Designation: C1721 – 15

Standard Guide for Petrographic Examination of Dimension Stone[1]

This standard is issued under the fixed designation C1721; 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 This guide outlines procedures for the petrographic examination of stone specimen material proposed for use as dimension stone used in construction.

1.2 This guide outlines the extent to which petrographic techniques should be used, the selection of petrographic related properties that should be looked for, and the manner in which such techniques may be employed in the examination of dimension stone.

1.3 The rock and mineral names given in Terminology C119 should be used, insofar as they are appropriate, in reports prepared in accordance with this guide.

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are provided for information purposes only.

1.5 *This standard does not purport to address all of the safety concerns, if any, 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.*

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C97 Test Methods for Absorption and Bulk Specific Gravity of Dimension Stone

C99 Test Method for Modulus of Rupture of Dimension Stone

C119 Terminology Relating to Dimension Stone

C120 Test Methods of Flexure Testing of Slate (Breaking Load, Modulus of Rupture, Modulus of Elasticity)

C121 Test Method for Water Absorption of Slate

C170 Test Method for Compressive Strength of Dimension Stone

C217 Test Method for Weather Resistance of Slate

C241 Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic

C406 Specification for Roofing Slate

C503 Specification for Marble Dimension Stone

C568 Specification for Limestone Dimension Stone

C615 Specification for Granite Dimension Stone

C616 Specification for Quartz-Based Dimension Stone

C629 Specification for Slate Dimension Stone

C880 Test Method for Flexural Strength of Dimension Stone

C1353 Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform Abraser

C1526 Specification for Serpentine Dimension Stone

C1527 Specification for Travertine Dimension Stone

C1528 Guide for Selection of Dimension Stone

C1799 Guide to Dimension Stone Test Specimen Sampling and Preparation

E883 Guide for Reflected–Light Photomicrography

3. Summary of Guide

3.1 The specific procedures employed in the petrographic examination of any specimen will depend to a large extent on the purpose of the examination and the nature of the specimen. In most cases the examination will require the use of optical microscopy. Complete petrographic examinations for particular purposes and to investigate particular problems may require examination of selected constituents by means of additional procedures, such as X-ray diffraction (XRD) analysis for crystalline structure, differential thermal analysis (DTA) for chemically and physically unstable minerals, infrared spectroscopy, scanning electron microscopy (SEM) energy dispersive X-ray analysis (EDX), or other procedures. Although these procedures are beyond the scope of this standard, these additional procedures may be more definitive than visual microscopic methods.

3.2 Identification of the minerals, composition, fabric, and structure of a specimen is a necessary step towards recognition of the properties that may be expected to influence the behavior

[1] This guide is under the jurisdiction of ASTM Committee C18 on Dimension Stone and is the direct responsibility of Subcommittee C18.01 on Test Methods.

Current edition approved May 1, 2015. Published July 2015. Originally published as C1721-09. Last previous edition approved in 2009 as C1721-09. DOI: 10.1520/C1721-15.

[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

of the material in its intended use, but identification is not an end in itself. The value of any petrographic examination will depend to a large extent on the representativeness of the specimens examined, the completeness and accuracy of the information provided to the petrographer concerning the source and proposed use of the material, and the petrographer's ability to correlate these data with the findings of the examination.

3.3 This guide does not attempt to describe the techniques of petrographic work since it is assumed that the guide will be used by persons who are qualified by education and experience to employ such techniques for the recognition of the characteristic properties of rocks and minerals and to describe and classify the constituents of a specimen. For some cases, the petrographer will have had experience adequate to provide detailed interpretation of the petrographic results. For many cases the interpretation will be made, in part, by engineers, familiar with the intended use of the dimension stone. In other cases, interpretation of the findings may require input of others, such as a chemist, qualified to relate the observations to the questions to be answered.

3.4 The petrographer should be familiar with the ASTM standards referenced in 2.1.

4. Significance and Use

4.1 Petrographic examinations are made for the following purposes:

4.1.1 Determine the physical and chemical characteristics (mineralogy, texture, and composition) of the stone specimen that may be observed by petrographic methods and that have a bearing on the performance of the material in its intended use.

4.1.2 Describe and classify the minerals of the specimen.

4.1.3 Classify the stone both commercially and geologically based on Terminology C119, recognizing the differences in nomenclature; and based on the following standards, as appropriate:

Specification C406
Specification C503
Specification C568
Specification C615
Specification C616
Specification C629
Specification C1526
Specification C1527

4.1.4 Determine the relative amounts of the minerals of the specimen and constituents that have a bearing on the performance of the material in its intended use.

4.1.5 Compare characteristics of the stone with specimens from one or more sources, for which test data or performance records are available.

4.2 The petrographer should be told in as much detail as necessary, the purposes and objectives of the examination, the kind of information needed, and the extent of examination desired.

4.2.1 Pertinent background information, including results of prior testing, such as physical and mechanical testing, should be made available. The petrographer's advice and judgment should be sought regarding the extent of the examination. Available physical and mechanical testing may include the following:

Test Methods C97
Test Method C99
Test Method C170
Test Method C880
Test Methods C120
Test Method C121
Test Method C241
Test Method C1353
Test Method C217

4.3 This guide may form the basis for establishing arrangements between a purchaser of consulting petrographic service and the petrographer. In such a case, the purchaser and the consultant should together determine the kind, extent, and objectives of the examination and analyses to be made, and should record their agreement in writing. The agreement may stipulate specific determinations to be made, observations to be reported, funds to be obligated, or a combination of these or other conditions.

4.4 Petrographic examinations provide identification of type and varieties of minerals and structures present in the specimen. However, as noted above, identification of all minerals and structures present in the specimen is not required.

4.5 The petrographic examination should establish whether the specimen contains chemically unstable minerals or volumetrically unstable materials.

4.6 Petrographic examination should identify weathered or otherwise altered constituents or minerals and describe the extent of that weathering or alteration. Where possible, describe potential aesthetic changes that may occur as a result of weathering.

NOTE 1—If the dimension stone will be exposed to freezing and thawing and may become wet or saturated in use, finely porous and highly weathered or otherwise altered minerals should be identified because these materials will be especially susceptible to damage by freezing and thawing.

4.7 Petrographic examination should identify constituents or minerals and the extent to which they may lead to staining and color change of the surface of the stone when the stone is exposed to the weather for exterior use.

4.8 Petrographic examination should identify and estimate proportions of constituents that may be susceptible to deterioration from attack by deicing agents where proposed for use at grade level in freezing environments where deicing salts are anticipated to be used.

4.9 Criteria are available for identifying minerals by their optical properties or by XRD. Criteria are available for identifying rocks by their mineral composition and texture. Examination in both reflected and transmitted light may be necessary to provide data for these identifications. X-ray microanalysis using energy-dispersive X-ray spectrometers with scanning electron microscopy (SEM/EDX) or wavelength-dispersive X-ray spectrometers in electron microprobes (EMPA/WDX) may provide useful information on the chemical composition of minerals and rocks.