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Designation: ~~C1301 – 95 (Reapproved 2009)ε1~~ C1301 – 95 (Reapproved 2014)

Standard Test Method for Major and Trace Elements in Limestone and Lime by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP) and Atomic Absorption (AA)[1]

This standard is issued under the fixed designation C1301; 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.

~~ε[1] NOTE—A units statement was added editorially as new paragraph 1.3 and subsequent paragraphs were renumbered in June 2009.~~

1. Scope

1.1 The following test method covers the use of inductively coupled plasma-atomic emission spectroscopy (ICP) and atomic absorption spectroscopy (AA) in the analysis of major and trace elements in limestone and lime (calcined limestone).

1.2 Table 1 lists some of the elements that can be analyzed by this test method and the preferred wavelengths. Also see U.S. EPA Methods 200.7 and 200.9.

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *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.*

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2. Referenced Documents

2.1 *ASTM Standards:*[2]

C51 Terminology Relating to Lime and Limestone (as used by the Industry)

D1193 Specification for Reagent Water

E135 Terminology Relating to Analytical Chemistry for Metals, Ores, and Related Materials

E863 Practice for Describing Atomic Absorption Spectrometric Equipment (Withdrawn 2004)[3]

E1479 Practice for Describing and Specifying Inductively-Coupled Plasma Atomic Emission Spectrometers

2.2 *U.S. EPA Standards:*

https://standards.iteh.ai/catalog/standards/astm/bc3b2994-241d-47e1-871c-dfeedcb0394f/astm-c1301-95-2014

Methods for the Determination of Metals in Environmental Samples; U.S. EPA Methods 200.2, 200.7, and 200.9; Smoley, C. K., 1992[4]

~~Method 6010,~~Method 6010 Inductively Coupled Plasma Method, SW-846, Test Methods for Evaluating Solid Waste[5]

3. Terminology

3.1 *Definitions*—Definitions for terms used in this test method can be found in Terminologies C51 and E135.

3.2 *Additional Definitions:*

3.2.1 *total recoverable, n*—trace element concentration in an unfiltered sample after heating in acid.

3.2.2 *total digestion, n*—complete digestion of a sample, including silica and silicate minerals, using the fusion-flux method.

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[1] This test method is under the jurisdiction of ASTM Committee C07 on Lime and Limestone and is the direct responsibility of Subcommittee C07.05 on Chemical Tests.

Current edition approved ~~June 1, 2009~~July 1, 2014. Published ~~September 2009~~July 2014. Originally approved in 1995. Last previous edition approved in ~~2001~~2009 as C1301 – 95~~(2001).~~(2009)ε. DOI: ~~10.1520/C1301-95R09E01.~~10.1520/C1301-95R14.

[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.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from CRC Press, 2000 Corporate Blvd., N. W., Boca Raton, FL 33431.

[5] Available from U.S. Government Printing ~~Office, Washington, DC 20402.~~ Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, http://www.access.gpo.gov.

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TABLE 1 Elements and Some Suggested Wavelengths[A]

~~Major Elements~~	~~ICP Wavelength, nm~~	~~AA Wavelength, nm~~
~~Calcium~~	~~317.933 (315.887)[B]~~	~~422.7~~
~~Magnesium~~	~~279.079 (285.213)~~	~~285.2~~
~~Silicon~~	~~251.611 (288.160)~~	~~251.6~~
~~Aluminum~~	~~308.215 (309.271)~~	~~309.3~~
~~Iron~~	~~259.940~~	~~248.3~~
~~Manganese~~	~~257.610~~	~~279.5~~
~~Sodium~~	~~588.995 (589.59)~~	~~589.0~~
~~Potassium~~	~~766.491~~	~~766.5~~
~~Phosphorus~~	~~214.914 (213.618)~~	~~...[C]~~
~~Strontium~~	~~421.552~~	~~460.7~~
~~Trace Elements~~	~~ICP Wavelength, nm~~	~~AA Wavelength, nm~~
~~Antimony~~	~~206.833~~	~~217.6~~
~~Arsenic~~	~~193.696~~	~~193.7~~
~~Barium~~	~~455.403 (493.409)~~	~~553.6~~
~~Beryllium~~	~~313.042~~	~~234.9~~
~~Boron~~	~~249.773~~	~~249.8~~
~~Cadmium~~	~~226.502 (228.80)~~	~~228.8~~
~~Chromium~~	~~267.716 (205.552)~~	~~357.9~~
~~Cobalt~~	~~228.616~~	~~240.7 (242.5)~~
~~Copper~~	~~324.754~~	~~324.8~~
~~Lead~~	~~220.353~~	~~217.0 (283.3)~~
~~Molybdenum~~	~~202.030 (203.844)~~	~~313.3~~
~~Nickel~~	~~231.604 (221.647)~~	~~232.0~~
~~Selenium~~	~~196.090~~	~~196.0~~
~~Silver~~	~~328.068~~	~~328.1~~
~~Sulfur~~	~~180.731 (180.669)~~	~~...[C]~~
~~Thallium~~	~~190.864~~	~~276.8~~
~~Tin~~	~~189.989~~	~~235.5 (286.3)~~
~~Vanadium~~	~~292.402~~	~~318.4~~
~~Zinc~~	~~213.856 (202.551)~~	~~213.9~~

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[A] The suggested wavelengths may vary for your particular instrument.
[B] Numbers in parentheses are alternate wavelengths.
[C] Not recommended or not used.