Natural Resources Canada | Ressources naturelles Canada

CCRMP
Canadian Certified Reference Materials Project

PCMRC
Projet canadien de matériaux de référence certifiés

Certificate of Analysis

First issued: February 2026 Version: February 2026

STSD-5

Certified Reference Material for a Stream Sediment

Table 1 — STSD-5 Certified Values

note: The certified, provisional and indicative values herein pertain to the material on an as-received basis. Values for the elements were generally derived from a variety of digestions with mixtures of acids and/or fusions, followed by instrumental analysis. The footnotes indicate the details of the analytical methods used to determine the values. For more detailed information, please refer to the certification report.

Analyte (see footnotes)	Units	Mean	Within-laboratory Standard Deviation	Between-laboratories Standard Deviation	95% Confidence Interval of Mean
Ag [a] AD2 + ICP	µg/g	0.241	0.010	0.010	0.006
Ag [b] AD4 + ICP	µg/g	0.270	0.019	0.019	0.010
Al [a] AD2 + ICP	%	1.253	0.030	0.030	0.021
Al_2O_3 [c] AD4 / FUS + ICP	%	11.83	0.16	0.31	0.13
Al_2O_3 [d] FUS + XRF	%	12.05	0.07	0.20	0.13
As [e] AD2 / AD4 + ICP	µg/g	11.9	0.6	1.4	0.5
Ba [a] AD2 + ICP	µg/g	311	11	21	13
Ba [f] AD4 / FUS + ICP / XRF	µg/g	1030	25	40	14
Be [b] AD4 + ICP	µg/g	1.407	0.043	0.093	0.050

Cont'd

CanmetMINING
555 Booth Street, Ottawa, Ontario, Canada K1A 0G1
Cell: (343) 543-6830
E-mail: **ccrmp-pcmrc@NRCan-RNCan.gc.ca**
www.ccrmp.ca

CanmetMINES
555, rue Booth, Ottawa (Ontario) Canada K1A 0G1
Mobile : (343) 543-6830
Courriel : **ccrmp-pcmrc@NRCan-RNCan.gc.ca**
www.pcmrc.ca

Canada

Table 1 — STSD-5 Certified Values *cont'd*

Analyte (see footnotes)	Units	Mean	Within-laboratory Standard Deviation	Between-laboratories Standard Deviation	95% Confidence Interval of Mean
Bi [e] AD2 / AD4 + ICP	µg/g	0.252	0.030	0.030	0.012
C [g] COMB + IR	%	3.71	0.05	0.19	0.10
Ca [a] AD2 + ICP	%	2.21	0.04	0.18	0.11
CaO [c] AD4 / FUS + ICP	%	5.10	0.07	0.12	0.05
CaO [d] FUS + XRF	%	5.153	0.016	0.047	0.034
Cd [e] AD2 / AD4 + ICP	µg/g	0.829	0.036	0.036	0.015
Ce [c] AD4 / FUS + ICP	µg/g	60.3	2.4	3.7	1.6
Co [a] AD2 + ICP	µg/g	11.12	0.26	0.29	0.19
Co [c] AD4 / FUS + ICP	µg/g	14.30	0.41	0.52	0.23
Cr [a] AD2 + ICP	µg/g	40.0	0.9	2.7	1.6
Cr [b] AD4 + ICP	µg/g	95.3	2.5	7.3	4.4
Cr [h] FUS + ICP	µg/g	114.0	5.4	5.4	2.8
Cs [c] AD4 / FUS + ICP	µg/g	3.14	0.10	0.12	0.06
Cu [i] AD2 / AD4 / FUS + ICP	µg/g	41.8	1.6	2.6	0.9
Dy [h] FUS + ICP	µg/g	4.54	0.16	0.16	0.10
Er [h] FUS + ICP	µg/g	2.67	0.16	0.16	0.08
Eu [c] AD4 / FUS + ICP	µg/g	1.220	0.055	0.055	0.023
Fe [a] AD2 + ICP	%	2.63	0.05	0.11	0.07
Fe_2O_3 [c] AD4 / FUS + ICP	%	5.22	0.07	0.16	0.07
Fe_2O_3 [d] FUS + XRF	%	5.374	0.028	0.053	0.039
Ga [a] AD2 + ICP	µg/g	4.05	0.16	0.49	0.35
Ga [c] AD4 / FUS + ICP	µg/g	14.22	0.36	0.52	0.25
Gd [c] AD4 / FUS + ICP	µg/g	4.91	0.21	0.21	0.06
Hf [b] AD4 + ICP	µg/g	1.92	0.12	0.15	0.11
Hf [h] FUS + ICP	µg/g	6.81	0.48	0.48	0.21

cont'd

Table 1 — STSD-5 Certified Values *cont'd*

Analyte (see footnotes)	Units	Mean	Within-laboratory Standard Deviation	Between-laboratories Standard Deviation	95% Confidence Interval of Mean
Ho [h] FUS + ICP	µg/g	0.891	0.053	0.053	0.022
In [b] AD4 + ICP	µg/g	0.0817	0.0044	0.0044	0.0027
K [a] AD2 + ICP	%	0.108	0.005	0.010	0.007
K_2O [c] AD4 / FUS + ICP	%	1.657	0.029	0.057	0.025
K_2O [d] FUS + XRF	%	1.680	0.016	0.025	0.018
La [a] AD2 + ICP	µg/g	14.17	0.53	0.53	0.41
La [c] AD4 / FUS + ICP	µg/g	31.2	1.2	1.7	0.7
Li [c] AD4 / FUS + ICP	µg/g	24.3	0.7	1.6	0.9
Mg [a] AD2 + ICP	%	1.205	0.020	0.044	0.030
MgO [c] AD4 / FUS + ICP	%	3.000	0.039	0.096	0.039
MgO [d] FUS + XRF	%	3.080	0.013	0.052	0.037
Mn [a] AD2 + ICP	µg/g	591	9	13	9
MnO [f] AD4 / FUS + ICP / XRF	%	0.1087	0.0018	0.0028	0.0011
Mo [a] AD2 + ICP	µg/g	3.33	0.10	0.17	0.11
Mo [c] AD4 / FUS + ICP	µg/g	3.80	0.11	0.19	0.11
Na_2O [c] AD4 / FUS + ICP	%	2.055	0.039	0.046	0.022
Nb [b] AD4 + ICP	µg/g	10.40	0.39	0.39	0.31
Nb [h] FUS + ICP	µg/g	12.09	0.42	0.57	0.40
Nd [c] AD4 / FUS + ICP	µg/g	28.4	1.0	1.1	0.6
Ni [a] AD2 + ICP	µg/g	29.83	0.81	0.88	0.55
Ni [c] AD4 / FUS + ICP	µg/g	37.9	1.0	1.7	0.7
P [a] AD2 + ICP	µg/g	890	23	30	20
P_2O_5 [f] AD4 / FUS + ICP / XRF	%	0.2256	0.0049	0.0056	0.0021

cont'd

Table 1 — STSD-5 Certified Values *cont'd*

Analyte (see footnotes)	Units	Mean	Within-laboratory Standard Deviation	Between-laboratories Standard Deviation	95% Confidence Interval of Mean
Pb [a] AD2 + ICP	µg/g	16.4	0.9	1.0	0.6
Pb [c] AD4 / FUS + ICP	µg/g	20.2	0.9	1.7	0.8
Pr [c] AD4 / FUS + ICP	µg/g	7.44	0.29	0.29	0.15
Rb [c] AD4 / FUS + ICP	µg/g	59.5	1.4	1.9	0.9
Sb [a] AD2 + ICP	µg/g	0.80	0.05	0.11	0.07
Sb [c] AD4 / FUS + ICP	µg/g	1.356	0.097	0.097	0.036
Sc [a] AD2 + ICP	µg/g	4.38	0.14	0.40	0.27
Sc [c] AD4 / FUS + ICP	µg/g	13.8	0.5	1.2	0.5
SiO_2 [h] FUS + ICP	%	57.53	0.56	0.56	0.34
SiO_2 [d] FUS + XRF	%	57.71	0.18	0.59	0.43
Sm [c] AD4 / FUS + ICP	µg/g	5.52	0.23	0.23	0.09
Sr [a] AD2 + ICP	µg/g	61.5	1.4	3.1	1.9
Sr [c] AD4 / FUS + ICP	µg/g	288	6	13	5
Ta [c] AD4 / FUS + ICP	µg/g	0.81	0.07	0.11	0.05
Tb [c] AD4 / FUS + ICP	µg/g	0.714	0.032	0.044	0.024
Th [a] AD2 + ICP	µg/g	3.41	0.30	0.30	0.23
Th [c] AD4 / FUS + ICP	µg/g	8.28	0.47	0.47	0.17
Ti [a] AD2 + ICP	%	0.072	0.003	0.012	0.007
TiO_2 [b] AD4 + ICP	%	0.707	0.015	0.060	0.038
TiO_2 [h] FUS + ICP	%	0.793	0.015	0.044	0.023
TiO_2 [d] FUS + XRF	%	0.8017	0.0059	0.0065	0.0050
Tl [b] AD4 + ICP	µg/g	0.471	0.017	0.020	0.014
U [a] AD2 + ICP	µg/g	2.35	0.12	0.12	0.07
U [b] AD4 + ICP	µg/g	3.80	0.16	0.18	0.12

cont'd

Table 1 — STSD-5 Certified Values *cont'd*

Analyte (see footnotes)	Units	Mean	Within-laboratory Standard Deviation	Between-laboratories Standard Deviation	95% Confidence Interval of Mean
U [h] FUS + ICP	µg/g	4.19	0.15	0.20	0.14
V [a] AD2 + ICP	µg/g	53.6	1.5	4.7	2.7
V [b] AD4 + ICP	µg/g	128.8	3.3	7.5	4.3
V [h] FUS + ICP	µg/g	141.8	2.9	7.4	4.2
Y [b] AD4 + ICP	µg/g	21.3	0.7	2.3	1.4
Y [h] FUS + ICP	µg/g	24.9	0.8	1.3	0.8
Yb [h] FUS + ICP	µg/g	2.51	0.14	0.14	0.06
Zn [a] AD2 + ICP	µg/g	193.1	4.5	8.7	5.1
Zn [c] AD4 / FUS + ICP	µg/g	213	6	12	5
Zr [b] AD4 + ICP	µg/g	67	3	10	6
Zr [h] FUS + ICP	µg/g	262	11	15	10

a. AD2 + ICP: Mean based exclusively on results obtained from two-acid digestion (hydrochloric and nitric), followed by inductively coupled plasma – optical emission or mass spectrometry.
b. AD4 + ICP: Mean based predominantly on results obtained from four-acid digestion, followed by inductively coupled plasma – optical emission or mass spectrometry.
c. AD4 / FUS + ICP: Mean based on results obtained from four-acid digestions or fusions using various fluxes, followed by inductively coupled plasma – optical emission or mass spectrometry.
d. FUS + XRF: Mean based predominantly on results obtained from fusions using various fluxes, followed by X-ray fluorescence spectrometry.
e. AD2 / AD4 + ICP: Mean based predominantly on results obtained from two-acid or four-acid digestion, followed by inductively coupled plasma – optical emission or mass spectrometry.
f. AD4 / FUS + ICP / XRF: Mean based predominantly on results obtained from four-acid digestion or fusions using various fluxes, followed by X-ray fluorescence spectrometry or inductively coupled plasma – optical emission or mass spectrometry.
g. COMB + IR: Mean based exclusively on results obtained from combustion, followed by infrared spectrometry.
h. FUS + ICP: Mean based predominantly on results obtained from fusions using various fluxes, followed by inductively coupled plasma – optical emission or mass spectrometry.
i. AD2 / AD4 / FUS + ICP: Mean based predominantly on results obtained from two-acid or four-acid digestions, or fusions, followed by inductively coupled plasma – optical emission or mass spectrometry.

Table 2 — STSD-5 Provisional Values

Analyte (see footnotes)	Units	Mean	Within-laboratory Standard Deviation	Between-laboratories Standard Deviation	95% Confidence Interval of Mean
Be [a] AD2 + ICP	µg/g	0.458	0.008	0.024	0.022
Ce [a] AD2 + ICP	µg/g	28.7	0.9	2.1	1.8
Cs [a] AD2 + ICP	µg/g	1.18	0.05	0.12	0.12
In [a] AD2 + ICP	µg/g	0.0571	0.0035	0.0046	0.0044
Li [a] AD2 + ICP	µg/g	13.65	0.27	0.71	0.67
Lu [b] AD4 / FUS + ICP	µg/g	0.385	0.021	0.021	0.012
Na_2O [c] FUS + XRF	%	2.076	0.014	0.066	0.048
Nb [a] AD2 + ICP	µg/g	1.19	0.05	0.18	0.16
Rb [a] AD2 + ICP	µg/g	10.54	0.32	0.88	0.74
S [d] AD2 / AD4 + ICP, COMB + IR	%	0.0861	0.0049	0.0049	0.0019
Se [e] AD2 / AD4 + ICP	µg/g	0.91	0.11	0.11	0.07
Sn [f] AD4 + ICP	µg/g	1.79	0.11	0.18	0.14
Sn [g] FUS + ICP	µg/g	2.40	0.49	0.49	0.46
Te [e] AD2 / AD4 + ICP	µg/g	0.072	0.014	0.014	0.006
Tl [a] AD2 + ICP	µg/g	0.140	0.009	0.011	0.009
Tm [b] AD4 / FUS + ICP	µg/g	0.380	0.024	0.024	0.014
W [a] AD2 + ICP	µg/g	0.61	0.18	0.18	0.14
W [f] AD4 + ICP	µg/g	1.39	0.20	0.20	0.14
Y [a] AD2 + ICP	µg/g	10.20	0.20	0.27	0.22
Yb [f] AD4 + ICP	µg/g	1.97	0.08	0.22	0.21
Zr [a] AD2 + ICP	µg/g	1.95	0.15	0.35	0.30

***a. AD2 + ICP:** Mean based exclusively on results obtained from two-acid digestion (hydrochloric and nitric), followed by inductively coupled plasma – optical emission or mass spectrometry.*

***b. AD4 / FUS + ICP:** Mean based on results obtained from four-acid digestions or fusions using various fluxes, followed by inductively coupled plasma – optical emission or mass spectrometry.*

***c. FUS + XRF:** Mean based predominantly on results obtained from fusions using various fluxes, followed by X-ray fluorescence spectrometry.*

***d. AD2 / AD4 + ICP, COMB + IR:** Mean based predominantly on results obtained from two-acid digestion or four-acid digestion, followed by inductively coupled plasma – optical emission or mass spectrometry, or combustion followed by infrared spectrometry.*

***e. AD2 / AD4 + ICP:** Mean based predominantly on results obtained from two-acid or four-acid digestion, followed by inductively coupled plasma – optical emission or mass spectrometry.*

***f. AD4 + ICP:** Mean based predominantly on results obtained from four-acid digestion, followed by inductively coupled plasma – optical emission or mass spectrometry.*

***g. FUS + ICP:** Mean based predominantly on results obtained from fusions using various fluxes, followed by inductively coupled plasma – optical emission or mass spectrometry.*

Table 3 — STSD-5 Indicative Values (semi-quantitative only)

Analyte (see footnotes)	Units	Mean	Number of Accepted Laboratories / Values
Au [a] AD2 / FUS + ICP	µg/g	0.005	5 / 25
Dy [b] AD2 + ICP	µg/g	2	3 / 15
Dy [c] AD4 + ICP	µg/g	4	5 / 25
Er [b] AD2 + ICP	µg/g	1	3 / 15
Er [c] AD4 + ICP	µg/g	2	5 / 25
Eu [b] AD2 + ICP	µg/g	0.6	3 / 15
F [d] AD4 / FUS + ISE	%	0.05	3 / 15
Gd [b] AD2 + ICP	µg/g	3	3 / 15
Ge [c] AD4 + ICP	µg/g	0.1	4 / 20
Hf [b] AD2 + ICP	µg/g	0.05	6 / 30
Hg [b] AD2 + ICP	µg/g	0.1	7 / 35
Ho [c] AD4 + ICP	µg/g	0.7	4 / 20
LOI [e]	%	12	18 / 88
Lu [b] AD2 + ICP	µg/g	0.1	3 / 15
Lu [c] AD4 + ICP	µg/g	0.3	4 / 20
moisture [f]	%	2	11 / 53
Na [b] AD2 + ICP	µg/g	300	7 / 35
Nd [b] AD2 + ICP	µg/g	15	3 / 15
Pr [b] AD2 + ICP	µg/g	4	3 / 15
Re [g] AD2 / AD4 + ICP	µg/g	0.002	5 / 25
Sm [b] AD2 + ICP	µg/g	3	3 / 15
Sn [b] AD2 + ICP	µg/g	0.6	8 / 40

Cont'd

Table 3 - STSD-5 Indicative Values (semi-quantitative only) *cont'd*

Analyte (see footnotes)	Units	Mean	Number of Accepted Laboratories / Values
Tb [b] AD2 + ICP	µg/g	0.4	4 / 20
Tm [b] AD2 + ICP	µg/g	0.2	3 / 15
W [h] FUS + ICP	µg/g	2	5 / 25
Yb [b] AD2 + ICP	µg/g	0.9	4 / 20

a. AD2 / FUS + ICP: Mean based on results obtained from two-acid digestion (hydrochloric and nitric) or fire assay, followed by inductively coupled plasma – optical emission or mass spectrometry, using sample weights of 0.5–1 g.
b. AD2 + ICP: Mean based exclusively on results obtained from two-acid digestion (hydrochloric and nitric), followed by inductively coupled plasma – optical emission or mass spectrometry.
c. AD4 + ICP: Mean based predominantly on results obtained from four-acid digestion, followed by inductively coupled plasma – optical emission or mass spectrometry.
d. AD4 / FUS + ISE: Mean based on results obtained from four-acid digestion or fusion, followed by ion-selective electrode.
e. Loss on ignition: Mean based on results obtained from as-received samples (1–3 g), ignited at 950–1,000 °C for varying durations; most samples dried to constant weight.
f. Moisture: Mean based on results obtained from as-received samples (1–3 g), dried at 100–110 °C for varying durations to constant weight.
g. AD2 / AD4 + ICP: Mean based predominantly on results obtained from two-acid or four-acid digestion, followed by inductively coupled plasma – optical emission or mass spectrometry.
h. FUS + ICP: Mean based predominantly on results obtained from fusions using various fluxes, followed by inductively coupled plasma – optical emission or mass spectrometry.

SOURCE

STSD-5 was prepared from a mixture of sediments obtained from various sites in Canada.

DESCRIPTION

The mineral species include: plagioclase (30.0%), quartz (8.1%), orthoclase/microcline (8.1%), clinochlore (5.3%), biotite (5.0%), dolomite (4.2%), amphibole/actinolite (2.0%), epidote (1.4%), hematite/magnetite (1.2%), calcite (1.1%), amphibole (hornblende) (0.8%), cordierite (0.7%), enstatite (0.5%), kaolinite (0.4%), titanite (0.3%), olivine (0.3%), muscovite (0.2%), apatite (0.2%), ankerite (0.2%), ilmenite (0.1%), rutile (0.1%), and unclassified (9.3%).

INTENDED USE

STSD-5 is suitable for the analysis of elements in rocks at major, minor and trace levels of concentration. Examples of intended use include quality control and method development.

INSTRUCTIONS FOR USE

STSD-5 should be used “as is”, without drying. The contents of the bottle should be thoroughly mixed before taking samples. The values herein pertain to the material when produced. CanmetMINING is not responsible for changes occurring after shipment.

HANDLING INSTRUCTIONS

Normal safety precautions for handling fine particulate matter are suggested, such as the use of safety glasses, breathing protection, gloves and a laboratory coat.

METHOD OF PREPARATION

The raw material was crushed, milled and sieved. The recovery of the fraction less than 75 µm (minus 200 mesh) was 81%. The product was blended and bottled in 100-gram units. This is the only size that is available.

HOMOGENEITY

The homogeneity of the stock was investigated using fifteen bottles chosen according to a stratified random sampling scheme. Three subsamples were analyzed from each bottle. Subsamples of 0.05 grams were digested with a mixture of hydrochloric, nitric and perchloric acids using a microwave oven for the determination of cerium, strontium and vanadium. Concentrations were determined using inductively coupled plasma – mass spectrometry. Carbon was determined in samples of 0.1 grams using a combustion apparatus with infrared detection.

A one-way analysis of variance technique (ANOVA)[1] and statistical analyses were used to assess the homogeneity of these elements. No significant between-bottles variation was observed for all elements.

Use of a smaller subsample than specified above will invalidate the use of the certified values and associated parameters.

CERTIFIED VALUES

Twenty-one industrial, commercial and government laboratories participated in an interlaboratory measurement program using methods of their own choice.

Methods for the determination of the concentration of the elements included mainly preparation with various combinations of acids or various types of fusions followed by the determination with inductively coupled plasma optical emission spectroscopy and inductively coupled plasma mass spectrometry. Additionally, the concentration of some elements was determined by the preparation of a fused bead prepared with various fluxes followed by X-ray fluorescence.

The concentration of carbon was determined mainly using combustion followed by infrared spectrometry.

ANOVA was used to calculate the consensus values and other statistical parameters from the data from the interlaboratory measurement program. Values are deemed to be certified if derived from 10 or more sets of data that meet CCRMP's statistical criterion regarding the agreement of the results. Ninety-two analytes were certified (see Table 1).

Full details of all work, including the statistical analyses, the methods and the names of the participating laboratories are contained in the Certification Report. For more details on how to use reference material data to assess laboratory results, users are directed to ISO Guide 33:2015, sections 8-9, and the publication, "Assessment of laboratory proficiency using CCRMP reference materials", at www.ccrmp.ca.

UNCERTIFIED VALUES

Twenty-one provisional values (Table 2) were derived from 8 or 9 sets of data that fulfill the CCRMP statistical criterion regarding agreement; or 10 or more sets of data, that do not fulfill the CCRMP statistical criteria required for certification; or 7 sets of data for which the statistical analysis of the data warranted provisional status. Indicative values for twenty-six analytes, shown in Table 3, were derived from the means of a minimum of 3 sets of data.

TRACEABILITY

The values quoted herein are based on the consensus values derived from the statistical analysis of the data from the interlaboratory measurement program, and the standards used by the individual laboratories. The report for this material provides the available details.

CERTIFICATION HISTORY

STSD-5 was released as a new material in February 2026.

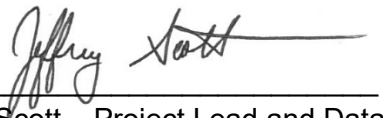
PERIOD OF VALIDITY

The certified values are valid until February 28, 2046.

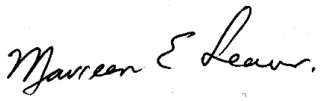
LEGAL NOTICE

CanmetMINING has prepared this reference material and statistically evaluated the analytical data of the interlaboratory measurement program to the best of its ability. The purchaser, by receipt hereof, releases and indemnifies CanmetMINING from and against all liability and costs arising out of the use of this material and information.

CERTIFYING OFFICERS



Jeffrey Scott – Project Lead and Data Processor



Maureen E. Leaver – CCRMP Manager

FOR FURTHER INFORMATION

STSD-5 was prepared in consideration of the principles in ISO 17034:2016 and ISO Guides 30, 31, 33 and 35. The Certification Report is available free of charge upon request to:

CCRMP
CanmetMINING (NRCan)
555 Booth Street, room 104
Ottawa, Ontario K1A 0G1
Canada

Telephone: (343) 543-6830

E-mail: ccrmp-pcmrc@nrcan-rncan.gc.ca

REFERENCES

1. Brownlee, K.A., Statistical Theory and Methodology in Science and Engineering; John-Wiley and Sons, Inc.; New York; 1960.