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OREAS
Certified Reference Materials

CERTIFICATE OF ANALYSIS FOR

LATERITIC SCANDIUM (NICKEL-COBALT) ORE
CERTIFIED REFERENCE MATERIAL
OREAS 199

Table 1. Certified Values, SDs, 95% Confidence and Tolerance Limits for OREAS 199.

Constituent	Certified Value	1SD	95% Confidence Limits		95% Tolerance Limits	
			Low	High	Low	High
Borate Fusion XRF						
Al_2O_3, Aluminium(III) oxide (wt.%)	17.47	0.105	17.41	17.52	17.35	17.59
CaO, Calcium oxide (wt.%)	0.208	0.004	0.206	0.209	0.203	0.213
Co, Cobalt (ppm)	554	12	547	562	542	567
Cr_2O_3, Chromium(III) oxide (wt.%)	0.686	0.009	0.681	0.691	0.680	0.693
Cu, Copper (ppm)	189	14	180	197	186	191
Fe_2O_3, Iron(III) oxide (wt.%)	41.01	0.238	40.88	41.13	40.79	41.22
K_2O, Potassium oxide (wt.%)	0.069	0.008	0.065	0.073	0.067	0.071
MgO, Magnesium oxide (wt.%)	0.742	0.031	0.723	0.761	0.729	0.755
MnO, Manganese oxide (wt.%)	1.94	0.026	1.93	1.96	1.93	1.96
Na_2O, Sodium oxide (wt.%)	0.339	0.015	0.329	0.349	0.327	0.350
Ni, Nickel (ppm)	995	35	970	1021	966	1025
P_2O_5, Phosphorus(V) oxide (wt.%)	0.065	0.003	0.063	0.067	0.063	0.066
SiO_2, Silicon dioxide (wt.%)	24.93	0.131	24.87	24.99	24.78	25.08
SO_3, Sulphur trioxide (wt.%)	0.080	0.008	0.070	0.090	IND	IND
TiO_2, Titanium dioxide (wt.%)	0.842	0.016	0.833	0.851	0.833	0.851
Zn, Zinc (ppm)	198	8	192	204	182	215
Thermogravimetry						
LOI^{1000}, Loss On Ignition @1000°C (wt.%)	10.99	0.242	10.85	11.13	10.91	11.08
Borate / Peroxide Fusion ICP						
Al_2O_3, Aluminium(III) oxide (wt.%)	17.26	0.413	17.03	17.49	16.99	17.52
Ba, Barium (ppm)	1442	37	1421	1463	1407	1477
Be, Beryllium (ppm)	1.69	0.33	1.53	1.85	IND	IND
CaO, Calcium oxide (wt.%)	0.212	0.044	0.186	0.239	0.193	0.232
Ce, Cerium (ppm)	191	20	174	209	184	199
Co, Cobalt (ppm)	557	18	551	564	542	572
Cr_2O_3, Chromium(III) oxide (wt.%)	0.682	0.024	0.669	0.696	0.671	0.694
Cs, Cesium (ppm)	0.19	0.03	0.18	0.21	IND	IND
Cu, Copper (ppm)	191	12	182	201	183	200
Dy, Dysprosium (ppm)	2.69	0.148	2.55	2.83	2.47	2.91
Er, Erbium (ppm)	1.46	0.099	1.36	1.56	IND	IND
Fe_2O_3, Iron(III) oxide (wt.%)	40.69	1.016	40.24	41.14	39.93	41.45
Ga, Gallium (ppm)	19.0	1.26	17.8	20.3	17.9	20.2
Gd, Gadolinium (ppm)	3.09	0.306	2.74	3.44	2.78	3.40
Hf, Hafnium (ppm)	1.14	0.12	1.01	1.27	IND	IND
Ho, Holmium (ppm)	0.52	0.038	0.49	0.55	IND	IND
La, Lanthanum (ppm)	8.43	0.99	7.46	9.41	8.12	8.75
Li, Lithium (ppm)	21.2	1.34	20.1	22.3	19.5	22.9
MgO, Magnesium oxide (wt.%)	0.730	0.020	0.720	0.740	0.708	0.752
MnO, Manganese oxide (wt.%)	1.91	0.056	1.88	1.93	1.87	1.94
Mo, Molybdenum (ppm)	< 5	IND	IND	IND	IND	IND
Na_2O, Sodium oxide (wt.%)	0.323	0.030	0.289	0.357	0.308	0.338

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
Borate / Peroxide Fusion ICP continued						
Nb, Niobium (ppm)	2.19	0.27	1.94	2.44	1.79	2.59
Nd, Neodymium (ppm)	12.6	0.91	11.9	13.3	11.7	13.5
Ni, Nickel (ppm)	995	51	968	1023	968	1022
P_2O_5, Phosphorus(V) oxide (wt.%)	0.063	0.011	0.056	0.069	IND	IND
Pr, Praseodymium (ppm)	3.04	0.152	2.88	3.20	2.93	3.15
Rb, Rubidium (ppm)	2.03	0.113	1.96	2.10	1.79	2.27
Sb, Antimony (ppm)	2.77	0.59	2.17	3.36	1.89	3.65
Sc, Scandium (ppm)	591	11	584	597	579	603
SiO_2, Silicon dioxide (wt.%)	24.74	0.804	24.48	25.00	24.14	25.34
Sm, Samarium (ppm)	3.73	0.230	3.57	3.89	3.48	3.98
Sr, Strontium (ppm)	87	5.2	84	90	84	90
Tb, Terbium (ppm)	0.50	0.016	0.48	0.51	IND	IND
Th, Thorium (ppm)	1.88	0.110	1.81	1.95	1.80	1.95
TiO_2, Titanium dioxide (wt.%)	0.826	0.024	0.813	0.838	0.808	0.843
Tl, Thallium (ppm)	0.96	0.10	0.89	1.03	IND	IND
Tm, Thulium (ppm)	0.21	0.04	0.18	0.23	IND	IND
U, Uranium (ppm)	3.05	0.162	2.94	3.17	2.92	3.18
V, Vanadium (ppm)	657	38	628	687	640	674
Y, Yttrium (ppm)	8.55	0.789	8.10	9.00	8.08	9.01
Yb, Ytterbium (ppm)	1.48	0.078	1.45	1.51	IND	IND
Zn, Zinc (ppm)	207	11	200	215	194	220
Zr, Zirconium (ppm)	31.8	3.06	29.3	34.2	30.1	33.4
Gas / Liquid Pycnometry						
SG, Specific Gravity (Unity)	3.14	0.189	2.98	3.29	3.11	3.17

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

OREAS 199 has been prepared from a blend of scandium mineralised laterite sourced from the Nyngan (Gilgai and Honeybugle) deposits, located about 450kms northwest of Sydney (Australia), supplemented with a small quantity of high grade, Ni-Co laterite ore (sourced from the Bulong deposit located 35km east of Kalgoorlie in Western Australia).

The Nyngan scandium ore is sourced from the upper lateritic zone consisting haematitic and limonitic clays from humid weathering of mafic/ultramafic rocks that intruded Cambrian-Ordovician metasediments.

The Bulong ore formed from prolonged lateritic weathering of Archaean (Yilgarn Craton) olivine rich ultramafic/komatiite flows. Grades of >1% Ni were generated in zones of more intense weathering associated with faulting and bedrock alteration. The Ni-Co nontronitic (Fe-Ni smectite clays) siliceous ores at Bulong formed with a goethitic overprint in the upper laterite profile.

COMMINUTION AND HOMOGENISATION PROCEDURES

The material constituting OREAS 199 was prepared in the following manner:

- drying to constant mass at 105°C;
- crushing and milling of the ore materials to 100% minus 35 microns;
- preliminary homogenisation and check assaying of all ore source materials;
- final homogenisation by blending the source materials in specific ratios to achieve target grades;
- packaging in 10g units sealed in laminated foil pouches and 1kg units in plastic jars.

ANALYTICAL PROGRAM

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

- Borate fusion with XRF for common nickel laterite assemblage (up to 14 laboratories depening on the analyte);
- Thermogravimetric analysis of LOI at 1000°C (15 labs);
- Borate or peroxide fusion for full elemental suite ICP-OES and ICP-MS finishes (up to 15 laboratories depending on the element);
- C and S by IR combustion furnace (14 labs);
- Specific gravity by gas (6 labs) or liquid (3 labs) pycnometry.

For the round robin program ten 250g test units were taken at predetermined intervals during the bagging stage, immediately following homogenisation and are considered representative of the entire 146kg batch. The six samples received by each laboratory were obtained by taking one 20g scoop split from each of six different test units. This format maximised representivity of the parent batch at each lab. Table 1 presents the 62 certified values together with their associated 1SD's, 95% confidence and tolerance limits and Table 2 below shows 27 indicative values. Table 3 provides performance gate intervals for the certified values based on their associated pooled standard deviations. Tabulated results of all elements together with analytical method codes, 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 199 DataPack.xlsx**).

Table 2. Indicative Values for OREAS 199.

Constituent	Unit	Value	Constituent	Unit	Value	Constituent	Unit	Value
Borate Fusion XRF								
As	ppm	*16.4*	Pb	ppm	*< 50*	Zr	ppm	*58*
BaO	ppm	*1880*	Sc	ppm	*600*			
Cl	ppm	*1547*	V_2O_5	ppm	*1092*			
Borate / Peroxide Fusion ICP								
Ag	ppm	*< 5*	Ge	ppm	*4.62*	S	wt.%	*0.033*
As	ppm	*8.47*	In	ppm	*0.12*	Se	ppm	*< 20*
B	ppm	*35.8*	K_2O	wt.%	*0.075*	Sn	ppm	*0.98*
Bi	ppm	*0.10*	Lu	ppm	*0.21*	Ta	ppm	*0.18*
Cd	ppm	*< 10*	Pb	ppm	*7.57*	Te	ppm	*< 1*
Eu	ppm	*0.93*	Re	ppm	*< 0.1*	W	ppm	*1.00*
Infrared Combustion								
C	wt.%	*0.055*	S	wt.%	*0.028*			

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. The Certified Values are the means of accepted laboratory means after outlier filtering.

The 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 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 scandium (Sc) by fusion ICP, where 99% of the time ($1-\alpha=0.99$) at least 95% of subsamples ($\rho=0.95$) will have concentrations lying between 579 and 603 ppm. 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). *Please note that tolerance limits pertain to the homogeneity of the CRM only and should not be used as control limits for laboratory performance.*

Based on the statistical analysis of the results of the inter-laboratory certification program it can be concluded that OREAS 199 is fit-for-purpose as a certified reference material (see 'Intended Use' below).

Table 3. Performance Gates for OREAS 199.

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
Borate Fusion XRF											
Al_2O_3, wt.%	17.47	0.105	17.26	17.68	17.15	17.78	0.60%	1.21%	1.81%	16.59	18.34
CaO, wt.%	0.208	0.004	0.199	0.216	0.195	0.221	2.08%	4.16%	6.24%	0.197	0.218
Co, ppm	554	12	530	578	518	590	2.17%	4.33%	6.50%	527	582
Cr_2O_3, wt.%	0.686	0.009	0.669	0.704	0.660	0.712	1.27%	2.54%	3.80%	0.652	0.721
Cu, ppm	189	14	162	216	148	229	7.16%	14.32%	21.48%	179	198
Fe_2O_3, wt.%	41.01	0.238	40.53	41.48	40.29	41.72	0.58%	1.16%	1.74%	38.95	43.06
K_2O, wt.%	0.069	0.008	0.054	0.084	0.046	0.092	11.16%	22.33%	33.49%	0.066	0.072
MgO, wt.%	0.742	0.031	0.681	0.803	0.650	0.834	4.13%	8.26%	12.39%	0.705	0.779
MnO, wt.%	1.94	0.026	1.89	2.00	1.87	2.02	1.34%	2.68%	4.02%	1.85	2.04
Na_2O, wt.%	0.339	0.015	0.309	0.369	0.294	0.384	4.42%	8.85%	13.27%	0.322	0.356
Ni, ppm	995	35	925	1066	889	1102	3.56%	7.13%	10.69%	946	1045
P_2O_5, wt.%	0.065	0.003	0.059	0.071	0.056	0.074	4.65%	9.31%	13.96%	0.061	0.068
SiO_2, wt.%	24.93	0.131	24.67	25.19	24.54	25.33	0.53%	1.05%	1.58%	23.69	26.18
SO_3, wt.%	0.080	0.008	0.064	0.096	0.056	0.104	9.97%	19.94%	29.91%	0.076	0.084
TiO_2, wt.%	0.842	0.016	0.811	0.874	0.795	0.890	1.87%	3.75%	5.62%	0.800	0.884
Zn, ppm	198	8	182	215	173	223	4.20%	8.40%	12.59%	188	208
Thermogravimetry											
LOI^{1000}, wt.%	10.99	0.242	10.51	11.48	10.26	11.72	2.20%	4.41%	6.61%	10.44	11.54
Borate / Peroxide Fusion ICP											
Al_2O_3, wt.%	17.26	0.413	16.43	18.08	16.02	18.50	2.40%	4.79%	7.19%	16.39	18.12
Ba, ppm	1442	37	1368	1516	1331	1553	2.56%	5.12%	7.68%	1370	1514
Be, ppm	1.69	0.33	1.03	2.35	0.70	2.68	19.55%	39.10%	58.65%	1.61	1.77
CaO, wt.%	0.212	0.044	0.124	0.301	0.080	0.345	20.71%	41.42%	62.13%	0.202	0.223
Ce, ppm	191	20	152	230	133	250	10.23%	20.45%	30.68%	182	201
Co, ppm	557	18	522	593	504	610	3.17%	6.34%	9.51%	529	585
Cr_2O_3, wt.%	0.682	0.024	0.633	0.731	0.609	0.756	3.59%	7.18%	10.77%	0.648	0.716
Cs, ppm	0.19	0.03	0.14	0.25	0.11	0.28	14.93%	29.87%	44.80%	0.18	0.20
Cu, ppm	191	12	167	216	154	228	6.46%	12.91%	19.37%	182	201
Dy, ppm	2.69	0.148	2.39	2.99	2.25	3.13	5.50%	11.00%	16.50%	2.56	2.82
Er, ppm	1.46	0.099	1.26	1.66	1.17	1.76	6.75%	13.49%	20.24%	1.39	1.53
Fe_2O_3, wt.%	40.69	1.016	38.66	42.72	37.64	43.74	2.50%	4.99%	7.49%	38.66	42.73
Ga, ppm	19.0	1.26	16.5	21.6	15.2	22.8	6.64%	13.28%	19.93%	18.1	20.0
Gd, ppm	3.09	0.306	2.48	3.70	2.17	4.01	9.90%	19.80%	29.71%	2.93	3.24
Hf, ppm	1.14	0.12	0.89	1.39	0.76	1.51	10.96%	21.91%	32.87%	1.08	1.19
Ho, ppm	0.52	0.038	0.45	0.60	0.41	0.64	7.31%	14.62%	21.93%	0.50	0.55
La, ppm	8.43	0.99	6.46	10.41	5.48	11.39	11.70%	23.39%	35.09%	8.01	8.86
Li, ppm	21.2	1.34	18.5	23.9	17.2	25.2	6.31%	12.62%	18.94%	20.1	22.3
MgO, wt.%	0.730	0.020	0.689	0.771	0.669	0.791	2.79%	5.58%	8.38%	0.694	0.767
MnO, wt.%	1.91	0.056	1.79	2.02	1.74	2.07	2.95%	5.89%	8.84%	1.81	2.00
Mo, ppm	< 5	IND	IND	IND	IND	IND	IND	IND	IND	IND	IND
Na_2O, wt.%	0.323	0.030	0.263	0.384	0.232	0.414	9.38%	18.76%	28.14%	0.307	0.340
Nb, ppm	2.19	0.27	1.66	2.72	1.39	2.99	12.13%	24.26%	36.39%	2.08	2.30
Nd, ppm	12.6	0.91	10.8	14.4	9.9	15.3	7.20%	14.39%	21.59%	12.0	13.2

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
Borate / Peroxide Fusion ICP continued											
Ni, ppm	995	51	893	1097	842	1148	5.13%	10.25%	15.38%	946	1045
P_2O_5, wt.%	0.063	0.011	0.042	0.084	0.031	0.095	16.91%	33.81%	50.72%	0.060	0.066
Pr, ppm	3.04	0.152	2.74	3.34	2.58	3.50	5.01%	10.02%	15.04%	2.89	3.19
Rb, ppm	2.03	0.113	1.80	2.25	1.69	2.37	5.55%	11.10%	16.64%	1.93	2.13
Sb, ppm	2.77	0.59	1.60	3.94	1.01	4.53	21.17%	42.34%	63.52%	2.63	2.91
Sc, ppm	591	11	569	612	558	623	1.84%	3.67%	5.51%	561	620
SiO_2, wt.%	24.74	0.804	23.13	26.35	22.33	27.15	3.25%	6.50%	9.75%	23.50	25.98
Sm, ppm	3.73	0.230	3.27	4.19	3.04	4.42	6.16%	12.33%	18.49%	3.54	3.92
Sr, ppm	87	5.2	76	97	71	103	6.03%	12.07%	18.10%	82	91
Tb, ppm	0.50	0.016	0.46	0.53	0.45	0.54	3.23%	6.45%	9.68%	0.47	0.52
Th, ppm	1.88	0.110	1.66	2.10	1.55	2.21	5.87%	11.73%	17.60%	1.78	1.97
TiO_2, wt.%	0.826	0.024	0.778	0.874	0.754	0.898	2.90%	5.80%	8.70%	0.784	0.867
Tl, ppm	0.96	0.10	0.77	1.16	0.67	1.25	10.09%	20.17%	30.26%	0.91	1.01
Tm, ppm	0.21	0.04	0.12	0.29	0.08	0.34	21.09%	42.18%	63.28%	0.20	0.22
U, ppm	3.05	0.162	2.73	3.38	2.57	3.54	5.31%	10.62%	15.93%	2.90	3.20
V, ppm	657	38	580	734	542	773	5.86%	11.71%	17.57%	624	690
Y, ppm	8.55	0.789	6.97	10.13	6.18	10.91	9.23%	18.46%	27.69%	8.12	8.98
Yb, ppm	1.48	0.078	1.32	1.63	1.25	1.71	5.25%	10.50%	15.75%	1.40	1.55
Zn, ppm	207	11	186	229	176	239	5.09%	10.18%	15.27%	197	218
Zr, ppm	31.8	3.06	25.6	37.9	22.6	40.9	9.65%	19.31%	28.96%	30.2	33.3
Gas / Liquid Pycnometry											
SG, Unity	3.14	0.189	2.76	3.52	2.57	3.71	6.02%	12.05%	18.07%	2.98	3.30

Note: intervals may appear asymmetric due to rounding.

PARTICIPATING LABORATORIES

1. ALS, Brisbane, QLD, Australia
2. ALS, Lima, Peru
3. ALS, Vancouver, BC, Canada
4. Argile Analytica, Calgary, Alberta, Canada
5. Bureau Veritas Commodities Canada Ltd, Vancouver, BC, Canada
6. Bureau Veritas Geoanalytical, Adelaide, SA, Australia
7. Bureau Veritas Geoanalytical, Perth, WA, Australia
8. Inspectorate (BV), Lima, Peru
9. Intertek Genalysis, Perth, WA, Australia
10. Intertek Testing Services, Cupang, Muntinlupa, Philippines
11. Intertek Testing Services, Townsville, QLD, Australia
12. Nagrom, Perth, WA, Australia
13. Ni Lab, Pouembout, New Caledonia
14. PT Geoservices Ltd, Cikarang, Jakarta Raya, Indonesia
15. SGS Australia Mineral Services, Perth, WA, Australia
16. SGS Geosol Laboratorios Ltda, Vespasiano, Minas Gerais, Brazil
17. SGS Mineral Services, Townsville, QLD, Australia

PREPARER AND SUPPLIER

Certified reference material OREAS 199 is prepared, certified and supplied by:

ORE RESEARCH & EXPLORATION

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It is available in unit sizes of 10g (single-use laminated foil pouches) and 1kg (plastic jars).

INTENDED USE

OREAS 199 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 199 is an oxidised reference material and is stable in the laminated foil pouches. Under normal conditions of storage it has a shelf life beyond ten years.

INSTRUCTIONS FOR CORRECT USE

The certified values determined via fusion ICP, C and S by infrared combustion furnace and SG by pycnometry refer to the concentration levels in the packaged state. There is no need for drying prior to weighing and analysis.

In contrast the certified values determined via borate fusion XRF and for LOI at 1000° C are on a dry basis. This requires the removal of hygroscopic moisture by drying in air to constant mass at 105° C. If the reference material is not dried prior to analysis, the certified values should be corrected to the moisture-bearing basis.

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.