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### CERTIFICATE OF ANALYSIS FOR

# IRON OXIDE COPPER-GOLD ORE
# CERTIFIED REFERENCE MATERIAL
# OREAS 522

**Summary Statistics for Key Analytes (see Table 1 for 155 additional certified values).**

| Constituent (ppm) | Certified Value | 1SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Pb Fire Assay** | | | | | | |
| Au, Gold (ppm) | 0.574 | 0.018 | 0.567 | 0.580 | 0.567* | 0.580* |
| **Aqua Regia Digestion** | | | | | | |
| Au, Gold (ppm) | 0.549 | 0.025 | 0.541 | 0.557 | 0.542† | 0.556† |
| **4-Acid Digestion** | | | | | | |
| Co, Cobalt (ppm) | 550 | 19 | 542 | 558 | 541 | 559 |
| Cu, Copper (wt.%) | 0.916 | 0.026 | 0.906 | 0.927 | 0.901 | 0.932 |
| **Infrared Combustion** | | | | | | |
| S, Sulphur (wt.%) | 3.11 | 0.082 | 3.07 | 3.14 | 3.05 | 3.17 |

*Gold Tolerance Limits for typical 30g fire assay charge weight determined from 20 x 85mg NAA results and the Sampling Constant (Ingamells & Switzer, 1973);
†Gold Tolerance Limits for typical 25g aqua regia sample weight determined as above;
Please note: intervals may appear asymmetric due to rounding.

The homogeneity of OREAS 522 is of a level such that ***negligible sampling error exists*** for a conventional fire assay, peroxide fusion, 4-acid digestion, 3-acid digestion, aqua regia digestion, infrared combustion or pycnometry determination.

## 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 522 was prepared from a blend of iron oxide copper-gold ore and magnetite-bearing waste rock (altered, porphyritic, intermediate volcanic rock). The mineralisation is hosted by a breccia comprising strongly altered and replaced felsic volcanic fragments in a matrix largely composed of magnetite, calcite, pyrite, biotite, chalcopyrite, K feldspar titanite and quartz. Accessory minerals include garnet, barite, molybdenite, fluorite, amphibole, apatite, monazite, arsenopyrite, a LREE fluorcarbonate, galena, cobaltite, sphalerite, scheelite, uraninite and tourmaline. Copper occurs as native copper, bornite and chalcopyrite. Gold occurs mainly in the molecular framework of the chalcopyrite. Significant levels of cobalt, molybdenum, rare earth elements and low levels of uranium are also present. The ore and waste materials were sourced from the Ernest Henry Mine located about 38 kilometres north-east of Cloncurry in north-west Queensland.

## COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 522 was prepared in the following manner:

- drying to constant mass at 105°C;
- crushing and milling of the ore material to 100% minus 35 microns;
- crushing and milling of the barren material to 99% minus 75 microns;
- blending in appropriate proportions to achieve the desired grades;
- packaging in 60g and 100g units sealed under nitrogen in laminated foil pouches.

## ANALYTICAL PROGRAM

Twenty six commercial analytical laboratories participated in the program to certify the 160 analytes reported in Table 1. The following methods were employed:

- Gold via 25-50g fire assay with AAS (18 labs) or ICP-OES (6 labs) finish;
- Gold via 15-40g aqua regia digestion with ICP-MS (12 labs) or AAS (5 labs) finish;
- Instrumental neutron activation analysis (INAA) for Au on 85mg subsamples to confirm homogeneity (1 lab);
- Peroxide fusion for full elemental suite ICP-OES and ICP-MS finishes (up to 19 laboratories depending on the element);
- 4-Acid digestion ($HF$-$HNO_3$-$HClO_4$-$HCl$) for full elemental suite ICP-OES and ICP-MS finishes (up to 22 laboratories depending on the element; one lab used an AAS finish for Cu only);

- 3-Acid digestion ($HNO_3$-$HClO_4$-HCl) for Ag, As, Co, Cu, Fe, Mo and S with ICP-OES or AAS finishes (up to 16 laboratories depending on the element; one lab used an ICP-MS finish for Ag, As and Mo);
- Aqua regia digestion (see note below) for full elemental suite ICP-OES and ICP-MS finishes (up to 14 laboratories depending on the element; some laboratories used an AAS finish for certain elements i.e. Ag, As, Co, Cu, Fe and Mo);
- S by IR combustion furnace (21 labs);
- Specific gravity by gas (11 labs) or liquid (5 labs) pycnometry.

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 twenty 1kg lot samples were taken at predetermined intervals during the bagging stage, immediately following final blending and are considered representative of the entire batch. The six samples received by each laboratory were obtained by taking two 110g scoop splits from each of three separate 1kg 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 160 certified values together with their associated 1SD’s, 95% confidence and tolerance limits and Table 2 shows 35 indicative values. Table 3 shows the gold instrumental neutron activation analysis (INAA) results for twenty 85mg subsamples determined by the Australian Nuclear Science & Technology Organisation (ANSTO) located in Lucas Heights, NSW, Australia. Table 4 provides performance gate intervals for the certified values of each method group based on their pooled 1SD’s. Tabulated results of all elements together with uncorrected means, medians, standard deviations, relative standard deviations and per cent deviation of lab means from the corrected mean of means (PDM[3]) are presented in the detailed certification data for this CRM (**OREAS 522 DataPack.xlsx**).

## STATISTICAL ANALYSIS

**Certified Values, Confidence Limits, Standard Deviations and Tolerance Limits** (Table 1) have been determined for each analytical method following the 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.

**Certified Values** are the means of accepted laboratory means after outlier filtering. The INAA data (see Table 3) is omitted from determination of the certified values for gold (fire assay and aqua regia) and is used solely for the calculation of Tolerance Limits and homogeneity evaluation of OREAS 522.

**Indicative Values** (Table 2) are provided where the number of laboratories reporting a particular analyte is insufficient (< 5) to support certification or inter-laboratory consensus is poor.

**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.*

**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's take into account errors attributable to measurement uncertainty and CRM variability. For an effective CRM the contribution of the latter should be negligible in comparison to measurement errors. The SD values thus include all sources of measurement uncertainty: between-lab variance, within-run variance (precision errors) and CRM variability. OREAS prepared 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 4 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 via 4-acid digestion where 99% of the time ($1-\alpha=0.99$) at least 95% of subsamples ($\rho=0.95$) will have concentrations lying between 0.901 and 0.932 wt.%. 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).

For gold, tolerance can be determined by INAA using the reduced analytical subsample method which utilises the known relationship between standard deviation and analytical subsample weight (Ingamells and Switzer, 1973). In this approach the latter parameter is substantially reduced to a point where most of the variability in replicate assays is due to inhomogeneity of the reference material and measurement error becomes negligible. In this instance very small subsample weights of 85 milligrams were employed and the 1RSD of 0.375% at a 30g charge weight (7.06% at 85mg weights) confirms the high level of gold homogeneity in OREAS 522 (see Table 3 below).

The homogeneity of OREAS 522 has also been evaluated in a **nested ANOVA** of the round robin program. Each of the twenty-six 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 522. The test was performed using the following parameters:

- Significance Level $\alpha = P$ (type I error) = 0.05;
- 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 no significant *p*-values for all 160 certified values (except for Hf by peroxide fusion ICP but this case is considered an artefact of reading resolution) and the Null Hypothesis is retained.

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 522 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 522 is fit-for-purpose as a certified reference material (see 'Intended Use' below). Furthermore, the homogeneity of OREAS 522 is of a level such that ***negligible sampling error exists*** for a conventional fire assay, peroxide fusion, 4-acid digestion, 3-acid digestion, aqua regia digestion, infrared combustion or pycnometry determination.

## PARTICIPATING LABORATORIES

1. Actlabs, Ancaster, Ontario, Canada
2. ALS, Brisbane, QLD, Australia
3. ALS, Lima, Peru
4. ALS, Loughrea, Galway, Ireland
5. ALS, Perth, WA, Australia
6. ALS, Vancouver, BC, Canada
7. ANSTO, Lucas Heights, NSW, Australia
8. Bureau Veritas Commodities Canada Ltd, Vancouver, BC, Canada
9. Bureau Veritas Geoanalytical, Adelaide, SA, Australia
10. Bureau Veritas Geoanalytical, Perth, WA, Australia
11. Bureau Veritas Minerals, Santiago, Chile
12. Geoanalitica, Antofagasta, Chile
13. Inspectorate (BV), Lima, Peru
14. Intertek Genalysis, Adelaide, SA, Australia
15. Intertek Genalysis, Perth, WA, Australia
16. Intertek Testing Services, Cupang, Muntinlupa, Philippines
17. MinAnalytical Services, Perth, WA, Australia
18. Mineracao Mine Lab, Paracatu, Minas Gerais, Brazil
19. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
20. PT Intertek Utama Services, Jakarta Timur, DKI Jakarta, Indonesia
21. SGS Australia Mineral Services, Perth, WA, Australia
22. SGS Canada Inc., Vancouver, BC, Canada
23. SGS CIMM T & S, Antofagasta, Chile
24. SGS del Peru, Lima, Peru
25. SGS Lakefield Research Ltd, Lakefield, Ontario, Canada
26. SGS Mineral Services, Townsville, QLD, Australia
27. Shiva Analyticals Ltd, Bangalore North, Karnataka, India

**Table 1. Certified Values, SD's, 95% Confidence and Tolerance Limits for OREAS 522.**

| Constituent | Certified Value | 1SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Pb Fire Assay** | | | | | | |
| Au, Gold (ppm) | 0.574 | 0.018 | 0.567 | 0.580 | 0.567* | 0.580* |
| **Peroxide Fusion ICP** | | | | | | |
| Al, Aluminium (wt.%) | 4.02 | 0.119 | 3.96 | 4.07 | 3.94 | 4.10 |
| As, Arsenic (ppm) | 522 | 33 | 508 | 536 | 504 | 539 |
| Ba, Barium (wt.%) | 2.38 | 0.192 | 2.19 | 2.56 | 2.30 | 2.45 |
| Bi, Bismuth (ppm) | 9.12 | 0.632 | 8.67 | 9.56 | 8.76 | 9.47 |
| Ca, Calcium (wt.%) | 3.87 | 0.188 | 3.77 | 3.96 | 3.79 | 3.94 |
| Ce, Cerium (ppm) | 163 | 7 | 159 | 167 | 158 | 168 |
| Co, Cobalt (ppm) | 555 | 34 | 537 | 573 | 539 | 571 |
| Cr, Chromium (ppm) | 34.5 | 6.2 | 30.3 | 38.8 | IND | IND |
| Cs, Cesium (ppm) | 0.67 | 0.062 | 0.63 | 0.71 | IND | IND |
| Cu, Copper (wt.%) | 0.923 | 0.024 | 0.911 | 0.936 | 0.909 | 0.938 |
| Dy, Dysprosium (ppm) | 3.50 | 0.261 | 3.34 | 3.67 | 3.32 | 3.69 |
| Er, Erbium (ppm) | 2.13 | 0.099 | 2.05 | 2.20 | 2.04 | 2.21 |
| Fe, Iron (wt.%) | 24.72 | 0.594 | 24.43 | 25.00 | 24.29 | 25.14 |
| Ga, Gallium (ppm) | 16.3 | 0.83 | 15.8 | 16.9 | 15.5 | 17.1 |
| Gd, Gadolinium (ppm) | 4.20 | 0.385 | 3.88 | 4.51 | 4.01 | 4.39 |
| Hf, Hafnium (ppm) | 3.35 | 0.54 | 2.95 | 3.75 | IND | IND |
| Ho, Holmium (ppm) | 0.72 | 0.08 | 0.67 | 0.77 | 0.66 | 0.78 |
| In, Indium (ppm) | 0.25 | 0.05 | 0.22 | 0.28 | IND | IND |
| K, Potassium (wt.%) | 2.89 | 0.133 | 2.82 | 2.96 | 2.81 | 2.96 |
| La, Lanthanum (ppm) | 222 | 10 | 215 | 228 | 215 | 228 |
| Lu, Lutetium (ppm) | 0.35 | 0.04 | 0.31 | 0.38 | 0.32 | 0.37 |
| Mg, Magnesium (wt.%) | 1.15 | 0.035 | 1.13 | 1.17 | 1.12 | 1.18 |
| Mn, Manganese (wt.%) | 0.418 | 0.020 | 0.408 | 0.428 | 0.410 | 0.426 |
| Mo, Molybdenum (ppm) | 207 | 15 | 196 | 217 | 200 | 213 |
| Nb, Niobium (ppm) | 6.00 | 0.90 | 5.27 | 6.73 | 5.53 | 6.48 |
| Nd, Neodymium (ppm) | 28.9 | 2.04 | 27.5 | 30.4 | 27.9 | 29.9 |
| Ni, Nickel (ppm) | 72 | 9 | 67 | 77 | 67 | 77 |
| P, Phosphorus (wt.%) | 0.089 | 0.007 | 0.086 | 0.093 | 0.082 | 0.097 |
| Pr, Praseodymium (ppm) | 10.4 | 0.81 | 9.8 | 11.0 | 10.0 | 10.9 |
| Rb, Rubidium (ppm) | 84 | 3.2 | 83 | 86 | 82 | 87 |
| S, Sulphur (wt.%) | 3.09 | 0.092 | 3.03 | 3.15 | 3.03 | 3.15 |
| Sb, Antimony (ppm) | 8.24 | 0.567 | 7.94 | 8.55 | 7.48 | 9.01 |
| Sc, Scandium (ppm) | 10.4 | 0.53 | 9.9 | 10.9 | IND | IND |
| Si, Silicon (wt.%) | 15.81 | 0.420 | 15.55 | 16.08 | 15.52 | 16.11 |
| Sm, Samarium (ppm) | 4.32 | 0.424 | 4.00 | 4.64 | 3.99 | 4.65 |
| Sn, Tin (ppm) | 10.8 | 0.86 | 10.1 | 11.5 | 9.5 | 12.1 |
| Sr, Strontium (ppm) | 236 | 8 | 232 | 241 | 229 | 243 |
| Tb, Terbium (ppm) | 0.61 | 0.042 | 0.59 | 0.63 | 0.57 | 0.65 |

Note: intervals may appear asymmetric due to rounding; *Gold Tolerance Limits for typical 30g fire assay charge weight determined from 20 x 85mg INAA results and the Sampling Constant (Ingamells & Switzer, 1973).

**Table 1 continued.**

| Constituent | Certified Value | 1SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Peroxide Fusion ICP continued** | | | | | | |
| Th, Thorium (ppm) | 8.69 | 0.667 | 8.32 | 9.07 | 8.44 | 8.95 |
| Ti, Titanium (wt.%) | 0.394 | 0.009 | 0.391 | 0.397 | 0.385 | 0.404 |
| Tm, Thulium (ppm) | 0.33 | 0.03 | 0.30 | 0.35 | 0.29 | 0.36 |
| U, Uranium (ppm) | 44.0 | 2.68 | 42.3 | 45.8 | 43.2 | 44.9 |
| V, Vanadium (ppm) | 182 | 17 | 170 | 194 | 175 | 189 |
| W, Tungsten (ppm) | 134 | 12 | 126 | 141 | 130 | 137 |
| Y, Yttrium (ppm) | 19.3 | 0.93 | 18.7 | 19.8 | 18.4 | 20.1 |
| Yb, Ytterbium (ppm) | 2.11 | 0.165 | 2.01 | 2.21 | 1.97 | 2.25 |
| Zr, Zirconium (ppm) | 111 | 11 | 96 | 125 | 105 | 116 |
| **4-Acid Digestion** | | | | | | |
| Ag, Silver (ppm) | 1.31 | 0.114 | 1.26 | 1.37 | 1.23 | 1.39 |
| Al, Aluminium (wt.%) | 3.95 | 0.120 | 3.90 | 4.00 | 3.87 | 4.02 |
| As, Arsenic (ppm) | 490 | 26 | 477 | 503 | 479 | 501 |
| Be, Beryllium (ppm) | 0.70 | 0.09 | 0.65 | 0.74 | 0.64 | 0.75 |
| Bi, Bismuth (ppm) | 8.72 | 0.499 | 8.51 | 8.92 | 8.45 | 8.98 |
| Ca, Calcium (wt.%) | 3.65 | 0.144 | 3.59 | 3.70 | 3.57 | 3.72 |
| Ce, Cerium (ppm) | 148 | 13 | 142 | 153 | 143 | 152 |
| Co, Cobalt (ppm) | 550 | 19 | 542 | 558 | 541 | 559 |
| Cr, Chromium (ppm) | 29.6 | 3.7 | 27.8 | 31.4 | 27.5 | 31.7 |
| Cs, Cesium (ppm) | 0.64 | 0.055 | 0.61 | 0.67 | 0.61 | 0.67 |
| Cu, Copper (wt.%) | 0.916 | 0.026 | 0.906 | 0.927 | 0.901 | 0.932 |
| Dy, Dysprosium (ppm) | 3.24 | 0.185 | 3.10 | 3.37 | 3.15 | 3.32 |
| Er, Erbium (ppm) | 1.97 | 0.088 | 1.91 | 2.03 | 1.91 | 2.02 |
| Eu, Europium (ppm) | 1.88 | 0.074 | 1.83 | 1.93 | 1.80 | 1.96 |
| Fe, Iron (wt.%) | 24.63 | 0.998 | 24.15 | 25.12 | 24.26 | 25.01 |
| Ga, Gallium (ppm) | 16.0 | 0.83 | 15.6 | 16.4 | 15.6 | 16.4 |
| Gd, Gadolinium (ppm) | 3.87 | 0.56 | 3.45 | 4.29 | 3.70 | 4.04 |
| Hf, Hafnium (ppm) | 2.96 | 0.146 | 2.89 | 3.03 | 2.85 | 3.06 |
| Ho, Holmium (ppm) | 0.66 | 0.042 | 0.63 | 0.69 | 0.63 | 0.70 |
| In, Indium (ppm) | 0.23 | 0.03 | 0.22 | 0.24 | 0.22 | 0.24 |
| K, Potassium (wt.%) | 2.83 | 0.103 | 2.78 | 2.87 | 2.75 | 2.90 |
| La, Lanthanum (ppm) | 171 | 30 | 157 | 184 | 163 | 178 |
| Li, Lithium (ppm) | 16.2 | 1.51 | 15.6 | 16.9 | 15.7 | 16.7 |
| Lu, Lutetium (ppm) | 0.31 | 0.020 | 0.29 | 0.32 | 0.29 | 0.32 |
| Mg, Magnesium (wt.%) | 1.12 | 0.067 | 1.09 | 1.15 | 1.10 | 1.14 |
| Mn, Manganese (wt.%) | 0.397 | 0.022 | 0.387 | 0.407 | 0.389 | 0.404 |
| Mo, Molybdenum (ppm) | 206 | 12 | 200 | 211 | 201 | 210 |
| Na, Sodium (wt.%) | 0.633 | 0.043 | 0.613 | 0.653 | 0.619 | 0.647 |
| Nb, Niobium (ppm) | 5.66 | 0.368 | 5.47 | 5.85 | 5.42 | 5.90 |
| Nd, Neodymium (ppm) | 27.2 | 1.20 | 26.4 | 28.0 | 26.5 | 28.0 |
| Ni, Nickel (ppm) | 70 | 4.4 | 68 | 72 | 69 | 72 |
| P, Phosphorus (wt.%) | 0.089 | 0.005 | 0.087 | 0.091 | 0.087 | 0.091 |

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 |
| **4-Acid Digestion continued** | | | | | | |
| Pb, Lead (ppm) | 12.5 | 1.3 | 11.8 | 13.1 | 12.0 | 12.9 |
| Pr, Praseodymium (ppm) | 9.76 | 0.631 | 9.28 | 10.24 | 9.51 | 10.01 |
| Rb, Rubidium (ppm) | 82 | 3.3 | 81 | 83 | 79 | 85 |
| Re, Rhenium (ppm) | 0.098 | 0.005 | 0.096 | 0.101 | 0.093 | 0.104 |
| S, Sulphur (wt.%) | 2.50 | 0.103 | 2.45 | 2.54 | 2.43 | 2.56 |
| Sb, Antimony (ppm) | 7.93 | 0.465 | 7.71 | 8.15 | 7.64 | 8.22 |
| Sc, Scandium (ppm) | 10.9 | 0.83 | 10.5 | 11.2 | 10.5 | 11.2 |
| Se, Selenium (ppm) | 2.74 | 0.51 | 2.49 | 2.98 | 2.54 | 2.93 |
| Sm, Samarium (ppm) | 4.17 | 0.196 | 4.02 | 4.32 | 4.03 | 4.32 |
| Sn, Tin (ppm) | 9.32 | 0.686 | 9.03 | 9.61 | 9.00 | 9.63 |
| Sr, Strontium (ppm) | 199 | 20 | 189 | 208 | 193 | 204 |
| Ta, Tantalum (ppm) | 0.44 | 0.06 | 0.40 | 0.47 | 0.42 | 0.46 |
| Tb, Terbium (ppm) | 0.59 | 0.053 | 0.55 | 0.62 | 0.56 | 0.61 |
| Te, Tellurium (ppm) | 1.14 | 0.092 | 1.11 | 1.18 | 1.09 | 1.20 |
| Th, Thorium (ppm) | 7.53 | 0.627 | 7.17 | 7.88 | 7.25 | 7.80 |
| Ti, Titanium (wt.%) | 0.344 | 0.018 | 0.336 | 0.352 | 0.334 | 0.353 |
| Tl, Thallium (ppm) | 0.29 | 0.016 | 0.28 | 0.29 | 0.27 | 0.30 |
| Tm, Thulium (ppm) | 0.28 | 0.015 | 0.27 | 0.29 | 0.27 | 0.30 |
| U, Uranium (ppm) | 42.2 | 3.17 | 40.7 | 43.8 | 41.1 | 43.4 |
| V, Vanadium (ppm) | 164 | 9 | 160 | 168 | 160 | 168 |
| W, Tungsten (ppm) | 135 | 11 | 130 | 140 | 131 | 139 |
| Y, Yttrium (ppm) | 18.5 | 0.94 | 18.1 | 18.9 | 18.0 | 19.0 |
| Yb, Ytterbium (ppm) | 1.97 | 0.115 | 1.90 | 2.03 | 1.89 | 2.05 |
| Zn, Zinc (ppm) | 30.2 | 2.14 | 29.1 | 31.3 | 28.8 | 31.7 |
| Zr, Zirconium (ppm) | 112 | 6 | 109 | 114 | 108 | 115 |
| **3-Acid Digestion (no HF)** | | | | | | |
| Ag, Silver (ppm) | 1.19 | 0.18 | 1.05 | 1.34 | IND | IND |
| As, Arsenic (ppm) | 502 | 17 | 493 | 512 | 489 | 516 |
| Co, Cobalt (ppm) | 547 | 22 | 534 | 560 | 538 | 556 |
| Cu, Copper (wt.%) | 0.908 | 0.022 | 0.896 | 0.920 | 0.894 | 0.922 |
| Fe, Iron (wt.%) | 24.91 | 0.563 | 24.65 | 25.17 | 24.36 | 25.45 |
| Mo, Molybdenum (ppm) | 193 | 9 | 188 | 198 | 189 | 197 |
| S, Sulphur (wt.%) | 2.74 | 0.167 | 2.63 | 2.85 | 2.67 | 2.81 |
| **Aqua Regia Digestion** | | | | | | |
| Ag, Silver (ppm) | 1.23 | 0.102 | 1.17 | 1.29 | 1.17 | 1.29 |
| Al, Aluminium (wt.%) | 1.29 | 0.044 | 1.26 | 1.32 | 1.26 | 1.31 |
| As, Arsenic (ppm) | 492 | 25 | 476 | 507 | 481 | 503 |
| Au, Gold (ppm) | 0.549 | 0.025 | 0.541 | 0.557 | 0.542† | 0.556† |
| Be, Beryllium (ppm) | 0.41 | 0.06 | 0.36 | 0.47 | 0.37 | 0.46 |
| Bi, Bismuth (ppm) | 8.87 | 0.487 | 8.59 | 9.15 | 8.51 | 9.23 |

Note: intervals may appear asymmetric due to rounding; †Gold Tolerance Limits for typical 25g aqua regia sample weight determined from 20 x 85mg INAA results and the Sampling Constant (Ingamells & Switzer, 1973).

**Table 1 continued.**

| Constituent | Certified Value | 1SD | 95% Confidence Limits | | 95% Tolerance Limits | |
|---|---|---|---|---|---|---|
| | | | Low | High | Low | High |
| **Aqua Regia Digestion continued** | | | | | | |
| Ca, Calcium (wt.%) | 3.43 | 0.154 | 3.33 | 3.53 | 3.32 | 3.54 |
| Ce, Cerium (ppm) | 153 | 9 | 147 | 160 | 149 | 158 |
| Co, Cobalt (ppm) | 533 | 33 | 512 | 553 | 524 | 541 |
| Cr, Chromium (ppm) | 28.6 | 1.32 | 27.7 | 29.6 | 27.4 | 29.9 |
| Cs, Cesium (ppm) | 0.52 | 0.05 | 0.48 | 0.57 | 0.50 | 0.54 |
| Cu, Copper (wt.%) | 0.904 | 0.031 | 0.885 | 0.922 | 0.889 | 0.918 |
| Fe, Iron (wt.%) | 24.13 | 0.615 | 23.75 | 24.51 | 23.67 | 24.60 |
| Ga, Gallium (ppm) | 13.2 | 1.5 | 12.1 | 14.3 | 12.6 | 13.8 |
| Hf, Hafnium (ppm) | 1.21 | 0.066 | 1.15 | 1.27 | 1.17 | 1.25 |
| In, Indium (ppm) | 0.23 | 0.023 | 0.21 | 0.25 | 0.22 | 0.24 |
| K, Potassium (wt.%) | 0.528 | 0.020 | 0.515 | 0.542 | 0.514 | 0.543 |
| La, Lanthanum (ppm) | 192 | 16 | 181 | 204 | 188 | 197 |
| Li, Lithium (ppm) | 15.9 | 1.55 | 14.7 | 17.1 | 15.4 | 16.5 |
| Lu, Lutetium (ppm) | 0.23 | 0.015 | 0.21 | 0.25 | 0.23 | 0.24 |
| Mg, Magnesium (wt.%) | 1.07 | 0.056 | 1.03 | 1.11 | 1.05 | 1.10 |
| Mn, Manganese (wt.%) | 0.367 | 0.020 | 0.353 | 0.382 | 0.358 | 0.377 |
| Mo, Molybdenum (ppm) | 198 | 12 | 189 | 207 | 193 | 203 |
| Nb, Niobium (ppm) | 0.91 | 0.066 | 0.84 | 0.97 | 0.86 | 0.95 |
| Ni, Nickel (ppm) | 64 | 3.2 | 62 | 66 | 63 | 66 |
| P, Phosphorus (wt.%) | 0.089 | 0.005 | 0.085 | 0.093 | 0.087 | 0.091 |
| Pb, Lead (ppm) | 12.5 | 1.18 | 11.5 | 13.4 | 11.9 | 13.1 |
| Rb, Rubidium (ppm) | 30.9 | 1.68 | 29.4 | 32.5 | 30.0 | 31.8 |
| S, Sulphur (wt.%) | 2.59 | 0.127 | 2.50 | 2.69 | 2.54 | 2.65 |
| Sb, Antimony (ppm) | 5.39 | 1.02 | 4.68 | 6.09 | 5.22 | 5.55 |
| Sc, Scandium (ppm) | 8.18 | 0.87 | 7.59 | 8.76 | 7.92 | 8.44 |
| Se, Selenium (ppm) | 3.06 | 0.56 | 2.61 | 3.50 | 2.81 | 3.30 |
| Sn, Tin (ppm) | 7.59 | 0.158 | 7.46 | 7.73 | 7.39 | 7.79 |
| Sr, Strontium (ppm) | 64 | 7 | 59 | 69 | 62 | 65 |
| Tb, Terbium (ppm) | 0.54 | 0.038 | 0.49 | 0.59 | 0.52 | 0.56 |
| Te, Tellurium (ppm) | 1.11 | 0.083 | 1.05 | 1.17 | 1.05 | 1.17 |
| Th, Thorium (ppm) | 7.33 | 0.573 | 6.88 | 7.77 | 7.13 | 7.53 |
| Ti, Titanium (wt.%) | 0.146 | 0.021 | 0.131 | 0.161 | 0.141 | 0.151 |
| Tl, Thallium (ppm) | 0.13 | 0.011 | 0.12 | 0.14 | IND | IND |
| U, Uranium (ppm) | 40.2 | 3.47 | 37.5 | 42.9 | 39.4 | 41.0 |
| V, Vanadium (ppm) | 153 | 8 | 147 | 158 | 149 | 156 |
| W, Tungsten (ppm) | 113 | 10 | 106 | 121 | 111 | 116 |
| Y, Yttrium (ppm) | 14.9 | 1.34 | 13.9 | 15.9 | 14.5 | 15.3 |
| Yb, Ytterbium (ppm) | 1.57 | 0.119 | 1.41 | 1.72 | IND | IND |
| Zn, Zinc (ppm) | 28.3 | 1.67 | 27.3 | 29.3 | 26.6 | 30.0 |
| Zr, Zirconium (ppm) | 45.7 | 3.55 | 42.7 | 48.8 | 44.0 | 47.5 |

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 |
| **Infrared Combustion** | | | | | | |
| S, Sulphur (wt.%) | 3.11 | 0.082 | 3.07 | 3.14 | 3.05 | 3.17 |
| **Gas / Liquid Pycnometry** | | | | | | |
| SG, Specific Gravity (Unity) | 3.26 | 0.076 | 3.22 | 3.30 | 3.23 | 3.29 |

Note: intervals may appear asymmetric due to rounding.

**Table 2. Indicative Values for OREAS 522.**

| Constituent | Unit | Value | Constituent | Unit | Value | Constituent | Unit | Value |
|---|---|---|---|---|---|---|---|---|
| **Pb Fire Assay** | | | | | | | | |
| Pd | ppb | *< 5* | Pt | ppb | *4* | | | |
| **Peroxide Fusion ICP** | | | | | | | | |
| Ag | ppm | *1.01* | Ge | ppm | *0.87* | Ta | ppm | *0.48* |
| B | ppm | *37.0* | Li | ppm | *17.6* | Te | ppm | *1.25* |
| Be | ppm | *< 1* | Pb | ppm | *12.5* | Tl | ppm | *< 0.5* |
| Cd | ppm | *< 1* | Re | ppm | *< 0.1* | Zn | ppm | *33.0* |
| Eu | ppm | *2.67* | Se | ppm | *3.35* | | | |
| **4-Acid Digestion** | | | | | | | | |
| Cd | ppm | *< 0.02* | Ge | ppm | *0.33* | Hg | ppm | *0.18* |
| **Aqua Regia Digestion** | | | | | | | | |
| B | ppm | *< 10* | Gd | ppm | *3.83* | Nd | ppm | *28.8* |
| Cd | ppm | *0.047* | Ge | ppm | *0.30* | Pr | ppm | *10.5* |
| Dy | ppm | *3.02* | Hg | ppm | *0.17* | Re | ppm | *0.10* |
| Er | ppm | *1.70* | Ho | ppm | *0.62* | Sm | ppm | *4.01* |
| Eu | ppm | *1.81* | Na | wt.% | *0.046* | Tm | ppm | *0.23* |
| **Sulphuric Acid Leach (5%)** | | | | | | | | |
| Cu | wt.% | *0.200* | | | | | | |

**Table 3. Instrumental Neutron Activation Analysis of Au on 20 x 85mg subsamples of OREAS 522.**

| Replicate No | INAA 85mg |
|---|---|
| 1 | 0.587 |
| 2 | 0.520 |
| 3 | 0.646 |
| 4 | 0.512 |
| 5 | 0.601 |
| 6 | 0.502 |
| 7 | 0.576 |
| 8 | 0.565 |
| 9 | 0.544 |
| 10 | 0.513 |
| 11 | 0.584 |
| 12 | 0.613 |

**Table 3 continued.**

| | |
|---|---|
| 13 | 0.546 |
| 14 | 0.579 |
| 15 | 0.523 |
| 16 | 0.595 |
| 17 | 0.583 |
| 18 | 0.577 |
| 19 | 0.626 |
| 20 | 0.588 |
| Mean | 0.569 |
| Median | 0.578 |
| Std Dev. | 0.040 |
| Rel.Std.Dev. | 7.06% |
| PDM[3] | -0.81% |

**Table 4. Performance Gates for OREAS 522.**

| 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 |
| **Pb Fire Assay** | | | | | | | | | | | |
| Au, ppm | 0.574 | 0.018 | 0.538 | 0.610 | 0.520 | 0.627 | 3.13% | 6.25% | 9.38% | 0.545 | 0.602 |
| **Peroxide Fusion ICP** | | | | | | | | | | | |
| Al, wt.% | 4.02 | 0.119 | 3.78 | 4.26 | 3.66 | 4.37 | 2.97% | 5.93% | 8.90% | 3.82 | 4.22 |
| As, ppm | 522 | 33 | 457 | 587 | 424 | 619 | 6.24% | 12.47% | 18.71% | 496 | 548 |
| Ba, wt.% | 2.38 | 0.192 | 1.99 | 2.76 | 1.80 | 2.95 | 8.10% | 16.21% | 24.31% | 2.26 | 2.49 |
| Bi, ppm | 9.12 | 0.632 | 7.85 | 10.38 | 7.22 | 11.01 | 6.93% | 13.86% | 20.79% | 8.66 | 9.57 |
| Ca, wt.% | 3.87 | 0.188 | 3.49 | 4.24 | 3.30 | 4.43 | 4.85% | 9.71% | 14.56% | 3.67 | 4.06 |
| Ce, ppm | 163 | 7 | 150 | 176 | 143 | 183 | 4.02% | 8.04% | 12.06% | 155 | 171 |
| Co, ppm | 555 | 34 | 487 | 623 | 454 | 656 | 6.08% | 12.17% | 18.25% | 527 | 583 |
| Cr, ppm | 34.5 | 6.2 | 22.1 | 47.0 | 15.8 | 53.3 | 18.06% | 36.13% | 54.19% | 32.8 | 36.3 |
| Cs, ppm | 0.67 | 0.062 | 0.55 | 0.80 | 0.49 | 0.86 | 9.19% | 18.37% | 27.56% | 0.64 | 0.71 |
| Cu, wt.% | 0.923 | 0.024 | 0.875 | 0.972 | 0.850 | 0.997 | 2.64% | 5.28% | 7.92% | 0.877 | 0.970 |
| Dy, ppm | 3.50 | 0.261 | 2.98 | 4.03 | 2.72 | 4.29 | 7.46% | 14.92% | 22.38% | 3.33 | 3.68 |
| Er, ppm | 2.13 | 0.099 | 1.93 | 2.33 | 1.83 | 2.43 | 4.65% | 9.30% | 13.94% | 2.02 | 2.24 |
| Fe, wt.% | 24.72 | 0.594 | 23.53 | 25.91 | 22.93 | 26.50 | 2.40% | 4.81% | 7.21% | 23.48 | 25.95 |
| Ga, ppm | 16.3 | 0.83 | 14.7 | 18.0 | 13.9 | 18.8 | 5.06% | 10.11% | 15.17% | 15.5 | 17.2 |
| Gd, ppm | 4.20 | 0.385 | 3.43 | 4.97 | 3.04 | 5.35 | 9.16% | 18.32% | 27.48% | 3.99 | 4.41 |
| Hf, ppm | 3.35 | 0.54 | 2.26 | 4.44 | 1.72 | 4.99 | 16.25% | 32.50% | 48.75% | 3.18 | 3.52 |
| Ho, ppm | 0.72 | 0.08 | 0.56 | 0.87 | 0.49 | 0.95 | 10.74% | 21.48% | 32.22% | 0.68 | 0.75 |
| In, ppm | 0.25 | 0.05 | 0.15 | 0.35 | 0.10 | 0.40 | 19.84% | 39.68% | 59.53% | 0.24 | 0.27 |
| K, wt.% | 2.89 | 0.133 | 2.62 | 3.16 | 2.49 | 3.29 | 4.61% | 9.22% | 13.83% | 2.75 | 3.03 |
| La, ppm | 222 | 10 | 201 | 242 | 191 | 253 | 4.64% | 9.28% | 13.92% | 211 | 233 |
| Lu, ppm | 0.35 | 0.04 | 0.26 | 0.43 | 0.22 | 0.47 | 12.28% | 24.56% | 36.84% | 0.33 | 0.36 |
| Mg, wt.% | 1.15 | 0.035 | 1.08 | 1.22 | 1.04 | 1.26 | 3.08% | 6.17% | 9.25% | 1.09 | 1.21 |
| Mn, wt.% | 0.418 | 0.020 | 0.378 | 0.458 | 0.358 | 0.478 | 4.77% | 9.55% | 14.32% | 0.397 | 0.439 |
| Mo, ppm | 207 | 15 | 177 | 236 | 163 | 251 | 7.10% | 14.20% | 21.30% | 196 | 217 |
| Nb, ppm | 6.00 | 0.90 | 4.21 | 7.80 | 3.31 | 8.70 | 14.96% | 29.93% | 44.89% | 5.70 | 6.30 |
| Nd, ppm | 28.9 | 2.04 | 24.9 | 33.0 | 22.8 | 35.0 | 7.04% | 14.08% | 21.12% | 27.5 | 30.4 |

Note: intervals may appear asymmetric due to rounding.

**Table 4 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 |
| **Peroxide Fusion ICP continued** | | | | | | | | | | | |
| Ni, ppm | 72 | 9 | 54 | 91 | 44 | 100 | 12.91% | 25.83% | 38.74% | 69 | 76 |
| P, wt.% | 0.089 | 0.007 | 0.076 | 0.102 | 0.070 | 0.109 | 7.30% | 14.61% | 21.91% | 0.085 | 0.094 |
| Pr, ppm | 10.4 | 0.81 | 8.8 | 12.0 | 8.0 | 12.9 | 7.79% | 15.57% | 23.36% | 9.9 | 10.9 |
| Rb, ppm | 84 | 3.2 | 78 | 91 | 75 | 94 | 3.75% | 7.51% | 11.26% | 80 | 89 |
| S, wt.% | 3.09 | 0.092 | 2.91 | 3.28 | 2.81 | 3.37 | 2.99% | 5.97% | 8.96% | 2.94 | 3.25 |
| Sb, ppm | 8.24 | 0.567 | 7.11 | 9.38 | 6.54 | 9.95 | 6.88% | 13.76% | 20.64% | 7.83 | 8.66 |
| Sc, ppm | 10.4 | 0.53 | 9.3 | 11.5 | 8.8 | 12.0 | 5.13% | 10.27% | 15.40% | 9.9 | 10.9 |
| Si, wt.% | 15.81 | 0.420 | 14.98 | 16.65 | 14.56 | 17.07 | 2.65% | 5.31% | 7.96% | 15.02 | 16.61 |
| Sm, ppm | 4.32 | 0.424 | 3.47 | 5.17 | 3.05 | 5.59 | 9.81% | 19.63% | 29.44% | 4.10 | 4.53 |
| Sn, ppm | 10.8 | 0.86 | 9.1 | 12.5 | 8.2 | 13.4 | 7.98% | 15.97% | 23.95% | 10.3 | 11.3 |
| Sr, ppm | 236 | 8 | 221 | 252 | 213 | 260 | 3.29% | 6.58% | 9.87% | 225 | 248 |
| Tb, ppm | 0.61 | 0.042 | 0.53 | 0.70 | 0.49 | 0.74 | 6.85% | 13.71% | 20.56% | 0.58 | 0.64 |
| Th, ppm | 8.69 | 0.667 | 7.36 | 10.03 | 6.69 | 10.69 | 7.67% | 15.34% | 23.01% | 8.26 | 9.13 |
| Ti, wt.% | 0.394 | 0.009 | 0.376 | 0.412 | 0.368 | 0.421 | 2.25% | 4.51% | 6.76% | 0.375 | 0.414 |
| Tm, ppm | 0.33 | 0.03 | 0.26 | 0.39 | 0.22 | 0.43 | 10.68% | 21.37% | 32.05% | 0.31 | 0.34 |
| U, ppm | 44.0 | 2.68 | 38.7 | 49.4 | 36.0 | 52.1 | 6.09% | 12.19% | 18.28% | 41.8 | 46.3 |
| V, ppm | 182 | 17 | 147 | 216 | 130 | 234 | 9.51% | 19.01% | 28.52% | 173 | 191 |
| W, ppm | 134 | 12 | 110 | 157 | 99 | 168 | 8.71% | 17.42% | 26.13% | 127 | 140 |
| Y, ppm | 19.3 | 0.93 | 17.4 | 21.1 | 16.5 | 22.0 | 4.81% | 9.62% | 14.42% | 18.3 | 20.2 |
| Yb, ppm | 2.11 | 0.165 | 1.78 | 2.44 | 1.62 | 2.60 | 7.81% | 15.62% | 23.43% | 2.00 | 2.22 |
| Zr, ppm | 111 | 11 | 88 | 133 | 77 | 144 | 10.02% | 20.04% | 30.06% | 105 | 116 |
| **4-Acid Digestion** | | | | | | | | | | | |
| Ag, ppm | 1.31 | 0.114 | 1.08 | 1.54 | 0.97 | 1.65 | 8.70% | 17.40% | 26.10% | 1.25 | 1.38 |
| Al, wt.% | 3.95 | 0.120 | 3.71 | 4.19 | 3.59 | 4.31 | 3.05% | 6.11% | 9.16% | 3.75 | 4.14 |
| As, ppm | 490 | 26 | 438 | 542 | 412 | 568 | 5.30% | 10.61% | 15.91% | 466 | 515 |
| Be, ppm | 0.70 | 0.09 | 0.52 | 0.87 | 0.43 | 0.96 | 12.56% | 25.13% | 37.69% | 0.66 | 0.73 |
| Bi, ppm | 8.72 | 0.499 | 7.72 | 9.71 | 7.22 | 10.21 | 5.72% | 11.44% | 17.16% | 8.28 | 9.15 |
| Ca, wt.% | 3.65 | 0.144 | 3.36 | 3.93 | 3.22 | 4.08 | 3.94% | 7.88% | 11.82% | 3.46 | 3.83 |
| Ce, ppm | 148 | 13 | 122 | 173 | 110 | 186 | 8.59% | 17.18% | 25.77% | 140 | 155 |
| Co, ppm | 550 | 19 | 512 | 588 | 493 | 607 | 3.43% | 6.86% | 10.28% | 523 | 578 |
| Cr, ppm | 29.6 | 3.7 | 22.2 | 37.0 | 18.5 | 40.7 | 12.53% | 25.06% | 37.59% | 28.1 | 31.1 |
| Cs, ppm | 0.64 | 0.055 | 0.53 | 0.75 | 0.48 | 0.80 | 8.55% | 17.10% | 25.64% | 0.61 | 0.67 |
| Cu, wt.% | 0.916 | 0.026 | 0.865 | 0.968 | 0.839 | 0.993 | 2.80% | 5.60% | 8.40% | 0.870 | 0.962 |
| Dy, ppm | 3.24 | 0.185 | 2.86 | 3.61 | 2.68 | 3.79 | 5.73% | 11.47% | 17.20% | 3.07 | 3.40 |
| Er, ppm | 1.97 | 0.088 | 1.79 | 2.14 | 1.70 | 2.23 | 4.49% | 8.97% | 13.46% | 1.87 | 2.06 |
| Eu, ppm | 1.88 | 0.074 | 1.73 | 2.03 | 1.66 | 2.10 | 3.95% | 7.90% | 11.85% | 1.79 | 1.98 |
| Fe, wt.% | 24.63 | 0.998 | 22.64 | 26.63 | 21.64 | 27.63 | 4.05% | 8.10% | 12.15% | 23.40 | 25.87 |
| Ga, ppm | 16.0 | 0.83 | 14.4 | 17.7 | 13.5 | 18.5 | 5.21% | 10.42% | 15.63% | 15.2 | 16.8 |
| Gd, ppm | 3.87 | 0.56 | 2.75 | 4.99 | 2.19 | 5.55 | 14.45% | 28.90% | 43.35% | 3.68 | 4.06 |
| Hf, ppm | 2.96 | 0.146 | 2.66 | 3.25 | 2.52 | 3.39 | 4.94% | 9.87% | 14.81% | 2.81 | 3.10 |
| Ho, ppm | 0.66 | 0.042 | 0.58 | 0.75 | 0.54 | 0.79 | 6.37% | 12.75% | 19.12% | 0.63 | 0.70 |
| In, ppm | 0.23 | 0.03 | 0.17 | 0.28 | 0.14 | 0.31 | 12.21% | 24.42% | 36.64% | 0.22 | 0.24 |
| K, wt.% | 2.83 | 0.103 | 2.62 | 3.03 | 2.52 | 3.13 | 3.66% | 7.31% | 10.97% | 2.68 | 2.97 |

Note: intervals may appear asymmetric due to rounding.

**Table 4 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 |
| **4-Acid Digestion continued** | | | | | | | | | | | |
| La, ppm | 171 | 30 | 111 | 230 | 82 | 259 | 17.35% | 34.69% | 52.04% | 162 | 179 |
| Li, ppm | 16.2 | 1.51 | 13.2 | 19.3 | 11.7 | 20.8 | 9.31% | 18.63% | 27.94% | 15.4 | 17.0 |
| Lu, ppm | 0.31 | 0.020 | 0.27 | 0.35 | 0.25 | 0.37 | 6.55% | 13.11% | 19.66% | 0.29 | 0.32 |
| Mg, wt.% | 1.12 | 0.067 | 0.99 | 1.25 | 0.92 | 1.32 | 5.99% | 11.98% | 17.97% | 1.06 | 1.18 |
| Mn, wt.% | 0.397 | 0.022 | 0.352 | 0.442 | 0.330 | 0.464 | 5.66% | 11.31% | 16.97% | 0.377 | 0.417 |
| Mo, ppm | 206 | 12 | 182 | 229 | 170 | 241 | 5.79% | 11.58% | 17.37% | 195 | 216 |
| Na, wt.% | 0.633 | 0.043 | 0.547 | 0.719 | 0.504 | 0.763 | 6.81% | 13.63% | 20.44% | 0.601 | 0.665 |
| Nb, ppm | 5.66 | 0.368 | 4.93 | 6.40 | 4.56 | 6.76 | 6.49% | 12.99% | 19.48% | 5.38 | 5.94 |
| Nd, ppm | 27.2 | 1.20 | 24.8 | 29.6 | 23.6 | 30.8 | 4.39% | 8.78% | 13.17% | 25.9 | 28.6 |
| Ni, ppm | 70 | 4.4 | 62 | 79 | 57 | 84 | 6.25% | 12.51% | 18.76% | 67 | 74 |
| P, wt.% | 0.089 | 0.005 | 0.078 | 0.099 | 0.073 | 0.105 | 5.95% | 11.90% | 17.85% | 0.084 | 0.093 |
| Pb, ppm | 12.5 | 1.3 | 9.9 | 15.0 | 8.7 | 16.2 | 10.05% | 20.11% | 30.16% | 11.8 | 13.1 |
| Pr, ppm | 9.76 | 0.631 | 8.50 | 11.02 | 7.87 | 11.65 | 6.46% | 12.93% | 19.39% | 9.27 | 10.25 |
| Rb, ppm | 82 | 3.3 | 75 | 89 | 72 | 92 | 3.98% | 7.95% | 11.93% | 78 | 86 |
| Re, ppm | 0.098 | 0.005 | 0.088 | 0.109 | 0.083 | 0.114 | 5.35% | 10.71% | 16.06% | 0.093 | 0.103 |
| S, wt.% | 2.50 | 0.103 | 2.29 | 2.70 | 2.19 | 2.81 | 4.11% | 8.22% | 12.32% | 2.37 | 2.62 |
| Sb, ppm | 7.93 | 0.465 | 7.00 | 8.86 | 6.54 | 9.33 | 5.86% | 11.72% | 17.58% | 7.53 | 8.33 |
| Sc, ppm | 10.9 | 0.83 | 9.2 | 12.5 | 8.4 | 13.4 | 7.60% | 15.20% | 22.80% | 10.3 | 11.4 |
| Se, ppm | 2.74 | 0.51 | 1.71 | 3.76 | 1.20 | 4.27 | 18.74% | 37.48% | 56.22% | 2.60 | 2.87 |
| Sm, ppm | 4.17 | 0.196 | 3.78 | 4.57 | 3.59 | 4.76 | 4.70% | 9.41% | 14.11% | 3.97 | 4.38 |
| Sn, ppm | 9.32 | 0.686 | 7.95 | 10.69 | 7.26 | 11.38 | 7.36% | 14.72% | 22.08% | 8.85 | 9.79 |
| Sr, ppm | 199 | 20 | 159 | 238 | 139 | 258 | 9.99% | 19.97% | 29.96% | 189 | 209 |
| Ta, ppm | 0.44 | 0.06 | 0.32 | 0.55 | 0.27 | 0.61 | 13.03% | 26.06% | 39.09% | 0.41 | 0.46 |
| Tb, ppm | 0.59 | 0.053 | 0.48 | 0.69 | 0.43 | 0.74 | 9.03% | 18.06% | 27.08% | 0.56 | 0.62 |
| Te, ppm | 1.14 | 0.092 | 0.96 | 1.33 | 0.87 | 1.42 | 8.03% | 16.06% | 24.09% | 1.09 | 1.20 |
| Th, ppm | 7.53 | 0.627 | 6.27 | 8.78 | 5.64 | 9.41 | 8.33% | 16.66% | 25.00% | 7.15 | 7.90 |
| Ti, wt.% | 0.344 | 0.018 | 0.307 | 0.380 | 0.289 | 0.399 | 5.32% | 10.65% | 15.97% | 0.327 | 0.361 |
| Tl, ppm | 0.29 | 0.016 | 0.25 | 0.32 | 0.24 | 0.33 | 5.60% | 11.21% | 16.81% | 0.27 | 0.30 |
| Tm, ppm | 0.28 | 0.015 | 0.25 | 0.31 | 0.23 | 0.33 | 5.52% | 11.05% | 16.57% | 0.27 | 0.29 |
| U, ppm | 42.2 | 3.17 | 35.9 | 48.6 | 32.7 | 51.8 | 7.51% | 15.01% | 22.52% | 40.1 | 44.4 |
| V, ppm | 164 | 9 | 147 | 181 | 138 | 190 | 5.30% | 10.60% | 15.91% | 156 | 172 |
| W, ppm | 135 | 11 | 113 | 157 | 102 | 168 | 8.18% | 16.37% | 24.55% | 128 | 142 |
| Y, ppm | 18.5 | 0.94 | 16.6 | 20.4 | 15.7 | 21.3 | 5.09% | 10.18% | 15.28% | 17.6 | 19.4 |
| Yb, ppm | 1.97 | 0.115 | 1.74 | 2.20 | 1.62 | 2.31 | 5.83% | 11.66% | 17.49% | 1.87 | 2.06 |
| Zn, ppm | 30.2 | 2.14 | 25.9 | 34.5 | 23.8 | 36.6 | 7.08% | 14.16% | 21.23% | 28.7 | 31.7 |
| Zr, ppm | 112 | 6 | 101 | 123 | 95 | 128 | 4.94% | 9.87% | 14.81% | 106 | 117 |
| **3-Acid Digestion (no HF)** | | | | | | | | | | | |
| Ag, ppm | 1.19 | 0.18 | 0.82 | 1.56 | 0.64 | 1.74 | 15.39% | 30.79% | 46.18% | 1.13 | 1.25 |
| As, ppm | 502 | 17 | 469 | 536 | 452 | 553 | 3.33% | 6.66% | 9.99% | 477 | 528 |
| Co, ppm | 547 | 22 | 503 | 591 | 481 | 613 | 4.00% | 8.00% | 12.01% | 520 | 574 |
| Cu, wt.% | 0.908 | 0.022 | 0.864 | 0.952 | 0.842 | 0.974 | 2.42% | 4.84% | 7.25% | 0.863 | 0.954 |
| Fe, wt.% | 24.91 | 0.563 | 23.78 | 26.03 | 23.22 | 26.60 | 2.26% | 4.52% | 6.77% | 23.66 | 26.15 |
| Mo, ppm | 193 | 9 | 175 | 211 | 167 | 220 | 4.60% | 9.19% | 13.79% | 184 | 203 |
| S, wt.% | 2.74 | 0.167 | 2.41 | 3.07 | 2.24 | 3.24 | 6.08% | 12.16% | 18.24% | 2.60 | 2.88 |

**Table 4 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** | | | | | | | | | | | |
| Ag, ppm | 1.23 | 0.102 | 1.03 | 1.43 | 0.92 | 1.54 | 8.31% | 16.63% | 24.94% | 1.17 | 1.29 |
| Al, wt.% | 1.29 | 0.044 | 1.20 | 1.37 | 1.15 | 1.42 | 3.42% | 6.84% | 10.26% | 1.22 | 1.35 |
| As, ppm | 492 | 25 | 442 | 541 | 417 | 566 | 5.03% | 10.07% | 15.10% | 467 | 516 |
| Au, ppm | 0.549 | 0.025 | 0.499 | 0.599 | 0.474 | 0.624 | 4.54% | 9.08% | 13.62% | 0.521 | 0.576 |
| Be, ppm | 0.41 | 0.06 | 0.28 | 0.54 | 0.22 | 0.60 | 15.52% | 31.05% | 46.57% | 0.39 | 0.43 |
| Bi, ppm | 8.87 | 0.487 | 7.89 | 9.84 | 7.41 | 10.33 | 5.49% | 10.97% | 16.46% | 8.42 | 9.31 |
| Ca, wt.% | 3.43 | 0.154 | 3.12 | 3.74 | 2.97 | 3.89 | 4.48% | 8.96% | 13.45% | 3.26 | 3.60 |
| Ce, ppm | 153 | 9 | 136 | 171 | 127 | 179 | 5.64% | 11.27% | 16.91% | 146 | 161 |
| Co, ppm | 533 | 33 | 467 | 598 | 434 | 631 | 6.17% | 12.34% | 18.51% | 506 | 559 |
| Cr, ppm | 28.6 | 1.32 | 26.0 | 31.3 | 24.7 | 32.6 | 4.61% | 9.22% | 13.83% | 27.2 | 30.1 |
| Cs, ppm | 0.52 | 0.05 | 0.42 | 0.63 | 0.36 | 0.69 | 10.19% | 20.38% | 30.58% | 0.50 | 0.55 |
| Cu, wt.% | 0.904 | 0.031 | 0.841 | 0.966 | 0.810 | 0.997 | 3.44% | 6.88% | 10.32% | 0.858 | 0.949 |
| Fe, wt.% | 24.13 | 0.615 | 22.90 | 25.36 | 22.29 | 25.98 | 2.55% | 5.10% | 7.64% | 22.93 | 25.34 |
| Ga, ppm | 13.2 | 1.5 | 10.3 | 16.2 | 8.8 | 17.6 | 11.18% | 22.37% | 33.55% | 12.6 | 13.9 |
| Hf, ppm | 1.21 | 0.066 | 1.07 | 1.34 | 1.01 | 1.40 | 5.48% | 10.97% | 16.45% | 1.15 | 1.27 |
| In, ppm | 0.23 | 0.023 | 0.18 | 0.27 | 0.16 | 0.30 | 9.96% | 19.92% | 29.88% | 0.22 | 0.24 |
| K, wt.% | 0.528 | 0.020 | 0.488 | 0.568 | 0.468 | 0.589 | 3.79% | 7.59% | 11.38% | 0.502 | 0.555 |
| La, ppm | 192 | 16 | 160 | 224 | 144 | 240 | 8.31% | 16.61% | 24.92% | 183 | 202 |
| Li, ppm | 15.9 | 1.55 | 12.8 | 19.0 | 11.3 | 20.6 | 9.73% | 19.47% | 29.20% | 15.1 | 16.7 |
| Lu, ppm | 0.23 | 0.015 | 0.20 | 0.26 | 0.19 | 0.28 | 6.60% | 13.20% | 19.80% | 0.22 | 0.25 |
| Mg, wt.% | 1.07 | 0.056 | 0.96 | 1.18 | 0.90 | 1.24 | 5.27% | 10.53% | 15.80% | 1.02 | 1.12 |
| Mn, wt.% | 0.367 | 0.020 | 0.328 | 0.407 | 0.308 | 0.427 | 5.38% | 10.75% | 16.13% | 0.349 | 0.386 |
| Mo, ppm | 198 | 12 | 173 | 223 | 161 | 236 | 6.30% | 12.61% | 18.91% | 188 | 208 |
| Nb, ppm | 0.91 | 0.066 | 0.77 | 1.04 | 0.71 | 1.10 | 7.29% | 14.58% | 21.88% | 0.86 | 0.95 |
| Ni, ppm | 64 | 3.2 | 58 | 70 | 55 | 74 | 4.95% | 9.89% | 14.84% | 61 | 67 |
| P, wt.% | 0.089 | 0.005 | 0.079 | 0.099 | 0.074 | 0.104 | 5.48% | 10.95% | 16.43% | 0.084 | 0.093 |
| Pb, ppm | 12.5 | 1.18 | 10.1 | 14.8 | 8.9 | 16.0 | 9.48% | 18.97% | 28.45% | 11.8 | 13.1 |
| Rb, ppm | 30.9 | 1.68 | 27.6 | 34.3 | 25.9 | 36.0 | 5.44% | 10.89% | 16.33% | 29.4 | 32.5 |
| S, wt.% | 2.59 | 0.127 | 2.34 | 2.85 | 2.21 | 2.97 | 4.88% | 9.77% | 14.65% | 2.46 | 2.72 |
| Sb, ppm | 5.39 | 1.02 | 3.35 | 7.42 | 2.33 | 8.44 | 18.88% | 37.77% | 56.65% | 5.12 | 5.65 |
| Sc, ppm | 8.18 | 0.87 | 6.45 | 9.91 | 5.58 | 10.77 | 10.58% | 21.16% | 31.74% | 7.77 | 8.59 |
| Se, ppm | 3.06 | 0.56 | 1.93 | 4.18 | 1.37 | 4.74 | 18.38% | 36.75% | 55.13% | 2.90 | 3.21 |
| Sn, ppm | 7.59 | 0.158 | 7.28 | 7.91 | 7.12 | 8.06 | 2.08% | 4.15% | 6.23% | 7.21 | 7.97 |
| Sr, ppm | 64 | 7 | 50 | 77 | 44 | 84 | 10.51% | 21.03% | 31.54% | 61 | 67 |
| Tb, ppm | 0.54 | 0.038 | 0.46 | 0.61 | 0.42 | 0.65 | 7.10% | 14.20% | 21.30% | 0.51 | 0.56 |
| Te, ppm | 1.11 | 0.083 | 0.94 | 1.27 | 0.86 | 1.36 | 7.51% | 15.01% | 22.52% | 1.05 | 1.16 |
| Th, ppm | 7.33 | 0.573 | 6.18 | 8.48 | 5.61 | 9.05 | 7.81% | 15.63% | 23.44% | 6.96 | 7.70 |
| Ti, wt.% | 0.146 | 0.021 | 0.103 | 0.188 | 0.082 | 0.210 | 14.54% | 29.08% | 43.62% | 0.139 | 0.153 |
| Tl, ppm | 0.13 | 0.011 | 0.11 | 0.16 | 0.10 | 0.17 | 8.30% | 16.60% | 24.89% | 0.13 | 0.14 |
| U, ppm | 40.2 | 3.47 | 33.3 | 47.1 | 29.8 | 50.6 | 8.63% | 17.26% | 25.89% | 38.2 | 42.2 |
| V, ppm | 153 | 8 | 138 | 168 | 130 | 175 | 4.94% | 9.89% | 14.83% | 145 | 160 |
| W, ppm | 113 | 10 | 93 | 134 | 83 | 144 | 8.98% | 17.96% | 26.95% | 108 | 119 |
| Y, ppm | 14.9 | 1.34 | 12.2 | 17.6 | 10.9 | 18.9 | 8.99% | 17.98% | 26.97% | 14.1 | 15.6 |

Note: intervals may appear asymmetric due to rounding.

**Table 4 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** | | | | | | | | | | | |
| Yb, ppm | 1.57 | 0.119 | 1.33 | 1.80 | 1.21 | 1.92 | 7.59% | 15.17% | 22.76% | 1.49 | 1.64 |
| Zn, ppm | 28.3 | 1.67 | 24.9 | 31.6 | 23.3 | 33.3 | 5.89% | 11.78% | 17.66% | 26.9 | 29.7 |
| Zr, ppm | 45.7 | 3.55 | 38.6 | 52.8 | 35.1 | 56.4 | 7.76% | 15.52% | 23.28% | 43.4 | 48.0 |
| **Infrared Combustion** | | | | | | | | | | | |
| S, wt.% | 3.11 | 0.082 | 2.94 | 3.27 | 2.86 | 3.36 | 2.65% | 5.29% | 7.94% | 2.95 | 3.26 |
| **Gas / Liquid Pycnometry** | | | | | | | | | | | |
| SG, Unity | 3.26 | 0.076 | 3.11 | 3.41 | 3.03 | 3.49 | 2.34% | 4.69% | 7.03% | 3.10 | 3.42 |

Note: intervals may appear asymmetric due to rounding.

## PREPARER AND SUPPLIER OF THE REFERENCE MATERIAL

Reference material OREAS 522 has been prepared, certified and is supplied by:


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OREAS 522 is available in unit sizes of 60g and 100g sealed under nitrogen in laminated foil pouches.

## INTENDED USE

OREAS 522 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 522 has been sourced from iron oxide copper-gold ore and waste rock from the Ernest Henry deposit. It contains reactive sulphide (3.11% S) and has been packaged under a nitrogen environment (single use laminated foil pouches only). In its unopened state and under normal conditions of storage the CRM 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 522 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.

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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

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