Division of Geological & Geophysical Surveys

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# LAND SELECTION UNIT 1 (TIEKEL UNIT; VALDEZ QUADRANGLE): GEOLOGIC SUMMARY, REFERENCES, DGGS SAMPLE LOCATIONS, GEOCHEMICAL AND MAJOR OXIDE DATA

by

L.E. Burns and G.H. Pessel

July 1993

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# LAND SELECTION UNIT 1 (TIEKEL; VALDEZ QUADRANGLE): GEOLOGIC SUMMARY, REFERENCES, DGGS SAMPLE LOCATIONS, GEOCHEMICAL AND MAJOR OXIDE DATA

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Assessment of evaluation unit 1 was accomplished using previous publications as well as a small amount of field work. This report includes a geologic summary, major oxide and geochemical data, a sample location map, and a list of references. The potential for mineral deposits of the area based on geological and geochemical data and estimated by a Monte Carlo simulation process is outlined in an executive summary by DGGS staff (in prep.).

Publications used on the geology of the area include Winkler and others (1981b), Burns (1983; 1985), Plafker and Hudson (1980), and Plafker and others (1992) and unpublished mapping of Burns and others (1985). The geophysical publications on the area include Burns (1981) and Case and others (1986); D.F. Barnes also kindly furnished us his unpublished gravity data on the area. Reports about economic geology of unit 1 include Foley and Barker (1985), Newberry (1986), and Foley and others (1988), and those about the entire Valdez quadrangle include Cobb and Matson (1972) and Winkler and others (1981a).

## GEOLOGIC SUMMARY

Evaluation unit 1 encompasses 423 thousand acres in the central part of the Valdez Quadrangle. The area is composed of three major geologic formations which are, from north to south, the Tonsina ultramafic/mafic complex, the McHugh Complex, and the Valdez Group. The ultramafic/mafic complex is composed of the rock types harzburgite, dunite, websterite, and gabbronorite, and has been interpreted as part of an ancient island arc ophiolite and associated underlying mantle rocks. The island arc rocks are Jurassic in age and are high pressure in origin. The McHugh Complex is a melange or mixed rock package which contains blocks of marble, chert, and pillow lavas in a highly deformed matrix of argillite, graywacke, and tuff. The McHugh Complex ranges in age from Jurassic to Cretaceous and is weakly metamorphosed to the prehnite-pumpellyite facies. The Valdez Group, dominantly Cretaceous in age, is a thick sequence of phyllite, slate, and argillite which is interpreted to have formed in a forearc region. The Valdez Group is metamorphosed to the lower greenschist facies. Felsite dikes and small plutons of Eocene age intrude all the units.

Gold-bearing quartz veins are abundant in the Valdez Group and are present, but are less abundant in the McHugh Complex. Two of the prospects within area 1 have had minor gold production. About 158,000 oz of gold have been produced from quartz veins in Valdez Group rock around the Prince William Sound area. Some of the quartz veins appear to be genetically associated with the felsite dikes, but the majority are probably formed by metamorphic processes.

No significant gold placer production is known to have occured within the area. Data suggests that gold placers are widespread in the Valdez Group, but are small and contain very fine gold. The chance for discovery of major new gold placers is considered to be low in this area.

Volcanogenic massive sulfide deposits (VMS) are also potentially present in Evaluation Unit 1. Copper-bearing deposits of volcanogenic or sedimentary origin and one former mine (the Midas mine) are present in the Valdez Group to the south and southwest of Evaluation Unit 1; except for the Midas mine, the deposits appear to be large tonnage, low grade prospects. There is a low likelihood that a VMS deposit of this type could be present in the Valdez Group within Evaluation Unit 1.

Platinum group element and chromite deposits are potentially present in the ultramafic and mafic rocks in the northwestern corner of Evaluation Unit 1. Analyses indicating very anomalous levels of platinum and paladium have been produced by two independent small studies.

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# Land Selection Index Map Evaluation Unit 1

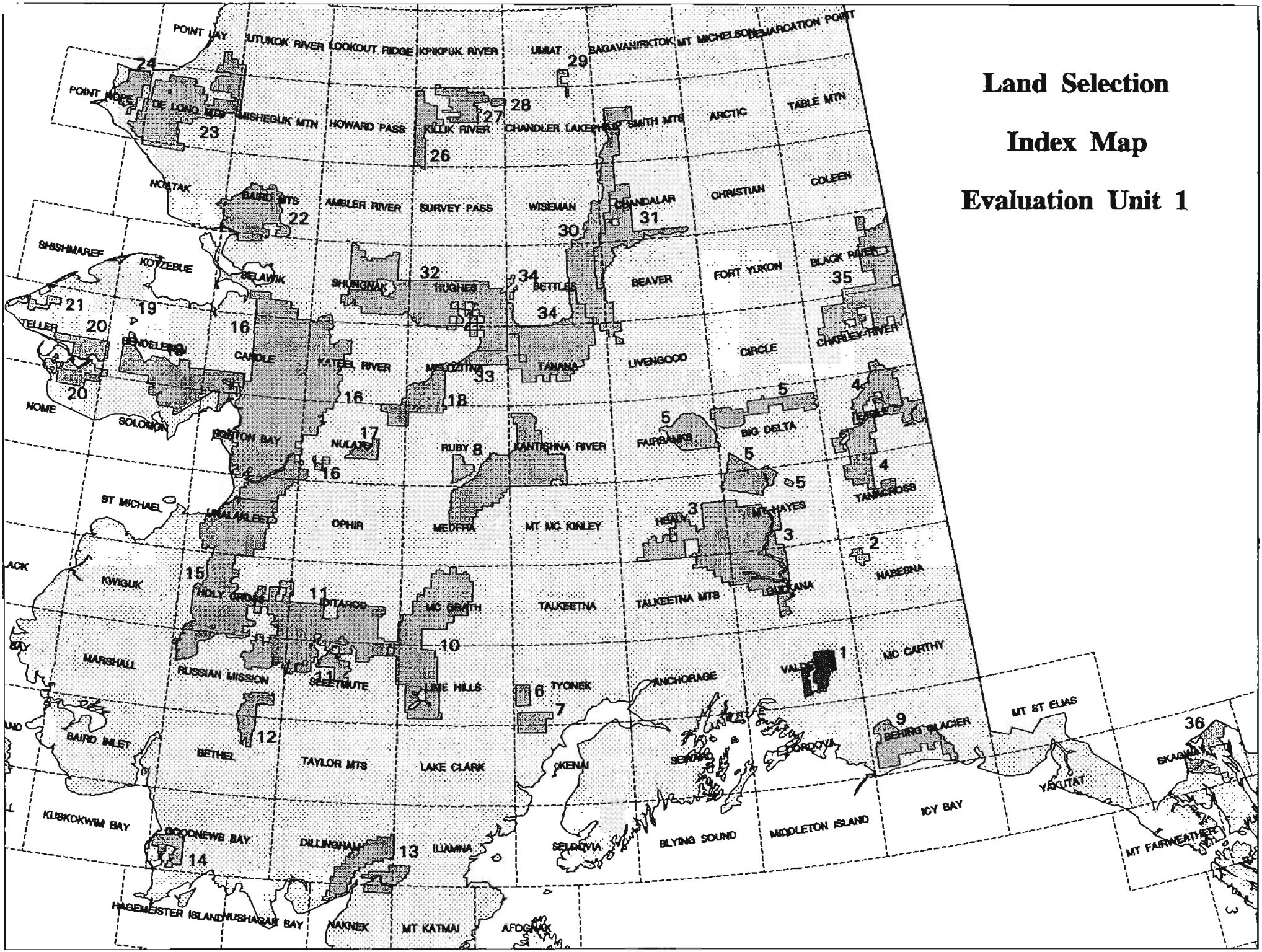

Table 1: Major oxide and selected trace element analyses for Unit 1

| ELMNTS | UNITS | 91LB100 | 91LB102 | 91LB107 | 91LB108 | 91LB111 | 91LB116 | 91LB118 | 91PE206 | 91PE218 | 91PE219 | 91PE221 | 91PE225 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SIO2 | % | 47.4 | 45.9 | 44.2 | 39.5 | 44.6 | 39.1 | 43.6 | 42.2 | 44.0 | 44.9 | 42.4 | 39.1 |
| AL2O3 | % | 7.45 | 9.02 | 25.30 | 14.60 | 19.20 | 9.03 | 26.10 | 21.40 | 26.80 | 28.30 | 10.70 | 8.58 |
| FE2O3tot | % | 8.7 | 9.12 | 4.85 | 16.8 | 10.5 | 15.6 | 6.06 | 10.5 | 5 | 3.59 | 13.8 | 15.4 |
| Fe2O3 | % | 3.7 | 3.9 | 1.5 | 5.4 | 2.6 | 6.7 | 2.4 | 3.4 | 1.7 | 1.0 | 4.1 | 5.9 |
| FEO | % | 4.5 | 4.7 | 3.0 | 10.3 | 7.1 | 8.0 | 3.3 | 6.4 | 3.0 | 2.3 | 8.7 | 8.6 |
| MGO | % | 13.90 | 13.60 | 5.59 | 10.60 | 9.67 | 26.70 | 8.23 | 7.48 | 8.00 | 2.89 | 25.50 | 28.60 |
| CAO | % | 21.00 | 20.20 | 15.40 | 11.70 | 12.30 | 5.23 | 14.30 | 14.00 | 14.40 | 16.30 | 5.98 | 4.75 |
| NA2O | % | 0.25 | 0.23 | 1.15 | 2.22 | 1.81 | 0.29 | 0.77 | 1.17 | 0.84 | 1.62 | 0.50 | 0.23 |
| K2O | % | -0.01 | -0.01 | -0.01 | 0.17 | 0.11 | 0.01 | 0.02 | 0.02 | 0.05 | 0.03 | 0.04 | -0.01 |
| TIO2 | % | 0.42 | 0.46 | 0.14 | 2.03 | 0.78 | 0.08 | 0.05 | 0.60 | 0.06 | 0.15 | 0.08 | 0.05 |
| P2O5 | % | 0.01 | 0.02 | 0.04 | 0.04 | 0.03 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 |
| MNO | % | 0.14 | 0.13 | 0.08 | 0.23 | 0.16 | 0.22 | 0.09 | 0.17 | 0.07 | 0.07 | 0.21 | 0.22 |
| LOI | % | 0.39 | 0.93 | 3.47 | 1.31 | 0.62 | 3.54 | 1.23 | 2.23 | 0.70 | 2.23 | 1.00 | 2.77 |
| TOTAL | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| S | % | -0.01 | -0.01 | -0.01 | -0.01 | 0.02 | -0.01 | -0.01 | 0.04 | 0.01 | -0.01 | -0.01 | -0.01 |
| CR | PPM | 1200 | 1140 | 205 | 274 | 142 | 649 | 35 | 38 | 38 | 128 | 414 | 716 |
| NI | PPM | 120 | 113 | 66 | 87 | 106 | 446 | 67 | 29 | 123 | -10 | 394 | 517 |
| RB | PPM | -10 | 15 | 11 | 21 | -10 | 29 | 11 | -10 | -10 | 17 | -10 | 11 |
| SR | PPM | 13 | 12 | 456 | 130 | 285 | 91 | 402 | 344 | 385 | 784 | 138 | 85 |
| Y | PPM | -10 | -10 | -10 | 22 | 23 | 16 | -10 | -10 | -10 | -10 | -10 | -10 |
| ZR | PPM | -10 | -10 | -10 | 32 | -10 | -10 | -10 | -10 | -10 | 11 | -10 | -10 |
| NB | PPM | 18 | 24 | -10 | 30 | 11 | 11 | 19 | 14 | -10 | 14 | -10 | -10 |
| BA | PPM | 17 | -10 | 15 | 83 | 57 | 96 | 54 | 30 | 11 | -10 | 96 | 102 |
| SUM | % | 99.85 | 99.78 | 100.30 | 99.28 | 99.84 | 99.95 | 100.53 | 99.84 | 99.99 | 100.23 | 100.32 | 99.84 |

Values below detection limit are shown as negative numbers.

Table 2: Trace element analyses for Unit 1

| Sample Id. | Au | Ir | Ag | Zn | Mo | Ni | Co | Cd | As | Sb | Fe | Se | Te |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analy Method | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA |
| Units | PPB | PPB | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PCT | PPM | PPM |
| Lower Limit | 5 | 100 | 5 | 200 | 2 | 20 | 10 | 10 | 1 | 0.2 | 0.5 | 10 | 20 |
| Upper Limit | 10000 | 1000 | 100 | 20000 | 20000 | 20000 | 20000 | 2000 | 10000 | 5000 | 10 | 2000 | 2000 |
| 91LB 103 | 10 | -100 | -5 | -200 | -2 | 140 | 46 | -10 | -1 | 0.2 | 8.4 | -10 | -20 |
| 91LB 104P | -5 | -100 | -5 | 230 | -2 | 33 | 56 | -10 | 1 | -0.2 | 10 | -10 | -20 |
| 91LB 105B | -5 | -100 | -5 | 240 | -2 | -20 | 62 | -10 | -1 | -0.2 | 10 | -10 | -20 |
| 91LB 105C | -5 | -100 | -5 | 200 | -2 | -20 | 66 | -10 | -1 | 0.3 | 10 | -10 | -20 |
| 91LB 106 | -5 | -100 | -5 | 260 | -2 | -20 | 46 | -10 | -1 | 0.3 | 10 | -10 | -20 |
| 91LB 107 | -5 | -100 | -5 | -200 | -2 | 52 | 24 | -10 | -1 | -0.2 | 3.5 | -10 | -20 |
| 91LB 108A | 6 | -100 | -5 | -200 | -2 | 39 | 92 | -10 | -1 | 0.4 | 10 | -10 | -20 |
| 91LB 108B | -5 | -100 | -5 | -200 | -2 | 32 | 91 | -10 | -1 | 0.5 | 10 | -10 | -20 |
| 91LB 109A | -5 | -100 | -5 | -200 | -2 | 50 | 32 | -10 | -1 | 0.4 | 3.4 | -10 | -20 |
| 91LB 112 | 22 | -100 | -5 | -200 | -2 | 130 | 47 | -10 | 1 | 0.2 | 7.1 | -10 | -20 |
| 91LB 114P | -5 | -100 | -5 | -200 | -2 | 27 | 20 | -10 | -1 | -0.2 | 2.4 | -10 | -20 |
| 91LB 119 | -5 | -100 | -5 | -200 | -2 | 380 | 140 | -10 | -1 | -0.2 | 10 | -10 | -20 |
| 91PE 200 | 25 | -100 | -5 | -200 | -2 | 110 | 71 | -10 | -1 | -0.2 | 9 | -10 | -20 |
| 91PE 201 | -5 | -100 | -5 | -200 | -2 | -20 | 47 | -10 | -1 | 0.3 | 10 | -10 | -20 |
| 91PE 202 | -5 | -100 | -5 | -200 | -2 | -20 | 51 | -10 | -1 | 0.3 | 8.5 | -10 | -20 |
| 91PE 203 | -5 | -100 | -5 | -200 | -2 | 40 | 44 | -10 | -1 | -0.2 | 7.1 | -10 | -20 |
| 91PE 204A | 11 | -100 | -5 | 300 | -2 | 41 | 91 | -10 | 1 | -0.2 | 10 | -10 | -20 |
| 91PE 204B | 64 | -100 | -5 | -200 | -2 | 54 | 74 | -10 | 1 | 0.2 | 10 | -10 | -20 |
| 91PE 204C | 15 | -100 | -5 | -200 | -2 | 47 | 82 | -10 | 1 | -0.2 | 10 | -10 | -20 |
| 91PE 205 | 7 | -100 | -5 | -200 | -2 | 61 | 130 | -10 | -1 | -0.2 | 10 | -10 | -20 |
| 91PE 205-21 | 13 | -100 | -5 | -200 | -2 | 300 | 240 | -10 | -1 | 0.3 | 10 | -10 | -20 |
| 91PE 205-21 | 9 | -100 | -5 | -200 | -2 | 67 | 95 | -10 | -1 | 0.3 | 10 | -10 | -20 |
| 91PE 207 | -5 | -100 | -5 | -200 | -2 | 58 | 51 | -10 | -1 | -0.2 | 7.6 | -10 | -20 |
| 91PE 209 | -5 | -100 | -5 | -200 | -2 | -20 | 34 | -10 | -1 | -0.2 | 6.4 | -10 | -20 |
| 91PE 210 | -5 | -100 | -5 | -200 | -2 | 25 | 32 | -10 | -1 | 0.5 | 8 | -10 | -20 |
| 91PE 211 | -5 | -100 | -5 | -200 | -2 | 100 | 75 | -10 | -1 | -0.2 | 8.1 | -10 | -20 |
| 91PE 212 | -5 | -100 | -5 | -200 | -2 | 470 | 140 | -10 | -1 | -0.2 | 10 | -10 | -20 |
| 91PE 213 | -5 | -100 | -5 | -200 | -2 | 56 | 27 | -10 | -1 | -0.2 | 2.8 | -10 | -20 |
| 91PE 214A | -5 | -100 | -5 | -200 | -2 | 140 | 85 | -10 | 1 | 0.2 | 8.5 | -10 | -20 |
| 91PE 214B | -5 | -100 | -5 | -200 | -2 | 130 | 84 | -10 | -1 | -0.2 | 8.4 | -10 | -20 |
| 91PE 215 | -5 | -100 | -5 | -200 | -2 | 51 | 43 | -10 | -1 | -0.2 | 5 | -10 | -20 |
| 91PE 216 | -5 | -100 | -5 | -200 | -2 | 220 | 80 | -10 | -1 | -0.2 | 6.9 | -10 | -20 |
| 91PE 217P | -5 | -100 | -5 | -200 | -2 | 41 | 49 | -10 | -1 | -0.2 | 7.5 | -10 | -20 |
| 91PE 220 | -5 | -100 | -5 | -200 | -2 | 110 | 42 | -10 | -1 | -0.2 | 4.5 | -10 | -20 |
| 91PE 223 | -5 | -100 | -5 | -200 | -2 | 440 | 170 | -10 | -1 | -0.2 | 10 | -10 | -20 |

Values below detection limit are shown as negative numbers.

| Sample Id. | Ba | Cr | Sn | W | Cs | La | Ce | Sm | Eu | Tb | Yb | Lu | Sc |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analy Method | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA |
| Units | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM |
| Lower Limit | 100 | 50 | 200 | 2 | 1 | 5 | 10 | 0.2 | 2 | 1 | 5 | 0.5 | 0.5 |
| Upper Limit | 20000 | 20000 | 20000 | 2000 | 10000 | 10000 | 10000 | 2000 | 2000 | 2000 | 2000 | 2000 | 2000 |
| 91LB 103 | -100 | 1900 | -200 | -2 | -1 | -5 | -10 | 0.6 | -2 | -1 | -5 | -0.5 | 90.3 |
| 91LB 104P | -100 | 220 | -200 | -2 | -1 | -5 | -10 | 0.9 | -2 | -1 | -5 | -0.5 | 54.6 |
| 91LB 105B | -100 | 62 | -200 | -2 | -1 | -5 | -10 | 1.8 | -2 | -1 | -5 | -0.5 | 58.3 |
| 91LB 105C | -100 | -50 | -200 | -2 | -1 | -5 | -10 | 1.5 | -2 | -1 | -5 | -0.5 | 67.2 |
| 91LB 106 | -100 | 100 | -200 | -2 | -1 | -5 | -10 | 3.9 | -2 | 1 | -5 | 0.7 | 75.3 |
| 91LB 107 | -100 | 210 | -200 | -2 | -1 | -5 | -10 | 0.3 | -2 | -1 | -5 | -0.5 | 20 |
| 91LB 108A | -100 | 100 | -200 | -2 | -1 | -5 | -10 | 0.5 | -2 | -1 | -5 | -0.5 | 59.5 |
| 91LB 108B | -100 | 100 | -200 | -2 | -1 | -5 | -10 | 0.5 | -2 | -1 | -5 | -0.5 | 58.9 |
| 91LB 109A | -100 | 330 | -200 | -2 | -1 | -5 | -10 | 0.2 | -2 | -1 | -5 | -0.5 | 16 |
| 91LB 112 | -100 | 400 | -200 | -2 | -1 | -5 | -10 | 1 | -2 | -1 | -5 | -0.5 | 32 |
| 91LB 114P | -100 | 360 | -200 | -2 | -1 | -5 | -10 | 0.3 | -2 | -1 | -5 | -0.5 | 22 |
| 91LB 119 | -100 | 880 | -200 | -2 | -1 | -5 | -10 | -0.2 | -2 | -1 | -5 | -0.5 | 6.3 |
| 91PE 200 | -100 | 890 | -200 | -2 | -1 | -5 | -10 | 1.2 | -2 | -1 | -5 | -0.5 | 101 |
| 91PE 201 | -100 | 190 | -200 | -2 | -1 | -5 | -10 | 1.3 | -2 | -1 | -5 | -0.5 | 60.2 |
| 91PE 202 | 120 | 240 | -200 | -2 | -1 | -5 | -10 | 1.3 | -2 | -1 | -5 | -0.5 | 50 |
| 91PE 203 | -100 | 460 | -200 | -2 | -1 | -5 | -10 | 1 | -2 | -1 | -5 | -0.5 | 50 |
| 91PE 204A | 120 | 260 | -200 | -2 | -1 | -5 | -10 | 1 | -2 | -1 | -5 | -0.5 | 77.2 |
| 91PE 204B | -100 | 260 | -200 | -2 | -1 | -5 | -10 | 0.9 | -2 | -1 | -5 | -0.5 | 68.2 |
| 91PE 204C | -100 | 240 | -200 | -2 | -1 | -5 | -10 | 0.9 | -2 | -1 | -5 | -0.5 | 64.5 |
| 91PE 205 | -100 | 73 | -200 | -2 | -1 | -5 | -10 | 2.2 | -2 | -1 | -5 | -0.5 | 86.2 |
| 91PE 205-21 | -100 | 450 | -200 | -2 | -1 | -5 | -10 | 2.2 | -2 | -1 | -5 | -0.5 | 77.9 |
| 91PE 205-21 | -100 | 160 | -200 | -2 | -1 | -5 | -10 | 0.6 | -2 | -1 | -5 | -0.5 | 33 |
| 91PE 207 | -100 | 780 | -200 | -2 | -1 | -5 | -10 | 0.7 | -2 | -1 | -5 | -0.5 | 55.2 |
| 91PE 209 | -100 | 69 | -200 | -2 | -1 | -5 | -10 | 0.4 | -2 | -1 | -5 | -0.5 | 22 |
| 91PE 210 | -100 | 150 | -200 | -2 | -1 | -5 | -10 | 0.4 | -2 | -1 | -5 | -0.5 | 33 |
| 91PE 211 | -100 | 500 | -200 | -2 | -1 | -5 | -10 | 0.4 | -2 | -1 | -5 | -0.5 | 43 |
| 91PE 212 | -100 | 3000 | -200 | -2 | -1 | -5 | -10 | -0.2 | -2 | -1 | -5 | -0.5 | 11 |
| 91PE 213 | -100 | 470 | -200 | -2 | -1 | -5 | -10 | -0.2 | -2 | -1 | -5 | -0.5 | 16 |
| 91PE 214A | -100 | 490 | -200 | -2 | -1 | -5 | -10 | 0.2 | -2 | -1 | -5 | -0.5 | 22 |
| 91PE 214B | -100 | 510 | -200 | -2 | -1 | -5 | -10 | 0.2 | -2 | -1 | -5 | -0.5 | 23 |
| 91PE 215 | -100 | 450 | -200 | -2 | -1 | -5 | -10 | 0.3 | -2 | -1 | -5 | -0.5 | 28 |
| 91PE 216 | -100 | 430 | -200 | -2 | -1 | -5 | -10 | 0.4 | -2 | -1 | -5 | -0.5 | 18 |
| 91PE 217P | -100 | 170 | -200 | -2 | -1 | -5 | -10 | 1 | -2 | -1 | -5 | -0.5 | 43 |
| 91PE 220 | -100 | 71 | -200 | -2 | -1 | -5 | -10 | 0.3 | -2 | -1 | -5 | -0.5 | 8.7 |
| 91PE 223 | -100 | 1600 | -200 | -2 | -1 | -5 | -10 | -0.2 | -2 | -1 | -5 | -0.5 | 7.3 |

Values below detection limit are shown as negative numbers.

Table 2: Trace element analyses for Unit 1

| Sample Id. | Hf | Ta | Th | U | Na | Br | Rb | Zr | Ag | Cu | Zn | Mo | Ni |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analy Method | INAA | INAA | INAA | INAA | INAA | INAA | INAA | INAA | ICP | ICP | ICP | ICP | ICP |
| Units | PPM | PPM | PPM | PPM | PCT | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM |
| Lower Limit | 2 | 1 | 0.5 | 0.5 | 0.05 | 1 | 10 | 500 | 0.5 | 1 | 2 | 1 | 1 |
| Upper Limit | 2000 | 2000 | 2000 | 2000 | 10 | 1000 | 10000 | 10000 | 50 | 20000 | 20000 | 20000 | 20000 |
| 91LB 103 | -2 | -1 | -0.5 | -0.5 | 0.4 | -1 | -10 | -500 | 0.9 | 230 | -2 | 10 | 130 |
| 91LB 104P | -2 | -1 | -0.5 | -0.5 | 1.3 | -1 | -10 | -500 | 0.7 | 70 | 39 | 2 | 27 |
| 91LB 105B | -2 | -1 | -0.5 | -0.5 | 1.3 | -1 | 15 | -500 | 0.7 | 89 | 64 | 3 | 26 |
| 91LB 105C | -2 | -1 | -0.5 | -0.5 | 1.1 | -1 | -10 | -500 | -0.5 | 74 | 55 | -1 | 15 |
| 91LB 106 | -2 | -1 | -0.5 | -0.5 | 1.6 | -1 | -10 | -500 | -0.5 | 42 | 68 | -1 | 18 |
| 91LB 107 | -2 | -1 | -0.5 | -0.5 | 1.2 | -1 | -10 | -500 | -0.5 | 36 | 3 | -1 | 50 |
| 91LB 108A | -2 | -1 | -0.5 | -0.5 | 0.82 | -1 | -10 | -500 | -0.5 | 166 | 16 | -1 | 39 |
| 91LB 108B | -2 | -1 | -0.5 | -0.5 | 0.76 | -1 | -10 | -500 | -0.5 | 193 | 17 | -1 | 46 |
| 91LB 109A | -2 | -1 | -0.5 | -0.5 | 1.2 | -1 | -10 | -500 | 0.6 | 50 | -2 | -1 | 58 |
| 91LB 112 | -2 | -1 | -0.5 | -0.5 | 1.1 | -1 | -10 | -500 | 0.7 | 1990 | 7 | -1 | 106 |
| 91LB 114P | -2 | -1 | -0.5 | -0.5 | 0.92 | -1 | -10 | -500 | -0.5 | 52 | -2 | -1 | 35 |
| 91LB 119 | -2 | -1 | -0.5 | -0.5 | 0.4 | -1 | -10 | -500 | -0.5 | 16 | 9 | 2 | 276 |
| 91PE 200 | -2 | -1 | -0.5 | -0.5 | 0.41 | -1 | -10 | -500 | -0.5 | 977 | -2 | 1 | 104 |
| 91PE 201 | -2 | -1 | -0.5 | -0.5 | 1.4 | -1 | -10 | -500 | -0.5 | 39 | 25 | 2 | 14 |
| 91PE 202 | -2 | -1 | -0.5 | -0.5 | 1.7 | -1 | -10 | -500 | -0.5 | 52 | 28 | -1 | 23 |
| 91PE 203 | -2 | -1 | -0.5 | -0.5 | 1.2 | -1 | -10 | -500 | -0.5 | 13 | 13 | 3 | 39 |
| 91PE 204A | -2 | -1 | -0.5 | -0.5 | 1.6 | -1 | -10 | -500 | -0.5 | 319 | 32 | 2 | 32 |
| 91PE 204B | -2 | -1 | -0.5 | -0.5 | 1.3 | -1 | -10 | -500 | -0.5 | 203 | 28 | -1 | 37 |
| 91PE 204C | -2 | -1 | -0.5 | -0.5 | 1.4 | -1 | -10 | -500 | -0.5 | 181 | 32 | -1 | 40 |
| 91PE 205 | -2 | -1 | -0.5 | -0.5 | 1.4 | -1 | -10 | -500 | -0.5 | 585 | 30 | 3 | 68 |
| 91PE 205-21 | -2 | -1 | -0.5 | -0.5 | 1.5 | -1 | -10 | -500 | -0.5 | 732 | 32 | 2 | 255 |
| 91PE 205-21 | -2 | -1 | -0.5 | -0.5 | 1.1 | -1 | -10 | -500 | -0.5 | 152 | 23 | 2 | 62 |
| 91PE 207 | -2 | -1 | -0.5 | -0.5 | 0.7 | -1 | -10 | -500 | -0.5 | 84 | 18 | 9 | 60 |
| 91PE 209 | -2 | -1 | -0.5 | -0.5 | 1 | -1 | -10 | -500 | -0.5 | 28 | 18 | 6 | 19 |
| 91PE 210 | -2 | -1 | -0.5 | -0.5 | 1.9 | -1 | -10 | -500 | -0.5 | 13 | 39 | 2 | 19 |
| 91PE 211 | -2 | -1 | -0.5 | -0.5 | 0.66 | -1 | -10 | -500 | -0.5 | 46 | 7 | -1 | 86 |
| 91PE 212 | -2 | -1 | -0.5 | -0.5 | 0.52 | -1 | -10 | -500 | -0.5 | 22 | 18 | 3 | 412 |
| 91PE 213 | -2 | -1 | -0.5 | -0.5 | 0.83 | -1 | -10 | -500 | -0.5 | 42 | -2 | 1 | 51 |
| 91PE 214A | -2 | -1 | -0.5 | -0.5 | 0.74 | -1 | -10 | -500 | -0.5 | 74 | 5 | 4 | 111 |
| 91PE 214B | -2 | -1 | -0.5 | -0.5 | 0.67 | -1 | -10 | -500 | -0.5 | 79 | 2 | 1 | 99 |
| 91PE 215 | -2 | -1 | -0.5 | -0.5 | 1.1 | -1 | -10 | -500 | -0.5 | 85 | 4 | -1 | 52 |
| 91PE 216 | -2 | -1 | -0.5 | -0.5 | 0.88 | -1 | 12 | -500 | -0.5 | 296 | 2 | 2 | 181 |
| 91PE 217P | -2 | -1 | -0.5 | -0.5 | 1.7 | -1 | 17 | -500 | -0.5 | 96 | 16 | 2 | 44 |
| 91PE 220 | -2 | -1 | -0.5 | -0.5 | 1.3 | -1 | -10 | -500 | -0.5 | 61 | -2 | -1 | 105 |
| 91PE 223 | -2 | -1 | -0.5 | -0.5 | 0.39 | -1 | -10 | -500 | -0.5 | 19 | 4 | 31 | 392 |

Values below detection limit are shown as negative numbers.

Table 2: Trace element analyses for Unit 1

| Sample Id. | Co | Cd | As | Sb | Fe | Mn | Te | Ba | Cr | V | Sn | W | Li |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analy Method | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP |
| Units | PPM | PPM | PPM | PPM | PCT | PPM | PPM | PPM | PPM | PPM | PPM | PPM | PPM |
| Lower Limit | 1 | 2 | 5 | 5 | 0.01 | 5 | 25 | 5 | 2 | 2 | 20 | 20 | 2 |
| Upper Limit | 20000 | 2000 | 2000 | 2000 | 10 | 20000 | 2000 | 2000 | 20000 | 2000 | 2000 | 2000 | 2000 |
| 91LB 103 | 35 | -2 | 11 | 10 | 5.12 | 1049 | -25 | 31 | 658 | 341 | -20 | -20 | 4 |
| 91LB 104P | 42 | -2 | -5 | -5 | 6.76 | 1224 | -25 | 47 | 113 | 370 | -20 | -20 | -2 |
| 91LB 105B | 48 | -2 | 14 | -5 | 9.48 | 1600 | -25 | 46 | 40 | 472 | -20 | -20 | 4 |
| 91LB 105C | 50 | -2 | 10 | -5 | 10 | 1415 | -25 | 30 | 33 | 543 | -20 | -20 | -2 |
| 91LB 106 | 37 | -2 | -5 | -5 | 8.02 | 1669 | -25 | 35 | 61 | 406 | -20 | -20 | -2 |
| 91LB 107 | 22 | -2 | 5 | -5 | 1.65 | 486 | -25 | 18 | 92 | 66 | -20 | -20 | 3 |
| 91LB 108A | 66 | -2 | -5 | -5 | 8.49 | 652 | -25 | 29 | 51 | 794 | -20 | -20 | 3 |
| 91LB 108B | 72 | -2 | -5 | -5 | 8.55 | 750 | -25 | 29 | 58 | 844 | -20 | -20 | 2 |
| 91LB 109A | 24 | -2 | -5 | -5 | 1.85 | 372 | -25 | 19 | 114 | 43 | -20 | -20 | -2 |
| 91LB 112 | 29 | -2 | 11 | -5 | 3.42 | 652 | -25 | 34 | 135 | 80 | -20 | 133 | -2 |
| 91LB 114P | 14 | -2 | 9 | -5 | 1.35 | 227 | -25 | 21 | 146 | 51 | -20 | 55 | -2 |
| 91LB 119 | 66 | -2 | -5 | -5 | 5.63 | 1067 | -25 | 25 | 132 | 21 | -20 | 21 | -2 |
| 91PE 200 | 46 | -2 | -5 | -5 | 5.41 | 1086 | -25 | 25 | 237 | 344 | -20 | -20 | -2 |
| 91PE 201 | 28 | -2 | 10 | -5 | 4.33 | 897 | -25 | 27 | 79 | 299 | -20 | -20 | -2 |
| 91PE 202 | 32 | -2 | 9 | -5 | 4.15 | 1081 | -25 | 56 | 80 | 233 | -20 | -20 | -2 |
| 91PE 203 | 26 | -2 | -5 | -5 | 3.17 | 798 | -25 | 26 | 157 | 225 | -20 | -20 | -2 |
| 91PE 204A | 59 | -2 | -5 | -5 | 7.37 | 1238 | -25 | 31 | 106 | 436 | -20 | -20 | -2 |
| 91PE 204B | 47 | -2 | -5 | -5 | 6.57 | 965 | -25 | 28 | 98 | 400 | -20 | -20 | -2 |
| 91PE 204C | 51 | -2 | -5 | -5 | 6.99 | 1140 | -25 | 32 | 104 | 410 | -20 | -20 | -2 |
| 91PE 205 | 86 | -2 | 5 | -5 | 7.67 | 1355 | -25 | 47 | 41 | 458 | -20 | -20 | -2 |
| 91PE 205-21 | 144 | -2 | -5 | -5 | 8.14 | 1209 | -25 | 39 | 137 | 449 | -20 | -20 | -2 |
| 91PE 205-21 | 62 | -2 | -5 | -5 | 5.34 | 955 | -25 | 23 | 60 | 245 | -20 | -20 | -2 |
| 91PE 207 | 34 | -2 | -5 | -5 | 3.71 | 961 | -25 | 29 | 285 | 216 | -20 | -20 | -2 |
| 91PE 209 | 21 | -2 | 30 | 6 | 3.02 | 953 | -25 | 18 | 35 | 151 | -20 | -20 | -2 |
| 91PE 210 | 18 | -2 | -5 | 6 | 3.82 | 1456 | -25 | 28 | 60 | 123 | -20 | -20 | -2 |
| 91PE 211 | 34 | -2 | -5 | -5 | 3.64 | 885 | -25 | 36 | 129 | 110 | -20 | -20 | -2 |
| 91PE 212 | 77 | -2 | -5 | -5 | 4.79 | 941 | -25 | 28 | 571 | 41 | -20 | -20 | -2 |
| 91PE 213 | 19 | -2 | 5 | -5 | 1.38 | 322 | -25 | 17 | 160 | 40 | -20 | -20 | -2 |
| 91PE 214A | 43 | -2 | 7 | -5 | 4.31 | 887 | -25 | 42 | 99 | 52 | -20 | 21 | -2 |
| 91PE 214B | 42 | -2 | 30 | -5 | 4.66 | 802 | -25 | 49 | 101 | 53 | -20 | -20 | -2 |
| 91PE 215 | 31 | -2 | 8 | -5 | 2.63 | 520 | -25 | 23 | 165 | 75 | -20 | -20 | -2 |
| 91PE 216 | 47 | -2 | -5 | 6 | 3.47 | 693 | -25 | 59 | 140 | 46 | -20 | -20 | -2 |
| 91PE 217P | 32 | -2 | -5 | -5 | 4.29 | 776 | -25 | 31 | 70 | 255 | -20 | -20 | -2 |
| 91PE 220 | 25 | -2 | 9 | 5 | 1.82 | 451 | -25 | 28 | 25 | 75 | -20 | -20 | -2 |
| 91PE 223 | 85 | -2 | 45 | -5 | 5.22 | 1265 | -25 | 27 | 182 | 26 | -20 | -20 | -2 |

Values below detection limit are shown as negative numbers.

Table 2: Trace element analyses for Unit 1

| Sample Id. | Ga | La | Ta | Ti | Al | Mg | Ca | Na | K | Nb | Sr | Y | Zr |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Analy Method | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP | ICP |
| Units | PPM | PPM | PPM | PCT | PCT | PCT | PCT | PCT | PCT | PPM | PPM | PPM | PPM |
| Lower Limit | 10 | 5 | 5 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 5 | 1 | 5 | 5 |
| Upper Limit | 2000 | 2000 | 2000 | 10 | 10 | 10 | 10 | 10 | 10 | 2000 | 2000 | 2000 | 2000 |
| 91LB 103 | -10 | -5 | -5 | 0.19 | 2.42 | 6.43 | 10 | 0.6 | 0.19 | 10 | 23 | 5 | 8 |
| 91LB 104P | -10 | -5 | -5 | 0.37 | 2.65 | 2.69 | 7.11 | 1.09 | 0.19 | 5 | 174 | -5 | -5 |
| 91LB 105B | -10 | -5 | -5 | 0.57 | 3.94 | 2.55 | 9.44 | 1.25 | 0.19 | 9 | 251 | 6 | -5 |
| 91LB 105C | -10 | -5 | -5 | 0.63 | 3.56 | 2.43 | 8.9 | 1.05 | 0.17 | -5 | 215 | 6 | -5 |
| 91LB 106 | -10 | -5 | -5 | 0.59 | 2.97 | 2.32 | 7.84 | 1.29 | 0.18 | 6 | 204 | 12 | -5 |
| 91LB 107 | -10 | -5 | -5 | 0.05 | 1.84 | 0.81 | 7.11 | 0.8 | 0.07 | 6 | 191 | -5 | 6 |
| 91LB 108A | -10 | -5 | -5 | 0.38 | 3.51 | 1.95 | 9.22 | 0.8 | 0.15 | -5 | 169 | -5 | -5 |
| 91LB 108B | -10 | -5 | -5 | 0.39 | 3.72 | 2.09 | 9.32 | 0.8 | 0.16 | -5 | 170 | -5 | -5 |
| 91LB 109A | -10 | -5 | -5 | 0.03 | 4.19 | 1.58 | 10 | 0.84 | 0.05 | 9 | 269 | -5 | -5 |
| 91LB 112 | -10 | -5 | -5 | 0.1 | 2.37 | 1.37 | 6.72 | 0.88 | 0.1 | 10 | 229 | -5 | -5 |
| 91LB 114P | -10 | -5 | -5 | 0.04 | 4.23 | 1.15 | 8.6 | 0.74 | 0.07 | 7 | 262 | -5 | 7 |
| 91LB 119 | -10 | -5 | -5 | 0.02 | 1.92 | 8.44 | 3.15 | 0.52 | 0.14 | -5 | 115 | -5 | 6 |
| 91PE 200 | -10 | -5 | -5 | 0.23 | 3.05 | 5.79 | 10 | 0.68 | 0.2 | 9 | 30 | 8 | 10 |
| 91PE 201 | -10 | -5 | -5 | 0.31 | 3.07 | 1.73 | 7.01 | 1.08 | 0.13 | -5 | 232 | -5 | -5 |
| 91PE 202 | -10 | -5 | -5 | 0.3 | 3.08 | 1.67 | 6.52 | 1.36 | 0.16 | -5 | 239 | -5 | -5 |
| 91PE 203 | -10 | -5 | -5 | 0.25 | 3.46 | 1.68 | 7.05 | 1.02 | 0.13 | 5 | 246 | -5 | -5 |
| 91PE 204A | -10 | -5 | -5 | 0.57 | 3.67 | 3.55 | 5.65 | 1.44 | 0.21 | -5 | 136 | -5 | -5 |
| 91PE 204B | -10 | -5 | -5 | 0.53 | 2.49 | 2.39 | 5.5 | 1.12 | 0.17 | -5 | 156 | -5 | -5 |
| 91PE 204C | -10 | -5 | -5 | 0.52 | 3.17 | 2.86 | 5.95 | 1.32 | 0.18 | -5 | 174 | -5 | -5 |
| 91PE 205 | -10 | -5 | -5 | 0.66 | 3.35 | 3.81 | 6.34 | 1.39 | 0.24 | -5 | 111 | 8 | -5 |
| 91PE 205-21 | -10 | -5 | -5 | 0.76 | 2.3 | 3.52 | 5.03 | 1.39 | 0.19 | -5 | 84 | 8 | -5 |
| 91PE 205-21 | -10 | -5 | -5 | 0.33 | 3.13 | 1.66 | 6.79 | 1.01 | 0.13 | 5 | 256 | -5 | -5 |
| 91PE 207 | -10 | -5 | -5 | 0.14 | 2.93 | 2.12 | 7.41 | 0.7 | 0.13 | 22 | 196 | -5 | 250 |
| 91PE 209 | -10 | -5 | -5 | 0.11 | 2.39 | 0.94 | 7.87 | 0.81 | 0.1 | 11 | 358 | -5 | 17 |
| 91PE 210 | -10 | -5 | -5 | 0.18 | 2.91 | 1.78 | 5.78 | 1.46 | 0.13 | 9 | 335 | -5 | 5 |
| 91PE 211 | -10 | -5 | -5 | 0.08 | 3.78 | 2.71 | 6.49 | 0.72 | 0.17 | 10 | 179 | -5 | 15 |
| 91PE 212 | -10 | -5 | -5 | 0.03 | 2.19 | 7.72 | 2.56 | 0.6 | 0.18 | 9 | 83 | -5 | 10 |
| 91PE 213 | -10 | -5 | -5 | 0.02 | 2.41 | 0.82 | 8.44 | 0.61 | 0.06 | 10 | 254 | -5 | 7 |
| 91PE 214A | -10 | -5 | -5 | 0.05 | 5.44 | 4.85 | 7.19 | 0.99 | 0.23 | 13 | 261 | -5 | 22 |
| 91PE 214B | -10 | -5 | -5 | 0.05 | 6.4 | 6.01 | 7.58 | 1.11 | 0.31 | 14 | 271 | -5 | 23 |
| 91PE 215 | -10 | -5 | -5 | 0.05 | 4.09 | 1.84 | 8.08 | 0.7 | 0.05 | 10 | 315 | -5 | -5 |
| 91PE 216 | -10 | -5 | -5 | 0.05 | 6.06 | 5.11 | 6.87 | 1.1 | 0.3 | 15 | 251 | -5 | 19 |
| 91PE 217P | -10 | -5 | -5 | 0.24 | 4.64 | 2.23 | 8.16 | 1.08 | 0.08 | 10 | 267 | -5 | -5 |
| 91PE 220 | -10 | -5 | -5 | 0.06 | 2.46 | 0.97 | 8.1 | 0.77 | 0.07 | 8 | 303 | -5 | 6 |
| 91PE 223 | -10 | -5 | -5 | 0.03 | 1.32 | 7.6 | 3.05 | 0.59 | 0.18 | -5 | 84 | -5 | 12 |

Values below detection limit are shown as negative numbers.

Table 2: Trace element analyses for Unit 1

| Sample Id. | Pb | Bi | Pt | Pd | S_Tot |
|---|---|---|---|---|---|
| Analy Method | AA | AA | DCP | DCP | LECO |
| Units | PPM | PPM | PPB | PPB | PCT |
| Lower Limit | 2 | 1 | 5 | 1 | 0.02 |
| Upper Limit | 10000 | 2000 | 5000 | 5000 | 100 |
| 91LB 103 | 4 | -1 | 27 | 53 | 0.09 |
| 91LB 104P | 4 | -1 | 14 | 292 | 0.03 |
| 91LB 105B | 4 | -1 | 10 | 2 | 0.05 |
| 91LB 105C | 5 | -1 | 8 | 1 | 0.08 |
| 91LB 106 | 3 | -1 | 12 | 3 | 0.08 |
| 91LB 107 | 3 | -1 | 12 | 2 | -0.02 |
| 91LB 108A | 5 | -1 | 17 | 1 | 0.36 |
| 91LB 108B | 6 | -1 | 15 | 2 | 0.35 |
| 91LB 109A | 3 | -1 | 15 | 2 | 0.03 |
| 91LB 112 | 4 | -1 | 13 | 4 | 0.52 |
| 91LB 114P | -2 | -1 | 20 | 3 | -0.02 |
| 91LB 119 | 4 | -1 | 48 | 16 | 0.02 |
| 91PE 200 | 3 | -1 | 15 | 3 | 0.38 |
| 91PE 201 | 4 | -1 | 20 | 3 | 0.02 |
| 91PE 202 | 3 | -1 | 8 | -1 | 0.03 |
| 91PE 203 | 5 | -1 | 18 | -1 | -0.02 |
| 91PE 204A | 4 | -1 | 16 | -1 | 0.76 |
| 91PE 204B | 4 | 1 | 15 | 214 | 0.77 |
| 91PE 204C | 3 | -1 | 22 | 263 | 0.85 |
| 91PE 205 | -2 | -1 | 15 | 8 | 1.29 |
| 91PE 205-21 | 4 | -1 | 19 | 4 | 2.67 |
| 91PE 205-21 | 3 | -1 | 29 | 10 | 1.19 |
| 91PE 207 | -2 | -1 | 18 | 2 | 0.12 |
| 91PE 209 | -2 | -1 | 18 | 3 | 0.03 |
| 91PE 210 | 3 | -1 | 12 | -1 | 0.06 |
| 91PE 211 | -2 | -1 | -5 | -1 | 0.06 |
| 91PE 212 | -2 | -1 | 24 | 728 | 0.04 |
| 91PE 213 | -2 | -1 | -5 | 1 | 0.03 |
| 91PE 214A | -2 | -1 | -5 | -1 | 0.07 |
| 91PE 214B | -2 | -1 | -5 | 3 | 0.08 |
| 91PE 215 | -2 | 1 | -5 | -1 | 0.12 |
| 91PE 216 | -2 | -1 | -5 | -1 | 0.12 |
| 91PE 217P | -2 | -1 | -5 | -1 | 0.12 |
| 91PE 220 | -2 | -1 | -5 | -1 | 0.05 |
| 91PE 223 | 5 | -1 | -5 | -1 | -0.02 |

Values below detection limit are shown as negative numbers.