The descriptions of sites, cores, and data included in the site chapter were completed within one year of the cruise, but many of the topical chapters that follow were finished several months later. More data were acquired and authors' interpretations matured during the interval, so readers may find some discrepancies between site chapter and topical papers. The timely publication of the *Initial Reports* series, which is intended to report the early results of each Leg, precludes our incurring the delays which would allow site chapters to be revised at a later stage of production.

1. EXPLANATORY NOTES[1]

Shipboard Scientific Party[2]

AUTHORSHIP OF THE HOLE 504B SUMMARY CHAPTER

The Hole 504B summary chapter presents an introduction to the objectives and results of Leg 83 drilling and experiments in Hole 504B. The separate sections of the summary chapter were written by shipboard scientists as follows:

Background and Objectives: Becker, Honnorez, Anderson
Operations: Norrie
Basement Lithostratigraphy: Adamson
Petrographic Classification of Basalts: Kempton
Basement Geochemistry: Emmermann
Basement Alteration Petrography: Alt, Laverne, Honnorez
Bore Water Chemistry: Mottl
Paleomagnetism: Newmark
Physical Properties: Kinoshita, Becker
Temperature Measurements: Becker
Permeability: Anderson
Borehole Televiewer: Newmark
Large-scale Resistivity Experiment: Becker
Logging: Anderson

GENERAL INFORMATION

The summary chapter also presents descriptions and photographs of the materials cored at Hole 504B. Investigators who wish to obtain samples should refer to the Sample Distribution Policy, which is stated at the front of the volume.

The following notes are intended to aid interested investigators in understanding the terminology, labeling, and numbering conventions used by the Deep Sea Drilling Project. The Leg 83 shipboard party followed these conventions, but two modifications should be noted here. First, in an attempt to increase the recovery rate, many of the Leg 83 cores in Hole 504B were cut at intervals shorter than the standard 9.5 m. Second, in the Visual Core Descriptions, the recovered basalts are described by units, rather than by cores. Units were defined by the shipboard scientists on the basis of petrology, alteration, thin-section analysis, X-ray diffraction mineralogy, and X-ray fluorescence geochemistry.

NUMBERING OF SITES, HOLES, CORES, SAMPLES

DSDP drill sites are numbered consecutively from the first site drilled by *Glomar Challenger* in 1968. Site numbers are slightly different from hole numbers. A site number refers to one or more holes drilled while the ship was positioned over one acoustic beacon. These holes could be located within a radius as great as 900 m from the beacon. Several holes may be drilled at a single site by pulling the drill pipe above the seafloor (out of one hole), moving the ship 100 m or more from the previous hole, and then drilling another hole.

The first (or only) hole drilled at a site takes the site number. A letter suffix distinguishes each additional hole at the same site. For example: the first hole takes only the site number; the second takes the site number with suffix A; the third takes 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 from different holes usually do not come from equivalent positions in the stratigraphic column.

There are two types of coring systems used on the *Glomar Challenger*: (1) the standard DSDP rotary-coring system, which cuts ~9.5 m cores and has been used since Leg 1; and (2) the Hydraulic Piston Coring (HPC) system, used since Leg 64.

HPC holes are not assigned a special letter designation. The HPC operates on the principle of a core barrel which is lowered inside the drill string, hydraulically ejected into the sediment, and retrieved. The pipe is then lowered to the next interval and the procedure repeated. Disturbance can occur in the top 50-100 cm of HPC cores, especially near the top of a hole. The standard DSDP rotary coring system typically disturbs the cores in the upper 100 m of sediment in any hole, and generally half or more of each sediment core is quite disturbed.

The cored interval is measured in meters below the seafloor. The depth interval of an individual core is the depth below seafloor that the coring operation began to the depth that the coring operation ended. For example, in the rotary-coring system, each coring interval is generally 9.5 m long, which is the nominal length of a core

[1] Anderson, R. N., Honnorez, J., Becker, K., et al., *Init. Repts. DSDP*, 83: Washington (U.S. Govt. Printing Office).

[2] Roger N. Anderson (Co-Chief Scientist), Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York 10964; Jose Honnorez (Co-Chief Scientist), Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida 33149; Keir Becker, Deep Sea Drilling Project, Scripps Institution of Oceanography, La Jolla, California 92093; Andrew C. Adamson, Department of Geology, The University, Newcastle-upon-Tyne NE1 7RU, United Kingdom (present address: Ocean Drilling Program, Texas A&M University, College Station, TX 77843-3469); Jeffery C. Alt, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Miami, Florida 33149 (present address: Dept. of Earth and Planetary Sciences Campus Box 1169, Washington University, St. Louis, MO 63130); Rolf Emmermann, Mineralogisch-Petrologisches Institut, Justus-Liebig-Universität, D-6300 Giessen, Federal Republic of Germany; Pamela D. Kempton, Department of Geological Sciences, Southern Methodist University, Dallas, Texas (present address: NASA—Johnson Space Center, Mail Code SN 2 Houston, TX 77058); Hajimu Kinoshita, Department of Earth Sciences, Chiba University, Chiba 260, Japan; Christine Laverne, Laboratoire de Geologie, Université de l'Océan Indien, 97490 Ste. Clotilde (Réunion), France (present address: Laboratoire de Géologie, Faculté des Sciences et Techniques, 3038 SFAX, Tunisia); Michael J. Mottl, Department of Chemistry, Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543; Robin Newmark, Lamont-Doherty Geological Observatory, Palisades, New York 10964.

barrel; however, the coring interval may be shorter or longer (rare). "Cored intervals" are not necessarily adjacent to each other, but may be separated by "drilled intervals." In soft sediment, the drill string can be "washed ahead" with the core barrel in place, but not recovering sediment, by pumping water down the pipe at high pressure to wash the sediment out of the way of the bit and up the space between the drill pipe and wall of the hole; however, if thin, hard, rock layers are present, then it is possible to get "spotty" sampling of these resistant layers within the washed interval, and thus have a cored interval greater than 9.5 m. In drilling hard rock, a center bit may replace the core barrel if it is necessary to drill without core recovery.

Cores taken from a hole are numbered serially from the top of the hole downward. Core numbers and their associated cored interval in meters below the seafloor are normally unique for a hole; however, problems may arise if an interval is cored twice. When this situation occurs, the core number is assigned a suffix, such as "S" for supplementary.[3] In the rotary-coring system, full recovery for a single core is normally 9.28 m of sediment or rock, which is in a plastic liner (6.6 cm internal diameter), plus about a 0.2 m sample (without a plastic liner) in the core catcher. The core catcher is a device at the bottom of the core barrel which prevents the cored sample from sliding out when the barrel is being retrieved from the hole. The sediment core, which is in the plastic liner, is then cut into 1.5 m sections and numbered serially from the top of the sediment core (Fig. 1). When we obtain full recovery, the sections are numbered from 1 through 7 with the last section possibly being shorter than 1.5 m. The core-catcher sample is placed below the last section when the core is described, and labeled core-catcher (CC); it is treated as a separate section.

When recovery is less than 100%, and if the sediment or rock is contiguous, the recovered sediment or rock is placed in the top of the cored interval, and then 1.5 m sections are numbered serially, starting with Section 1 at the top. There will be as many sections as are needed to accommodate the length of the core recovered (Fig. 1); for example, 3 m of core sample in plastic liners will be divided into two 1.5 m sections. Sections are cut starting at the top of the recovered sediment, and the last section may be shorter than the normal 1.5 m.

This technique differs from the labeling systems used on Legs 1 through 45, which had a designation called "zero section." On Legs 1-45 there were seven sections labeled 0, 1, 2, 3, 4, 5, and 6. The new system used from Legs 46 to the present has seven sections, but they are labeled 1, 2, 3, 4, 5, 6, and 7.

When recovery is less than 100%, the original stratigraphic position of the sediment or rock in the cored interval is unknown, so we employ a convention assigning the top of the sediment recovered to the top of the cored interval. This is done for convenience in data handling, and consistency. If recovery is less than 100% and core fragments are separated, and if shipboard scientists believe the sediment was not contiguous, then sections are numbered serially and the intervening sections are noted as void, whether contiguous or not. The core-catcher sample is described in the visual core descriptions beneath the lowest section.

Samples are designated by centimeter distances from the top of each section to the top and bottom of the sample in that section. A full identification number for a sample consists of the following information: Leg, Site, Hole, Core Number, Section Number, Interval in centimeters from the top of section.

For example, a sample identification number of "75-531A-6-3, 12-14 cm" is interpreted as follows: 12-14 cm designates a sample taken at 12 to 14 cm from the top of Section 3 of Core 6, from the second hole drilled at Site 531 during Leg 75. A sample from the core catcher of this core is designated as "75-531A-6, CC (12-14 cm)".

The depth below the seafloor for a sample numbered at "75-531A-6-3, 12-14 cm", is the summation of the following: (1) the depth to the top of the cored interval for Core 6, which is 430 m; (2) plus 3 m for Sections 1 and 2 (each 1.5 m long); plus the 12 cm depth below the top of Section 3. All of these variables add up to 433.21 m, which by convention is the sample depth below the seafloor.

SPECIAL CORES AND SAMPLES

Occasionally, special cores or samples are recovered that require specific identification. These are designated as follows:

X = miscellaneous debris or out-of-sequence core material.

C = center bit samples; that is, samples obtained upon removal of the center bit (a device to prevent core recovery while drilling or washing ahead for some interval).

S = sidewall core; that is, a core taken in the side of the hole, usually to obtain a sample of material not recovered during previous coring.

H = a wash core; that is, a core taken while washing ahead for an interval larger than 9.5 m (say, 50 m), but without the center bit in place. Such a core may sample at several places in the washed interval, but their depths cannot be specified within that interval.

B = bit material; that is, material removed from core bits upon retrieval of the drill string following completion of a hole, or prior to reentry with a new core bit.

Cores or samples of these types are designated X1, X2, H1, H2, etc., each type in the sequence they were obtained. Additional types of special samples may be designated by the shipboard party or cruise operations manager. The letter designation for these samples is chosen in consultation with the DSDP curatorial representative and laboratory officer, and is indicated on each core description form.

[3] Note that this designation has been used on previous legs as a prefix to the core number for sidewall core samples.

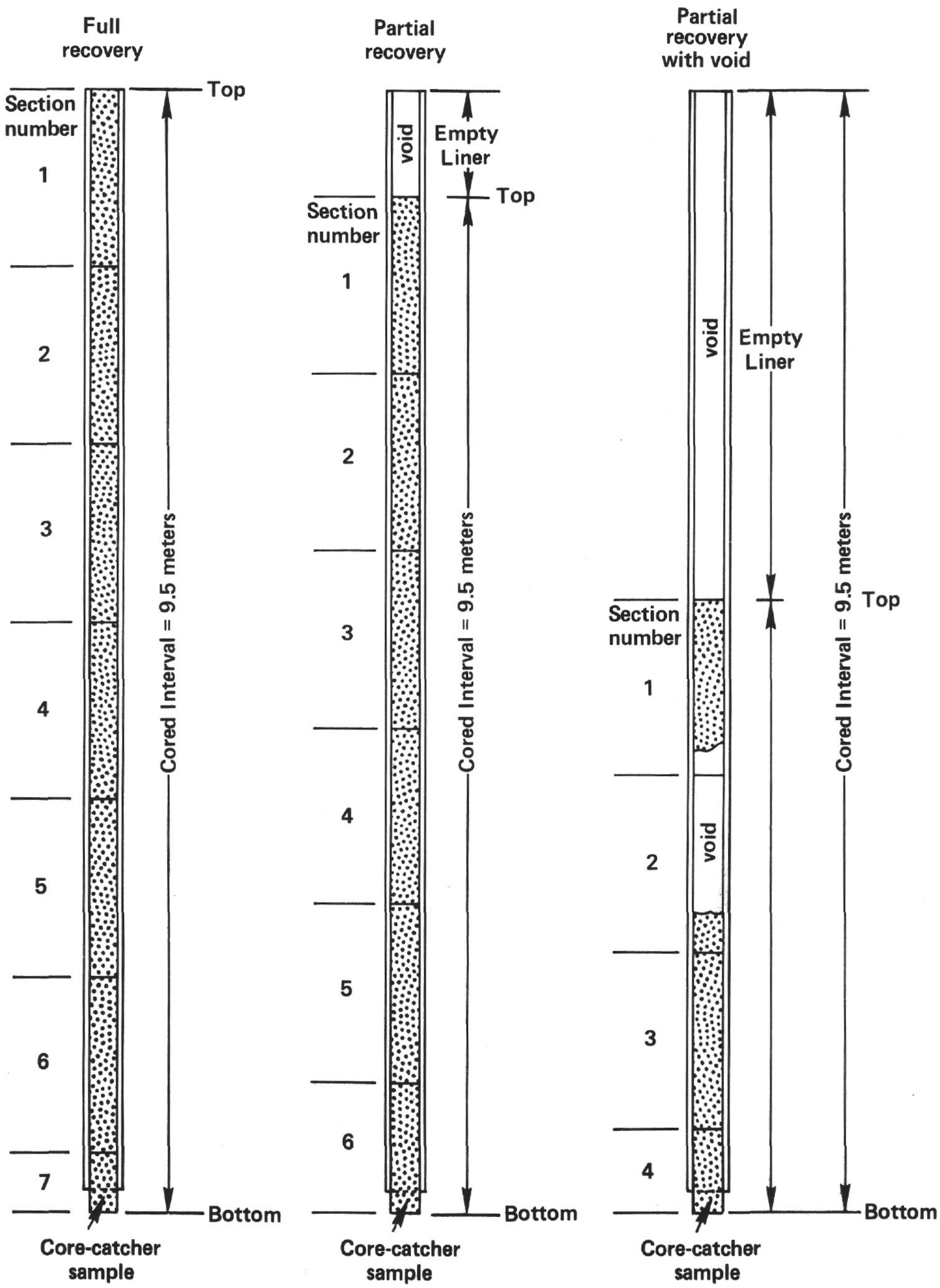

Figure 1. Diagram showing procedure in cutting and labeling of core sections.

BASEMENT DESCRIPTION CONVENTIONS

Core Forms

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, are used for more complete graphic representation. All shipboard data per 1.5 m section of core are listed on the modified forms as well as summary hand-specimen and thin-section descriptions. The symbols and a number of format conventions for igneous rocks are presented on Figure 2.

Igneous and metamorphic rocks are split using a rock saw with a diamond blade into archive and working halves. The latter is described and sampled on board ship. On a typical igneous rock description form (Figure 3), the left column is a visual representation of the working half using the symbols of Figure 2. 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 could be fitted together before splitting are given the same number, but are consecutively lettered, as 1A,

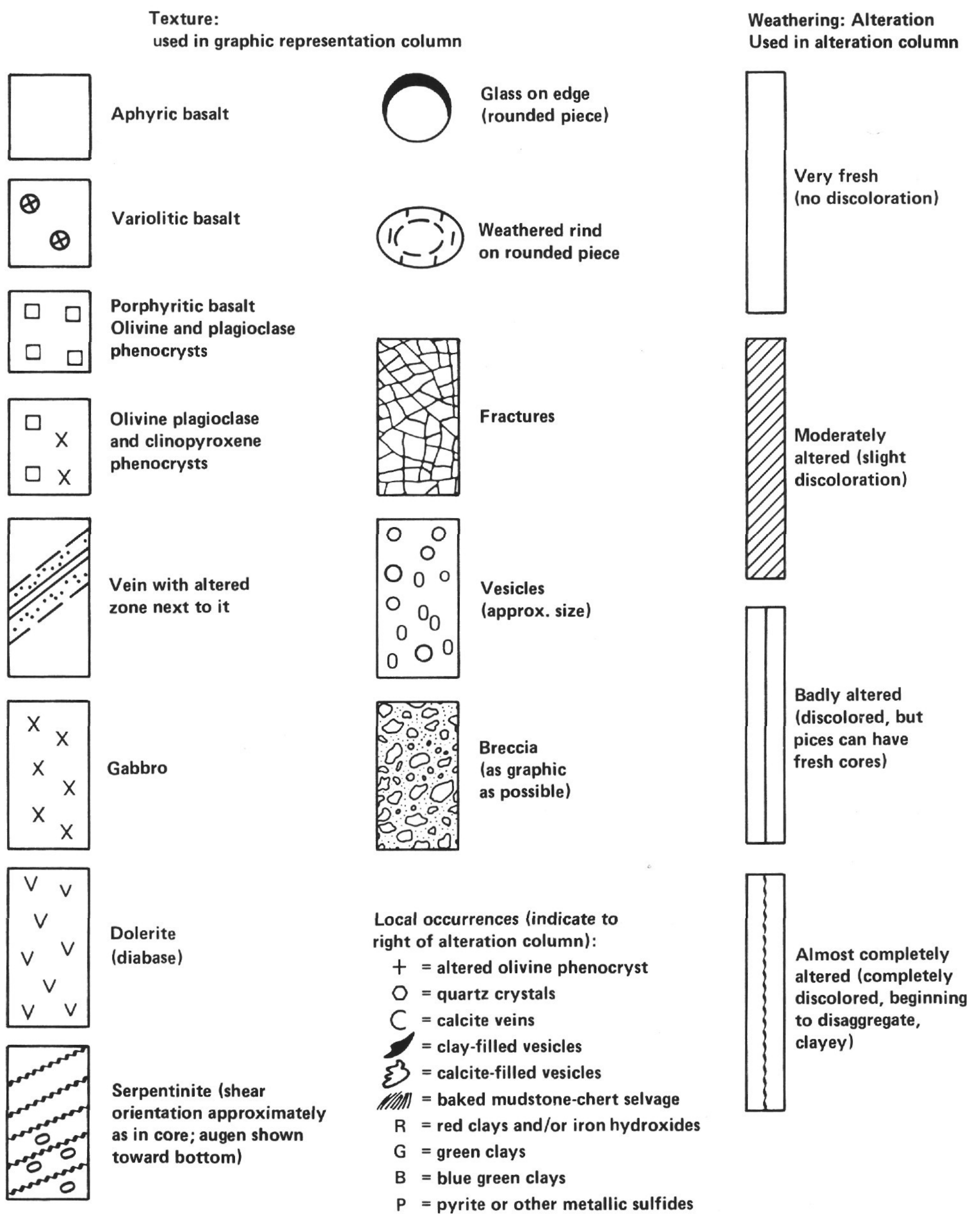

Figure 2. List of symbols for igneous rock description forms.

1B, 1C, etc. Spacers are placed between pieces with different number, 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 is high, it is impractical to use spacers. In these cases, drilling gaps are indicated only by a change in numbers. All pieces 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 are used to ensure that orientation is 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 are rotated during drilling, it is not possible to sample for declination studies.

Samples are 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:

XRD = X-ray diffraction analysis
X = X-ray fluorescence analysis
M = magnetics measurements
T = thin section
PP = physical properties measurements: sonic velocity, density, porosity, and thermal conductivity

Up to seven such visual representations can be included on a single igneous rock core description sheet (Fig. 4),

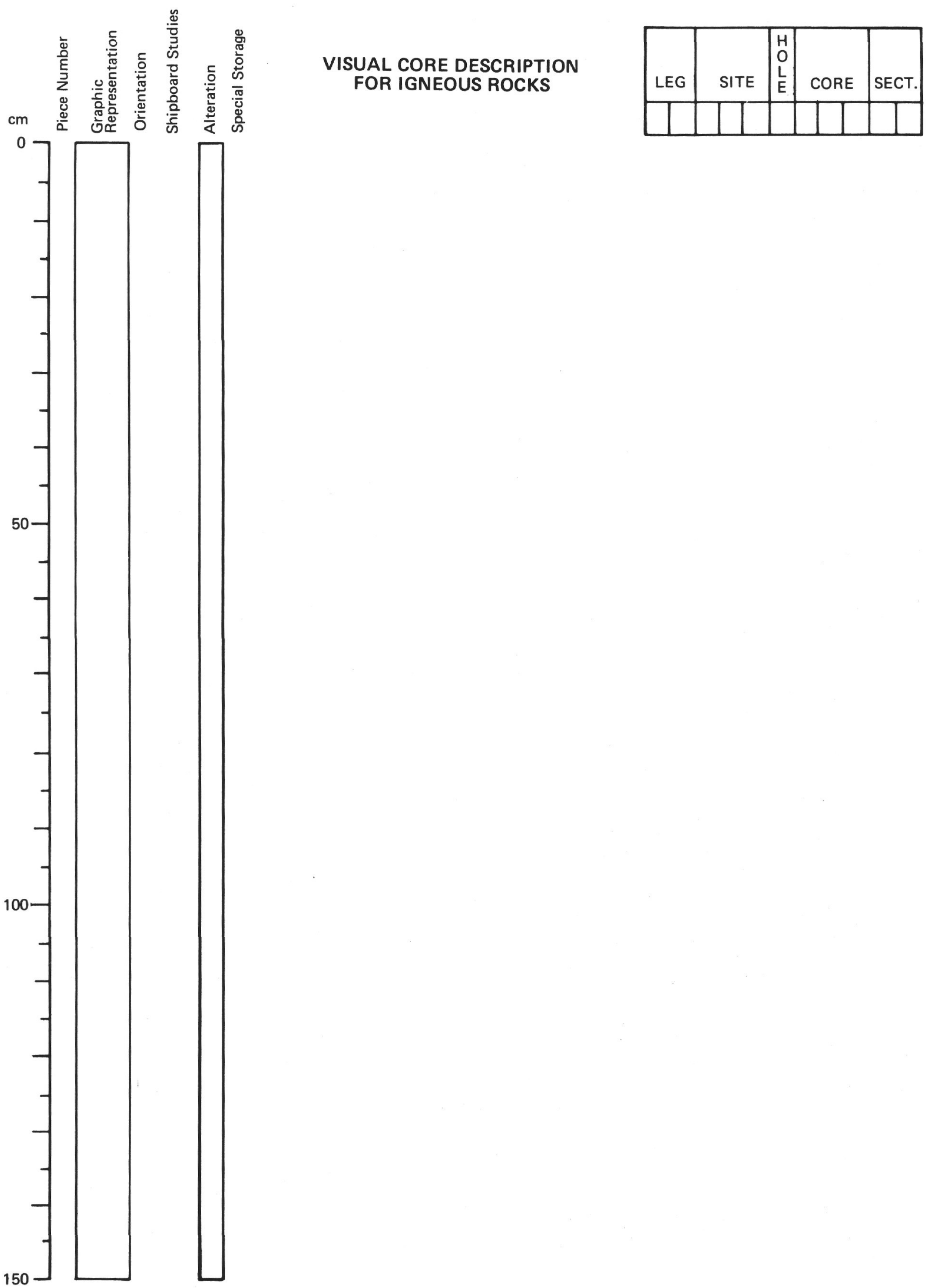

Figure 3. Typical igneous rock description form.

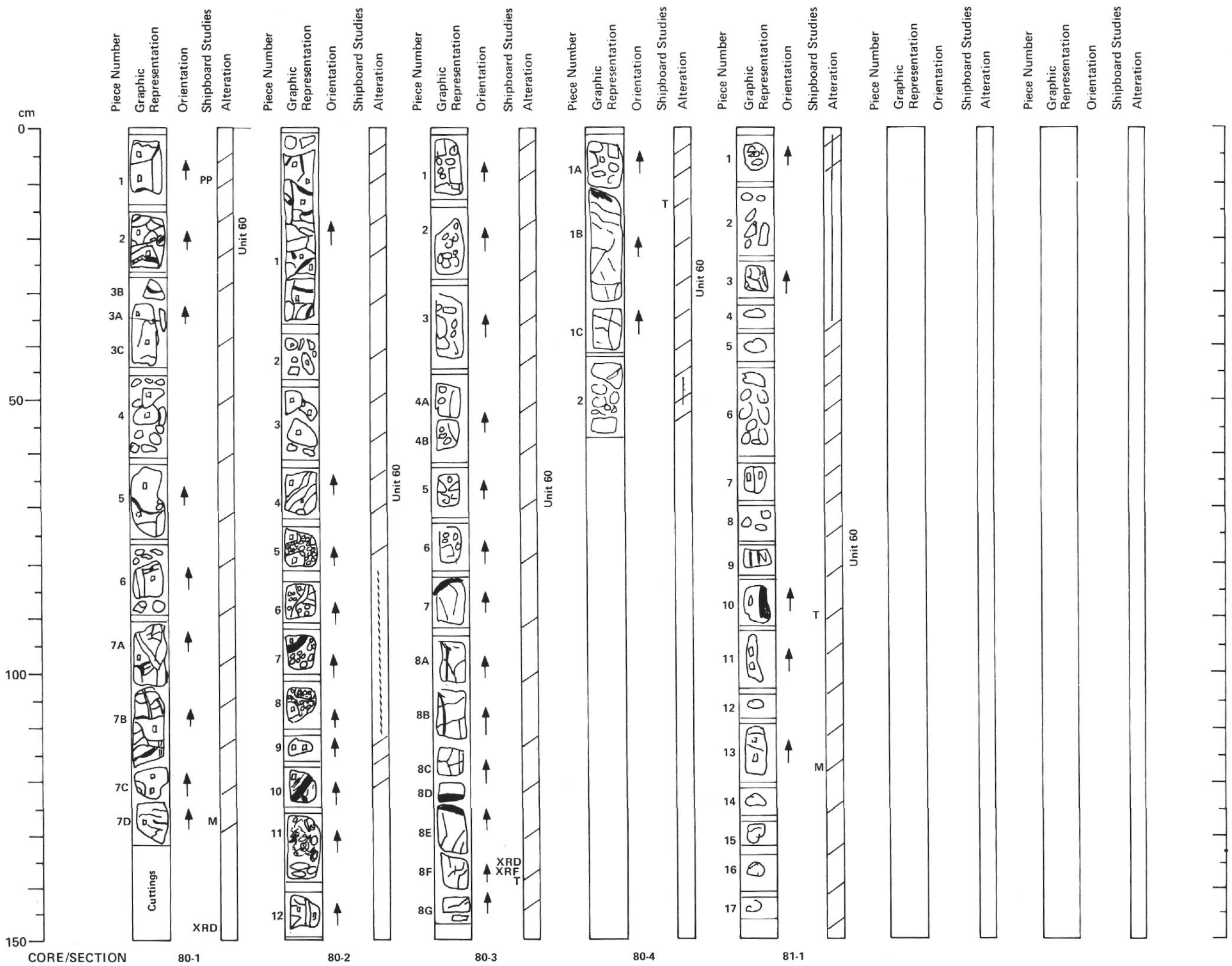

Figure 4. Igneous rock description sheet.

Unit 60 (909.5–958.5 m).

This unit consists of a thick sequence of pillow lavas recovered in six consecutive cores (80 through 85). Numerous chilled pillow margins (several confirmed by thin section) and hyaloclastic breccias are distributed throughout the unit. Fracturing was so intense in some of the recovered material, from both the pillow margins and interiors, that recovery was reduced to rubble at several horizons. The upper sections of the unit (approximately Cores 80 through 83) consist of a sparsely to moderately olivine-plagioclase phyric basalt. Phenocryst contents can vary from 2% (sparsely phyric) to 6–8% (moderately phyric) depending on the pillows. In the sparsely phyric pillows olivine (0.5–2 mm) and plagioclase (up to 2 mm) phenocrysts are in roughly equal proportions. In the more moderately phyric basalts the plagioclase content increases to about 5%, and the olivine to about 3% in total. Rare chrome spinel can be recognized in thin section as subhedral/euhedral micro-phenocrysts (0.2 mm). Olivine phenocrysts are euhedral and replaced by chlorite, plagioclase phenocrysts (exhibiting replacement by albite in varying degrees) commonly occur in glomerocrystic aggregates. Towards the base of the unit (Cores 84 and 85) the phenocrysts assemblages of the pillows change to include clinopyroxene; these are moderately olivine-plagioclase-clinopyroxene phyric basalts. The amounts of olivine and plagioclase phenocrysts in these pillows are similar to those described in the pillows from higher in the sequence and are again variably phyric but with anhedral/subhedral clinopyroxene phenocrysts (0.2–3 mm) forming an additional 1–5% of the rock. In both groups textures are dependent on the distance from the pillow margins or interior (see petrography chapter). All the pillows are of a similar pale grayish-green to green color. Alteration is intense, most fractures and all the hyaloclastic breccias are cemented by clays and various other alteration minerals. Clays are generally a bluish-green or a dark green in color (chlorite). Laumontite, quartz, talc, and calcite, sometimes cutting earlier clay veins, and epidote are also common throughout the pillow sequence. Pyrite is abundant, often cementing the breccias together with chlorite. Sphalerite is present in some veins, but is not common.

which includes a summary core description and petrographic and analytical data.

Igneous Rock Classification

Igneous rocks are classified mainly on the basis of mineralogy and texture. Thin-section work in general adds little new information to hand-specimen classification.

Basalts are termed aphyric, sparsely phyric, moderately phyric, or phyric, depending upon the proportion of phenocrysts visible with the binocular microscope ($\sim \times 12$). The basalts are called aphyric if phenocrysts are absent. For practical purposes, this means that if one piece of basalt is found with a phenocryst or two in a section where all other pieces lack phenocrysts, and no other criteria such as grain size or texture distinguish this basalt from the others, then it is described as aphyric. A note on the rare phenocrysts is included in the general description, however. This approach enables us to restrict the number of lithologic units to those that appear to be clearly distinct.

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

Moderately phyric basalts contain 2–10% phenocrysts. Aphyric basalts within a group of moderately phyric basalts are separately termed aphyric basalts.

Phyric basalts contain more than 10% phenocrysts. No separate designation is made for basalts with more than 20% 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 phyric, sparsely phyric, etc. For example, a plagioclase-olivine moderately phyric basalt contains 2–10% phenocrysts, most of them plagioclase, but with some olivine.

Date of Acceptance: 12 December 1983