

































McARTHUR RIVER PROJECT - DIAMOND DRILL CORE LOGGING

LITHOLOGY

Lithology

Sedimentary		Nodule Beds	NOD
Conglomerate	CON	Chert	CHT
Pebbly/Cobbly Sandstone	PSS	Breccia	BRX
Sandstone	SST	Regolith	REG
Sandy siltstone	SSL	Volcanic/Intrusive	
Siltstone	SLT	Basalt	BAS
Mudstone/Claystone	MST	Dolerite	DOL
Organic/bituminous shale	BSH	Intermediate Volcanic	INT
Dolostone	DLS	Rhyolite	RHY
Ooidal dolostone	ODS	Peperite	PEP
Dolorudite	DRD	Volcaniclastic	VCL
Dolarenite	DAR	Tuff	TUF
Dololutite	DLT		

LITHOLOGY

 Chert	 Mudst+fine sst	 Organic shale	 Muddy dololutite	 'Tuffite'	 hornfelsed mdst
 Breccia	 Sandy siltstone	 Dolomitic shale	 Dololutite	 Dolomitic Lst	 Peperite
 regolith	 Sandstone and siltstone	 Dolomitic siltstone	 Sandy dolarenite	 Limestone	 Basalt
 'Basement'	 Sandstone	 Mudstone	 Dolarenite		 dolerite
	 Pebbly/cobbly sandstone	 Silty shale	 Dolorudite		 Rhyolite
	 Conglomerate	 Claystone	 Ooidal Dolst		 Coarse rhyolite
			 Dolostone		

Colour

AABBCC

6CharAlpha

AA	Qualifier	LT	Light
		MD	Moderate
		DK	Dark

BB Colour Qualifier

CC Main Colour

Colours	BK	Black	KH	Khaki
	BR	Brown	PP	Purple
	CR	Cream	RD	Red
	GR	Green	WH	White
	GY	Grey	YW	Yellow

e.g. LTRDBR Light reddish brown DKGYGR Dark greyish green

Texture

PHYSICAL STRUCTURES

Abundant Moderate

Pervasive Common Rare

	Trough cross-bedding		Tool marks		Concretion
	Planar tabular bedding		Flute moulds/casts		Authigenic quartz nodules
	High-angle tabular bedding		Current crescent		Flat pebble breccia
	Low-angle tabular bedding		Current lineation		Stylolites
	Herringbone cross-strat.		Rill marks		Diagenetic nodules
	Reactivation Surface		Runzel marks		Digitate-domal bioherm
	Cross-lamination		Graded bedding		Stromatolites
	Symmetrical ripples		Load casts		Sand-filled fractures
	Asymmetrical ripples		Convolute bedding		Flow banding
	Climbing ripples		Slump structure		Autobreccia
	Flaser bedding		Chaotic bedding		Vesicles/amygdales
	Wavy parallel bedding		Water escape structure		Vug or cavity
	Parallel lamination		Mud cracks		Paleosol horizon
	Massive to diffuse bedding		Synaeresis cracks		Brecciated
	Hummocky cross-stratification		Mud drapes		
			Scour		
			Imbrication		

LITHOLOGIC ACCESSORIES

	Dolomitic		Pebbles/cobbles		Cherty		Pyrite
	Calcareous		Pebbles/granules		Gypsum pseudomorphs		Disseminated Cu
	Feldspathic		Sand lamina		Halite pseudomorphs		Fracture-hosted Cu
	Lithic		Mudstone lamina		Anhydrite		Hydraulic fractures/breccia
	Ferruginous		Ooids		Unidentified evaporite		qtz+dol+chl+sid+/-jas+/-lim
	Chlorite		Pisolites				dol+chl+cpy or mal
	Micaceous		Peloids				Bituminous-chloritic
	Glauconitic		Mudstone intraclasts				

WEATHERING

Fresh	FR	
Weakly Oxidised	WOX	<10% "SAPROCK"
Moderately Oxidised	MOX	
Strongly Oxidised	SOX	
Completely oxidised	OX	

ALTERATION

Type

Chloritic	CHL	Micaceous	MIC
Dolomite	DOL	Feldspathic	FEL
Silicification	SIL	Graphitic	GRP

Mineral

Assorted 3Char abbreviations, detailed in Comments section

Intensity

Pervasive	>90%	P
Strong	41-90%	S
Moderate	21-40%	M
Weak	1-20%	W
Trace	<1%	T

BRECCIATION

Description

Clasts	Shape	Angular, Subangular, Subrounded, Rounded (milled?), Tabular
	Type	Monomict, Polymict, “Jigsaw”, “Crackle”
	Size	mm, cm, dm, metre
	Support	Clast-support, matrix-support
	Composition	Rocktype or types, alteration and mineralisation
Matrix	Type	Cement, “Rock Flour”
	Composition	

Genetic

Intrusive, magmatic hydrothermal, phreatomagmatic (maar and diatreme), phreatic, hydrothermal, fault, volcanic, dilational, alteration clay matrix pseudobreccia

Full description in Comments Section

VEINING

Mineral

Quartz	QZ	Limonite	LIM
Dolomite	DOL	Carbonate	CB
Chlorite	CHL	Quartz sulphide	QS
Siderite	SID	Chalcopyrite	CPY
Jarosite	JAR	Pyrite	PY

Depth

Depth, vein thickness, and type

STRUCTURE

Sedimentary

Parallel lamination	PLM	Bituminous	BIT
Cross bedding	XBD	Gypsum pseudomorphs	GYP
Tabular bedding	TBD	Ahydrite pseudomorphs	ANH
Herringbone cross stratification	HXS	Halite casts	HAL
Symmetrical ripples	SRP	Structural	
Assymetrical ripples	ARP	Fault	FLT
Ooids	OID	Fracture	FRT
		Fault breccia	FBX

Full description in Comments Section

MINERALISATION

Mineralogy

e.g. Sph 20%, Py 10%, Gn 2%, Cpy 5%, Graphite 5%

Style

e.g. Disseminated, laminar, massive, stringer vein, breccia fill etc

STRATIGRAPHY

	Main Unit	Subunit
Tertiary		
Quaternary Regolith	REG	
Proterozoic	Redbank Package	Tawallah Group
Warramana Sandstone	PTW	
Gold Creek Volcanics	PTG	
Wollogorang Formation	PTO	
Settlement Creek Dolerite	PTS	
Wollogorang Subdivision		
After Rawlings 2002		
Upper Sandstone-rich unit	PTOR2	
Lower Dolostone-mudstone unit	PTOR1	
Which can be subdivided into informal subunits...		
Black Mudstone Facies		PTO2BM
Red-brown Mudstone Facies		PTO2RM
Hummocky Facies		PTO2HM
Herringbone Facies		PTO2HB
Dolostone Facies		PTO2DS
Dolarenite Facies		PTO2DA
Sandstone Facies		PTO2SS
Conglomerate Facies		PTO2CG
Unit 4 Upper Carbonates	PTO1U4	
Unit 3 Nodule Beds	PTO1U3	
Unit 2 Lower Carbonates	PTO1U2	
Unit 1 Basal Red Beds	PTO1U1	

Lower Wollogorang PTOR1 Descriptions

Unit 4 Upper Carbonates PTO1U4

- Fawn to maroon **dolomitic mudstone and dololutite** **20-40m**
- Grades upwards into interbedded dololutite/dolorudite
- In core colour changes upwards from grey/fawn to with decreasing TOC
- Flat pebble breccias (FPB) in the lower part, grading up with cross beds and ripple structures
- Lower boundary somewhat arbitrary, based on:
 - Upper extent of nodular concretions, OR
 - Increase in dolomite content of siltstone, OR
 - Increase in moderate energy agitation structures (cross lamination, scour/fill, and FPB)
- Interpretation – Shallow marine carbonate platform, gradually shallowing, from storm dominated to current/wave influenced structures (upper part)

Unit 3 Nodule Beds PTO1U3

- Grey to **black laminar dolomitic siltstone** **20-40m**
- with **characteristic cm-dm ovoid/nodular concretions** composed of crystalline dolomite/chert
- In weathered outcrop light yellow brown to white silicified siltstone with loose nodules
- Nodules decrease in abundance and size, from 20-40cm ovoids in the lower half to digitate and flat/platy and ca. 2-4cm wide
- Bituminous, with high organic content (to 6% TOC)
- Pyritic with associated Zn/Pb geochemical anomalism and very fine sulphides
- May contain ca. 50cm green clay-rich “tuff” horizons
- Interpretation – **low energy** (below wave base) and **anoxic (restricted) shallow** marine

Unit 2 Lower Carbonates PTO1U2

- **Dolarenite** with lesser dolorudite, dololutite and mudstone, coarsening upwards **5-10m**
- Variety of structures: cross lamination, ripples, cross beds, conical stromatolites, ooid and pelloid grainstones, and flat pebble breccias (FPB). Pseudomorphs of anhydrite and halite locally common
- Disseminated pyrite, chalcopyrite and malachite occur locally
- In the Mallapunyah Dome area have a lower fawn brown dolostone grading into upper grey crystallised limestone with carbonate nodules
- Interpretation – shallow water (to emergent) saline to hypersaline high energy (current features)

Unit 1 Basal Red Beds PTO1U1

- **Red-brown** to maroon **dolomitic mudstone** **5-15m**
- Abundant hopper halite casts to 4cm
- Massive to finely parallel laminations and wavy laminations with rare ripples and dessication cracks
- Lower contact to Settlement Creek Dolerite – sharp planar to broadly sinuous, locally brecciated, brown/green hornfelsed mudstone over 200-300cm
- Interpretation – **emergent saline low energy mudflat** (shallowing from Aquarium Formation)

After AGPL 1969**Rawlings Equiv.**

Dolomite	PTO8	PTO2BM?
Fine grained mauve to purple dolomite		
Chert	PTO7	PTO2RM?
Thin interbedded algal dolomite, chert, dolomite and silty dolomite		
Red weathered Dolomitic Siltstone	PTO6	PTO2DS? or DA?
Thin bedded Pink Dolarenite	PTO5	PTO2DA? or SS?
... and sandstone ad sandy dolomite.		
Silty Dolomite	PTO4	PTO1U4
... and dolomitic siltstone and dolomite. Dark weathering.		
Ovoid Beds	PTO3	PTO1U3
Fissile thin bedded, light yellow brown to grey when weathered, dark grey to black bituminous dolomitic siltstone, shale, argillite and dolomite. Lower part large ovoid stromatolitic bioherms (10-30cm), becoming progressively smaller (to 2cm) and irregular/digitate in the upper part.		
White Dolomite Beds.	PTO2	PTO1U2
Fine to medium grained, sugary, white to dark grey dolomite. Locally dark blue grey limestone and dolomitic limestone. Basal half typically flaggy with the upper half composed of algal breccia.		
Silty Dolomite	PTO1	PTO1U1
... and dolomite, fine grained greenish grey		

			AGPL	Rawlings
OR	Upper Wollogorang	PTOU	PTO4-8	
	Ovoid Beds	PTOO	PTO3	PTO1U3
	Lower Wollogorang	PTOL	PTO1-2	PTO1U1 and 2

Table 2: McArthur River Project – Stratigraphic/Lithological Codes

	Tertiary		
QA	Alluvium	ES	Residual soil
QC	Colluvium, scree	EST	Thin (<2m thick) residual soil
QS	Sheetwash	CZ	Black soil (not residual, ineffective sample medium)
	Proterozoic		
PM	McArthur Group (undifferentiated)		
	PME	Emmerugga Dolomite	
	PMT	Tooganinie Formation	
	PMD	Tatoola Sandstone	
	PMA	Amelia Dolomite	
	PML	Mallapunyah Formation	
	PMN	Masterton Formation	
PT	Tawallah Group (undifferentiated)		
PTG	Gold Creek Volcanics		
	PTGV	Trachytic intermediate volcanic. Tuff, agglomerate, pyroclastic/volcaniclastics. PTO and PTE xenoliths	
	PTGI	Trachyte/microsyenite intrusive. Brecciated and strongly altered (calcite). Wthd = buff/pale green, fresh = pink.	
PTO	Wollogorang Formation		
	PTOU	Upper (PTO-04 to PTO-08)	
	PTOO	Ovoid Beds (PTO-03)	
	PTOL	Lower (PTO-01 and PTO-02)	
	OR		
	PTO8	Dolomite. Massive, fgr, cream/purple	
	PTO7	Algal chert marker. Thinly interbedded algal dol./chert	
	PTO6	Dolomitic siltstone. Red wthd, poorly outcropping	
	PTO5	Thin bedded pink dolarenite, sandstone, and sandy dolomite	
	PTO4	Silty dolomite, dolomitic siltstone, dolomite. Dark wthg.	
	PTO3	Ovoid beds. Thin bedded and fissile. Black bituminous to grey wthd. Dolomitic siltstone, shale, argillite, and dolomite. Lower section - black mgr dolomite ovoids 10-30cm, becoming progressively smaller and more irregularly shaped	
	PTO2	Dolomite beds, f-mgr sugary, white to dark grey	
	PTO1	Basal silty dolomite/dolomite, fgr, greenish grey	
PTE	Settlement Creek Dolerite (was "Volcanics")		
	PTEM	Mafic/intermediate f-mgr igneous microgabbro	
	PTEI	Intermediate fgr igneous microsyenite/micromonzonite	
	PTEF	Feldspathic tuff?/siltstone. Red, pink, purple.	
	PTES	Shale, siltstone minor dolomitic shale. Fresh green, wthd red, purple grey.	
PTL	Sly Creek Sandstone		

COMMENTS

Measured structure on oriented core

Either Alpha and beta angles e.g. “FLT A 54 B 34”

OR Dip and Dipdirection e.g. “FLT 50/240”

Measured structure on un-oriented core

Alpha angle e.g. “FLT A 54”

RECOVERY

Block to block Interval Metres e.g. 2.75m, 1.45m etc

Percentage e.g. 96%, 100% etc

SAMPLE No.

pXRF RED Zn_ppm, Cu_ppm, Pb_ppm

Lab ICP BLACK