

## **COMBINED ANNUAL REPORT**

EL 10121, 24349, 24373, 24374, 24714, 24946, 24996, 24997, 25070

# **Exploration Licence Year ending 10 April 2007**

# BORROLOOLA PROJECT McArthur Basin, NT

1:250,000: Mt Young (SD53-15), Bauhinia Downs (SE53-03)

1:100,000: Mount Young (6067), Rosie Creek (6167), Mantangula (5966), Tawallah Range (6066), Bing Bong (6166), Bauhinia Downs (5965), Batten (6065), Mallapunyah (6064)

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April 2007

Report No. 2007/NT/02



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#### **SUMMARY**

This report details exploration conducted by Sandfire Resources NL (Sandfire) on the Borroloola Project exploration licences. These licenses (10121, 24349, 24373, 24374, 24714, 24946, 24996, 24997, and 25070) are located west of Borroloola in the McArthur Basin. As this is the first combined report for this project, the beginning of the reporting period is different for individual titles, but ends on 10 April 2007 for them all. Sandfire considers the project area prospective for base metals and diamonds.

Exploration work during the reporting period has consisted of processing and interpretation of previous Induced Polarization (IP) surveys, a limited RC/Diamond drilling program at Gordon's copper prospect, geochemical analysis of diamond core and RC samples, preparation and analysis of diamond core thin sections, reprocessing of open-file airborne electromagnetic ("AEM") data, reconnaissance mapping and rock-chip sampling, and a regional review of open file information.

At Gordon's copper prospect, four RC/DD holes were drilled to test IP targets. A total of 2284m were drilled. Zones of low grade disseminated chalcopyrite mineralisation were intersected in each hole.

Based on the results of the AEM data reprocessing, target areas have been defined and plans have been made to fly new AEM surveys during 2007 over five areas.

Review of regional open-file data is currently still in progress. The results of this data review will be reported in the next annual report.



#### 1. INTRODUCTION

This report details exploration conducted by Sandfire Resources NL (Sandfire) on the Borroloola Project exploration licences. As this is the first combined report for this project, the beginning of the reporting period is different for individual titles, as shown in the following table, but ends on 10 April 2007 for them all.

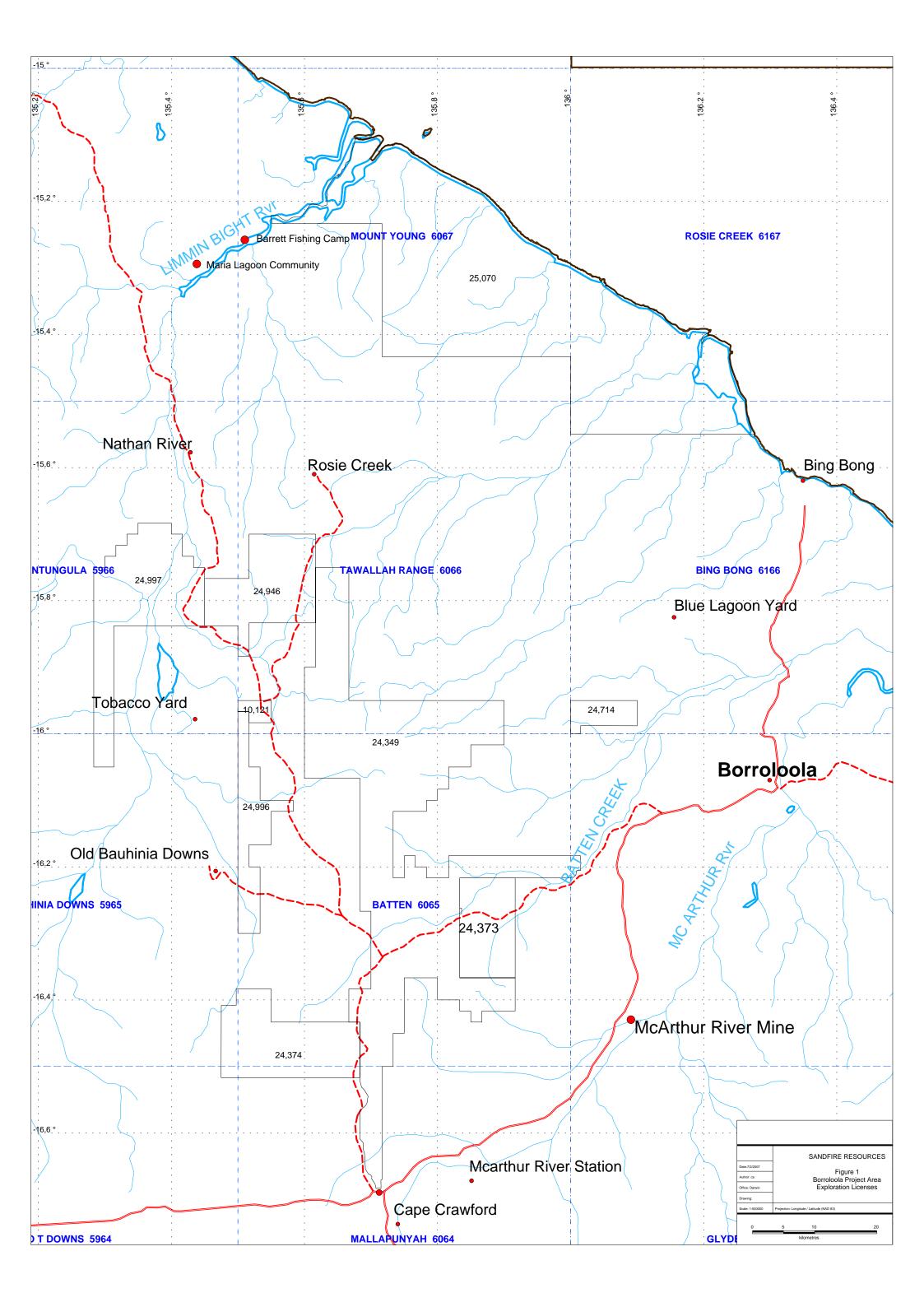
Table 1: Individual Reporting Periods

<b>Exploration License</b>	Start of reporting period	Current EL Year
10121	4 September 2006	4
24349	10 April 2006	2
24373	10 April 2006	2
24374	10 April 2006	2
24714	1 December 2005	2
24946	26 April 2006	1
24996	21 August 2006	1
24997	21 August 2006	1
25070	14 August 2006	1

#### 1.1 Location and Access

The project is centred about 660 km southeast of Darwin in the "Gulf Country" of the Northern Territory, Australia. On the eastern boundary are the township of Borroloola and the McArthur River (HYC) Mine. To the south is Cape Crawford and to the north-west is Roper Bar (fig 1).

Access is good to some parts via bitumen and unsealed roads. From Darwin access can be gained by travelling about 590 km southwards along the Stuart Highway to Daly Waters and then eastwards along Carpentaria Highway to Cape Crawford (270 km). The unsealed Nathan River road and Ryan's Bend road cross some of the tenements. Access deteriorates significantly in the northern parts of the project area.





#### 2. PREVIOUS EXPLORATION

Prior exploration since the early 1960's within the project area has been summarised in previous Annual Reports for EL10121 (C. Vieru, 2004) and a combined report for EL24349, 24373, and 24374 (2006).

Sandfire Resources began work on the project in 2004, primarily seeking copper, lead, zinc, silver, and gold, on EL10121. A small amount of work was done on this title to test a gravity anomaly which showed some of the characteristics of a kimberlite pipe. Detailed reporting of the company's work on the project from May 2004 to September 2005 has been submitted in the form of two earlier annual reports (C. Vieru, 2004, Vieru, Roberts and Wynne, 2005).

A brief summary of this work follows.

## September 2003 – September 2004 EL10121

- geological mapping at 1:10,000 scale;
- rock chip sampling;
- stream sediment sampling;
- petrological analyses;
- ground magnetics;
- An Induced Polarisation (IP) survey; and
- A gravity survey.

# September 2004 – September 2005 EL10121

- Authority certificate for exploration works within EL 10121 and MLN 624 on PPL 1069 (Billengarah) obtained from the Aboriginal Areas Protection Authority on September 30, 2004
- Limited RC/Diamond drilling program conducted to test six of the targets generated by the previous gravity and IP surveys
- Geochemical analysis of RC chip and diamond core
- Petrographic and mineragraphic work undertaken on the mineralised drill sections.
- 2004 IP survey remodelled
- 2004 Gravity survey remodelled

September 2005 – September 2006



#### EL10121

• An Induced Polarisation survey.

The eight additional exploration licenses were obtained during 2006. Work on these titles prior to the current reporting period included extensive literature and open-filed data review and reprocessing of open file AEM data. This work is described in detail in the 2006 Combined Annual Report for EL24349, 24373, and 24374.



#### 3. GEOLOGICAL FRAMEWORK

## Project Area

Two extensive reports on the geology of the entire project area and its prospectivity for base metal mineralisation and diamondiferous intrusion have been submitted with as part of a previous combined report for three of the project ELs (2006 Combined Annual Report for EL24349, 24373, 24374).

## Gordon's Copper prospect

The geology of the Gordon's prospect area consists of middle Proterozoic sediments of the Tawallah, McArthur and Roper Groups of the McArthur Basin. They rest unconformably on the Scrutton Volcanics and are partially concealed by Cretaceous and Tertiary deposits.

Early Proterozoic acid to intermediate volcanics and volcaniclastics of the <u>Scrutton Volcanics</u>, which are considered the basement of the area, outcrop immediately south-east of EL 10121, as detailed in the Mt. Young 1:250,000 and Tawallah Range 1:100,000 geological map series of the NTGS. This formation displays a strong radiometric and aeromagnetic signature and probably continues at depth in the central and north-western part of the current tenements. It consists mainly of rhyolitic to dacitic pyroclastics, dacitic flows, minor intrusives and rare basaltic lavas.

Within the EL10121 area this formation crops out along the Coppermine Creek Fault as sporadic up-faulted blocks, close to the Four Archers Fault contact. It has been identified as felsic volcaniclastic, strongly silicified and with traces of malachite, possibly representing a hydrothermal sinter cap, as described in the B28 petrographic sample (C. Vieru, 2004).

The <u>Tawallah Group</u> crops out on the western part of the EL10121 area, and outside the eastern boundary of EL10121, bounding a graben-like structure consisting of McArthur Group rocks to the south and Roper Group rocks to the north. They comprise coarse clastic sediments as sandstones and microconglomerates. The Tawallah Group also contains mafic volcanics which are not exposed within the current tenements, but could offer an explanation for the copper mineralization within the area.

The <u>McArthur Group</u> is the dominant unit in the EL10121 area. The rocks are dominantly dolomitic and are bounded to the west by the Tawallah Group and to the north by the Roper Group. According to the NTGS regional mapping, three major formations outcrop in the area; Amelia Dolomite, Tatoola Sandstone and Tooganinie Formation. The underlying <u>Mallapunyah Formation</u> was intersected by

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the BHP Minerals Ltd MYD 007 diamond drill hole under the Amelia Dolomite and consists of reddish mudstones, siltstones and calcarenitic sandstones (D. Stephens, 1997). The <u>Amelia Dolomite</u> is considered from previous drilling to be about 125 metres thick and consists of dolomite, dololutite, dolarenite and stromatolitic dolostone. The rocks are generally silicified, chertified and laminated.

The <u>Tatoola Sandstone</u> is dominantly a siliciclastic unit and consists of medium-coarse grained sandstone with interbedded calcarenitic, dololutitic, dolarenitic and dolomitic sequences. It is assumed not to exceed 150 metres in thickness.

The <u>Tooganinie Formation</u> is deeply weathered, silicified and poorly exposed, consisting of a rhythmic alternation of dolostone and siliciclastic rocks estimated at 150-200 metres in thickness. Detailed mapping within the EL10121 area assigned those rocks previously thought to belong to this unit to the Tatoola Formation.

The <u>Roper Group</u> outcrops mainly north of the Coppermine Creek Fault and is represented by the <u>Mainoru Formation</u>. The lithology comprises red-brownish micaceous and glauconitic mudstone and siltstone. It is estimated to measure about 500 metres in thickness. One of the best sections through this formation is displayed in the DDH McA15 diamond drill hole undertaken by BHP Co. Ltd in 1983 (BHP,1983).

<u>Cretaceous</u> sedimentary rocks crop out in the southern part of the EL10121 area concealing the tectonic contact between the Tawallah Group, to the west, and the McArthur Group, to the east. They consist of conglomerate, polymictic breccias and lithic sandstone. A marked unconformity is present between this sequence and the underlying Proterozoic formations.

<u>Tertiary</u> deposits have limited outcrop distribution over the current tenure. They are present as small remnants of lateritic caps on the western and north-eastern parts of the exploration licence.



#### 4. WORK UNDERTAKEN BY SANDFIRE RESOURCES

## 4.1 Modelling and interpretation of IP data

Raw data from the 2004 and 2006 IP surveys was provided previously in the Annual Report for EL10121, Year 4. Since then, processing and interpretation of both the 2004 and 2006 IP data has been completed by Western Geoscience Pty Ltd. A complete report of this work is included in Appendix 1. This report includes plans of pseudo-sections and depth sections.

## 4.2 RC and Diamond Core Drilling and Geochemistry

## **Drilling**

A program consisting of five RC/DD drill holes was planned to test an IP anomaly coincident with the Coppermine Creek fault. Drilling commenced in early September 2006.

Drilling was undertaken by Roche Mining using a six member crew working in two shifts with a multi-purpose UDR-650 rig on tracks.

Due to deflection in both dip and azimuth, sufficient to direct the hole off-target, some holes had to be abandoned and the target re-drilled. In the case of Target D, a satisfactory penetration of the target area was never achieved, despite four attempts. At its closest, this hole passed 150m to the east of and 150m below the centre of the target area. No clear conclusion could be drawn with regard to the cause of these difficulties. Both drilling technique and ground conditions may have been the cause of these deflections. The highest rate of deflection was experienced during RC drilling. Therefore, some holes were drilled using diamond coring from the surface. As a result of delays caused by these difficulties, only four of the targets were drilled.

Nine holes were drilled totaling 2284.4m (599.3m of RC and 1685.1m of diamond drilling). Table 2 details all holes drilled. Drill-hole locations are shown in **fig. 2**. Detailed geological logs are tabulated in Appendix 2. Down-hole survey data is tabulated in Appendix 3.

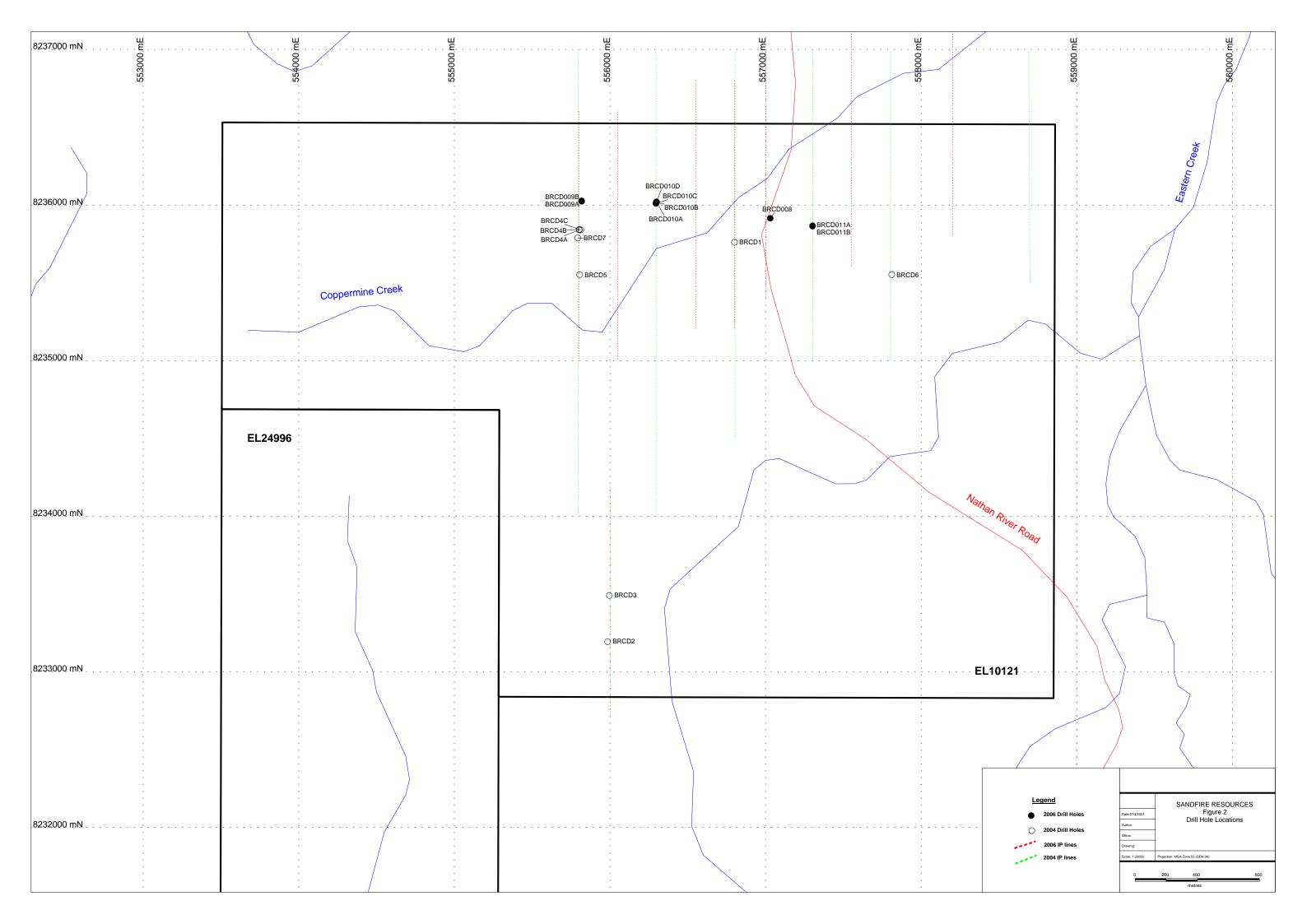


Table 2: Drill-hole Details

Target	Hole_ID	Grid_ID	Amg_N	Amg_E	Drilling_Type	Precollar_Depth	Final_Depth
Α	BRCD008	GDA94	8235915	557030	RCDD	138	373.2
В	BRCD009A	GDA94	8236024	555818	RC	48	48
В	BRCD009B	GDA94	8236027	555818	RCDD	150	337.8
D	BRCD010A	GDA94	8236021	556299	RCDD	102	150
D	BRCD010B	GDA94	8236016	556298	RCDD	101.6	110.9
D	BRCD010C	GDA94	8236010	556295	RCDD	72.4	128.4
D	BRCD010D	GDA94	8236019	556298	RCDD	18	621.3
С	BRCD011A	GDA94	8235867	557302	RC	84	84
С	BRCD011B	GDA94	8235864	557302	RCDD	17.3	430.8

The holes targeted induced polarization (IP) chargeability anomalies which had been generated by processing data acquired by geophysical surveys in 2004 and 2006. Interpretation of the data indicated there are resistive carbonates 200-300 m thick within the McArthur Group rocks, south of the Coppermine Fault Zone (Massey, 2007). In addition, zones of moderate to strong chargeability are associated with the fault and dip subvertically or steeply to the north (Massey, 2007). The drill-holes intersected four of these (targets A-D; Table 2); each target contained zones of hydrothermal alteration and disseminated sulphides, locally with anomalous Cu.

## **Drill-hole Geology**

BRCD008 was drilled down to a down-hole depth of 373.2 m. The hole intersected dolomitic siltstones and mudstones (probably Tatoola Sandstone) down to 214.65 m. Below this the hole intersected the Amelia Dolomite, dominantly comprising silicified dolomite (to 283.4 m), and Mallapunyah Formation mudstones, sandstones and dolomitic mudstones, with the lowermost 70m of the hole dominated by thick clastic breccias or debris flow deposits. The main zone of hydrothermal alteration extends from 163.9 m down to 287.7 m, straddling the upper and lower contacts of the Amelia Dolomite. The alteration comprises silicification and hematitic alteration, with locally guartz+carbonate and dark green to black chlorite veining. Narrow zones of brecciation occur locally. Disseminated sulphides (pyrite and chalcopyrite) occur in quartz+carbonate and chlorite veinlets or in selvedges to them, or may be disseminated through zones of brick-red hematite alteration. Thinner zones of alteration, associated with veining and disseminated sulphides, occur in the Tatoola Sandstone (intermittently between 141 and 157 m). Despite the broad zones of hydrothermal alteration and disseminated sulphides, Cu concentrations are generally low (Table 2), the best interval being 6 m @ 2016 ppm Cu (249-



255 m), suggesting that much of the disseminated sulphide is pyrite rather than chalcopyrite.

BRCD009 intersected a sequence of alternating dolomites, mudstones and dolomitic mudstones, with thin beds of sandstone and hematitic mudstone. It is not entirely clear where these units fit into the stratigraphic sequence, but they could belong to the Mallapunyah Formation. Hydrothermal alteration is restricted to relatively narrow zones: 150.25-153.7 m, 156.7-157.7 m, 158.6-181.4 m, 202.85-207.33 m and 282.8-300.6 m. There are three main modes of chalcopyrite occurrence. Between 160 and 168.7 m, chalcopyrite is spatially associated with deformed clasts of hematitic mudstone, occurring as coarse grains along fractures or along the margins of the clasts, or in zones of relatively intense brick-red hematitic alteration associated with the clasts. intersection is 2.7 m @ 2700 ppm Cu (165-167.7 m). Secondly, disseminated chalcopyrite occurs in thin (generally <4 mm wide) quartz-carbonate veinlets; 33 veinlets, locally with up to 20% chalcopyrite, occur between 282.8 and 300.8 m, but the best intersection was 1 m @ 836 ppm Cu (296.8-297.8 m). Thirdly, disseminated chalcopyrite, togrther with disseminated pyrite, occurs in veinlets (quartz+carbonate and chlorite) and hematitic alteration zones.

BRCD010 intersected faulted block of Roper Group rocks down to 492.6 m. The Roper sequence consists mainly of Mainoru Formation mudstones (with rare thin sandstones, siltstones and greywackes) and one faulted-out horizon of Limmen Sandstone (pale grey to pink sandstone; 266.17-296.37 m). Hydrothermal alteration is rare, with a narrow zone, subparallel to the core axis, of quartz veining, irregular zones of bleaching and fine-grained disseminated pyrite. The best intersection was 1 m @ 0.25 ppm Au (235-236 m). The faulted contact with McArthur Group rocks was interpreted to cccur at 492.6 m depth. The McArthur Group rocks consist of the Tooganinie Formation (mainly dolomitic mudstones: 492.6-569.5 m), the Amelia Dolomite (silicified dolomite; 569.5-592 m) and the Mallapunyah Formation (dolomitic and hematitic mudstones; 592-621.3 m (EOH)). There are two principal zones of hydrothermal alteration: at 492.6-513.33 m, adjacent to the Coppermine Fault zone, silicification and quartz+carbonate veining, locally with disseminated pyrite; and silica-hematite alteration with disseminated sulphides in Amelia Dolomite at 572.8-579.8 m. The best intersection was 7 m @ 3730 ppm Cu (572.8-579.8 m).

BRCD011 intersected an alternating sequence of sandstones, siltstones, shales (locally carbonaceous), mudstones (locally carbonaceous) and cherts (generally silicified shales and mudstones). Relatively weak silica-hematite alteration was intersected below 300 m depth. The best intersection was 2.28 m @ 4330 ppm Cu (309.54-311.82 m), including 0.53 m @ 1..095% Cu (coarse-grained chalcopyrite in a guartz vein).

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The general conclusions that can be reached from the diamond drilling are that mineralisation (albeit weak) and hydrothermal alteration are not restricted to the Amelia Dolomite, but extend above and below, where they abut the Coppermine Fault Zone. Also noteworthy is the narrow pyritic quartz vein with anomalous Au within the Roper Group.

## **Drill-hole Geochemistry**

Northern Australian Laboratories in Pine Creek, Northern Territory, carried out analysis of RC chips and diamond core (Report code NA 04573). Results, sample details and technical information are tabulated in Appendix 4. Table 3 summarizes the sulphidic intervals and best intersection for each drill hole.



Table 3: Summary of Sulphidic Intervals and best intersections

Drill-hole number	Final depth (m)	Sulphidic interval (m)	Best intersection	Depth of best intersection (m)
BRCD008	373.2	139.8-145.8 (6)	1 m @ 718 ppm	143.8-144.8
Target A		150.3-158.2 (7.9)	1 m @ 427 ppm	156.2-157.2
J		162.9-178 (15.1)	1 m @ 666 ppm	165.9-166.9
		,	1 m @ 602 ppm	168.9-169.9
		187.7-218.3 (30.6)	4.2 m @ 635 ppm	193.6-197.8
		, ,	1 m @ 816 ppm	195.2-196.2
			1.2 m @ 553 ppm	199.8-201
			0.4 m @ 1430 ppm	216.9-217.3
		221.7-260.5 (38.8)	7.5 m @ 554 ppm	235.5-243
		, ,	6 m @ 2016 ppm	249-255
		262.3-290.2 (27.9)	1.04 m @ 653 ppm	265.34-266.38
			0.86 m @ 479 ppm	268.46-269.3
		292.2-297.6 (5.4)		
		352.8-356.8 (4)		
BRCD009	337.8	160-168.7 (8.7)	1.4 m @ 3300 ppm	161.9-163.3
Target B			2.7 m @ 2700 ppm	165-167.7
		173.3-180.7 (7.4)	2.4 m @ 726 ppm	173.3-175.7
			1.35 @ 1280 ppm	177.7-179.05
		182.2-185 (2.8)	0.7 m @ 974 ppm	184.3-185
		255-258 (3)		
		281.8-300.8 (19)	1 m @ 836 ppm	296.8-297.8
BRCD010	621.3	229-238.2 (9.2)		
Target D		497-508 (9)		
		556.75-559.2 (2.45)		
		571.8-580.8 (9)	7 m @ 3730 ppm	572.8-579.8
			Incl. 1 m @ 2.14%	576.8-577.8
BRCD011	430.8	300.6-311.82 (11.22)	2.28 m @4330 ppm	309.54-311.82
Target C			Incl. 0.53 m @ 1,095%	310.29-310.82
		376-387 (11)		
		402-404 (2)		
		409-422 (13)		
		427-430 (3)		
Total	1763.1			



There were two anomalous intersections in the precollars:

BRCD008 84-88 m 4 m @ 427 ppm Cu BRCD009 116-120 m 4m @ 795 ppm

All samples were analyzed for Cu. Some samples from BRCD008-010 were also analyzed for Au and/or Cu, Pb, Zn, Ag, Bi, Mn, Fe, Ni, Co and Ba. Au concentrations are uniformly low (generally <0.02 ppm), except for one sample (0.25 ppm) in BRCD010, from a narrow zone of quartz veining, bleached haloes and fine-grained disseminated pyrite (in purple mudstone, Roper Group). Silver and Bi are normally below detection limit (1 and 10 ppm respectively). There is detectable Bi in two samples in BRCD008, over 2 m (195.2-197.2 m) associated with minor anomalous Cu (529-816 ppm). Lead and Zn concentrations are low (<102 ppm), as are Ni and Co (<20 and <50 ppm respectively). At this stage, apart from a minor association with Bi, there does not appear to be any geochemical association between Cu and any of the elements analyzed.

## 4.3 Petrological and Mineragraphic Work

Six samples from holes BRDC008-010 were sent for thin and polished thin sections. Sample details and petrographic descriptions are summarized in Table 4. The full petrographic descriptions are provided in Appendix 5.

<u>Table 4: Summary of Diamond Core Thin Section Petrographic Descriptions</u>

Sample	Thin (TS) or polished thin section (PTS)	Description
BRCD008 265.92-266 m	PTS	silica-hematite alteration with disseminated sulphides
BRCD009 162.93-163.01 m	PTS	disseminated sulphides around hematitic mudstone clasts
BRCD009 297.37-297.5 m	PTS	quartz+carbonate veining with disseminated sulphides
BRCD010 502.85-502.91 m	PTS	silicified zone with disseminated sulphides
BRCD010 577.3-577.35 m	PTS	silica-hematite alteration with disseminatred sulphides
BRCD010 588.53-588.59 m	TS	silicified dolomite with disseminated ?barite

## 4.4 Open-file AEM data reprocessing

The open file data for the Mt Young, Lorella, Yalco North, Batten, HYC, Emu Creek and Boomerang Creek surveys were reprocessed by Fugro Airborne Surveys. These surveys were selected as the survey parameters were considered to be appropriate to the geological environment.

The survey data were reprocessed as Conductive Depth Images and presented as stacked sections (Appendix 6). Specific targets and target areas were selected from the data for follow up and based on this review five areas were selected for additional AEM data collection. Fugro Airborne Surveys has been contracted to begin flying this additional AEM in May 2007.

## 4.5 Reconnaissance mapping and rock-chip sampling

Four rock-chip samples were collected. Sample locations and most significant assays are listed in Table 5.

Table 5: Summary of Rock-chip Samples and Assays

Sample number	Position (MGA53)		Description	Assays
TW001	8227319	569248	Chert breccia with Fe oxides and quartz veining (shear zone)	1360 ppm Cu
TW002	8223268	563929	"Malachite" staining on joint plane in sandstone	108 ppm Cu
EC001	8247835	550631	Dolomitic breccia with disseminated pyrite	419 ppm Cu
Apollo1	8233755	569922	Silicified Amelia Dolomite with disseminated galena	3 ppm Ag; 6850 ppm Pb

An attempt was made to investigate an anomaly identified in the reprocessed open-file AEM data. This anomaly is centred at approximately 583000E 8207000N (Zone 53 MGA94). Deteriorating weather conditions meant that only a brief visit to the location was possible. No samples were taken and no evidence of significant mineralisation was found, although further investigation is required.

#### 4.6 Open-file geochemical data review



Review of open-file geochemical data is currently in progress. Capture of information not included in the latest edition (January, 2007) of "Northern Territory geochemical datasets" will occur where relevant. The results of this data review will be reported in the next annual report.

#### 6. REFERENCES

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#### 7. EXPENDITURE

Individual expenditure statements for EL24349, 24373 and 24374 are found in Appendix 7.