

MONGOLIA
CENTRAL GEOLOGICAL LABORATORY



CERTIFICATE OF ANALYSIS

Certified Reference Material "OTH"

Gold-copper ore "CGL 123"

Certified values (CV) and their confidence interval ($\pm\Delta_A$)

No.	Oxides/ Elements	Unit	CV	$\pm\Delta_A$	N
1.	SiO ₂	%	52.09	0.32	19
2.	TiO ₂	%	0.93	0.17	19
3.	Al ₂ O ₃	%	14.58	0.16	20
4.	CaO	%	3.14	0.05	16
5.	MgO	%	5.52	0.10	17
6.	MnO	%	0.12	0.03	18
7.	Na ₂ O	%	2.36	0.07	19
8.	K ₂ O	%	2.81	0.14	19
9.	P ₂ O ₅	%	0.27	0.02	15
10.	SO ₃	%	3.87	0.15	12
11.	Loss on ignition	%	5.43	0.17	15
12.	Cu	%	0.75	0.05	20
13.	Au	mg/kg	0.91	0.09	17
14.	Ba	mg/kg	249	15	8
15.	Co	mg/kg	24.3	2.3	9
16.	Cr	mg/kg	99.3	3.4	13
17.	Mo	mg/kg	51.8	6.3	15
18.	Ni	mg/kg	25.4	5.8	10
19.	Pb	mg/kg	27	3	12
20.	Sr	mg/kg	259	73	13
21.	V	mg/kg	335	15	17
22.	Zn	mg/kg	136	6	16
23.	Zr	mg/kg	78.3	11.1	11

Information values (IV)

No.	Oxides/ Elements	Unit	IV
1	Fe ₂ O ₃	%	10.95
2	FeO	%	4.91
3	H ₂ O	%	0.28
4	CO ₂	%	1.51
5	F	%	0.14
6	Ag	mg/kg	2.51
7	W	mg/kg	12.00

Classification criteria

CV – certified value satisfying certification criteria

IV - not certified value not satisfying certification criteria

Description of the sample

The bulk for a reference material is taken from the Oyu-tolgoi deposit of the Umnugobi aimag of Mongolia. The material consists of a homogeneous powder (particles have passed a sieve with apertures smaller than 63 µm).

The mineral composition of the material has been determined to be:

Minerals	Percentage, % m/m	Minerals	Percentage, % m/m
Pyrite	24.6	Zunyite	few particles
Chalcopyrite	1.2	Dolomite	0.2
Bornite	1.5	Calcite	0.1
Chalcosine	0.3	Chlorite	1.3
Covillite	0.1	Kaolin	4.2
Enargite	0.5	Potassium feldspar	0.5
Tennantite	0.1	Muscovite	5
Magnetite	0.05	Sericite	5
Goethite	0.1	Apatite	few particles
Caustolite	few particles	Zircon	few particles
Ilmenite	few particles	Monazite	few particles
Rutile	0.6	Barite	few particles
Leucoxene	0.2	Sphen	few particles
Quartz	30	Fluorite	few particles
Pyrophyllite	23	Topaz	1.5
Plagioclase	2	Silver	few particles
Diaspore	few particles	Gold	few particles
Alunite	0.1		

Instructions for Storage and Use

The recommended minimum sample intake is 100 mg. If there is a need of sample intake below 100 mg for an analytical method (e.g. the optic emission spectrometry), weigh more than 100 mg and mix in an agate mortar. Then weigh necessary weight.

Taken portions should not be poured back in a bottle as it may contaminate the material.

The reference material is stored in a polyethylene bottle of 100 g. The bottle should be stored preferably in a dry place at the room temperature, protected from an effect of chemical reagents.

The reference material can be transported by any kind of transport means.

Validity of the Certificate

Duration of production is 2003-2006. Duration of use is 20 years.

Availability of Material

This reference material will be classified as "CGL 123" in the future in accordance with CGL CRM classification system.

Central Geological Laboratory
CGL building,
Songinokhairkhan District
Ulaanbaatar - 18080
MONGOLIA

Tel.: + (976 11) 632904, 632914
Fax: + (976 11) 632944, 632564
e-mail: cengeolab@mongol.net
cengeolab@magicnet.mn
web: www.cengeolab.com

Participating Laboratories

Preparation, homogeneity and stability testing:

Central Geological Laboratory

Certification analyses:

- Laboratory of Methods, Standards, Control and Metrology of the Central Geological Laboratory, Ulaanbaatar, Mongolia
- Laboratory of Chemical & Physical Techniques of the Central Geological Laboratory, Ulaanbaatar, Mongolia
- Nuclear Research Centre, Mongolian State University, Ulaanbaatar, Mongolia
- Laboratory of Precious Metals, the Faculty of Chemistry, Mongolian State University, Ulaanbaatar, Mongolia

- Chemical and Technological Centre for New Materials, Mongolian State University, Ulaanbaatar, Mongolia
- Exploitation and Investigation Center of Technology of Mineral Resources, Ulaanbaatar, Mongolia
- Institute of Physics and Technology, Mongolian Academy of Science, Ulaanbaatar, Mongolia
- Laboratory of Fire Assaying, "Mongol Gazar" Company, Mongolia
- SGS Welshpool Minerals, Australia
- Federal Institute for Geosciences and Natural Resources (BGR), RFA-Laboratory, Hannover, Germany
- SGS Mongolia Minerals, Ulaanbaatar, Mongolia
- Institute de Tecnologia Ceramica, Chemical Analysis Unit, Spain
- Geoscience Laboratories, Ontario, Canada
- The Geological Survey of Israel, Israel
- Geological Institute of Hungary, Hungary
- National Research Center for Geoanalysis, China
- Beijing Research Institute of Uranium Geology, China
- State Geological Institute of Dionyz Stur, Geoanalytical Laboratories, Slovak
- Eurotest Control JSC, Bulgaria

Methods used

Methods of final determination were:

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|-----------------------------------|--|
| - Atomic absorption spectrometry | Fe ₂ O ₃ , MnO, MgO, CaO, Na ₂ O, K ₂ O, Au, Ag, Co, Cu, Mo, Ni, Pb, Sr, V, Zn |
| - X-ray fluorescence spectrometry | SiO ₂ , TiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , MnO, MgO, CaO, Na ₂ O, K ₂ O, P ₂ O ₅ , SO ₃ , Au, Ag, Ba, Co, Cr, Cu, Mo, Ni, Pb, Sr, W, V, Zn, Zr |
| - flame photometry | Na ₂ O, K ₂ O |
| - photometry | SiO ₂ , TiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , MnO, P ₂ O ₅ , Au, Ag, Cr, Cu, Mo, V, W, Zr |
| - ICP spectrometry | SiO ₂ , TiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ , MnO, MgO, CaO, Na ₂ O, K ₂ O, P ₂ O ₅ , H ₂ O, SO ₃ , Au, Ag, Ba, Co, Cr, Cu, Mo, Ni, Pb, Sr, V, W, Zn, Zr |
| - gravimetric | SiO ₂ , H ₂ O, SO ₃ , Lol, Au, Ba |
| - volumetric | Al ₂ O ₃ , Fe ₂ O ₃ , FeO, MgO, CaO |
| - Fire Assay -AAS | Au |

Certification

This reference material was confirmed and given the number USZ 41-2006 by the Mongolian National Center for Standardization and Metrology.

Note

A detailed technical report on the analysis procedure and the treatment of the analytical data is supplied with each sample.