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AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Practices for Preserving and Transporting Rock Core Samples[1]

This standard is issued under the fixed designation D 5079; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 These practices cover the preservation, transportation, storage, cataloging, retrieval, and post-test disposition of rock core samples obtained for testing purposes and geologic study.

1.2 These practices apply to both hard and soft rock, but exclude ice and permafrost.

1.3 These practices do not apply to those situations in which changes in volatile gas components, contamination of the pore fluids, or mechanical stress relaxation affect the intended use for the core.

1.4 *This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 420 Practice for Investigating and Sampling Soil and Rock for Engineering Purposes[2]

D 2113 Practice for Diamond Core Drilling for Site Investigation[2]

D 4220 Practice for Preserving and Transporting Soil Samples[2]

2.2 *API Standard:*

API RP-40 Recommended Practice for Core Analysis Procedure[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *critical care*—samples which are fragile or fluid or temperature sensitive. This protection level includes the requirements prescribed for routine and special care.

3.1.2 *routine care*—non-sensitive, non-fragile samples for which only general visual identification is necessary, and samples which will not change or deteriorate before laboratory testing.

3.1.3 *soil-like care*—materials which are so poorly consolidated that soil sampling procedures must be employed to obtain intact pieces of core.

3.1.4 *special care*—fluid sensitive samples and those which must later be subjected to testing. Requirements for this level of protection include those prescribed for routine care.

4. Significance and Use

4.1 The geologic characteristics and the intended use of the rock core samples determine the extent and type of preservation required. If engineering properties are to be determined for the core, it must be handled and preserved in such a way that the measured properties are not significantly influenced by mechanical damage, changes in chemistry, and environmental conditions of moisture and temperature, from the time that the core is recovered from the core drill until testing is performed. Drill core is also the sample record for the subsurface geology at the borehole location, and as such must be preserved for some period of timed, in some cases indefinitely, for future geologic study.

4.2 These practices present a selection of curatorial requirements which apply to the majority of projects. The requirements are given for a variety of rock types and project types ranging from small to large and from noncritical to critical. Noncritical projects are those in which failure of an element or the structure would result in negligible risk of injury and property loss, while there is great risk to property and life after failure of critical structures and projects. Guidance is given for the selection of those specific requirements which should be followed for a given project.

5. Guide for Implementation

5.1 A qualified person shall be assigned to have curatorial management responsibility for a given project. This person shall be technically competent in the management of rock core samples and shall have a knowledge of the various end uses for the cores and their associated preservation requirements. This responsible person shall have the authority to implement the requirements selected from these practices. In some cases, he or she may also have to decide between competing uses for the same core.

5.2 The responsible person shall select from Sections 6-11 those requirements and procedures that should be applied for the core from a particular project. The curatorial manager shall then see that these procedures are implemented, and also see that the records specified in Section 12 are kept.

[1] These practices are under the jurisdiction of ASTM Committee D-18 on Soil and Rock and are the direct responsibility of Subcommittee D18.12 on Rock Mechanics.

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] Available from American Petroleum Institute, 1220 L Street, Washington, DC 20005.

5.3 The following factors should be considered when selecting the curatorial requirements from Sections 6-11:

5.3.1 Project requirements for use of the core range from simple ones, in which the only need is to identify and locate the various lithologic units, to complex and critical ones in which detailed property testing of the core is required for engineering design. Priorities for multiple uses or different types of tests must sometimes be established when available core lengths are limited and when one use or test precludes another. For example, splitting a core for detailed geologic study prevents later strength testing, which requires an intact core.

5.3.2 Mechanical property tests for structural design purposes should be performed on a core in its natural moisture state, particularly if the rocks are argillaceous. Irreversible changes occur when such rocks are allowed to dry out, often resulting in invalid design data. The initial moisture content of such a core should therefore be preserved.

5.3.3 Freezing of pore water in the core may reduce the strength of the rock. The high temperature associated with unventilated storage sheds in summer, and temperatures alternating between hot and cold, may cause moisture migration from the core and weakening of the rock due to differential thermal expansion and contraction between grains. Such temperature extremes should therefore be avoided, particularly for weak sedimentary rock types.

5.3.4 A weak rock core may be broken or further weakened by careless handling, such as dropping a core box, or by mechanical vibration and shock during transportation. Breaking of the core reduces sample lengths available for testing. Weakening caused by such mechanical stressing may lower measured strength parameters and may affect other properties.

5.3.5 The required preservation time may vary from as short as three months to several years, and sometimes core may need to be stored indefinitely. A core taken simply to identify the bedrock lithology beneath a small structure may be needed for a few months only. For large and critical structures, it may be necessary to retain the core for many years as re-examination and testing may be required at some later time for additional geologic study or re-evaluation of property data. Some states have regulations governing the disposition and storage of core obtained within the state.

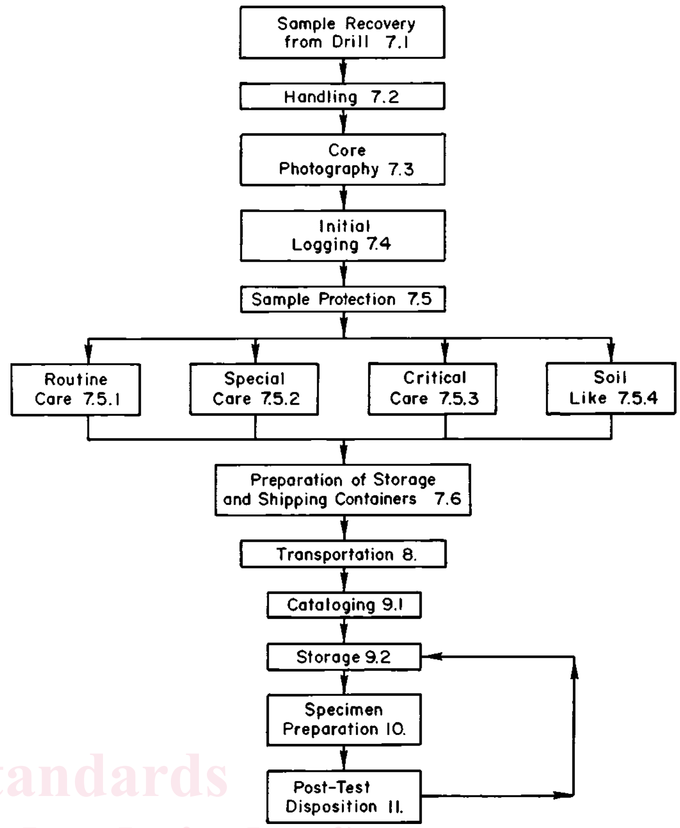
5.4 Fig. 1 is a flow chart that shows the various core handling, use, and storage activities and the corresponding section numbers in these practices. Note that four care or protection levels are defined in Section 3 to account for the great variety of rock sensitivities and core uses encountered in practice.

5.5 The person assigned curatorial management responsibility should study the flow chart in Fig. 1 as it relates to the designated Sections 6-11 in these practices. Note in particular, that a selection of the required protection must be made in 7.5, where four levels of protection are specified, namely routine care, special care, critical care, and soil-like care.

5.6 Special attention is also directed to records requirements in Section 12, that document the history of the core handling, preservation, and storage.

6. Apparatus

6.1 *Camera*, for taking photographs of cores for logging.



NOTE 1—Numbers refer to corresponding sections of this practice.

FIG. 1 Flow Chart for Core Handling, Use, and Storage Activities

6.2 *Controlled Humidity Room*.

6.3 *Core Boxes*—See 7.6.1.

6.4 *Vinylidene Chloride Plastic Film, Aluminum Foil, Plastic Microcrystalline Wax*, for sealing in moisture content of cores.

6.5 *Polyethylene Layflat Plastic Tubing*.

6.6 *Poly(vinyl chloride) Tubing*.

6.7 *Sawdust, Rubber, Polystyrene*, or material of similar resiliency to cushion the core.

6.8 *Miscellaneous Equipment*, such as adhesive tape and waterproof felt-tip markers.

7. Requirements and Procedures at the Drilling Site

7.1 *Sample Recovery*:

7.1.1 Accomplish sample recovery in accordance with Practice D 2113 or API RP-40.

7.1.2 Whichever approved drilling method is used, remove the samples from the core barrel with a minimum of disturbance.

7.2 *Handling*:

7.2.1 Each borehole shall be given full-time attention by a qualified inspector constantly available for observing, directing, photographing, and field logging. The inspector shall not perform simultaneously the same duties for more than one boring unless the borings are close enough to each other so that the entire inspection process can be done for each boring.

7.2.2 For relatively solid pieces of core that will not be adversely affected, the inspector shall use a marker, such as a

felt-tip, to orient each piece so that later users will always be able to distinguish top from bottom. Acceptable formats are a continuous line with arrows or parallel solid and dashed lines with the dashed line always on the same side of the solid line. The direction convention shall be recorded in the log book. Locations of known depths should be marked directly on the core when the orientation marks are drawn.

7.3 *Core Photography*:

7.3.1 Perform core photography on all core samples with a camera of 35 mm (minimum) format using color film to record permanently the unaltered appearance of the rock. The film selected should be color balanced for the available lighting (daylight, flash, incandescent, or florescent), or an appropriate filter should be placed on the camera to compensate for the difference. The core should be cleaned prior to any photography.

7.3.2 A commercially available color strip chart should be included in the photo frame to serve as a reference to check the accuracy of the photographic reproduction of the rock core colors.

7.3.3 For rock placed in core boxes, take one photo of each box once it is filled to capacity. Include the inside of the box lid with appropriate identification data and a clearly visible length scale laid along one edge of the box so that it also shows in the photo.

7.3.4 Where very long, intact cores are being preserved in single plastic tubes, make detail-revealing close-ups of each core interval in addition to a single photo showing the complete core.

7.3.5 Take photographs before the core is obscured by protective sealants and wraps, and before any deterioration begins in particularly fragile or sensitive rock types.

7.3.6 For a boxed core that is not particularly sensitive and for which maintenance of in-situ moisture content is not important, two photos should be made: one with the core in a surface dry condition and one with the core in a wet condition to bring out optical properties that would not otherwise be apparent.

7.3.7 This procedure may require photography both in the field and then later in the storage facility, but it must be completed before any test core removal and before damage from mishandling has a chance to occur.

7.3.8 Where it is impossible for a photo to show identification data marked directly on the sample or its container, then mount appropriately marked placards so as to be included in the frame.

7.3.9 Organize the photographs and mount in a folder for easy access and preservation.

7.4 *Initial Logging*:

7.4.1 The boring inspector must complete at least a preliminary field log of the core before it is packed away to be transported. Suggested procedures for logging are given in the literature.[4, 5, 6, 7] The preliminary log must include all identification data for the borehole and personnel and equipment involved, notations of coring run depths, recovery percentages, lithologic contact depths, types and locations of protection applied to samples, and any facts that would otherwise be unknown to whomever may complete a more detailed log at a later time. It is desirable that detailed logs be completed by the same inspector who does the field logging. It is advisable for the inspector immediately to make notations on the depths at which, in his judgment, any core losses occurred. Sometimes it is possible later to fill in gaps in the initial log by interpretations from wireline logs.

7.4.2 The inspector is to complete a detailed log on the drill site (see the literature[4, 5, 6, 7]) in cases where the core is likely to deteriorate or otherwise change before being examined again.

7.4.3 For fragile core that must be immediately protected by wrapping and sealing, preliminary logging should take place in the field, but application of protective measures are to take precedence over time-consuming detailed logging.

NOTE 1—It is permissible later to make changes in detailed logs when laboratory analysis indicates original misidentification of rock type or other geologic features.

7.5 *Sample Protection*—Four levels of sample protection are covered (see Section 3): routine care, special care, critical care, and soil-like care. The level of protection chosen will depend on the geologic character of the rock and the intended use for the core.

7.5.1 *Routine care (see* Fig. 2*)*:

7.5.1.1 For rock cored in 5 to 10-ft. runs, samples are sufficiently protected if placed in structurally sound core boxes. Enclosing the core in a loose-fitting polyethylene sleeve (layflat tubing) prior to placing the core in the core box is recommended.

7.5.1.2 Where very long solid cores have been recovered and need to be preserved intact, place each core in a reasonably stiff tube (poly(vinyl chloride) (PVC) tubing is recommended) of equal or slightly greater length and secure both ends to prevent slippage. The inside diameter of the tube should be slightly greater than the core diameter; the wall thickness of the tube must be sufficient to provide the rigidity to prevent core breakage due to bending.

7.5.2 *Special Care*:

7.5.2.1 The moisture state of some rocks, and even the moisture-state history of rocks such as shales, affects their properties. If tests are to be performed on the core, and if it is possible that a change in the moisture state may influence the test results, then the core must be sealed to prevent changes in the moisture state until the time of testing. This same procedure also applies to other samples where it is important to maintain fluids other than water (for example, hydrocarbons).

7.5.2.2 Seal samples requiring special care. Such sealing shall consist of a tightly fitting wrapping of a plastic film, such

[4] Association of Engineering Geologist, Core Logging Committee, South Africa Section, "A Guide to Core Logging for Rock Engineering," *Bulletin of the Association of Engineering Geologist*, Vol 15, No. 3, 1978, pp. 295–328.

[5] Deere, D. U., Dunn, J. R., Fickies, R. H., and Proctor, R. J., "Geologic Logging and Sampling of Rock Core for Engineering Purposes (Tentative)," Association of Professional Geological Scientists, 1977.

[6] The Geological Society, Engineering Group Working Party, "The Logging of Rock Core for Engineering Purposes," *Quarterly Journal of Engineering Geology*, Vol 3, 1970, pp. 1–24.

[7] International Society for Rock Mechanics, "Basic Geotechnical Description of Rock Masses, "*International Journal of Rock Mechanics and Mining Sciences and Geomechanics Abstracts*, Vol 18, 1980, pp. 85–110.