

Reference number: 100/209/2000

CERTIFICATE

OF REFERENCE MATERIAL No. 003

ZEOLITE 1

Type of material: **natural zeolite**

Certified values:

Component	Content %	u_c
Al ₂ O ₃	12.21	0.16
CaO	4.51	0.08
Fe ₂ O ₃ Total	1.75	0.03
K ₂ O	2.19	0.04
MgO	1.41	0.02
MnO	0.045	0.001
Na ₂ O	0.612	0.011
P ₂ O ₅	0.055	0.003
SiO ₂	67.11	0.31
TiO ₂	0.190	0.003

Component	Content $\mu\text{g/g}$	u_c
As	1.96	0.09
Ba	779	13
Be	1.96	0.08
Ce	52.3	2.6
Cs	3.88	0.13
Cu	5.12	0.25
Ga	13.9	0.2
Hg	0.329	0.008
La	32.6	1.2
Pb	20.8	0.4
Rb	95.7	1.9
Sb	0.379	0.025
Sr	617	6
V	12.6	0.4
Y	21.8	0.7
Zn	38.2	1.2
Zr	158	3

*combined standard uncertainty

Traceability: Traceability of certified values of reference material compounds - Zeolite 1 were assured through the single-element certified reference materials and certified reference materials with similar mineralogical and chemical composition, which were applied in all participating laboratories to the calibration of the measuring equipment.

Valid until: **February 28, 2020**

Packing: **50g \pm 1g** of the powdered material with particle size < 0,09 mm

Minimal weight for analysis: **150 mg**

Lot: **0399**

Bratislava, June 26, 2000




Peter Knepp
 director

Producer: **Geological Survey of Slovak Republic, Geoanalytical Laboratories, Accredited testing laboratories, Reference Laboratory of the Ministry of the Environment of Slovak Republic, Markušovská cesta 1, 052 40 Spišská Nová Ves, Slovakia**
Tel./Fax: ++421 - 965/4426096

Responsible person: **Pavol Lučivjanský, Daniela Mackových**

Method of certification:

The interlaboratory comparative tests and one-stage nested design according ISO Guide 35 was used for the certification of reference material. Twenty one foreign and six Slovak Laboratories took part in the certification of chemical composition of zeolite. The certified values were calculated as the arithmetic mean of laboratory means after excluding of outlying values. The combined standard uncertainty - u_c was evaluated according to: ISO Guide to the expression of uncertainty in measurement, 1st edition, 1993.

Storage:

Storage of the reference material does not request specific arrangements. The certified reference material is necessary to store at 15 – 25°C in a dark and dry ambient.

Object of application:

The reference material is assigned to the calibration of measuring equipments, validation of analytical methods and determination of measured values of components in tested materials with similar structure of matrix.

Instruction for use:

Determination the humidity has to be determined separately by drying at 105°C into constant mass and the analytical results have to be recalculated.

The producer does not guarantee the certified values in the case of the CRM depreciation due to user



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**Appendix to the Certificate
of Reference Material No. 003
ZEOLITE 1**

1. List of Participating Laboratories:

1. British Geological Survey, Nottingham, Great Britain
2. CEVA, s.r.o., Trenčín, Slovakia
3. Czech Geological Survey, Analytical Laboratory, Prague, The Czech Republic
4. ECOCHEM-stredisko ICP, Prague The Czech Republic
5. Ekologické laboratóriá, s.r.o., Spišská Nová Ves, Slovakia
6. Federal Institute for Geosciences and Natural Resources, Hannover, Germany
7. Geoekologické laboratóriá, š.p., Turčianske Teplice, Slovakia
8. Geological Institute of Hungary, Laboratory, Budapest, Hungary
9. Geological Institute of Romania, Environmental Geochemistry Department, Bucharest, Romania
10. Geological Survey of Austria, Wien, Austria
11. Geological Survey of Estonia, Tallinn, Russia
12. Geological Survey of Finland, Chemical Laboratory, Espoo, Finland
13. Geological Survey of Norway, Laboratory Section, Trondheim, Norway
14. Geologická služba SR, Geoanalytické laboratóriá, Spišská Nová Ves, Slovakia
15. Geologický ústav SAV, Bratislava, Slovakia
16. Institute of Geology of Lithuania, Spectroscopy Laboratory, Vilnius, Lithuania
17. Institute of Inorganic Chemistry and Metallurgy of Rare Elements, Wrocław University of Technology, Wrocław, Poland
18. Katedra chemie, Zemědělská fakulta, Jihočeská universita, České Budějovice, The Czech Republic
19. Netherlands Inst. Of Applied Geoscience TNO – National Geological Survey, Section of Geochem.Lab., Haarlem, The Netherland
20. Okregowa Stacja Chemiczno-Rolnicza w Warszawie, Warszawa, Poland
21. Polish Geological Institute, Central Chemical Laboratory, Warszawa, Poland
22. U.S.Geological Survey, Colorado, Denver, U.S.A.
23. University of Pavia, Laboratorio Energia Nucleare Applicata, Pavia, Italy
24. University of Ljubljana, Dep. of Chemistry, Ljubljana, Slovenija
25. Vernadsky Institute of Geochemistry and Anal. Chemistry RSA, Moscow, Russia
26. VSEGEI HIMLAB, St.-Petersburg, Russia
27. VSŽ LABORTEST, s.r.o., Košice, Slovakia

2. Noncertified values

The contents of elements in a Slovak zeolite – ZEOLITE 1

Component	Component content in µg/g	u _c	N	N _p	n	np	Analytical Method
LOI	9.49(%)	0.36	19	15	70	54	L0,L1
Ag	0.040	*	1	1	4	4	D
Bi	0.198	*	2	1	8	4	D,J
Cd	0.065	0.011	4	4	12	12	BD,D
Co	2.26	0.21	20	15	68	48	AC,BE,C,D,J,K,L5
Cr	4.33	0.52	23	15	79	50	AA,AC,AD,C,D,J,K,L5,L7
Dy	3.72	*	2	2	8	8	C,D
Er	2.51	*	2	2	8	8	C,D
Eu	0.565	0.059	3	3	12	12	C,D,L7
Gd	3.31	*	2	2	8	8	C,D
Ge	1.62	*	3	2	9	8	D,K
Hf	4.05	0.63	4	3	13	9	D,J,K,L7
Ho	0.693	*	1	1	4	4	D
In	0.026	*	1	1	4	4	D
Li	14.1	2.5	4	4	13	13	AA,D
Lu	0.337	*	2	2	8	8	D,L7
Mo	1.57	*	3	2	9	5	D,J
Nb	11.9	1.8	6	6	21	21	C,D,J,K,L5
Nd	22.0	0.9	4	4	13	13	C,D,L7
Ni	2.86	0.29	21	10	71	30	AC,BC,BE,C,D,J,K,L5
Pr	6.54	*	2	2	8	8	C,D
Sc	5.13	0.36	5	5	17	17	D,J,L5,L7
Se	0.260	*	1	1	4	4	D
Sm	3.66	0.12	3	3	12	12	C,D,L7
Sn	3.05	0.23	10	7	34	25	D,J,K,L5
Ta	0.94	*	3	2	12	8	D,J,L7
Tb	0.570	*	1	1	4	4	D
Th	10.40	0.72	4	4	13	13	D,J,L7
Tl	0.467	0.109	3	3	9	9	D
Tm	0.420	*	2	2	8	8	C,D
U	4.51	0.43	4	4	13	13	D,J,L7
W	2.60	*	2	2	8	6	D,J
Yb	2.69	0.33	5	5	13	13	C,D,L5,L7

* - number of accepted laboratory means < 2

u_c - combined standard uncertainty

N - number of all laboratory means

N_p - number of accepted laboratory means

n - number of all laboratory measurements

np - number of accepted laboratory measurements

3. LEGEND

Analytical techniques

Atomic absorption spectrometry – Flame

- AA Without background correction using air-acetylene
- AB Without background correction using N₂O-acetylene
- AC With deuterium background correction using air-acetylene
- AD With deuterium background correction using N₂O-acetylene
- AG Others

Atomic absorption spectrometry – electrothermal atomization

- BC With deuterium background correction without chemical modifier
- BD With deuterium background correction with chemical modifier
- BE With Zeeman background correction without chemical modifier
- BF With Zeeman background correction with chemical modifier
- BG Others

Another techniques

- C Atomic emission spectrometry with inductively coupled plasma
- D Inductively coupled plasma mass spectrometry
- E Spectrophotometry
- F Hydride technique
- F1 Atomic absorption spectrometry – VGA technique
- H Cold vapor technique
- J X-ray fluorescence with material melted
- K X-ray fluorescence with material pressed
- L0 Others
- L1 Gravimetry
- L2 Complexometry
- L3 Atomic absorption spectrometry – AMA
- L4 Flamephotometry
- L5 Optical emission spectrometry
- L6 Volumetry
- L7 Neutron activation analysis