

Certificate of Certified Reference Materials

NCS DC 73014—NCS DC73022

Stream Sediment

Issued in 2010

Approved by China National Analysis Center for Iron and Steel

( Beijing China )

These Certified Reference Materials are prepared in accordance with the ISO guides 30-35. The intended use for these CRMS is for the quality control in Stream Sediment analysis, the evaluating methods of analysis and the calibration of analytical instruments.

Samples were dried, sieved pass 1mm and mixed. Stoved at 120°C for 24 hours then grinded in ball mill until over 99% the grain sizes less then 0.074mm, then packed in bottle.

Analytical method:

Element	Pretreatment	Analytical method
Ag	DP8 DA1 DMA1 DF1 DFI1	AES8 GFAAS2 ICPMS1 AAS1
As	DA8 DF2 DP2	AFS7 ICPMS3 XRF1 INAA1
B	DP7 DFC1	AES7 ICPE1
Ba	DF6 DP6 FU2 DFC1	ICPMS9 XRF5 INAA1
Be	DF9 DFC1 DMA1	ICPE6 ICPMS5
Bi	DA6 DF4 DFC1	ICPMS6 AFS5
Br	DP4 FU3	XRF4 ICPMS2 IC1
Cd	DF6 DMA3 DFC1 DFI1	GFAAS4 ICPMS6 ICPE1 AAS1
Ce	FU6 DP2 DF1 DFC1 DMA1 DFI1	ICPMS6 ICPE4 XRF1 INAA1
Cl	DP5 FU2 DF1	XRF5 ICPMS1 VOL1 IC1
Co	DF8 DP3 FU2 DMA1 DFC1	ICPMS8 ICPE4 XRF2 INAA1
Cr	DF6 DP5 DFC1 FU1	ICPMS4 ICPE4 XRF4 INAA1
Cs	DF6 DP2 DFC1	ICPMS6 INAA1 XRF1 AAS1
Cu	DF10 DP4 DMA1	ICPE7 XRF4 ICPMS3 AAS1
Dy	DF3 FU3 DFC1 DMA1 DFI1	ICPMS8 ICPE1
Er	DF3 FU3 DFC1 DMA1 DFI1	ICPMS8 ICPE1
Eu	DF3 FU3 DFC1 DP1 DMA1 DFI1	ICPMS8 ICPE1 INAA1
F	FU8	ISE8
Ga	DP6 DF5 FU1 DFC1	ICPMS7 XRF6
Gd	DF3 FU3 DFC1 DMA1 DFI1	ICPMS9
Ge	DA3 DMA2 DF2 FU1 DFC1	AFS7 ICPMS2
Hf	DF3 DP2 FU1 DFC1	ICPMS4 ICPE1 XRF1 INAA1
Hg	DA8	AFS8
Ho	DF3 FU3 DFC1 DMA1 DFI1	ICPMS8 ICPE1
I	FU7 DMA1	COL5 ICPMS3
In	DF5 FU2 DA1 DFC1	ICPMS9
La	DF4 FU3 DP3 DMA2 DFI1 DFC1	ICPMS7 ICPE4 XRF2 INAA1
Li	DF9 DMA1	ICPE5 ICPMS4 AAS1
Lu	DF3 FU3 DFI1 DMA1 DFC1	ICPMS8 ICPE1 INAA1
Mn	DF6 DP5 FUS2 DMA1 DA1	ICPE6 XRF6 ICPMS1 AAS1
Mo	DF5 FU3 DP2 DFC1	ICPMS6 POL2 ICPE1 AES1 XRF1
N	DA7 DMA1 FU1	VOL9
Nb	DP6 DF4 FU2 DFC1	XRF6 ICPMS6 ICPE1
Nd	DF5 FU2 DFI1 DFC1 DP1	ICPMS8 ICPE1 INAA1
Ni	DF9 DP4 DFC1 DMA1	ICPE6 ICPMS5 XRF4
P	DF5 DP4 FU3 FUS2	XRF6 ICPE4 COL3 ICPMS1

Continue

Element	Pretreatment	Analytical method
Pb	DF7 DP5 DFC1	XRF5 ICPMS5 ICPE52 AAS1
Pr	FU3 DF3 DFI1 DMA1 DFC1	ICPMS8 ICPE51
Rb	DP7 DF6	XRF6 ICPMS4 ICPE51 AAS1 INAA1
S	DP5 FU1 COB1 DH1	XRF4 VOL3 COL1
Sb	DA8 DF2	AFS7 ICPMS3
Sc	DF9 DMA2 DP2	ICPMS7 ICPE54 XRF1 INAA1
Se	DA5 DMA1 FU1 DF1	AFS8
Sm	DF3 FU3 DFC1 DFI1 DP1	ICPMS8 ICPE51 INAA1
Sn	DP7 DFC1	AES7 ICPMS1
Sr	DF7 DP6 FU2	XRF6 ICPMS5 ICPE54
Ta	DF3 FU2 DFC1 DP1	ICPMS6 INAA1
Tb	FU3 DF3 DFC1 DFI1 DP1	ICPMS8 ICPE51 INAA1
Te	DMA2 DF1	ICPMS3
Th	DF8 DP3 FU1	ICPMS8 XRF2 INAA1 ICPE51
Ti	DP4 DF3 FUS3 FU2	XRF7 ICPE52 COL2 ICPMS1
Tl	DF7 DA1 DFC1 FU1	ICPMS9 GFAAS1
Tm	DF4 FU3 DFI1 DFC1	ICPMS8 ICPE51
U	DF7 FU2 DFC1 DP1 DA1	ICPMS9 POL1 INAA1 LF1
V	DF7 DP3 FU1	ICPE56 XRF3 ICPMS2
W	DF4 FU4 DFC1 DP1	ICPMS6 POL3 INAA1
Y	DP5 DF4 FU3 DFC1 DFI1	ICPMS8 XRF5 ICPE52
Yb	DF3 FU3 DFI1 DMA1 DP1	ICPMS8 ICPE51 INAA1
Zn	DF11 DP6	ICPE56 XRF5 ICPMS4 INAA1
Zr	DP5 DF3 FU1 DFC1	XRF5 ICPMS4 ICPE51
SiO <sub>2</sub>	FU8 FUS3	GR6 XRF3 VOL2
Al <sub>2</sub> O <sub>3</sub>	FU8 DF4 FUS2	VOL8 ICPE53 XRF2 ICPMS1
TFE <sub>2</sub> O <sub>3</sub>	FU6 DF4 FUS3 DMA1 DP1	ICPE55 COL4 XRF3 VOL2 INAA1
FeO	DF3	VOL3
MgO	DF7 FU3 FUS2 DMA1	ICPE55 VOL3 XRF2 AAS2 ICPMS1
CaO	DF7 FU3 FUS3 DMA1	ICPE56 XRF3 VOL3 AAS2
Na <sub>2</sub> O	DF8 FUS3 DMA1 DP1	ICPE56 AAS3 XRF3 INAA1
K <sub>2</sub> O	DF8 FUS3 DMA1 DP1	ICPE56 AAS3 XRF3 INAA1
H <sub>2</sub> O <sup>+</sup>	DH6 DP1	GR7
CO <sub>2</sub>	DA4 FU1 DH1	VOL6
Corg	DH6 FU1 DA1 DMA1	VOL9
C	DH4 DA1 DP1	VOL5 XRF1

Note:

DA: Decomposed by aqua regia

DF or DFC: Decomposed by mixed acid including hydrofluoric acid

FU or FUS: Fuse method

DMA: Decomposed by mixed acid.

COB: combustion method

DH: Decomposed by heat

DFI: Decomposed by alkali fuse then concentrated by ion exchange method.

AAS: Atomic Absorption spectrometry

AES: Atomic Emission Spectrography

ICP: Inductively Coupled Plasma spectrography

MS: Mass Spectrometry

XRF: X-Ray Fluorescence spectrometry

VOL: Volumetry

AFS: Atomic Fluorescence spectrophotometry

GR: Gravimetry

GFAAS: Graphite Flame Atomic Absorption spectrometry

INAA: Instrument Neutron activation Analyses method

IC: Ion Chromatography

POL: Polarography

ISE: Ion Selective Electrode method

LF: Laser Fluorescence spectrometry

COL: Colorimetry

CERTIFIED VALUES OF STREAM SEDIMENT REFERENCE MATERIALS

µg/g	NCS DC 73014	NCS DC 73015	NCS DC 73016	NCS DC 73017	NCS DC 73018	NCS DC 73019	NCS DC 73020	NCS DC 73021	NCS DC 73022
Ag	0.14±0.01	0.050±0.007	0.74±0.14	0.044±0.014	0.092±0.005	0.082±0.008	0.14±0.01	0.068±0.010	2.1±0.3
As	14.3±0.9	3.6±0.4	43±4	4.4±0.3	3.0±0.4	51±3	19.2±1.9	10.5±0.6	304±20
B	53±7	48±6	62±6	5.5±1.2	14±3	28±2	35±6	46±10	70±8
Ba	455±9	600±20	623±18	1054±17	567±11	360±8	727±15	584±14	590±10
Be	2.2±0.1	3.6±0.4	2.9±0.3	1.6±0.1	1.9±0.1	1.3±0.2	1.5±0.1	1.5±0.1	2.4±0.1
Bi	0.51±0.03	0.48±0.03	1.25±0.04	0.33±0.04	0.22±0.01	0.17±0.02	0.20±0.01	0.25±0.02	13.1±0.6
Br	0.8±0.2	0.61±0.13	3.7±0.5	1.0±0.2	1.0±0.2	1.1±0.4	(0.9)	1.3±0.2	1.4±0.2
Cd	0.34±0.02	0.093±0.009	4.3±0.5	0.095±0.010	0.12±0.01	0.22±0.01	0.76±0.03	0.165±0.010	4.8±0.5
Ce	47±2	24±2	63±2	32±2	90±4	39±2	44±2	47±1	79±2
Cl	53±5	33±3	133±9	(30)	62±5	38±6	0.28±0.02*	298±39	46±8
Co	10.2±0.4	4.4±0.2	9.4±0.2	12.5±0.9	19.5±0.6	29±2	8.8±0.4	10.0±0.5	14.4±0.5
Cr	61±4	21±3	35±2	8.4±1.2	79±3	220±16	32±4	48±3	72±3
Cs	5.8±0.3	7.2±0.2	6.0±0.3	1.5±0.2	4.6±0.3	2.9±0.2	2.2±0.6	5.4±0.3	10.3±0.4
Cu	132±5	7.2±0.5	26.5±1.0	3.9±0.6	43±1	45±1	296±10	22.6±0.8	483±20
Dy	4.1±0.3	1.7±0.1	4.7±0.3	1.3±0.1	6.5±0.3	3.4±0.2	4.5±0.2	4.5±0.4	5.2±0.2
Er	2.5±0.2	0.93±0.09	3.0±0.3	0.8±0.1	3.7±0.2	2.0±0.2	2.7±0.2	2.6±0.3	3.0±0.2
Eu	1.20±0.06	0.62±0.03	0.98±0.04	0.54±0.05	1.4±0.1	1.12±0.04	1.11±0.06	1.08±0.05	1.36±0.06
F	550±21	279±8	460±37	131±20	664±22	390±21	535±22	506±28	603±29
Ga	14.6±0.6	12.4±0.5	17.7±0.6	12.0±0.6	16.5±0.4	15.5±0.5	15.7±0.5	13.4±0.4	21.5±1.0
Gd	4.1±0.2	1.7±0.1	4.8±0.2	1.4±0.1	7.0±0.5	3.6±0.6	4.3±0.4	4.5±0.3	5.5±0.2
Ge	1.87±0.14	1.64±0.14	1.15±0.07	1.21±0.07	1.45±0.08	1.15±0.08	1.06±0.08	1.05±0.04	1.74±0.16
Hf	3.8±0.8	2.1±0.4	6.7±0.8	2.7±0.5	7.8±0.7	(3.3)	4.8±0.4	4.1±0.3	7.4±1.3
Hg	0.018±0.006	(0.007)	0.108±0.011	0.016±0.005	(0.014)	0.089±0.009	0.025±0.005	0.019±0.004	0.115±0.023
Ho	0.83±0.08	0.33±0.02	0.99±0.08	0.26±0.03	1.27±0.05	0.70±0.07	0.93±0.08	0.92±0.10	1.04±0.08
I	0.47±0.08	0.27±0.08	2.0±0.2	0.46±0.10	0.4±0.1	0.36±0.07	1.6±0.2	1.7±0.3	1.8±0.2
In	0.14±0.01	0.018±0.004	0.104±0.009	(0.014)	0.068±0.008	0.050±0.007	0.11±0.01	0.046±0.006	0.36±0.03
La	24±1	13.9±1.0	35±1	11.8±0.6	45±2	20±1	21±1	24±1	40±1
Li	20.7±2.0	40±2	23.6±1.6	8.1±0.8	43±2	19.4±0.5	16.2±0.8	28±1	38±2
Lu	0.42±0.04	0.16±0.02	0.52±0.03	0.14±0.03	0.60±0.08	0.31±0.03	0.47±0.05	0.42±0.04	0.48±0.02
Mn	0.142±0.004*	290±7	0.149±0.004*	0.122±0.004*	798±31	0.113±0.003*	829±9	675±19	0.103±0.003*
Mo	0.94±0.04	0.33±0.04	1.6±0.2	0.64±0.05	0.84±0.08	0.81±0.11	1.7±0.1	1.1±0.1	1.56±0.20
N	(150)	(79)	0.276±0.027*	218±27	291±36	204±37	(140)	312±35	711±62
Nb	9.4±0.7	5.1±0.7	13.6±0.8	9.5±0.7	15.3±0.8	12.3±1.4	9.2±0.8	9.2±0.4	16.4±0.7
Nd	22±1	9.8±0.4	28±1	8.9±1.0	40±2	17.9±0.7	22±1	23±1	33±1
Ni	18.9±0.7	7.0±0.6	14.4±0.7	4.7±0.5	70±2	102±3	13.4±0.9	26±2	29±1

CERTIFIED VALUES OF STREAM SEDIMENT REFERENCE MATERIALS (continue)

μg/g	NCS DC 73014	NCS DC 73015	NCS DC 73016	NCS DC 73017	NCS DC 73018	NCS DC 73019	NCS DC 73020	NCS DC 73021	NCS DC 73022
P	568±17	335±15	0.107±0.005*	234±13	459±15	850±36	608±16	571±14	589±39
Pb	210±6	31±2	341±15	22±1	19±1	24±2	26±1	17±1	126±5
Pr	5.9±0.4	2.9±0.3	7.7±0.6	2.5±0.4	11.0±0.8	4.6±0.3	5.5±0.4	5.9±0.3	8.9±0.6
Rb	96±4	118±3	139±3	81±2	121±4	39±2	53±4	77±2	130±4
S	432±60	87±10	532±84	66±10	110±18	(350)	0.67±0.06*	(0.62)*	1.17±0.09*
Sb	1.18±0.07	0.16±0.03	2.0±0.2	0.29±0.03	0.15±0.04	1.9±0.6	1.00±0.07	0.90±0.06	25±4
Sc	11.4±0.3	4.9±0.4	7.2±0.3	2.1±0.2	16.9±0.4	23±1	12.4±0.4	10.3±0.4	13.8±0.3
Se	0.47±0.10	0.053±0.013	0.32±0.09	0.072±0.009	0.24±0.02	0.18±0.01	1.55±0.34	0.21±0.01	0.69±0.08
Sm	4.5±0.2	1.9±0.1	5.4±0.2	1.6±0.1	7.5±0.2	3.7±0.2	4.7±0.2	4.7±0.2	6.2±0.2
Sn	2.5±0.4	2.3±0.2	7.2±1.0	(1.0)	1.9±0.3	1.9±0.4	2.0±0.4	2.0±0.4	6.7±0.6
Sr	171±5	253±13	156±5	167±10	117±3	251±8	355±13	273±11	111±4
Ta	0.65±0.07	0.72±0.10	1.1±0.1	0.81±0.14	1.04±0.08	0.80±0.13	0.59±0.06	0.63±0.07	1.23±0.08
Tb	0.68±0.05	0.29±0.02	0.8±0.1	0.22±0.02	1.14±0.08	0.58±0.04	0.74±0.02	0.77±0.04	0.91±0.05
Te	(0.05)	(0.02)	(0.05)	(0.03)	(0.05)	(0.05)	(0.25)	(0.05)	(1.4)
Th	8.3±0.9	4.1±0.6	10.9±0.4	5.4±0.6	15.4±1.0	5.4±0.9	5.5±0.8	7.8±0.5	14.0±1.3
Ti(%)	0.32±0.01	0.146±0.011	0.293±0.010	0.151±0.014	0.53±0.01	0.53±0.02	0.328±0.020	0.285±0.020	0.45±0.02
Tl	0.91±0.07	0.83±0.08	1.38±0.17	0.44±0.06	0.77±0.07	0.31±0.07	0.32±0.02	0.48±0.03	1.05±0.08
Tm	0.40±0.04	0.16±0.02	0.49±0.04	0.13±0.02	0.59±0.05	0.31±0.03	0.46±0.03	0.43±0.05	0.49±0.03
U	2.2±0.2	1.9±0.1	4.8±0.3	1.1±0.1	3.5±0.2	1.54±0.10	2.1±0.2	2.3±0.3	3.7±0.3
V	77±3	31±1	49±3	28±2	120±4	160±10	83±4	69±3	101±3
W	2.0±0.1	0.66±0.08	3.0±0.2	0.58±0.06	1.7±0.2	1.1±0.2	0.97±0.11	1.3±0.1	15.5±0.8
Y	23±2	9.7±0.7	29±2	7.0±0.6	34±2	19±2	26±2	25±3	28±2
Yb	2.6±0.3	1.0±0.1	3.2±0.3	0.83±0.04	3.8±0.3	2.0±0.2	3.0±0.3	2.7±0.3	3.1±0.1
Zn	209±6	27±2	579±17	19±2	74±3	97±3	289±6	59±2	874±19
Zr	132±4	71±7	219±6	100±11	275±13	122±8	179±13	150±11	241±30
(%)									
SiO <sub>2</sub>	69.40±0.29	74.33±0.23	61.96±0.31	77.42±0.22	66.02±0.23	54.17±0.30	63.12±0.34	51.43±0.20	64.35±0.45
Al <sub>2</sub> O <sub>3</sub>	11.06±0.13	11.65±0.13	12.94±0.12	11.44±0.13	11.25±0.08	13.94±0.11	13.08±0.10	10.73±0.08	13.61±0.12
TFe <sub>2</sub> O <sub>3</sub>	7.00±0.10	1.79±0.05	3.80±0.05	1.86±0.05	6.31±0.07	7.84±0.09	4.80±0.05	3.81±0.04	7.05±0.11
FeO	(1.83)	(0.57)	(2.55)	(0.2)	(2.1)	(2.0)	(0.73)	(0.66)	(1.1)
MgO	1.70±0.03	0.71±0.04	1.29±0.02	0.18±0.03	2.34±0.04	4.66±0.08	2.01±0.04	1.83±0.04	1.25±0.05
CaO	2.96±0.04	2.85±0.08	2.08±0.05	0.85±0.06	3.82±0.06	5.36±0.12	4.09±0.08	13.12±0.31	1.64±0.05
Na <sub>2</sub> O	1.40±0.02	2.85±0.04	2.09±0.05	2.53±0.04	0.83±0.02	2.35±0.05	3.15±0.05	1.68±0.03	0.41±0.04
K <sub>2</sub> O	2.35±0.03	2.96±0.05	3.17±0.04	3.89±0.06	2.41±0.03	1.33±0.02	2.44±0.04	2.17±0.04	2.76±0.07
H <sub>2</sub> O <sup>+</sup>	2.31±0.09	0.98±0.13	(4.0)	(1.0)	3.23±0.25	(4.6)	(3.1)	(3.5)	(4.4)
CO <sub>2</sub>	(0.76)	(1.34)	(0.98)	(0.11)	2.57±0.28	4.18±0.30	1.36±0.17	8.60±0.28	(1.36)
Corg	0.28±0.03	(0.08)	4.43±0.26	0.20±0.02	0.34±0.05	0.32±0.04	0.11±0.02	0.18±0.02	(0.56) **
TC	(0.48)	(0.46)	4.76±0.30	(0.25)	1.01±0.09	1.46±0.08	(0.48)	2.6±0.1	0.93±0.10

Note: value with \* is in percent; value with \*\* is calculated value; value in ( ) is for reference only. Value behind “±” is uncertainty

1. 14 independent laboratories take part in the analysis work.

$$\text{Uncertainty } U = t_{0.05(n-1)} \cdot \sqrt{U_a^2 + U_b^2}$$

$U_a$  is got by standard deviation of values between Labs.

$U_b$  is got by deviation of analysis methods.

2. The sample is powder packed in bottle. The minimum package is 70 grams.

The minimum weight for analysis is 0.1g.

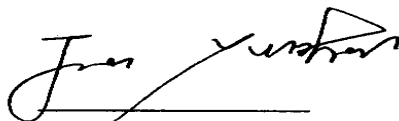
3. The sample should be stored at dry and cool place.

4. The valid time of the sample is 15 years, although we reserve the right to make change as issue revisions.

#### Statement:

This material is used only in labs and for analysis work, producer will be not responsible for any problem caused by misuse or not properly store.

Please check carefully the package, quantity and type of the material after receiving it. Related compensation is only limited in the certified materials, any other losses will be not included.



**Jia Yunhai**

**Laboratory Director**