ORE RESEARCH & EXPLORATION P/L ABN 28 006 859 856
37A Hosie Street · Bayswater North · VIC 3153 · AUSTRALIA
61 3 9729 0333 Fax 61 3 9729 8338
info@ore.com.au www.ore.com.au

OREAS
Certified Reference Materials

## CERTIFICATE OF ANALYSIS FOR

# LOW LEVEL GOLD OXIDE
# CERTIFIED REFERENCE MATERIAL
# OREAS H1

**Table 1. Certified Values, SD's, 95% Confidence and Tolerance Limits for OREAS H1.**

| Constituent | Certified Value | 1SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Fire Assay** | | | | | | |
| Au, Gold (ppb) | 12 | 1 | 11 | 12 | IND | IND |
| **Aqua Regia Digestion** | | | | | | |
| Ag, Silver (ppm) | 0.906 | 0.087 | 0.865 | 0.947 | 0.878 | 0.934 |
| Al, Aluminium (wt.%) | 2.03 | 0.35 | 1.82 | 2.23 | 1.95 | 2.11 |
| As, Arsenic (ppm) | 1.90 | 0.24 | 1.76 | 2.05 | 1.62 | 2.18 |
| Au, Gold (ppb) | 12 | 1 | 12 | 13 | IND | IND |
| B, Boron (ppm) | < 10 | IND | IND | IND | IND | IND |
| Ba, Barium (ppm) | 50 | 3.9 | 48 | 52 | 49 | 52 |
| Be, Beryllium (ppm) | < 0.5 | IND | IND | IND | IND | IND |
| Bi, Bismuth (ppm) | 5.67 | 0.361 | 5.47 | 5.87 | 5.52 | 5.81 |
| Ca, Calcium (ppm) | 134 | 42 | 115 | 153 | 127 | 142 |
| Cd, Cadmium (ppm) | 0.84 | 0.068 | 0.80 | 0.87 | 0.81 | 0.86 |
| Ce, Cerium (ppm) | 47.1 | 5.6 | 43.4 | 50.7 | 45.7 | 48.4 |
| Co, Cobalt (ppm) | 2.36 | 0.48 | 2.14 | 2.59 | 2.22 | 2.51 |
| Cr, Chromium (ppm) | 21.4 | 1.31 | 20.7 | 22.1 | 20.3 | 22.5 |
| Cs, Cesium (ppm) | 0.54 | 0.07 | 0.49 | 0.58 | 0.51 | 0.56 |
| Cu, Copper (ppm) | 28.0 | 1.48 | 27.3 | 28.7 | 26.9 | 29.0 |
| Fe, Iron (ppm) | 2883 | 329 | 2721 | 3045 | 2768 | 2998 |
| Ga, Gallium (ppm) | 10.8 | 2.0 | 9.7 | 11.9 | 10.3 | 11.3 |
| Ge, Germanium (ppm) | < 0.2 | IND | IND | IND | IND | IND |
| Hf, Hafnium (ppm) | 1.81 | 0.34 | 1.57 | 2.05 | 1.72 | 1.90 |
| Hg, Mercury (ppm) | 0.14 | 0.02 | 0.12 | 0.16 | IND | IND |
| In, Indium (ppm) | < 0.05 | IND | IND | IND | IND | IND |
| K, Potassium (ppm) | 416 | 59 | 388 | 444 | 397 | 435 |

Please note: intervals may appear asymmetric due to rounding.

**Table 1 continued.**

| Constituent | Certified Value | 1SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Aqua Regia Digestion continued** | | | | | | |
| La, Lanthanum (ppm) | 25.9 | 4.9 | 23.5 | 28.2 | 24.9 | 26.9 |
| Li, Lithium (ppm) | < 3 | IND | IND | IND | IND | IND |
| Lu, Lutetium (ppm) | 0.050 | 0.005 | 0.045 | 0.056 | IND | IND |
| Mg, Magnesium (ppm) | 657 | 54.8 | 634 | 680 | 627 | 687 |
| Mo, Molybdenum (ppm) | 4.24 | 0.83 | 3.80 | 4.68 | 4.04 | 4.44 |
| Na, Sodium (ppm) | 1331 | 69.5 | 1298 | 1364 | 1302 | 1360 |
| Nb, Niobium (ppm) | < 0.2 | IND | IND | IND | IND | IND |
| Nd, Neodymium (ppm) | 17.2 | 2.7 | 13.4 | 20.9 | 16.3 | 18.0 |
| Ni, Nickel (ppm) | 10.6 | 0.68 | 10.3 | 11.0 | 10.2 | 11.1 |
| P, Phosphorus (ppm) | 51 | 12 | 45 | 57 | 44 | 57 |
| Pb, Lead (ppm) | 17.0 | 3.0 | 15.5 | 18.5 | 16.2 | 17.8 |
| Rb, Rubidium (ppm) | 5.85 | 1.00 | 5.19 | 6.50 | 5.62 | 6.08 |
| Re, Rhenium (ppm) | < 0.05 | IND | IND | IND | IND | IND |
| S, Sulphur (ppm) | 197 | 8.7 | 193 | 202 | 185 | 210 |
| Sb, Antimony (ppm) | 3.24 | 0.56 | 2.92 | 3.56 | 3.15 | 3.32 |
| Sc, Scandium (ppm) | 2.11 | 0.47 | 1.86 | 2.36 | 1.96 | 2.26 |
| Se, Selenium (ppm) | 2.05 | 0.51 | 1.72 | 2.39 | IND | IND |
| Sm, Samarium (ppm) | 2.69 | 0.47 | 2.05 | 3.32 | 2.50 | 2.87 |
| Sn, Tin (ppm) | 6.45 | 0.483 | 6.15 | 6.74 | 6.23 | 6.66 |
| Sr, Strontium (ppm) | 5.64 | 1.11 | 4.99 | 6.29 | 5.38 | 5.90 |
| Ta, Tantalum (ppm) | < 0.05 | IND | IND | IND | IND | IND |
| Tb, Terbium (ppm) | 0.21 | 0.03 | 0.18 | 0.24 | 0.19 | 0.22 |
| Te, Tellurium (ppm) | 2.90 | 0.43 | 2.62 | 3.19 | 2.76 | 3.05 |
| Th, Thorium (ppm) | 20.0 | 1.34 | 19.3 | 20.6 | 19.4 | 20.6 |
| Tl, Thallium (ppm) | 0.049 | 0.009 | 0.044 | 0.055 | IND | IND |
| U, Uranium (ppm) | 2.75 | 0.172 | 2.63 | 2.86 | 2.67 | 2.82 |
| V, Vanadium (ppm) | 25.3 | 2.09 | 24.2 | 26.4 | 24.4 | 26.1 |
| W, Tungsten (ppm) | < 0.1 | IND | IND | IND | IND | IND |
| Y, Yttrium (ppm) | 4.66 | 0.79 | 4.20 | 5.13 | 4.53 | 4.80 |
| Yb, Ytterbium (ppm) | 0.32 | 0.05 | 0.29 | 0.36 | 0.30 | 0.35 |
| Zn, Zinc (ppm) | 4.54 | 1.43 | 3.87 | 5.22 | IND | IND |
| Zr, Zirconium (ppm) | 74 | 12 | 67 | 81 | 71 | 77 |

Please note: intervals may appear asymmetric due to rounding.

## INTRODUCTION

OREAS reference materials are intended to provide a low cost method of evaluating and improving the quality of analysis of geological samples. To the geologist they provide a means of implementing quality control in analytical data sets generated in exploration from the grass roots level through to prospect evaluation, and in grade control at mining operations. To the analyst they provide an effective means of calibrating analytical equipment, assessing new techniques and routinely monitoring in-house procedures.

## SOURCE MATERIALS

Certified Reference Material (CRM) OREAS H1 was prepared from lateritic 'waste' samples sourced from the Hedges Gold Mine located within the Saddleback Greenstone Belt, 130 kms southeast of Perth, Western Australia. This lateritic gold deposit was developed over and proximal to primary gold–copper mineralisation in felsic to intermediate volcanics and felsic intrusions of the Saddleback Greenstone Belt.

## COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS H1 was prepared in the following manner:

- drying to constant mass at 105°C;
- crushing and milling to 100% minus 30 microns;
- homogenisation;
- packaging in 60g units sealed in laminated foil pouches and 500g units in plastic jars.

## ANALYTICAL PROGRAM

Twenty-two commercial analytical laboratories participated in the program to certify the 55 elements reported in Table 1. The following methods were employed:

- Gold via 25-50g fire assay with ICP-MS (10 labs), ICP-OES (7 labs) or AAS (4 labs) finish;
- Gold via 15-40g aqua regia digestion with ICP-MS (13 labs), AAS (2 labs) or graphite furnace AAS (1 lab) finish;
- Aqua regia digestion (see note below) for full elemental suite ICP-OES and ICP-MS (up to 20 laboratories depending on the element).

It is important to note that in the analytical industry there is no standardisation of the aqua regia digestion process. Aqua regia is a partial empirical digest and differences in recoveries for various analytes are commonplace. These are caused by variations in the digest conditions which can include the ratio of nitric to hydrochloric acids, acid strength, temperatures, leach times and secondary digestions. Recoveries for sulphide-hosted base metal sulphides approach total values, however, other analytes, in particular the lithophile elements, show greater sensitivity to method parameters. This can result in lack of consensus in an inter-laboratory certification program for these elements. The approach applied here is to report certified values in those instances where reasonable agreement exists amongst a majority of participating laboratories. The results of specific laboratories may differ significantly from the certified values, but will, nonetheless, be valid and reproducible in the context of the specifics of the aqua regia method in use. Users of this reference material should, therefore, be mindful of this limitation when applying the certified values in a quality control program.

For the round robin program samples were taken at 10 predetermined intervals (sampling lots) during the packaging stage and are considered representative of the entire batch. The six samples received by each laboratory were obtained by taking two 60g samples from each of three separate sampling lots. This format enabled nested ANOVA treatment of the results to evaluate homogeneity, i.e. to ascertain whether between-unit variance is

greater than within-unit variance. Table 1 presents the 55 certified values together with their associated 1SD's, 95% confidence and tolerance limits and Table 2 shows 85 indicative values. Table 3 provides performance gate intervals for the certified values of each method group based on their pooled 1SD's. Tabulated results of all elements (including Au INAA analyses) together with uncorrected means, medians, standard deviations, relative standard deviations and percent deviation of lab means from the corrected mean of means (PDM[3]) are presented in the detailed certification data for this CRM (**OREAS H1 DataPack.xlsx**).

**Table 2. Indicative Values for OREAS H1.**

| Constituent | Unit | Value | Constituent | Unit | Value | Constituent | Unit | Value |
|---|---|---|---|---|---|---|---|---|
| **Pb Fire Assay** | | | | | | | | |
| Pd | ppb | *< 1* | Pt | ppb | *1* | | | |
| **Borate Fusion XRF** | | | | | | | | |
| $Al_2O_3$ | wt.% | *26.17* | $Fe_2O_3$ | wt.% | *1.01* | Pb | ppm | *20.0* |
| As | ppm | *20.0* | $K_2O$ | wt.% | *0.670* | $SiO_2$ | wt.% | *59.57* |
| Ba | ppm | *125* | MgO | wt.% | *0.200* | Sn | ppm | *< 10* |
| CaO | wt.% | *0.025* | MnO | wt.% | *0.020* | $SO_3$ | wt.% | *0.060* |
| Co | ppm | *< 10* | $Na_2O$ | wt.% | *0.335* | $TiO_2$ | wt.% | *1.72* |
| Cr | ppm | *100* | Ni | ppm | *20.0* | U | ppm | *< 10* |
| Cu | ppm | *35.0* | $P_2O_5$ | wt.% | *0.045* | Zn | ppm | *12.5* |
| **Thermogravimetry** | | | | | | | | |
| $LOI^{1000}$ | wt.% | *9.75* | | | | | | |
| **Laser Ablation ICP-MS** | | | | | | | | |
| Ag | ppm | *0.950* | Ho | ppm | *0.96* | Sn | ppm | *9.60* |
| As | ppm | *4.80* | In | ppm | *0.063* | Sr | ppm | *22.1* |
| Ba | ppm | *134* | La | ppm | *59* | Ta | ppm | *3.46* |
| Be | ppm | *0.90* | Lu | ppm | *0.57* | Tb | ppm | *0.72* |
| Bi | ppm | *5.80* | Mn | wt.% | *0.012* | Te | ppm | *4.90* |
| Cd | ppm | *1.00* | Mo | ppm | *7.90* | Th | ppm | *31.9* |
| Ce | ppm | *82* | Nb | ppm | *38.6* | Ti | wt.% | *1.04* |
| Co | ppm | *4.85* | Nd | ppm | *31.7* | Tl | ppm | *< 0.2* |
| Cr | ppm | *107* | Ni | ppm | *29.0* | Tm | ppm | *0.51* |
| Cs | ppm | *1.98* | Pb | ppm | *38.0* | U | ppm | *8.34* |
| Cu | ppm | *44.0* | Pr | ppm | *10.2* | V | ppm | *77* |
| Dy | ppm | *4.38* | Rb | ppm | *70* | W | ppm | *9.05* |
| Er | ppm | *2.91* | Re | ppm | *< 0.01* | Y | ppm | *26.8* |
| Eu | ppm | *0.83* | Sb | ppm | *4.90* | Yb | ppm | *3.38* |
| Ga | ppm | *45.6* | Sc | ppm | *8.15* | Zn | ppm | *45.0* |
| Gd | ppm | *4.52* | Se | ppm | *< 5* | Zr | ppm | *1890* |
| Hf | ppm | *53* | Sm | ppm | *5.72* | | | |
| **Aqua Regia Digestion** | | | | | | | | |
| Dy | ppm | *0.94* | Ho | ppm | *0.18* | Pt | ppb | *4* |
| Er | ppm | *0.39* | Mn | ppm | *35.5* | Ti | ppm | *460* |
| Eu | ppm | *0.29* | Pd | ppb | *< 10* | Tm | ppm | *0.045* |
| Gd | ppm | *2.03* | Pr | ppm | *5.02* | | | |

Note: the number of significant figures reported is not a reflection of the level of certainty of stated values. They are instead an artefact of ORE's in-house CRM-specific LIMS.

# STATISTICAL ANALYSIS

**Certified Values, Confidence Limits, Standard Deviations and Tolerance Limits** (Table 1) have been determined for each analyte following removal of individual, laboratory dataset (batch) and 3SD outliers (single iteration). For individual outliers within a laboratory batch the z-score test is used in combination with a second method that determines the per cent deviation of the individual value from the batch median. Outliers in general are selected on the basis of z-scores > 2.5 and with per cent deviations (i) > 3 and (ii) more than three times the average absolute per cent deviation for the batch. In certain instances statistician's prerogative has been employed in discriminating outliers. Each laboratory data set mean is tested for outlying status based on z-score discrimination and rejected if > 2.5. After individual and laboratory data set (batch) outliers have been eliminated a non-iterative 3 standard deviation filter is applied, with those values lying outside this window also relegated to outlying status.

**95% Confidence Limits** are inversely proportional to the number of participating laboratories and inter-laboratory agreement. It is a measure of the reliability of the certified value. A 95% confidence interval indicates a 95% probability that the true value of the analyte under consideration lies between the upper and lower limits. *95% Confidence Limits should not be used as control limits for laboratory performance.*

**Indicative (uncertified) values** (Table 2) are provided for the major and trace elements determined by borate fusion XRF ($Al_2O_3$ to Zn) and laser ablation with ICP-MS (Ag to Zr) and are the means of duplicate assays from Bureau Veritas, Perth. Additional indicative values by other analytical methods are present where the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification or where inter-laboratory consensus is poor.

**Standard Deviation** values (1SDs) are reported in Table 1 and provide an indication of a level of performance that might reasonably be expected from a laboratory being monitored by this CRM in a QA/QC program. The SD values include all sources of measurement uncertainty: between-lab variance, within-run variance (precision errors) and CRM variability. For an effective CRM the contribution of the latter should be negligible in comparison to measurement errors. OREAS reference materials have a level of homogeneity such that the observed variance from repeated analysis has its origin almost exclusively in the analytical process rather than the reference material itself.

The SD for each analyte's certified value is calculated from the same filtered data set used to determine the certified value, i.e. after removal of any individual, lab dataset (batch) and 3SD outliers (single iteration). These outliers can only be removed after the absolute homogeneity of the CRM has been independently established, i.e. the outliers must be confidently deemed to be analytical rather than arising from inhomogeneity of the CRM. **The standard deviation is then calculated for each analyte from the pooled accepted analyses generated from the certification program.**

In the application of SD's in monitoring performance it is important to note that not all laboratories function at the same level of proficiency and that different methods in use at a particular laboratory have differing levels of precision. Each laboratory has its own inherent SD (for a specific concentration level and analyte-method pair) based on the analytical process and this SD is not directly related to the round robin program.

The majority of data generated in the round robin program was produced by a selection of world class laboratories. The SD's thus generated are more constrained than those that would be produced across a randomly selected group of laboratories. To produce more generally achievable SD's the 'pooled' SD's provided in this report include inter-lab bias. This 'one size fits all' approach may require revision at the discretion of the QC manager concerned following careful scrutiny of QC control charts.

Table 3 shows **Performance Gates** calculated for two and three standard deviations. As a guide these intervals may be regarded as warning or rejection for multiple 2SD outliers, or rejection for individual 3SD outliers in QC monitoring, although their precise application should be at the discretion of the QC manager concerned. A second method utilises a 5% window calculated directly from the certified value. Standard deviation is also shown in relative percent for one, two and three relative standard deviations (1RSD, 2RSD and 3RSD) to facilitate an appreciation of the magnitude of these numbers and a comparison with the 5% window. Caution should be exercised when concentration levels approach lower limits of detection of the analytical methods employed as performance gates calculated from standard deviations tend to be excessively wide whereas those determined by the 5% method are too narrow.

**Tolerance Limits** (ISO Guide 3207) were determined using an analysis of precision errors method and are considered a conservative estimate of true homogeneity. The meaning of tolerance limits may be illustrated for copper by aqua regia digestion, where 99% of the time ($1-\alpha=0.99$) at least 95% of subsamples ($\rho=0.95$) will have concentrations lying between 26.9 and 29.0ppm. Put more precisely, this means that if the same number of subsamples were taken and analysed in the same manner repeatedly, 99% of the tolerance intervals so constructed would cover at least 95% of the total population, and 1% of the tolerance intervals would cover less than 95% of the total population (ISO Guide 35).

The homogeneity of OREAS H1 has also been evaluated in a **nested ANOVA** of the round robin program. Each of the twenty-two round robin laboratories received six samples per CRM and these samples were made up of paired samples from three different, non-adjacent sampling intervals. The purpose of the ANOVA evaluation is to test that no statistically significant difference exists in the variance between-units to that of the variance within-units. This allows an assessment of homogeneity across the entire prepared batch of OREAS H1. The test was performed using the following parameters:

- Gold fire assay – 126 samples (21 laboratories each providing analyses on 3 pairs of samples);
- Gold aqua regia digestion – 90 samples (15 laboratories each providing analyses on 3 pairs of samples);
- Null Hypothesis, $H_0$: Between-unit variance is no greater than within-unit variance (reject $H_0$ if $p$-value < 0.05);
- Alternative Hypothesis, $H_1$: Between-unit variance is greater than within-unit variance.

*P*-values are a measure of probability where values less than 0.05 indicate a greater than 95% probability that the observed differences in within-unit and between-unit variances are real. The dataset was filtered for both individual and laboratory data set (batch) outliers prior to the calculation of the *p*-value. This process derived *p*-values of 0.70 for Au by fire assay and 0.76 for Au by aqua regia digestion. Both *p*-values are insignificant and the Null

Hypothesis is retained. Additionally, none of the other 53 certified values showed significant *p*-values.

It is important to note that ANOVA is not an absolute measure of homogeneity. Rather, it establishes whether or not the analytes are distributed in a similar manner throughout the packaging run of OREAS H1 and whether the variance between two subsamples from the same unit is statistically distinguishable to the variance from two subsamples taken from any two separate units. A reference material therefore, can possess poor absolute homogeneity yet still pass a relative homogeneity test if the within-unit heterogeneity is large and similar across all units.

Based on the statistical analysis of the results of the inter-laboratory certification program it can be concluded that OREAS H1 is fit-for-purpose as a certified reference material (see 'Intended Use' below).

**Table 3. Performance Gates for OREAS H1.**

| Constituent | Certified Value | Absolute Standard Deviations | | | | | Relative Standard Deviations | | | 5% window | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1SD | 2SD Low | 2SD High | 3SD Low | 3SD High | 1RSD | 2RSD | 3RSD | Low | High |
| **Fire Assay** | | | | | | | | | | | |
| Au, ppb | 12 | 1 | 10 | 14 | 9 | 15 | 7.81% | 15.61% | 23.42% | 11 | 12 |
| **Aqua Regia Digestion** | | | | | | | | | | | |
| Ag, ppm | 0.906 | 0.087 | 0.731 | 1.081 | 0.644 | 1.168 | 9.65% | 19.30% | 28.95% | 0.861 | 0.951 |
| Al, wt.% | 2.03 | 0.35 | 1.32 | 2.73 | 0.97 | 3.08 | 17.31% | 34.62% | 51.92% | 1.92 | 2.13 |
| As, ppm | 1.90 | 0.24 | 1.43 | 2.37 | 1.20 | 2.61 | 12.39% | 24.78% | 37.17% | 1.81 | 2.00 |
| Au, ppb | 12 | 1 | 10 | 15 | 9 | 16 | 10.43% | 20.85% | 31.28% | 12 | 13 |
| B, ppm | < 10 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| Ba, ppm | 50 | 3.9 | 43 | 58 | 39 | 62 | 7.64% | 15.28% | 22.92% | 48 | 53 |
| Be, ppm | < 0.5 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| Bi, ppm | 5.67 | 0.361 | 4.95 | 6.39 | 4.59 | 6.75 | 6.36% | 12.72% | 19.08% | 5.38 | 5.95 |
| Ca, ppm | 134 | 42 | 51 | 217 | 9 | 259 | 31.00% | 62.00% | 93.00% | 127 | 141 |
| Cd, ppm | 0.84 | 0.068 | 0.70 | 0.97 | 0.63 | 1.04 | 8.08% | 16.16% | 24.24% | 0.79 | 0.88 |
| Ce, ppm | 47.1 | 5.6 | 35.8 | 58.3 | 30.2 | 63.9 | 11.96% | 23.92% | 35.87% | 44.7 | 49.4 |
| Co, ppm | 2.36 | 0.48 | 1.41 | 3.32 | 0.93 | 3.80 | 20.27% | 40.55% | 60.82% | 2.25 | 2.48 |
| Cr, ppm | 21.4 | 1.31 | 18.8 | 24.0 | 17.5 | 25.3 | 6.11% | 12.21% | 18.32% | 20.3 | 22.5 |
| Cs, ppm | 0.54 | 0.07 | 0.39 | 0.68 | 0.31 | 0.76 | 13.78% | 27.57% | 41.35% | 0.51 | 0.56 |
| Cu, ppm | 28.0 | 1.48 | 25.0 | 31.0 | 23.5 | 32.5 | 5.30% | 10.61% | 15.91% | 26.6 | 29.4 |
| Fe, ppm | 2883 | 329 | 2225 | 3541 | 1896 | 3870 | 11.41% | 22.82% | 34.23% | 2739 | 3027 |
| Ga, ppm | 10.8 | 2.0 | 6.8 | 14.8 | 4.8 | 16.8 | 18.63% | 37.27% | 55.90% | 10.2 | 11.3 |

Please note: intervals may appear asymmetric due to rounding.

**Table 3 continued.**

| Constituent | Certified Value | Absolute Standard Deviations | | | | | Relative Standard Deviations | | | 5% window | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1SD | 2SD Low | 2SD High | 3SD Low | 3SD High | 1RSD | 2RSD | 3RSD | Low | High |
| **Aqua Regia Digestion continued** | | | | | | | | | | | |
| Ge, ppm | < 0.2 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| Hf, ppm | 1.81 | 0.34 | 1.12 | 2.50 | 0.78 | 2.84 | 19.04% | 38.08% | 57.12% | 1.72 | 1.90 |
| Hg, ppm | 0.14 | 0.02 | 0.09 | 0.18 | 0.07 | 0.21 | 16.78% | 33.56% | 50.34% | 0.13 | 0.14 |
| In, ppm | < 0.05 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| K, ppm | 416 | 59 | 298 | 534 | 240 | 593 | 14.14% | 28.28% | 42.42% | 395 | 437 |
| La, ppm | 25.9 | 4.9 | 16.1 | 35.7 | 11.1 | 40.6 | 18.97% | 37.94% | 56.91% | 24.6 | 27.2 |
| Li, ppm | < 3 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| Lu, ppm | 0.050 | 0.005 | 0.040 | 0.061 | 0.035 | 0.066 | 10.24% | 20.49% | 30.73% | 0.048 | 0.053 |
| Mg, ppm | 657 | 55 | 547 | 767 | 493 | 821 | 8.35% | 16.69% | 25.04% | 624 | 690 |
| Mo, ppm | 4.24 | 0.83 | 2.58 | 5.90 | 1.75 | 6.72 | 19.54% | 39.09% | 58.63% | 4.03 | 4.45 |
| Na, ppm | 1331 | 70 | 1192 | 1470 | 1123 | 1540 | 5.22% | 10.44% | 15.67% | 1264 | 1398 |
| Nb, ppm | < 0.2 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| Nd, ppm | 17.2 | 2.7 | 11.7 | 22.6 | 9.0 | 25.3 | 15.91% | 31.82% | 47.73% | 16.3 | 18.0 |
| Ni, ppm | 10.6 | 0.68 | 9.3 | 12.0 | 8.6 | 12.7 | 6.43% | 12.85% | 19.28% | 10.1 | 11.2 |
| P, ppm | 51 | 12 | 26 | 75 | 14 | 87 | 23.86% | 47.71% | 71.57% | 48 | 53 |
| Pb, ppm | 17.0 | 3.0 | 11.1 | 22.9 | 8.1 | 25.8 | 17.41% | 34.82% | 52.23% | 16.1 | 17.8 |
| Rb, ppm | 5.85 | 1.00 | 3.84 | 7.85 | 2.84 | 8.85 | 17.13% | 34.26% | 51.39% | 5.56 | 6.14 |
| Re, ppm | < 0.05 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| S, ppm | 197 | 9 | 180 | 215 | 171 | 223 | 4.38% | 8.76% | 13.15% | 188 | 207 |
| Sb, ppm | 3.24 | 0.56 | 2.12 | 4.36 | 1.56 | 4.92 | 17.31% | 34.63% | 51.94% | 3.08 | 3.40 |
| Sc, ppm | 2.11 | 0.47 | 1.17 | 3.05 | 0.70 | 3.52 | 22.20% | 44.41% | 66.61% | 2.01 | 2.22 |
| Se, ppm | 2.05 | 0.51 | 1.04 | 3.07 | 0.53 | 3.57 | 24.65% | 49.31% | 73.96% | 1.95 | 2.16 |
| Sm, ppm | 2.69 | 0.47 | 1.75 | 3.63 | 1.27 | 4.10 | 17.53% | 35.05% | 52.58% | 2.55 | 2.82 |
| Sn, ppm | 6.45 | 0.483 | 5.48 | 7.41 | 5.00 | 7.89 | 7.49% | 14.97% | 22.46% | 6.12 | 6.77 |
| Sr, ppm | 5.64 | 1.11 | 3.42 | 7.85 | 2.32 | 8.96 | 19.63% | 39.27% | 58.90% | 5.36 | 5.92 |
| Ta, ppm | < 0.05 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| Tb, ppm | 0.21 | 0.03 | 0.14 | 0.27 | 0.11 | 0.30 | 15.30% | 30.61% | 45.91% | 0.20 | 0.22 |
| Te, ppm | 2.90 | 0.43 | 2.05 | 3.76 | 1.62 | 4.19 | 14.70% | 29.39% | 44.09% | 2.76 | 3.05 |
| Th, ppm | 20.0 | 1.34 | 17.3 | 22.7 | 15.9 | 24.0 | 6.72% | 13.44% | 20.17% | 19.0 | 21.0 |
| Tl, ppm | 0.049 | 0.009 | 0.032 | 0.067 | 0.024 | 0.075 | 17.49% | 34.98% | 52.47% | 0.047 | 0.052 |
| U, ppm | 2.75 | 0.172 | 2.40 | 3.09 | 2.23 | 3.26 | 6.25% | 12.51% | 18.76% | 2.61 | 2.88 |
| V, ppm | 25.3 | 2.09 | 21.1 | 29.4 | 19.0 | 31.5 | 8.25% | 16.50% | 24.75% | 24.0 | 26.5 |

Please note: intervals may appear asymmetric due to rounding.

**Table 3 continued.**

| Constituent | Certified Value | Absolute Standard Deviations | | | | | Relative Standard Deviations | | | 5% window | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1SD | 2SD Low | 2SD High | 3SD Low | 3SD High | 1RSD | 2RSD | 3RSD | Low | High |
| **Aqua Regia Digestion continued** | | | | | | | | | | | |
| W, ppm | < 0.1 | IND | IND | IND | IND | IND | IND | IND | IND | IND | IND |
| Y, ppm | 4.66 | 0.79 | 3.08 | 6.24 | 2.29 | 7.03 | 16.94% | 33.88% | 50.81% | 4.43 | 4.90 |
| Yb, ppm | 0.32 | 0.05 | 0.22 | 0.43 | 0.17 | 0.48 | 15.64% | 31.28% | 46.92% | 0.31 | 0.34 |
| Zn, ppm | 4.54 | 1.43 | 1.68 | 7.40 | 0.25 | 8.83 | 31.48% | 62.96% | 94.44% | 4.32 | 4.77 |
| Zr, ppm | 74 | 12 | 51 | 97 | 39 | 109 | 15.63% | 31.26% | 46.88% | 70 | 78 |

Please note: intervals may appear asymmetric due to rounding.

## PARTICIPATING LABORATORIES

1. Actlabs, Ancaster, Ontario, Canada
2. ALS, Johannesburg, South Africa
3. ALS, Lima, Peru
4. ALS, Loughrea, Galway, Ireland
5. ALS, Perth, WA, Australia
6. ALS, Vancouver, BC, Canada
7. Bureau Veritas Commodities Canada Ltd, Vancouver, BC, Canada
8. Bureau Veritas Geoanalytical, Adelaide, SA, Australia
9. Bureau Veritas Geoanalytical, Perth, WA, Australia
10. Bureau Veritas Kalassay, Perth, WA, Australia
11. Intertek Genalysis, Adelaide, SA, Australia
12. Intertek Genalysis, Perth, WA, Australia
13. Intertek Minerals (IMI), Jakarta, Indonesia
14. Intertek Testing Services, Shunyi, Beijing, China
15. Intertek Testing Services, Townsville, QLD, Australia
16. NAGROM, Perth, WA, Australia
17. Newmont Metallurgical Services, Engelwood, Colorado, USA
18. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
19. SGS Canada Inc., Vancouver, BC, Canada
20. SGS Geosol Laboratorios Ltda, Vespasiano, Minas Gerais, Brazil
21. SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
22. TSL Laboratories Inc., Saskatoon, Saskatchewan, Canada

## PREPARER AND SUPPLIER

Certified reference material OREAS H1 is prepared, certified and supplied by:

ORE RESEARCH & EXPLORATION

ORE Research & Exploration Pty Ltd
37A Hosie Street
Bayswater North VIC 3153
AUSTRALIA

Tel: +613-9729 0333
Fax: +613-9729 8338
Web: www.ore.com.au
Email: info@ore.com.au

It is available in unit sizes of 60g (single-use laminated foil pouches) and 500g (plastic jars).

## INTENDED USE

OREAS H1 is intended for the following uses:

- for the monitoring of laboratory performance in the analysis of analytes reported in Table 1 in geological samples;
- for the verification of analytical methods for analytes reported in Table 1;
- for the calibration of instruments used in the determination of the concentration of analytes reported in Table 1.

## STABILITY AND STORAGE INSTRUCTIONS

OREAS H1 has been prepared from lateritic 'waste' samples sourced from the Hedges Gold Mine. It is low in reactive sulphide (197ppm S) and in its unopened state and under normal conditions of storage has a shelf life beyond ten years. Its stability will be monitored at regular intervals and purchasers notified if any changes are observed.

## INSTRUCTIONS FOR CORRECT USE

The certified values for OREAS H1 refer to the concentration level in its packaged state. It should not be dried prior to weighing and analysis.

## HANDLING INSTRUCTIONS

Fine powders pose a risk to eyes and lungs and therefore standard precautions such as the use of safety glasses and dust masks are advised.

## TRACEABILITY

The analytical samples were selected in a manner to represent the entire batch of prepared CRM. This 'representivity' was maintained in each submitted laboratory sample batch and ensures the user that the data is traceable from sample selection through to the analytical results that underlie the consensus values. Each analytical data set has been validated by its assayer through the inclusion of internal reference materials and QC checks during analysis. The laboratories were chosen on the basis of their competence (from past performance in inter-laboratory programs) for a particular analytical method, analyte or analyte suite, and sample matrix. Most of these laboratories have and maintain ISO 17025 accreditation. The certified values presented in this report are calculated from the means of accepted data following robust statistical treatment as detailed in this report.

## LEGAL NOTICE

Ore Research & Exploration Pty Ltd has prepared and statistically evaluated the property values of this reference material to the best of its ability. The Purchaser by receipt hereof releases and indemnifies Ore Research & Exploration Pty Ltd from and against all liability and costs arising from the use of this material and information.

## QMS ACCREDITED

ORE Pty Ltd is accredited to ISO 9001:2008 by Lloyd's Register Quality Assurance Ltd for its quality management system including development, manufacturing, certification and supply of CRMs.

## CERTIFYING OFFICER

Craig Hamlyn (B.Sc. Hons - Geology), Technical Manager - ORE P/L

## REFERENCES


ISO Guide 30 (1992), Terms and definitions used in connection with reference materials.
ISO Guide 31 (2000), Reference materials – Contents of certificates and labels.
ISO Guide 3207 (1975), Statistical interpretation of data - Determination of a statistical tolerance interval.
ISO Guide 35 (2006), Certification of reference materials - General and statistical principals.