

ANNEX VIII: APPENDIX E

MINERALOGY RESULTS



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Table E-1 Mineralogical Analysis of Waste Rock Samples

Sample ID	HC-Pdef-1 ^(a)	HC-Pdef-3 ^(a)	HC-Pdef-4 ^(a)	HC-Pdef-5 ^(a)	HC-Pdef-10 ^(a)	HC-Pdef-16 ^(a)	HC-Pdef-29 ^(a)	HC-Pdef-30 ^(a)	BDC-05-48 Leach Pre-test ^(b)	BDC-05-48 Leach Post-test ^(b)	97-54 29.57 Leach Pre-test ^(c)	97-54 29.57 Leach Post-test ^(c)	97-54 41.30 Leach Pre-test ^(c)	97-54 41.3 Leach Post-test ^(c)	SDC-12 386.16 Leach Pre-test ^(d)	SDC-12 386.16 Leach Post-test ^(d)	SDC-07 114.7 Leach Pre-test ^(d)	SDC-07 114.7 Leach Post-test ^(d)
Rock Type	Diabase	Meta-sediment	Meta-sediment	Meta-sediment	Meta-sediment	Meta-sediment	Grano-diorite	Grano-diorite	Biotite Schist	Biotite Schist	Biotite Granite	Biotite Granite	Diabase	Diabase	Two-Mica Granite/Pegmatite	Two-Mica Granite/Pegmatite	Biotite Granite	Biotite Granite
Area	Pigeon	Pigeon	Pigeon	Pigeon	Pigeon	Pigeon	Pigeon	Pigeon	Beartooth	Beartooth	Pigeon	Pigeon	Pigeon	Pigeon	Sable	Sable	Sable	Sable
Mineral Identification and Formula																		
Alb - Albite, calcian - (Na,Ca)Al(Si,Al) ₃ O ₈	51.3	2.3	9.2	37.9	—	9.5	24.7	19.6	—	—	—	—	—	—	—	—	—	—
Ap - Apatite - Ca ₅ (PO ₄) ₃ (OH) _{0.33} F _{0.33} Cl _{0.33}	—	—	—	—	—	—	—	—	Trace	Trace	—	—	—	—	—	—	<1	<1
Aug - Augite, aluminian - Ca(Mg,Fe,Al)(Si,Al) ₂ O ₆	36.1	—	—	—	—	—	—	—	—	—	1	1	35	35	—	—	—	—
Bt - Biotite - K(Mg,Fe) ₃ (AlSi ₃ O ₁₀)(F,OH) ₂	—	—	—	—	—	—	—	—	12	12	—	—	—	—	5	5	5	5
Cal - Calcite - CaCO ₃	—	—	2.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Calm - Calcite, magnesian - (Ca,Mg)CO ₃	—	2.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Car - Carbonate	—	—	—	—	—	—	—	—	Trace	Trace	—	—	—	—	<1	<1	—	—
Chl - Chlorite - (Mg,Fe,Al) ₆ (Si,Al) ₄ O ₁₀ (OH) ₂	4.9	21	8.2	10.3	5.4	37.5	4.5	10	<1	<1	—	—	—	—	<1	3	3	3
Cpx - Clinopyroxene - (Ca,Mg,Fe,Al) ₂ (Si,Al) ₂ O ₆	—	—	—	—	—	—	—	—	—	—	—	—	10	10	—	—	—	—
Cpy - Chalcopyrite - CuFeS ₂	—	—	—	—	—	—	—	—	Trace	Trace	<1	<1	<1	<1	—	—	Trace	Trace
Dol - Dolomite - CaMg(CO ₃) ₂	—	—	1.3	—	1.1	—	—	—	—	—	—	—	—	—	—	—	—	—
Ede - Edenite - Na _{0.46} Ca _{1.7} Mg _{3.44} Fe _{1.72} Al _{1.1} Si _{6.9} O ₂₃ (OH)	—	—	5.2	—	86	—	—	—	—	—	—	—	—	—	—	—	—	—
Ep - Epidote - Ca ₂ Fe _{2.25} Al _{0.75} (SiO ₄) ₃ (OH)	—	—	—	—	—	—	—	—	—	—	—	Trace	<1	—	<1	<1	1	1
Hm - Hematite - Fe ₂ O ₃	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Ill - Illite - (K,H ³ O)Al ₂ Si ₃ AlO ₁₀ (OH) ₂	1.2	11.3	5	7.3	0.2	11.7	13.5	6.9	—	—	1	1	4	4	—	—	—	—
Ilm - Ilmenite - Fe _{1.10} Ti _{1.90} O ₃	0.8	—	—	—	0.6	—	0.6	0.7	—	—	—	—	—	—	—	—	1	1
Kaol - Kaolinite - Al ₂ Si ₂ O ₅ (OH) ₄	1.1	0.4	2.3	0.9	0.3	1.6	0.8	1.1	15	15	25	25	—	—	20	20	12	12
KFd - Potassium Feldspar - KAlSi ₃ O ₈	0.5	2.0	1.3	2	1.2	0.6	0.2	0.3	—	—	5	5	—	—	—	—	—	—
M-L - Mixed Layer	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ms - Muscovite - KAl ₃ Si ₃ O ₁₀ (OH) _{1.8} F _{0.2}	—	—	—	—	—	—	—	—	2	2	25	25	—	—	—	—	2	2
Mt - Magnetite - Fe ₃ O ₄	—	—	—	—	—	—	—	—	1	1	—	—	12	12	<1	<1	<1	<1
Phl - Phlogopite - KMg ₃ (Si ₃ Al)O ₁₀ (OH) ₂	0.6	13.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Phl1 - Phlogopite (Fe-rich) - K(Mg _{2.22} Fe _{0.78})(Si _{2.63} Al _{1.37})O _{10.49} (OH) _{1.51}	—	—	18.7	10.1	1	—	14.1	5.8	—	—	—	—	—	—	—	—	—	—
Phl2 - Phlogopite (Fe - K(Mg _{2.22} Fe _{0.78})(Si ^{2.63} Al _{1.37})O _{10.49} (OH) _{1.51})	—	—	—	—	—	11.9	—	—	—	—	—	—	—	—	—	—	—	—
Plag - Sodium Feldspar - NaAlSi ₃ O ₈	—	—	—	—	—	—	—	—	35	35	10	10	35	35	35	35	30	30
Po - Pyrrhotite - Fe _{0.95} S	—	—	—	—	—	—	—	—	Trace	—	—	—	—	—	—	—	—	—
Py - Pyrite - FeS ₂	—	—	—	—	—	—	—	—	<1	<1	Trace	—	—	—	1	1	<1	<1



Table E-1 Mineralogical Analysis of Waste Rock Samples

Sample ID	HC-Pdef-1 ^(a)	HC-Pdef-3 ^(a)	HC-Pdef-4 ^(a)	HC-Pdef-5 ^(a)	HC-Pdef-10 ^(a)	HC-Pdef-16 ^(a)	HC-Pdef-29 ^(a)	HC-Pdef-30 ^(a)	BDC-05-48 Leach Pre-test ^(b)	BDC-05-48 Leach Post-test ^(b)	97-54 29.57 Leach Pre-test ^(c)	97-54 29.57 Leach Post-test ^(c)	97-54 41.30 Leach Pre-test ^(c)	97-54 41.3 Leach Post-test ^(c)	SDC-12 386.16 Leach Pre-test ^(d)	SDC-12 386.16 Leach Post-test ^(d)	SDC-07 114.7 Leach Pre-test ^(d)	SDC-07 114.7 Leach Post-test ^(d)
Rock Type	Diabase	Meta-sediment	Meta-sediment	Meta-sediment	Meta-sediment	Meta-sediment	Grano-diorite	Grano-diorite	Biotite Schist	Biotite Schist	Biotite Granite	Biotite Granite	Diabase	Diabase	Two-Mica Granite/Pegmatite	Two-Mica Granite/Pegmatite	Biotite Granite	Biotite Granite
Area	Pigeon	Pigeon	Pigeon	Pigeon	Pigeon	Pigeon	Pigeon	Pigeon	Beartooth	Beartooth	Pigeon	Pigeon	Pigeon	Pigeon	Sable	Sable	Sable	Sable
Mineral Identification and Formula (Continued)																		
Qtz - Quartz - SiO ₂	3.5	43.6	46.2	31.5	4.2	27.2	41.6	55.6	35	35	30	30	3	3	35	35	45	45
Rt - Rutile - TiO ₂	—	—	—	—	—	—	—	—	Trace	Trace	2	2	—	—	<1	<1	—	—
Sid - Siderite - FeCO ³	—	1.1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sl - Sphalerite - (Zn,Fe)S	—	—	—	—	—	—	—	—	—	Trace	—	—	—	—	—	—	—	—
Smec - Smectite	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total Clay - Kaol+Ill+Clr+M-L+Smec	6.6	34.3	14.5	19.6	6.8	49.8	18.2	17.2	—	—	Trace	Trace	<1	<1	—	—	—	—
Tour - Tourmaline - NaFe ₃ Al ₆ (BO ₃) ₃ Si ₆ O ₁₈ (OH) ₄	—	—	—	—	—	—	—	—	—	—	—	Trace	—	—	<1	—	—	—

Note: All values in the table above represent percentages.
a) Source: GR Petrology Consultants Inc. 2013. XRD, SEM, and Elemental Analysis of Eight Solid Samples for Maxxam Analytics. Report prepared for Maxxam Analytics. Submitted May 2013.
b) Source: SRK Consulting. 2003. Beartooth Pipe Acid/Alkaline Rock Drainage (ARD) and Geochemical Characterization Plan. Report prepared for BHP Billiton Diamonds Inc. Submitted January 2003.
c) Source: SRK Consulting. 2003. Pigeon Pipe Acid/Alkaline Rock Drainage (ARD) and Geochemical Characterization Plan. Report prepared for BHP Billiton Diamonds Inc. Submitted January 2003.
d) Source: SRK Consulting. 2003. Sable Pipe Acid/Alkaline Rock Drainage (ARD) and Geochemical Characterization Plan. Report prepared for BHP Billiton Diamonds Inc. Submitted January 2003.
— = mineral was not identified in sample; < = less than; ID identification.

Table E-2 Mineralogical Analysis of Kimberlite Coarse Reject Samples

Sample	Carbonate	Sulfide	Comment
TP 1 4 m	Trace; in altered matrix of kimberlite chips	Pyrrhotite (sharp edges, extremely minor pitting)	Mixed granite, kimberlite – garnet
TP 2 0 - 0.7 m	Patches of extremely fine-grained, slightly brown, in soft groundmass of kimberlite - appears to be less than in 2 - 2.5 m	Trace - pyrrhotite with rim of goethite (visible in plane light); embayed edges; round "framboidal" grains - typically in fine-grained groundmass	Mixed granite, kimberlite – garnet with strong reaction coronas
TP 2 2.5 m	Trace-01, rimming oliving grain; with serpentine; typically fine-grained; one grain as replacement of phenocryst	Trace, extremely fine - dominantly Pyrrhotite, minor round form, also subhedral; slightly embayed, pitted	Garnet (with coronas), granite, kimberlite
TP 3 1.5 m	None observed - may be extremely fine-grained in groundmass	Rare, including trace amounts of "framboids"	Kimberlite fragments, large garnet with strong rim, granite
TP 4 0 - 0.5 m	Patches and fine grained, in groundmass of kimberlite; one 0.5 mm chip carbonate (calcite)	Liberated grain, clean edges - no embayments; chip with "framboids"	Dominantly kimberlite, with garnet, minor granite
TP 5 0 m	Extremely fine-grained, granular mosaics in groundmass	One 0.5 mm grn pyrite, embayed edges; minor rounded grains, <5 µm	Mixed granite and kimberlite chips
TP 6 0 - 0.5 m	None observed	Trace free grains, embayed edges, minor round form	Kimberlite, garnet - with coronas, minor granite
TP 09B 0 - 15 cm	Fine-grained in kimberlite groundmass	Minor rounded forms; typically in dark, fine laminated chips	Kimberlite, garnet present, minor granite
TP 09B 0.15 - 0.25 m	Section unusable	Section unusable	Section unusable
TP 09 0 - 10 cm	None observed	Rare chip with rounded grains	Kimberlite, garnet, minor granite chips, rare shale
TP 09 10 - 20 cm	Extremely fine in groundmass of one chip	Trace, subhedral to extremely rare rounded; clean edges	Kimberlite, minor granite chips, garnet
TP 09 0.2 m	Trace, replacement of round grains	Euhedral grain in granite chip; sporadic, rare liberated grains - clean rims	Kimberlite, granite; garnet chips with reaction rims/fractures
TP 10 dk gry	Trace carbonate, fine-grained in matrix; rare discrete grain	Trace, Irregular, rimmed, extremely fine grained - typically subrounded	Kimberlite, garnet; granite chips present
TP 10 0 - 0.05 cm	Discrete grain in groundmass, possible minor aggregates in groundmass	Round forms in individual chips, one larger aggregate (anisotr)	Kimberlite chips, garnet
TP 10 0 - 5 cm (same sample as above)	Trace in groundmass	Minor round forms, in chips; irregular trace, embayed fine-grained	Kimberlite, garnet, large Ilmenite (opaque-drk red, low refl)
TP 12 0.2 - 0.25 m	No carbonate observed	Trace sulfide, round forms	Kimberlite, Organic matter in pile (Tundra)
TP-13 10 - 15 cm	No carbonate observed	Aggregate - orange/brown, granular appearance; rare "framboids," also orange in appearance; one grain blue-violet to pink brown anisotr. - white reflect	Kimberlite, granite chips dominant; garnet
TP 14 0 - 10	No carbonate observed	5% chips with round forms, shale	Kimberlite, garnet with strong alteration rims; minor granite

Table E-2 Mineralogical Analysis of Kimberlite Coarse Reject Samples

Sample	Carbonate	Sulfide	Comment
CK "as is"	Carbonate as granular mosaics in groundmass of kimberlite	Black shale fragments with "framboids"; also sporadic in kimberlite groundmass	Mixed kimberlite and granite chips
CK + 2 mm	Carbonate in matrix of kimberlitic material	Needle, irregular pyrrhotite; also zone with round, "framboids" in shale	Kimberlite, granite - approx. 15 coarse chips
CK - 2 mm	No observed carbonate	One aggregate of pyrrhotite, 2 mm across; clean rims	Numerous chips (>50), kimberlitic and granite
10 g CK 190 g	No observed carbonate	Extremely fine, probably "framboids" (in shale)	Kimberlite and granite chips, organic material
40 g CK 160 g	One minute grain	Extremely fine, typically round, "framboid" in dark, fine-grained groundmass	Kimberlite and granite chips, organic material

Source: SRK. 2003. 2002 Waste Rock Storage Area Seepage and Waste Rock Survey Report. Prepared for BHP Billiton Diamonds Inc. Vancouver, BC, Canada.

m = metre; mm= millimetre; µm = micrometre; < = less than; > = greater than; % = percent.