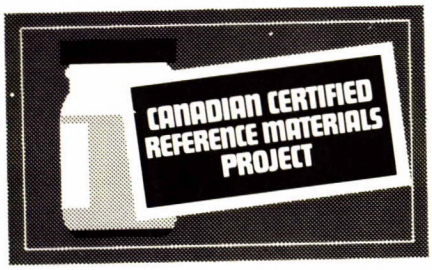
Energy, Mines and Resources Canada
Énergie, Mines et Ressources Canada

CANMET
Canada Centre for Mineral and Energy Technology
Centre canadien de la technologie des minéraux et de l'énergie

CERTIFIED AND PROVISIONAL REFERENCE MATERIALS AVAILABLE FROM THE CANADA CENTRE FOR MINERAL AND ENERGY TECHNOLOGY, 1978

G.H. Faye



MINERALS RESEARCH PROGRAM
MINERAL SCIENCES LABORATORIES
CANMET REPORT 78-3

Available by mail from:

Printing and Publishing
Supply and Services Canada,
Ottawa, Canada K1A 0S9

CANMET
Energy, Mines and Resources Canada,
555 Booth St.,
Ottawa, Canada K1A 0G1

or through your bookseller.

Catalogue No. M38–13/78-3
ISBN 0-660-01804-7

Price: Canada: $1.25
Other countries: $1.50

Price subject to change without notice.

En vente par la poste:

Imprimerie et Édition
Approvisionnements et Services Canada,
Ottawa, Canada K1A 0S9

CANMET
Énergie, Mines et Ressources Canada,
555, rue Booth
Ottawa, Canada K1A 0G1

ou chez votre libraire.

Nº de catalogue M38–13/78-3
ISBN 0-660-01804-7

Prix: Canada: $1.25
Autres pays: $1.50

Prix sujet à changement sans avis préalable.

CERTIFIED AND PROVISIONAL REFERENCE MATERIALS AVAILABLE FROM THE CANADA CENTRE FOR MINERAL AND ENERGY TECHNOLOGY, 1978

Compiled by
G.H. Faye*

PREFACE

The Canadian Certified Reference Materials Project (CCRMP) is a facet of the Mineral Technology Development Activity of CANMET's Minerals Research Program. In this project, compositional reference materials, for use in analytical laboratories associated with mining, metallurgy and the earth sciences, are prepared. The CCRMP is an off-shoot of activities of several outside technical organizations which, in 1955, undertook the preparation of some metals and alloys for spectrographic purposes. Although emphasis in the CCRMP is on producing reference ores and related products, demand from commercial and industrial laboratories has also resulted in the certification of three rock samples, copper of commercial-grade purity, copper alloys and a blast furnace slag.

Work is currently, under way to certify commercial-grade concentrates of zinc, lead and copper, a high-grade uranium ore, and a suite of four Canadian soil samples, the latter in collaboration with Agriculture Canada.

This catalogue describes all of the certified and provisional reference materials that may be purchased from CANMET through the Coordinator of the CCRMP. Where possible, source, chemical composition, recommended values of the certified elements, and price are given for each available material. Also included are brief descriptions of materials being processed and approximate dates of their availability.

It is anticipated that further catalogues will be prepared periodically as new reference materials are certified.

*Coordinator, Canadian Certified Reference Materials Project, Mineral Sciences Laboratoires, Canada Centre for Mineral and Energy Technology, Department of Energy, Mines and Resources, Ottawa, Canada.

DES MATERIAUX DE REFERENCE CERTIFIES ET PROVISOIRES DISPONIBLES AU CENTRE CANADIEN DE LA TECHNOLOGIE DES MINERAUX ET DE L'ENERGIE, 1978

Compilé par
G.H. Faye*

AVANT-PROPOS

Le Programme canadien de matériaux de référence certifiés (CCRMP) fait partie de l'Activité de développement de la technologie des minéraux du Programmme de recherches sur les minéraux à CANMET. Dans ce programme, des matériaux de référence à l'usage des laboratoires analytiques en rapport avec l'exploitation minière, la métallurgie et les sciences de la terre, ont été préparés. Le CCRMP est né des activités de plusieurs organismes techniques extérieurs qui, en 1955, entreprirent la préparation de certains métaux et alliages à des fins spectrographiques. Quoique le CCRMP ait surtout mis l'emphase sur la production de minerais de référence et autres produits apparentés, la demande provenant de laboratoires commerciaux et industriels a aussi entraîné l'homologation de trois échantillons de roche, du cuivre commercial, des alliages de cuivre et un laitier de haut-fourneau.

En ce moment, le travail est effectué afin d'homologuer les concentrés de zinc, de plomb et de cuivre commerciaux, un minerais d'uranium de première qualité et un ensemble de quatre échantillons de sol canadien. Ceux-ci ont été homologués en collaboration avec Agriculture Canada.

Ce catalogue décrit tous les matériaux de référence certifiés et provisoires qui peuvent être achetés de CANMET par l'entremise du coordinateur de CCRMP. Lorsque c'est possible, l'origine, la composition chimique, les valeurs recommandées des éléments certifiés et le prix sont donnés pour chacun des matériaux disponibles. Il y a également inclues, de brèves descriptions des matériaux sous traitement et la date approximate de leur disponibilité.

De nouveaux catalogues devraient être préparés périodiquement à mesure que de nouveaux matériaux de référence certifiés viennent s'ajouter à la liste.

*Coordinateur, Programme canadien de matériaux de référence certifiés, Laboratoires des sciences minérales, Centre canadien de la technologie des minéraux et de l'énergie, Ministère de l'Energie, des Mines et des Ressources, Ottawa, Canada.

CONTENTS

CERTIFIED REFERENCE MATERIALS

CERTIFIED REFERENCE MATERIALS

ORES AND RELATED MATERIALS

CAVEAT PERTAINING TO SULPHIDE-BEARING ORES

Finely ground sulphide-bearing ores are susceptible to oxidation on long or repeated exposure to air. Users of such reference materials are therefore advised to protect their samples, particularly MP-1, KC-1, SU-1, UM-1, RU-1 and CD-1, from unnecessary exposure to air, and to store bottles in a dessicator, preferably in an inert atmosphere.

Stability of the sulphide-bearing reference materials is regularly monitored at CANMET and the assigned values for the certified constituents pertain to the date when issued. The CCRMP is not responsible for changes occurring after receipt by the user.

At the time of compilation of this catalogue, preparations were being made to seal all bottles of high-sulphide reference materials, under nitrogen, in laminated foil pouches. This is expected to preserve the validity of the reference materials indefinitely.

Antimony Ore CD-1

CD-1 was prepared in 1975 from ore of the Lake George mine of Consolidated Durham Mines and Resources Limited at Prince William, New Brunswick. It was chosen as a reference material because it contained significant concentrations of antimony and arsenic, and thus should be especially useful in assessing methods in which there is potential interference between these elements. The following minerals are present in approximate decreasing order of abundance: quartz, mica, clay minerals, stibnite, pyrite, arsenopyrite, pyrrhotite, and traces of chalcopyrite and chalcostibnite. The approximate chemical composition of CD-1 is given in the following table.

Approximate Chemical Composition of CD-1

	(wt %)
Sb	3.57*
As	0.66*
Si	32.9
Al	5.5
Ca	1.4
Mg	0.6
Fe	2.8
Na	0.1
K	1.8
Pb	0.02
Cu	<0.01
S	3.1
Total C	0.2
Moisture (105°C)	0.2
L.O.I. (950°C)	4.0

*Recommended value, see below

Twenty laboratories provided analytical results for either antimony or arsenic or both. The recommended values and their 95% confidence limits, are as follows:

RECOMMENDED VALUES AND CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN CD-1

	Sb (wt %)	As (wt %)
Recommended value	3.57	0.66
95% Confidence limits		
low	3.53	0.65
high	3.60	0.68

A copy of CANMET Report 77-63, entitled "Antimony-Arsenic Ore, CD-1 — A Certified Reference Material", will be provided with each order of CD-1.

Blast Furnace Slag, SL-1

SL-1 was prepared in 1975 from material donated by the Steel Company of Canada Ltd., at Hamilton, Ontario. A reference material such as SL-1, certified for a number of constituents, is needed by analytical laboratories associated with the iron and steel industry.

Although the interlaboratory analytical program, which involved 21 laboratories, yielded results for 13 constituents only six met the criteria for certification; values for the others are provisional, or are given for interest only. The recommended or certified values for SL-1 and their 95% confidence limits, together with provisional values for certain other constituents are given in the following tables:

RECOMMENDED VALUES AND CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN SL-1

	SiO_2	CaO	MgO	Al_2O_3	Total Fe as FeO	S
			(wt %)			
Recommended value	35.73	37.48	12.27	9.63	0.92	1.26
95 % Confidence limits						
Low	35.61	37.30	12.12	9.56	0.89	1.23
High	35.86	37.65	12.41	9.71	0.96	1.28

Provisional Values for SL-1

	TiO_2	MnO	Na_2O	K_2O
		(wt %)		
Provisional value	0.38	0.86	0.39	0.51

A copy of CANMET Report 77-57, entitled "Blast Furnace Slag SL-1: Its Preparation for Use as a Certified Reference Material" will be provided with each order of CD-1.

Copper-Molybdenum Ore, HV-1

HV-1 is a mixture of materials taken from large, low-grade copper-molybdenum porphyry deposits in the Highland Valley area of British Columbia; it is intended to be representative of samples analyzed in large numbers by enterprises associated with the exploitation of these deposits. The calculated mineralogical composition and approximate chemical composition are given in the following tables:

Calculated Mineralogical Composition of HV-1 (wt %)

Minerals	Calculated Mineral Composition
Bornite	0.6
Chalcopyrite	0.3
Pyrite	0.1
Molybdenite	0.1
Quartz	40.7
Plagioclase	26.9
Orthoclase	10.6
Sericite	12.3
Biotite	2.3
Amphibole and pyroxene	2.0
Clay minerals	1.0
Zircon	trace
Calcite	1.5
Hematite and magnetite	0.6
Rutile	0.3
Barite	0.1
Tramp iron (presence indicated from polished section; calculated by difference)	0.4
Total	99.8

Approximate Chemical Composition of HV-1 (wt %)

O	49.2
Si	33.9
Al	6.61
Fe (total)	1.88
Ca	1.40
Mg	0.34
Na	2.26
K	2.82
Ti	0.16
Mn	0.03
Cu	0.52*
Mo	0.058*
S (comb)	0.34
S (grav)	0.35
C (total)	0.20
H_2O (980°C)	1.42
Total	101.1
Correction for O in H_2O	1.3
Adjusted Total	99.8

*Recommended value (see below)

Twenty-three laboratories provided analytical results for copper and molybdenum for certifying HV-1; recommended values and their 95% confidence limits are as follows:

RECOMMENDED VALUES AND THEIR CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN HV-1 (wt %)

	Cu	Mo
Recommended value	0.522	0.058
95 % Confidence limits		
Low	0.517	0.056
High	0.526	0.059

A full account of the work done on HV-1 is given in Mines Branch Technical Bulletin TB 167, entitled "Copper-Molybdenum Ore, HV-1: Its Characterization and Preparation for Use as a Standard Reference Material". A copy of this bulletin will be provided with each order of HV-1.

Gold Ore, MA-1

MA-1 was prepared from mill feed from Willroy Mines Limited, Macassa Division, Kirkland Lake, Ontario. It was chosen because of demand for a relatively simple siliceous ore containing elemental gold. Although the CCRMP has issued several certified gold-bearing materials (see PTC-1, p. 12 and PTM-1, p. 13), these are rich in one or more of copper, nickel, and iron, and contain platinum-group metals, thus being unsatisfactory for laboratories wanting a simple gold ore as a reference material.

The approximate chemical composition is given in the following table:

Approximate Chemical Composition of MA-1 (wt %)

O*	45
Si	24.9
Al	5.7
Fe	5.3
Ca	4.4
Na	1.5
K	4.2
S	1.5
Total C	2.1
C from CO_2	1.8
H_2O (1000°C)	2.0
H_2O (105°C)	0.1
L.O.I.	6.5

*Determined by neutron activation analysis in the Mineral Sciences Laboratories.

Twenty-four laboratories provided gold results by one or more of three methods; the recommended value and its 95% confidence limits are given in the following table:

RECOMMENDED GOLD VALUE AND ITS CONFIDENCE LIMITS

	oz/ton	ppm
Recommended value	0.518	17.8
95% Confidence limits		
Low	0.513	17.6
High	0.523	17.9

A full account of the work done on MA-1 is given in Canada Centre for Mineral and Energy Technology (CANMET) Internal Report MSL 75-29(TR), entitled "Gold Ore, MA-1: Its Preparation and Characterization for Use as a Certified Reference Material"; a copy will be provided with each order of MA-1.

Iron Ore, SCH-1

Reference ore SCH-1 was donated to the CCRMP by the Iron Ore Company of Canada in 1973. It is from the Schefferville, Quebec area and is hematite with a mixture of unidentified hydrous oxides of iron, minor magnetite and trace pyrolusite. The gangue consists mainly of quartz with minor amounts of feldspar and traces of biotite, chlorite and amphibole.

Twenty-four laboratories provided analytical results for one or more of the selected elements in SCH-1; the recommended values and their 95% confidence limits are given in the following table:

A full account of the certification of SCH-1 is given in Canada Centre for Mineral and Energy Technology technical report MSL 75-168(TR), entitled "Iron Ore SCH-1: Its Characterization and Preparation for Use as a Certified Reference Material". A copy of this report will be provided with each order of SCH-1.

RECOMMENDED VALUES AND THEIR CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN SCH-1 (wt %)

	Fe	Si	Al	Ca	Mg	Na	K	Mn	Ti	S	P
Recommended value ...	60.73	3.78	0.509	0.029	0.020	0.019	0.026	0.777	0.031	0.007	0.054
95 % Confidence limits											
Low	60.65	3.74	0.500	0.027	0.019	0.017	0.024	0.769	0.029	0.007	0.051
High	60.82	3.81	0.517	0.032	0.021	0.020	0.027	0.785	0.033	0.008	0.057

Molybdenum Ore, PR-1

Molybdenum ore PR-1 was obtained from the Preissac Molybdenum mine near Cadillac, Quebec in 1970. It is from a vein-type deposit in a sericite granite. The calculated mineralogical composition and the approximate chemical composition are given in the following tables:

Mineralogical Composition of PR-1 (wt %)

Minerals	Calculated mineralogical composition
Fluorite	0.96
Calcite	2.37
Garnet	0.07
Chlorite	1.29
Muscovite	2.30
Feldspar	
Na-feldspar	6.17
K-feldspar	12.29
Quartz	70.27
Rutile	0.05
Molybdenite	1.02
Sphalerite	0.03
Galena	0.04
Chalcopyrite	0.03
Bismuth	0.06
Bismuthinite	0.08
Pyrite	0.58
Pyrrhotite	not calculated
Hematite	"
Magnetite	"
Fe + O + Ni + H_2O	1.26
Total	98.87

Approximate Chemical Composition of PR-1 (wt %)

O	49.2
Si	39.2
Al	2.39
Fe	1.24*
Ca	1.44
Mg	0.09
Na	0.54
K	1.95
S	0.79*
Mo	0.59*
Bi	0.11
Ti	0.03
Pb	0.04
Zn	0.02
Mn	0.02
Ni	0.01
Cu	0.01
F	0.47
H_2O	0.29
Total C as CO_2	1.08
actual CO_2	1.04

*Recommended value (see below).

Nineteen laboratories participated in the program to certify PR-1 for molybdenum, bismuth, iron, and sulphur. A statistical evaluation of the analytical results for these elements yielded the recommended values tabulated below.

RECOMMENDED VALUES AND THEIR CONFIDENCE INTERVALS FOR SELECTED ELEMENTS IN PR-1 (wt %)

	Mo	Bi	Fe	S
Recommended values	0.594	0.111	1.244	0.793
95 % Confidence Interval				
Low	0.578	0.107	1.225	0.777
High	0.610	0.114	1.263	0.809

A full account of the certification of PR-1 is given in Mines Branch Technical Bulletin TB 139, entitled "Molybdenum Ore, PR-1: Its Characterization and Preparation for Use as a Standard Reference Material". A copy of this bulletin will be provided with each order of PR-1.

Nickel-Copper-Cobalt, SU-1

SU-1 is a composite of sample rejects collected in 1958 at Falconbridge Nickel Mines Limited, Falconbridge, Ontario and is representative of the Sudbury nickel-copper ores. It was originally intended as a reference material primarily for spectroscopists . It has been widely distributed to laboratories throughout the world and a large number of analytical results for minor and trace elements have been accumulated. Most of these analyses, however, were obtained by emission spectroscopy and only single values for each element were received from each laboratory. Because of the wide range in results for most elements it was not previously possible to assign recommended values. However, through work completed in 1973 the CCRMP certified SU-1 for nickel, copper, and cobalt.

The approximate chemical composition is given in the following table:

Approximate Chemical Composition of SU-1 (wt %)

O	31.2
Si	16.2
Al	5.01
Fe	22.9
Ca	2.86
Mg	2.47
Na	0.77
K	0.53
Ti	0.50
Mn	0.08
Ni	1.51*
Cu	0.87*
Co	0.063*
Zn	0.03
S	12.1
P	0.04
H (from H_2O)	0.33

*Recommended value (see below).

For the certification of SU-1, twenty-five laboratories provided analytical results for nickel, copper, and cobalt; the recommended values and their 95% confidence limits are given in the following table:

RECOMMENDED VALUES AND THEIR CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN SU-1 (wt %)

	Ni	Cu	Co
Recommended value	1.51	0.87	0.063
95 % Confidence limits			
Low	1.50	0.86	0.061
High	1.52	0.88	0.065

A full account of the certification of SU-1 is given in Mines Branch Technical Bulletin TB 177, entitled "Nickel-Copper-Cobalt Ores SU-1 and UM-1: Their Characterization and Preparation for Use as Standard Reference Materials". A copy of this bulletin will be provided with each order of SU-1.

References

(1) Report of Non-metallic Standards Committee Canadian Association for Applied Spectroscopy, Appl. Spectrosc., 15, 159-161 (1961).

(2) Second Report of Analytical Data for CAAS Syenite and Sulphide Standards, by G.R. Webber, Geochim, Cosmochim. Acta, 29, 229-248 (1965).

(3) Third Report of Analytical Data for CAAS Sulphide Ore and Syenite Rock Standards, by N.M. Sine, W.O. Taylor, G.R. Webber and C.L. Lewis, Geochim, Cosmochim. Acta, 33, 121-131 (1969).

Nickel-Copper-Cobalt, UM-1

Although UM-1 is termed an ore because of its relatively high base-metal sulphide content, it is an ultramafic rock from the Giant Mascot mine at Hope, British Columbia. It is one of a suite of three ultramafic rocks, the others being coded as UM-2 and UM-4 that have been termed geochemical standards for the determination of ascorbic acid/-hydrogen peroxide-soluble nickel, copper, and cobalt (see p. 24). Because UM-1 contained ore-grade concentrations of nickel, copper, and cobalt, and was already ground, it was chosen, along with SU-1, for certifying these three elements.

Details of the mineralogy of UM-1 are given in the reference below, and the approximate chemical composition is as follows:

Approximate Chemical Composition of UM-1 (wt %)

O	36.5
Si	17.6
Al	0.53
Fe	13.4
Ca	1.67
Mg	21.7
Na	0.06
K	0.02
Ti	0.06
Cr	0.31
Mn	0.12
Ni	0.88*
Cu	0.43*
Co	0.035*
S	3.53
H (from H_2O)	0.05
C (from CO_2)	0.07

*Recommended value (see below).

For the certification of UM-1, twenty-five laboratories provided analytical results for nickel, copper, and cobalt; the recommended values and their 95% confidence limits are given in the following table:

RECOMMENDED VALUES AND THEIR CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN UM-1 (wt %)

	Ni	Cu	Co
Recommended value	0.88	0.43	0.035
95 % Confidence limits			
Low	0.87	0.43	0.034
High	0.89	0.44	0.035

A full account of the certification of UM-1 is given in Mines Branch Technical Bulletin TB 177, entitled "Nickel-Copper-Cobalt Ores SU-1 and UM-1: Their Characterization and Preparation for Use as Standard Reference Materials". A copy of this bulletin will be provided with each order of UM-1.

Reference

Three Geochemical Standards of Sulphide-bearing Ultramafic Rock: UM-1, UM-2, UM-4, compiled by E.M. Cameron, Geological Survey of Canada, Paper 71-35 (1972).

Noble-Metals-Bearing Sulphide Concentrate, PTC-1

PTC-1, PTM-1 (p. 13) and PTA (p. 14) comprise a suite of certified reference materials containing the platinum-group metals. PTC-1 is a flotation concentrate of Sudbury ore, its principal constituents being Cu-5.2%; Ni-9.4%; S-23.5%; and Fe-26.9%.

Ten laboratories provided analyses for the certification of five selected elements. A statistical evaluation of these results yielded the recommended values and their 95% confidence limits, given in the following table:

A full account of the certification of PTC-1 is given in Mines Branch Technical Bulletin TB 176, entitled "Noble-Metals-Bearing Sulphide Concentrate, PTC-1: Its Characterization and Preparation for Use as a Standard Reference Material". A copy of this bulletin will be provided with each order of PTC-1.

RECOMMENDED VALUES AND THEIR CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN PTC-1

	Pt		Pd		Rh		Au		Ag	
	(oz/ton)	(ppm)	(oz/ton)	(ppm)	(oz/ton)	(ppm)	(oz/ton)	(ppm)	(oz/ton)	(ppm)
Recommended value	0.087	3.0	0.37	12.7	0.018	0.62	0.019	0.65	0.17	5.8
95 % Confidence limits										
Low	0.081	2.8	0.35	12.0	0.016	0.55	0.016	0.55	0.16	5.5
High	0.093	3.2	0.38	13.0	0.020	0.69	0.021	0.72	0.18	6.2

(ppm = µg/g)

Noble-Metals-Bearing Nickel-Copper Matte, PTM-1

Matte PTM-1 was produced from Sudbury ore and was provided by Falconbridge Nickel Mines Limited. This material was chosen because it contains appreciable concentrations of most platinum-group metals. Approximate chemical analyses for the major constituents gave the following values: Ni-44.8%; Cu-30.2%; Fe-1.58%; S-21.6%. The recommended values for platinum, palladium, rhodium, gold and silver, and their 95% confidence limits are given in the following table:

An account of the certification of PTM-1 is given in Mines Branch Technical Bulletin TB 182, entitled "Noble Metals-Bearing Nickel-Copper Matte PTM-1: Its Characterization and Preparation for Use as a Standard Reference Material". A copy of Technical Bulletin TB 182 will be forwarded with each order of PTM-1.

RECOMMENDED VALUES AND THEIR CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN PTM-1

	Pt		Pd		Rh		Au		Ag	
	(oz/ton)	(ppm)	(oz/ton)	(ppm)	(oz/ton)	(ppm)	(oz/ton)	(ppm)	(oz/ton)	(ppm)
Recommended value	0.17	5.8	0.24	8.1	0.026	0.9	0.052	1.8	1.9	66
95 % Confidence limits										
Low	0.16	5.5	0.22	7.4	0.021	0.7	0.047	1.6	1.7	59
High	0.18	6.2	0.26	8.8	0.030	1.0	0.057	1.9	2.1	73

(ppm = µg/g)

Platiniferous Black Sand, PTA-1

The material used to prepare PTA-1 was supplied by B.H. Levelton and Associates, Vancouver. It is from the Tulameen River area of British Columbia. Careful mineralogical examination of similar material revealed the presence of at least ten minerals known to contain platinum-group elements, with an iron-bearing platinum alloy being predominant. Approximate chemical analyses for the major constituents of PTA-1 gave the following values: Fe-63.0%; SiO_2-3.6%; Al-2.9%; Ca-1.2; and Mg-0.6%.

Nine laboratories provided platinum analyses for the certification of PTA-1. A statistical evaluation of these results yielded the recommended platinum value and 95% confidence limits given in the following table:

RECOMMENDED VALUE AND THE CONFIDENCE LIMITS FOR PLATINUM IN PTA-1

	(ppm)	(troy oz/ton)
Recommended value	3.05	0.089
95 % Confidence limits		
Low	2.91	0.085
High	3.17	0.092

An account of the certification of PTA-1 is given in Mines Branch Technical Bulletin TB 138, entitled "Characterization and Preparation of Standard Reference Materials that Contain Noble Metals: (A) PTA (Ores) and (B) PTM (Nickel-Copper-Matte)". A copy of this bulletin will be provided with each order of PTA-1.

Tungsten Ores, CT-1, BH-1, and TLG-1

CT-1 is a sample of a scheelite ore obtained in 1973 from Canada Tungsten Corporation, Tungsten, N.W.T. In decreasing order of abundance, the minerals present are: pyroxene, quartz, pyrrhotite, amphibole, calcite, mica, dolomite, feldspar, scheelite, chalcopyrite, and clay minerals.

BH-1 is a sample of a wolframite ore, hand-picked in 1973 from a stockpile at the Burnt Hill deposit near Fredericton, New Brunswick, the deposit being owned by International Paper Company Limited. Minerals present in decreasing order of abundance, are quartz, biotite, chlorite, muscovite, feldspar, pyrrhotite, beryl and topaz, wolframite, cassiterite and rutile, pyrite, molybdenite, bismuth, bismuthinite and galena, and chalcopyrite.

TLG-1 is a sample of a low-grade scheelite ore from Browne's Lake Mine, Beaverhead County, Montana, and was donated by General Electric Company, Cleveland, Ohio. In decreasing order of abundance, minerals present are: quartz, calcite, hydrogarnet, amphibole, dolomite, chlorite, feldspar, mica, clay minerals, scheelite, hematite, magnetite, sphalerite and chalcopyrite.

The recommended tungsten values and their confidence limits for the three tungsten ores are:

RECOMMENDED TUNGSTEN VALUES AND THEIR CONFIDENCE LIMITS IN CT-1, BH-1 AND TLG-1 (wt %)

	CT-1	BH-1	TLG-1
Recommended value	1.04	0.42	0.083
95 % Confidence limits			
Low	1.025	0.415	0.080
High	1.058	0.430	0.087

A full account of the certification of CT-1, BH-1 and TLG-1 is given in CANMET Report 76-5 entitled "Tungsten Ores CT-1, BH-1 and TLG-1: Their Characterization and Preparation for Use as Certified Reference Materials". A copy of this report will be provided with each order of CT-1, BH-1 or TLG-1.

Uranium-Thorium Ores, DH-1, DL-1, BL-1, BL-2, BL-3, and BL-4

These materials have been prepared to replace the previous reference materials of the Canadian Uranium Producers Analytical Sub-committee, the major supply of which is now exhausted. Materials from both of the principal uranium producing areas of Canada have been selected. Two of the samples, DH-1 and DL-1, are of ore-grade and waste-grade material, respectively, from the Elliot Lake area of Ontario and contain both thorium and uranium.

Four samples designated BL-1, BL-2, BL-3, and BL-4, from the Beaverlodge area of northwestern Saskatchewan, are relatively free of thorium, are in radioactive equilibrium, and cover a range of concentrations that should make them useful as reference materials for radiometric methods of analysis. The recommended values for uranium and thorium and their 95% confidence intervals are given in the following table:

RECOMMENDED VALUES FOR URANIUM AND THORIUM AND THEIR 95% CONFIDENCE INTERVALS (wt %)

Designation	Description	Thorium, as Th	Uranium, as U
DH-1	brannerite, Elliot Lake, Ont. ore-grade material	0.104 ± 0.005	0.177 ± 0.003
DL-1	brannerite, Elliot Lake, Ont. waste rock material	ppm 83 ± 5	0.0041 ± 0.0002
BL-1	pitchblende, Beaverlodge, Sask. radiometric reference material	15 ± 1	0.022 ± 0.001
BL-2	pitchblende, Beaverlodge, Sask. radiometric reference material	(16 ± 4)*	0.453 ± 0.005
BL-3	pitchblende, Beaverlodge, Sask. radiometric reference material	(15 ± 6)*	1.02 ± 0.01
BL-4	pitchblende, Beaverlodge, Sask. radiometric reference material	(14 ± 3)*	0.173 ± 0.004

*Because of excessive variation between laboratories, these values are given for information purposes only.

A copy of CANMET Report 77-64, entitled "Radioactive Ores DH-1, DL-1, BL-1, BL-2, BL-3 and BL- 4: Certified Reference Materials" will be provided with each order of one or more of the samples.

Zinc-Copper Ore, RU-1

RU-1 was prepared in 1975 from ore of the Ruttan mine of Sherritt Gordon Mines Limited at Lynn Lake, Manitoba. It was chosen as a reference material because its relatively low zinc and high iron and sulphur contents are appreciably different from those of the other base-metal ores previously certified in the CCRMP. The following tables give the mineralogical and approximate chemical composition of RU-1.

Calculated Mineralogical Composition of RU-1 (wt %)

Minerals	Calculated Content of mineral
Pyrite	30.0
Pyrrhotite	10.0
Sphalerite	3.8
Chalcopyrite	2.5
Plagioclase	14.5
Chlorite	12.7
Amphibole	10.0
Quartz	7.0
Orthoclase	3.6
Magnetite	1.0
Goethite	1.0
Mica	1.0
Dolomite	1.0
Siderite	0.8
Calcite	0.4
Total	99.3

Approximate Chemical Composition of RU-1 (wt %)

Zn	2.24*
Cu	0.85*
Fe	24.41*
S	24.71*
Si	12.1
Al	4.3
Ca	2.8
Mg	3.3
Na	0.8
K	0.6
Mn	0.1
Ti	0.2
Ni	0.007
Cd	0.007
C	0.3
H_2O (at 950°C)	1.7
Moisture (at 105°C)	0.3
Ag	7 ppm (µg/g)
Au	0.3 ppm (µg/g)

*Recommended value (see below).

Twenty-five laboratories provided analytical results for one or more of the constituents whose recommended values and 95% confidence limits are given in the following table:

RECOMMENDED VALUES AND THEIR CONFIDENCE LIMITS FOR SELECTED ELEMENTS IN RU-1

	Zn	Cu	Fe	S
Recommended value	2.24	0.85	24.40	21.71
95 % Confidence Limits				
Low	2.22	0.85	24.34	21.49
High	2.25	0.86	24.47	21.74

A copy of CANMET Report 77-7, entitled "Zinc-Copper Ore, RU-1: Its Characterization and Preparation for Use as a Certified Reference Material", will be provided with each order of RU-1.

Zinc-Lead Tin-Silver Ore, KC-1

KC-1 was prepared from material that was hand-picked at the Kidd Creek deposit of Ecstall Mining Company Limited,Timmins, Ont., and was chosen to represent a typical high-grade base-metal ore. KC-1 also acts as a complement to the certified base-metal ore MP-1 (see p. 19), which contains lower zinc, lead and silver values but higher copper and tin values than KC-1. The mineralogical and approximate chemical composition of KC-1 are given in the following tables:

Calculated Mineralogical Composition of KC-1

Minerals		Composition (wt %)
Sphalerite	Zn - 20.4, Fe - 1.4, Cd - 0.08, Mn - 0.02 S - 10.8	32.7
Pyrite	Fe - 13.9, S - 16.0	29.9
Galena	Pb - 7.0, S - 1.1	8.1
Cassiterite	Sn - 0.7, O - 0.2	0.9
Siderite	Fe - 0.24, CO_2 - 0.15	0.4
Pyrrhotite	Fe - 0.2, S - 0.1	0.3
Chalcopyrite ...	Cu - 0.1, Fe - 0.1, S - 0.1	0.3
Silver		0.1
Tetrahedrite + stephanite		0.05
Quartz		20.6
Feldspar	K_2O - 0.1, Na_2O - 0.3 CaO - 0.4, Al_2O_3 - 1.3, SiO_2 - 2.9	5.0
Chlorite	FeO - 0.3, MgO - 0.1, Al_2O_3 - 0.15, SiO_2 - 0.25, H_2O - 0.1	0.9
Carbon		0.2
	Total	99.5

Approximate Chemical Composition of KC-1 (wt %)

O	14[a]
Si	11
Al	0.8
Fe	16
Ca	0.3
Mg	0.05
Na	0.2
K	0.1
Mn	0.05
S	28
C	0.2
Zn	20.07*
Pb	6.87*
Sn	0.67*
Cu	0.112*
Ag	0.112*
H_2O (1800°)	0.7

[a]Determined by neutron-activation analysis in the Mineral Sciences Laboratories (CANMET).
*Recommended value (see below).

Recommended values for five elements in KC-1 were assigned in 1974. However, in early 1977 it was discovered that, the overall composition of KC-1 had changed significantly by oxidation. Consequently, an interlaboratory program was undertaken to establish a new value for zinc, which in turn permitted revising the recommended values for the other four constituents by using a correction factor. The revised values are given in the table below:

It should be noted that in early 1978 all bottles of KC-1 were sealed, under nitrogen, in protective envelopes, thus the new recommended values should be valid indefinitely. Users are advised to protect their sample(s) of KC-1 from unnecessary exposure to the atmosphere and to store bottles in a dessicator.

RECOMMENDED VALUES AND CONFIDENCE LIMITS FOR SELECTED CONSTITUENTS IN KC-1 (1978)

	Zn	Pb	Sn (wt %)	Cu	Ag
Recommended value	20.07	6.87	0.67	0.112	0.112
95 % Confidence limits					
Low	20.01	6.83	0.66	0.110	0.110
High	20.14	6.91	0.68	0.114	0.113

A copy of Technical Bulletin TB 193 entitled "Zinc-Lead-Tin-Silver Ore KC-1: Its Preparation and Characterization for Use as a Certified Reference Material" and CANMET Report 78-2 entitled "Revision of Recommended Values for Reference Ores MP-1 and KC-1" will be provided with each order of KC-1.

Zinc-Tin-Copper-Lead Ore, MP-1

Reference ore MP-1 was obtained from the deposit of Brunswick Tin Mines Limited in southwestern New Brunswick in 1971. It consists of material from two sulphide veins blended with a small amount of mineralized rock. The calculated mineralogical composition and the approximate chemical composition of MP-1 are given in the following tables:

Calculated Mineralogical Composition of MP-1

Minerals		Calculated Mineralogical Composition (wt %)
Sphalerite*	ZnS - 24.0, FeS - 0.8, CdS - 0.1, InS - 0.1, MnS - 0.07	25.1
Chalcopyrite ...	Cu - 1.3, Fe - 1.2, S - 1.3	3.8
Stannite-kesterite	Cu - 0.8, Sn - 0.8, Fe - 0.2, S - 0.9	2.9
Galena	Pb - 1.9, S - 0.3	2.2
Cassiterite	Sn - 1.6, O - 0.4	2.0
Arsenopyrite ...	As - 0.8, Fe - 0.6, S - 0.3	1.7
Pyrite	Fe - 0.6, S - 0.7	1.3
Bismuth		0.03
Wolframite	WO_3 - 0.03, (FeO + MnO) - 0.01	0.04
Molybdenite	Mo - 0.01, S - 0.01	0.02
Quartz	SiO_2 - 34.7	34.7
Chlorite	SiO_2 - 1.9, Al_2O_3 - 1.7, FeO - 3.0, MgO - 0.1, H_2O - 0.3	7.0
Fluorite	Ca - 3.4, F - 3.2	6.6
Topaz	SiO_2 - 1.8, Al_2O_3 - 2.9, F - 0.9, H_2O - 0.5	6.1
Kaolinite	SiO_2 - 2.7, Al_2O_3 - 2.3, H_2O - 0.8	5.8
Feldspar	SiO_2 - 0.5, Al_2O_3 - 0.1, K_2O - 0.1, Na_2O - 0.1	0.8
Rutile	TiO_2 - 0.05	0.05
	Total	100.14

* The metals Fe, Cd, In, and Mn are incorporated in the lattice of sphalerite, but some In also occurs as the mineral roquesite.

Approximate Chemical Composition of MP-1 (wt %)

O	26.8
Si	19.4
Al	3.63
Fe	5.68
Mg	0.04
Ca	3.36
K	0.10
Na	0.01
Ti	0.07
Mn	0.05
S	11.8
H_2O at 980°	1.57
C	0.10
F	4.04
Zn	15.90*
Sn	2.43*
Cu	2.09*
Pb	1.88*
As	0.77*
In	0.069*
Bi	0.024*
Mo	0.014*
Cd	0.07
W	0.02
Total	100.5
Corrected for O in H_2O	1.4
Corrected total	99.1

*Recommended value (see below).

Recommended values for nine elements in MP-1 were assigned in 1972. However, in early 1977 it was discovered that, the overall composition of MP-1 had changed significantly through oxidation. Consequently, an interlaboratory program was undertaken to establish a new value for zinc, which in turn permitted revising recommended values for the other eight constituents using a correction factor. The revised values are given in the table which follows.

It should be noted that in early 1978 all bottles of MP-1 were sealed, under nitrogen, in protective envelopes, thus, the new recommended values should be valid indefinitely. Users are advised to protect their sample(s) from unnecessary exposure to air and to store bottles in a dessicator, preferably containing an inert gas.

(See overleaf for Recommended Values)

RECOMMENDED VALUES AND CONFIDENCE LIMITS FOR SELECTED CONSTITUENTS IN MP-1 (1978)

	Recommended value (wt %)	95% Confidence limits
Zn	15.90	15.84 - 15.96
Sn	2.43	2.32 - 2.54
Cu	2.09	2.06 - 2.12
Pb	1.88	1.85 - 1.91
Mo	0.014	0.013 - 0.015
In	0.069	0.066 - 0.072
Bi	0.024	0.022 - 0.026
As	0.77	0.75 - 0.79
Ag	57.9 (ppm)	55.7 - 60.1

A copy of Technical Bulletin TB 155 entitled "Zinc-Tin-Copper-Lead Ore, MP-1: Its Characterization and Preparation for Use as a Standard Reference Material" and CANMET Report 78-2 entitled "Revision of Recommended Values for Reference Ores Mp-1 and KC-1" will be provided with each order of MP-1.

ROCKS

Syenites, SY-2 and SY-3

SY-2 is a syenite from the Bancroft area of Eastern Ontario. At the time of its preparation in 1968, it was known that it contained minor to trace amounts of uranium, thorium, and rare earths; however, analyses subsequently showed that the concentration of these constituents was lower than desired. Therefore, to produce a material having concentrations closer to the target values, a batch of syenite from the same source as SY-2 was ground autogenously with lumps of a concentrate containing uraninite, allanite and betafite, subsequently being coded as SY-3.

SY-2 and SY-3 were prepared several years ago, but samples distributed internationally were analyzed on a casual basis only, to provide provisional values for a number of constituents. Only recently however were they analyzed in a systematic round-robin program to certify them as compositional reference materials. The recommended values for the major and minor constituents of SY-2 and SY-3 are given in the table below. An account of the certification program for SY-2 and SY-3 is given in CANMET Technical Report MSL 75-132 (TR) entitled "SY-2, SY-3 and MRG-1: A Report on the Collaborative Analysis of Three Canadian Rock Samples for Use as Certified Reference Materials". A copy of this report will be provided with each order for SY-2 and SY-3.

Gabbro, MRG-1

MRG-1 is an augite-olivine gabbro from Mount Royal at Montreal, Quebec, intruded into sedimentary rocks of the lower Paleozoic. MRG-1 is compositionally different from other certified reference rock samples and the recommended values given in the following table should be of interest to rock analysts. An account of the certification program for MRG-1 is given in CANMET Technical Report MSL 75-132 (TR) entitled "SY-2, SY-3 and MRG-1: A Report on the Collaborative Analysis of Three Canadian Rock Samples for Use as Certified Reference Materials". A copy of this report will be forwarded with each order for MRG-1.

RECOMMENDED VALUES FOR MAJOR AND MINOR CONSTITUENTS IN SY-2, SY-3 AND MRG-1

	SY-2	SY-3 wt %	MRG-1
SiO_2	60.07	59.71	39.22
Al_2O_3	12.15	11.70	8.51
Fe_2O_3	2.31	2.46	8.36
FeO	3.61	3.61	8.61
MgO	2.66	2.63	13.49
CaO	8.03	8.30	14.68
Na_2O	4.37	4.17	0.72
K_2O	4.52	4.20	0.18
H_2O	0.41	0.49	1.02
CO_2	0.49	0.36	1.04
TiO_2	0.15	0.15	3.69
ZrO_2	0.04	0.04	0.01
ThO_2	0.04	0.11	
RE_2O_3T*	0.09	0.75	0.01
Sc_2O_3			0.01
B_2O_3	0.03	0.04	
P_2O_5	0.44	0.55	0.08
V_2O_5	0.01	0.01	0.09
Nb_2O_5		0.02	0.01
F	0.47	0.66	0.03
S	0.01	0.05	0.06
Cr_2O_3			0.07
NiO			0.02
CoO			0.01
CuO			0.02
MnO	0.32	0.33	0.17
BaO	0.05	0.05	0.01
SrO	0.03	0.04	0.03
PbO	0.01	0.01	
ZnO	0.03	0.03	0.02
Li_2O	0.02	0.02	
Rb_2O	0.02	0.02	
U_3O_8	0.03	0.08	
Σ	100.41	100.59	100.20
O/F,S	0.20	0.30	0.04
Σ (corrected)	100.21	100.29	100.16
Fe_2O_3TR**	6.34	6.45	17.84
Fe_2O_3TC***	6.32	6.47	17.93

*RE_2O_3T: Total rare earth oxides.
**Fe_2O_3TR: Total iron, expressed as ferric oxide, reported as such.
***Fe_2O_3TC: Total iron, expressed as ferric oxide, calculated from FeO and Fe_2O_3.

METALS AND ALLOYS

Commercial Purity Copper Rods, SSC-1, SSC-2, SSC-3, and SSC-4

The copper rods are intended as reference materials for spectrographic purposes. They were prepared and tested for homogeneity in the Mines Branch, between 1964 and 1966; the starting materials were donated by Canadian Copper Refiners Limited, Montreal, Quebec, and Metals and Alloys Limited, Leaside, Ontario.

To dope the copper matrix, impurities in granulated form, were mixed with high-purity anode swarf, the mixture was cold-pressed into pellets one inch (25.4 mm) in diameter, and then the pellets were added to molten high-purity copper in appropriate quantites.

For certifying the copper rods, ten laboratories provided analytical results for one or more of the elements listed in the following table which gives recommended values and standard deviations.

RECOMMENDED VALUES FOR COPPER RODS SSC-1, SSC-2, SSC-3 AND SSC-4

(Concentration in ppm, µg/g)

Element	Recommended value	Std. dev.	Recommended value	Std. dev.	Recommended value	Std. dev.	Recommended value	Std. dev.
Ag	18.8	5.81	13.9	3.38	16.1	3.59	21.0	4.83
As	1.16	0.483	1.18	0.612	5.45	1.93	2.81	0.507
Bi	1.15	0.325	0.097	0.044	0.59	0.012	0.23	0.05
Cd	N.F.	—	10.0	1.05	N.F.	—	19.2	3.27
Fe	39.2	7.18	31.9	7.05	40.0	8.82	50.4	8.85
Ni	17.6	3.36	3.17	1.04	48.0	7.68	24.5	3.76
O	216	68.3	176	59.3	176	46.7	48.5	17.6
Pb	65.3	7.02	6.12	1.20	4.58	1.51	15.8	1.37
S	19.6	6.79	28.9	8.53	16.7	8.93	88.0	14.7
Sb	2.64	0.543	5.80	0.662	1.63	0.989	10.8	1.26
Se	7.28	1.61	2.58	0.821	3.87	0.744	2.87	0.79
Sn	54.9	6.70	10.0	1.93	12.0	1.68	21.4	2.60
Te	4.57	0.775	1.24	0.514	2.53	0.629	1.35	0.425
Zn	33.3	7.91	16.3	5.15	15.3	3.60	30.3	6.76
For information only								
Mn	2.18		2.75					
H	0.4		1.3					
N	5.2		7.1					

N.F. — Not Found.

1. The materials are in the form of hot-rolled rods, 12 in. x 5/6 in. dia. (300 mm x 8 mm).
2. Although some laboratories did not determine all the elements listed, the results are based on figures from a minimum of four and a maximum of eleven laboratories. The minimum number of determinations per element was seven, and the maximum fifty-one. The coefficient of variation ranged from 5.4% to 60.7%, with an overall mean of 25% at the 10 ppm (µg/g) level.

A copy of Report MRP/MSL 75-149 (TR) entitled "Commercial Purity Copper Rod SSC-1, SSC-2, SSC-3, SSC-4: Their Preparation and Certification as Certified Reference Materials" will be provided with each order of one or more of these alloys.

Phosphor Bronze Discs, 293, 304 and 477

These 60-mm x 7-mm phosphor bronze discs, weighing 160 g each, are intended as reference alloys for spectrographic purposes; they were cast and tested for homogeneity in the Mines Branch in 1962.

For each phosphor bronze, a composite of chips from 10 randomly selected discs was prepared and a 100-g sample of this material was sent to each of five participating laboratories for analysis. The recommended values for the constituents were determined mainly by chemical methods and are given in the following table:

RECOMMENDED VALUES FOR PHOSPHOR BRONZES (wt %)

	293	304	477
Cu	94.89	86.48	91.24
Sn	4.96	9.67	7.15
Fe	0.026	0.035	0.071
Pb	0.01	0.46	0.053
Zn	0.037	2.99	0.75
P	0.030	0.007	0.43
Al	—	0.05	—
Ni*	—	—	0.12

* Ni value for interest only.

A copy of Report MRP/MSL 74-148 (TR), entitled "Phosphor Bronze Discs, No. 293, 304 and 477: Their Preparation and Certification as Certified Reference Materials" will be included with each order of one or more of these materials.

MATERIALS WITH PROVISIONAL VALUES FOR SELECTED ELEMENTS

Sulphide-Bearing Ultramafic Rocks, UM-1, UM-2, and UM-4

UM-1 is a sulphide-bearing ultramafic rock from the Giant Mascot at Hope, British Columbia. UM-2 and UM-4 are similar but are from the Werner Lake-Gordon Lake district of northwestern Ontario. Although these rock samples are classified as reference materials, they are intended for a special purpose, i.e., for determination of ascorbic acid/hydrogen peroxide-soluble copper, nickel, and cobalt in ultramafic rocks. Such materials are useful in evaluating the ore potential of ultramafic rocks.

Details of the mineralogy of UM-1, UM-2, and UM-4 are given in Geological Survey of Canada Paper 71-35, entitled "Three Geochemical Standards of Sulphide-Bearing Ultramafic Rock: UM.1, UM.2 and UM.4[1]. The following table provides analyses for the major and minor elements from this paper. These values are intended for information purposes only and are not to be considered as certified values.

REFERENCE

1. Three Geochemical Standards of Sulphide-Bearing Ultramafic Rock: UM.1, UM.2, UM.4, compiled by E.M. Cameron, Geological Survey of Canada, Paper 71-35 (1972).

Approximate Chemical Composition (wt %)

Constituent	UM-1	UM-2	UM-4
SiO_2	37.6	39.2	39.35
TiO_2	0.10	0.24	0.35
Al_2O_3	1.00	7.23	8.98
Total Fe as FeO	17.2	12.95	12.8
MnO	0.16	0.08	0.15
MgO	36.05	25.45	22.5
CaO	2.34	4.68	6.27
Na_2O	0.08	0.32	0.45
K_2O	0.03	0.11	0.18
P_2O_5	0.00	0.02	0.02
H O	0.42	6.27	4.86
CO_2	0.26	0.10	0.26
S	3.53	0.94	0.44
Cr_2O_3	0.45	1.51	2.59
ZnO	0.012	0.004	0.008

G.S.C. Values for copper, nickel, and cobalt by ascorbic acid/hydrogen peroxide method (wt %)

Sample	Cu	Ni	Co
UM-1	0.41	0.83	0.029
UM-2	0.095	0.29	0.012
UM-4	0.054	0.19	0.007

See page 11 for certification of UM-1 for nickel, copper and cobalt.

MATERIALS BEING PROCESSED

The following are descriptions of materials that are being characterized and prepared for use as certified reference materials by the CCRMP as of January, 1978.

Zinc Concentrate, CZN-1; Lead Concentrate CPB-1; and Copper Concentrate CCU-1

CZN-1 and CPB-1 were donated to the CCRMP by Cominco Limited, Trail, B.C. and CCU-1 by Sherritt Gordon Mines Limited, Lynn Lake, Manitoba. The approximate chemical composition of these concentrates is as follows:

	CZN-1	CPB-1 (wt%)	CCU-1
Constituent			
Zn	45	4	3
Pb	7	65	0.1
Cu	0.1	0.3	25
Fe	11	8	31
S	30	18	36
Si	0.5	0.3	1
Ca	0.2	0.6	0.1
Mg	0.2	0.1	0.7
Al	0.1	0.2	0.1

Each concentrate has been ground to minus 74µm and blended in one lot. X-ray fluorescence and chemical analyses have shown them to be sufficiently homogeneous to be used as reference materials. The concentrates have been bottled in 200-g units and random samples distributed to laboratories throughout the world. It is anticipated they will be certified for the major metals as well as for a number of minor metals and trace elements and that they will be available in late 1978 or early 1979.

High-Grade Uranium Ore, BL-5

BL-5 is a sample of a uraninite ore from the Beaverlodge deposit in Saskatchewan; it was donated to the CCRMP by the Geological Survey of Canada. It contains the following minerals in decreasing order of abundance: plagioclase, feldspars, hematite, quartz, calcite and dolomite, chlorite, muscovite, uraninite, and pyrite. BL-5 contains approximately 7% U, 5% Fe, and 40 ppm Th.

BL-5 was ground to minus 74µm at CANMET, blended in one lot, and was found by X-ray and chemical analyses to be sufficiently homogeneous for use as a reference material. It is anticipated it will be certified for uranium and will be available by late 1978.

Canadian Soils SO-1, SO-2, SO-3, and SO-4

The Soil Research Institute, Agriculture Canada, assisted by the CCRMP, organized an international program for certifying four soil samples. The samples were obtained from the Canada Soil Survey Committee and their descriptions are: SO-1 from the C horizon of Rideau clay, a Regosolic soil; SO-2 from the B horizon of a Ferro-Humic Podzol; SO-3, calcareous glacial till parent material of the Guelph series, a gray-brown Luvisol; and SO-4, from the A horizon of a black Chernozemic soil.

Each soil sample has been ground to -200 mesh, sterilized by dry heating, and blended in a conical blender in one lot. By X-ray fluorescence analysis, the soils were found sufficiently homogeneous for bottling in 200-g units and distributed to participating laboratories. It is planned to certify the four soil samples for as many elements as possible, and in particular, for B, Cr, Mn, Co, Ni, Cu, Zn, Se, Mo, Cd, Pb and Hg.

PRICE LIST

(Shipping costs included)

ORES AND RELATED MATERIALS	Quantity (g)	Prices ($Can.)
Antimony ore, CD-1 (Sb-3.57%, As-0.66%)	200	50.00
Blast-furnace slag, SL-1 (SiO_2-35.73%, CaO-37.48, MgO-12.27, Al_2O_3-9.63, FeO-0.92, S-1.26%)	200	50.00
Copper-molybdenum ore, HV-1 (Cu-0.52%, Mo-0.058%)	200	50.00
Gold ore, MA-1 (Au-0.519 oz/ton (17.8 ppm))	200	50.00
Iron ore, SCH-1 (Fe-60.73%, Si-3.78%, Al-0.509%, Ca-0.029%, Mg-0.020%, Mn-0.777%, Ti-0.031%, S-0.007%, P-0.054%, Na-0.019%, K-0.026%)	200	50.00
Molybdenum ore, PR-1 (Mo-0.59%, Bi-0.11%, Fe-1.24%, S-0.79%)	200	50.00
Nickel-copper-cobalt ore, SU-1 (Ni-1.51%, Cu-0.87%, Co-0.063%)	100	25.00
Nickel-copper-cobalt ore, UM-1* (Ni-0.88%, Cu-0.43%, Co-0.035%)	100	25.00
Noble-metals-bearing sulphide concentrate, PTC-1 (Pt-0.09, Pd-0.37, Rh-0.02, Au-0.02, Ag-0.17 oz/ton)	200	50.00
Noble-metals-bearing copper-nickel matte, PTM-1 (Pt-0.17, Pd-0.24, Rh-0.03, Au-0.05, Ag-1.9 oz/ton)	400	100.00
Platiniferous black sand, PTA-1 (Pt-0.09 oz/ton)	400	50.00
Tungsten ores, CT-1 (W-1.04%), BH-1 (W-0.42%) and TLG-1 (W-0.083%) each	200	50.00
Uranium-thorium ore, DH-1 (U-0.177%, Th-0.104%)	200	50.00
Uranium-thorium ore, DL-1 (U-0.0041%, Th-0.0083%)	200	50.00
Uranium-thorium ore, BL-1 (U-0.022%, Th-15 ppm)	100	25.00
Uranium ore, BL-2 (U-0.453%)	100	25.00
Uranium ore, BL-3 (U-1.02%)	100	25.00
Uranium ore, BL-4 (U-0.173%)	200	50.00
Zinc-copper ore, RU-1 (Zn-2.24%, Cu-0.85%, Fe-24.44%, S-21.71%)	200	50.00
Zinc-lead-tin-copper-silver ore, KC-1 (Zn-20.07%, Pb-6.87%, Sn-0.67%, Cu-0.112%, Ag-0.112%)	200	50.00
Zinc-tin-copper-lead ore, MP-1 (Zn-15.9%, Sn-2.43%, Cu-2.09%, Pb-1.88%, Mo-0.014%, In-0.069%, Bi-0.024, As-0.77%, Ag-57.9 ppm)	200	50.00

Note - Except where otherwise indicated, contents are expressed as wt%.

* Also issued as one of a suite of ultramafic rocks, UM-1, UM-2, and UM-4 with provisional values for hydrogen peroxide/ascorbic acid-soluble Ni, Cu and Co (see p. 24).

ROCKS		
Gabbro, MRG-1	100	25.00
Syenite, SY-2	100	25.00
Syenite, SY-3 (enriched in radioactive minerals)	100	25.00
Ultramafic rock, UM-1, UM-2, UM-4 (provisional values for ascorbic acid-hydrogen peroxide soluble Cu, Ni, and Co), each	100	25.00
METALS AND ALLOYS		
Commercial purity copper rods, SSC-1-4 (300 mm x 7.9 mm)	Set of four	160.00
Phosphor-bronze discs (57 mm x 9.5 mm) (Sn-5, 7 and 10% nominal)	Set of three	60.00

PURCHASE PROCEDURE

Purchase orders for reference materials should be addressed to:

Coordinator
Canadian Certified Reference Materials Project
C/O Mineral Sciences Laboratories, CANMET
Canada Centre for Mineral and Energy Technology
555 Booth Street
Ottawa, Ontario Canada
K1A 0G1
Phone: (613) 995-4738 or 995-4325
Telex: 053-3395

Prices are subject to revision; when possible, customers will be notified of such change before orders are dispatched. No discounts are given on purchase of reference materials. All shipping and insurance charges are prepaid; such charges are not added to invoice.

Payment is expected within 30 days of receipt of invoice. Payment on foreign orders can be made by:
- banker's draft against a Canadian bank,
- bank to bank transfer to a Canadian bank,
- letter of credit on a Canadian bank,
- International Money Order, or
  UNESCO coupons.

Cheques, drafts, etc., are payable to : Receiver General for Canada (re: Canadian Certified Reference Materials Project). Certificate of Origin service requires 6 to 8 weeks and is furnished only to those requesting it.

Only the documents listed below will be furnished:
- Commercial Invoices,
- Packing List,
- Postal receipt for material shipped by International Air Parcel Post,
- Airway Bill.

Shipments in Canada will be made by first class mail; those to North and South America and overseas by Air Parcel Post.