

APPENDIX 3
Lithological Descriptions

Drill-hole ID	Total Depth	From (m)	To (m)	Colour	Lithology	Description	Possible Stratigraphic Formation	NTGS LithCode	Geochemical Samples	Indicator Mineral Samples
LV09-001	606.20	0.00	1.00	Gy	sand	Surface grey clayey quartz sand	Tertiary sand	Qa	no	no
LV09-001	606.20	1.00	59.40	YeOr+Pk+Gn	fine-medium sandstone with siltstone interbeds	Alternating layers of green or pink-brown siltstone/mudstone with much thicker sequences of mostly fine to medium well-sorted quartz sandstone. Variable amounts of limonitic iron staining in sandstone	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	59.40	87.45	PkPu	fine-medium sandstone	Fine to medium mostly well sorted quartz sandstone, similar to above but with a pervasive, dominantly haematitic iron stain	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	87.45	88.05	Gn+Bn	siltstone	Finely laminated siltstone with fine-grained quartz. Upper and lower zones near the contact are green, whereas the central portion is a dark reddish brown.	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	88.05	104.90	PkPu	fine-grained sandstone with siltstone interbeds	Mostly fine-grained quartz sandstone bedded on 10mm-scale with variable pervasive haematitic iron stain. In places the unit is laminated (1-5mm thickness) and interbedded brown siltstone. Green mica present on some bedding planes.	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	104.90	110.85	PkBn	haematitic fine-medium sandstone	Fine to medium well sorted quartz sandstone with strong pervasive, dominantly haematitic iron stain. No mica observed	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	110.85	113.20	Gn+Bn	siltstone	Finely laminated siltstone - mostly dark brown. Bedding is distorted in places - soft sediment slumping. Green mica common along bedding planes	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	113.20	114.55	BnCr	medium-grained sandstone	Medium-grained well-sorted quartz sandstone. Dark green plus pale micas common on some bedding planes.	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	114.55	118.65	Bn+Gn	fine-grained sandstone + siltstone	Mostly fine-grained well-sorted quartz sandstone bedded on 5-10mm scale - highlighted by brown staining. Narrow units of distinct brown finely laminated siltstone present within sandstone. Seracite plus dark green mica (? chlorite) common along certain bedding planes	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	118.65	130.70	Gn+(Bn)	medium-grained sandstone	Medium-grained well-sorted quartz sandstone. Bedding on 5-20mm scale highlighted by colour changes. Minor inclusions of Bn + Gn siltstone common	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	130.70	132.75	Gn+Bn	fine-grained clayey sandstone with ?haematite after magnetite or ilmenite	Fine-grained clayey quartz sandstone finely-laminated on 1 to 10mm scale. Some mica present - seracite plus dark green (?chlorite). Numerous copper-brown 1-2mm blebs - ?haematitic after magnetite or ilmenite?	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	132.75	134.55	Bn	fine-medium sandstone	Fine-medium grained quartz sandstone bedded on 2-10mm scale. Minor small Bn mica flakes. Sharp undulating boundary with underlying unit.	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	134.55	140.20	Gn	fine-medium sandstone with sulfides	Mostly fine-medium quartz sandstone with fine-grained sulfides common along breakage surfaces, Small dark Gn blebs - ?chlorite. Finely laminated at top (1-5mm), becoming more coarsely bedded downwards (5-10mm scale)	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	140.20	141.35	GyGn	interbedded fine and coarse sandstone	interbedded fine-med and med-coarse quartz sandstone. Bedding varies from 2 to 20mm in thickness, with coarser-grained beds tending to be thicker. Unit appears coarser towards base.	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	141.35	142.15	GnGy	very coarse sandstone	Fine to very coarse quartz sandstone with bedding on 5-20mm scale. Basal 30cm comprises very coarse sst with grains to 2mm. Basal contact is sharp and undulating	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	142.15	142.50	Gn	siltstone with sulfides	Finely laminated siltstone with very fine-grained quartz. Sulfides (fine grained) common on bedding planes. Basal contact is shape and undulating with siltstone appearing to infill cracks in underlying unit	Bukalara Sandstone	Clb	no	no
LV09-001	606.20	142.50	148.10	CrWh+Gn	silicified dololutite	Rock has dolomitic textures but very hard and no reaction to HCl acid, Unit comprises white, cream, and grey irregular bands 2-20mm in thickness. Soft fine-grained green mudstone with pyrite commonly along boundaries. White bands form ovoid and lozenge shapes - silica nodules? Soft sediment deformation and brecciation present between 147.15 top 148.10m, with ?silica forming the matrix. Fine-grained sulfides along fracture surfaces.	Yalco Formation	Pmj	no	no
LV09-001	606.20	148.10	155.45	CrWh+Gn	silicified dololutite	Similar to above but with some haematitic iron stain (pink colouration) from 153.55m. Circular and ovoid silica nodules present but not common. Sulfide-rich zone between 153.7 to 153.9m - very fine-grained with no distinct crystal form and greenish colour - ?marcassite. Secondary infilling of cracks and sub-parallel to bedding.	Yalco Formation	Pmj	no	no

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LV09-001	606.20	155.45	166.95	Cr+Gn+Pk	dololutite + dolarenite	Mostly dololutite, with minor dolarenite units interbedded with finely laminated green mudstone layers (2-5mm) and cream fine-grained clayey sandy calcareous sandstone/siltstone. Silica nodules, mostly ovoid in shape and parallel to bedding, are common. Base of unit defined by end of nodules.	Yalco Formation	Pmj	no	no
LV09-001	606.20	166.95	171.05	Pk+Cr	dololutite + calcarenite	Interbedded finely laminated green mudstone with fine-grained calcareous clayey sandstone/siltstone (sandy dolarenite). Some bands have dolomitic texture. Narrow coarser bands with grains up to 5mm are common with rounded quartz grains. These bands tend to have strong haematitic iron-stain. Narrow silicified bands to 20mm are rare.	Hot Spring Member	Pmnh	no	no
LV09-001	606.20	171.05	173.40	Cr+Gn	calcarenite	Finely-bedded (1-5mm) carbonate horizon with fine-grained quartz. Pods and bands of coarser pelletal carbonate included. Probably more calcite than dolomite as reacts readily to acid	Hot Spring Member	Pmnh	no	no
LV09-001	606.20	173.40	180.90	Gn+Cr	dolomitic mudstone + siltstone	Interbedded green mudstone + dolomitic siltstone + fine-grained sandstone. Finely laminated with wavy, undulating beds showing small slump structures and soft sediment deformation features. Unit also contains minor bands 10-20mm thick of coarser pelletal carbonate + rounded quartz to 2mm.	Hot Spring Member	Pmnh	no	no
LV09-001	606.20	180.90	189.15	GnGy	dolomitic fine-grained sandstone	Finely-bedded fine-grained dolomitic clayey quartz sandstone. Bedding mostly on 2-5mm scale - planar and regular, defined by grainsize changes. Dip is very slight, about 5 degrees. Unit includes some coarser bands 10-30mm thick with medium-coarse quartz + grains to 5mm of pelletal orange carbonate. Some bands include angular fragments of laminated dark Gn mudstone	Hot Spring Member	Pmnh	no	no
LV09-001	606.20	189.15	193.20	Gy+BnGy	dolomitic mudstone/ carbonaceous shale + dolomitic sandstone	Laminated grey black dolomitic mudstone/shale with probably carbonaceous bands interbedded with fine to medium dolomitic quartz sandstone. Bedding on 5-30mm scale and defined by changes in grainsize. Fine-grained pyrite crystals common along bedding planes	Hot Spring Member	Pmnh	no	no
LV09-001	606.20	193.20	204.90	GnGy+BnGy	dolomitic siltstone + dolomitic sandstone	Interbedded dolomitic siltstones and fine-grained sandstones. Bedding planar and regular, dip ~5 degrees. Thinly bedded - 5-20mm scale. Few coarse bands with rounded qtz grains to 2mm plus coarse pelletal carbonate. Fine-grained sulfides (pyrite) also present in these coarser horizons	Hot Spring Member	Pmnh	no	no
LV09-001	606.20	204.90	207.10	CrBn+GnBn	dolomitic siltstones and pyritic carbonaceous shale	Laminated dolomitic siltstones and mudstones with carbonaceous shale bands. Bedding is undulating and displays small slump structures and soft sediment deformation features. Fine-grained pyrite common along bedding planes and fractures. Base of unit marked by coarser band comprising pieces of the underlying carbonate unit	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	207.10	209.45	Cr+GnBn	dololutite + dolomitic shale	Layers of fine-grained massive carbonate interbedded with darker finely laminated bands. A 10-30mm thick band of coarser pelletal material commonly marks the start of the cycles. Fine-grained pyrite common along fractures and more carbonaceous bands.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	209.45	211.10	Gy	carbonaceous pyritic shale	Grey finely-laminated dolomitic carbonaceous shale with fine-grained pyrite common along carbonaceous layers and along fractures	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	211.10	212.80	CrBn+GnBn	dololutite	Dolomitic unit comprising fine-grained pelletal carbonate with bedding 5 to 30mm thick, interbedded with horizons of fine-grained carbonaceous laminated mudstone layers 1 to 10mm thick	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	212.80	215.55	Cr+Gn	dolomitic siltstone/mudstone + dololutite	Laminated dolomitic siltstone/mudstones interbedded with massive fine-grained dolomite. Bedding is sub-horizontal and uniform. Within the unit are coarser bands of dolarenite comprising pelletal carbonate.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	215.55	224.40	Cr+Gn	dolomitic siltstone/mudstone + dololutite	Similar to above but bedding more undulating. Bands 10-40mm thick of dolarenite, e.g. @ 218.05 and 221.3m, comprise pelletal carbonate + fragments of ?pelletal siderite + large rounded quartz grains. Fine-grained pyrite common along fractures. Carbonate-dominated dololutite bands show some internal textures, with faint undulating laminae and anastomosing layers. Minor carbonaceous shale band @ 221.7m	Caranbirini Member	Pmnc	no	no

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LV09-001	606.20	224.40	240.10	CrBn+GnBn	dolomitic shale + dololutite	Interbedded CrBn dololutite layers with green laminated siltstone/shale bands, with minor fine-grained calcareous sandstone. Minor dolarenite bands comprise pelletal carbonate grains + minor large rounded quartz grains. Carbonate-dominated dololutite layers show more internal textures than above. Siltstone/shale bands are finely-laminated and show some small-scale soft-sediment deformation features. Fine-grained sulfides common along fracture surfaces.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	240.10	248.95	Cr+Bn	dolomitic shale + dololutite + dolomitic fine sandstone	Similar to above, but less green laminated siltstone/shale bands. Coarser dolarenite bands , e.g. @ 241.7m + 244.75m show, possible erosional periods, with fragments of underlying carbonate unit included in layer above. Horizons of calcareous fine-grained sandstone, usually 5 to 20mm thick are common	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	248.95	255.85	CrBn+GnGy	dololutite+ carbonaceous mudstone + dolomitic fine sandstone	Laminated dolomitic ?carbonaceous mudstone interbedded with 5 to 10mm thick fine-grained sandstone bands, and cream fine-grained pelletal dololutite. Bedding is fairly uniform, with low dip (~5°). Unit includes bleached strongly calcareous layers 200-500mm thick - ?overprinted by calcite as internal structures are similar to remainder of unit	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	255.85	261.60	Cr+Gn	dolomitic carbonaceous mudstone + dolomitic fine sandstone	Similar to above but dolomitic fabric is better developed, especially in upper portion of unit. Strong calcite overprint in sections has destroyed primary textures.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	261.60	268.35	Cr+Bn+Gy	dolomitic shale + dololutite	Subhorizontal, undulating finely-bedded dolomitic siltstone + mudstone. Bedding on 5 to 20mm scale, with alternating cream and brown/grey beds. Darker beds are finely-laminated, and comprise cream and brown carbonate(?siderite) + mud. Some dolomitic textures in more massive layers. Soft-sediment deformation and slumping noted. Minor fine-grained sulfides present in brown carbonate layers.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	268.35	275.65	Cr+BnGy	dololutite + dolomitic mudstone	Cream fine-grained pelletal dolomite with more typical dolomite textures, interbedded with grey-brown dolomitic mudstone bands. Dololutite bands are 5-10mm thick near top of unit increasing to 20-40mm near base.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	275.65	284.00	Cr+GnGy	dololutite + dolarenite + dolomitic carbonaceous shale	Unit comprises fine-grained dolomite horizons, 50-200mm thick interbedded with finely-laminated grey-green dolomitic shale bands 5 to 20mm thick. Unit also contains bands of dolarenite comprising pelletal carbonate + rounded quartz + angular fragments of carbonate + small blebs of fine-grained sulphide. Shale bands less reactive to HCl due partly to presence of carbonaceous material.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	284.00	285.65	Cr+GnGy	dololutite + dolomitic carbonaceous shale	Cream dololutite interbedded with grey-green finely laminated dolomitic mudstone bands. Similar to above but layers disrupted by soft sediment deformation as dipping more steeply	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	285.65	300.50	Cr+GyBn	dololutite + dolomitic carbonaceous shale	Finely-bedded dololutite interbedded with zones of finely laminated brown carbonate-mudstone/siltstone bands. Cream dololutite sequence is bedded on 2-10mm scale and includes thin bands of grey ?carbonaceous mudstone comprising v thin individual mud layers interbedded with dololutite. The zones of laminated brown carbonate-mudstone/siltstone are 25 to 100mm in thickness. These comprise fine-grained qtz + carbonate finely laminated with v fine layers of BnBl carbonaceous clay + carbonate ?siderite. Bedding is mostly sub-horizontal, except in zones of soft sediment deformation	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	300.50	305.00	GyBn	dololutite + dolomitic shale	As above, but strongly deformed - layers are very jumbled due to soft sediment deformation. Zones of ?secondary silica overprint - very hard with no reaction to HCl	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	305.00	306.45	CrGy	dololutite	Dominantly fine-grained dololutite, with only minor grey siltstone/mudstone bands. Reacts readily to HCl, so maybe overprinted with calcite alteration	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	306.45	316.30	Gy+Bn	dolomitic siltstone	Finely-bedded siltstone interbedded with laminated grey-brown mudstone. Rock comprises mostly fine-grained qtz with carbonate, and darker horizons having more clay and less quartz. Bedding on 1 to 5mm scale and is fairly uniform and subhorizontal with minor undulations. Some soft-sediment deformation disrupting bedding.	Caranbirini Member	Pmnc	no	no

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LV09-001	606.20	316.30	323.00	Cr+Bn	calcitic dololutite	Finely bedded calcareous siltstone with interbedded mudstone. Unit is strongly deformed and jumbled from soft-sediment deformation. Rock readily reacts to HCl - ?calcitic silty dololutite	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	323.00	337.35	Cr+GyBn	calcitic dololutite + minor laminated carbonaceous siltstone	Mostly fine-grained carbonate with vigorous reaction to HCl - calcitic dololutite. Minor laminated siltstone horizons with interbedded carbonaceous mudstone. Layering in much of this unit is strongly distorted by soft sediment deformation. ?some secondary overprinting by silica	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	337.35	339.55	GyBn	calcitic dololutite + laminated carbonaceous siltstone	Finely-bedded carbonate (dololutite) interbedded with laminated siltstone/carbonaceous mudstone units. Bedding on 2 to 10mm scale - subhorizontal and undulating.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	339.55	343.70	Cr+Gy	calcitic dololutite + laminated carbonaceous siltstone	Dololutite interbedded with horizons of finely-laminated carbonate/mudstone. Bedding mostly on 2 to 10mm scale, with one 300mm thick section of dominantly dololutite. Bedding is undulating and sub-horizontal. Some probable soft sediment deformation features. From 341.7 to 343.0m, unit contains lozenge-shaped pieces of pelletal carbonate (dolarenite) that seem overprinted by silica. More typical finer sediment layers wrap around these pieces	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	343.70	349.30	Cr+Gy	dololutite + laminated carbonate-mudstone	Unit comprises repeating cycles of finely-bedded calcitic dololutite with narrow bands of finely laminated carbonate-carbonaceous mudstone. Dololutite cycles are 200-300mm, with much narrower bands of laminated carbonate-mudstone 10-20mm. Unit contains sections with strong soft sediment deformation textures with fine-grained sulfides common in places between intraclasts.	Caranbirini Member	Pmnc	no	no
LV09-001	606.20	349.30	351.10	Cr+Gy	dolarenite + dololutite	Medium-grained pelletal carbonate (dolarenite) horizons interbedded with much coarser (dolorudite) horizons. The dolarenite horizons are laminated on 2-5mm scale and include fine laminae of dark grey carbonaceous mudstone. Dolorudite horizons comprise coarse pelletal carbonate with minor large rounded qtz grains. Possible sulfides along bedding	Reward Dolomite	Pmx	no	no
LV09-001	606.20	351.10	361.00	Cr+Gy	dololutite + laminated carbonate-carbonaceous mudstone	Unit similar to 343.7 to 349.3m as comprises repeating cycles of weakly-defined finely-bedded calcitic dololutite with narrow bands of finely laminated carbonate-carbonaceous mudstone. Dololutite cycles are 100-500mm, with narrow bands of laminated carbonate-mudstone are thick being 50-200mm.	Reward Dolomite	Pmx	no	no
LV09-001	606.20	361.00	367.40	Cr+Gy	dololutite + laminated carbonate-mudstone	Similar to above but cycles thinner - decrease in carbonate only sedimentation and increase in laminated carbonate-mudstone depositions. Carbonate-dominated horizons have very weakly-defined internal bedding	Reward Dolomite	Pmx	no	no
LV09-001	606.20	367.40	370.20	Cr+GnGy	dololutite	Dominantly fine-grained thinly-bedded dololutite. Bedding (10 to 50mm) defined by variations in the amount of ?clay flakes subparallel to bedding. Unit also contains minor bands 10 to 30mm thick of laminated carbonate/carbonaceous mudstone. Subvertical fractures filled with green carbonate are common. Minor fine-grained sulfides along cracks and bedding planes.	Reward Dolomite	Pmx	no	no
LV09-001	606.20	370.20	372.40	CrGy	dololutite + laminated carbonate-carbonaceous mudstone	Interbedded horizons of dololutite with finely-laminated brown-black carbonate-carbonaceous mudstone - bedding on 5-10mm scale. Minor thicker zones of dololutite-only. Bedding is undulating and sub-horizontal (~5deg dip). Some possible desiccation fracturing in dololutite bands	Reward Dolomite	Pmx	no	no
LV09-001	606.20	372.40	387.95	CrGy	dololutite + laminated carbonate-carbonaceous mudstone	Similar to above, but less dololutite-only horizons. Secondary pinkish dolomite patches and veining common. Laminated carbonate/carbonaceous mudstone sequences react more readily to acid suggesting increase in calcite compared to above. Unit is finely bedded with dololutite forming horizons 1 to 5mm, and mudstone lamina <1mm. Some possible desiccation cracks in thin carbonate horizons.	Reward Dolomite	Pmx	no	no
LV09-001	606.20	387.95	390.65	Bn	pyritic shale	Finely-laminated fine-grained carbonaceous sediment with very fine-grained sulfides in matrix and along bedding planes, plus forming blebs. Laminae on <1mm scale. Top portion of unit is messy with subangular blocks of carbonate-rich mudstone incorporated in shale.	Barney Creek Formation	Pmq	no	no

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LV09-001	606.20	390.65	396.20	CrGy	dololutite intraclast breccia	Unit comprises interbedded dololutite with carbonate/carbonaceous mudstone shale that is strongly deformed. Top portion of unit has bedding that is very chaotic with soft sediment deformation plus secondary dolomite blebs overprinting bedding. The remainder of unit comprises an intraclast breccia with angular fragments of laminated carbonate. Basal contact is sharp transition to planar subhorizontal laminae.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	396.20	406.95	CrGy+Bn	dololutite + laminated carbonate-mudstone shale	Sequence of dololutite interbedded with finely laminated carbonate-mudstone. Bedding on 5 to 10mm scale, regular and planar. Soft sediment deformation features in places, and desiccation cracks in dololutite in places. Laminated carbonate-mudstone bands are brown, and the brown laminae are less reactive to acid and contain small sulfide blebs and fine-grained sulfide along bedding.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	406.95	422.50	Bn+Gy	dololutite + laminated carbonate-mudstone shale	Similar to above, but the dololutite bands include small brown mudflakes sub-parallel to bedding. Some desiccation features suggest emergent periods. Between 402.15 to 411.35m the unit is overprinted with secondary dolomite forming irregular patches that overprint bedding.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	422.50	434.50	Bn+Gy	laminated carbonate-mudstone shale	Dominantly brown finely-laminated carbonate-mudstone shale, with very few dololutite bands. Fine-grained pyrite scattered throughout, and also concentrated along fractures. Secondary carbonate blebs overprint bedding between 430.1 and 431.6m. Some section have disrupted and crinkly bedding indicating soft sediment deformation	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	434.50	444.70	Bn+Gy	dololutite + laminated carbonate-mudstone shale	Cyclic sequence of dololutite with minor to abundant small brown mudflakes alternating with finely-laminated carbonate-mudstone. Dololutite bands tend to be 10 to 50mm thick and the laminated shale sequences are 10 to 150mm in thickness. In places, the dololutite is a pale cream-grey - these sections tend to react more readily to HCl, suggesting a more calcitic dololutite	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	444.70	448.00	Bn+Gy	dololutite + laminated carbonate-mudstone shale	Similar to above, but periods for each sequence type are thicker. Dololutite sequences are 50 to 200mm thick, and contain minor to numerous small brown mudflakes. Some desiccation features noted on upper contacts. Carbonate-mudstone shale sequences are 50 to 250mm thick. Scattered fine-grained sulfide present but minor. Sulfide more concentrated along contacts between dololutite and shale sequences.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	448.00	450.05	Bn	pyritic laminated carbonate-mudstone shale	Finely-laminated carbonate-mudstone shale. No dololutite-only horizons, except for 100mm thick unit at base that contains numerous small brown mudflakes. Unit is overprinted with irregular blebs of white carbonate that react vigorously to HCl - probably calcite. Some carbonate blebs contain sulfide crystals. Fine-grained scattered sulfide crystals common throughout unit.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	450.05	455.25	GyBn+Bn	pyritic laminated carbonate-mudstone shale	Similar to above but with minor weakly-bedded dololutite horizons. Significant difference is and apparent increase in dip of bedding to between 20-30 degrees. Change in dip probably due to slumping as sections within the unit have a dip closer to 'normal' - 5 degrees. Between 454.45 to 454.70m has disrupted bedding due to soft-sediment deformation.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	455.25	462.85	CrGy+Bn	dololutite + laminated pyritic carbonate-mudstone shale	Alternating bands of cream-grey weakly-bedded dololutite with minor to common small brown mudflakes and finely-laminated brown carbonate-mudstone shale. Dololutite bands are 20 to 200mm thick and shale bands are 50mm to 1m thick - more shale than dololutite. Scattered fine-grained pyrite common in shale bands. Soft-sediment deformation disrupting bedding between 461.3 to 462.0m	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	462.85	466.05	CrGy+Bn	dololutite + minor laminated pyritic carbonate-mudstone shale	Unit comprises alternating bands of massive dololutite, weakly-bedded dololutite with small brown mudflakes subparallel to bedding, and narrow (<20mm) bands of brown finely-laminated carbonate-mudstone shale. Scattered fine-grained pyrite common in dololutite with mudflakes plus shale bands. Layering disrupted by soft-sediment deformation over much of unit. Possible desiccation fractures in upper contacts of massive dololutite horizons, plus concentrations of mudflakes at base of horizons - desiccation breccia.	Barney Creek Formation	Pmq	no	no

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LV09-001	606.20	466.05	468.50	Bn	pyritic laminated carbonate-mudstone shale	Unit comprises mostly finely-laminated carbonate-mudstone shale with scattered fine-grained pyrite common. Band of massive fine-grained sulfides at 466.6m. Layering disrupted by soft-sediment deformation in basal portion of unit	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	468.50	472.25	CrGy+Bn	dololutite + laminated pyritic carbonate-mudstone shale	Alternating bands of cream-grey weakly-bedded dololutite with small brown mudflakes, and finely-laminated pyritic brown carbonate-mudstone shale. Mudflakes subparallel to bedding in dololutite and concentrated near base in places - possible desiccation breccia, e.g. at 470.65m	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	472.25	489.00	Bn	sulfide-rich laminated carbonate-mudstone shale	Dominantly finely-laminated brown carbonate-mudstone shale interbedded with thin (50-100mm) dololutite with minor brown mudflakes. Sharp increase in amount of fine-grained sulfide present, with a 50mm-thick band of high concentration sulfide at 475.85m. Sulfides include pyrite and possible sphalerite - fine white crystals grow on outside of core and along fractures in damp hot conditions, ?Goslorite (hydrated zinc sulfate). Fine-grained and coarser (+1mm) pyrite present in dololutite unit at 481.55m. Bedding varies from normal 5 to 7 degree dip at top and basal section of unit to about 20 degrees in the central portion. Some soft-sediment deformation of bedding and intraclast brecciation between 474.4 to 475.85m	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	489.00	495.50	GyCr+Bn	calcitic dololutite + laminated pyritic carbonate-mudstone shale	Weakly-bedded dololutite alternating with thin bands of brown finely-laminated carbonate-mudstone shale. Carbonate units are 20 to 200mm thick, and most contain small brown mudflakes subparallel to bedding, Probably calcitic dololutite as reacts readily to HCl. Possible desiccation cracks at upper contact with overlying shale. Mudflakes tend to be more concentrated at base of dololutite, decreasing upwards. Shale units are 10 to 50mm in thickness with scattered fine-grained pyrite common. Few clots and fractures infilled with fine-grained sulfide. Soft-sediment deformation disrupting bedding between 492.1 to 492.7m.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	495.50	510.20	Bn+CrBn	dololutite + laminated pyritic carbonate-mudstone shale	Alternating layers of brown finely-laminated carbonate-mudstone shale with cream-brown silty dololutite with numerous small brown mudflakes. Fine-grained scattered pyrite common in shale bands. Pyrite also present as blebs and concentrated along fractures and bedding planes. Disrupted bedding below 506.6m with some intraclast brecciation.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	510.20	513.50	GyBn	dololutite	Dololutite bands alternating with CrBn silty dololutite with small brown mudflakes aligned subparallel to bedding. No true carbonate-mudstone shale horizons. Fracture filled with carbonate contains large (+5mm) honey-yellow blebs overprinting original fabric - ?siderite. Bedding disrupted by soft-sediment deformation in upper metre.	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	513.50	517.00	GyBn	dololutite + laminated pyritic carbonate-mudstone shale	Interbedded sequences of finely-laminated brown carbonate-mudstone shale with grey massive dololutite, plus BnCr weakly-bedded dololutite with numerous small to large (2-10mm) brown mudflakes aligned subparallel to bedding. Possible desiccation fractures on upper contacts of dololutite horizons. Scattered fine-grained pyrite common in shale horizons and less common in mudflake dololutite. Cracks filled with fine-grained pyrite at 515.85m	Barney Creek Formation	Pmq	no	no
LV09-001	606.20	517.00	520.05	GyBn	intraclastic brecciated dololutite + laminated pyritic carbonate-mudstone shale	Polymictic intraclastic breccia of sequence similar to above - massive dololutite + weakly-bedded mudflake dololutite plus finely-laminated carbonate-mudstone shale. Breccia clasts are moderately angular, suggesting brittle deformation. Fragments vary in size from 2 to 100mm. In places, unit appears overprinted with secondary carbonate. Fine-grained pyrite common in places as blebs or scattered crystals within clasts.	?Cooley Dolomite Member	Pmq(c)	no	no
LV09-001	606.20	520.05	528.40	GyBn	intraclastic brecciated dololutite + laminated pyritic carbonate-mudstone shale	Strongly-disrupted interbedded sequence very similar to above, but brecciation less brittle - looks more like soft-sediment deformation. Unit darker than above as contains more sulfide within clasts and in matrix. More regular bedding between 524.4 to 525.0m	?Cooley Dolomite Member	Pmq(c)	no	no

APPENDIX 3
Lithological Descriptions

Drill-hole ID	Total Depth	From (m)	To (m)	Colour	Lithology	Description	Possible Stratigraphic Formation	NTGS LithCode	Geochemical Samples	Indicator Mineral Samples
LV09-001	606.20	528.40	533.10	Bn+Gy	intraclastic brecciated dololutite + laminated pyritic carbonate-mudstone shale	Strongly-disrupted and brecciated polymictic sequence of brown finely-laminated carbonate-mudstone shale with massive CrGy dololutite plus weakly-bedded mudflake dololutite. Some clasts are angular, but most are subrounded. Matrix mostly fine-grained silty carbonate with some crystalline carbonate (calcite) infilling fractures. Section between 531.1 to 531.95m shows more regular bedding with subvertical fractures filled with secondary carbonate, probably calcite.	?Cooley Dolomite Member	Pmq(c)	no	no
LV09-001	606.20	533.10	540.00	CrBn	intraclastic brecciated dololutite with less laminated carbonate-mudstone shale	Very similar to above, but more dololutite and mudflake dololutite , and less carbonate-mudstone shale. Bedding strongly disrupted and brecciated. Some large dololutite pieces contain >1mm cubic pits - ?after pyrite or ?halite e.g. at 535.8m + 537.05m. Section of dololutite between 537.7 to 537.95m contains lenticular pitting - ?after gypsum crystals?	?Cooley Dolomite Member	Pmq(c)	no	no
LV09-001	606.20	540.00	551.65	Cr+Gy	pyritic intraclastic brecciated dololutite with minor laminated carbonate-mudstone shale	Similar to unit above, but only minor brown carbonate-mudstone shale that has much less brown mudstone laminae and only trace fine-grained scattered pyrite. Unit displays a much larger range of intraclast sizes, and generally subrounded. Minor fine-grained pyrite present as blebs, along fractures, and rimming clast boundaries - shows as 'rust' spots. Some stylolite development.	?Cooley Dolomite Member	Pmq(c)	no	no
LV09-001	606.20	551.65	552.60	Gy	pyritic intraclastic brecciated dololutite with minor laminated carbonate-mudstone shale	Similar rocktypes to above, but brecciation less developed. Unit appears more regular with some planar bedding. Stylolite development occurring between different lithologies, e.g. between fine to coarse units	?Cooley Dolomite Member	Pmq(c)	no	no
LV09-001	606.20	552.60	559.45	Gy+Cr+Bn	dolarenite + dololutite	Repeating cycles of upwardly-fining grey dolomite. Cycles mostly range in thickness from 50 to 150mm. Between cycles, there is commonly a 10-40mm horizon of brown or tan finely-laminated very fine dololutite. Some horizons are a pinkish tan - ?potassium-rich mudstone as very little no reaction to HCL. Contact between these horizons and the graded dolomite is commonly sharp and discordant, being either at a slight angle (e.g. at 553.05m) or overlying desiccation cracking. Fine-grained sulfides are present along fractures infilled with probable calcite. Fining-upward sequences commonly have 10-20mm of coarse pelletal dolomite at base. Unit has subvertical fractures + a set at 45deg to core. Fractures are fine and branching, and filled with crystalline calcite. Few small vugs lined with a hard clear carbonate. Stylolites common and filled with black fine-grained mineral (?goethite) that 'rusts', leaving Or Fe stain at contact. Dip of bedding is between 15 to 25 degrees.	Teena Dolomite	Pmp	no	no
LV09-001	606.20	559.45	564.25	Gy+Bn	dolarenite + dololutite	Similar to above, but with only minor tan bands of very fine dololutite. Fining upward sequences are thicker with most being 100-150mm. Basal portion comprises pelletal dolarenite grading upward to dololutite. Upper contact of each sequence is marked a by a narrow band of black fine-grained carbonaceous shale/mudstone. Upper contact is sharp and commonly stylolitic, filled with goethite. Dololutite sequences commonly include small brown mudflakes subparallel to bedding. Unit becomes more silty towards base. Carbonate-filled subvertical and bedding parallel fractures are common.	Teena Dolomite	Pmp	no	no
LV09-001	606.20	564.25	566.40	Gy+Bn	dolarenite + dololutite	Similar to above, but sequences are thinner - most 20 to 100mm. Doloarenite portion is silty and finer with grains mostly <1mm, grading upwards to dololutite, with upper contact marked by fine carbonaceous mudstone/shale. Bedding mostly about 20 degrees. Cross-bedding common. Minor fine mudflakes in dololutite.	Teena Dolomite	Pmp	no	no
LV09-001	606.20	566.40	569.20	Gy+Bn	dolarenite + dolorudite	Mostly dolarenite - still upwardly-fining cycles, but less dololutite. Doloarenite is pelletal with some quartz. Finer portions are silty. Top contacts are sharp and marked by mostly brown fine-grained laminated mudstone/shale. Fine brown mudflakes are common, especially in basal portions. Between 568.15 and 568.25m, unit is very coarse (dolorudite). Cross-bedding present in finer horizons. No stylolite development noted.	Teena Dolomite	Pmp	no	no

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Lithological Descriptions

Drill-hole ID	Total Depth	From (m)	To (m)	Colour	Lithology	Description	Possible Stratigraphic Formation	NTGS LithCode	Geochemical Samples	Indicator Mineral Samples
LV09-001	606.20	569.20	574.50	CrGy+Bn	dolarenite + dololutite with bitumen in vugs	Mainly fining-upward sequences of dolarenite + dololutite. Less quartz, and less carbonaceous mudstone/shale marking upper contacts. Dololutite has more dolomitic textures, with nodule formation. Some desiccation fractures at top of dololutite bands. Minor stylolite formation subparallel to bedding. Between 570.1 to 570.85m, strong brecciation. Matrix is crystalline carbonate with vugs lined with clear crystalline carbonate and filled with soft black pliable material with high lustre and conchoidal fracture - probably bitumen.	Teena Dolomite	Pmp	no	no
LV09-001	606.20	574.50	579.40	Gy+Bn	dolarenite + dololutite + laminated carbonate-mudstone shale	Unit is much finer than above with fining-upward sequences of dolarenite plus mostly dololutite, interbedded with sequences of finely laminated brown carbonate/mudstone shale. Shale horizons show some soft-sediment deformation features. No scattered fine-grained pyrite observed, but iron staining at core breaks suggests some pyrite present. Basal 200mm is dolarenite with inclusions of brown laminated mudstone and mudflakes, with fine-grained pyrite common. Bedding within unit is dipping mostly at about 20 degrees. Bedding disrupted by network veining between 575.9 to 576.5m. Sequence brecciated between 578.95 to 579.3m with pyrite common in this section, along fractures and at the boundary to clasts.	Teena Dolomite	Pmp	no	no
LV09-001	606.20	579.40	583.45	GyBn	silty dololutite	Silty dololutite with small brown mudflakes. Massive with no discernible laminae or bedding. Minor small 'bleached' patches with similar texture but lighter colour and more reactive to HCl - calcite overprinting? Many of these zones contain fine-grained sulfides e.g. at 582.55m. Bleached zones more common towards base of unit	Mitchell Yard Dolomite Member	Pmei	no	no
LV09-001	606.20	583.45	590.45	GyBn	silty calcitic dololutite	Similar to above, but increase in calcitic overprint blebs. Unit displays undulating laminae defined by slight colour changes. Dip of bedding is 20 to 22 degrees. Calcite overprint blebs increase down unit giving mottled appearance. Blebs commonly contain fine-grained sulfide. Unit becomes coarser towards base with pelletal texture discernable. Overall unit has a higher calcite content than above.	Mitchell Yard Dolomite Member	Pmei	no	no
LV09-001	606.20	590.45	592.90	GyBn	silty calcitic dololutite	Calcitic dololutite similar to above with calcite blebs, plus small vugs and bedding-parallel fractures filled with crystalline carbonate, probably dolomite. From 591.1m, unit contains subround fragments of coarse laminated Cr + Bn dololutite. Fragments commonly contain minor scattered fine-grained pyrite - possibly a slump breccia. Fine-grained sulfides common along fractures. Vugs lines with well-formed clear crystals, probably carbonate and some vugs contain bitumen.	Mitchell Yard Dolomite Member	Pmei	no	no
LV09-001	606.20	592.90	606.20	GyBn	dololutite + dolarenite + dolorudite	Interbedded horizons of dololutite and dolarenite, with bands of dolorudite. Dololutite bands tend to be more grey and smoother with little internal structure. Doloarenite bands are either dark brown or cream-grey, and fine-upwards. These comprises pelletal carbonate with the darker bands having minor scattered fine-grained pyrite. Bedding has typical dolomite undulations and wavy form. Overall dip is about 15 degrees. Below 597.0m, layering is less regular with possible nodule development - irregular but lenticular zones which appear finer. Bands of dolorudite, between 20 to 150mm thick, are present throughout the unit. The basal contact is normally sharp and planar, where as the upper contact is more undulating. These bands comprise large carbonate pellets (+2mm) plus rounded pieces of finer pelletal carbonate. Some horizons have small blebs of fine-grained sulfides shown by 'rust' spots. Stylolites are common, and form mainly along lithological boundaries and are lined with goethite but no visible pyrite. Stylolites are at 15-30cm intervals. In place, the core is fractured at steep angle and lines with crystalline dolomite and fine-grained sulfides.	Mara Dolomite Member	Pmea	no	no