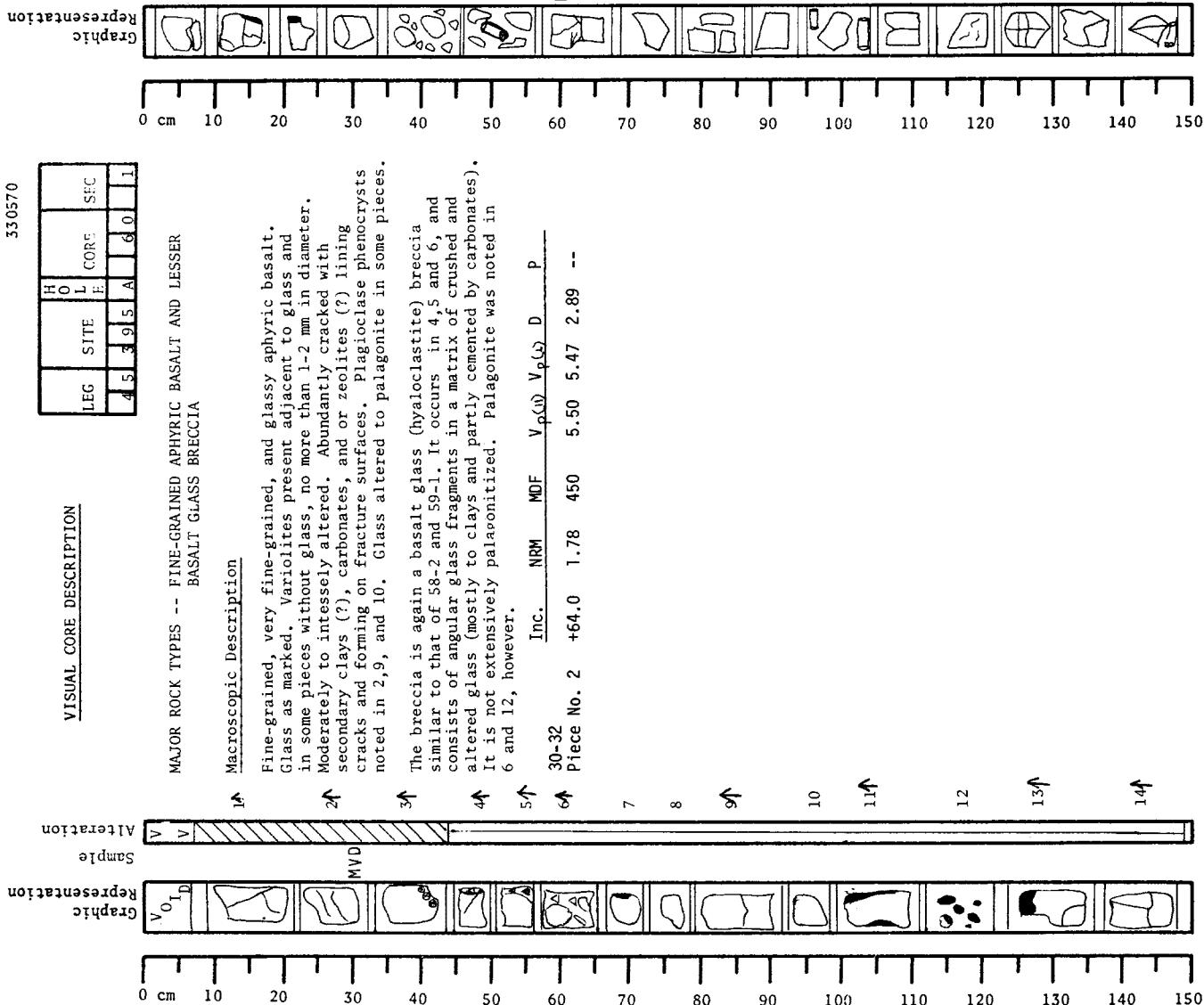
MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

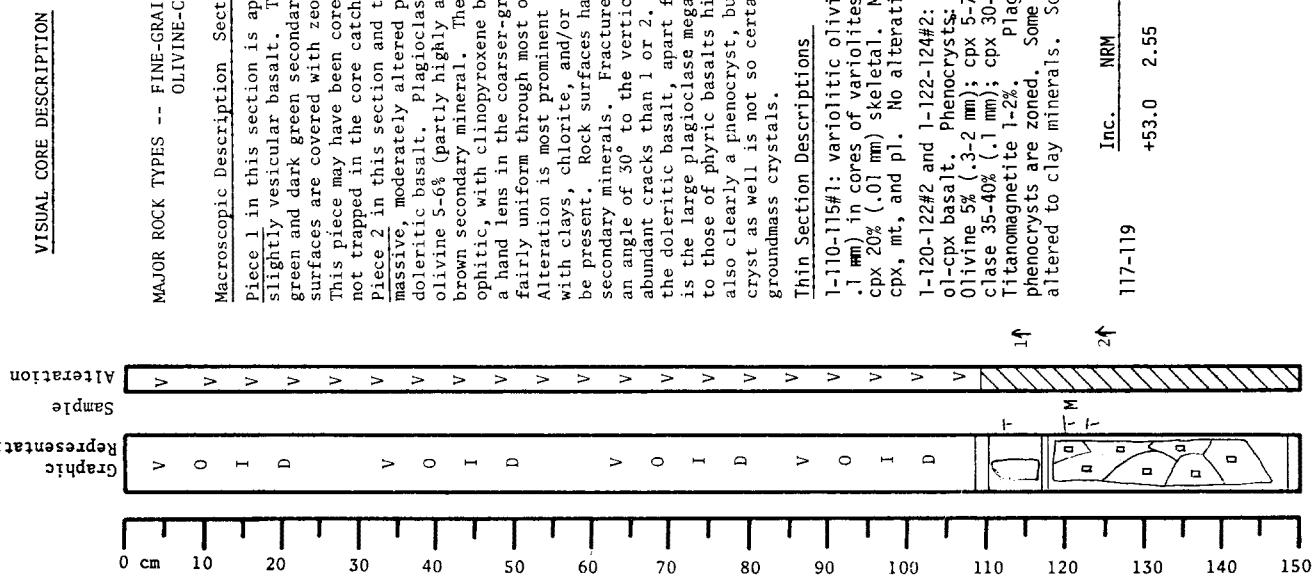
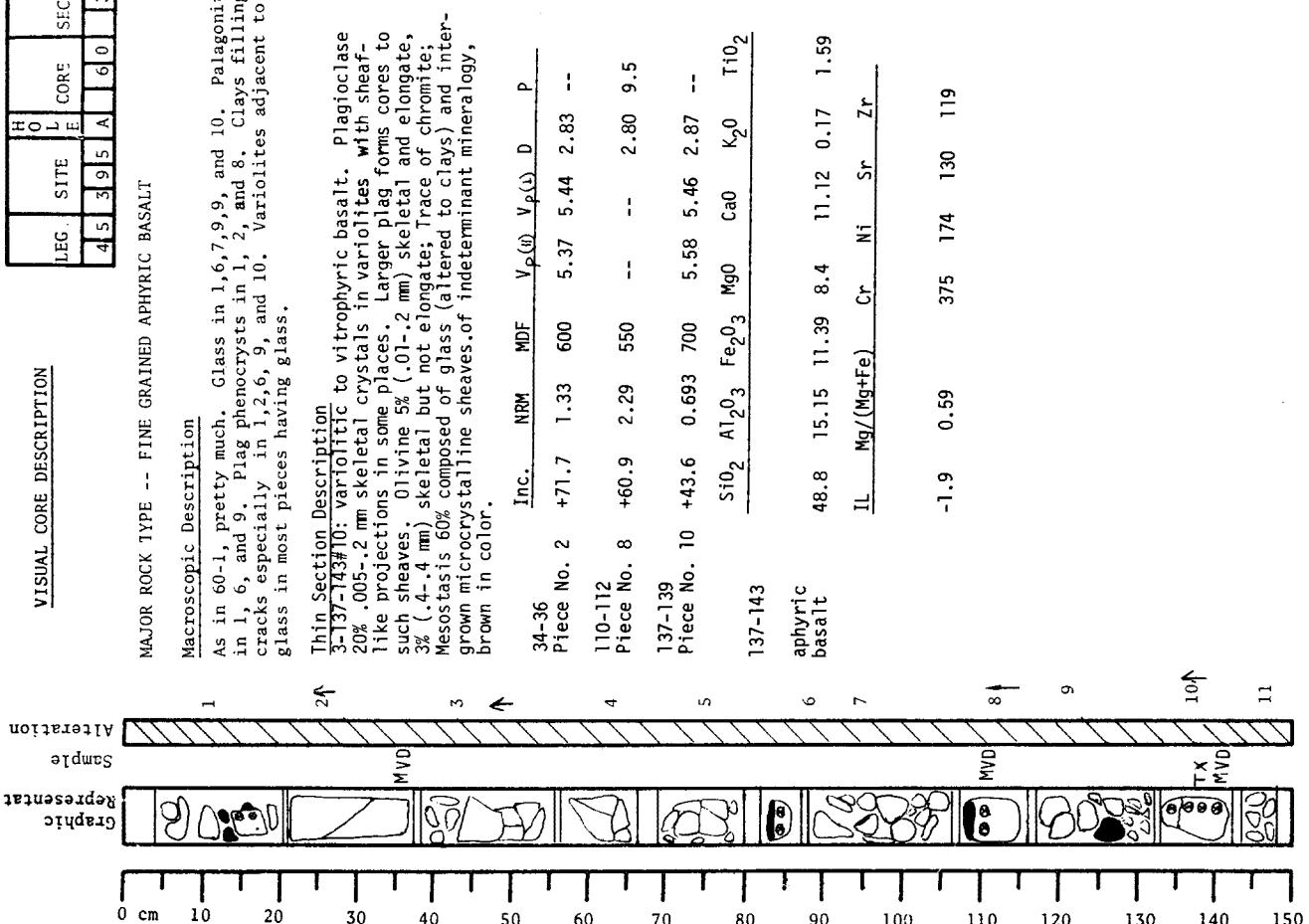
Macroscopic Description

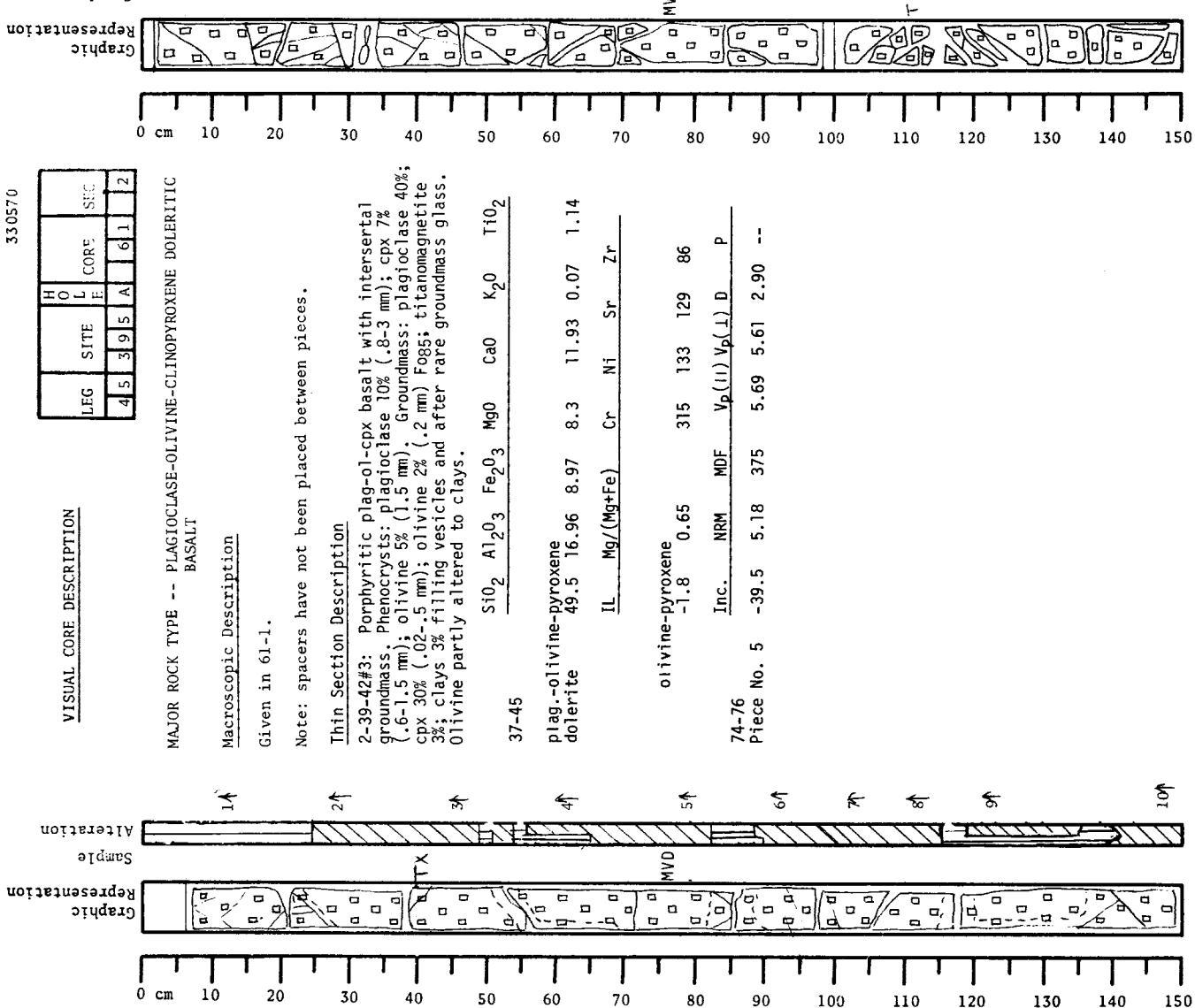
As given in 60-1. Glass in 2 and 3, partially altered to palagonite. Glass and variolites in 14. An increase in grain size is noted from 6 to 12, and a decrease from 12 to 15. The soft pale green (clay) minerals of crack fillings from 6, 11, and 16 are kept in glass bottles. They expanded noticeably after the section was split.

Inc. NRM MDF $V_{p(\text{H})}$ $V_{p(\text{Q})}$ D P

Piece No. 7 +64.2 1.47 650 4.71 4.91 2.72 10.7







LEG:	SITE	H			CORER	SRC
		4	5	3		
4	5	3	9	5	A	6
4	5	3	9	5	A	6
1	4	6	1	2		3

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

Given in 61-1.
Note: spacers have not been placed between all pieces.

Thin Section Description

3-110-112#8: Porphyritic plagioclase-ol basalt, subophitic texture. Phenocrysts: plagioclase 20% (to 4 mm); olivine 5%; cpx 1%. Groundmass: plagioclase 40%; cpx 30%; ol tr; titanomagnetite 1%; secondary calcite 4%. Carbonate forms in vesicles and veinlets. Pale green and green clays also fill vesicles. Olivine highly altered to red-brown clays and Fe-hydroxides (?).

INC.	NRM	MDF	V _P (U)	V _P (L)	D	P
75-77	Piece No. 6	-38.0	3.14	475	5.82	5.89

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	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
			6	1	c/c

MAJOR ROCK TYPE -- PLAGIOLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

Given in 61-1.

Thin Section Description

cc-40-4#4. Plagioclase-cpx-o1 phric dolerite. Phenocrysts: Plagioclase 30% (.2-.10 mm); olivine 5%; cpx 10% (2 mm). Groundmass: plagioclase 20% (1 mm); cpx 25% (.2 mm); olivine-trace; titanomagnetite 5%; spinel-trace; chlorite (?) 5%. Plag is An70, some zoned. Olivine very altered to brownish clays and 4(broke)light chlorite (?). Some carbonate in veins and vesicles (fragments)

Inc. NRM MDF $V_{D(\text{II})}$ $V_{D(\text{I})}$ D P

13-15

Piece No. 2 -39.5 4.94 75 5.59 5.78 2.88 --

53-55

Piece No. 5 -39.0 3.87 375 5.43 5.68 2.88 --

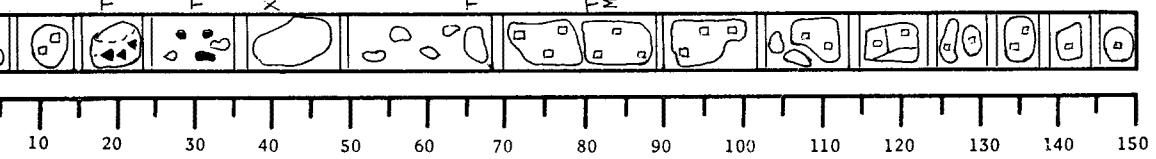
5

†

MVD

Sample

Graphic Representation



Representative Sample

Alteration

0 cm 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

VISUAL CORE DESCRIPTION

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
			6	1	c/c

MAJOR ROCK TYPES -- PLAGIOLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT AND FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Pieces 1, 2, and 7a through 14 are plagioclase-olivine-clino-pyroxe doleritic basalt, essentially identical to that described in 61-1. Pieces 7a, 7b, and 8 are medium grained basalts; 9-14 are coarser grained, closer to true dolerite. This suggests that the dolerite recovered in Core 61 is a separate cooling unit than pieces in this core.

Pieces 4-6 are fine-grained aphyric basalts of the type recovered above the dolerite. Piece 3 has a large clast of fine-grained aphyric basalt attached to a basalt glass breccia similar to those described in 49-1 and 58-2. Fragments in 4 include glass.

Thin Section Descriptions

1-17-22#3.1-25-36#4.1-60-6#7#6: Variolitic olivine basalts, no phenocrysts. 3 and 6 have 50-60% plagioclase up to .5 mm skeletal. 4 has only 10% and a greater proportion of mesostasis. Mesostasis contains titanomagnetite dust, cpx, plag, and altered glass (to clays). Vesicles 2-3% filled with clays.

1-80-87#7b: porphyritic basalt. Phenocrysts: plagioclase 20%

(up to 2 mm); cpx 3% (.3-.5 mm) olivine 5% (.4 mm); Groundmass:

plagioclase 30% (.05 mm laths); cpx 25% (.05 mm) olivine - trace;

Titanomagnetite, 7%; chlorite (?) after olivine and in interstitial spaces. Plag is An75, is locally zoned, and contains glass blebs in larger phenocrysts. Olivine is Fo85.

40-42

aphyratic basalt

58-87

plag.-olivine-clinopyroxene dolerite

9

olivine-clinopyroxene

12

40-42

Piece No. 5

84-86

Piece No. 7B

84-86

84-86

84-86

84-86

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84-86

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84-86

84-86

84-86

84-86

84-86

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
			6	2	1

MAJOR ROCK TYPES -- PLAGIOLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT AND FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Pieces 1, 2, and 7a through 14 are plagioclase-olivine-clino-pyroxe doleritic basalt, essentially identical to that described in 61-1. Pieces 7a, 7b, and 8 are medium grained basalts; 9-14 are coarser grained, closer to true dolerite. This suggests that the dolerite recovered in Core 61 is a separate cooling unit than pieces in this core.

Pieces 4-6 are fine-grained aphyric basalts of the type recovered above the dolerite. Piece 3 has a large clast of fine-grained aphyric basalt attached to a basalt glass breccia similar to those described in 49-1 and 58-2. Fragments in 4 include glass.

Thin Section Descriptions

1-17-22#3.1-25-36#4.1-60-6#7#6: Variolitic olivine basalts, no phenocrysts. 3 and 6 have 50-60% plagioclase up to .5 mm skeletal. 4 has only 10% and a greater proportion of mesostasis. Mesostasis contains titanomagnetite dust, cpx, plag, and altered glass (to clays). Vesicles 2-3% filled with clays.

1-80-87#7b: porphyritic basalt. Phenocrysts: plagioclase 20%

(up to 2 mm); cpx 3% (.3-.5 mm) olivine 5% (.4 mm); Groundmass:

plagioclase 30% (.05 mm laths); cpx 25% (.05 mm) olivine - trace;

Titanomagnetite, 7%; chlorite (?) after olivine and in interstitial spaces. Plag is An75, is locally zoned, and contains glass blebs in larger phenocrysts. Olivine is Fo85.

84-86

olivine-clinopyroxene

84-86

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
			6	2	1

MAJOR ROCK TYPES -- PLAGIOLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT AND FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Pieces 1, 2, and 7a through 14 are plagioclase-olivine-clino-pyroxe doleritic basalt, essentially identical to that described in 61-1. Pieces 7a, 7b, and 8 are medium grained basalts; 9-14 are coarser grained, closer to true dolerite. This suggests that the dolerite recovered in Core 61 is a separate cooling unit than pieces in this core.

Pieces 4-6 are fine-grained aphyric basalts of the type recovered above the dolerite. Piece 3 has a large clast of fine-grained aphyric basalt attached to a basalt glass breccia similar to those described in 49-1 and 58-2. Fragments in 4 include glass.

Thin Section Descriptions

1-17-22#3.1-25-36#4.1-60-6#7#6: Variolitic olivine basalts, no phenocrysts. 3 and 6 have 50-60% plagioclase up to .5 mm skeletal. 4 has only 10% and a greater proportion of mesostasis. Mesostasis contains titanomagnetite dust, cpx, plag, and altered glass (to clays). Vesicles 2-3% filled with clays.

1-80-87#7b: porphyritic basalt. Phenocrysts: plagioclase 20%

(up to 2 mm); cpx 3% (.3-.5 mm) olivine 5% (.4 mm); Groundmass:

plagioclase 30% (.05 mm laths); cpx 25% (.05 mm) olivine - trace;

Titanomagnetite, 7%; chlorite (?) after olivine and in interstitial spaces. Plag is An75, is locally zoned, and contains glass blebs in larger phenocrysts. Olivine is Fo85.

84-86

olivine-clinopyroxene

84-86

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A
			6	2	1

MAJOR ROCK TYPES -- PLAGIOLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT AND FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Pieces 1, 2, and 7a through 14 are plagioclase-olivine-clino-pyroxe doleritic basalt, essentially identical to that described in 61-1. Pieces 7a, 7b, and 8 are medium grained basalts; 9-14 are coarser grained, closer to true dolerite. This suggests that the dolerite recovered in Core 61 is a separate cooling unit than pieces in this core.

Pieces 4-6 are fine-grained aphyric basalts of the type recovered above the dolerite. Piece 3 has a large clast of fine-grained aphyric basalt attached to a basalt glass breccia similar to those described in 49-1 and 58-2. Fragments in 4 include glass.

Thin Section Descriptions

1-17-22#3.1-25-36#4.1-60-6#7#6: Variolitic olivine basalts, no phenocrysts. 3 and 6 have 50-60% plagioclase up to .5 mm skeletal. 4 has only 10% and a greater proportion of mesostasis. Mesostasis contains titanomagnetite dust, cpx, plag, and altered glass (to clays). Vesicles 2-3% filled with clays.

1-80-87#7b: porphyritic basalt. Phenocrysts: plagioclase 20%

(up to 2 mm); cpx 3% (.3-.5 mm) olivine 5% (.4 mm); Groundmass:

plagioclase 30% (.05 mm laths); cpx 25% (.05 mm) olivine - trace;

Titanomagnetite, 7%; chlorite (?) after olivine and in interstitial spaces. Plag is An75, is locally zoned, and contains glass blebs in larger phenocrysts. Olivine is Fo85.

84-86

olivine-clinopyroxene

84-86

	H	O	L	CORE	SEC</th
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	LEG	SITE	H O	L	CORE	SEC
	4	5	3	9	5	A
	4	5	3	9	5	A

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

This core and the upper sections of Core 64 contain several meters of largely continuously recovered doleritic basalt, virtually identical to that recovered in Cores 61 and 62. The dolerite in 63 and 64 is the major part of the second dolerite which begins in 62. In this second dolerite, plagioclase is again prominent as megacrysts and glomerocrysts, and alteration is most extensive along cracks lined with clays, carbonates, and possibly zeolites. As in the previous dolerite, cracks appear to be conjugate, and close to 30° from the vertical. In section 63-1, grain size increases from pieces 4 to 11b, accompanied by an increase in the proportion of plagioclase and a decrease in the proportion of olivine.

4	5, 6, 7, 8, 9	10, 11a, 11b	11c, 11d, 12a, 12b
15	15-20	~20	15-20
%01	~5	<5	5

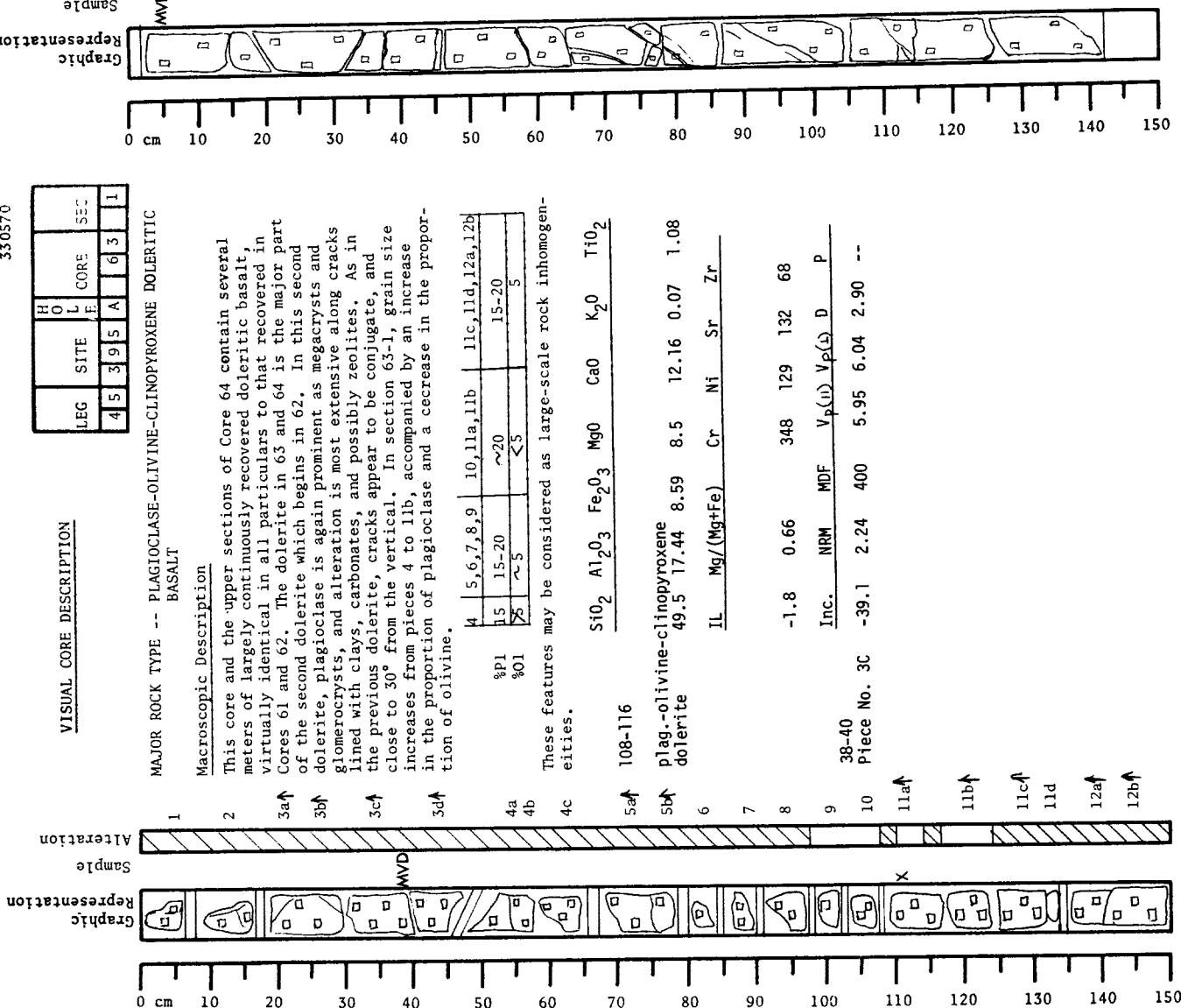
These features may be considered as large-scale rock inhomogeneities.

5a↑ 108-116

plag.-olivine-clinopyroxene dolerite 49.5 17.44 8.59 8.5 12.16 0.07 1.08

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
Inc.	NRM	MDF	V _{P(D)}	V _{P(D)}	P

9	38-40	Piece No. 3C	-39.1	2.24	400	5.95	6.04	2.90	--
10	38-40	Piece No. 3C	-39.1	2.24	400	5.95	6.04	2.90	--



VISUAL CORE DESCRIPTION

	LEG	SITE	H O	L	CORE	SEC
	4	5	3	9	5	A
	4	5	3	9	5	A

MAJOR ROCK TYPE -- PLAGIOLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

A continuation of the dolerite described in 62-2 and 63-1. No systematic change in grain size nor modal composition was detected. Plagioclase is 15-20% (up to 1.5 cm), olivine 5-7%, and clinopyroxene about 1% as visible phenocrysts. Groundmass is subophitic. Alteration moderate except right next to cracks where secondary minerals abound. Piece 11 is badly altered.

Note: spacers have not been placed in this section because it appears to have been continuously recovered.

Inc.	NRM	MDF	V _{P(D)}	V _{P(D)}	D	P
2-4	Piece No. 1A	-36.4	3.20	350	5.68	--

1d↑

1b↑

1c↑

1e↑

1f↑

1g↑

1h↑

1i↑

1j↑

1a↑

Sample MWD

Graphic Representation

0 cm

10

20

30

40

50

60

70

80

90

100

110

120

130

140

150

	LEG	SITE	H O	L	CORE	SEC
	4	5	3	9	5	A
	4	5	3	9	5	A

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

This core and the upper sections of Core 64 contain several meters of largely continuously recovered doleritic basalt, virtually identical to that recovered in Cores 61 and 62. The dolerite in 63 and 64 is the major part of the second dolerite which begins in 62. In this second dolerite, plagioclase is again prominent as megacrysts and glomerocrysts, and alteration is most extensive along cracks lined with clays, carbonates, and possibly zeolites. As in the previous dolerite, cracks appear to be conjugate, and close to 30° from the vertical. In section 63-1, grain size increases from pieces 4 to 11b, accompanied by an increase in the proportion of plagioclase and a decrease in the proportion of olivine.

4	5, 6, 7, 8, 9	10, 11a, 11b	11c, 11d, 12a, 12b
15	15-20	~20	15-20
%01	~5	<5	5

These features may be considered as large-scale rock inhomogeneities.

5a↑ 108-116

plag.-olivine-clinopyroxene dolerite 49.5 17.44 8.59 8.5 12.16 0.07 1.08

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
Inc.	NRM	MDF	V _{P(D)}	V _{P(D)}	P

9	38-40	Piece No. 3C	-39.1	2.24	400	5.95	6.04	2.90	--
10	38-40	Piece No. 3C	-39.1	2.24	400	5.95	6.04	2.90	--

VISUAL CORE DESCRIPTION		H	O	L	CORE	SSC
LEG	SITE	E	E	E	E	
4 5	3 9	5	A	6	3	3

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE
DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in 62-2 and 63-1, apparently continuously recovered at least from the top of piece 12a in 63-1 probably to the end of the core. Grain size in this section is fairly coarse, subophitic, with about 20% plagioclase phenocrysts, 5% olivine phenocrysts, and less than 1%. Alteration and fracture inclinations as in the previous sections. Texture is uniform.

In this section, pieces 1e-1h have an auto- or proto-clastic texture. In this breccia zone, rock fracturing has apparently proceeded to such an extent that pieces of rock have been crushed against each other. The result is "clastes" in a breccia "matrix" of crushed dolerite. Alteration is fairly extensive in the breccia matrix, with clays and possibly chlorite abundant. Shear planes in the section inclined at about 30° to the vertical cross-cut the breccia, hence are younger. Some shear planes in Core 63 are coated with secondary minerals which are slickensided.

Inc.	NRM	MDF	$V_p(11) V_p(1\perp) D$	P
50-52 Piece No. 1D	-39.4	2.72	100	5.69 5.78 2.88 --

		H	O	L	CORE	SEC
LEG	SITE	E	E	E	E	
4 5	3 9	5	A	6	3	4

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE
DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in 62-2 and 63-1, with similar alteration and conjugate fracture patterns. Plagioclase phenocrysts are bit less abundant (15%) and olivine a bit more abundant (7%) than in sections 1 and 2. Some cracks are coated with chlorite and agreenish-white clay mineral. Others are coated with a "spherical" carbonate partly covered with fine gray minerals (esp. le). In such instances, a clear hard mineral is also observed. Cracks are so abundant in 1b and 1g that the pieces are nearly breccias such as those described in 63-3.

Inc.	NRM	MDF	$V_p(11) V_p(1\perp) D$	P
32-34 Piece No. 1C	-39.7	3.60	325	5.72 5.67 2.87 --

VISUAL CORE DESCRIPTION		H	O	L	CORE	SSC
LEG	SITE	E	E	E	E	
4 5	3 9	5	A	6	3	3

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE
DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in 62-2 and 63-1, apparently continuously recovered at least from the top of piece 12a in 63-1 probably to the end of the core. Grain size in this section is fairly coarse, subophitic, with about 20% plagioclase phenocrysts, 5% olivine phenocrysts, and less than 1%. Alteration and fracture inclinations as in the previous sections. Texture is uniform.

In this section, pieces 1e-1h have an auto- or proto-clastic texture. In this breccia zone, rock fracturing has apparently proceeded to such an extent that pieces of rock have been crushed against each other. The result is "clastes" in a breccia "matrix" of crushed dolerite. Alteration is fairly extensive in the breccia matrix, with clays and possibly chlorite abundant. Shear planes in the section inclined at about 30° to the vertical cross-cut the breccia, hence are younger. Some shear planes in Core 63 are coated with secondary minerals which are slickensided.

Inc.	NRM	MDF	$V_p(11) V_p(1\perp) D$	P
50-52 Piece No. 1D	-39.4	2.72	100	5.69 5.78 2.88 --

VISUAL CORE DESCRIPTION		H	O	L	CORE	SSC
LEG	SITE	E	E	E	E	
4 5	3 9	5	A	6	3	3

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE
DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in 62-2 and 63-1, apparently continuously recovered at least from the top of piece 12a in 63-1 probably to the end of the core. Grain size in this section is fairly coarse, subophitic, with about 20% plagioclase phenocrysts, 5% olivine phenocrysts, and less than 1%. Alteration and fracture inclinations as in the previous sections. Texture is uniform.

In this section, pieces 1e-1h have an auto- or proto-clastic texture. In this breccia zone, rock fracturing has apparently proceeded to such an extent that pieces of rock have been crushed against each other. The result is "clastes" in a breccia "matrix" of crushed dolerite. Alteration is fairly extensive in the breccia matrix, with clays and possibly chlorite abundant. Shear planes in the section inclined at about 30° to the vertical cross-cut the breccia, hence are younger. Some shear planes in Core 63 are coated with secondary minerals which are slickensided.

Inc.	NRM	MDF	$V_p(11) V_p(1\perp) D$	P
50-52 Piece No. 1D	-39.4	2.72	100	5.69 5.78 2.88 --

VISUAL CORE DESCRIPTION		H	O	L	CORE	SSC
LEG	SITE	E	E	E	E	
4 5	3 9	5	A	6	3	3

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE
DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in 62-2 and 63-1, apparently continuously recovered at least from the top of piece 12a in 63-1 probably to the end of the core. Grain size in this section is fairly coarse, subophitic, with about 20% plagioclase phenocrysts, 5% olivine phenocrysts, and less than 1%. Alteration and fracture inclinations as in the previous sections. Texture is uniform.

In this section, pieces 1e-1h have an auto- or proto-clastic texture. In this breccia zone, rock fracturing has apparently proceeded to such an extent that pieces of rock have been crushed against each other. The result is "clastes" in a breccia "matrix" of crushed dolerite. Alteration is fairly extensive in the breccia matrix, with clays and possibly chlorite abundant. Shear planes in the section inclined at about 30° to the vertical cross-cut the breccia, hence are younger. Some shear planes in Core 63 are coated with secondary minerals which are slickensided.

Inc.	NRM	MDF	$V_p(11) V_p(1\perp) D$	P
50-52 Piece No. 1D	-39.4	2.72	100	5.69 5.78 2.88 --

VISUAL CORE DESCRIPTION		H	O	L	CORE	SSC
LEG	SITE	E	E	E	E	
4 5	3 9	5	A	6	3	3

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE
DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in 62-2 and 63-1, apparently continuously recovered at least from the top of piece 12a in 63-1 probably to the end of the core. Grain size in this section is fairly coarse, subophitic, with about 20% plagioclase phenocrysts, 5% olivine phenocrysts, and less than 1%. Alteration and fracture inclinations as in the previous sections. Texture is uniform.

In this section, pieces 1e-1h have an auto- or proto-clastic texture. In this breccia zone, rock fracturing has apparently proceeded to such an extent that pieces of rock have been crushed against each other. The result is "clastes" in a breccia "matrix" of crushed dolerite. Alteration is fairly extensive in the breccia matrix, with clays and possibly chlorite abundant. Shear planes in the section inclined at about 30° to the vertical cross-cut the breccia, hence are younger. Some shear planes in Core 63 are coated with secondary minerals which are slickensided.

Inc.	NRM	MDF	$V_p(11) V_p(1\perp) D$	P
50-52 Piece No. 1D	-39.4	2.72	100	5.69 5.78 2.88 --

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LEG.	SITE	H	O	L	CORE	SEC.
4	5	3	9	5	A	6
4.5	3.9	5	1	6	3	c/c

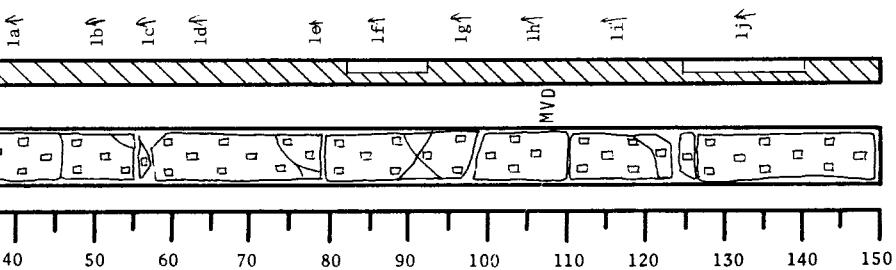
VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- PLAGIOLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT.

Macroscopic Description

A continuation of the doleritic basalt described in 62-2 and 63-1. Plag phenocrysts 2-10 mm are 15-20%; ol phenocrysts 2-6 mm are 5-7%. Cpx phenocrysts up to 5 mm are rare. No systematic macroscopic variation in phenocryst and groundmass grain size and in modal composition of phenocrysts is detected. Alteration along cracks similar to that in dolerite of Cores 62 and 63. Olivine here is sometimes altered to brownish secondary minerals, but is generally fresh. This section was continuously recovered.

Inc.	106-108	Piece No.	1H	-40.3	3.55	25	6.07	6.05	2.90	--	P



330570

LEG.	SITE	H	O	L	CORE	SEC.
4	5	3	9	5	A	6
4.5	3.9	5	1	6	3	c/c

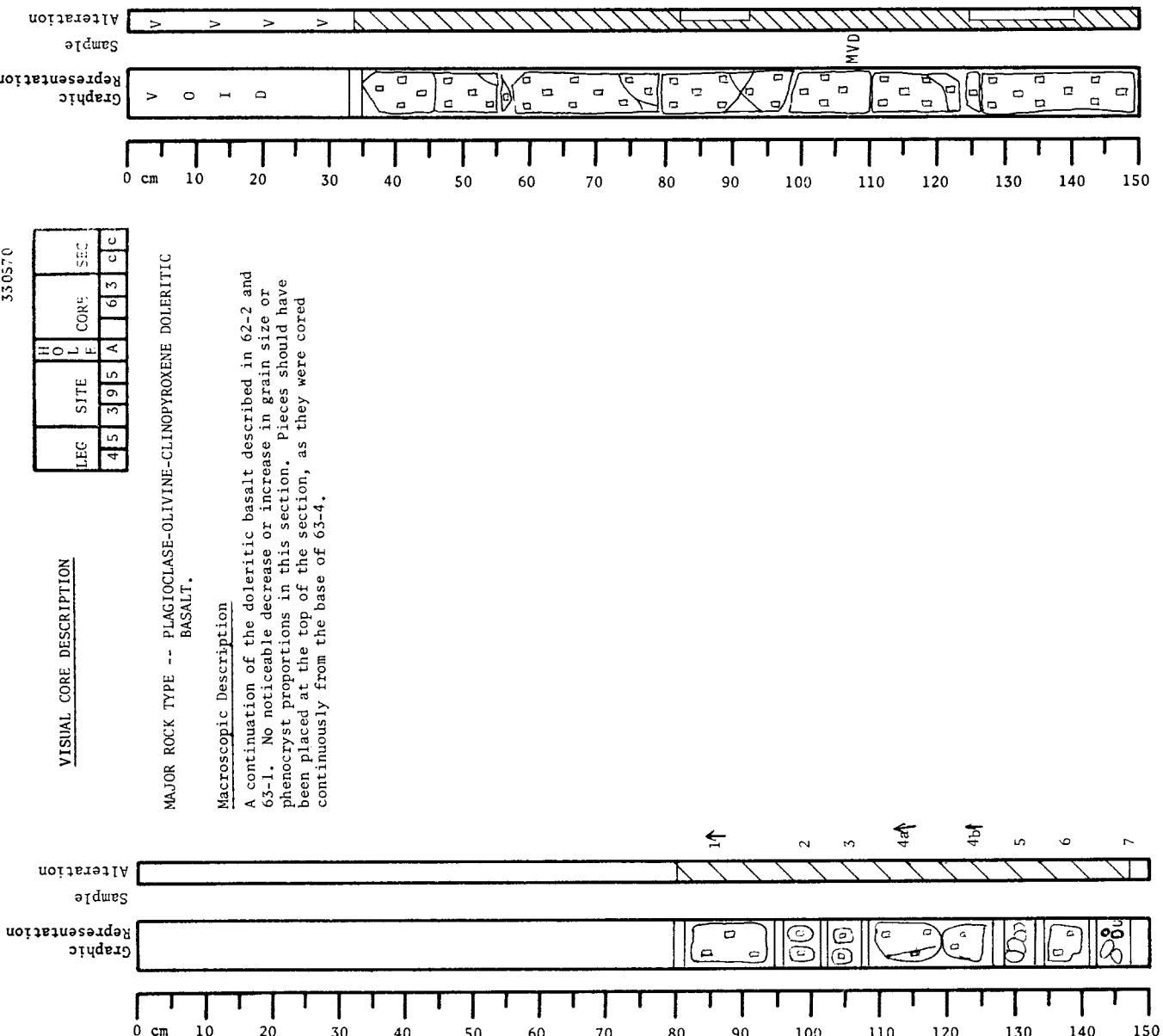
VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- PLAGIOLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT

Macroscopic Description

A continuation of the doleritic basalt described in 62-2 and 63-1. No noticeable decrease or increase in grain size or phenocryst proportions in this section. Pieces should have been placed at the top of the section, as they were cored continuously from the base of 63-4.

Inc.	106-108	Piece No.	1H	-40.3	3.55	25	6.07	6.05	2.90	--	P



VISUAL CORE DESCRIPTION		H	O	L	CORE	SEC
LEG	SITE	E				
4	5	3	9	5	A	6
						4

MAJOR ROCK TYPES -- PLAGIOCLASE-OLIVINE-CLINOPYROXENE DOLERITIC BASALT AND FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Dolomite from 0-133 cm. Note: no numbers on pieces. Intervals are marked on the pieces. The dolerite is a continuation of that described in 62-2 and 63-1. A chill zone is located at the base of the dolerite (129-133 cm). Fracturing and alteration of the dolerite are as described in previous sections.

The aphyric basalt below 133 cm has one large (2 cm) plagioclase phenocryst about 1 cm from the base of the section. The aphyric basalt is partially altered to reddish secondary minerals. Basaltic glass fragments occur at 133 cm but it is not clear whether they are from the chill zone at the base of the dolerite or from the top of the aphyric basalt. The glass fragments are rather badly altered.

Thin Section Description

2-116-122: Plagioclase-clinopyroxene-olivine aphyric doleritic basalt. Phenocrysts: plagioclase 25% (.6-.4 mm); clinopyroxene 3% (.2 mm); olivine 10% (.2-.2 mm). Groundmass: Plagioclase 20% (.1 mm); clinopyroxene 30% (.04 mm); olivine - trace; titanomagnetite 10%. Olivine is Fo95. Plag is An75; phenocrysts are zoned, and contain blebs of glass. Some glomerocrysts of plagioclase and olivine occur. No information on alteration given.

VISUAL CORE DESCRIPTION		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
LEG	SITE							

VISUAL CORE DESCRIPTION		SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
LEG	SITE							
116	122	-2.0	0.65					

olivine-clinopyroxene

plag.-olivine-clinopyroxene

dolerite

Inc. NRM

MDF

Vp(11)Vp(14)

D P

56-58

--

135-137

--

LEG	SITE	H	O	L	CORE	SEC
4	5	3	9	5	A	6
						4
						5

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, with isolated rare phenocrysts of plagioclase up to 7 mm across. Section too fractured to remove from liner for numbering. Intervals indicated directly on cut surfaces of pieces. Glass present at 24 cm, variolites just above, brecciated nearly glassy aphyric basalt below (cemented with greenish white clay minerals and very rare carbonate, and "intruded" by a reddish-brown vein. Basalt glass is partly palagonitized). Glass also present at 82 cm and at 99 cm. Partially brecciated and glassy at 107-108 cm. Glass present at 142 cm with variolitic fragmented basalt above and below. Section is moderately altered throughout. Sequence appears to be pillow lavas fairly highly fractured probably by overburden weight.

Chemical Composition

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
48-53						

Mineralogy

Mineral Abundance

Mineral Size

Mineral Shape

Mineral Orientation

Mineral Position

Mineral Distribution

Mineral Alteration

Mineral Weathering

Mineral Dissolution

Mineral Oxidation

Mineral Reduction

Mineral Volatilization

Mineral Sublimation

Mineral Deposition

Mineral Migration

Mineral Intrusion

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LEG	SITE	H O E	L CORE	SEC	
45	395	A	64	4	

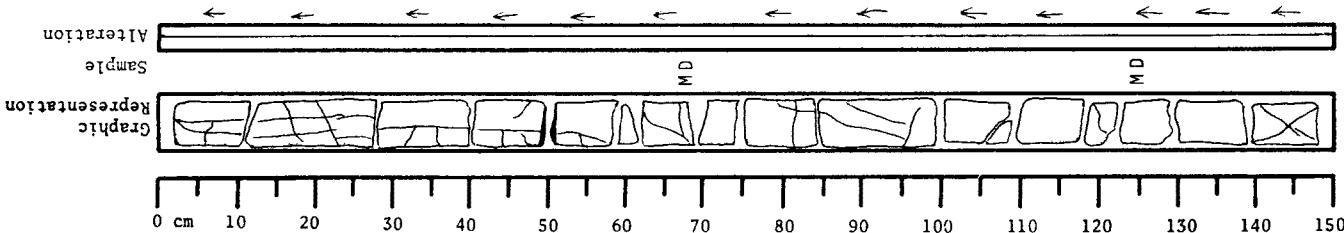
MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

A continuation of the pillow sequence of fine-grained, very fine-grained and glassy basalts described in 64-3. Glass present at 50 cm. Secondary clays, chlorite, hydrous iron oxide minerals, and possibly zeolites are abundant in the numerous cracks. Interiors of some of the larger basalt fragments are fresher than the edges, but cracks are so abundant that overall the section is intensely altered.

Note: surface of samples marked with intervals.

	Inc.	NRM	MDF	$V_p(11) V_p(11)$	D	P
67-69	-38.7	1.17	600	--	--	2.79
123-125	-41.2	2.39	700	--	--	2.86



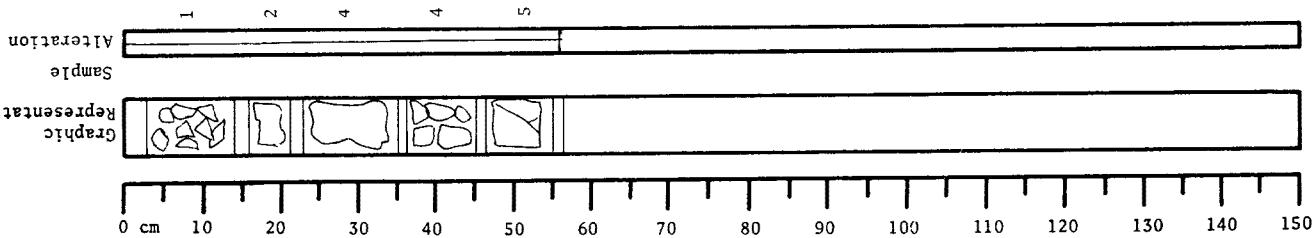
330570

LEG	SITE	H O E	CORE	SEC
45	395	A	64	CC

VISUAL CORE DESCRIPTION

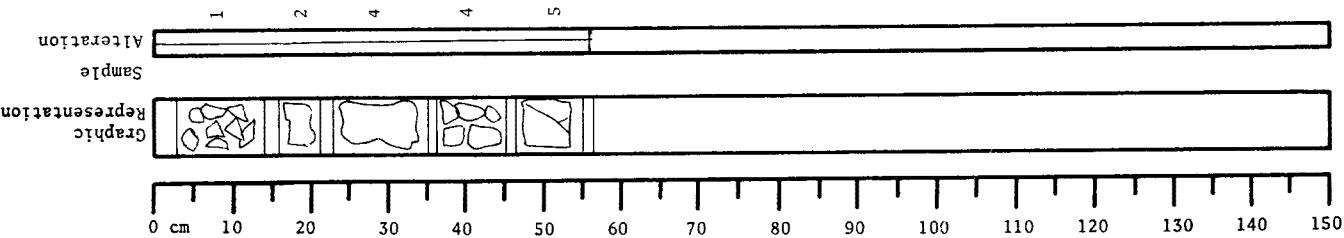
MAJOR ROCK TYPE == FINE-GRAINED APHYRIC BASALT

Macroscopic Description Given in 64-3 and 64-4. Crack planes covered with dark green chloritic mineral. Zeolites may be present.



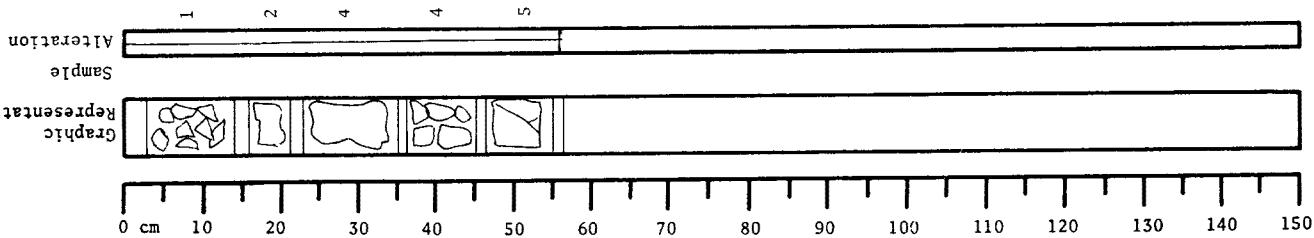
VISUAL CORE DESCRIPTION

Macroscopic Description Given in 64-3 and 64-4. Crack planes covered with dark green chloritic mineral. Zeolites may be present.



VISUAL CORE DESCRIPTION

Macroscopic Description Given in 64-3 and 64-4. Crack planes covered with dark green chloritic mineral. Zeolites may be present.



330570

LEG.	SITE	H	O	L	CORE	SEC
4	5	3	9	5	A	6
5	1					

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, with rare isolated plagioclase phenocrysts up to 7 mm across, generally intensely altered with secondary clays, chlorite, and possibly zeolites abundant in numerous cracks and fractures. Cracks and fractures are so abundant that pieces could not be removed from liners without disruption. Intervals are marked on sawed surface of pieces. The topmost piece in the section is a piece of plagioclase-clinopyroxene doleritic basalt, which apparently fell down the hole from the interval drilled at 61.1 to 64.2.

Glass is present at 70-72 cm and at 101-105 cm, with adjacent variolites. The glass at 70-72 verges on hyaloclastite and is cemented by palagonite, clays and other secondary minerals. The entire section is overall intensely altered, with secondary minerals concentrated in the numerous cracks and in the rare tiny vesicles.

SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
81-86						

IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr
148-150	-23.3	0.868	700	5.34	--

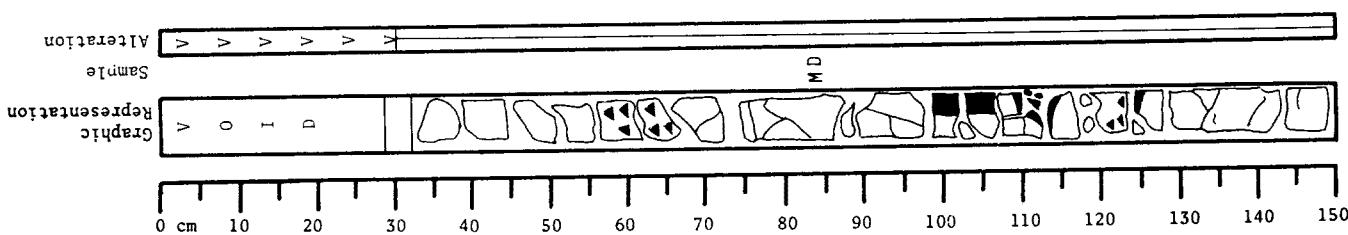
	H	O	L	SITE	E	CORE	SEC
LEG	4	5	3	9	5	A	6
	4	5	3	9	5	A	6

MAJOR ROCK TYPE-- FINE-GRAINED APHYRIC BASALT.

Macroscopic Description

Fine-grained, very fine-grained, and glassy aphyric basalt, with rare isolated plagioclase phenocrysts, generally intensely altered, with secondary clays, chlorite, and possibly zeolites abundant in numerous cracks and fractures. Cracks and fractures are so abundant that the pieces could not be removed from the liner without disruption. Intervals are thus marked on sawed surfaces of pieces. Glass is present from 56-62 cm, 63-67 cm, 98-112 cm and 122-126 cm. Variolites are present near the glass. Vesicles are rare and tiny, locally filled with secondary minerals. Glass from 123-126 cm is partly palagonitized.

Inc. NRM MDF Vp (11) Vp (L) D P
83-85 unstable ~26 0.591 >1000 -- -- 2.88 4.6

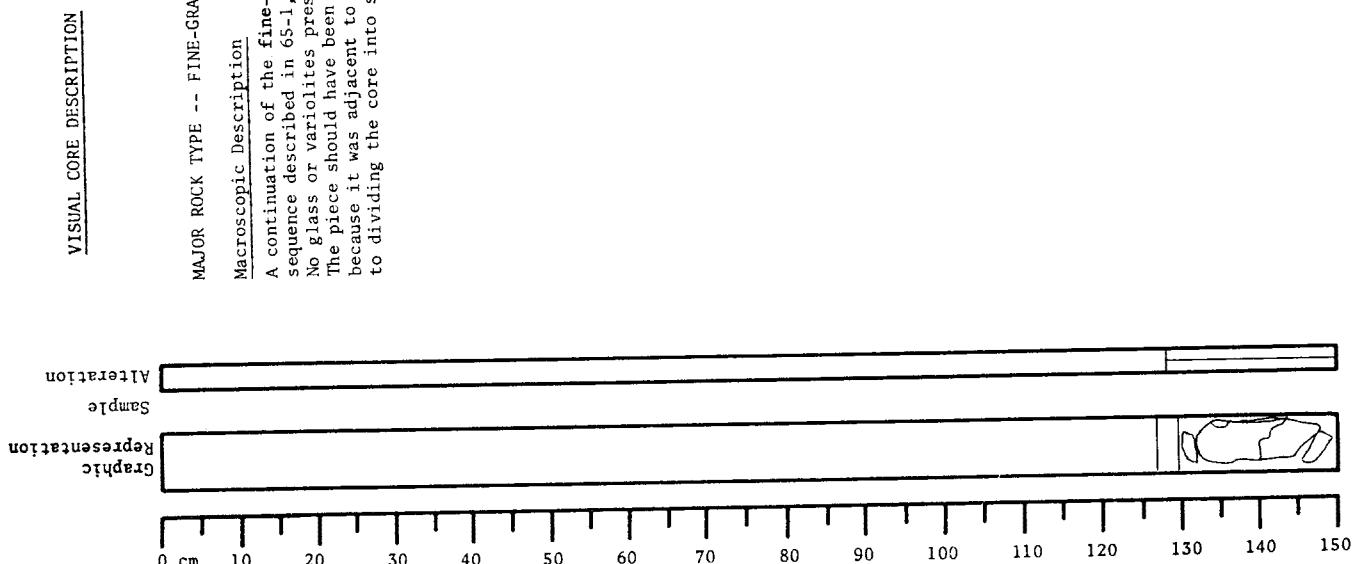


	H	O	L	SITE	E	CORE	SEC
LEG	4	5	3	9	5	A	6
	4	5	3	9	5	A	6

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

A continuation of the fine-grained, aphyric basalt pillow sequence described in 65-1, essential in all particulars. No glass or variolites present. Alteration intense. The piece should have been placed at the top of the section because it was adjacent to the lowest piece in 65-2 prior to dividing the core into sections.



330570

VISUAL CORE DESCRIPTION

LEG	H	O	L	CORE	SEC
4	5	3	9	5	A
4	5	3	9	5	A

MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

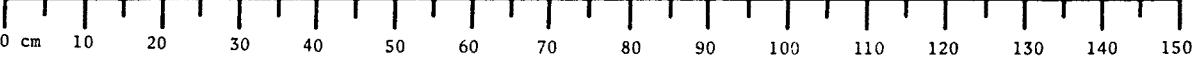
Macroscopic Description

A continuation of the fine-grained pillow sequence recovered in 66-1, essentially identical in most particulars. Glassy breccia is present from 70-80 cm and from 112-120 cm, associated with fine-grained variolitic basalt. Alteration is intense throughout, especially along cracks where clay, chlorite, and possibly zeolites are well developed. Some pieces have up to 5% vesicles filled with yellow-green, green, and white clays. The glass-breccia zones are partly palagonitized. Druses partially filled with clays are present from 35-38 cm.

SiO₂ Al₂O₃ Fe₂O₃ MgO CaO K₂O TiO₂

66-71	49.1	15.24	11.65	8.3	11.17	0.20	1.64
aphyric basalt	IL	Mg/(Mg+Fe)	Cr	Ni	Sr	Zr	

Alteration Sample



VISUAL CORE DESCRIPTION

VISUAL CORE DESCRIPTION

LEG	H	O	L	CORE	SEC
4	5	3	9	5	A
4	5	3	9	5	A

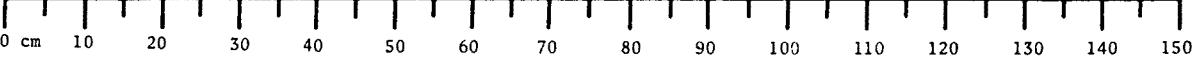
MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy basalt with glass present in 14 only, with 3-5% vesicles (0.5-1 mm) filled with secondary yellow-green and dark-brown minerals. Alteration is intense throughout, as described in previous sections of this core.

- 3↑
1
2
4
5
6
7↑
8↑
9
10
11↑
12
Piece No. 11 -44.7 1.11 450 5.22 5.23 2.82 7.7
P

Alteration Sample



VISUAL CORE DESCRIPTION

VISUAL CORE DESCRIPTION

LEG	H	O	L	CORE	SEC
4	5	3	9	5	A
4	5	3	9	5	A

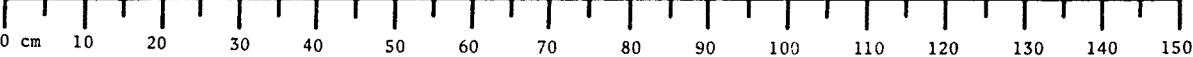
MAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALT

Macroscopic Description

Fine-grained, very fine-grained, and glassy basalt with glass present in 14 only, with 3-5% vesicles (0.5-1 mm) filled with secondary yellow-green and dark-brown minerals. Alteration is intense throughout, as described in previous sections of this core.

- 1
2
3↑
4
5
6
7↑
8↑
9
10
11↑
12
Piece No. 11 -44.7 1.11 450 5.22 5.23 2.82 7.7
P

Alteration Sample



	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE -- FINE-GRAINED APHYRIC BASALTMacroscopic Description

Highly fractured fine-grained aphyric basalt with bits of glass in some places. The basalt is microcrystalline to glassy, with some pieces showing variolitic texture. In the fractures are greenish white to white and clear secondary minerals (chlorite plus zeolites?). Glass is present from 137-142 cm and may be present from 133-135 cm because secondary alteration products there resemble palagonite. The basalt is so highly fractured (perhaps by compression from the overburden weight) that it is effectively a breccia. Alteration is intense throughout, especially on fracture surfaces, but even the largest basalt pieces are pretty rotten.

	Inc.	NRM	MDF	Vp(11)Vp(1)D	P
83-85	-75.0	5.56	800	--	--
113-115	-66.0	4.03	500	--	--

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A

MAJOR ROCK TYPE -- HIGHLY FRACTURED FINE-GRAINED APHYRIC BASALTMacroscopic Description

Highly fractured, aphyric, partly glassy to microcrystalline basalt, intensely altered, with secondary clays, chlorite and zeolites (?) abundant on fracture surfaces and in cracks. Glass is present from 7-9 cm, 125-124 cm, 132-136 cm and from 142-145 cm. From 18-25 cm, crack planes are coated with reddish brown secondary minerals, and partly with a dark green chloritic mineral. In most cracks and on fracture surfaces from 2-121 cm, secondary chlorites (?) and brownish green minerals have a shiny luster. A large plagioclase phenocryst occurs at 110 cm (7 mm across).

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
54-59							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
aphyric basalt	49.9	15.10	10.56	7.3	11.40	0.29	1.69

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
88-90							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Inc.							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
MDF							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Vp(11)Vp(1)D							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
D							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
P							

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A

MAJOR ROCK TYPE -- HIGHLY FRACTURED FINE-GRAINED APHYRIC BASALTMacroscopic Description

Highly fractured, aphyric, partly glassy to microcrystalline basalt, intensely altered, with secondary clays, chlorite and zeolites (?) abundant on fracture surfaces and in cracks. Glass is present from 7-9 cm, 125-124 cm, 132-136 cm and from 142-145 cm. From 18-25 cm, crack planes are coated with reddish brown secondary minerals, and partly with a dark green chloritic mineral. In most cracks and on fracture surfaces from 2-121 cm, secondary chlorites (?) and brownish green minerals have a shiny luster. A large plagioclase phenocryst occurs at 110 cm (7 mm across).

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
aphyric basalt	49.9	15.10	10.56	7.3	11.40	0.29	1.69

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
88-90							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Inc.							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
MDF							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Vp(11)Vp(1)D							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
D							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
P							

	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	5	A

MAJOR ROCK TYPE -- HIGHLY FRACTURED FINE-GRAINED APHYRIC BASALTMacroscopic Description

Highly fractured, aphyric, partly glassy to microcrystalline basalt, intensely altered, with secondary clays, chlorite and zeolites (?) abundant on fracture surfaces and in cracks. Glass is present from 7-9 cm, 125-124 cm, 132-136 cm and from 142-145 cm. From 18-25 cm, crack planes are coated with reddish brown secondary minerals, and partly with a dark green chloritic mineral. In most cracks and on fracture surfaces from 2-121 cm, secondary chlorites (?) and brownish green minerals have a shiny luster. A large plagioclase phenocryst occurs at 110 cm (7 mm across).

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
aphyric basalt	49.9	15.10	10.56	7.3	11.40	0.29	1.69

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
88-90							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Inc.							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
MDF							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
Vp(11)Vp(1)D							

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂
D							

	SiO₂	Al₂O₃	Fe₂O₃	MgO	CaO	K₂O	TiO₂
<tbl_info cols

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LEG	SITE	H O	L F	CORE	SEC
4	5	3	9	5	A
					c

VISUAL CORE DESCRIPTION

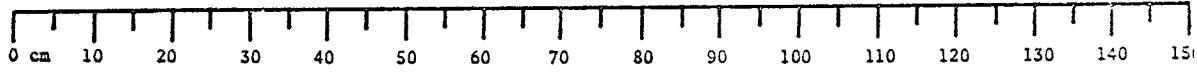
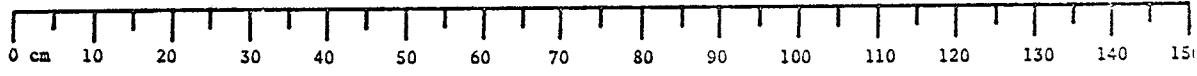
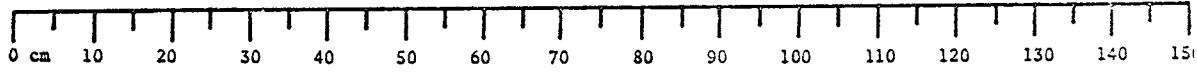
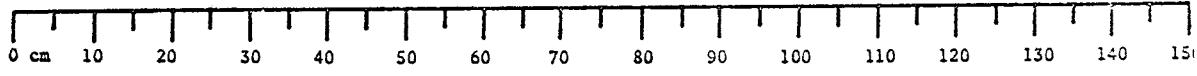
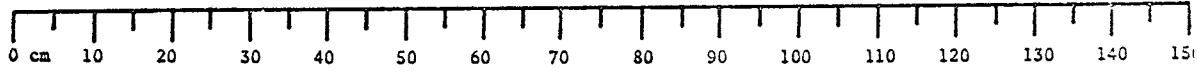
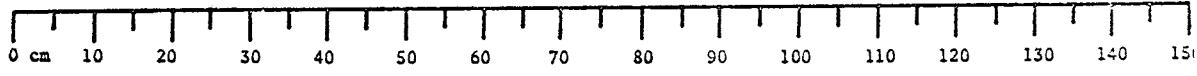
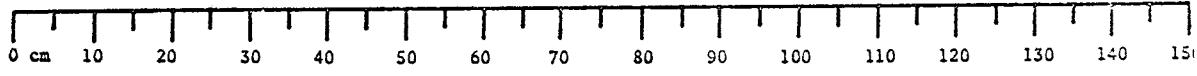
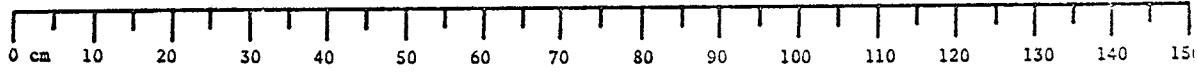
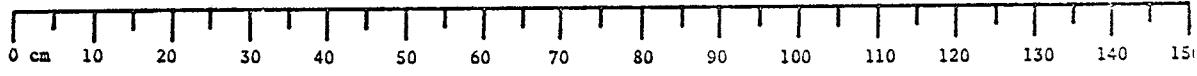
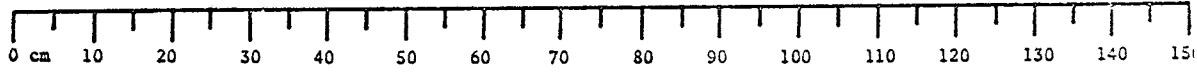
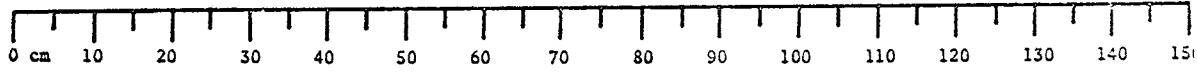
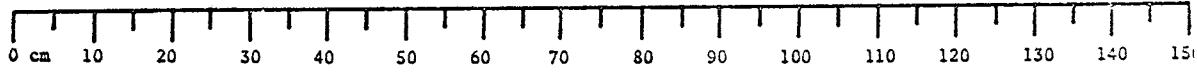
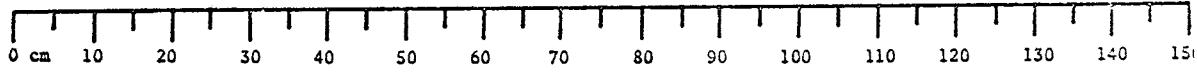
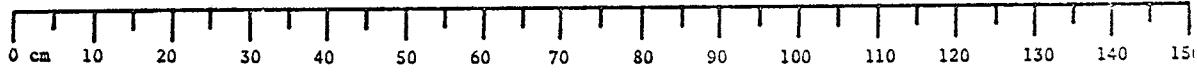
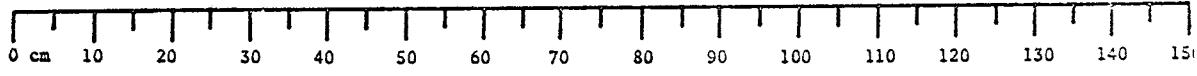
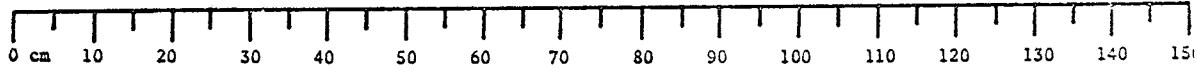
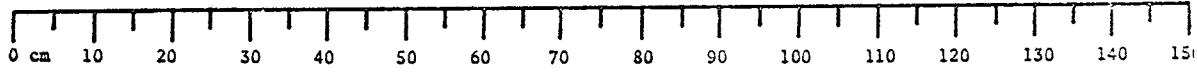
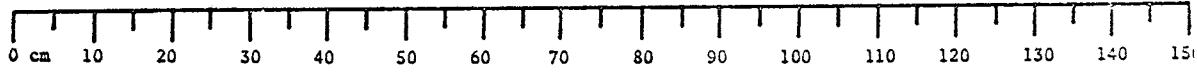
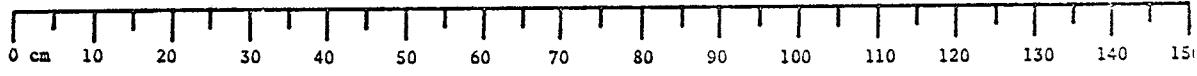
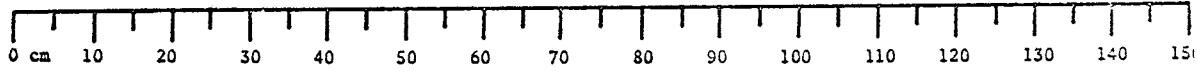
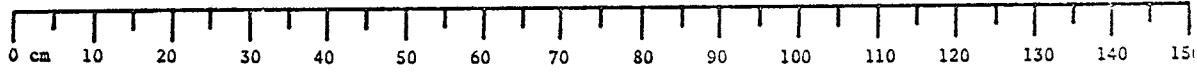
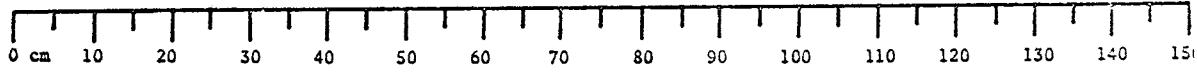
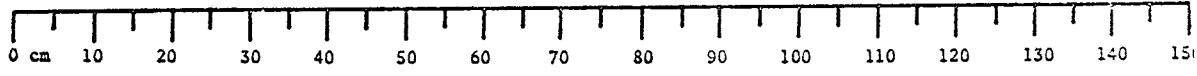
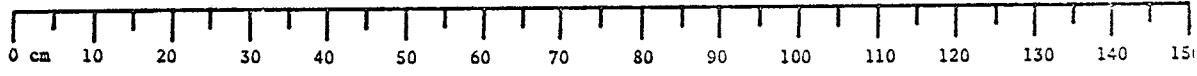
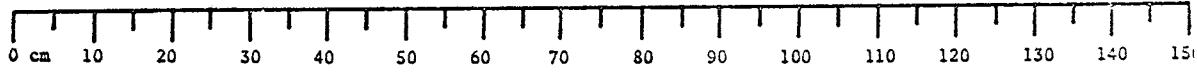
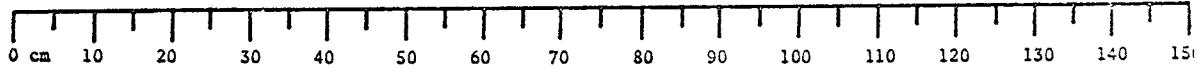
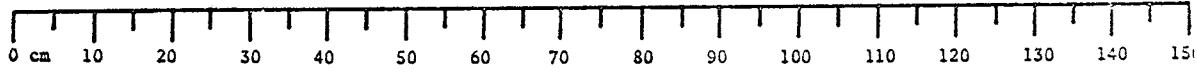
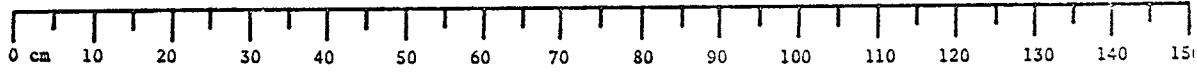
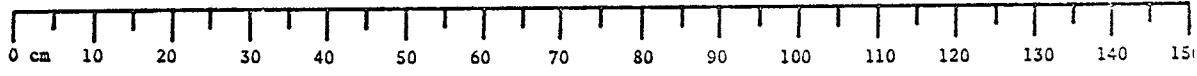
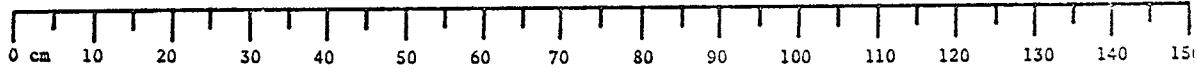
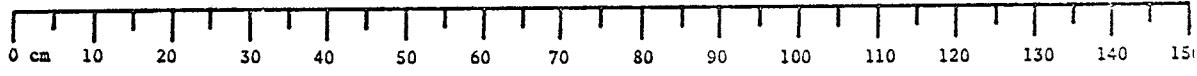
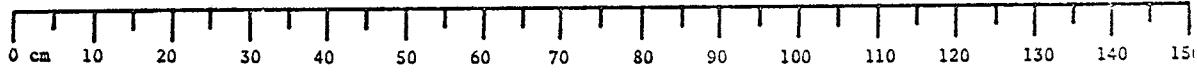
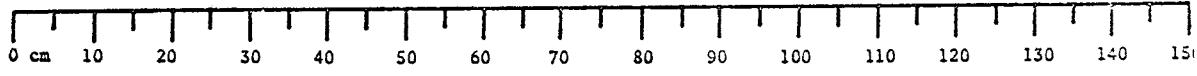
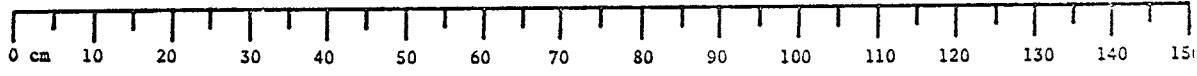
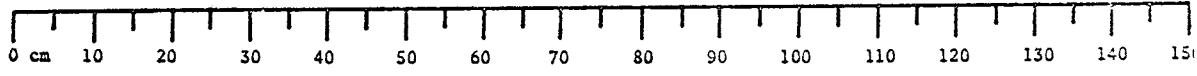
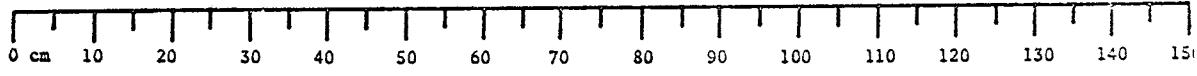
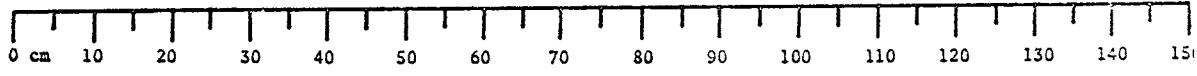
MAJOR ROCK TYPE -- HIGHLY FRACTURED FINE-GRAINED APHYRIC
BASALT

Macrosopic Description

General description given in 67-1 and 67-2.* The interval from 130-139 cm is coarser grained than that above or below. Alteration pervasive. Cracks lined with greenish-white clays. Pieces should have been put at the top of the section, as they were contiguous with those in 67-2.

VISUAL CORE DESCRIPTION

Drilling Breccia, containing fragments of plagioclase, olivine, clinopyroxene, volcanic glass, foraminifera and basalt chips. This core was recovered following cementing of the lower part of the hole and re-entry. No cement was recovered. The cuttings in section 1 are finer-grained than in sections 2 and cc.

VISUAL CORE DESCRIPTIONSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlterationGraphitic RepresentationSampleAlteration

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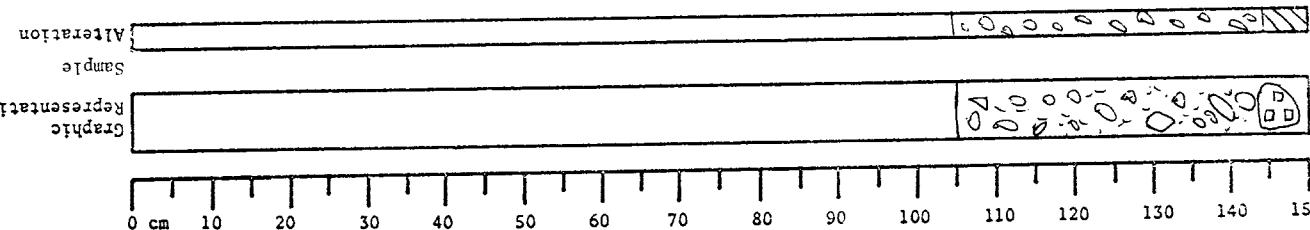
	H	O	I	CORE	SITE	L.E.G
LEG						
4	5	3	9	5	A	6
	2	4				

VISUAL CORE DESCRIPTION

drilling cuttings

Fragments of fine-grained phryic basalt in fairly coarse cuttings. Phenocrysts of plagioclase, olivine, and rare clinopyroxene in phryic basalts. Plagioclase phenocrysts about 5% (up to 2 mm); clinopyroxene less than 1% (up to 1 mm). Vesicles are less than 1% (0.5-1.0 mm) and filled by white and greenish white secondary minerals.

Note: cuttings were removed from the core catcher and placed in the liner in their approximate original position in the core catcher. They should have been placed at the top of the liner since they were recovered contiguous to those in 68-4.



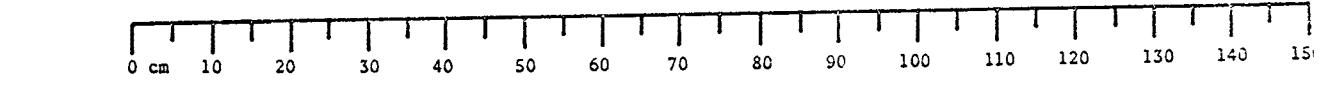
	H	O	I	CORE	SITE	L.E.G
LEG						
4	5	3	9	5	A	6
	2	4				

VISUAL CORE DESCRIPTION

Drilling cuttings.

Fragments of fine-grained phryic basalt in fairly coarse cuttings. Phenocrysts of plagioclase, olivine, and rare clinopyroxene in phryic basalts. Plagioclase also present. From 143-148 cm is a large fragment of dolerite (5x4 cm). Plagioclase phenocrysts about 5% (up to 2 mm); clinopyroxene less than 1% (up to 1 mm). Vesicles are less than 1% (0.5-1.0 mm) and filled by white and greenish white secondary minerals.

Note: cuttings were removed from the core catcher and placed in the liner in their approximate original position in the core catcher. They should have been placed at the top of the liner since they were recovered contiguous to those in 68-4.



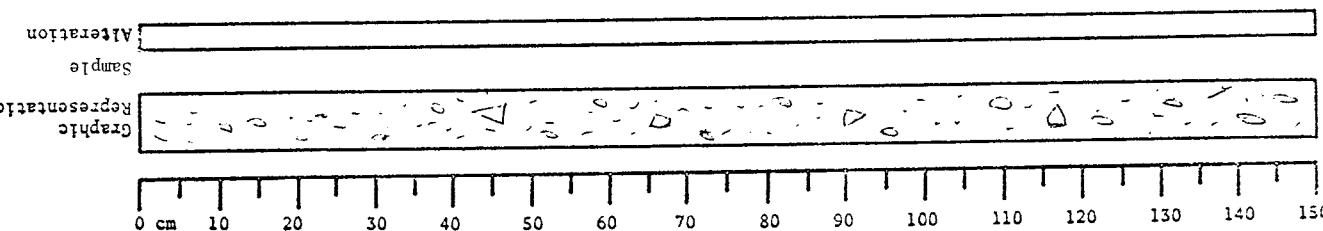
	H	O	I	CORE	SITE	L.E.G
LEG						
4	5	3	9	5	A	6
	2	4				

VISUAL CORE DESCRIPTION

drilling cuttings

Fragments of fine-grained phryic basalt in fairly coarse cuttings. Phenocrysts of plagioclase, olivine, and rare clinopyroxene in phryic basalts. Plagioclase also present. From 143-148 cm is a large fragment of dolerite (5x4 cm). Plagioclase phenocrysts about 5% (up to 2 mm); clinopyroxene less than 1% (up to 1 mm). Vesicles are less than 1% (0.5-1.0 mm) and filled by white and greenish white secondary minerals.

Note: cuttings were removed from the core catcher and placed in the liner in their approximate original position in the core catcher. They should have been placed at the top of the liner since they were recovered contiguous to those in 68-4.



SITE SUMMARY SHEET

LEG 45	Site 396 Hole 396
Date Occupied	<u>January 11, 1976 (0200)</u>
Date Departed	<u>January 14, 1976 (2230)</u>
Time on Hole	<u>3 days, 20 hrs., 30 min.</u>
Position: Latitude	<u>22°58.88'N</u>
Longitude	<u>43°30.95'W</u>
Water Depth (sea level)	<u>4450 corrected meters, echo sounding</u>
Water Depth (rig floor)	<u>4460 corrected meters, echo sounding</u>
Bottom Felt at	<u>4460 meters, drill pipe</u>
Penetration	<u>221.49 meters</u>
Number of Holes	<u>1</u>
Number of Cores	<u>25</u>
Total Length of Cored Section	<u>221.49 meters</u>
Total Core Recovered	<u>133.28 meters</u>
Percentage Core Recovery	<u>60%</u>

Oldest Sediment Cored

Depth Subbottom	<u>125 meters</u>
Nature	<u>Foram-nanno ooze</u>
Age	<u>upper Miocene</u>
Measured Velocity	<u>1.5-1.8 km/sec</u>

Basement

Depth Subbottom	<u>96 meters sub-basement</u>
Nature	<u>Basalt</u>
Velocity Range	<u>-- km/sec</u>

Principal Stratigraphic Units

<u>Cores</u>	<u>Depth Below Sea Surface (m)</u>	<u>Description</u>
1 to 14.6	4450.0-4557.4	Foraminifer-nannofossil ooze and nannofossil ooze. Metaliferous clays in Core 13, and marly clays in Cores 13 and 14.

Site 396 Hole 396 (continued)

<u>Cores</u>	<u>Depth Below Sea Surface (m)</u>	<u>Description</u>
14-6 to 25		Aphyric and plagioclase-olivine sparsely phryic or moderately phryic basalts. Several chemical types were identified but precise boundaries have not been assigned because the number of comagmatic units is still being determined. Possible comagmatic sequences are in Cores 21-14 and 25-22 (the latter have higher Sr). A sharp change in magnetic inclination occurs in Core 22 (close to +40° above, and -5° below).

Site 396		Hole	Core 5	Cored Interval:
AGE	ZONE			4493.10-4502.37 m (35.10-42.57 m subbottom)
UPPER PLIOCENE				
LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	LITHO. SECTION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
0	FORAMINIFER-MANNOFOSSIL 002E	0	VOID	MANNOFOSSIL Ooze
0.5	10YR 6/4	0.5	+	Light yellowish brown (10YR 6/4) to very pale brown (10YR 7/3 or 10YR 7/4), sandy to highly deformed nanofossil ooze.
1	10YR 6/4	1	*	Darker patches approach marly ooze (pelagic clay plus ooze).
1.0	10YR 6/4	1.0	*	Smear Slides: 1-81, 2-90, 3-117, 4-67, 5-75, 6-75,
1.0	Forams Nannos Fe-Ox Tr- 1%	1.0	*	Shear Slides: 1-81, 2-90, 3-117, 4-67, 5-75,
1.0	Forams Nannos Fe-Ox Tr- 99%	1.0	*	10YR 7/4
1.0	Fe-Ox Tr	1.0	*	10YR 8/4
1.0	Sponge Spic. Tr	1.0	*	10YR 7/4
1.0	Fish Debris Tr	1.0	*	10YR 8/4
1.0	Sand 0%	1.0	*	10YR 7/4
1.0	Silt Tr- 1%	1.0	*	10YR 7/4
1.0	Clay 99-100%	1.0	*	10YR 7/4
2	10YR 6/4	2	*	10YR 7/4
2	Carbon Carbonate CC	2	*	10YR 7/4
2	2-100 10.3 0.0	2	*	10YR 7/4
2	Grain Size 86	2	*	10YR 7/4
2	4-50 0.1 15.7	2	*	10YR 7/4
2	84.2	2	*	10YR 7/4
3	10YR 6/4	3	*	10YR 6/4
3	Gz	3	*	10YR 6/4
4	10YR 7/4	4	*	10YR 6/4
4	Core Catcher	4	*	10YR 6/4
5	CC	5	*	10YR 6/4
6	Core Catcher	6	*	10YR 6/4

Site 396		Hole	Core 3	Cored Interval:
AGE	ZONE			4474.-28-4483.84 m (14.28-23.84 m subbottom)
PLEISTOCENE				
LITHO. SAMPLE	LITHOLOGIC DESCRIPTION	LITHO. SECTION	LITHO. SAMPLE	LITHOLOGIC DESCRIPTION
0	FORAMINIFER-MANNOFOSSIL 002E	0	VOID	MANNOFOSSIL Ooze
0.5	10YR 6/4	0.5	+	Light yellowish brown (10YR 6/4) to very pale brown (10YR 7/3 or 10YR 7/4), sandy to highly deformed nanofossil ooze.
1	10YR 6/4	1	*	Darker patches approach marly ooze (pelagic clay plus ooze).
1	10YR 6/4	1	*	Smear Slides: 1-81, 2-90, 3-117, 4-67, 5-75, 6-75,
1	Forams Nannos Fe-Ox Tr- 99%	1	*	Shear Slides: 1-81, 2-90, 3-117, 4-67, 5-75,
1	Forams Nannos Fe-Ox Tr	1	*	10YR 7/4
1	Fe-Ox Tr	1	*	10YR 8/4
1	Sponge Spic. Tr	1	*	10YR 7/4
1	Fish Debris Tr	1	*	10YR 7/4
1	Sand 0%	1	*	10YR 7/4
1	Silt Tr- 1%	1	*	10YR 7/4
1	Clay 99-100%	1	*	10YR 7/4
2	10YR 6/4	2	*	10YR 7/4
2	Carbon Carbonate CC	2	*	10YR 7/4
2	2-100 10.3 0.0	2	*	10YR 7/4
2	Grain Size 86	2	*	10YR 7/4
2	4-50 0.1 15.7	2	*	10YR 7/4
2	84.2	2	*	10YR 7/4
3	10YR 6/4	3	*	10YR 6/4
3	Gz	3	*	10YR 6/4
4	10YR 7/4	4	*	10YR 6/4
4	Core Catcher	4	*	10YR 6/4
5	CC	5	*	10YR 6/4
6	Core Catcher	6	*	10YR 6/4

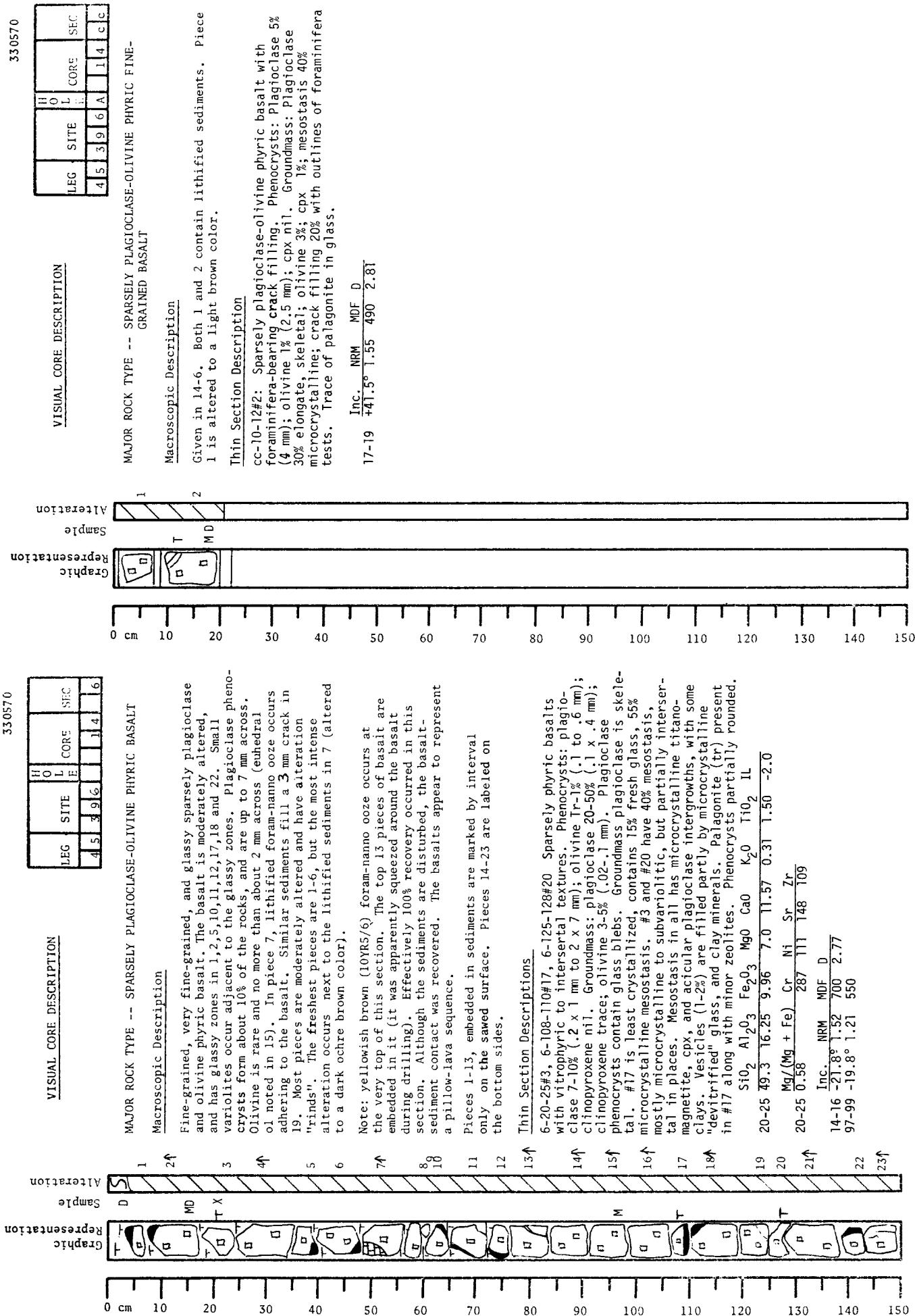
Core 7		Cored Interval: 4511.92-4521.47 m (51.92-61.16 m subbottom)	
Hole	Site 396	Litho. Sample	Lithologic Description
AGE		MATERIAL	
			NANOFossil ooze
			Intensely deformed pale yellowish brown (10YR 7/4 and 10YR 8/3) nanofossil ooze.
			Shear Slides: 1-80, 2-80, 3-115, 4-80, 5-110, 5-130, 6-8, 6-40, 6-55, 6-80, 6-122, CC
			Forams 0- 3% Sand 0%
			Nannos 99-100% Silt 0- 2%
			Fe-Ox Tr Clay 98-100%
			Carbon, Carbonate
			2-100 10-6 0.2 86
			Grain Size
			4-50 0.1 26.3 73.7
			10YR 8/3
			10YR 7/4
			10YR 8/3
			10YR 8/2
			10YR 7/3
			10YR 7/4
			10YR 7/3
			Core Catcher

Core 6		Cored Interval: 4502.37-4511.92 m (42.37-51.92 m subbottom)			
Site 396	Hole	AGE	FOSSIL CHARACTER	SECTION	LITHOLOGY
		ZONE	NANOS	FONAMS	DEFORMATION
					LITHO-SAMPLE
					KANNOFOSSIL Ooze
					Soupy to intensely deformed, pale yellow brown (10R 8/3) nanofossil ooze with almost white (10R 8/6) foraminifer layers, the largest in Section 3.
					Sample Slides: 1-140, 2-70, 3-30, 5-66, 6-50, CC
					Forams 0-2% Sand -% Nanom 98-100% Silt 1-2% Fe-Ox Tr Clay 98-100%
					3-3
					Carbon Carbonate
					4.100 10.9 0.0 90 CC 10.7 0.7 83
					Grain Size
					2-50 14.8 34.0 51.2 CC 2.2 22.2 73.7
					10YR 8/2
					CC *
					10YR 7/3
					*
					10YR 8/4
					*
					10YR 8/3
					CC *
					Core Catcher
					CC *

Site 396		Hole	Core 11	Cored Interval: 4549.18-4558.41 m (89.18-98.41 m subbottom)
				LITHOLOGIC DESCRIPTION
AGE	ZONE			LITHOLOGY
				NANOFOSIL Ooze
				Moderately to intensely deformed pale yellow brown (10R 7/3) or very pale brown (10R 7/4) nanofossil ooze. No structures. Very homogeneous. Shades of color differents only.
				Smear Slides: 1-120, 2-100*, 3-51
				Forams Tr Nanof 99% Fe-Ox Tr Sand 0% Silt 99-100% Clay
				FORAMINIFER-NANOFOSIL Ooze
				Moderately deformed pale yellow brown (10R 8/3) foraminifer-nanofossil ooze. Very homogeneous.
				Smear Slides: 3-130, 4-90, 5-93, 6-81, CC
				Forams 5-60% Nanof 40-95% Fe-Ox Tr Sand 0-2% Silt 5-60% Clay 40-95%
				Carbon Carbonate
				2-100 10.7 0.9 82
				Grain Size
				4-50 30.3 44.1 25.6
				Note: Sand and silt fraction of smear slides is likely to be underestimated because coarse materials tend to be scraped off during smear slide preparation.
				G2
				4
				10R 8/3
				10R 7/3
				10R 6/4
				Voids
				G2
				5
				10R 8/3
				10R 7/3
				6
				10R 8/3
				Core Catcher

Site 396		Hole	Core 10	Cored Interval: 4539.95-4549.18 m (79.64-89.18 m subbottom)
				LITHOLOGIC DESCRIPTION
AGE	ZONE			LITHOLOGY
				NANOFOSIL Ooze
				Moderately to intensely deformed pale yellow brown (10R 7/3) or very pale brown (10R 7/4) nanofossil ooze. No structures. Very homogeneous. Shades of color differents only.
				Smear Slides: 1-120, 2-100*, 3-51
				Forams Tr Nanof 99% Fe-Ox Tr Sand 0% Silt 99-100% Clay
				FORAMINIFER-NANOFOSIL Ooze
				Moderately deformed pale yellow brown (10R 8/3) foraminifer-nanofossil ooze. Very homogeneous.
				Smear Slides: 3-130, 4-90, 5-93, 6-81, CC
				Forams 5-60% Nanof 40-95% Fe-Ox Tr Sand 0-2% Silt 5-60% Clay 40-95%
				Carbon Carbonate
				2-100 10.7 0.9 82
				Grain Size
				4-50 30.3 44.1 25.6
				Note: Sand and silt fraction of smear slides is likely to be underestimated because coarse materials tend to be scraped off during smear slide preparation.
				G2
				4
				10R 8/3
				10R 7/3
				10R 6/4
				Voids
				G2
				5
				10R 8/3
				10R 7/3
				6
				10R 8/3
				Core Catcher

Core 12		Cored interval: 4558.41-4567.36 m (98.41-107.36 m subbottom)	
Site 396	Hole	Fossil Character	Age
		Zones	Lower Pliocene
LITHO-SAMPLE	DEFINITION	LITHOLOGY	LITHOLOGIC DESCRIPTION
0	0.5	V VOID	NANOFOSIL OOLITE AND FORAMINIFER-NANOFOSIL OOLITE
1	1.0	V +	Very pale brown (10YR 7/3 or 10YR 7/4) nanofossil oolite, moderately to intensely deformed, plus one layer in Section 5 of gritty foraminifer-nanofossil oolite, pale yellow brown (10YR 8/3). Nanofossil oolite is homogeneous. No obvious bedding planes except the foram-rich layer in Section 5.
2	10YR 7/3	CC	Smear Slides: 1-140 2-140 3-140 4-140 6-130 and cc
3	10YR 7/3	CC	Forams Tr-3% Sand 0% Nanof. 97-100% Silt Tr-2% Fe-Ox Tr Clay 98-100%
4	10YR 7/3	GZ	Forams 30 30% Sand 5% Nanof. 70% Silt 25% Fe-Ox -- Clay 70%
5	10YR 7/3	GZ	Carbon Carbonate
6	10YR 8/3	GZ	
			Core Catcher



330570

	H	O	L	CORE	SFC
LEG	SITE	E			
4	5	3	9	6	A
				1	5
				2	1

VISUAL CORE DESCRIPTION

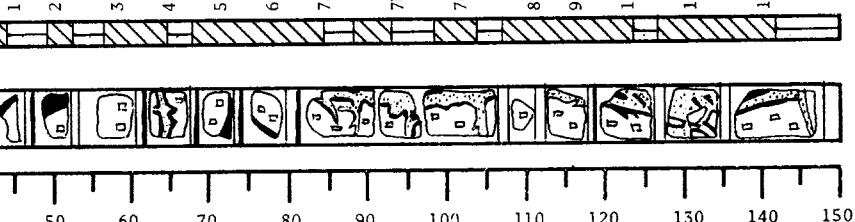
MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOLASE - OLIVINE PHYRIC FINE-GRAINED BASALT

Macroscopic Description

Fine-grained, very fine-grained and glassy plagioclase-olivine phyric basalt. Plagioclase 7-10% (1-2 mm); olivine Tr-2% (1-2 mm). Glass present in many pieces as shown. Glass locally partially palagonitized. Abundant baked and lithified sediments adhering to basalt pieces and in cracks, sometimes with glass on either side of cracks. Smear slides show mainly recrystallized limestone, but relict foraminifers appear in thin sections. Sediments in 10 and 11 have inclusions of palagonitized glass. 11 is essentially hyaloclastite.

This sequence, like basalts in Core 14, extruded into ooze.

1



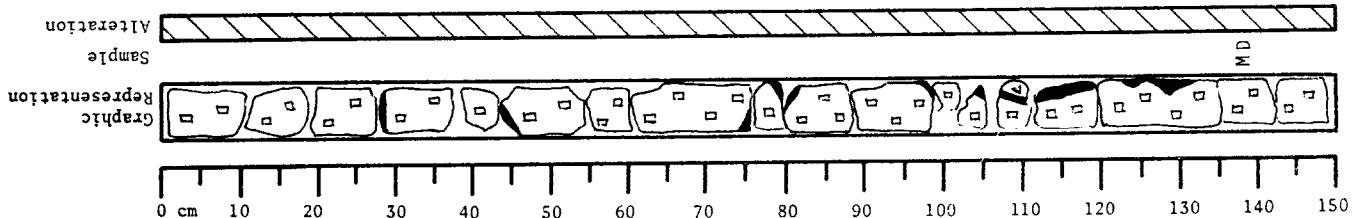
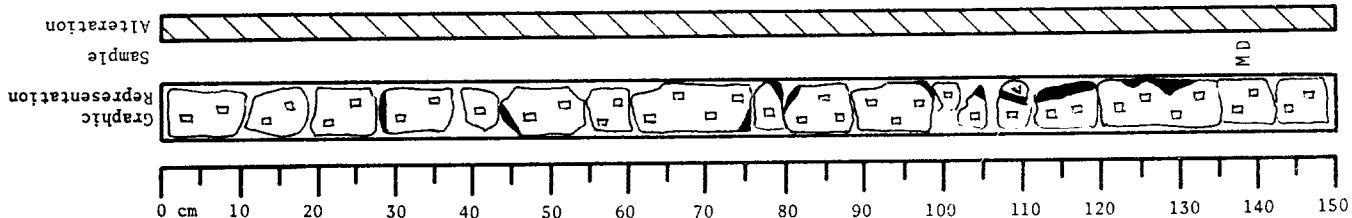
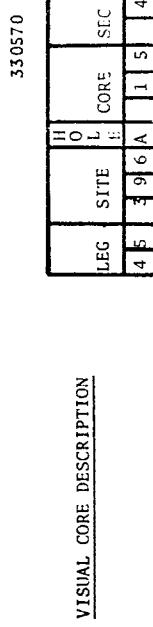
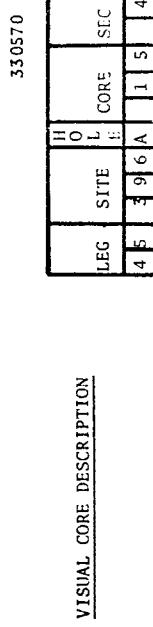
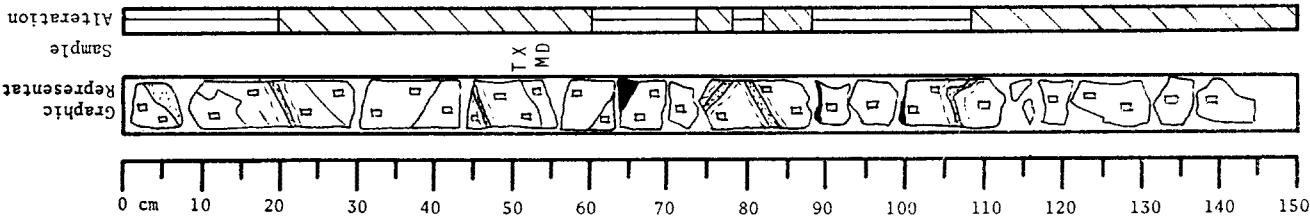
	H	O	L	CORE	SEC
LEG	SITE	E			
4	5	3	9	6	1
	<td></td> <td></td> <td>5</td> <td>3</td>			5	3

MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIoclASE-OLIVINE
PHYRIC FINE-GRAINED BASALT

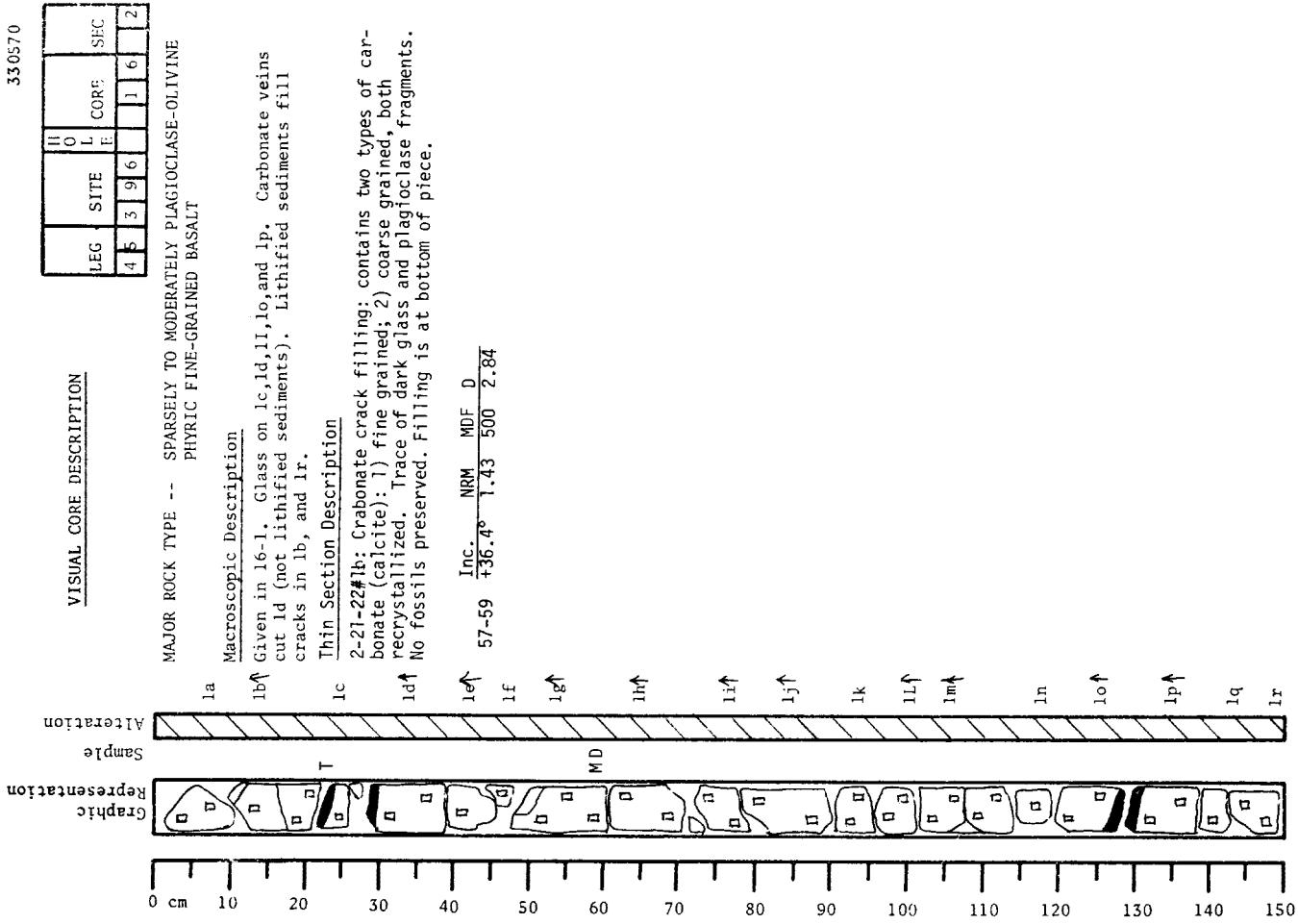
Macroscopic Description

A continuation of basalts described in 15-1 and 15-2. Glass zones common, as marked, often associated with lithified sediment pockets, as at 107 cm, 124 cm-115 cm. Glass-sediment breccia at 110 cm.

Inc. NRM MDF D
138-140 +36.1° 1.51 425 2.86

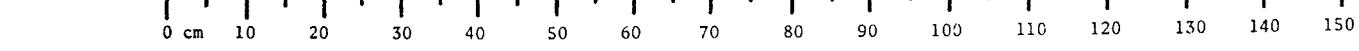


330570



LEG	SITE	H O	L	CORE: L	SEC: L
4	5	3	9	6	1
					6
					3

Sample
Graphic
Representation



VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOCLASE-OLIVINE PHRIC FINE-GRAINED BASALT

Macroscopic Description

Given in 1a-1. Glass present in 1a, 1L, and 1N. Carbonate veins (not lithified sediments) present in some pieces. Lithified sediments not noted in this section.

Thin Section Descriptions

3-101-103: Sparsely phric olivine-plagioclase basalt, variolitic to subvariolitic groundmass. Phenocrysts: plagioclase 5% (.2 x 1 mm up to 4 x 9 mm) eu-subhedral; olivine trace (.2-.1 mm). Groundmass: plagioclase 1% skeletal; elongate, the rest microcrystalline and variolitic. Plagioclase phenocrysts contain some glass blebs. Some as well are rounded. Carbonate in cracks and around the edges of some plagioclase crystals.

3-137-142#1R: Sparsely phric olivine-plagioclase basalt, intersertal groundmass. Phenocrysts: plagioclase 5% (.2-3 mm) eu-subhedral, with relict blebs of basaltic glass, some rounded; olivine: 1% (1-1.5 mm) eu-subhedral, partly altered to clays. Groundmass: plagioclase 50%; clinopyroxene 40%; olivine 5%; titanomagnetic 1%; picotite trace. Groundmass partly altered to clays. Vesicles (1-2%) filled with yellow-gray and yellow-brown clays. Spinel is "devitrified" glass (?).

The above two thin sections probably represent an edge and the interior of a single cooling unit.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂	IL
137-142	49.8	16.73	9.24	8.1	11.95	0.24	1.27	-2.4
137-142	0.63	0.63	Mg/(Mg + Fe)	Cr	Ni	Sr	Zr	

68-70 Inc. NRM MDF D

Sample
Graphic
Representation

LEG	SITE	H O	L	CORE: L	SEC: L
4	5	3	9	6	1
					6
					3

Sample
Graphic
Representation



Sample
Graphic
Representation

LEG	SITE	H O	L	CORE: L	SEC: L
4	5	3	9	6	1
					6
					3

Sample
Graphic
Representation

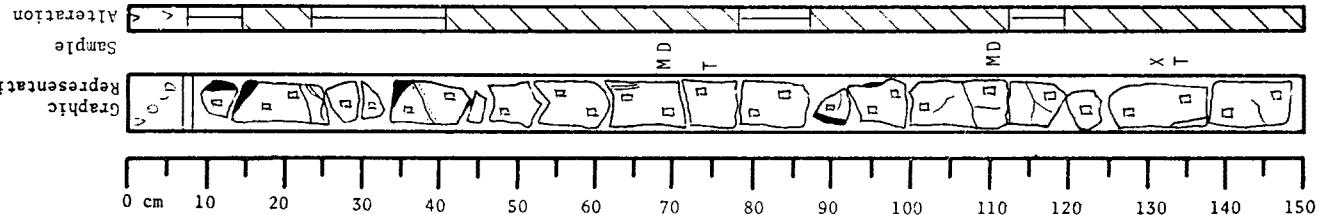


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LEG	SITE	H O	L CORE	CORE	SEC	SEC
4 5	3 9 6			1 6	c c	

VISUAL CORE DESCRIPTION

LEG	SITE	H O	L CORE	CORE	SEC	SEC
4 5	3 9 6			1 6	c c	

MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PHYRIC PLAGIOLASE-OLIVINE
PHYRIC FINE-GRAINED BASALTMacroscopic Description
Given in 16-1.

45-396-17 No recovery

LEG	SITE	H O	L CORE	CORE	SEC	SEC
4 5	3 9 6			1 6	c c	

MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOLASE-OLIVINE
PHYRIC BASALTMacroscopic Description
18-1 through 18-cc

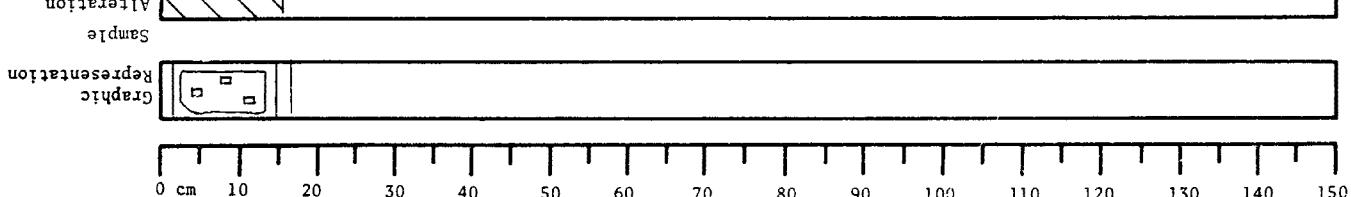
Fine-grained, very fine-grained, and glassy plagioclase-olivine phryic basalt. Plagioclase 2-7% (1-5 mm), olivine Tr-2% (1-3 mm). Glass present in many places as shown. Has cracks lined with carbonate, but no recrystallized forsterite-nano ooze is present. Alteration is moderate to intense throughout, especially adjacent to cracks and glass. Vesicles are Tr-3%, less than 1 mm, and partially filled with secondary clays. Glass is partially palagonitized. There are minor fluctuations in the abundance of plagioclase phenocrysts; some pieces are virtually aphyric, many have no more than 3% plagioclase phenocrysts, others contain as much as 5-7%. Olivine is more constant 1-2%, but is generally partially altered to reddish secondary minerals. Grain size ranges from glassy, through subvariolitic zones of incipient crystallization, to fine-grained but essentially holocrystalline rocks, representing the transition from pillow selvage to pillow interior. It is doubtful whether a single pillow thicker than about 1 meter was cored in this interval.

Thin Section Descriptions

1-70-78#1g: Sparsely phryic plagioclase-olivine basalt, subvariolitic to subophitic groundmass. Phenocrysts: plagioclase 5-7% (.2-.4 mm) eu-subhedral; olivine 1% (.2-.1.5 mm) eu-subhedral. Both olivine and plagioclase phenocrysts contain rounded inclusions of glass. Picotite is rare. Matrix (90%) contains skeletal olivine (1%), skeletal plagioclase (45%), titanomagnetite (1-3%, dust sized), and clinopyroxene (50%). It is partly altered to clay minerals, and is partly subvariolitic "swirls", and partly interlocking crystal laths.

1-70-78#1N: Sparsely phryic plagioclase-olivine basalt, subvariolitic groundmass. Phenocrysts: plagioclase 10% (.2-3 mm) eu-subhedral; olivine 1% (.2-.8 mm) eu-subhedral. The groundmass is largely dark, microcrystalline sub-variolitic "swirls". MD with about 5% tiny skeletal olivine crystals. Needle-like plagioclase and clinopyroxene in about equal proportions make up the swirls, which are dusted with fine opaques. Chrome spinel is accessory. The matrix is partly altered to clays, and has minor secondary calcite. Plagioclase phenocrysts are rounded, and contain blebs of glass.

Sample	Alteration	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂	IL
1m		49.7	16.93	9.68	7.9	12.09	0.29	1.27	-2.6
1n		130-136	Mg/(Mg + Fe)	Cr Ni Sr Zr	383	142	146	87	
1o		68-70	+33.8°	.944	440	D			
		109-111	+37.7°	.251	450	2.71			



330570

LEG	SITE	H L	O E	L	COR. SEC	SEC
4	5	3	9	6	1	8
						2

MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIoclase-OLIVINE

PHYRIC BASALT

VISUAL CORE DESCRIPTION

Macroscopic Description

1a↑ MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIoclase-OLIVINE
PHYRIC BASALT

1a↑ Basic description given in 18-1. In this section, glass is present in 1b, 1c, 1d, 1i, 1j, and 1m. Plagioclase is more abundant than usual in the glassy zones of 1b and 1c. Plagioclase phenocrysts decrease in abundance from 7% to 3% from 1d to 1h, whereas olivine increases from less than 1% to 2-3%. In 1h, plagioclase increases abruptly back to 7% and olivine again decreases. Plagioclase is also concentrated in the glassy part of 1j, is low in 1k, but increases back to about 7% at the bottom of the section.

Thin Section Description

1f↓ 2-10-19#1c: Sparsely phryic plagioclase-olivine basalt with glassy-variolitic groundmass. Phenocrysts: plagioclase 4% (.2-5 mm); olivine trace, skeletal. Matrix is microcrystalline, variolitic, or glassy. Glass pale brown, variolites dark brown to black; microcrystalline portions very dark but with fine, acicular plagioclase needles forming in swirls. Glass contains some palagonite. Phenocrysts are partly rounded; olivine phenocrysts partly altered to clays, and surrounded by plagioclase phenocrysts in some cases. Carbonate (5%) crystallized in tiny cracks and in portions of olivine crystals altered to clays.

42-44 Inc. NRM MDF D
+32.8° 1.26 350 2.79

VISUAL CORE DESCRIPTION

Macroscopic Description

1a↑ MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIoclase-OLIVINE
PHYRIC BASALT

Thin Section Description

1f↓ 1g↑ 1h↓ 1i↑ 1j↑ 1k↑ 1l↑ 1m↑ 1n↑ 1o↑ 1p↑

1a↑ Basic description given in 18-1. Glass present in 1e and 1f. Basalt is more altered along zones of glass. Glass is partly altered to palagonite and clay minerals (?). Carbonate veins are present in 1a, 1b, and 1k, and to a lesser extent in other pieces. No lithified sediments are present.

3-118-120#11: Sparsely phryic plagioclase-olivine basalt, with microcrystalline groundmass. Phenocrysts: Plagioclase 7%, eu-subhedral, up to 5 mm; olivine - trace, up to 3 mm; titanomagnetite 3% (up to .1 mm). Matrix 90%, acicular skeletal crystals of plagioclase, cpx, and euhedral olivine in proportions 12:7:1. Trace of clay minerals. Olivine altered to "iddingsite" and clear clays.

1e↑ 124-126 Inc. NRM MDF D
+27.9° 1.53 225 2.86

VISUAL CORE DESCRIPTION

Macroscopic Description

1a↑ MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIoclase-OLIVINE
PHYRIC BASALT

Thin Section Description

1f↓ 1g↑ 1h↓ 1i↑ 1j↑ 1k↑ 1l↑ 1m↑ 1n↑ 1o↑ 1p↑

1a↑ Basic description given in 18-1. Glass present in 1e and 1f. Basalt is more altered along zones of glass. Glass is partly altered to palagonite and clay minerals (?). Carbonate veins are present in 1a, 1b, and 1k, and to a lesser extent in other pieces. No lithified sediments are present.

3-118-120#11: Sparsely phryic plagioclase-olivine basalt, with microcrystalline groundmass. Phenocrysts: Plagioclase 7%, eu-subhedral, up to 5 mm; olivine - trace, up to 3 mm; titanomagnetite 3% (up to .1 mm). Matrix 90%, acicular skeletal crystals of plagioclase, cpx, and euhedral olivine in proportions 12:7:1. Trace of clay minerals. Olivine altered to "iddingsite" and clear clays.

1e↑ 124-126 Inc. NRM MDF D
+27.9° 1.53 225 2.86

VISUAL CORE DESCRIPTION

Macroscopic Description

1a↑ MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIoclase-OLIVINE
PHYRIC BASALT

Thin Section Description

1f↓ 1g↑ 1h↓ 1i↑ 1j↑ 1k↑ 1l↑ 1m↑ 1n↑ 1o↑ 1p↑

1a↑ Basic description given in 18-1. Glass present in 1e and 1f. Basalt is more altered along zones of glass. Glass is partly altered to palagonite and clay minerals (?). Carbonate veins are present in 1a, 1b, and 1k, and to a lesser extent in other pieces. No lithified sediments are present.

3-118-120#11: Sparsely phryic plagioclase-olivine basalt, with microcrystalline groundmass. Phenocrysts: Plagioclase 7%, eu-subhedral, up to 5 mm; olivine - trace, up to 3 mm; titanomagnetite 3% (up to .1 mm). Matrix 90%, acicular skeletal crystals of plagioclase, cpx, and euhedral olivine in proportions 12:7:1. Trace of clay minerals. Olivine altered to "iddingsite" and clear clays.

1e↑ 124-126 Inc. NRM MDF D
+27.9° 1.53 225 2.86

	H	O	L	CORE	SEC
LEG			E		c/c
	4	5	3	9	6

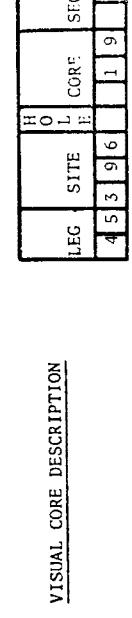
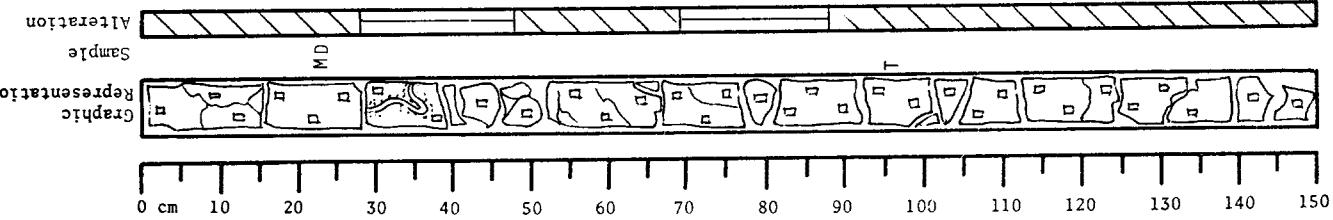
MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

1a↑ Basic description given in 18-1. Glass present in 1d and 1e
Plagioclase most abundant (5-7%) in 1a and 1b, but as low as 3% in other pieces. Carbonate veinlets in all pieces.

1d↓ 10-12 Inc. $+29.4^\circ$ NRM 1.16 MDF 0 2.82

1e↑



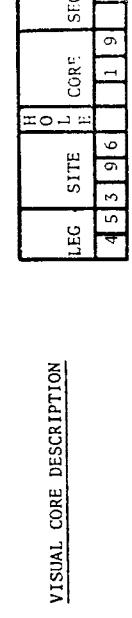
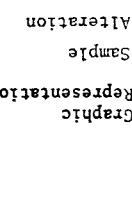
MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description, 19-1 and 19-2

Fine-grained, very fine-grained, and glassy plagioclase-olivine phyric basalt. Plagioclase 3-7% (1-3 mm), olivine Tr-2% (1-3 mm). Glass present only in section 2. Olivine is generally partially altered to reddish secondary minerals. Moderately to intensely altered throughout, especially adjacent to carbonate veins which are locally abundant. In section 1, carbonate veins are most abundant in 1c-f. There is a large carbonate vein in 1c.

Thin Section Description

1-93-95#1j: Sparsely phryic plagioclase-olivine basalt, with subvariolitic to intersertal groundmass. Phenocrysts: plagioclase 5-7% (.2-4 mm) subhedral; olivine less than 1% (.2-.8 mm) subhedral; spinel (chromian) Ir. Groundmass: plagioclase 40% euhedral laths and acicular needles; olivine 2-3%, euhedra; intersertal matrix of titanomagnetite dust (10% of matrix), plagioclase (20% of matrix) and clinopyroxene (70% of matrix), all microcrystalline. Some olivine phenocrysts are altered to clays. Some plagioclase phenocrysts contain blebs of microcrystalline "devitrified" glass.



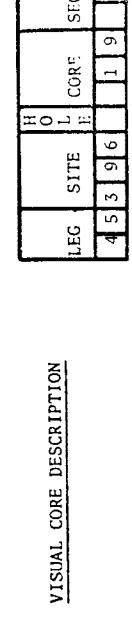
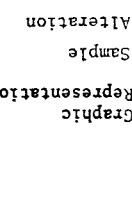
MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description, 19-1 and 19-2

Fine-grained, very fine-grained, and glassy plagioclase-olivine phyric basalt. Plagioclase 3-7% (1-3 mm), olivine Tr-2% (1-3 mm). Glass present only in section 2. Olivine is generally partially altered to reddish secondary minerals. Moderately to intensely altered throughout, especially adjacent to carbonate veins which are locally abundant. In section 1, carbonate veins are most abundant in 1c-f. There is a large carbonate vein in 1c.

Thin Section Description

1-93-95#1j: Sparsely phryic plagioclase-olivine basalt, with subvariolitic to intersertal groundmass. Phenocrysts: plagioclase 5-7% (.2-4 mm) subhedral; olivine less than 1% (.2-.8 mm) subhedral; spinel (chromian) Ir. Groundmass: plagioclase 40% euhedral laths and acicular needles; olivine 2-3%, euhedra; intersertal matrix of titanomagnetite dust (10% of matrix), plagioclase (20% of matrix) and clinopyroxene (70% of matrix), all microcrystalline. Some olivine phenocrysts are altered to clays. Some plagioclase phenocrysts contain blebs of microcrystalline "devitrified" glass.



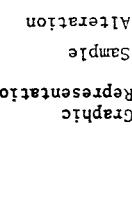
MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALT

Macroscopic Description, 19-1 and 19-2

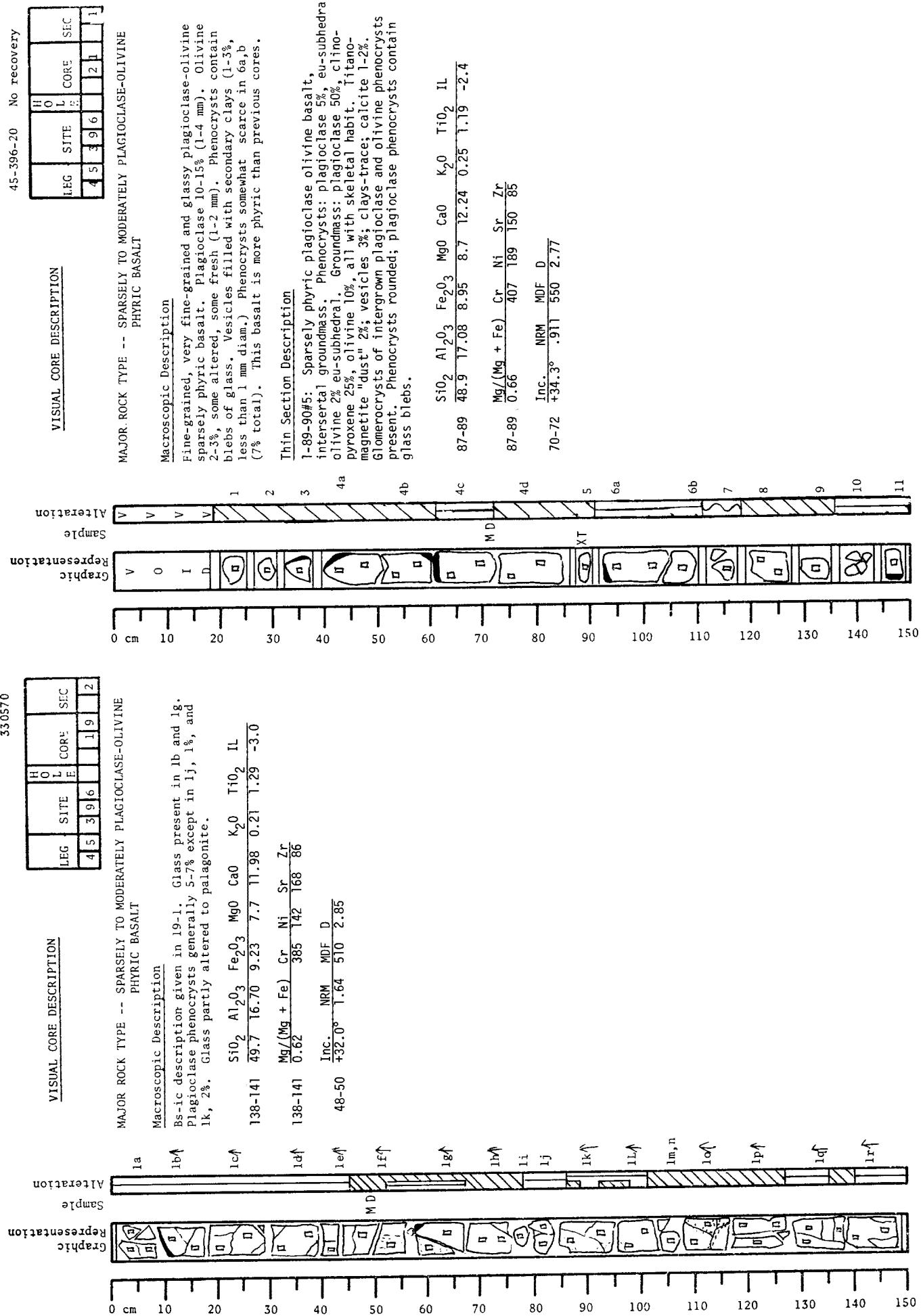
Fine-grained, very fine-grained, and glassy plagioclase-olivine phyric basalt. Plagioclase 3-7% (1-3 mm), olivine Tr-2% (1-3 mm). Glass present only in section 2. Olivine is generally partially altered to reddish secondary minerals. Moderately to intensely altered throughout, especially adjacent to carbonate veins which are locally abundant. In section 1, carbonate veins are most abundant in 1c-f. There is a large carbonate vein in 1c.

Thin Section Description

1-93-95#1j: Sparsely phryic plagioclase-olivine basalt, with subvariolitic to intersertal groundmass. Phenocrysts: plagioclase 5-7% (.2-4 mm) subhedral; olivine less than 1% (.2-.8 mm) subhedral; spinel (chromian) Ir. Groundmass: plagioclase 40% euhedral laths and acicular needles; olivine 2-3%, euhedra; intersertal matrix of titanomagnetite dust (10% of matrix), plagioclase (20% of matrix) and clinopyroxene (70% of matrix), all microcrystalline. Some olivine phenocrysts are altered to clays. Some plagioclase phenocrysts contain blebs of microcrystalline "devitrified" glass.



330570



LEG	H	O	L	CORE	SFC
4	5	3	9	6	2
LEG	SITE			CORE	SFC

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOLASE-OLIVINE PHYRIC BASALT

Macroscopic Description 22-1 through 22-cc

Fine-grained, very fine-grained, and glassy plagioclase-olivine sparsely to moderately phryic basalt. Plagioclase 3-10% (1-5 mm) olivine 1-3% (2-4 mm), vesicles 1-2% (less than 1 mm). Alteration moderate to intense. Olivine partly altered to reddish secondary minerals. Carbonate veins locally abundant. Glass partially palagonitized, associated with some zeolites.

In section 1, an exceptionally large (1 cm) plagioclase phenocryst occurs in 1a. From 1b to 1f, plagi increases from 3 to 7% and olivine from 1 to 5%.

139-141 $\frac{\text{Inc.}}{+33.3^\circ}$ $\frac{\text{NRM}}{.811}$ $\frac{\text{MDF}}{700}$ $\frac{\text{D}}{2.81}$

LEG	H	O	L	CORE	SFC
4	5	3	9	6	2
LEG	SITE			CORE	SFC

VISUAL CORE DESCRIPTION

MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOLASE-OLIVINE PHYRIC BASALT

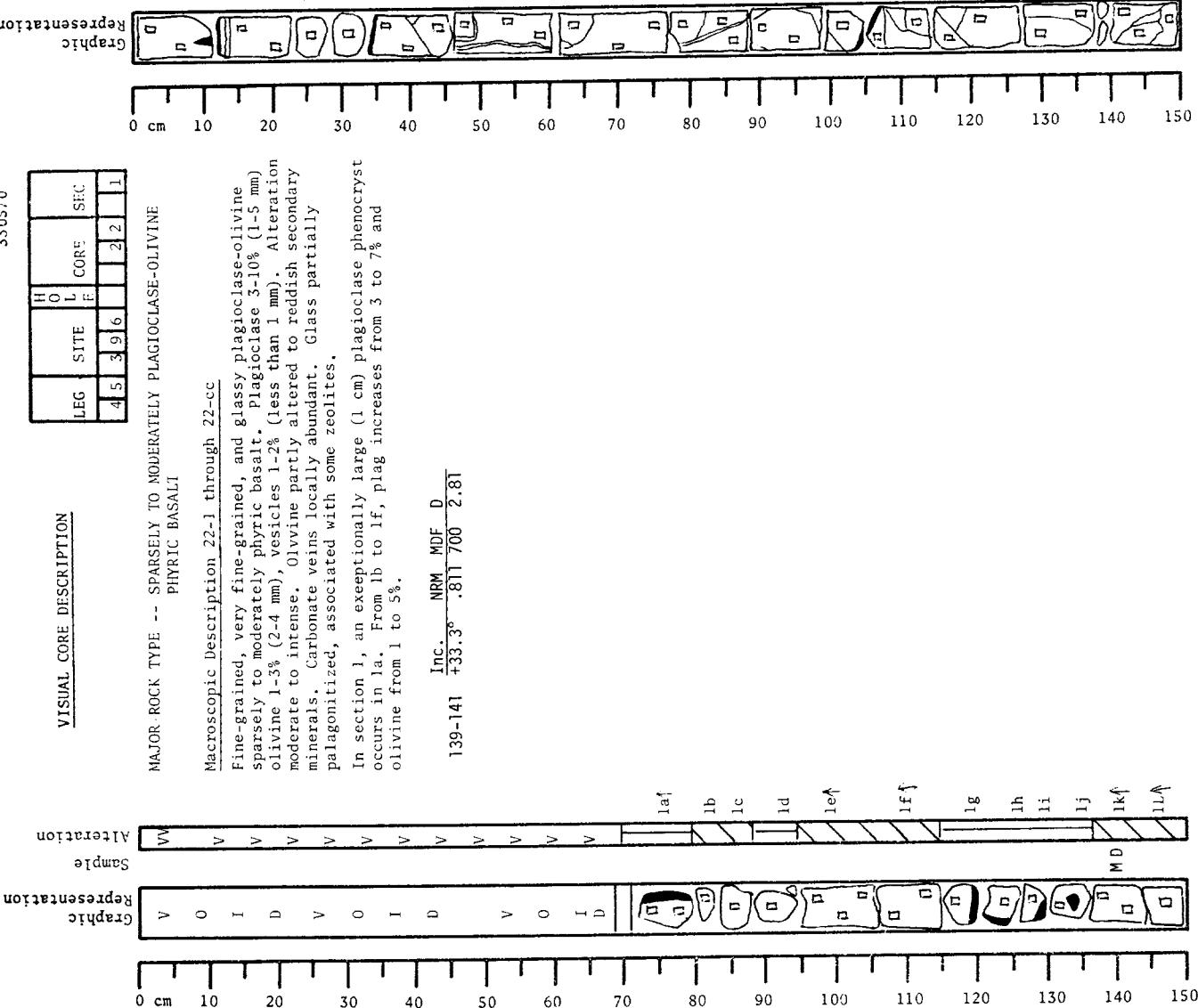
Macroscopic Description

General description given in 22-1. Glass present in 1a, 1b, 1e, 1j, and 1k. Pieces 1e-1j probably represent a single pillow in which olivine increases from about 3% near the top to 7% near the bottom. A plagioclase crystal in 1f is 1.5 cm across. One in 1g is 1 cm across. Carbonate veinlets are present in all specimens.

Thin Section Description

2-25-27#1c: Moderately phryic plagioclase-olivine basalt, sub-volcanic groundmass. Phenocrysts: plagioclase 20% (.2-.5 mm) eu-subhedral; olivine 5% (.1-.2 mm); spinel - trace. Mesostasis 70% is microcrystalline, cpx:plagi:monomagnetite = 10:7:1. Partly altered to clay minerals. Vesicles 1-2% partly filled by carbonates and clays. Plagioclase phenocrysts locally contain blebs of glass, and some are zoned. Olivine contains blebs of microcrystalline glass and chrome spinel.

131-133 $\frac{\text{Inc.}}{+34.5^\circ}$ $\frac{\text{NRM}}{1.42}$ $\frac{\text{MDF}}{550}$ $\frac{\text{D}}{2.82}$



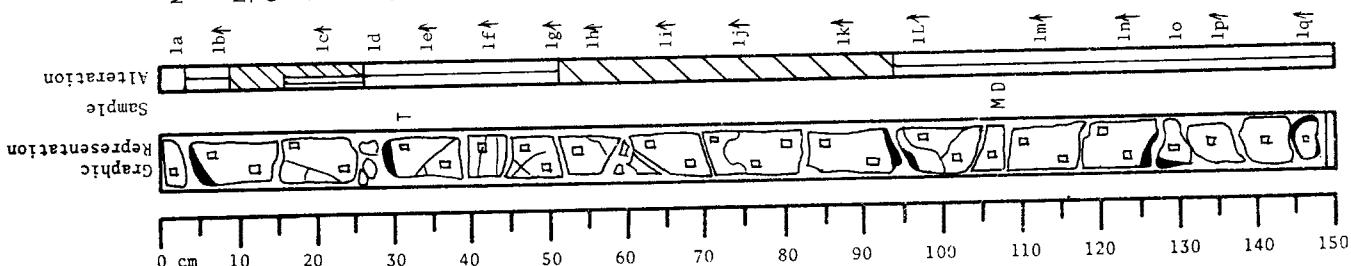
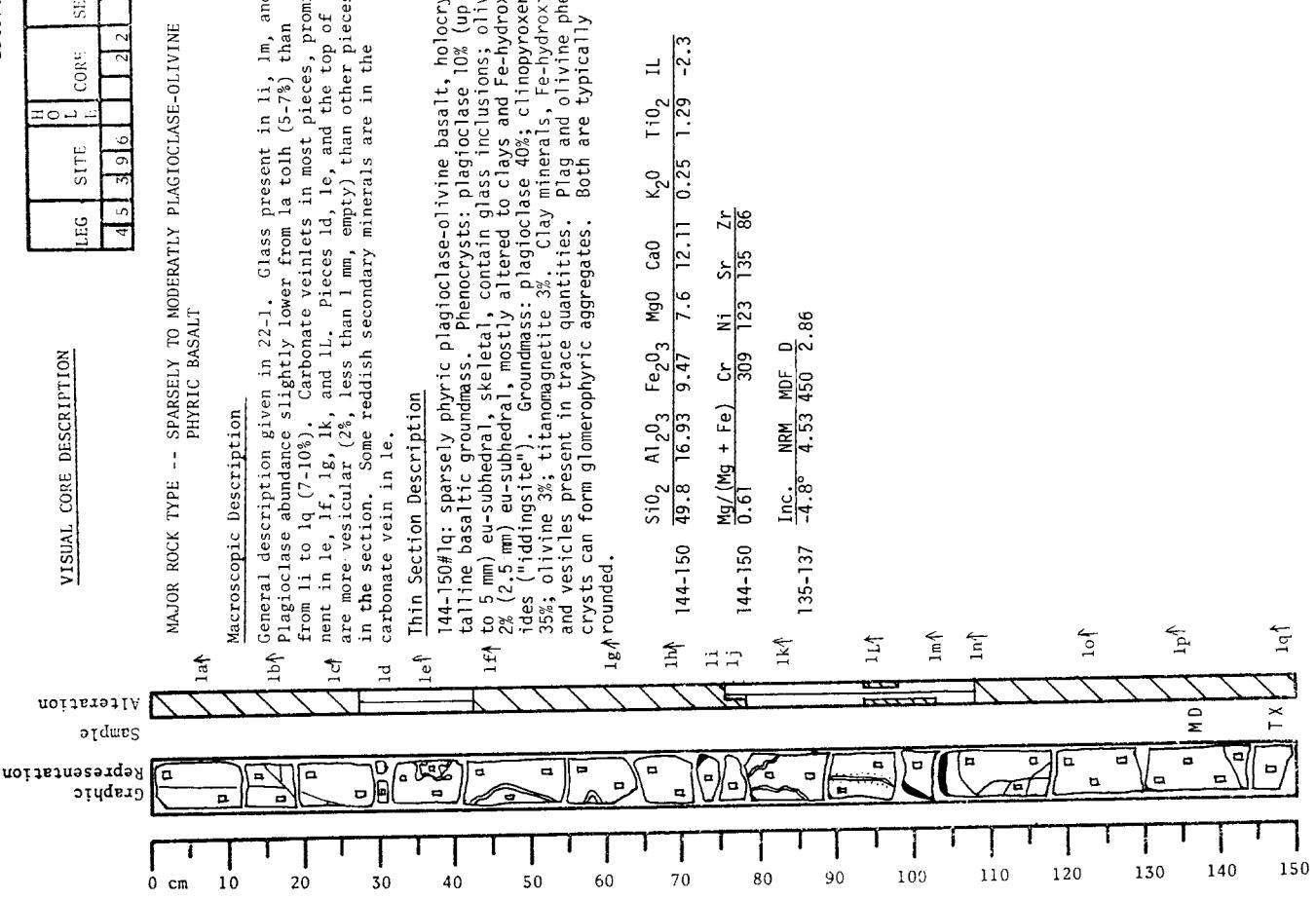
LEG	SITE	H	O	L	CORE	SEC
4	5	3	9	6		2
5	3	9	6			2

VISUAL CORE DESCRIPTION	
LEG	SITE
4 5 3	9 6

MAJOR ROCK TYPE -- SPARSELY TO MODERATELY PLAGIOCLASE-OLIVINE PHRIC BASALT

1a↓ Macroscopic Description
General description given in 22-1. Glass present in 1b, 1e, 1k, 1L, 1n, 1o, and 1q.. Pieces 1e-1k are probably a section through a pillow. Plagioclase and olivine phenocrysts increase in abundance and grain size from 1e (plag about 3% or less than 1%) to 1h and 1i (Plag 7%, ol 3%, partly fresh) and then decrease again to 1k. A similar sequence probably representing a pillow was recognized between 1L and 1q. At glassy zones, reddish brown alteration (palagonite?) is present. Olivine, most altered in intensely altered pieces; partly fresh in moderately altered pieces.

1f↓ Thin Section Description
3-29-31# 1e: moderately phric plagioclase-olivine basalt, vitro-phric groundmass. Phenocrysts: plagioclase 13% up to 7 mm; olivine 2%, up to 2 mm; both surrounded, skeletal. Matrix ranges from glassy (pale brown) to dark brown and black, where spherulites coalesce. Within this dark matrix, tiny needles of plagioclase and crystals of olivine can be seen here and there. Portions of the glass are altered to palagonite. Plag is An70. Olivine phenocrysts contain blebs of clear glass.

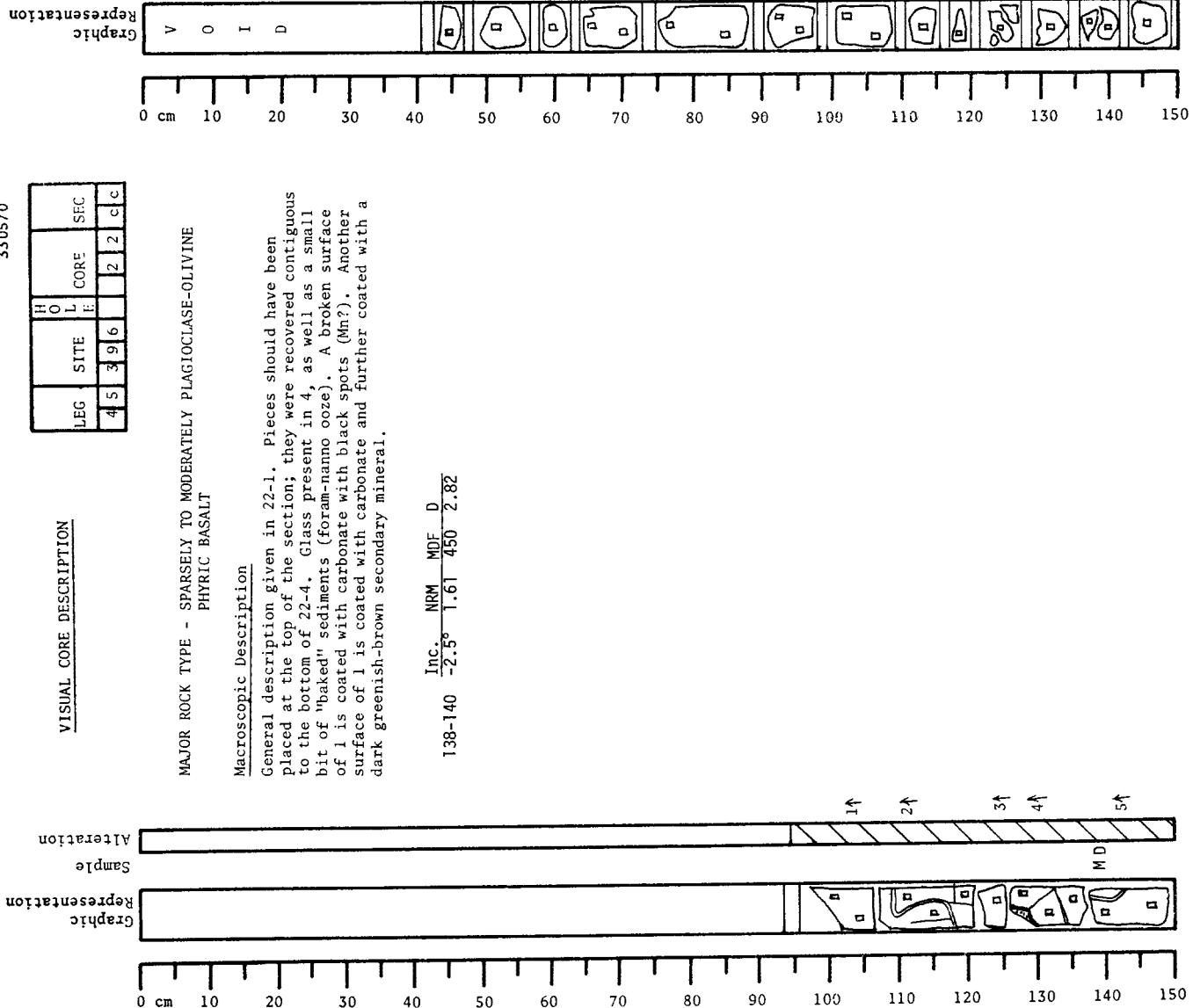
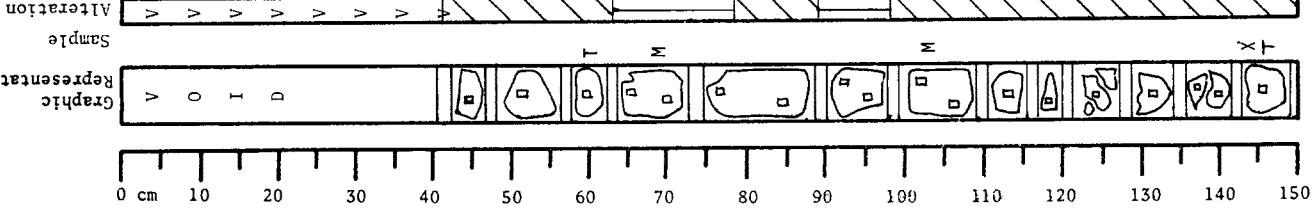


LEG	SITE	H O	L	CORE	SEC
4 5	3 9 6			2 2	c c

VISUAL CORE DESCRIPTIONMAJOR ROCK TYPE - SPARSELY TO MODERATELY PLAGIOLASE-OLIVINE PHRYCIC BASALTMacroscopic Description

General description given in 22-1. Pieces should have been placed at the top of the section; they were recovered contiguous to the bottom of 22-4. Glass present in 4, as well as a small bit of "baked" sediments (foram-nanno ooze). A broken surface of 1 is coated with carbonate and further coated with a dark greenish-brown secondary mineral.

138-140 Inc. -2.5° NRM 1.61 MDF D 2.82



330570

LEG	SITE	H	O	L	CORE	SEC
4	5	3	9	6		
					2	4
						1

MAJOR ROCK TYPE -- PLAGIOCLASE-OLIVINE PHYRIC BASALTMacroscopic Description 24-1 through 24-3

Fine-grained, very fine-grained, and glassy plagioclase-olivine phyric basalt. Plagioclase 5-20%, more abundant in section 1 than in sections 2 or 3, and usually 1-3 mm across, rarely 5 to 10 mm across. Olivine Tr-3% and 1-3 mm, usually partially altered to reddish secondary minerals. Alteration moderate to intense throughout. Carbonate veinlets present in most pieces, sometimes associated with manganese spots. (especially visible on fracture surfaces coated with carbonate).

In section 1, glass present on la, 1e, and 1f. Proportion of plagioclase phenocrysts in le is low (5%) increasing to the top of the cooling unit (20% in 1a).

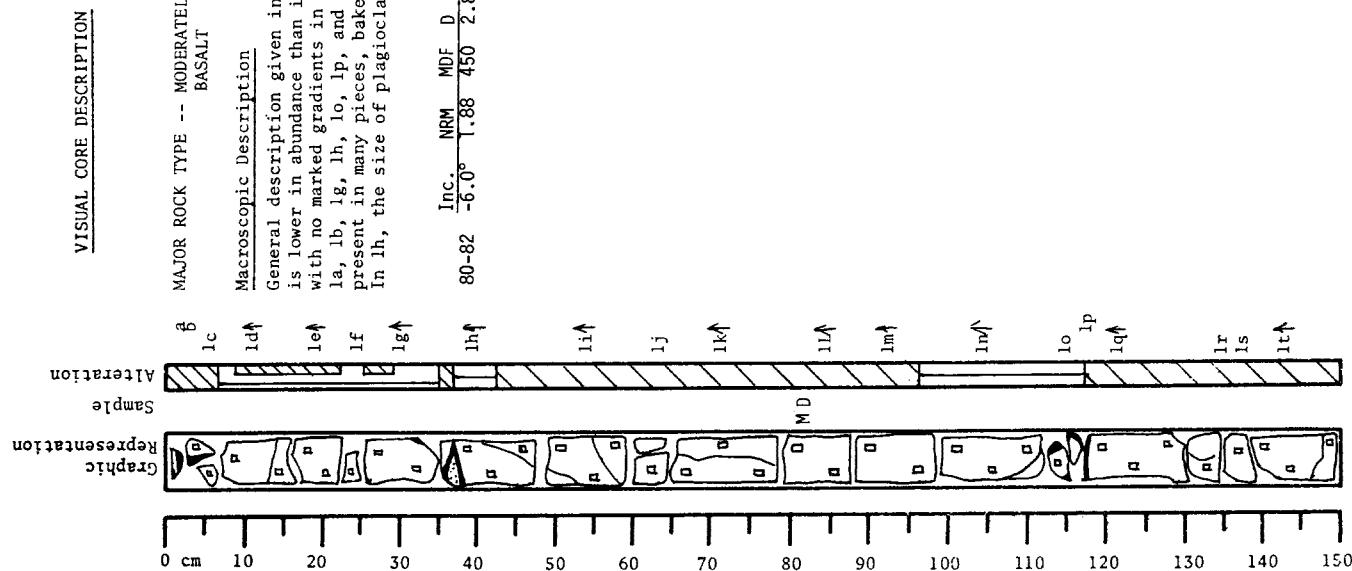
$$107-109 \quad \text{Inc.} -8.3^\circ \quad \text{NRM} 1.71 \quad \text{MDF} 900 \quad D 2.76$$


330570

LEG	SITE	H	O	L	CORE	SEC
4	5	3	9	6		
					2	4
						1

MAJOR ROCK TYPE -- MODERATELY PLAGIOCLASE-OLIVINE PHYRIC BASALTMacroscopic Description

General description given in 24-1. In this section, plagioclase is lower in abundance than in section 1 (7-10% this section) with no marked gradients in proportion. Glass is present in la, lb, lg, lh, lo, lp, and 1q. Carbonate veinlets are present in many pieces, baked sediments only in lh. In lh, the size of plagioclase phenocrysts increases downward.

$$80-82 \quad \text{Inc.} -6.0^\circ \quad \text{NRM} 1.88 \quad \text{MDF} 450 \quad D 2.85$$


VISUAL CORE DESCRIPTION			H	O	L	CORE	SEC
LEG	SITE	E					
4	5	3	9	6	2	4	3

MAJOR ROCK TYPE -- MODERATELY PLAGIOLASE-OLIVINE PHYRIC BASALT

Macroscopic Description

General description given in 24-1. From 24-2, 1p to 24-3, 1i is an apparent cooling unit. No significant variation of plagioclase phenocrysts is observed in this cooling unit. Olivine is only about 1% in the glass of 1i, however, and 3% in the cooling unit interior. From 1j to 1p, plagioclase phenocrysts increase from 5% to 10%, and olivine phenocrysts from less than 1% to about 3%. Black spots of Mn are seen on carbonates of 1d, 1j, and 1m.

Thin Section Description

3-73-78#11: Moderately phryic plagioclase olivine basalt, sub-variolitic to interstitial groundmass. Phenocrysts: plagioclase 20% (.2-4 mm) sub-euhedral; olivine 1% (.1-.4 mm) eu-subehedral. Plag is An70-75. Groundmass: plagioclase 10% acicular, skeletal; olivine 1% skeletal. Matrix mostly finely crystalline cpx:plag = 2:1, with a fine dust of titanomagnetite. Some phenocrysts of plagioclase and olivine are rounded. Some vesicles (1-2%) contain microcrystalline glass, partly altered.

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂	IL
1h†	73-78	49.1	16.58	9.68	7.9	12.07	0.23	1.29 -2.0
1i†	73-78	0.62	Cr	Ni	Sr	Zr		
1j	138-140	Inc.	NRM	MD	D			

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	MgO	CaO	K ₂ O	TiO ₂	IL
1g	96-100	49.7	16.71	9.49	7.4	11.99	0.13	1.29 -2.2
1h	96-100	0.61	Mg/(Mg + Fe)	Cr	Ni	Sr	Zr	
1i	111-113	Inc.	NRM	MD	D			

