# 7.3 Appendix C – Chapter 4 Materials

## 7.3.1. Section 1: Gold mining history in the Yellowknife region

The discovery of gold mineralization along the Yellowknife Greenstone Belt in the early 1930s saw the establishment of the Con/Negus and Giant mines, which were the largest of several operations that occurred in the region (Figure 4.1). Long-lived gold production from both mines, especially Giant Mine (~7 million ounces of gold between 1948 and 1999), stimulated the economy of the Northwest Territories and directly contributed to the establishment of the city of Yellowknife as territorial capital (Bullen and Robb, 2005). Due to the refractory mineralogy of the gold-bearing ores in the Yellowknife supergroup, ore roasting (at 500°C) was employed to liberate gold from the gold-bearing sulfides. These ore processing activities left behind a legacy of As contamination at the surrounding landscape and in area lakes (Palmer et al., 2015; Galloway et al., 2012, 2015, 2017). A byproduct of the roasting procedure was the release of arsenic trioxide ($As_2O_3$) particulate and SOx vapor that were emitted directly to the atmosphere through roaster stack emissions. The first decade of ore processing at Giant Mine saw the release of $As_2O_3$ to the atmosphere (~2600 tonnes/year; MacDonald, 1997; Wrye, 2008) with an estimated 20,000 tonnes of $As_2O_3$ aerially emitted prior to implementation of any emission controls that significantly reduced emissions from 1951 to 1958 (Jackson et al., 1996). Further emission reductions were achieved following installation of a bag house in 1985. However, a significant proportion of the legacy of As2O3 contamination emitted during the early years of mining remains distributed across the regional landscape (Schuh et al., 2017; Van Den Berghe et al., 2017).

Numerous studies from the Yellowknife region have reported levels of As in the soil (Hocking, 1978), lake sediments (Jackson et al., 1996; Mace, 1998; Galloway et al., 2015, 2017), and lake water samples (Jackson et al., 1996; Palmer et al., 2015) that significantly exceed thresholds detailed in the Canadian Council of the Ministers of the Environment (CCME) guidelines for all three media (Supplementary Table 4; CCME, 1997; CCME, 2002; GNW Environment and Natural Resources, 2003). For this reason the ongoing impact of As contamination on local ecosystems and human health remain a concern to the residents of Yellowknife even after the official cessation of the Giant Mine activities in 1999, after which 237,176 tonnes of $As_2O_3$ was placed in cryostorage within the former Giant Mine site (Jamieson et al., 2014). Studies aimed at assessing residual levels of As contamination in the environment within and around the two gold mines and work on the development of efficient monitoring, remediation, and mitigation methodologies are ongoing (Andrade et al., 2010; Palmer et al., 2015; Nasser et al., 2016; Galloway et al., 2015, 2017; Schuh et al., 2017; Van Den Berghe et al., 2017).

## 7.3.2. Section 2: Detailed description of the five identified Arcellinidan assemblages

### *7.3.2.1 Assemblage 1 - 'High Arsenic Contamination Assemblage' (HAC; n= 15)*

The High Arsenic Contamination Assemblage (HAC) inhabited relatively small lakes (median lake area= 24.6 ha) located mainly along the northern and western transects (93.2% of the samples; *n* = 14) (Figure 4.1). The assemblage was exclusively comprised of samples collected during the 2012 survey (i.e. BC12). Lakes hosting the HAC were relatively close to Giant Mine with a median distance of 11.1 km. Arcellinidan taxa characterizing this assemblage were mainly found at a relatively shallow water depth (median water depth = 1.5 m) in silty substrates (median silt% = 75.4%) (Supplementary Table 1). The SDI measured for this assemblage ranged between 1-2.2 SDI (Median SDI = 1.5), which is reflective of stressed to transitional environmental conditions (Magurran, 1988).

Results of NMDS, RDA and cluster analysis demonstrate that samples containing HAC closely clustering together (Figure 4.4, 4.5, 4.6). The RDA tri-plot also showed that HAC correlated positively with As, S1-carbon, and Hg, and negatively with Ba, Na and Ca (Figure 4.7). The positive correlation between the assemblage, As and S1-carbon is expected as samples comprising HAC were characterized by the highest concentrations of sedimentary As (median As = 290.4 ppm; range = 38.1-10000 ppm) and S1-carbon (median S1-carbon = 50.4 mg HC/g rock; range = 33.9-66.5 HC/g rock) among the identified assemblages (Supplementary Table 1). All samples had levels of As exceeding the interim sediment quality guidelines (ISQG = 5.9 ppm) and the probable effect levels (PEL = 17 ppm; CCEM, 2002). Such high As concentrations were expected since the majority of lakes hosting HAC are located downwind from the site of Giant Mine, with the exception of a single outlier in BC36 located along the eastern transect (Figure 4.1).

The assemblage composition of HAC was dominated by the highest average abundance of *Difflugia elegans* Penard, 1890 (median abunance = 40.5%) compared to the other assemblages (Supplementary Table 4.1). *Centropyxis constricta* (Ehrenberg 1843) strain "aerophila" (median abunance = 27.9%) and *Centropyxis constricta* (Ehrenberg 1843) strain "constricta" (median abunance = 13.9%) were also present in significant numbers. Species like *Difflugia oblonga* Ehrenberg 1832 strain "oblonga" (median abunance = 1.8%), *Curcurbitella tricuspis* (Carter 1856) (median abunance = 1.1%) are present but only in low proportions. The dominance of *D. elegans* and other centropyxid taxa and the relatively low presence of *D. oblonga* strain 'oblonga' and *C. tricuspis* is reflective of relatively stressed environmental conditions in the lakes hosting HAC. This is supported by the measured SDI values for the assemblage (SDI=1-2.2), which suggest stressed to transitional environmental conditions (Magurran, 1988).

### *7.3.2.2 Assemblage 2 - 'Arsenic Contamination Assemblage' (AC; n= 16)*

The Arsenic Contamination Assemblage (AC) is found in relatively small lakes (median lake area = 33.2 ha) along the western and northern transects (87.5% of the samples; *n* = 14) (Figure 4.1). The assemblage is mostly made up of samples collected during the 2014 survey (81.25% YK14 samples; *n* = 13). On average, the sampled lakes characterized by the AC were relatively close to GM (median distance = 8.7 km) and are even closer to the mine. Similar to HAC, Arcellinidan taxa characterizing AC were mainly found at relatively shallow water depth (median water depth = 2.1 m) in silty substrates (median silt% = 77.8%) (Supplementary Table 4.1). The SDI measured for this assemblage (1.4-2 SDI; median SDI = 1.8) is reflective of stressed to transitional environmental conditions (Magurran, 1988).

Results of NMDS and RDA analysis are mostly in agreement with the findings of cluster analysis and showed members of AC clustering distinctly from the other assemblages (Figures 4.4, 4.5, 4.6). An exception to that is sample YK17, which still belongs to AC in all analyses, but plots closely to HAC in NMDS and RDA (Figures 4.5, 4.6). The faunal composition of YK17, while mostly similar to AC, have notably low *C. aculeata* (Ehrenberg 1832) strains "aculeata" (median abunance = 1%), which is more characteristic to HACA (Supplementary Table 4.1). The RDA tri-plot showed that AC correlated positively with As, S1-carbon, TOC, and negatively with Ba, Distance to Giant Mine and P (Figure 4.6). Similar to HAC, the strong positive correlation between the assemblage, As and S1-carbon is expected as samples composing AC were characterized by the second highest sedimentary As average (median As = 280.6 ppm; range = 21.1-3312 ppm) and very similar S1- carbon (median S1-carbon= 53.2 mg HC/g rock; range = 34.8-59.8 HC/g rock) (Supplementary Table 4.1). The majority of samples had As levels beyond CCME guidelines, with the exception of three outliers (BC49, BC50 and YK24) having levels below 35 PPM (Supplementary Table 4.1; CCEM, 2002). In fact, this assemblage is almost identical to HAC in all aspects with the exception of (1) the reduced, yet high, As and S1 median, and (2) the subtle increase in taxa diversity in AC (1.4-2 SDI; median SDI = 1.8).

While still dominant in AC, *D. elegans* Penard, 1890 (median abunance = 30.3%) experienced a notable reduction coupled with an increase in the relative abundance of *C. aculeata* (Ehrenberg 1832) strains "aculeata" (median abunance = 10.2%), *C. aculeata* (Ehrenberg 1832) strains "discoides" (median abunance = 6%), and *C. constricta* (Ehrenberg 1843) strain "constricta" (median abunance = 17.2%) (Supplementary Table 1). *C. constricta* (Ehrenberg 1843) strain "aerophila" (median abunance = 16.7%) were still present in significant, yet reduced, numbers (Supplementary Table 1). *Difflugia oblonga* Ehrenberg 1832 strain "oblonga" (median abunance = 0.8%), and *C. tricuspis* (Carter 1856) (median abunance = 2.1%) are also common in some of the samples, but in low proportions.

The continued presence of high proportions of stress-indicating taxa (e.g. *D. elegans* and centropyxid species and strains), low numbers of healthy-lakes dwellers (e.g. *D. oblonga strain* 'oblonga' and *C. tricuspis*), and the relatively high As concentration median indicates continued stress in the lakes hosting AC.

However, the abundance of the dominant taxa in this assemblage is reduced when compared to the values of HAC. This reduction of stress-indicating taxa is interpreted to be in response to reduced stress in lakes hosting AC. This is supported by a subtle increase in assemblage diversity (1.4-2 SDI; median SDI = 1.8) and reduction of the levels of As and key stress-indicating taxa. However, species like *D. oblonga strain* “oblonga” and *C. tricuspis* did not seem to respond to reduced As concentration. This is likely attributed to the fact that As levels were still high enough to cause unfavorable conditions for these species to thrive and grow. This is likely the case as only stress-indicators like *C. aculeata* strains “aculeata”, *C. aculeata* strains “discoides”, and *C. constricta* strain “constricta” were able to take advantage of stress adjustment.

### *7.3.2.3 Assemblage 3 - ‘Centropyxis aculeata Assemblage’ (CA; n= 14)*

The Moderate Arsenic Contamination Assemblage (CA) is characteristic of relatively small lakes (median lake size = 21.9 ha) located mostly to the east and north of Giant Mine (71.4% of the samples; *n* = 10) Figure 4.1). The assemblage is mostly made up of samples collected during the 2014 survey (85.7% YK14 samples; *n* = 12). On average, lakes within CA are the closest to the Giant Mine property (median distance = 6.6 km) with only two outliers (YK25 and YK40) that are >18 km away from the mine site (Supplementary Table 4.1). Samples containing CA were mainly collected in relatively shallow water depth (median water depth =0.7

m) in silt-dominated substrates (median silt% = 77.9%) (Supplementary Table 4.1). The SDI measured for this assemblage (1.3-2.5 SDI; median SDI = 2) falls in the range of stressed to relatively healthy environmental conditions (Magurran, 1988).

Results of NMDS and RDA show samples comprising CA group closely, with the exception of one outlier (YK40), which overlapped with H assemblage (Figures 4.4, 4.5, 4.6). The RDA tri-plot shows that CA correlates positively with Ca, and Na, and negatively with Distance to Giant Mine and Hg (Figure 4.6). The tri-plot also suggests a waning influence of As and S1 on the assemblage. This is supported by the moderate As concentrations (median As = 258.1 ppm; range = 33.4-921.1 ppm) and S1- carbon (median S1-carbon = 23.1 HC/g rock; range = 10.8-50.9 HC/g rock) characterizing CA (Supplementary Table 4.1). This is expected as 57% of the lakes hosting the CA, while relatively close to GM, were located to the east and south of the historic mine (Figure 4.1). Nevertheless, levels of As remain higher than the proposed guidelines in all the samples of CA (CCEM, 2002).

The assemblage composition in CA experienced an interesting shift in dominant species, with *C. aculeata* strains "aculeata" (median abunance = 26.5%) dominating the assemblage composition instead of *D. elegans*, which was present in notably reduced proportions (median abunance = 12.9%) compared to the previous assemblages (Supplementary Table 4.1). Additionally, *C. constricta* strain "aerophila" (median abunance = 2.5%) and *C. constricta* strain "constricta" (median abunance = 4.4%), and *C. aculeata* strain "discoides" (median abunance = 3.9%) all showed a similar reduction in numbers. Interestingly, *D. oblonga* strain "oblonga" (median abunance = 4.1%), *C. tricuspis* (median abunance = 7.3%) and *D. glans* Penard 1902 strain "glans" (median abunance = 1.3%)[7] experienced a notable increase in abundance.

The assemblage seems to be influenced by lower environmental stress compared to the previous three assemblages. This is evident in the notably reduced numbers of stress-indicators, with the exception of *C. aculeata* strains "aculeata", which seems to flourish in the CA. Another sign of reduced stress is reflected by the small, yet notable increase in the numbers of *D. oblonga* strain "oblonga", *C. tricuspis*, and *D. glans* strain "glans" as well as an increase in diversity, as reflected by SDI values for this assemblage (1.3-2.5 SDI; median SDI = 2). However, it is rather interesting how most of the increase in *C. aculeata strain 'aculeata'* seems to be restricted to the YK14 samples, especially in CA and AC where the number of *C. aculeata strain "aculeata"* is high on average. Also, whenever there is an increase in the numbers of *C. aculeata strain 'aculeata'* there is a notable increase in diversity. This suggests that as soon as stress conditions are lower, *C. aculeata strain "aculeata"* compete with the rest of centropyxids and even *D. elegans* on food sources, thus creating more diverse assemblages in the process.

### *7.3.2.4 Assemblage 4 - 'Transitional Assemblage' (T; n= 14)*

The Transitional Conditions Assemblage (T) is found in relatively small lakes (median lake size = 39.5 ha) located mostly to the north and west of the Giant Mine property (71.3% of the samples; *n* = 10) (Figure 4.1). This assemblage is exclusive to samples collected during the 2012 survey. On average, lakes within TA are at a considerable distance from the Giant Mine site (median distance =12.6) (Supplementary Table 4.1). Samples containing T assemblage were mainly collected in relatively deeper water depth compared to the previous assemblages (median water depth = 4 m) and from silt-dominated substrates (median silt% = 73.9%) (Supplementary Table 4.1). The SDI measured for this assemblage (1.6-2.5 SDI; median SDI= 2.1) falls in the range of transitional to relatively healthy environmental conditions (Magurran, 1988).

The plots of NMDS and RDA show the samples comprising T assemblage grouping closely, with the exception of sample BC24, which plotted closer to H assemblage due to faunal similarities (Figure 4.4, 4.5, 4.6). The RDA tri-plot showed that T assemblage correlated positively with P, and distance to Giant Mine, and negatively with Ca and Na (Figure 4.6). Similar to CA, the tri-plot also suggest further reduction of the influence of As and S1-carbon on the assemblage. This is supported by the relatively low As concentration (median As = 76.5 ppm; range = 16.1-740.7 ppm) and S1-carbon (median S1-carbon = 31.9 HC/g rock; range = 2.2-60.9 HC/g rock) that characterizes the sediments in lakes containing the T assemblage (Supplementary Table 4.1). Lower As concentrations are expected in lakes hosting T assemblage that are mostly located > 10 km away from the historic mine site ($n$ = 11) (Figure 4.1).

The assemblage composition in T assemblage is dominated by stress-indicating taxa, like *D. elegans* (median abunance = 26%), *C. constricta* strain “aerophila” (median abunance = 16.9%), and *C. constricta* strain “constricta” (median abunance = 8.9%), with low but notable numbers of *C. aculeata* strains “aculeata” (median abunance = 2%) and *C. aculeata* strains “discoides” (median abunance = 1%) in some samples. While dominant, these species and strains occur in lower relative abundance than the other assemblages. Instead, *D. oblonga* strain “oblonga” (median abunance = 10.1%), *C. tricuspis* (median abunance = 5.4%), and *D. glans* strain “glans” (median abunance = 8.8%) are important.

The assemblage seems to reflect transitional to relatively healthy conditions based on the low numbers of the stress-indicating taxa, moderate sedimentary As concentrations and the increased presence of healthy lake dwellers like *D. oblonga* strain “oblonga”, *C. tricuspis* ($\bar{x}$= 6.9% ± 7.2 SD), and *D. glans* strain “glans”. This is probably attributed to the fact that most of the lakes comprising this assemblage are located >10 km from Giant Mine, even though a significant number of the samples came from the northern and western transects (71.3%; $n$ = 10). The increased diversity is also reflected by the SDI (1.6-2.5 SDI; median SDI = 2.1).

#### *7.3.2.5 Assemblage 5 - ‘Healthy Assemblage’ (H; n= 25)*

The Healthy Lakes Assemblage (H) is characteristic of relatively small lakes (median lake size = 39.8 ha), located mostly to the south and east of Giant Mine (72% of the samples; $n$ = 18) (Figure 4.1). On average, lakes within H assemblage are the furthest from Giant Mine (median distance = 19.6 km). Samples containing H assemblage were mainly collected in relatively shallow water depth (median water depth = 2.5 m) in silt-dominated substrates (median silt% = 71.5%)

(Supplementary Table 1). The SDI measured for this assemblage (1.6-2.4 SDI; median SDI = 2.1) falls in the range of transitional to relatively healthy environmental conditions (Magurran, 1988).

While results of NMDS and RDA show samples comprising H assemblage grouping closely, the loadings of these samples exhibited more spread than any of the previous assemblages (Figure 4.4, 4.5, 4.6). This lead to an overlap between this assemblage and two other assemblages (CA and T). The RDA tri-plot shows that H assemblage correlated positively with Ba, Na, Distance to Giant Mine and P, and negatively with As, S1, TOC, and Hg (Figure 4.6). The negative correlation between this group and As and S1, in particular, is to be expected as H assemblage occurs in sediments with the lowest As concentration (median As = 30.3 ppm; range = 6.3-905.2 ppm) and S1-carbon (median S1-carbon = 18.9 HC/g rock; range = 0.4-36.4 HC/g rock) among the identified groups, possibly due to the fact that most of the lakes hosting this assemblage are located either to the east or south of Giant Mine and/or are distal lakes. However, while S1-cabon levels are the lowest in this assemblage, they remain high enough to sustain a healthy and diverse Arcellinidan population.

The response of Arcellinida to reduced environmental stress is indicated by, *C. tricuspis* (median abunance = 27.3%) as the dominant species. Other species like *D. oblonga* strain "oblonga" (median abunance = 8.2%) and *D. glans* strain "glans" (median abunance = 6.9%) are more abundant in the samples of H assemblage. On the other hand, stress-indicating species, like *D. elegans* (median abunance = 7.5%), *C. constricta* strain "aerophila" (median abunance = 1.6%), *C.*

*constricta* strain "constricta" (median abunance = 1.4%), *C. aculeata* strains "aculeata" (median abunance = 4.1%) and *C. aculeata* strains "discoides" (median abunance = 0.6%) were common, but occurred in much lower proportions compared to the other assemblages.

This assemblage an example on the Arcellinida community that could be found in transitional to relatively healthy benthic lake conditions. The shift from stress-dominated taxa to healthy-lake dwellers is indicative of the presence of suitable conditions to sustain a diverse assemblage. This improvement in environmental conditions is likely attributed to the fact that most lakes hosting H assemblage are located upwind and at considerable distance (median distance = 19.6 km), thus likely being beyond the influence of the Giant Mine.

## 7.3.3. References


Andrade CF, Jamieson HE, Kyser TK, Praharaj T, Fortin D, 2010. Biogeochemical redox cycling of arsenic in mine-impacted lake sediments and coexisting pore waters near Giant Mine, Yellowknife Bay, Canada. Applied Geochemistry 25: 199-211.

Bullen W, Robb M, 2005. Socio-economic Contribution of Gold Mining in the Yellowknife Mining District, Chapter 4. In Gold in the Yellowknife Greenstone Belt, Northwest Territories: Results of the EXTECH III Multidisciplinary Research Project; Anglin; Falck; Wright; Ambrose, Eds.; Association of Canada, Mineral Deposits Division: Canada.

Canadian Council of Ministers of the Environment (CCME), 1987. Appendix XXIII—Canadian water quality guidelines: Updates (June 1997), arsenic, bromacil, carbaryl, chlorpyrifos, deltamethin, and glycols. In: Canadian water quality guidelines, Canadian Council of Resource and Environment Ministers. Prepared by the Task Force on Water Quality Guidelines.

Canadian Council of Ministers of the Environment (CCME), 2002. Canadian Sediment Quality Guidelines for the Protection of Aquatic Life, in, Canadian Environment Quality Guidelines.

Magurran AE, 1988. Ecological diversity and its measurement. Princeton University Press, Princeton, 185.

Galloway JM, Palmer M, Jamieson HE, Patterson RT, Nasser N, Falck H, Macumber AL, Goldsmith SA, Sanei H, Normandeau P, Hadlari T, Roe HM, Neville LA, Lemay D, 2015. Geochemistry of lakes across ecozones in the Northwest Territories and implications for the distribution of arsenic in the Yellowknife region. Part 1: Sediments; Geological Survey of Canada, Open File 7908, 50 p. + appendix, 1 .zip file.

Galloway JM, Sanei H, Patterson RT, Mosstajiri T, Hadlari T, Falck H, 2012. Total arsenic concentrations of lake sediments near the City of Yellowknife, Northwest Territories. Geological Survey of Canada Open File 7037, 47 p.

Galloway JM, Swindles GT, Jamieson HE, Palmer M, Parsons MB, Sanei H, Macumber AL, Patterson RT, Falck H, 2017. Organic matter control on the distribution of arsenic in lake sediments impacted by ~65years of gold ore processing in subarctic Canada. Science of the Total Environment.

Government of the Northwest Territories – Environment and Natural Resources, 2003. Environmental Guideline for Contaminated Site Remediation. Environmental Guidelines produced by the Environment Division (ED) of GNWT-ENR 39 p.

MacDonald DD, 1997. Controlling arsenic releases to the environment in the Northwest Territories – Summary; Prepared for Environmental Protection, Environment Canada, Yellowknife, N.W.T., by MacDonald Environmental Services Ltd.: Ladysmith B.C.

Nasser NA, Patterson RT, Roe HM, Galloway JM, Falck H, Palmer MJ, Spence C, Sanei H, Macumber AL, Neville LA, 2016. Lacustrine Arcellinina (testate amoebae) as bioindicators of arsenic contamination. Microbial Ecology 72:130–149.

Palmer M, Galloway JM, Jamieson HE, Patterson RT, Falck H, Kokelj SV, 2015. The concentration of arsenic in lake waters of the Yellowknife area 15 years after the end of gold ore processing. Northwest Territories. Geological Survey Open File 16.

Schuh CE, Jamieson HE, Palmer MJ, Martin AJ, 2017. Solid-phase speciation and post-depositional mobility of arsenic in lake sediments impacted by ore roasting at legacy gold mines in the Yellowknife area, Northwest Territories, Canada. Applied Geochemistry 91:208–220.

Van Den Berghe MD, Jamieson HE, Palmer MJ, 2017. Arsenic mobility and characterization in lakes impacted by gold ore roasting, Yellowknife, NWT, Canada. Environmental Pollution 234:630–641.

Wrye L, 2008. Distinguishing between natural and anthropogenic sources of arsenic in soils from the Giant Mine, Northwest Territories, and the North Brookfield Mine, Nova Scotia. M.Sc. Dissertation, Queen's University, Kingston, Ontario, Canada.

**Supplementary Table 4.1:** Lake parameters, Rock Eval, particle size analysis (PSA), ICP-MS results, and Arcellinida relative abundance results in lake sediment-water interface samples (n = 93) from 90 lakes in the Yellowknife area, Northwest Territories, Canada.

| Site Name | Depth at sampling location | Surface water pH | Bottom water pH | Surface water dissolved oxygen | Bottom water dissolved oxygen | Surface water conductivity | Bottom water conductivity |
|---|---|---|---|---|---|---|---|
| Method Detection Limit[s] | | | | | | | |
| Units | (m) | | | (mg/L) | | (μm/S) | (μm/S) |
| BC-01 | 4.6 | 6.87 | 7.29 | 11.66 | 9.65 | 53.1 | 58 |
| BC-02 | 7.0 | 7.32 | 7.07 | 9.55 | 7.95 | 40.2 | 40.2 |
| BC-03 | 2.4 | 8.12 | 8.15 | 11.71 | 10.35 | 93.2 | 93.2 |
| BC-04 | 2.9 | 7.98 | 7.41 | 10.77 | 8.72 | 33.8 | 40.5 |
| BC-05 | 3.0 | 7.86 | 7.75 | 11.71 | 10.25 | 55.8 | 55.6 |
| BC-06 | 11.5 | 7.94 | 6.88 | 10.09 | 0.05 | 95.4 | 115.6 |
| BC-07 | 1.3 | 7.98 | 7.75 | 12.35 | 12.12 | 31.3 | 31.3 |
| BC-08 | 1.1 | 7.65 | 7.46 | 10.98 | 10.53 | 44.3 | 44.2 |
| BC-09 | 1.0 | 7.63 | 7.48 | 11.88 | 11.17 | 45.1 | 45.1 |
| BC-10 | 13.3 | 8.18 | 6.97 | 11.33 | 1.81 | 89.9 | 104 |
| BC-11 | 5.2 | 8.2 | 8.65 | 10.37 | 3.44 | 90.2 | 102.1 |
| BC-12 | 1.0 | 7.31 | 7.22 | 11.27 | 10.66 | 43.1 | 43 |
| BC-13 | 4.5 | 7.59 | 7.73 | 11.08 | 10.31 | 65.4 | 65.3 |
| BC-14 | 1.0 | 7.57 | 7.46 | 10.65 | 9.87 | 110.3 | 112.6 |
| BC-15 | 2.0 | 7.88 | 7.71 | 11.59 | 10.58 | 65.3 | 65.3 |
| BC-16 | 1.3 | 7.94 | 7.88 | 12.16 | 11.74 | 65.2 | 65.1 |
| BC-17 | 0.8 | 7.78 | 7.79 | 11.53 | 11.6 | 93.2 | 93.4 |
| BC-18 | 1.0 | 8.45 | 8.42 | 12.4 | 12.18 | 182.5 | 182.2 |
| BC-19 | 0.7 | 8.05 | 8.03 | 11.49 | 11.47 | 162.6 | 162.6 |
| BC-20 | 1.4 | 8.48 | 8.32 | 11.58 | 10.54 | 326.6 | 326.4 |
| BC-21 | 0.6 | 7.91 | 7.65 | 11.34 | 11.34 | 118.7 | 118.7 |
| BC-22 | 2.5 | 7.56 | 7.02 | 7.23 | 4.31 | 88.6 | 96.1 |
| BC-23 | 5.1 | 7.42 | 7.21 | 9.48 | 9.01 | 70.8 | 70.8 |
| BC-24 | 3.1 | 7.26 | 7.05 | 10.66 | 10.17 | 34.5 | 34.6 |
| BC-25 | 1.0 | 7.26 | 7.38 | 12.5 | 12.51 | 51.8 | 51.8 |
| BC-26 | 1.0 | 7.69 | 7.75 | 12.02 | 11.89 | 175 | 175.1 |
| BC-27 | 3.6 | 7.81 | 7.65 | 11.81 | 11.37 | 99.4 | 99.1 |
| BC-28 | 1.3 | 7.99 | 7.97 | 13.75 | 13.79 | 84.3 | 84.3 |
| BC-29 | 1.5 | 8.29 | 8.27 | 14.12 | 13.87 | 97.1 | 97 |
| BC-30 | 3.5 | 7.97 | 7.77 | 13.68 | 13.51 | 36.6 | 36.6 |
| BC-31 | 0.8 | 7.6 | 7.44 | 11.12 | 10.23 | 63.5 | 64.8 |
| BC-32 | 1.2 | 7.65 | 7.62 | 13.61 | 11.82 | 55.9 | 56.7 |
| BC-33 | 3.3 | 7.52 | 7.39 | 11.44 | 8.73 | 66.6 | 67.7 |
| BC-34 | 2.8 | 7.6 | 7.68 | 12.8 | 12.24 | 60.4 | 60.3 |
| BC-35 | 5.9 | 7.79 | 7.48 | 10.93 | 10.21 | 72 | 71.9 |
| BC-36 | 1.5 | 8.11 | 7.99 | 12.7 | 13.55 | 55.2 | 55.4 |

**Supplementary Table 4.1:** Continued.

| Site Name | Lake area (ha) | Latitude | Longitude | Year collected | Lake area (Google Earth Orthophoto) | Distance to Giant Mine historic roaster stack | S1 | S1 |
|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | | | | | | | | |
| Units | | degrees N | degrees W | | ha | km | mg HC/g rock | wt.%[h] |
| BC-01 | 111.07 | 62.6987 | -114.4489 | 2012 | 111.07 | 22.38 | 46.42 | 3.85 |
| BC-02 | 24.92 | 62.6552 | -114.3856 | 2012 | 24.92 | 17.10 | 4.97 | 0.41 |
| BC-03 | 576.75 | 62.6566 | -114.4471 | 2012 | 576.75 | 17.77 | 48.46 | 4.02 |
| BC-04 | 4.86 | 62.6330 | -114.4465 | 2012 | 4.86 | 15.26 | 40.78 | 3.38 |
| BC-05 | 53.6143666 | 62.6158 | -114.4944 | 2012 | 53.61 | 14.47 | 46.43 | 3.85 |
| BC-06 | 106.215604 | 62.6362 | -114.4744 | 2012 | 106.22 | 16.08 | 53.09 | 4.41 |
| BC-07 | 16.6413635 | 62.6147 | -114.4248 | 2012 | 16.64 | 12.99 | 60.93 | 5.06 |
| BC-08 | 0.7318823 | 62.6080 | -114.4045 | 2012 | 0.73 | 12.02 | 33.96 | 2.82 |
| BC-09 | 0.93175276 | 62.6063 | -114.4103 | 2012 | 0.93 | 11.90 | 21.48 | 1.78 |
| BC-10 | 99.9472746 | 62.5900 | -114.3678 | 2012 | 99.95 | 9.78 | 19.59 | 1.63 |
| BC-11 | 99.9472746 | 62.5840 | -114.3756 | 2012 | 99.95 | 9.15 | 11.51 | 0.96 |
| BC-12 | 2.22484933 | 62.5987 | -114.4096 | 2012 | 2.22 | 11.07 | 33.90 | 2.81 |
| BC-13 | 285.965934 | 62.5269 | -114.4441 | 2012 | 285.97 | 5.15 | 40.96 | 3.40 |
| BC-14 | 18.9692946 | 62.5179 | -114.4311 | 2012 | 18.97 | 4.10 | 59.56 | 4.94 |
| BC-15 | 130.16 | 62.5266 | -114.6112 | 2012 | 130.16 | 3.47 | 58.48 | 4.85 |
| BC-16 | 130.16 | 62.5000 | -114.4227 | 2012 | 130.16 | 3.33 | 54.52 | 4.53 |
| BC-17 | 15.1667929 | 62.4910 | -114.4206 | 2012 | 15.17 | 3.22 | 66.50 | 5.52 |
| BC-18 | 15.23 | 62.5010 | -114.3967 | 2012 | 15.23 | 2.64 | 47.50 | 3.94 |
| BC-19 | 15.23 | 62.5048 | -114.3897 | 2012 | 15.23 | 2.49 | 50.58 | 4.20 |
| BC-20 | 42.4299549 | 62.4834 | -114.3883 | 2012 | 42.43 | 1.66 | 40.65 | 3.37 |
| BC-21 | 9.01593076 | 62.4905 | -114.4401 | 2012 | 9.02 | 4.55 | 22.94 | 1.90 |
| BC-22 | 0.80379121 | 62.5411 | -114.8400 | 2012 | 0.80 | 25.20 | 9.33 | 0.77 |
| BC-23 | 26.876424 | 62.5422 | -114.8054 | 2012 | 26.88 | 23.47 | 6.45 | 0.54 |
| BC-24 | 1.11032885 | 62.5466 | -114.7452 | 2012 | 1.11 | 20.55 | 31.11 | 2.58 |
| BC-25 | 20.1798958 | 62.5727 | -114.7628 | 2012 | 20.18 | 22.26 | 30.09 | 2.50 |
| BC-26 | 4.24452979 | 62.5638 | -114.7707 | 2012 | 4.24 | 22.34 | 22.49 | 1.87 |
| BC-27 | 132.523565 | 62.5226 | -114.7345 | 2012 | 132.52 | 19.53 | 18.93 | 1.57 |
| BC-28 | 38.5940192 | 62.5444 | -114.6748 | 2012 | 38.59 | 16.99 | 50.42 | 4.18 |
| BC-29 | 24.5866118 | 62.5338 | -114.6719 | 2012 | 24.59 | 16.55 | 46.57 | 3.87 |
| BC-30 | 59.5697752 | 62.5199 | -114.6072 | 2012 | 59.57 | 13.01 | 24.24 | 2.01 |
| BC-31 | 33.7288791 | 62.5418 | -114.5780 | 2012 | 33.73 | 12.16 | 36.23 | 3.01 |
| BC-32 | 11.2903756 | 62.5069 | -114.5361 | 2012 | 11.29 | 9.20 | 39.40 | 3.27 |
| BC-33 | 25.6176697 | 62.5342 | -114.4850 | 2012 | 25.62 | 7.45 | 61.25 | 5.08 |
| BC-34 | 105.191985 | 62.5626 | -114.4080 | 2012 | 105.19 | 7.17 | 32.63 | 2.71 |
| BC-35 | 30.3793291 | 62.5148 | -113.9134 | 2012 | 30.38 | 22.94 | 13.07 | 1.08 |
| BC-36 | 13.2384218 | 62.5395 | -113.9326 | 2012 | 13.24 | 22.28 | 57.20 | 4.75 |

**Supplementary Table 4.1:** Continued.

| Site Name | S2 | S2 | S3 | S3 | RC | TOC | Sand | Silt | Clay | Mo | Cu | Pb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | | | | | | | | | | *0.01* | *0.01* | *0.01* |
| Units | mg HC/g rock | wt.% | mg HC/g rock | wt.% | % | % | % | % | % | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ |
| BC-01 | 91.27 | 7.58 | 33.07 | 2.74 | 12.85 | 25.80 | 8.90 | 74.39 | 16.73 | 2.58 | 31.32 | 10.13 |
| BC-02 | 36.75 | 3.05 | 56.37 | 4.68 | 9.33 | 14.93 | 3.90 | 78.74 | 17.33 | 13.37 | 24.77 | 9.16 |
| BC-03 | 91.75 | 7.62 | 36.57 | 3.04 | 13.15 | 26.44 | 4.10 | 83.73 | 12.20 | 1.99 | 28.06 | 9.72 |
| BC-04 | 102.40 | 8.50 | 37.15 | 3.08 | 12.84 | 26.36 | 4.30 | 75.39 | 20.32 | 2.47 | 34.65 | 17.39 |
| BC-05 | 105.19 | 8.73 | 31.25 | 2.59 | 11.48 | 25.46 | 19.90 | 66.83 | 13.26 | 2.72 | 32.6 | 4.83 |
| BC-06 | 73.07 | 6.06 | 36.41 | 3.02 | 12.25 | 24.34 | 5.80 | 83.19 | 11.01 | 3.71 | 28.98 | 10.92 |
| BC-07 | 87.10 | 7.23 | 35.32 | 2.93 | 9.49 | 23.27 | 6.60 | 77.93 | 15.46 | 2.05 | 17.87 | 6.47 |
| BC-08 | 76.56 | 6.35 | 29.54 | 2.45 | 9.76 | 20.18 | 24.90 | 61.91 | 13.24 | 3.2 | 28.58 | 5.76 |
| BC-09 | 59.38 | 4.93 | 23.78 | 1.97 | 9.18 | 16.97 | 13.10 | 67.64 | 19.27 | 2.56 | 38.42 | 8.25 |
| BC-10 | 49.00 | 4.07 | 21.80 | 1.81 | 6.85 | 13.48 | 30.30 | 62.77 | 6.93 | 15.13 | 60.71 | 13.76 |
| BC-11 | 14.44 | 1.20 | 6.03 | 0.50 | 1.60 | 4.03 | 79.20 | 17.35 | 3.41 | 7.07 | 16.3 | 7.83 |
| BC-12 | 89.50 | 7.43 | 41.78 | 3.47 | 13.34 | 25.44 | 13.50 | 72.04 | 14.47 | 1.55 | 20.35 | 7.79 |
| BC-13 | 71.18 | 5.91 | 26.72 | 2.22 | 9.87 | 20.37 | 18.00 | 66.09 | 15.92 | 6.16 | 38.48 | 10.6 |
| BC-14 | 111.49 | 9.25 | 37.79 | 3.14 | 11.95 | 27.75 | 9.50 | 75.87 | 14.61 | 1.77 | 29.88 | 9.24 |
| BC-15 | 103.77 | 8.61 | 32.42 | 2.69 | 10.67 | 25.56 | 7.00 | 74.63 | 18.34 | 5.35 | 34.72 | 9.92 |
| BC-16 | 103.47 | 8.59 | 31.87 | 2.65 | 11.54 | 26.10 | 12.00 | 73.88 | 14.08 | 7.12 | 37.03 | 5.63 |
| BC-17 | 88.31 | 7.33 | 38.53 | 3.20 | 12.38 | 26.92 | 8.20 | 81.40 | 10.44 | 3.2 | 26.75 | 32.9 |
| BC-18 | 135.66 | 11.26 | 37.44 | 3.11 | 13.31 | 30.13 | 9.90 | 76.80 | 13.33 | 8.35 | 37.27 | 9 |
| BC-19 | 114.26 | 9.48 | 40.65 | 3.37 | 13.06 | 28.50 | 12.80 | 81.11 | 6.09 | 9.06 | 44.1 | 41.99 |
| BC-20 | 64.70 | 5.37 | 27.95 | 2.32 | 7.20 | 17.12 | 5.50 | 79.94 | 14.53 | 13.59 | 69.32 | 13.53 |
| BC-21 | 99.75 | 8.28 | 43.62 | 3.62 | 17.21 | 29.34 | 7.20 | 84.07 | 8.72 | 2.38 | 26.1 | 5.25 |
| BC-22 | 34.89 | 2.90 | 15.70 | 1.30 | 6.91 | 11.34 | 4.90 | 68.18 | 26.96 | 1.64 | 33.35 | 12.63 |
| BC-23 | 24.57 | 2.04 | 10.62 | 0.88 | 4.72 | 7.81 | 1.70 | 88.86 | 9.48 | 0.79 | 24.81 | 12.38 |
| BC-24 | 112.61 | 9.35 | 41.75 | 3.47 | 17.11 | 30.90 | 25.30 | 65.65 | 9.09 | 2.52 | 28.73 | 3.31 |
| BC-25 | 112.29 | 9.32 | 38.77 | 3.22 | 13.95 | 27.49 | 8.00 | 73.39 | 18.57 | 1.47 | 18.67 | 6.02 |
| BC-26 | 102.13 | 8.48 | 35.78 | 2.97 | 15.20 | 27.15 | 4.40 | 84.04 | 11.57 | 1.08 | 15.51 | 5.79 |
| BC-27 | 82.34 | 6.83 | 26.66 | 2.21 | 11.71 | 21.34 | 15.90 | 61.22 | 22.85 | 1.59 | 25.11 | 10.23 |
| BC-28 | 106.88 | 8.87 | 36.35 | 3.02 | 9.75 | 24.38 | 6.60 | 75.42 | 17.96 | 1.68 | 18.02 | 5.86 |
| BC-29 | 101.83 | 8.45 | 30.65 | 2.54 | 8.59 | 22.28 | 7.00 | 75.40 | 17.56 | 3.5 | 23.73 | 8.2 |
| BC-30 | 54.36 | 4.51 | 16.52 | 1.37 | 5.76 | 13.01 | 21.30 | 66.95 | 11.71 | 0.69 | 16.44 | 6.67 |
| BC-31 | 110.68 | 9.19 | 37.46 | 3.11 | 12.48 | 26.34 | 6.40 | 73.10 | 20.53 | 1.44 | 22 | 6.26 |
| BC-32 | 116.26 | 9.65 | 41.41 | 3.44 | 12.46 | 27.18 | 5.30 | 72.76 | 21.98 | 2.18 | 21.24 | 10.35 |
| BC-33 | 86.36 | 7.17 | 37.61 | 3.12 | 12.75 | 26.65 | 7.30 | 77.41 | 15.24 | 3.7 | 34.93 | 3.8 |
| BC-34 | 83.35 | 6.92 | 23.03 | 1.91 | 8.98 | 19.67 | 5.10 | 80.65 | 14.27 | 6.09 | 41.22 | 12.44 |
| BC-35 | 50.36 | 4.18 | 17.36 | 1.44 | 6.57 | 12.61 | 4.00 | 90.32 | 5.72 | 0.64 | 45.09 | 11.08 |
| BC-36 | 134.24 | 11.14 | 39.17 | 3.25 | 12.86 | 30.42 | 13.10 | 74.50 | 12.44 | 1.14 | 37.33 | 9.14 |

**Supplementary Table 4.1:** Continued.

| Site Name | Zn | Ag | Ni | Co | Mn | Fe | As | U | Au | Th |
|---|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | *0.1* | *0.002* | *0.1* | *0.1* | *1* | *100* | *0.1* | *0.1* | *0.0002* | *0.1* |
| Units | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ |
| BC-01 | 91.2 | 0.12 | 21.3 | 8.9 | 226 | 16500 | 107.9 | 53.4 | 0.0133 | 1.8 |
| BC-02 | 240.2 | 0.119 | 28.6 | 39.5 | 10000 | 87300 | 905.2 | 172.5 | 0.0156 | 7.5 |
| BC-03 | 108.7 | 0.12 | 20.8 | 9.1 | 604 | 19600 | 126.3 | 33.4 | 0.0122 | 2.6 |
| BC-04 | 128.8 | 0.15 | 24.8 | 9.7 | 226 | 3900 | 555.4 | 31.7 | 0.0858 | 1 |
| BC-05 | 139.7 | 0.127 | 20.2 | 9 | 179 | 12200 | 90.9 | 10.9 | 0.0008 | 1.1 |
| BC-06 | 93.7 | 0.098 | 18.6 | 10.6 | 820 | 18700 | 236.1 | 36.2 | 0.038 | 1.8 |
| BC-07 | 83.8 | 0.069 | 18.3 | 4 | 73 | 4400 | 19.5 | 19.2 | 0.0147 | 1.7 |
| BC-08 | 91.4 | 0.073 | 28.7 | 8.6 | 263 | 10900 | 41.9 | 19.8 | 0.0047 | 1.9 |
| BC-09 | 110.6 | 0.079 | 28.3 | 11.1 | 694 | 14700 | 35.5 | 37.5 | 0.0059 | 1.5 |
| BC-10 | 91.2 | 0.165 | 28.4 | 10.1 | 1210 | 14800 | 192.8 | 9.3 | 0.0742 | 1.1 |
| BC-11 | 41.8 | 0.032 | 14.6 | 4.5 | 100 | 10300 | 16.1 | 1.3 | 0.0126 | 3.6 |
| BC-12 | 103.3 | 0.083 | 24.8 | 11.8 | 440 | 8600 | 372.2 | 3.5 | 0.0301 | 0.4 |
| BC-13 | 130.1 | 0.152 | 26.4 | 9.7 | 401 | 17200 | 740.7 | 15 | 0.0532 | 0.7 |
| BC-14 | 109 | 0.148 | 18.5 | 5.8 | 193 | 8300 | 1063.8 | 8.2 | 0.0449 | 0.9 |
| BC-15 | 85.8 | 0.115 | 20.2 | 4.6 | 206 | 7000 | 290.4 | 13.2 | 0.0512 | 0.8 |
| BC-16 | 86.3 | 0.072 | 22.2 | 4.7 | 156 | 9300 | 92.3 | 13.4 | 0.006 | 1 |
| BC-17 | 89.1 | 0.409 | 16.7 | 5.5 | 223 | 8300 | 4778.2 | 11.6 | 0.5466 | 0.7 |
| BC-18 | 105.3 | 0.137 | 17.4 | 6.9 | 503 | 8800 | 906.9 | 11.2 | 0.0412 | 0.5 |
| BC-19 | 120.3 | 0.449 | 16.3 | 6.3 | 116 | 5000 | **10000** | 5.3 | 0.5707 | 0.5 |
| BC-20 | 51 | 0.138 | 36 | 9.8 | 292 | 11300 | 160.4 | 7.2 | 0.0823 | 1.1 |
| BC-21 | 71.5 | 0.107 | 22.4 | 5.8 | 254 | 9100 | 368.4 | 6.3 | 0.0264 | 1.2 |
| BC-22 | 119.3 | 0.126 | 47.8 | 24.9 | 730 | 29900 | 43.7 | 3.9 | 0.0207 | 8.8 |
| BC-23 | 98.2 | 0.116 | 31.7 | 12 | 406 | 29100 | 30.2 | 7.2 | 0.0042 | 9.6 |
| BC-24 | 221.7 | 0.109 | 24.6 | 13.8 | 296 | 6300 | 71.9 | 9 | 0.0015 | 0.4 |
| BC-25 | 49.9 | 0.069 | 18.9 | 5.8 | 253 | 8400 | 39.6 | 6.7 | 0.0089 | 1.3 |
| BC-26 | 75 | 0.082 | 23.9 | 8.5 | 510 | 16500 | 30.3 | 2 | 0.0025 | 4.2 |
| BC-27 | 89 | 0.103 | 32.1 | 11.2 | 707 | 27100 | 112.6 | 6.9 | 0.013 | 5.2 |
| BC-28 | 62 | 0.062 | 17.9 | 5.8 | 262 | 10600 | 93.9 | 4 | 0.008 | 2.3 |
| BC-29 | 86.7 | 0.105 | 22.2 | 6.9 | 243 | 15100 | 397.5 | 5.7 | 0.0288 | 1.9 |
| BC-30 | 67.5 | 0.061 | 19.7 | 7.1 | 1342 | 18600 | 117.1 | 1.9 | 0.0226 | 2.3 |
| BC-31 | 116.4 | 0.096 | 24.8 | 10.8 | 391 | 10400 | 299.8 | 4 | 0.0223 | 0.8 |
| BC-32 | 77 | 0.143 | 23 | 7.4 | 312 | 9700 | 955.1 | 2.9 | 0.0736 | 1.2 |
| BC-33 | 89.9 | 0.083 | 25.4 | 7.5 | 344 | 8500 | 260 | 5.6 | 0.0106 | 1 |
| BC-34 | 152.4 | 0.141 | 35.1 | 14.1 | 292 | 19200 | 289.4 | 16.1 | 0.0425 | 2 |
| BC-35 | 99 | 0.113 | 52.5 | 11.9 | 718 | 23100 | 9.7 | 4.1 | 0.0036 | 3.8 |
| BC-36 | 103.4 | 0.146 | 42.9 | 5.9 | 272 | 4600 | 38.1 | 2.4 | 0.0168 | 0.4 |

**Supplementary Table 4.1:** Continued.

| Site Name | Sr | Cd | Sb | Bi | V | Ca | P | La | Cr | Mg |
|---|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | *0.5* | *0.01* | *0.02* | *0.02* | *2* | *100* | *10* | *0.5* | *0.5* | *100* |
| Units | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ | $mg{\cdot}kg^{-1}$ |
| BC-01 | 56.2 | 0.5 | 3.49 | 0.18 | 20 | 8300 | 980 | 33.1 | 22.2 | 2800 |
| BC-02 | 97.7 | 0.78 | 9.52 | 0.29 | 38 | 10500 | 2430 | 59.1 | 24.3 | 1300 |
| BC-03 | 52.6 | 0.65 | 4.37 | 0.18 | 20 | 9200 | 1040 | 30.7 | 17.9 | 2000 |
| BC-04 | 46.4 | 0.83 | 14.84 | 0.16 | 18 | 11300 | 1220 | 13.9 | 19.6 | 1200 |
| BC-05 | 39.6 | 0.65 | 2.67 | 0.09 | 25 | 6400 | 740 | 16.1 | 18.4 | 2700 |
| BC-06 | 49.1 | 0.48 | 14.82 | 0.15 | 15 | 9400 | 1640 | 13.5 | 18.9 | 2600 |
| BC-07 | 49.9 | 0.26 | 0.96 | 0.07 | 7 | 10500 | 860 | 10.8 | 11.5 | 1700 |
| BC-08 | 53.4 | 0.22 | 1.09 | 0.16 | 19 | 10900 | 930 | 15.1 | 21.2 | 3900 |
| BC-09 | 41.8 | 0.34 | 1.37 | 0.28 | 23 | 9800 | 780 | 20 | 30.3 | 4600 |
| BC-10 | 39.5 | 0.38 | 6.59 | 0.44 | 23 | 10200 | 1750 | 19.8 | 35.7 | 5000 |
| BC-11 | 14 | 0.07 | 3.28 | 0.09 | 16 | 4100 | 440 | 11.7 | 19.5 | 3900 |
| BC-12 | 62 | 0.38 | 5.78 | 0.1 | 17 | 14500 | 1160 | 6.1 | 15.7 | 2300 |
| BC-13 | 33.2 | 0.48 | 16.21 | 0.25 | 25 | 7300 | 1100 | 15.5 | 26.4 | 3700 |
| BC-14 | 41.6 | 0.42 | 20.4 | 0.19 | 12 | 11800 | 880 | 7.1 | 15.8 | 3000 |
| BC-15 | 37.9 | 0.48 | 10.96 | 0.17 | 16 | 8200 | 660 | 10.4 | 16 | 2600 |
| BC-16 | 40.7 | 0.39 | 2.3 | 0.17 | 15 | 8500 | 630 | 11.5 | 17.7 | 2800 |
| BC-17 | 48.1 | 0.47 | 44.4 | 0.15 | 10 | 10900 | 1030 | 6.6 | 12.7 | 3500 |
| BC-18 | 46.3 | 0.46 | 18.33 | 0.08 | 10 | 13700 | 590 | 5.9 | 11.7 | 2700 |
| BC-19 | 36.2 | 0.6 | 187.37 | 0.16 | 11 | 11100 | 770 | 4.5 | 9.7 | 3000 |
| BC-20 | 123.8 | 0.2 | 8.16 | 0.14 | 23 | 62300 | 1010 | 6.4 | 33.4 | 6200 |
| BC-21 | 71.2 | 0.4 | 7.82 | 0.11 | 14 | 18000 | 860 | 9.7 | 16.4 | 3500 |
| BC-22 | 51.2 | 0.33 | 2.1 | 0.31 | 50 | 6300 | 1060 | 32.2 | 49.9 | 10000 |
| BC-23 | 42.8 | 0.2 | 2.78 | 0.34 | 49 | 5000 | 910 | 33.3 | 48.5 | 8800 |
| BC-24 | 56.7 | 0.59 | 1.98 | 0.23 | 15 | 10100 | 1370 | 9.3 | 16.8 | 2500 |
| BC-25 | 56.6 | 0.14 | 3.38 | 0.14 | 19 | 9800 | 1220 | 12.7 | 18.5 | 3900 |
| BC-26 | 86.2 | 0.23 | 1.04 | 0.17 | 24 | 15400 | 830 | 14.3 | 23.5 | 5800 |
| BC-27 | 58.3 | 0.35 | 6.91 | 0.25 | 36 | 9200 | 1230 | 24 | 35.6 | 6500 |
| BC-28 | 45.7 | 0.2 | 2.74 | 0.12 | 21 | 8200 | 1250 | 11.4 | 18.3 | 3800 |
| BC-29 | 50.2 | 0.34 | 9.54 | 0.15 | 21 | 9100 | 720 | 11 | 17.4 | 3500 |
| BC-30 | 31.7 | 0.2 | 10.51 | 0.12 | 23 | 6700 | 1650 | 15.1 | 23.2 | 3800 |
| BC-31 | 49.9 | 0.47 | 8.63 | 0.14 | 18 | 10400 | 850 | 12.8 | 19.9 | 2800 |
| BC-32 | 55.5 | 0.45 | 18.21 | 0.12 | 15 | 14300 | 940 | 7.8 | 16 | 3200 |
| BC-33 | 40.4 | 0.53 | 12.01 | 0.07 | 14 | 9300 | 680 | 15.3 | 18.1 | 2800 |
| BC-34 | 35.1 | 0.44 | 13.05 | 0.25 | 29 | 7400 | 820 | 21.4 | 36.8 | 5300 |
| BC-35 | 62 | 0.22 | 0.66 | 0.29 | 39 | 10400 | 2080 | 34 | 48.2 | 8500 |
| BC-36 | 45.6 | 0.45 | 1.41 | 0.11 | 11 | 11200 | 1170 | 8.1 | 20.2 | 3200 |

**Supplementary Table 4.1:** Continued.

| Site Name | Ba | Ti | Al | Na | K | W | Sc | Tl | S | Hg |
|---|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | *0.5* | *10* | *100* | *10* | *100* | *0.1* | *0.1* | *0.02* | *200* | *0.005* |
| Units | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ |
| BC-01 | 79.8 | 180 | 9200 | 220 | 900 | 0.2 | 1.5 | 0.17 | 18700 | 0.108 |
| BC-02 | 919.4 | 100 | 20100 | 100 | 500 | 3 | 3.3 | 0.56 | 3900 | 0.2 |
| BC-03 | 96.1 | 130 | 7700 | 300 | 600 | 0.3 | 1.1 | 0.16 | 19800 | 0.124 |
| BC-04 | 60.2 | 90 | 8700 | 120 | 300 | 0.1 | 0.7 | 0.17 | 8000 | 0.369 |
| BC-05 | 88.5 | 150 | 9800 | 220 | 700 | 0.2 | 1.6 | 0.12 | 9500 | 0.073 |
| BC-06 | 85.1 | 150 | 8100 | 300 | 800 | 0.4 | 1.5 | 0.16 | 12100 | 0.193 |
| BC-07 | 75.3 | 110 | 4100 | 190 | 500 | 0.2 | 1.3 | 0.06 | 8200 | 0.095 |
| BC-08 | 164.1 | 290 | 8400 | 200 | 1300 | 0.2 | 2.2 | 0.1 | 6200 | 0.103 |
| BC-09 | 163.1 | 280 | 13200 | 150 | 1300 | 0.1 | 2.6 | 0.12 | 4800 | 0.099 |
| BC-10 | 107.1 | 230 | 10000 | 190 | 2200 | 0.7 | 1.5 | 0.14 | 6700 | 0.107 |
| BC-11 | 49.2 | 240 | 6100 | 100 | 1100 | 0.2 | 1.5 | 0.07 | 2200 | 0.03 |
| BC-12 | 133.7 | 80 | 6100 | 240 | 700 | 0.1 | 0.7 | 0.08 | 6800 | 0.157 |
| BC-13 | 61.5 | 150 | 10600 | 190 | 1000 | 0.2 | 1.4 | 0.11 | 9300 | 0.127 |
| BC-14 | 85.5 | 120 | 5000 | 340 | 700 | 0.2 | 1.4 | 0.07 | 13600 | 0.114 |
| BC-15 | 77.1 | 150 | 5400 | 220 | 700 | 0.2 | 1.6 | 0.07 | 10600 | 0.079 |
| BC-16 | 79.7 | 160 | 5200 | 240 | 700 | 0.1 | 1.5 | 0.07 | 13900 | 0.056 |
| BC-17 | 71.5 | 100 | 4800 | 480 | 600 | 0.3 | 1.1 | 0.07 | 16500 | 0.195 |
| BC-18 | 99.1 | 70 | 4500 | 160 | 300 | 0.2 | 1.2 | 0.06 | 16000 | 0.108 |
| BC-19 | 62.9 | 70 | 3900 | 230 | 400 | 0.3 | 1.2 | 0.07 | 16600 | 0.347 |
| BC-20 | 71.9 | 190 | 6900 | 1330 | 1000 | 0.7 | 2.5 | 0.06 | 8500 | 0.057 |
| BC-21 | 103.8 | 140 | 6500 | 280 | 900 | 0.1 | 1.4 | 0.07 | 10200 | 0.091 |
| BC-22 | 252.2 | 650 | 21100 | 520 | 4400 | 0.2 | 5.2 | 0.28 | 3400 | 0.114 |
| BC-23 | 191.5 | 610 | 21500 | 350 | 3700 | 0.1 | 5.4 | 0.27 | 2200 | 0.092 |
| BC-24 | 92.6 | 70 | 6600 | 160 | 400 | 0.1 | 1 | 0.11 | 6100 | 0.144 |
| BC-25 | 134.9 | 170 | 7700 | 280 | 1300 | 0.2 | 1.3 | 0.08 | 5800 | 0.06 |
| BC-26 | 178.6 | 270 | 9200 | 420 | 2300 | 0.1 | 2.5 | 0.1 | 6300 | 0.048 |
| BC-27 | 200.3 | 380 | 14300 | 360 | 2700 | 0.1 | 3.4 | 0.17 | 6300 | 0.089 |
| BC-28 | 115 | 220 | 6700 | 400 | 1300 | 0.1 | 2 | 0.1 | 5900 | 0.036 |
| BC-29 | 98.9 | 190 | 7100 | 470 | 1000 | 0.2 | 1.6 | 0.11 | 13100 | 0.108 |
| BC-30 | 140.9 | 230 | 8400 | 200 | 1600 | 0.2 | 2 | 0.11 | 5400 | 0.055 |
| BC-31 | 138.9 | 140 | 8800 | 160 | 900 | 0.1 | 1.3 | 0.11 | 5400 | 0.114 |
| BC-32 | 133.4 | 130 | 6500 | 240 | 800 | 0.2 | 1.6 | 0.09 | 9500 | 0.116 |
| BC-33 | 59.9 | 130 | 6300 | 270 | 600 | 0.1 | 1.8 | 0.09 | 11400 | 0.096 |
| BC-34 | 112.1 | 310 | 14100 | 230 | 1900 | 0.3 | 2.9 | 0.15 | 10200 | 0.116 |
| BC-35 | 257.8 | 460 | 22200 | 360 | 4200 | 0.2 | 3.9 | 0.23 | 4000 | 0.131 |
| BC-36 | 106 | 130 | 4900 | 300 | 600 | 0.2 | 0.8 | 0.07 | 12500 | 0.209 |

**Supplementary Table 4.1:** Continued.

| Site Name | Se | Ga | Cs | Hf | Nb | Rb | Sn | Zr | Y | Ce |
|---|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | *0.1* | *0.1* | *0.02* | *0.02* | *0.02* | *0.1* | *0.1* | *0.1* | *0.01* | *0.1* |
| Units | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ | mg·kg$^{-1}$ |
| BC-01 | 0.6 | 1.8 | 0.96 | **0.01** | 0.66 | 8.7 | 0.2 | 0.7 | 11.5 | 56.9 |
| BC-02 | 1.5 | 3.6 | 0.74 | 0.12 | 0.41 | 4.5 | 0.2 | 4.4 | 25.7 | 107 |
| BC-03 | 1.8 | 1.6 | 0.61 | **0.01** | 0.5 | 4.7 | 0.2 | 1.3 | 10.74 | 55.2 |
| BC-04 | 0.9 | 1.3 | 0.46 | 0.09 | 0.56 | 2.9 | 0.2 | 2.1 | 13.38 | 27.9 |
| BC-05 | 1.3 | 1.7 | 0.64 | 0.04 | 0.39 | 5.7 | 0.1 | 1 | 8.53 | 29.8 |
| BC-06 | 0.8 | 1.9 | 0.88 | 0.04 | 0.52 | 6.8 | 0.2 | 1.2 | 7.32 | 24.6 |
| BC-07 | 0.6 | 0.8 | 0.61 | 0.03 | 0.43 | 4.5 | **0.05** | 1.4 | 5.87 | 17.5 |
| BC-08 | 0.8 | 2.7 | 1.76 | 0.07 | 1.05 | 13.5 | 0.3 | 3.4 | 6.39 | 29.1 |
| BC-09 | 0.6 | 4 | 2.7 | 0.04 | 1.24 | 16.8 | 0.4 | 2.3 | 8.44 | 36.9 |
| BC-10 | 1.8 | 3.2 | 2.02 | 0.05 | 0.77 | 24 | 0.7 | 1.7 | 8.83 | 35.7 |
| BC-11 | 0.2 | 2.3 | 0.77 | 0.04 | 0.47 | 9.7 | 0.7 | 1.8 | 3.32 | 23.4 |
| BC-12 | 0.8 | 1.1 | 0.43 | 0.08 | 0.55 | 5.1 | 0.2 | 2.4 | 4.07 | 13.4 |
| BC-13 | 1.1 | 2.8 | 0.83 | **0.01** | 0.7 | 10.3 | 0.3 | 0.9 | 6.69 | 27.9 |
| BC-14 | 1.7 | 1.2 | 0.6 | **0.01** | 0.37 | 5.1 | 0.3 | 1.8 | 3.48 | 14 |
| BC-15 | 0.9 | 1.6 | 0.61 | 0.02 | 0.48 | 6.6 | 0.3 | 1.6 | 5.69 | 19.8 |
| BC-16 | 1.1 | 1.4 | 0.58 | **0.01** | 0.48 | 6.6 | 0.2 | 1.6 | 5.64 | 21.3 |
| BC-17 | 1.7 | 1 | 0.51 | **0.01** | 0.29 | 4.1 | 0.2 | 1.3 | 3.42 | 13 |
| BC-18 | 1.5 | 0.8 | 0.33 | 0.03 | 0.23 | 2.3 | **0.05** | 1.4 | 3.88 | 10.5 |
| BC-19 | 1.8 | 0.8 | 0.36 | **0.01** | 0.19 | 2.7 | 0.3 | 0.9 | 2.8 | 9.3 |
| BC-20 | 0.7 | 2 | 0.47 | 0.05 | 0.25 | 4.7 | 0.2 | 1.6 | 2.93 | 12.4 |
| BC-21 | 1.4 | 1.6 | 0.7 | 0.08 | 0.7 | 7.8 | 0.2 | 5.5 | 4.47 | 17.9 |
| BC-22 | 1 | 7.6 | 1.99 | 0.22 | 2.7 | 39.4 | 1 | 10.2 | 9.91 | 66.5 |
| BC-23 | 0.3 | 8.1 | 1.95 | 0.2 | 2.27 | 39.9 | 1 | 8.4 | 9.6 | 65.3 |
| BC-24 | 1.5 | 1.3 | 0.5 | 0.02 | 0.52 | 4.8 | 0.2 | 1.2 | 4.97 | 19.4 |
| BC-25 | 1 | 2.7 | 0.76 | 0.07 | 0.97 | 12.8 | 0.4 | 4.6 | 4.57 | 25.4 |
| BC-26 | 1.3 | 3.1 | 0.95 | 0.24 | 1.39 | 17.7 | 0.4 | 10.5 | 5.31 | 30.2 |
| BC-27 | 1.3 | 5 | 1.46 | 0.15 | 1.87 | 26 | 0.6 | 7.9 | 8.29 | 47.4 |
| BC-28 | 1.2 | 2.1 | 0.75 | 0.08 | 0.83 | 11.5 | 0.3 | 3.7 | 4.09 | 22.1 |
| BC-29 | 1.5 | 2.2 | 0.72 | 0.06 | 0.7 | 10 | 0.2 | 2.5 | 4.66 | 21.9 |
| BC-30 | 0.6 | 2.8 | 1.03 | **0.01** | 0.73 | 15 | 0.2 | 1.6 | 6.9 | 31.3 |
| BC-31 | 1.2 | 2 | 0.85 | 0.05 | 0.78 | 9.6 | 0.2 | 2.2 | 5.47 | 24.2 |
| BC-32 | 1.2 | 1.7 | 0.67 | 0.09 | 0.6 | 8.1 | 0.2 | 4.3 | 3.68 | 15.3 |
| BC-33 | 1.2 | 1.5 | 0.64 | 0.04 | 0.6 | 6.3 | 0.1 | 3 | 8.05 | 25.8 |
| BC-34 | 0.7 | 4.2 | 1.68 | 0.05 | 1.41 | 22.1 | 0.5 | 3.7 | 8.29 | 42.1 |
| BC-35 | 0.8 | 7.6 | 2.13 | 0.15 | 2.08 | 41.1 | 1 | 6.5 | 13.1 | 68.3 |
| BC-36 | 1.2 | 1.1 | 0.59 | 0.03 | 0.43 | 5.2 | **0.05** | 1.2 | 3.84 | 14.9 |

**Supplementary Table 4.1:** Continued.

| Site Name | Be | Li | Total Test Count | SDI | AV | CAA | CAD | CCA | CCC |
|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | *0.1* | *0.1* | % | Measurment | % | % | % | % | % |
| Units | mg·kg-1 | mg·kg-1 | | | | | | | |
| BC-01 | 0.7 | 11.4 | 302 | 1.89 | 1 | 0 | 6 | 68 | 53 |
| BC-02 | 2.6 | 8.1 | 190 | 1.56 | 1 | 1 | 1 | 1 | 1 |
| BC-03 | 1 | 7.2 | 225 | 1.57 | 0 | 3 | 0 | 67 | 25 |
| BC-04 | 0.4 | 3.5 | 302 | 1.35 | 3 | 0 | 0 | 43 | 5 |
| BC-05 | 0.6 | 7.2 | 341 | 1.93 | 8 | 4 | 1 | 120 | 53 |
| BC-06 | 0.3 | 11.4 | 186 | 2.26 | 0 | 7 | 7 | 36 | 19 |
| BC-07 | 0.4 | 6.3 | 226 | 2.05 | 0 | 3 | 2 | 63 | 32 |
| BC-08 | 0.5 | 13.2 | 317 | 2.51 | 0 | 19 | 8 | 58 | 40 |
| BC-09 | 0.7 | 22.6 | 293 | 2.47 | 0 | 6 | 8 | 36 | 38 |
| BC-10 | 0.2 | 18.5 | 26 | | 0 | 0 | 2 | 6 | 0 |
| BC-11 | 0.2 | 13.9 | 304 | 2.10 | 0 | 2 | 3 | 57 | 34 |
| BC-12 | 0.1 | 3.8 | 233 | 2.18 | 6 | 7 | 4 | 61 | 39 |
| BC-13 | 0.6 | 16.1 | 268 | 2.11 | 0 | 2 | 0 | 60 | 25 |
| BC-14 | 0.2 | 7.8 | 165 | 1.55 | 0 | 6 | 0 | 46 | 23 |
| BC-15 | 0.3 | 7.3 | 349 | 1.47 | 0 | 0 | 0 | 117 | 49 |
| BC-16 | 0.4 | 8.7 | 294 | 1.47 | 0 | 1 | 2 | 59 | 19 |
| BC-17 | 0.2 | 8.8 | 291 | 1.54 | 0 | 3 | 9 | 107 | 59 |
| BC-18 | 0.1 | 3.8 | 213 | 1.84 | 15 | 21 | 25 | 75 | 47 |
| BC-19 | 0.05 | 4.8 | 223 | 1.66 | 1 | 3 | 20 | 77 | 35 |
| BC-20 | 0.05 | 12.6 | 6 | | 0 | 0 | 1 | 1 | 1 |
| BC-21 | 0.4 | 6.5 | 257 | 2.51 | 6 | 35 | 36 | 13 | 14 |
| BC-22 | 0.8 | 34.7 | 145 | 1.89 | 2 | 7 | 2 | 2 | 2 |
| BC-23 | 1.3 | 40 | 198 | 1.73 | 0 | 0 | 1 | 9 | 0 |
| BC-24 | 0.2 | 2.9 | 177 | 1.62 | 1 | 0 | 4 | 23 | 2 |
| BC-25 | 0.3 | 10.4 | 196 | 2.45 | 2 | 17 | 5 | 3 | 12 |
| BC-26 | 0.4 | 15.3 | 214 | 2.20 | 4 | 23 | 9 | 7 | 6 |
| BC-27 | 0.7 | 23.8 | 299 | 2.11 | 4 | 7 | 1 | 0 | 1 |
| BC-28 | 0.4 | 11.4 | 259 | 1.54 | 0 | 0 | 0 | 89 | 13 |
| BC-29 | 0.4 | 11.3 | 203 | 1.11 | 0 | 0 | 2 | 47 | 11 |
| BC-30 | 0.5 | 14.9 | 266 | 2.42 | 0 | 8 | 17 | 41 | 21 |
| BC-31 | 0.4 | 10 | 278 | 2.36 | 11 | 3 | 1 | 37 | 16 |
| BC-32 | 0.4 | 6.9 | 256 | 1.48 | 1 | 1 | 0 | 58 | 30 |
| BC-33 | 0.1 | 9.5 | 218 | 1.32 | 0 | 7 | 3 | 100 | 20 |
| BC-34 | 0.8 | 25.4 | 234 | 1.76 | 0 | 0 | 0 | 46 | 15 |
| BC-35 | 1 | 42.1 | 206 | 1.51 | 0 | 1 | 0 | 14 | 0 |
| BC-36 | 0.1 | 8.3 | 276 | 1.04 | 3 | 1 | 0 | 51 | 39 |

**Supplementary Table 4.1:** Continued.

| Site Name | CCS | CP | CT | Dbac | DB | MC | DF | Dnod | DGG | DGD | Dglob | DOBry |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[s] | | | | | | | | | | | | |
| Units | % | % | % | % | % | % | % | % | % | % | % | % |
| BC-01 | 4 | 0 | 12 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 89 | 2 | 0 | 0 |
| BC-03 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 11 | 1 | 0 | 0 |
| BC-04 | 2 | 0 | 3 | 1 | 0 | 0 | 0 | 0 | 12 | 2 | 0 | 0 |
| BC-05 | 2 | 4 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 2 | 0 |
| BC-06 | 3 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 33 | 0 | 0 | 0 |
| BC-07 | 4 | 2 | 5 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 |
| BC-08 | 9 | 13 | 14 | 0 | 0 | 13 | 0 | 0 | 3 | 0 | 0 | 0 |
| BC-09 | 3 | 5 | 18 | 0 | 0 | 3 | 2 | 0 | 3 | 0 | 0 | 0 |
| BC-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 |
| BC-11 | 9 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 34 | 1 | 0 | 0 |
| BC-12 | 8 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 14 | 1 | 0 | 0 |
| BC-13 | 2 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 35 | 0 | 0 | 0 |
| BC-14 | 2 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| BC-15 | 3 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 |
| BC-16 | 1 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| BC-17 | 44 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| BC-18 | 10 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-19 | 10 | 9 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| BC-21 | 20 | 3 | 12 | 1 | 0 | 3 | 0 | 0 | 3 | 0 | 0 | 0 |
| BC-22 | 0 | 41 | 45 | 0 | 0 | 2 | 0 | 0 | 12 | 0 | 0 | 0 |
| BC-23 | 0 | 0 | 7 | 0 | 4 | 0 | 0 | 0 | 36 | 0 | 0 | 3 |
| BC-24 | 7 | 2 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| BC-25 | 3 | 0 | 61 | 0 | 0 | 12 | 0 | 0 | 6 | 1 | 0 | 0 |
| BC-26 | 4 | 0 | 68 | 0 | 0 | 4 | 0 | 0 | 6 | 0 | 0 | 0 |
| BC-27 | 1 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| BC-28 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-29 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-30 | 0 | 1 | 18 | 0 | 2 | 3 | 0 | 0 | 25 | 0 | 0 | 0 |
| BC-31 | 0 | 5 | 20 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 |
| BC-32 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| BC-33 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-34 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 |
| BC-35 | 0 | 0 | 63 | 0 | 0 | 0 | 0 | 5 | 83 | 0 | 0 | 0 |
| BC-36 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |

**Supplementary Table 4.1:** Continued.

| Site Name | DOLan | DOLin | DOO | DOS | DOT | DP | DA | DC | DUE | DUU | DU | Dscal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limits[s] | | | | | | | | | | | | |
| Units | % | % | % | % | % | % | % | % | % | % | % | % |
| BC-01 | 0 | 0 | 27 | 0 | 0 | 2 | 10 | 1 | 0 | 2 | 0 | 2 |
| BC-02 | 1 | 0 | 45 | 1 | 0 | 0 | 24 | 0 | 0 | 1 | 0 | 0 |
| BC-03 | 0 | 0 | 9 | 1 | 0 | 3 | 0 | 0 | 0 | 22 | 0 | 0 |
| BC-04 | 0 | 0 | 4 | 0 | 0 | 1 | 17 | 16 | 0 | 5 | 0 | 0 |
| BC-05 | 0 | 0 | 24 | 3 | 2 | 1 | 5 | 14 | 0 | 1 | 0 | 5 |
| BC-06 | 5 | 0 | 22 | 0 | 17 | 2 | 4 | 0 | 0 | 1 | 0 | 0 |
| BC-07 | 0 | 0 | 9 | 0 | 0 | 14 | 7 | 0 | 0 | 2 | 0 | 0 |
| BC-08 | 0 | 0 | 45 | 8 | 0 | 8 | 10 | 0 | 0 | 7 | 0 | 4 |
| BC-09 | 0 | 1 | 62 | 14 | 0 | 2 | 14 | 4 | 0 | 4 | 0 | 10 |
| BC-10 | 0 | 0 | 9 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-11 | 0 | 0 | 42 | 2 | 7 | 11 | 4 | 0 | 0 | 0 | 0 | 1 |
| BC-12 | 0 | 0 | 0 | 0 | 6 | 1 | 15 | 11 | 0 | 1 | 0 | 1 |
| BC-13 | 0 | 0 | 6 | 0 | 26 | 5 | 10 | 0 | 0 | 1 | 0 | 0 |
| BC-14 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-15 | 0 | 0 | 2 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-16 | 0 | 0 | 5 | 0 | 4 | 2 | 5 | 0 | 0 | 0 | 0 | 7 |
| BC-17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-18 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-19 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-21 | 3 | 0 | 19 | 1 | 11 | 0 | 7 | 2 | 6 | 0 | 0 | 0 |
| BC-22 | 0 | 0 | 20 | 0 | 0 | 0 | 1 | 2 | 2 | 0 | 0 | 0 |
| BC-23 | 13 | 0 | 87 | 6 | 7 | 0 | 2 | 7 | 5 | 1 | 1 | 0 |
| BC-24 | 0 | 0 | 100 | 1 | 0 | 0 | 8 | 0 | 1 | 0 | 0 | 0 |
| BC-25 | 2 | 0 | 16 | 1 | 4 | 10 | 5 | 2 | 0 | 0 | 0 | 0 |
| BC-26 | 6 | 0 | 31 | 3 | 1 | 2 | 0 | 0 | 2 | 1 | 0 | 0 |
| BC-27 | 129 | 0 | 50 | 8 | 1 | 32 | 20 | 7 | 0 | 0 | 0 | 0 |
| BC-28 | 2 | 0 | 20 | 0 | 2 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| BC-29 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-30 | 0 | 0 | 43 | 0 | 4 | 3 | 13 | 0 | 0 | 2 | 0 | 0 |
| BC-31 | 0 | 0 | 22 | 0 | 7 | 5 | 20 | 3 | 0 | 0 | 0 | 0 |
| BC-32 | 0 | 0 | 7 | 0 | 0 | 0 | 3 | 0 | 0 | 1 | 0 | 1 |
| BC-33 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| BC-34 | 0 | 0 | 10 | 5 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| BC-35 | 0 | 0 | 22 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| BC-36 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Supplementary Table 4.1:** Continued.

| Site Name | Dcur | DE | HS | LV | LS | NC | PC |
|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | | | | | | | |
| Units | % | % | % | % | % | % | % |
| BC-01 | 0 | 101 | 0 | 3 | 5 | 0 | 0 |
| BC-02 | 7 | 2 | 2 | 0 | 4 | 0 | 7 |
| BC-03 | 1 | 78 | 0 | 0 | 0 | 0 | 0 |
| BC-04 | 0 | 187 | 0 | 0 | 0 | 0 | 1 |
| BC-05 | 0 | 82 | 0 | 3 | 3 | 0 | 0 |
| BC-06 | 3 | 22 | 0 | 1 | 0 | 0 | 0 |
| BC-07 | 5 | 57 | 0 | 1 | 2 | 0 | 0 |
| BC-08 | 5 | 42 | 0 | 2 | 9 | 0 | 0 |
| BC-09 | 0 | 40 | 0 | 6 | 7 | 0 | 7 |
| BC-10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BC-11 | 5 | 87 | 0 | 0 | 3 | 0 | 0 |
| BC-12 | 0 | 48 | 0 | 0 | 0 | 0 | 0 |
| BC-13 | 9 | 70 | 3 | 2 | 6 | 0 | 1 |
| BC-14 | 1 | 71 | 0 | 1 | 1 | 0 | 0 |
| BC-15 | 3 | 142 | 0 | 2 | 1 | 0 | 0 |
| BC-16 | 2 | 170 | 0 | 1 | 6 | 0 | 0 |
| BC-17 | 0 | 65 | 0 | 0 | 0 | 0 | 0 |
| BC-18 | 0 | 12 | 0 | 1 | 1 | 0 | 0 |
| BC-19 | 0 | 65 | 0 | 0 | 0 | 0 | 0 |
| BC-20 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| BC-21 | 7 | 49 | 0 | 1 | 4 | 0 | 1 |
| BC-22 | 0 | 3 | 0 | 0 | 2 | 0 | 0 |
| BC-23 | 1 | 0 | 0 | 2 | 1 | 0 | 5 |
| BC-24 | 8 | 9 | 0 | 2 | 0 | 0 | 0 |
| BC-25 | 13 | 10 | 0 | 1 | 10 | 0 | 0 |
| BC-26 | 5 | 26 | 0 | 3 | 3 | 0 | 0 |
| BC-27 | 24 | 3 | 0 | 0 | 1 | 0 | 0 |
| BC-28 | 0 | 104 | 0 | 4 | 3 | 0 | 8 |
| BC-29 | 0 | 128 | 0 | 2 | 3 | 0 | 2 |
| BC-30 | 5 | 46 | 0 | 2 | 10 | 0 | 2 |
| BC-31 | 11 | 85 | 0 | 2 | 16 | 0 | 3 |
| BC-32 | 0 | 128 | 0 | 3 | 3 | 0 | 0 |
| BC-33 | 0 | 78 | 0 | 1 | 2 | 0 | 0 |
| BC-34 | 0 | 100 | 0 | 3 | 6 | 0 | 1 |
| BC-35 | 0 | 8 | 0 | 2 | 0 | 0 | 3 |
| BC-36 | 0 | 176 | 0 | 0 | 0 | 0 | 0 |

**Supplementary Table 4.1:** Continued.

| Site Name | Depth at sampling location | Surface water pH | Bottom water pH | Surface water dissolved oxygen | Bottom water dissolved oxygen | Surface water conductivity | Bottom water conductivity | Site Name |
|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | | | | | | | | Method Detection Limit[a] |
| Units | (m) | | | (mg/L) | | (μm/S) | (μm/S) | Units |
| BC-37 | 7.3 | 7.91 | 7.49 | 9.83 | 4.29 | 202.1 | 208.5 | BC-37 |
| BC-38 | 12.0 | 8.13 | 6.78 | 11.18 | 0.07 | 99.1 | 100.5 | BC-38 |
| BC-39 | 8.7 | 8.27 | 8.3 | 11.62 | 11.64 | 133.9 | 133 | BC-39 |
| BC-40 | 4.4 | 8.09 | 7.66 | 11.71 | 10.16 | 112.9 | 119.2 | BC-40 |
| BC-41 | 1.4 | 7.71 | 7.61 | 12.12 | 11.8 | 89.2 | 88.6 | BC-41 |
| BC-42 | 2.9 | 7.59 | 7.47 | 11.97 | 11.76 | 63.5 | 63.6 | BC-42 |
| BC-43 | 5.3 | 8.44 | 8.31 | 12.04 | 9.88 | 264.3 | 276.4 | BC-43 |
| BC-45 | 2.9 | 8.14 | 8.01 | 11.83 | 11.11 | 185.8 | 183.2 | BC-45 |
| BC-46 | 4.2 | 7.8 | 7.49 | 10.16 | 8.68 | 125.2 | 126.1 | BC-46 |
| BC-47 | 3.4 | 7.91 | 8.15 | 12.53 | 12.49 | 182.4 | 182 | BC-47 |
| BC-48 | 3.3 | 9.01 | 9.08 | 11.83 | 11.25 | 626 | 626 | BC-48 |
| BC-49 | 5.7 | 8.45 | 8.39 | 10.69 | 10.35 | 284.5 | 284.8 | BC-49 |
| BC-50 | 4.9 | 8.45 | 8.43 | 10.68 | 10.46 | 284.9 | 284.4 | BC-50 |
| BC-51 | 1.0 | 8.2 | 7.87 | 11.53 | 11.23 | 94.3 | 94 | BC-51 |
| BC-52 | 1.6 | 7.91 | 7.64 | 11.07 | 10.68 | 112.8 | 112.2 | BC-52 |
| BC-53 | 1.5 | 7.69 | 7.52 | 11.08 | 10.4 | 72.4 | 73.6 | BC-53 |
| BC-54 | 1.5 | 7.71 | 7.7 | 10.65 | 10.4 | 162 | 163.4 | BC-54 |
| BC-55 | 3.8 | 7.77 | 7.49 | 11.09 | 8.98 | 83 | 84.9 | BC-55 |
| BC-57 | 9.0 | 8 | 7.68 | 11.75 | 10.32 | 92.2 | 93.2 | BC-57 |
| BC-58 | 2.0 | 8.18 | 7.66 | 10.07 | 1.38 | 184.6 | 193.9 | BC-58 |
| BC-59 | 6.7 | 8.01 | 7.89 | 10.82 | 10.64 | 93.5 | 93.4 | BC-59 |
| BC-60 | 4.5 | 8.53 | 8.39 | 11.23 | 10.84 | 166.2 | 165.3 | BC-60 |
| BC-61 | 6.5 | 8.16 | 8.17 | 10.46 | 9.23 | 219.7 | 219.5 | BC-61 |
| YK-11 | 1.5 | 7.21 | no data | 11.64 | no data | 275.9 | no data | YK-11 |
| YK-12 | 1.3 | 7.44 | no data | 12.1 | no data | 195.7 | no data | YK-12 |
| YK-14 | 1.1 | 6.65 | no data | 11.5 | no data | 160.8 | no data | YK-14 |
| YK-15 | no data | no data | no data | no data | no data | no data | no data | YK-15 |
| YK-17 | 5.10 | 6.99 | no data | 11.97 | no data | 106.7 | no data | YK-17 |
| YK-18 | 0.80 | 7.06 | no data | 10.28 | no data | 82.4 | no data | YK-18 |
| YK-20 | 0.26 | 7.94 | no data | 11.52 | no data | 234.6 | no data | YK-20 |
| YK-21 | 1.3 | 7.87 | no data | 10.81 | no data | 313.7 | no data | YK-21 |
| YK-22 | 0.4 | 7.65 | no data | 10.63 | no data | 375.7 | no data | YK-22 |
| YK-23 | 0.46 | 7.94 | no data | 12.12 | no data | 136.9 | no data | YK-23 |
| YK-24 | 2.1 | 8.22 | no data | 11.84 | no data | 82.8 | no data | YK-24 |
| YK-25 | 0.8 | 7.95 | no data | 11.82 | no data | 261.6 | no data | YK-25 |
| YK-27 | 1.5 | 7.77 | no data | 10.79 | no data | 377.2 | no data | YK-27 |
| YK-28 | 0.3 | 8.34 | no data | 10.77 | no data | 334.3 | no data | YK-28 |

**Supplementary Table 4.1:** Continued.

| Site Name | Lake area (ha) | Latitude | Longitude | Year collected | Lake area (Google Earth Orthophoto) | Distance to Giant Mine historic roaster stack | S1 | S1 |
|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[s] | | | | | | | | |
| Units | | degrees N | degrees W | | ha | km | mg HC/g rock | wt.%[h] |
| BC-37 | 272.771806 | 62.5189 | -113.9626 | 2012 | 272.77 | 20.44 | 27.61 | 2.29 |
| BC-38 | 35.6423794 | 62.5049 | -113.9754 | 2012 | 35.64 | 19.70 | 21.78 | 1.81 |
| BC-39 | 425.892674 | 62.4992 | -114.0331 | 2012 | 425.89 | 16.74 | 2.23 | 0.19 |
| BC-40 | 43.258329 | 62.5342 | -114.0450 | 2012 | 43.26 | 16.50 | 31.07 | 2.58 |
| BC-41 | 7.76216967 | 62.5385 | -114.0669 | 2012 | 7.76 | 15.51 | 26.15 | 2.17 |
| BC-42 | 39.8435968 | 62.5606 | -114.1029 | 2012 | 39.84 | 14.64 | 26.39 | 2.19 |
| BC-43 | 34.357683 | 62.5092 | -114.1759 | 2012 | 34.36 | 9.40 | 35.04 | 2.91 |
| BC-45 | | 62.4957 | -114.2813 | 2012 | 14.69 | 4.05 | 0.40 | 0.03 |
| BC-46 | 23.8833968 | 62.5270 | -114.3357 | 2012 | 23.88 | 2.98 | 18.90 | 1.57 |
| BC-47 | 67.625511 | 62.5591 | -114.3501 | 2012 | 67.63 | 6.34 | 23.29 | 1.93 |
| BC-48 | 19.24323882 | 62.6440 | -114.1193 | 2012 | 19.24 | 19.99 | 49.76 | 4.13 |
| BC-49 | 317.430664 | 62.5385 | -113.9822 | 2012 | 317.43 | 19.76 | 46.57 | 3.87 |
| BC-50 | 317.430664 | 62.5462 | -114.0246 | 2012 | 317.43 | 17.84 | 56.23 | 4.67 |
| BC-51 | 11.3731994 | 62.2872 | -113.9623 | 2012 | 11.37 | 31.35 | 28.05 | 2.33 |
| BC-52 | 8.81157871 | 62.2941 | -114.0033 | 2012 | 8.81 | 29.57 | 13.25 | 1.10 |
| BC-53 | 128.574455 | 62.3087 | -114.0213 | 2012 | 128.57 | 27.72 | 28.67 | 2.38 |
| BC-54 | 22.4731588 | 62.3335 | -114.0302 | 2012 | 22.47 | 25.31 | 36.39 | 3.02 |
| BC-55 | 42.7553125 | 62.3385 | -114.0669 | 2012 | 42.76 | 23.65 | 26.15 | 2.17 |
| BC-57 | 58.0771917 | 62.3729 | -114.0998 | 2012 | 58.08 | 19.63 | 7.35 | 0.61 |
| BC-58 | 51.41686 | 62.4211 | -114.0632 | 2012 | 51.42 | 17.69 | 15.54 | 1.29 |
| BC-59 | 59.94808771 | 62.4161 | -114.1392 | 2012 | 59.95 | 14.82 | 17.67 | 1.47 |
| BC-60 | 950.369924 | 62.4115 | -114.1596 | 2012 | 950.37 | 13.38 | 6.54 | 0.54 |
| BC-61 | 323.193413 | 62.4876 | -114.2426 | 2012 | 323.19 | 6.16 | 7.67 | 0.64 |
| YK-11 | no data | 62.4845 | -114.4161 | 2014 | 54.86 | 3.60 | 51.84 | 4.30 |
| YK-12 | no data | 62.4864 | -114.4248 | 2014 | 6.42 | 3.88 | 46.61 | 3.87 |
| YK-14 | no data | 62.5573 | -114.8057 | 2014 | 56.93 | 23.85 | 27.79 | 2.31 |
| YK-15 | no data | 62.5500 | -114.7641 | 2014 | 30.19 | 21.58 | 58.09 | 4.82 |
| YK-17 | no data | 62.5075 | -114.5032 | 2014 | 36.11 | 7.51 | 53.97 | 4.48 |
| YK-18 | no data | 62.5421 | -114.5442 | 2014 | 48.79 | 10.57 | 59.75 | 4.96 |
| YK-20 | no data | 62.52005 | -114.37501 | 2014 | 32.90 | 2.17 | 22.86 | 1.90 |
| YK-21 | no data | 62.54353 | -114.37782 | 2014 | 13.35 | 4.71 | 55.65 | 4.62 |
| YK-22 | no data | 62.54876 | -114.32846 | 2014 | 16.62 | 5.40 | 22.82 | 1.89 |
| YK-23 | no data | 62.53063 | -114.40330 | 2014 | 10.90 | 3.93 | 55.28 | 4.59 |
| YK-24 | 15.6793012 | 62.61440 | -114.37312 | 2014 | 15.68 | 12.52 | 57.29 | 4.76 |
| YK-25 | no data | 62.67065 | -114.53847 | 2014 | 2.92 | 20.93 | 47.18 | 3.92 |
| YK-27 | no data | 62.57175 | -114.25936 | 2014 | 50.70 | 9.25 | 11.81 | 0.98 |
| YK-28 | no data | 62.50683 | -114.20079 | 2014 | 18.38 | 8.11 | 29.44 | 2.44 |

**Supplementary Table 4.1:** Continued.

| Site Name | S2 | S2 | S3 | S3 | RC | TOC | Sand | Silt | Clay | Mo | Cu | Pb |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Method Detection Limit[a] | | | | | | | | | | *0.01* | *0.01* | *0.01* |
| **Units** | **mg HC/g rock** | **wt.%** | **mg HC/g rock** | **wt.%** | **%** | **%** | **%** | **%** | **%** | **mg·kg$^{-1}$** | **mg·kg$^{-1}$** | **mg·kg$^{-1}$** |
| BC-37 | 88.94 | 7.38 | 26.70 | 2.22 | 9.92 | 20.75 | 27.80 | 52.05 | 20.14 | 0.77 | 27.24 | 8.55 |
| BC-38 | 54.45 | 4.52 | 18.38 | 1.53 | 7.78 | 15.00 | 3.20 | 86.30 | 10.47 | 1.43 | 46.4 | 13.76 |
| BC-39 | 11.92 | 0.99 | 7.24 | 0.60 | 2.65 | 4.16 | 9.10 | 80.08 | 10.80 | 0.47 | 25.47 | 11.37 |
| BC-40 | 112.22 | 9.31 | 37.79 | 3.14 | 15.13 | 28.70 | 5.80 | 74.77 | 19.40 | 0.84 | 22.11 | 6.74 |
| BC-41 | 98.80 | 8.20 | 36.79 | 3.05 | 15.39 | 27.41 | 8.30 | 71.48 | 20.26 | 0.68 | 21.41 | 5.77 |
| BC-42 | 95.50 | 7.93 | 36.90 | 3.06 | 16.00 | 27.81 | 14.80 | 70.30 | 14.90 | 1.5 | 27.92 | 8.11 |
| BC-43 | 111.46 | 9.25 | 37.47 | 3.11 | 13.28 | 27.14 | 4.10 | 83.33 | 12.55 | 1.01 | 29.09 | 5.97 |
| BC-45 | 2.41 | 0.20 | 2.40 | 0.20 | 1.03 | 1.39 | 8.90 | 80.31 | 10.79 | 1.29 | 35.2 | 14.1 |
| BC-46 | 58.30 | 4.84 | 21.01 | 1.74 | 8.94 | 16.32 | 32.30 | 56.60 | 11.08 | 1.89 | 31.7 | 14.93 |
| BC-47 | 73.50 | 6.10 | 21.00 | 1.74 | 7.51 | 16.49 | 2.30 | 81.01 | 16.69 | 2.4 | 37.93 | 14.9 |
| BC-48 | 132.09 | 10.96 | 39.32 | 3.26 | 11.65 | 28.34 | 11.91 | 72.55 | 15.54 | 0.92 | 23.67 | 5.09 |
| BC-49 | 64.56 | 5.36 | 27.33 | 2.27 | 7.92 | 18.30 | 12.81 | 71.33 | 15.87 | 0.47 | 12.04 | 5.05 |
| BC-50 | 83.66 | 6.94 | 35.00 | 2.91 | 10.17 | 23.23 | 7.50 | 69.03 | 23.47 | 0.6 | 13.26 | 4.49 |
| BC-51 | 113.90 | 9.45 | 41.97 | 3.48 | 17.82 | 31.45 | 10.87 | 67.81 | 21.33 | 1.56 | 14.76 | 3.57 |
| BC-52 | 52.47 | 4.36 | 17.38 | 1.44 | 7.94 | 14.22 | 17.97 | 61.37 | 20.66 | 0.82 | 23.81 | 7.85 |
| BC-53 | 104.87 | 8.70 | 39.36 | 3.27 | 15.47 | 28.32 | 11.35 | 61.15 | 27.49 | 1.47 | 16.27 | 5.88 |
| BC-54 | 122.68 | 10.18 | 44.76 | 3.72 | 16.83 | 31.97 | 23.53 | 59.73 | 16.74 | 1.37 | 14.96 | 4.76 |
| BC-55 | 88.52 | 7.35 | 38.18 | 3.17 | 15.13 | 26.38 | 10.30 | 78.11 | 11.59 | 1.26 | 20.24 | 7.3 |
| BC-57 | 23.37 | 1.94 | 11.27 | 0.94 | 4.11 | 7.18 | 5.16 | 87.37 | 7.47 | 0.36 | 22.35 | 10.65 |
| BC-58 | 73.69 | 6.12 | 26.66 | 2.21 | 11.29 | 19.89 | 1.08 | 63.37 | 35.55 | 1.19 | 32.68 | 8.32 |
| BC-59 | 76.81 | 6.38 | 35.75 | 2.97 | 13.64 | 23.11 | 9.78 | 69.27 | 20.95 | 1.46 | 21.22 | 5.79 |
| BC-60 | 17.83 | 1.48 | 7.10 | 0.59 | 2.64 | 5.00 | 52.54 | 43.96 | 3.50 | 0.26 | 13.1 | 4.83 |
| BC-61 | 32.14 | 2.67 | 12.07 | 1.00 | 4.72 | 8.58 | 0.00 | 69.01 | 30.99 | 0.52 | 25.45 | 11.2 |
| YK-11 | 96.62 | 8.02 | 34.69 | 2.88 | 9.61 | 23.56 | 4.62 | 83.63 | 11.74 | 22.34 | 35.19 | 48.52 |
| YK-12 | 113.46 | 9.42 | 36.03 | 2.99 | 11.26 | 26.30 | 7.67 | 80.01 | 12.31 | 2.99 | 27.9 | 11.99 |
| YK-14 | 110.29 | 9.15 | 35.27 | 2.93 | 13.02 | 26.19 | 6.20 | 76.47 | 17.34 | 0.99 | 18.75 | 6.52 |
| YK-15 | 103.67 | 8.60 | 43.66 | 3.62 | 13.30 | 28.76 | 9.31 | 76.12 | 14.57 | 1 | 24.54 | 8.51 |
| YK-17 | 108.94 | 9.04 | 37.47 | 3.11 | 11.80 | 27.08 | 12.16 | 77.51 | 10.32 | 3.14 | 28.2 | 4 |
| YK-18 | 115.24 | 9.56 | 41.89 | 3.48 | 12.16 | 28.60 | 11.25 | 76.05 | 12.70 | 2.23 | 28.69 | 11.65 |
| YK-20 | 97.77 | 8.11 | 38.50 | 3.20 | 14.59 | 26.38 | 5.87 | 76.82 | 17.31 | 3.97 | 25.71 | 10.00 |
| YK-21 | 125.53 | 10.42 | 37.56 | 3.12 | 10.91 | 27.71 | 13.23 | 77.43 | 9.34 | 1.97 | 42.14 | 10.01 |
| YK-22 | 51.42 | 4.27 | 23.85 | 1.98 | 5.48 | 12.66 | 15.04 | 78.38 | 6.57 | 3.02 | 11.39 | 1.66 |
| YK-23 | 129.49 | 10.75 | 46.35 | 3.85 | 14.92 | 32.42 | 15.49 | 73.62 | 10.90 | 1.77 | 18.97 | 3.94 |
| YK-24 | 123.20 | 10.23 | 38.26 | 3.18 | 12.61 | 29.44 | 7.40 | 80.74 | 11.86 | 1.46 | 11.51 | 2.01 |
| YK-25 | 100.10 | 8.31 | 47.93 | 3.98 | 11.76 | 26.08 | 13.61 | 71.19 | 15.20 | 4.69 | 58.93 | 10.52 |
| YK-27 | 52.76 | 4.38 | 33.20 | 2.76 | 11.19 | 18.25 | 4.89 | 83.64 | 11.47 | 0.86 | 21.93 | 6.63 |
| YK-28 | 102.65 | 8.52 | 44.99 | 3.73 | 16.80 | 29.95 | 13.19 | 74.57 | 12.24 | 1.28 | 14.35 | 4.79 |