

**CENTRAL GEOLOGICAL LABORATORY**

**CERTIFIED REFERENCE MATERIAL**

**CERTIFICATE OF ANALYSIS**

**USZ 3-85, GSO 3319-85, ST SEV 5748-86**  
**Copper-molybdenum ore "CuMo"**

Elements	Mass fraction (based on dry mass at 105°C)		Number of accepted sets of results p
	Certified value <sup>(1)</sup> expressed as cg.g <sup>-1</sup>	95% confidence interval <sup>(2)</sup> expressed as cg.g <sup>-1</sup>	
Cu	0.817	0.014	39
Mo	0.017	0.001	31
SiO <sub>2</sub>	67.02	0.22	15
TiO <sub>2</sub>	0.47	0.02	19
Al <sub>2</sub> O <sub>3</sub>	16.35	0.25	15
Fe <sub>2</sub> O <sub>3</sub> total	3.95	0.13	26
MnO	0.020	0.003	19
MgO	0.71	0.02	18
CaO	0.29	0.02	12
Na <sub>2</sub> O	1.59	0.07	19
K <sub>2</sub> O	3.68	0.15	15
S total	2.09	0.05	17
LoI	4.13	0.12	9
Ag	0.00025	0.00005	12
As	0.0189	0.0013	9
Ba	0.0893	0.0012	7
Ce	0.0045	0.0006	8
Co	0.0013	0.0002	12
Cr	0.0021	0.0002	7
Cs	0.00023	0.00003	6
Rb	0.0081	0.0008	10
Sb	0.0024	0.0002	7
Sr	0.0172	0.0032	10
Zn	0.0097	0.0010	13

<sup>(1)</sup> This value is the unweighted mean of p accepted sets of results.

<sup>(2)</sup> The 95% confidence interval is a measure of the uncertainty and is acceptable when the reference material is used for calibration purposes.

## DESCRIPTION OF THE SAMPLE

The material is a reference material taken from the copper-molybdenum deposit in the Erdenet Ovoo area of Mongolia. The material consists of a homogeneous powder (particles have passed a sieve with apertures smaller than 63 µm). The material contains the following minerals expressed as cg.g<sup>-1</sup>:

Quartz: 33.0	Sericite: 25.0
Feldspar: 35.0	Pyrite: 3.5
Chacocite, chalcopyrite, covellite, molybdenite and others : 3.5	

Additional information is presented on the attached sheet.

## INSTRUCTION FOR USE, STORAGE AND TRANSPORTATION

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 transportation in simple conditions.

The date of production is May, 1981. Duration of use is 5 years.

## PARTICIPATING LABORATORIES

### Preparation:

- Central Geological Laboratory of the Ministry of Geology, Mining and Industry
- Mongolian-Soviet joint venture "Erdenet" Concentrator

### Homogeneity and stability testing:

- Central Geological laboratory of the Ministry of Geology, Mining and Industry
- Nuclear Research Laboratory of Mongolian State University
- Central Board of State Metrology Service of the State Committee of the Price and Standards

### Certification analyses:

- Геолошко предприятие за лабораторни изследвания, Комитет по геология, София, НРБ
- Magyar Allami Földtani Intezet, Budapest, MNK
- Zentrales Geologisches Institut, Berlin, DDR
- Ministerio de la Industria Basica, Centro de Investigaciones Geologicas, La Habana, Republica de Cuba

- Sub-laboratory of Reference Material, Central Geological Laboratory of the Ministry of Geology, Mining and Industry, Ulaanbaatar, Mongolian People's Republic
- Chemistry sub-laboratory, Central Geological Laboratory of the Ministry of Geology, Mining and Industry, Ulaanbaatar, Mongolian People's Republic
- Chemistry Laboratory of Mongolian-Soviet joint venture "Erdenet" Concentrator, Erdenet, Mongolian People's Republic
- Nuclear Research Laboratory of Mongolian State University, Ulaanbaatar, Mongolia
- Optic methods Laboratory of the General and Analytical Chemistry Department, Faculty of Natural science, Mongolian state University, Ulaanbaatar, Mongolia
- Expertise Laboratory of Mining Production of the Central Board of State Metrology Service, State Committee of the Price and Standards, Ulaanbaatar, Mongolian People's Republic
- Institute for Physics and Techniques of the Academy of Science, Ulaanbaatar, Mongolian People's Republic
- Chemistry Institute of the Academy of Science, Ulaanbaatar, Mongolian PR
- All-Union Scientific-research Institute of Mineral Resources (VIMS), Moscow, USSR
- Institut Geologiczny, Warszawa, PRL
- Central Laboratory PGO "IRKUTSKGEOLOGY", Irkutsk, USSR
- Central Laboratory PGO "UJKAZGEOLOGY", Alma-Ata, USSR
- All-Union Scientific-research Institute of Mineral Resources (VIMS), Complex expedition, Naro-Fominsk, USSR
- Geological and Geochemistry Expedition of the Institute for Rare Elements Mineralogy, Geochemistry and Crystallochemistry, Bronitsi, USSR
- Institute for Geophysics and Geochemistry, Academy of Science of BSSR, Minsk, USSR
- Institute for Geology of Kolsky Branch of the Academy of Science, Anatity, USSR
- Institute "UNIPROMED", Sverdlowk, USSR
- Territorial Geological Board of Ural, Sverdlowk, USSR
- Institute "IRGIREDMET", Irkutsk, USSR
- Institute for Geology and Geophysics of the Academy of Science of USSR, Novosibirsk, USSR
- Norilsk GMK, Norilsk, USSR
- VNITsVETMET, Ust-Kamenogorsk, USSR
- Ústav pro vyzkum rud, Praha, CSSR
- Ústav nerostnych surovin, Kutná Hora, CSSR

## METHODS USED

Methods of final determination were:

- gravimetric (SiO<sub>2</sub>, LoI, S)
- volumetric (Cu, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, CaO, MgO, S)
- photometry (Cu, Mo, SiO<sub>2</sub>, TiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, Fe<sub>2</sub>O<sub>3</sub>, CaO, MgO, P<sub>2</sub>O<sub>5</sub>, Ag, As, Ce, Co, Cr)

- Atomic absorption spectrometry (Cu, Mo, Fe<sub>2</sub>O<sub>3</sub>, TiO<sub>2</sub>, Al<sub>2</sub>O<sub>3</sub>, MgO, CaO, MnO, Na<sub>2</sub>O, K<sub>2</sub>O, Ag, Co, Cs, Pb, Rb, Sb, Sr, Zn)
- Flame photometry (Na<sub>2</sub>O, K<sub>2</sub>O, Rb, Sr)
- emission spectrometry (Cu, Mo, As, Pb)
- spectrograph (Mo, MnO, Ag, Ba, Rb, Sb, Sr)
- arc emission spectrometry (Cu, Mo, TiO<sub>2</sub>, MnO, Ba, Co, Cr, Pb, Sr)
- X-ray fluorescence spectrometry (Cu, Mo, TiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub>, MnO, K<sub>2</sub>O, Rb, Sr)
- gamma and neutron activation (Cu, Mo, TiO<sub>2</sub>, Fe<sub>2</sub>O<sub>3</sub>, MnO, CaO, MgO, Na<sub>2</sub>O, K<sub>2</sub>O, Ag, As, Ba, Ce, Co, Cr, Cs, Pb, Rb, Sb, Sr, Zn)
- polarigraph (Cu, S)

## LEGAL NOTICE

This reference material was confirmed by the State Committee of Price and Standards of MPR and the Standards Committee of USSR, under the sponsorship of the Council of the Mutual Economical Assistance. A number ST SEV 5748-86 was given by the Council, UST 3-85 - by the State Committee of Price and Standards of MPR and GSO 3319-85 by the Standards Committee of USSR.

## NOTE

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

**INFORMATION SHEET ATTACHED TO THE CERTIFICATE  
OF UST 3-85**

Additional information (not certified) on various contents is presented here. The data are mean values of various sets of results obtained by various techniques in various laboratories.

Elements and compounds	Mass fraction expressed as $\text{cg.g}^{-1}$		Number of individual sets
	Content	Standard deviation	
$\text{P}_2\text{O}_5$	0.15	0.02	13

Elements	Mass fraction expressed as $\mu\text{g.g}^{-1}$			Number of individual sets
	Mean value	Minimum value	Maximum value	
Be	2.2	1.5	4.1	4
Eu	0.77	0.47	0.96	6
Ga	32	14	60	3
Hf	3.5	3	3.9	5
La	20.5	11	24.4	6
Li	6.2	3.4	7.6	4
Lu	0.19	0.09	0.37	4
Nb	13.3	6.5	20	2
Nd	22.6	16	35.2	5
Ni	24	6	57	12
Pb	108	35	371	16
Re	1.4	0.5	2	3
Se	6.3	2	8.8	3
Sc	5.5	4.4	6.7	5
Sm	3.1	2	3.8	5
Sn	3.9	3.3	4.7	3
Tb	0.77	0.3	1.78	4
Te	7.8	7.8	7.8	2
Th	3.3	2	3.9	5
U	5.8	1.2	11.3	3
V	58	23	75	6
W	30	7	48	4
Yb	1.2	0.7	2.7	5
Zr	131	80	146	6