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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

MINERAL REPORT

Results of Analyses of Standard and Blank Samples Tested At Selected Assay Laboratories In North America

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Introduction

The Bureau of Land Management (BLM) administers the Public Lands of the United States. Authority to administer is delegated by the Secretary of the Department of the Interior. The BLM also administers mineral actions under various United States Mining laws (30 USC 22, et seq), Mineral Leasing laws (30 USC 181) and Material Sales laws (30 USC 601).

Because of documented Public Land administration problems caused by inaccurate or nonreproducible precious metal assays, BLM's Washington Office assigned the National Training Center in Phoenix to develop and implement a scientific survey of assay laboratory results. The project was undertaken by Geologists Matthew W. Shumaker and Burrett W. Clay.

Shumaker and Clay designed and commenced the laboratory survey in late 1999. The majority of the samples had been submitted by May, 2002, and most results were received by the end of July, 2002.

This report, including the results in Attachment 6, are intended for the use of Bureau of Land Management personnel in evaluating laboratory results submitted to them, and for reference in selecting laboratories to analyze samples. Any other use of this report or the information herein is beyond the original scope and objectives of the project. For the purposes of this report, we made no attempt to determine the reasons one or another laboratory may have reported acceptable, unacceptable or marginal results. A statistical analysis of results from laboratories is beyond the scope and objectives of this project, and is not a part of this report.

This report copy is complete only if it contains the one page cover sheet, all nine printed pages of text, Attachments 1 through 4 of one printed page each, Attachment 5 of two pages, and Attachment 6 containing eighteen printed pages.

II. Assays Generally

Black's Law Dictionary (1979) defines an assay as:

> The proof or trial, by chemical experiments, of the purity or the fineness of metals; particularly of the precious metals, gold and silver. Examination as to characteristics (as weight, measure, or quality). (Citations omitted.)

The definition in *Black's* is often quoted but not necessarily complete or applicable. It best describes purity testing of bullion or dore'[1]. The *Black's* definition is not a useful one to describe what is done

[1] Thrush (1996) defines "dore'" in a fire assaying context as "Gold and silver bullion which remains in a cupelling furnace after the lead has been oxidized and skimmed off." When the dore' results from a fire assay, it will normally also contain platinum group metals, but only if they were present in the material assayed. The term dore' also applies to gold and silver, prior to refining, which is derived from a mine's

when a mineral examiner or a related professional submits a sample of earth material or concentrates to an assay laboratory to determine what elements or compounds of economic interest it contains.

The Dictionary of Mining, Minerals and Related Terms (Thrush, 1996) provides a definition for assay that is more applicable to work undertaken in mining claim examinations and related work:

> a. To analyze the proportion of metals in an ore; to test an ore or mineral for composition, purity, weight, or other properties of commercial interest.
> b. The test or analysis itself; its results.

The Center for Advanced Mineral and Metallurgical Processing (CAMP, 2000), at Montana Tech, in Butte, provides a succinct and useful definition:

> Assaying is generally defined as the quantitative determination of the metals in ores and furnace products.

Assay definitions may appear to imply that only ores are assayed, as opposed to samples of rock. The term *ore* possesses an economic meaning. An *ore* is a rock or mineral that can be mined, processed and sold at a profit under current technological and economic conditions. Tens of thousands of samples of rocks and other mineral matter are submitted to assay laboratories annually. Only a fraction of them turn out to be *ore*.

The terms "assay" and "analysis" are used almost interchangeably in the minerals industry and in governmental agencies with responsibility for mineral resources. Both terms describe a chemical or pyrochemical protocol used to quantitatively determine the concentration of certain elements or chemical compounds of interest in samples of rock or other materials. There are numerous proven, conventional methods of performing assays, including fire assay (FA), neutron activation (NA), several methods of induction coupled plasma arc spectrometry (ICP), and atomic absorption spectrophotometry (AA)[2].

An acceptable assay or analysis by any method must be undertaken in a scientifically accepted manner in a laboratory free of contamination. It must be repeatable within standard laboratory parameters. The elements or chemical compounds measured may include a wide spectrum of potentially valuable commodities, such as calcium carbonate, magnesium oxide, gold, silver or platinum.

(footnote 1, continued) precious metal recovery facility. In that context, the dore' may also contain residual zinc from the recovery process (such as Merrill-Crowe), as well as other precious metals, and sometimes, copper.

[2] A complete listing of assay and analysis methods, with a description of how they work, is beyond the scope of this report. A good place to start when researching assay methods is U.S. Geological Survey Bulletin 1445 (1977), *A Manual on Fire Assaying and Determination of the Noble Metals in Geological Materials*.

As illustrated by the definition in Thrush (1996), there is no rigid differentiation between an assay and an analysis. Tests for industrial minerals and some non-precious metals, are often referred to as analyses, or chemical analyses. When undertaken properly, a chemical analysis is comparable in precision to an assay. Within the mineral industry in the United States, the word "assay" is most often applied to describe the protocol of a physical and chemical process that determines, using precise methodology, the concentration of the precious metals in a sample. The sample thus assayed may consist of material from an interesting prospect, of material believed to be ore, of slag, of material thought to be mine waste, or of simple earth material. The written result is usually called an "assay sheet" or "report of assay." In informal usage, the written result is often called simply an "assay." Throughout this report, the terms *analysis* and *assay* are used interchangeably, except where differentiation is necessary.

III Survey of Assay Laboratories

Standards and Blanks Used

Various sources in Australia, Canada, the United States and elsewhere prepare and sell standard or certified reference materials of known metal content. Hereinafter referred to as "standards," they consist of ore that has been finely ground and thoroughly homogenized. The homogenized standards are repeatedly assayed by a number of different laboratories. The results are statistically analyzed so that a mean result can be determined, and the expected laboratory deviation reflecting high confidence can be developed.

In North America, standards are readily available from CANMET, a division of Natural Resources Canada, and from the Nevada Bureau of Mines and Geology (NBMG), both governmental agencies. CANMET refers to their standards as "certified reference materials." NBMG refers to their standards as "standard reference materials." The CANMET and NBMG standards are both derived from bulk samples of ores from known mines that have been crushed, pulverized, and extensively homogenized. CANMET and NBMG standards are all analyzed in a "round robin" analysis program through which numerous laboratories perform replicate analyses of each sample. Both CANMET and NBMG standards are of very high quality. NBMG's standard reference materials tend to be less expensive, and are derived from mines in the United States. Standards from NBMG are readily available for sale to anyone at a reasonable price. A description of how NBMG's standard reference materials are prepared is included in this report as Attachment 5.

We selected three standards produced by the Nevada Bureau of Mines and Geology (NBMG) for this project.

NBMG Standard Reference Material 4b. This standard consists of pulverized and homogenized gold ore from the Mesquite mine in southeastern California (Attachment 1).

NBMG Standard Reference Material 2b. This standard consists of pulverized and homogenized gold ore from the Jerritt Canyon Mine, in Nevada (Attachment 2).

NBMG Standard Reference Material 6b. This standard consists of pulverized and homogenized platinum and palladium ore from the J-M Reef, at the Stillwater Mine in Montana (Attachment 3).

A blank sample contains no precious metals. Some blanks derived from natural sources may contain insignificant, minuscule concentrations of precious metals at or below their average crustal abundance. If a laboratory reported precious metal concentrations above crustal abundance in blanks, all their reported results would be suspect. Selection of a blank is not as simple as it might first appear. A traditionally used blank consists of silica sand, which could be purchased at a hardware store. Silica sand is becoming less widely available due to health and safety concerns about airborne silica. Silica sand consists almost exclusively of quartz, with minuscule amounts of other minerals. It has a very bright, white color that is unlike virtually all ore materials. When pulverized to the size range of the standards that we selected, silica sand maintains a distinctive white "powdered sugar" appearance, and is an obvious blank. Silica sand was not appropriate for this project for that reason.

The standards that we selected ranged from a buff to a dark gray color, so it was necessary for us to develop a blank that was not obviously silica sand, and that at least superficially resembled one or more of the standards.

The blank that we used contains more than one mineral, unlike silica sand, so we termed it a "complex blank." We developed that term on the basis of the definition of a "complex ore"[3] as being an ore that contains several metals (Thrush, 1996). Its tan color resembles common mineral matter of interest in many examinations because it contains many dark accessory minerals common to most felsic igneous rocks. It consists of landscaping material derived from the front yard of the personal residence of one of the authors of this report. Our complex blank has been analyzed by seven reputable laboratories that are recognized by the mining industry. Their analyses (Attachment 4) showed that the complex blank contained no gold, silver, or platinum group metals above average crustal abundance (Weast, 1973). Our complex blank also has the advantage of being readily available at no cost to the government.

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[3] As illustrated in Thrush (1996), the term "complex ore" has an imprecise meaning. The most useful definitions of "complex ore" are (1), "An ore containing several metals," and (2), "Ores named for two or more valuable metals, such as lead-zinc ores, gold-silver ores, etc." In metallurgical terms, "complex ore" can also denote ores that may be difficult or costly to treat because of the presence of deleterious materials, such as antimony or arsenic. The term "complex ore" has been extensively *misused* to describe what are actually common earth materials, which are barren of precious metals, that will reportedly show precious metal values only when they are "assayed" using unconventional methods, or only when the "assays" are performed by certain laboratories.

Survey Methodology

Once we had selected standards and blanks, we sent suites of samples to North American laboratories that would perform assays for the general public for money. We selected laboratories through their advertising in print and on the Internet, plus referrals and references to them in print, on the Internet, and through professional contacts. Some laboratories were selected because they have previously provided assay results used in matters pertaining to the public lands. We tested 65 laboratories, mostly in the United States, and several in Canada. We did not test *all* laboratories.

We utilized one blank and three samples of known content. Where possible, we sent each laboratory six samples, each differently numbered. These included two duplicate samples of the blank, and two duplicate samples of NBMG Standard Reference Material 6b. We sent duplicates because it is also important to determine if a laboratory can repeat results. If a laboratory's results cannot be repeated, all of their results may be suspect.

In some cases, we sent fewer than six samples to a laboratory due to their high assay cost. We sent more than one suite of the same samples to some laboratories. In a few cases, partial suites of blanks and standards for this project were included in the series of samples sent for one or more concurrent validity examinations. In all cases, Shumaker and/or Clay physically prepared and packed the samples. In some cases, other qualified personnel sent samples that we had prepared to various laboratories on our behalf. To maintain the chain of custody in those cases, we provided samples that we had previously sealed, plus specific handling and shipping instructions to the person sending the samples.

Each sample within each suite normally contained between 60 and 100 grams of material. Since a standard fire assay uses about 30 grams, we believed that would be a sufficient amount. At some laboratories, their gold and silver assays are done on a separate split from those analyzed for platinum and palladium. Most laboratories using conventional assaying methods publish catalogs of available assay services. Most of those catalogs specify the minimum amount of material that they will need when several metals are to be analyzed. Those requirements did not exceed 90 grams.

Where there was no published catalog, we asked how much sample was needed. A few laboratories asked for "a coffee can full" or "several pounds." Because a 300 gram jar of each NBMG standard cost about $50, we were reluctant to send very large samples. Where unusually large samples were requested, we sent 90 to 120 grams. No laboratory asked for more sample material.

In our experience, most relatively large laboratories assay numerous samples daily. Each sample is typically assigned a working number for use in the laboratory, which bears no connection to the sample number provided by the client until the final assay report is produced. Laboratory technicians at larger competent laboratories generally do not know--or care--who submitted a particular sample. They would know the sample only by its working number. Because of the large number of samples that they analyze, those laboratories would simply report what they found.

Many smaller laboratories are operated by only one or two people. Their situation can be different, where smaller numbers of samples are handled only by the proprietor or an assistant. Detection of platinum in samples submitted by the general public could surprise a small, but competent laboratory. (Discovering that a sample actually contains platinum or palladium above crustal abundance levels is, indeed, a rare occurrence.) In such cases, the lab could run a replicate assay on whatever volume of sample was left from the initial work. This would be intended to rule out laboratory error or contamination in their laboratory. We provided enough sample material for a laboratory to conduct one or two replicate assays. We did not provide enough sample material for laboratories to do so extensively, as explained above. The surprising presence of platinum was specifically mentioned by a few small laboratories. These included Mineral Research Laboratory in Monrovia, California, Mineral Assay office in Mina, Nevada, Mother Lode Assaying in Foresthill, California, and Cone Geochemical in Denver. ACTLabs/Skyline, a medium sized laboratory in Tucson, also noted the presence of platinum.

Where a laboratory published a catalog of services, we normally selected a "package" assay that included gold, platinum, and palladium. In some cases, a silver assay cost extra. In many cases, the package assay consisted of a fire assay (FA) preconcentration followed by an Induction Coupled Plasma Arc (ICP) finish. In other cases, the laboratory would not specify the method that was used, or they asserted a proprietary method that was undefined or unexplained. A few laboratories provided results for rhodium, osmium, rhenium, ruthenium, and the rare earth elements at no extra cost. Laboratories employing conventional assay methods that are accepted by the mainstream mining industry did not do so.

Many laboratories offer assay and analysis packages at various levels of precision, with lower detection limits that can quantify minuscule, crustal abundance levels of metals. Assays using such low detection limits tend to cost more, and are usually described in the laboratory's catalog of services. We did not normally choose the quantitative method with the lowest detection limits where more than one method was offered. Based on our experience, we instead selected the quantitative method that would most likely be used in exploration or deposit delineation. In a few cases, notably Bondar-Clegg and Acme, the most cost-effective platinum and gold package was also very precise. We did not knowingly select *qualitative* methods, although some assay reports appeared to list qualitative numbers. Where no catalog was published or where there was no choice of method, we accepted what the laboratory offered. In those cases, the laboratory rarely provided detection limits or information on the method's precision.

Each laboratory received samples that we had assigned alphanumeric designators. We used numerous different designators which did not indicate the actual origin of the samples. The alphanumeric designators were designed so that we could keep track of the origin of each sample, regardless of how complex any designator appeared. In the results portrayed in Attachment 6, only the origin of the sample is shown. We submitted samples, and paid for their analysis, in a manner that assured that the results reported would be the same as would be reported to any member of the public.

Interpreting Results

All assay results herein are reported in Troy ounces per ton. Where we received results in parts per million (ppm) or parts per billion (ppb), we mathematically converted those results to Troy ounces per ton. Where the assay costs are shown, those costs are in United States Dollars unless otherwise indicated.

Several laboratories were surprisingly slow in producing results. We have not yet received results from some laboratories. Other laboratories ceased operations and disappeared after receiving the sample suites. The results tabulated in Attachment 6 represent what we have received as of the date of this report.

Because of the differing methods used by each laboratory, and the wide disparity in precious metal concentrations reported, we did not analyze the results statistically. Had we done so, any such analysis involving all the results would have been of limited value. **The best way to evaluate results for each element from each laboratory would be to compare that laboratory's results only to the range of recommended values[4] reported by NBMG for each standard** (see Attachments 1 through 4), and to compare the analyses of the duplicate samples to one another within each laboratory's report. Results from laboratories should not be compared against results from other laboratories, only to the recommended values provided by the NBMG. The ranges of recommended values are as follows:

Standard Reference Material NBM-4b, Mesquite mine, California, in troy ounces per ton				
Element	Recommended Value		Lower Value	Upper Value
Gold (Au)	0.012	+/- 0.002	0.010	0.014
Silver (Ag)	0.03	+/- 0.04	0.0	0.07

Standard Reference Material NBM-2b, Jerritt Canyon Mine, Nevada in troy ounces per ton				
Element	Recommended Value		Lower Value	Upper Value
Gold (Au)	0.228	+/- 0.008	0.220	0.236
Silver (Ag)	0.02	+/- 0.03	0.0	0.05

4 "Recommended Value" is the term used by NBMG to indicate the mean precious metal concentrations resulting from their multiple assays of the standard. Results of competently done assays using methods of comparable precision should be very close to that number.

Standard Reference Material NBM-6b, JM Reef, Stillwater Mine, MT, in troy ounces per ton				
Element	Recommended Value		Lower Value	Upper Value
Gold (Au)	0.023	+/- 0.003	0.020	0.026
Platinum (Pt)	0.352	+/- 0.083	0.269	0.435
Palladium (Pd)	1.13	+/- 0.136	0.994	1.266

Attachment 6 lists the name and location of each laboratory tested, with results of the tests. Relatively larger laboratories typically employ many people. Smaller laboratories typically involve only the proprietor or the proprietor and a technician. In the case of small laboratories, we listed the name of the lab technician or proprietor, or both, when that information was available. That information can be important, because some proprietors have been known to go out of business under one laboratory name, and reappear later under a different laboratory name.

Depending on the analysis methods used, some of the platinum and palladium in NBMG Standard Reference Material 6b could be reported as silver and/or gold. That result would be most likely where a lead collector fire assay is performed, after which the results are determined gravimetrically. The potential for error is compounded due to the high grade of the Stillwater ore that we used[5]. The problem will generally not occur with more precise methods, such as where the fire assay is used as preconcentration, followed by an ICP analysis of the prill or bead. When analyzing samples which contain significant amounts of platinum group elements other than gold and silver, proper assay techniques need to be utilized which will address this issue (Lewis, Pers. Comm. 2002)[6]. These techniques are described in Bugbee (1940, pages 131-2). When platinum is actually present, it will almost always cause a discolored bead or prill, and discolor the parting acid when present in large relative concentrations, such as in NBMG standard reference material 6b. Palladium will cause a discolored nitric acid parting solution. Both effects should be evident to the assayer, and should be noted on the assay report. Whatever methods are used, the assay must be performed correctly, otherwise the result will be wrong.

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[5] NBMG now offers a lower grade platinum and palladium standard reference material, which was not available when we began the project.

[6] If platinum and palladium are actually present, gold, platinum, and palladium need to each be specifically determined--usually instrumentally, and then the silver can be determined by difference.

If gold and silver are both being determined gravimetrically, then some of the platinum will report as gold and some as silver since it is partially soluable in nitric acid, and the palladium will report as silver. (Palladium is soluble in nitric acid, while platinum is partially soluble). An excellent discussion of the ramifications can be found in Bugbee (1940 pages 131-2).

If the Au is being determined by an instrumental finish (and silver gravimetrically by difference), but platinum and palladium are not being analyzed, then the gold result should be correct, but the silver will be high by the amount of platinum and palladium present.

Results significantly different from the expected values (Attachments 1 - 4) may be due to contamination, poor technique, incorrect application of an otherwise proper technique, errors, incompetence, or fraud. In some cases, where unexpected results are provided by a laboratory, the cause may have been an internal calculation error that is easily corrected. Customers who send samples to a laboratory for analysis expect that the results will be right the first time. We did not contact any laboratory for clarification or correction when the results they produced fell outside the expected range of results.

IV. Selected References

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Standard Reference Material NBM-4b

(Mesquite Mine, California low grade ore)

Accepted fire-assayable gold and silver values based on mean results from 14 separate laboratories. Data are in troy ounces/short ton and parts per million by weight; precision figures are for 95% confidence. Each laboratory assayed 3 splits in triplicate (9 determinations) resulting in 126 assays. This material is nominally >95% -200 mesh:

Gold (Au) = 0.012 +/- 0.002 oz/ton (0.41 +/- 0.07 ppm)

Silver (Ag) = 0.03 +/- 0.04 oz/ton (1.0 +/- 1.4 ppm)

For questions or comments contact:

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Attachment 1

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STANDARD REFERENCE MATERIAL NBM-2b

(Jerritt Canyon, Nevada carbonaceous Au, Ag ore)

Accepted gold and silver values are based on mean results from 13 separate laboratories. Data are in troy ounces/short ton and parts per million by weight; precision figures are for 95% confidence. Each laboratory (with few exceptions) assayed three splits in triplicate (9 determinations) resulting in n = 50-55 for this SRM. This material is nominally >95% -200 mesh:

Gold (Au) = 0.228 ± 0.008 oz/ton (7.81 ± 0.27 ppm)

Silver (Ag) = 0.02 ± 0.03 oz/ton (0.68 ± 1.03 ppm)

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Attachment 2

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Standard Reference Material NBM-6b

(Stillwater Mine, Montana J-M Reef ore)

Accepted gold, platinum, and palladium values based on mean results from 8 to 11 separate laboratories (depending on element). Data are in troy ounces/short ton and parts per million by weight; precision figures are for 95% confidence. Each laboratory (with few exceptions) assayed 3 splits in triplicate (9 determinations) resulting in n = 70 to 100 for this SRM. This material is nominally >95% -200 mesh:

Gold (Au) = 0.023 ± 0.003 oz/ton (0.793 ± 0.091 ppm)

Platinum (Pt) = 0.352 ± 0.083 oz/ton (12.1 ± 2.85 ppm)

Palladium (Pd) = 1.13 ± 0.136 oz/ton (38.6 ± 4.66 ppm)

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Attachment 3

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
National Training Center
9828 North 31st Avenue
Phoenix, AZ 85051

In reply refer to:

3800

May 29, 2001

Complex Blank Reference Material

(Maricopa County, Arizona, residential yard landscape material)

The values listed below are the result of replicated analyses by laboratories denoted below. Data are in troy ounces per ton, where above lower detection limits.

XX indicates below lower detection limits. NT denotes element was not analyzed.

Au	Ag	Pt	Pd	Rh	Ir	Ru	Os	Lab
XX	XX	XX	XX	XX	XX	XX	XX	Legend[1]
XX	XX	XX	XX	XX	XX	XX	XX	Chemex (two separate submissions at different dates)
0.00015	XX	XX	XX	XX	XX	XX	XX	Bondar-Clegg[2]
XX	NT	XX	NT	NT	NT	NT	NT	Alfred H. Knight
XX	XX	XX	XX	NT	NT	NT	NT	Florin Analytical Services[3]
XX	XX	XX	XX	NT	NT	NT	NT	Inspectorate – Rocky Mountain Geochemical, Sparks, NV[3]
XX	XX	XX	XX	XX	XX	XX	XX	Nevada Bureau of Mines & Geology

Notes:
1. Legend ceased performing assays and analyses in September, 1999. They performed four replicate analyses of this material at different times under different sample numbers.
2. Bondar-Clegg's method had a lower detection limit of 1 ppb (part per billion) or 0.00003 troy ounces per ton. The result reported for gold is within the expected average crustal abundance for that element.
3. Submitted together as blind duplicates with different identifying numbers.

Attachment 4

nbmg NEVADA GEOLOGY

Quarterly Newsletter of the Nevada Bureau of Mines and Geology

The NBMG Standard Reference Material Project

Spring 1991

The Nevada Bureau of Mines and Geology provides inexpensive standard reference materials (SRMs) for precious-metal assays. In addition to producing quality assurance standards for geochemical laboratories, this project is designed to assess the quality of data generated by specific laboratories and to determine the variation in analytical results among laboratories. The SRMs produced by this project are priced significantly lower than the typical prices for SRMs, encouraging greater use of SRMs for quality assurance in precious-metal assays.

At present, six mines have supplied bulk samples for this project: the Mesquite (metamorphic-hosted) mine in California; the Paradise Peak (andesite-hosted), the Jerritt Canyon (carbonaceous limestone-hosted), the Round Mountain (rhyolite-hosted), and the Boss (carbonate-hosted) mines in Nevada; and the Stillwater (mafic-hosted) mine in Montana. At most of these mines, three bulk samples are taken: high-grade ore, low-grade ore, and unmineralized host rock.

All bulk samples are pulverized, ball-milled for 24 hours, and blended in a cement mixer at the NBMG laboratory. The resulting samples are 98% -200 mesh and are homogeneous, as indicated by repeated fire assays at the NBMG laboratory. Fifteen geochemical laboratories are analyzing splits of each of these samples for gold and silver. Boss and Stillwater samples are also being analyzed for platinum-group elements.

Analyses have been completed for five SRMs from Paradise Peak and Jerritt Canyon; these are now ready to use. SRMs from the remaining four mines are expected to become available during 1991. Results of fire assays of the five currently available SRMs can be summarized as follows:

SRM	Gold content			Silver content		
No.	Mean	Std. dev.	Median	Mean	Std. dev.	Median
	Paradise Peak (andesite-hosted)					
NBM-1a	9.8 ppb	--	5.0 ppb	575 ppb	--	400 ppb
NBM-1b	0.046	0.003	0.045	0.41	0.09	0.40
NBM-Ic	0.464	0.016	0.468	5.79	0.54	5.80
	Jerritt Canyon (carbonaceous limestone-hosted)					
NBM-2a	9.6 ppb	--	5.0 ppb	270 ppb	--	200 ppb
NBM-2b	0.228	0.010	0.228	0.02	--	0.01

All values are in troy ounces per short ton except where noted. The gold and silver contents of the two

Attachment 5-1

unmineralized samples (NBM-la and NBM-2a) are below the detection limits of several participating laboratories. The silver content of the ore sample from Jerritt Canyon is also close to detection limits of most laboratories. Standard deviations are not given for the unmineralized samples and the silver content of NBM-2b because their distribution curves are rather badly skewed due to truncation at the detection limits, and standard deviation is meaningless as an estimator of confidence limits when the distribution is not approximately normal. In these three cases the median is a more useful statistic than the mean because the means were calculated from detectable values only.

The distributions of the gold and silver measurements by the participating laboratories for the ore-grade SRMs are shown in the histograms on the next page. Distributions of gold values appear more tightly constrained than the silver values. This is probably a reflection of the poorer analytical precision for silver than a description of the homogeneity of silver in the SRMs.

These SRMs can be purchased in 30-gram bags and 300-gram bottles at the sales office (room 310 in the Scrugham Engineering-Mines Building on the University of Nevada, Reno campus), by mail (Nevada Bureau of Mines and Geology/178, University of Nevada, Reno, NV 89557-0088), by FAX (702-784-1709), or by telephone (702-784-6691). Mail orders must either be prepaid by check or money order made out to "Board of Regents," or charged to a MasterCard or VISA credit card. Telephone and FAX orders must be charged to MasterCard or VISA. When ordering by mail or FAX with a credit card, please include card number and expiration date. Each 300-gram bottle is US$50.00 + $5.00 shipping ($8.00 international) and each 30-gram bag is US$7.00 + $1.00 shipping ($3.00 international).

This project would not have been possible without the help and cooperation of the mine operators that contributed bulk ore samples and the geochemical laboratories that analyzed the blended materials. We appreciate the assistance of the following: American Assay Laboratories, Barringer Laboratories, Bondar-Clegg Inc., Chemex Laboratories Ltd., Cone Geochemical Inc., FMC Gold Company, Geochemical Services Inc., Goldfields Operating Company, Independence Mining Company, Legend Metallurgical Laboratory Inc., Mineral Processing and Environmental Laboratories Inc., Rocky Mountain Geo- chemical of Nevada, Round Mountain Gold Corporation, Skyline Laboratories Inc., Stillwater Mining Company, U.S. Bureau of Mines, and U.S. Geological Survey.

---Paul J. Lechler, Chief Chemist/Geochemist, and Mario O. Desilets, Assistant Chemist

Attachment 5-2