Report ARU-14/009

FINAL REPORT FOR MCCs 950-953, KURINELLI, NORTHERN TERRITORY, AUSTRALIA

By

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BSc Hons, MAIG

1:100,000 – Hatches 5956
1:250,000 - Frew SF 53-3
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SUMMARY

MA 74 (previously AC 74) encompasses MCCs 950-953, all of which were held 100% by Arafura Resources. MA 74 covers the main part of the Kurinelli goldfield, situated in the northeast Davenport Province about 140 kilometres southeast of Tennant Creek in the central part of Northern Territory. Gold mineralisation was first discovered in the area in 1898 by prospector/explorer Davidson but this area is still regarded as a greenfields area and has only received limited attention. The exploration activity in this region is mostly restricted to local prospectors attempting to recover gold nuggets using metal detectors. Several hundred to several thousand ounces of gold are estimated to have been recovered in this way over the past 30-30 years.

Arafura was the first to conduct significant exploration in this area using modern techniques. Arafura acquired semi-detailed airborne geophysical data over the region and followed this up with systematic regional, and then detailed infill, gold-in-soil geochemical sampling surveys. A total of 5,662 2mm gold-in-soil geochemical samples were collected from the B/C soil horizon and assayed in six separate sampling phases across the project area in 2004-2007. This exploration activity demonstrated significant gold-in-soils geochemical anomalism in parts of the project area with a total of 1,165 sites (~21%) yielding average Au values of 10 ppb or more, and 65 sites yielding 100 ppb or more. The highest average gold-in-soil value was 5,020 ppb on MCC 950. A total of 131 gold-in-soil sample sites were on the minerals leases (MCCs 950-953). Most of the mineral lease area was substantially disturbed by surface mining and metal detecting activities in the 1980s-90s and hence the value of the soils data in this area is questionable.

A number of gold-in-soil geochemical anomalies were targeted for exploration drilling within the project area. A total of 57 holes and 3,597 metres of slimline reverse-circulation percussion drilling was completed in the Kurinelli project area in 2006. Despite the disturbed nature of the soils on the mineral leases, a total of four RC holes were drilled on the mineral leases at Kurinelli with all holes located on MCC 950. Unfortunately no significant gold results were encountered in the areas drill tested.
INTRODUCTION

Background


The Kurinelli goldfield is situated in the northeast Davenport Province in the central part of Northern Territory, 140 kilometres southeast of Tennant Creek (Figures 1-2). Gold mineralisation was discovered in the area in 1898 by prospector/explorer Davidson (Davidson, 1905) but the region has been subjected to only limited, spasmodic attention since that time. Current activity by local prospectors is directed towards recovery of gold nuggets from shallow alluvial and colluvial deposits using metal detectors. Several hundred to several thousand ounces of gold are estimated to have been recovered in this way over the past 10-20 years. The author observed a substantial haul of hand-detected nuggets won from shallow workings and scrapings during the NTGS metallogenic assessment of the Davenport Province in 1994; gold nuggets were up to about 4cm in size and the stated totals of all nuggets exceeded 100 Oz of Au.

Historical activity centred on gold mineralisation within quartz veins which characteristically occur within interbedded sandstone/siltstone (Rooneys Formation) and conformable gabbro/dolerite. The two main mines were the Kurinelli Mine (former MCC59) and the Dempsey’s Choice Mine (MCC191). Historical production was about 400 ounces of gold.

The central part of the field covers an area of 8 x 20 kilometres. More scattered mineralisation is recorded in similar host rocks over an area in excess of 20 x 30 kilometres. The units which host the mineralisation also occur elsewhere in the Davenport Province.

Despite the presence of outcropping gold mineralisation, the Kurinelli goldfield has never been subjected to systematic exploration using modern geophysical and geochemical exploration methods developed in the past 10-15 years. Of particular importance is the fact that the area received little attention in the BLEG ‘gold rush’ of the 1980’s though it may have been covered in Australia-wide open range exploration of this type by one multi-national group.

This lack of activity over the past two decades can be attributed to a combination of factors which included:

- the subdued nature of the topography, the arid climate and a widespread thin cover of aeolian sand;
- fragmented exploration title over the area prior to 1994;
- a Reserve From Exploration (RE) over the entire field between 1994 and 1996 where title could only be held as mineral claims and mining leases (which resulted in even more fragmentation of ownership);
- a Reserve from Occupation (RO) between 1996-2004, where no form of mining or exploration tenure could be applied for or granted; and
- uncertainty in mining and exploration tenure in the Northern Territory especially between 1996-2002 because of the ramifications of the Native Title Act.

Although many companies have held tenure in the Davenport Province in the past, most work has been superficial, and drilling is notable for its almost total absence away from the old mining centre at Hatches Creek, which is about 20-30 kilometres south of the Kurinelli field.

Current interest in the area stems from the discovery in mid-late 1996 of highly elevated levels of nickel, platinum, palladium and gold in magnetic ironstone boulders which had been recovered by local gold miners. The boulders, which were up to 200 millimetres in diameter, were located by the use of metal detectors being employed by the local miners to find nugget gold in surficial deposits.
Figure 1. Geological Regions of the Northern Territory (image from Ahmad and Scrimgeour 2004) showing the approximate area of interest for the Kurinelli project area.
After an initial burst of excitement when a multitude of mineral claims were pegged by the local operators and smaller exploration companies, a suggestion arose that the ironstone boulders, rather than being nickeliferous gossan as had first been thought, were fragments of an iron meteorite. This idea gained some support from semi-formal reports mainly from academics at tertiary institutions and curators at museums. However, as acid-etching of specimens of Kurinelli ironstones revealed breccia and vein textures which seemed totally inconsistent with an extra-terrestrial origin for the ironstones, McCleary Investments Pty Ltd (MIPL, a predecessor of Arafura Resources) commissioned additional scientific studies to resolve the question of the origin of the boulders.

Investigations undertaken by MIPL were documented by Goulevitch (1997) and comprised:

- acid-etching of ironstones;
- conventional and ICP-MS/OES analyses of several ironstones;
- petrographic studies of polished sections from four ironstone boulders by reputable consultants;
- laser-ablation ICP-MS analyses on the polished sections;
- petrological review and description of doleritic and gabbroic rocks from the Kurinelli area;
- reconnaissance soil and lag sampling in the vicinity of the discovery, in particular within areas which had been pegged by MIPL and its associates;
- review of the regional geology and of aeromagnetic data from the region; and
- a search for relevant data in the open file company reports from previous exploration in the area.

Most of the investigations on the ironstones proved inconclusive but finally, in 1999, acid etching of ironstones provided by local occupant, Mr Colin Wessels, revealed unmistakeable triangular (octahedral) widmanstatten texture which is a diagnostic indicator of massive iron of meteoritic origin.

Despite this set back, the Kurinelli ironstones drew attention to the under-explored gold potential in the area and this became the main focus of attention of Arafura Resources as early as 1997. At that time, the NT Government, having already imposed an RO over the area in response to the intensive pegging activity in late 1996, called for expressions of interest from parties interested in undertaking more systematic and professional exploration over the central Kurinelli area and its immediate surrounds. Arafura’s application was successful but it would be another 7 years before Native Title and other tenure issues were resolved and Authority C74 granted in mid-2004. Arafura immediately embarked on a programme of regional geochemical soil sampling.

Initial results from the programme confirmed gold potential in the area and follow-up infill sampling was required to confirm the nature of gold anomalism. The results from the first year of exploration activities were reported by Goulevitch (2005). The results of follow-up more detailed systematic soil sampling programmes were reported in Hussey (2006).

The gold anomalism thus identified, an RC drill testing program was conducted in May – June 2006 to determine the relationship of the anomaly to the underlying bedrock. Results proved that the majority of geochemical anomaly is located above low levels of gold mineralisation within the bedrock. There were no economically significant intersections of gold mineralisation identified by this drill program.

In July – August 2007 an additional soil sampling program occurred 1km to the NE of 2006 RC drilling. 2635 samples at an infill grid of 25 x 50m were collected over an anomaly identified in earlier Phase 1 and 2 sampling. Results of this program are reported here in full.

**Location and access**

Kurinelli is located in the northeast Davenport Ranges, about 140 kilometres southeast of Tennant Creek in the Northern Territory (Figure 2).

Access to the Kurinelli area is via the unsealed Davenport Loop Road (DLR) which leaves the Stuart
Highway 87 kilometres south of Tennant Creek and 27 kilometres north of the Wauchope Roadhouse. The Davenport Loop Road returns to the Stuart Highway 36 kilometres south of the Wauchope Roadhouse.

The northern access passes through Kurundi and Epenarra Stations situated 52 and 121 kilometres respectively from the Stuart Highway. Access tracks to Kurinelli lead from the DLR at a point 45 kilometres east of Kurundi (23 kilometres to Kurinelli Bore) and at Rooney Yard, 15 kilometres south of Epenarra (20 kilometres to Kurinelli Bore). At the request of the landholder access was via a track just south of Rooney Yard. The southern DLR access passes through Ali Curung and Murray Downs Station reaching the abandoned mining town of Hatches Creek 129 kilometres from the Stuart Highway. Rooney Yard is another 49 kilometres north from Hatches Creek.

Bush tracks and graded fence lines provide access across AC 74 and cross-country 4WD vehicle passage is possible to many areas.

The Kurinelli area is generally inaccessible between January to April each year as seasonal rainfall, scattered though it may be, regularly makes different sections of the DLR and local access tracks impassable.

**Topography and drainage**

The Kurinelli project area is located near the northeast margin Davenport Range in central Australia. Topography within AC 74 is largely subdued with most of the area at an elevation of 335-400 metres AHD (Figure 2).

The southern part of AC 74 borders the foothills that form the main spine of the Davenport Range and the proposed Davenport National Park. The land surface gradually slopes away from the Davenport Range, from about 380-420 metres AHD in the south to about 335 metres AHD adjacent to the Frew River which drains along the eastern side of the title. The Frew River drains to the north and is sourced in the Davenport Range south of the title. Lennee Creek, a major tributary of the Frew River, also drains the range country to the southwest and passes through the southern part of the title. The western and northwestern portion of the title is drained by Blackfellow Creek and then Whistleduck Creek which drains north across the title.

North trending lines of low hills, which parallel erosionally different basement rock units, occur in the west of AC 74 with peak heights to about 415 metres AHD NW of Kurinelli Bore (“Outstation” on map). Less extensive NNE trending ridges of similar height occur in the centre of the title to the SE of Kurinelli Bore and more isolated knolls of lesser height (peak 378 metres AHD) occur in the north and east of the tenement.

Numerous permanent and semi-permanent waterholes occur in the Frew River, Lennee Creek, Blackfellow Creek and Whistleduck Creek but the watercourses only flow for short periods after heavy summer rain.

**Climate**

The Kurinelli area is relatively arid with an average annual rainfall of about 300 millimetres. Most of this falls in the period between December and March when the remnants of monsoonal tropical lows and cyclones can pass across the area and deposit several hundred millimetres of rain in a few days. Otherwise the area relies on intermittent summer storm rain. Peak average monthly rainfall is in February.

Maximum temperatures peak at over 40ºC in summer and minima below 10ºC are common in winter. Occasional frosts can occur.
“Spinifex with low trees and shrubs is the most abundant vegetation. Small patches of turpentine bush on rocky ridges and mulga and gidgea in depressions are common locally. Eucalypts line some of the larger watercourses, especially near waterholes. A variety of grasses grow on plains and valley floors” (Blake et al 1986).

Figure 2. Location of tenure for Kurinelli project.
TENURE

Mining/Mineral Rights

Four granted mineral claims, (MCC 950-953; 68 hectares) are held by Arafura within the Kurinelli gold project area. These titles were originally granted on 10 May 1989 and were purchased from Mr T Campbell. Arafura also had an option to purchase two additional mineral claims (MCC 22798-22799; 31 hectares) in this area from Mr B. Rayner, but Arafura declined this option on 30 April 2009.

Authorisation C74 of 226 blocks (677 square kilometres), which encompasses Reserve from Occupation 24323, was granted to Arafura Resources NL in accordance with Section 178(2) of the Mining Act on 22 July, 2004, for a period of six years. Conditions specified in the grant document are essentially the same as those which apply to Exploration Licences with the exception that any subsequent mineral claims or authorisations granted to other parties will be restricted to a maximum depth of 5 metres to ensure that bona fide prospectors and local miners are not unduly prevented from carrying on activities directed at the recovery of gold nuggets. Such mineral claims or authorisations shall not exceed the size of an existing mineral claim or authorisation surrendered prior to the grant of a new claim or authorisation.

At the date of grant the area of AC 74 was effectively reduced by the area of 9 granted mineral claims held by third parties and 16 applications for mineral claims by third parties, all of which titles pre-dated Arafura’s expression of interest in the area. Should any of these be surrendered or cancelled their ground will become available to the holder of AC 74. The combined area of these titles and applications is less than 600 hectares.

The surrounding AC 74 was reduced to 113 blocks for the third year of grant. All 113 blocks were retained in years 4 and 5. AC 74 was further reduced to 57 blocks for the sixth year of grant. The renewal application for the continuation of AC 74 until 21 July 2013 was approved 22 May 2012, following a meeting with the Titles Advisory Board on 3 May 2012. AC 74 became MA 74 under the Minerals Title Act 2012.

Land Tenure

Background land tenure under AC 74 is part of:

- Kurundi Station, Perpetual Pastoral Lease 1109 - NT portion 716, owned by Brenda Marie SAINT of Kurundi Station, PO Box 508, TENNANT CREEK 0861 (Ph: 8964 1516 Fax: 8964 1964)

The boundary between Kurundi Station and Epenarra Station (PPL 1206; Fax 89641552) is located within a few hundred metres of the northern boundary of AC 74.

The southern and southwestern boundaries of AC 74 follow the boundary between Kurundi Station and the proposed Davenport National Park (Crown Lease Perpetual 1117) (Figure 2).

Native Title

A registered native title claim is in place over Kurundi Station:

- D6017/01 - DC01/017 Kurundi, C/- Central Land Council

Arafura Resources has negotiated and executed an Exploration Agreement with the Central Land Council (on behalf of registered Native Title Claimant Groups). AC 74, adjacent EL 9701 and MCCs 950-953.
950-953 are subject to this agreement. As a result, there are no Native Title impediments to continued exploration on these titles other than holding appropriate consultations, avoiding sacred sites and, in due course, paying agreed amounts of financial compensation.

In accordance with Condition 6 of the Second Schedule attached to the grant documents of AC 74, the registered native title claimants were invited to a meeting held in Hatches Creek on 18 August, 2004, to explain the exploration programme which is the subject of this report. 20-25 indigenous persons and several CLC representatives attended the meeting. This also constituted the “introductory meeting” required by the Exploration Agreement (see below).

Should mining eventuate within the area of AC 74, a mining compensation agreement will have to be negotiated both with the holder of the pastoral lease in accordance with the Mining Act, and also with the registered Native Title Claimants in accordance with the Right To Negotiate provisions of the Native Title Act. A mining tenement can only be granted where an appropriate Native Title agreement is emplaced. The terms of the Exploration Agreement provide for continuation of exploration on the area of the proposed mining tenement while the mining agreement is being negotiated with the registered Native Title Claimants.

Site Clearances

Prior to the commencement of soil sampling activities in 2004 an Aboriginal Sacred Sites survey was conducted over the area of intended activity by members of the relevant Native Title Group. The survey was coordinated by Anthropologist, Mr Phil Lannono, and Mining Officer, Ms Julie-Ann Stoll, of the Central Land Council. The CLC subsequently advised Arafura of the location of exclusion zones around identified sacred sites and these areas were avoided during the sampling programmes other than where they overlapped with existing roads and tracks. The exclusion zones also encompassed all sites listed on the Sacred Sites Register of the Aboriginal Areas Protection Authority (AAPA).

The sacred sites clearance issued by the CLC is effective for “Phases 1-3” of exploration at Kurinelli as defined in correspondence from Arafura to the CLC dated 22 June, 2004. Phase 1 (soil sampling) was completed in 2004. Phase 2 was completed in two stages in April-May and October-November, 2005. Phase 3 is RAB or RC drilling of identified targets. Prior to the commencement of Phase 3 detailed location plans and work programmes have to be submitted to the CLC in accordance with the provisions of the Exploration Agreement.

In accordance with the provisions of Arafura’s Exploration Agreement, the CLC and the relevant Native Title Group were invited to a meeting in March 2006 to explain and detail the proposed drilling programme planned as part of Phase 3 exploration activities in the Kurinelli project area. The proposed drill sites and the surrounding area were subjected to a further assessment by the CLC and Native Title claimants for the purpose of Sacred Site avoidance, the result of which were reported to Arafura in April 2006, prior to commencing earthworks for the 2006 RC drilling program.
GEOLOGICAL SETTING

Regional Geology

(after Hussey 2007)

Prospective basement rocks in the Kurinelli Project Area are part of the Palaeoproterozoic Ooradidgee Group within the Davenport Province of the Tennant Creek Region in central Northern Territory. The geology of the Davenport Province was first described in detail by Blake et al (1987) but their description and maps have been modified since that time, most recently by Donnellan (2004) and Donnellan and Johnstone (2002, 2004) after close-spaced low level airborne geophysical surveys were completed over the region. The following summary is written mainly with reference with the 1:500 000 scale Tennant Creek Region maps of Donnellan (2002) and Donnellan and Johnstone, (2004) and to a lesser extent with the 1:250 000 scale Davenport Province map of Blake et al (1988).

“The Tennant Creek Region is a composite term used for the pre-Barramundi basement (Warramunga Province) and the unconformably overlying Palaeo- to Mesoproterozoic North Australian Platform Cover successions of the Davenport and Ashburton provinces to the south and north respectively. To the east and west the Palaeozoic Georgina and Wiso basins overlie the Tennant Creek Region.” (NTGS website, February, 2005)

In the central Tennant Creek Region, volcaniclastic/volcanic rocks and flysch sediments of the Warramunga Province were intruded by granites and deformed by the Tennant Orogeny at ~1850 Ma. These units and intrusives are unconformably overlain by relatively undeformed and predominantly sedimentary successions of the Ashburton Province to the north and mildly deformed and metamorphosed sedimentary and volcanic successions of the Davenport Province to the south. (after NTGS website, February, 2005)

The basal unit in the Davenport Province, the Ooradidgee Group, crops out predominantly in a discrete inlier (here termed the “Kurinelli Block”) some 85 x 50 kilometres in extent centered on the Kurinelli area. The Kurinelli Block, which is evident as a discrete magnetic/gravity domain in geophysical images (Donnellan 2004; Donnellan and Johnstone 2004), is bounded to the south by the overlying sequences of the Hatches Creek Group and to the north and east by Cambrian, Cainozoic and Recent sediments. An intrusive plug of “Devil’s Suite” granite (1710 Ma, Donnellan and Johnstone 2002; here termed the “Hanlon Creek Granite”), some 10-15 x 25 kilometres in extent (obscured for the most part by a veneer of the younger sediment listed above), largely defines the eastern limit of the lower Oorididgee Group units in the Kurinelli Block but upper Oorididgee Group rocks have been mapped to the east of the granite. The presence of the Hanlon Creek Granite is clearly demonstrated on aeromagnetic images of the region by a domain of uniformly even magnetic character with coincident low Bougier gravity response (Donnellan 2004; Donnellan and Johnstone 2004).

Lesser exposures of the Ooradidgee Group occur in major anticlinal domes near Kurundi and Wauchope in the Murchison and Davenport Ranges, 50-80 kilometres west of Kurinelli; at Hatches Creek, Skinner Pound and Murray Downs in the Davenport Range, 30-50 kilometres south of Kurinelli; and at Newlands Creek, 100 kilometres to the southeast of Kurinelli. However, it is only in the Kurinelli Block and at Newlands Creek that oldest sediments of the Ooradidgee Group, the Rooney Formation, are exposed and, in the Kurinelli area, it is this unit, and dolerites which intrude this unit, that hosts the known gold mineralisation.

In the Kurinelli Block, the lowest exposed units of Ooradidgee Group are the Epenarra Volcanics and the Rooney Formation. According to Blake et al (1987), the Rooney Formation is conformable on and interfingers with the Epenarra Volcanics but the relationship between these units is not clear on published maps of the area where they are shown to be separated by, and overlain by the Kurinelli Sandstone. Elsewhere in the Kurinelli Block the Epenarra Volcanics are separated from the Kurinelli Sandstone by the Edmirringe Volcanics, and the Kurinelli Sandstone is overlain by the Taragan...
Sandstone and the Treasure Volcanics. Map codes, thicknesses (Blake et al 1987) and descriptions of rock components of these units are listed in Table 1.

The units of the Oorididgee Group are intruded by dolerite (Pdl) and dioritic to rhyolitic granophyre (Pgy). According to Blake et al (1987) the mafic intrusions consist of fine grained dolerite ranging to coarse gabbro, they are generally altered, and they are not present any higher in the sequence that the lower part of the Wauchope Sub-Group (lower Hatches Creek Group) which unconformably overlies the Oorididgee Group. Outcrop and magnetic patterns suggest that some of the dolerites consist of folded stratiform sheets (Donnellan and Johnstone 2002) and this is especially the case where the dolerite (?)sills intrude the Rooneys Formation in the middle of the Kurinelli Block. It would seem from this that intrusion of dolerite sills in the Kurinelli Block preceded regional deformation and metamorphism of the Oorididgee Group and some may have been associated with “Treasure Suite” volcanism in late Oorididgee times (1820 Ma, Donnellan and Johnstone 2002).

**TABLE 1: Description of Oorididgee Group units in the Kurinelli Block.**

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<th>THICKNESS (m)</th>
<th>CODE</th>
<th>DESCRIPTION</th>
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<tr>
<td>Treasure Volcanics</td>
<td>0→1800</td>
<td>Pot</td>
<td>Potrhyolitic to dacitic lava and pyroclastics including ignimbrite, felsic intrusives, feldspathic/lithic arenite, quartz arenite, minor basaltic lava</td>
</tr>
<tr>
<td>Taragan Sandstone</td>
<td>0→1000</td>
<td>Poa</td>
<td>Poafeldspathic/sublithic arenite, quartz arenite and conglomerate, minor siltstone, mudstone and altered felsic lava</td>
</tr>
<tr>
<td>Edmirripping Volcanics</td>
<td>0-2500</td>
<td>Pog</td>
<td>Pogbasaltic lava, minor volcaniclastic arenite and felsic lava</td>
</tr>
<tr>
<td>Kurinelli Sandstone</td>
<td>0-2600</td>
<td>Pok</td>
<td>Poksubarkosic/lithic arenite, quartz arenite, siltstone and minor felsic and mafic lava and tuff</td>
</tr>
<tr>
<td>Epenarra Volcanics</td>
<td>0→3000</td>
<td>Por</td>
<td>Porfelsic lava and pyroclastic rocks including ignimbrite and lapilli tuff, volcaniclastic arenite and conglomerate, minor mafic lava</td>
</tr>
<tr>
<td>Rooneys Formation</td>
<td>0→1200</td>
<td>Pon</td>
<td>Pon greywacke, siltstone, subarkosic/sublithic/lithic arenite, minor felsic porphyry; locally schistose</td>
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Local Geology

The surrounding MA 74 covers a large part of the central core of the Kurinelli Block. The Palaeoproterozoic basement rocks of the Kurinelli area are dominantly arenites and siltstones of the Rooneys Formation with intrusive sills of dolerite and gabbro bordered to the northwest, west and southeast by Kurinelli Sandstone. To the south and northeast the basement rocks are obscured by surficial sedimentary deposits of Cambrian, Cainozoic and Holocene ages. MCCs 950-953 are dominated by dolerite and gabbro with lesor Rooneys Formation. Small quartz veins with associated alteration are evident.

Most economic interest in AC 74 derives from the area underlain by the Rooneys Formation and associated intrusive dolerite sills which attain apparent thicknesses of up to 800-1000 metres. In discontinuous outcrops, the Rooneys Formation and dolerites occupy an area that is some 20 kilometres long in a northeast-southwest direction tapering from 10 kilometres wide in the northeast to less than 2 kilometres in the southwest. On the basis of a distinctive aeromagnetic signature, this area is shown to be about 27 kilometres long and comprise an area of about 200 square kilometres. This area is referred to here as the “Kurinelli Zone” and it hosts all of the known gold mineralisation in the Kurinelli field.
The southeast limit of the Kurinelli Zone is defined by a major east-northeast trending fault structure along which discontinuous lenticular quartz ridges are developed. This has been mapped over a strike length of about 50 kilometres and, in aeromagnetic imagery, it coincides with a lineament which can be traced over a distance of at least 75 kilometres and as much as 150 kilometres. Part of the structure where it traverses AC 74 is clearly evident in the magnetic image. Field observations suggest that the structure dips shallowly to the southeast and that the same structure forms the western boundary of the Kurinelli Zone where it dips shallowly to the west and northwest. One interpretation of the Kurinelli Zone is that it occurs as a domed klippe of older basement rocks bounded to the southeast, west and north by a single shallow outward dipping thrust fault. Alternatively the southeast and west boundaries can be interpreted to be arcuate splays from a semi-regional southwest-northeast trending fracture system.

Approximately 70% of the area in the Kurinelli Zone is obscured by Quaternary deposits. Some of these areas may be underlain by a thin veneer of flat lying Cambrian carbonate sediments of the Georgina Basin sequence, and probably also by Tertiary silcrete and ferricrete. Substantial calcrete development can be seen in the upper 3-5 metres of both dolerite and dolomitic/calcareous siltstone beds of the Rooneys Formation. Development is likely related to evaporation of groundwater during the Tertiary (Blake et al., 1986).

Gold mineralisation at Kurinelli is historically associated with quartz vein-swarms and reefs. Prospectors identified large nuggets near reefs that dwindled in size with distance away from the reef. Sampling of waste rock around old workings indicates gold is more intimately associated with alteration zones in dolerite and contact margins with Rooneys Formation sediments. Linear alteration trends, (020° and 120°), in dolerite are broadly similar to anomalism trends of gold in the area. The geological map used in Figure 3 is not accurate at a local scale and presents northwestern sample sites on dolerite which is incorrect. For accurate geological interpretation refer to McGilvray (2006). Hornfelsed sediments in the east are also anomalous in gold. Quartz reefs are coincident with minor gold anomalism.

Figure 3. Geological setting of Kurinelli project (digital data from NTGS).
PREVIOUS INVESTIGATIONS

PRIOR TO 1996

The following summary of exploration activity in the area prior to Arafura's involvement was prepared by Drummond (2001-2003).

Kurinelli is an historical Au mining region, with the first activity undertaken in the 1890's. In subsequent times a number of small shafts were sunk and a small stamp mill was operational in the 1950's. The field has received scant attention by scientific exploration - possibly because its importance has only recently been emphasised by the significant Au production, from a large area, by prospectors using metal detectors. Discussion with them leads to the conclusion that about 150 kg have been recovered in the last few years.

Review of Historic Exploration

(a) **Gold & Mineral Exploration N L (1972 - 74) EL633. CR75-123**

This tenement was in the Kurinelli area. Work done was essentially of a prospecting nature, with bulldozer costeaning. In that time of low Au price and no effective geochemical or geophysical techniques available, their effort was unsuccessful. Evaluation of a small Cu show (locality uncertain) did not provide encouragement.

(d) **Mineral Horizons N L (1985 - 1989) EL4815. CR89-148, 90-075**

The original tenement covered some 1300 sq km, being the central part of the Davenport Ranges, including much of Arafura's ELs 9710 and 9711. The first year's work consisted predominantly of prospecting and visiting known Au occurrences. Analogies to Telfer were drawn. In the second year reconnaissance surface sampling of various prospects and an introductory stream sampling programme was carried out - neither of which advanced matters much. By the third year, effort was being concentrated around Arafura's Kurinelli Project area in consequence of the returns from prospectors' metal detecting. Mapping programmes, rock chip sampling and costeaning were initiated which emphasised that Au seemed to be preferentially associated with sediment and dolerite/gabbro contacts especially where brecciation is evident. There was additional work to the south of the field and out of the Kurinelli Zone around the Aztec and Great Davenport prospects.

Poorly ground-located rock chip sampling over basal Treasure Volcanics in the south west of EL9711 is viewed as most encouraging by Drummond. Twenty-metre composite rock chips returned values of 1.04 g/t and 0.41 g/t Au: an indication for potential for higher bulk Au deposits, rather than confinement to narrow quartz veins.


This small tenement (4 blocks) was centered around an Au show which is situated about 4 km south of the old Kurinelli battery. Sampling around it produced disappointing results, with only one of 10 samples returning better than 1.0 g/t. Trenching and bulk sampling were undertaken, but the latter was not processed. Interestingly, this is the first report which mentions carbonate cementation in the weathered zone and the observation of calcrete. Soil sampling was undertaken over a small prospect 7 km south of the battery with no real encouragement, but the sampling was over a small area, and utilised a technique possibly not sufficiently sensitive, in Drummond's opinion.

This small tenement (12 blocks) occurred in the southern part of the Kurinelli zone. Most of the tenement has an alluvial cover and Wellington undertook no exploration designed to test the cover, or through it. It examined outcropping reef mineralisation elsewhere in the field and decided that the quartz reefs were narrow and lacked the structural setting and alteration associated with significant mineralisation.


The tenements occupied the northern 60% of Arafura's AC74. The target was to discover new quartz veins in the poorly outcropping district by using ground magnetics and refraction seismic and mapping. Broadly spaced soil BLEG was undertaken and it indicated significant anomalism. Shields' BLEG predominantly covered areas in the south-west corner of AC74, and to the north-east of it centred around 20°33'S, 135°08E: these areas did not return anomalous (i.e. >1.0 ppb Au BLEG) assays. However traverses which generally lie in the east of RE1345 were consistently anomalous. The more southerly traverse returned six consecutive anomalous values - averaging 5.5 ppb over a traverse of almost 4 km. The traverse to the north-east returned six anomalous readings from eight sites over almost 6 km: the eight samples averaged 3.8 ppb. An outlying sample at 20°34'S, 135°05'E returned 107 ppb. Drummond considers that this highlights the extent of mineralisation in the Kurinelli Zone beyond areas of known surface gold accumulation. It also demonstrates the usefulness of the soil BLEG survey technique in the area. The areas which did not return anomalous Au in Shields' programme may simply require sample collection below transported alluvium. Shields also noted that it may only be sub-sections of a quartz reef system that might be mineralised, citing examples such as Woods Point and Walhalla in Victoria.


This small EL was centred around an old Au show mapped 6 km south-east of the Great Davenport mine. Of 35 stream sediment samples panned or tested in a Au wheel some 16 returned either a trace or a colour. This indicates the general Au anomalism at the southern wedge-out of the Kurinelli zone.

(n) BHP Gold Ltd/Newcrest Operations Ltd 1991. Various EL Applications

In 1991, during a corporate and operational transitional change between Newcrest and BHP Gold, the former applied for Exploration Licences which covered almost all of the Davenport Ranges, and extended south-easterly sufficiently to cover Arafura's Supplejack Project. Before the tenements were granted BHP Gold undertook an extensive stream sediment sampling programme and samples were assayed by BLEG techniques for precious metals, and by conventional techniques for base metals. Although BHP Gold defined anomalous areas for follow-up, the project was terminated before any of the Exploration Licences was granted and there were no reporting requirements to NTDME.

Newcrest kindly provided access to its report which does not include the raw assay data. Rather it mainly consists of plots, on a per element basis, of the assay results which BHP Gold considered to be anomalous. Accordingly Drummond has accepted, and considers it reasonable to do so, BHP Gold's definitions of anomalism without being able to undertake any independent checking of the data or the statistical analysis.
General conclusions which can be drawn from a study of BHP Gold's results are as follows,

1. **Gold**

The Kurinelli Sandstone, to the south-east of the Great Davenport mine, and beyond the Kurinelli Zone, is anomalous over about 20 sq km. Despite its evident Au mineralisation, the Kurinelli Zone generally did not provide much anomalism. But this is presumably due to the fact that its north-eastern part, i.e. beyond 1 km north-east from the old battery site, was not sampled. Additionally the south-western part is known to be covered by thicker alluvium.

**INVESTIGATIONS BY ARAFURA RESOURCES IN THE KURINELLI PROJECT AREA**

Initial activities undertaken by Arafura Resources and its associates in 1996 and 1997 have been described by Goulevitch (1997) as:

- acid-etching of ironstones;
- conventional and ICP-MS/OES analyses of several ironstones;
- petrographic studies of polished sections from four ironstone boulders by reputable consultants;
- laser-ablation ICP-MS analyses on the polished sections;
- petrological review and description of doleritic and gabbroic rocks from the Kurinelli area;
- reconnaissance soil and lag sampling in the vicinity of the discovery;
- review of the regional geology and of aero magnetic data from the region; and
- a search for relevant data in the open file company reports from previous exploration in the area.

**Geophysical survey**

The whole of the Kurinelli Block was included in the NTGS's Bonney Well airborne geophysical survey which covered the Bonney Well and Frew River 1:250 000 map sheets. The survey was flown in 1999 and involved low level acquisition of terrain, magnetic and radiometric data on lines spaced 400 metres apart.

Over AC 74, and more specifically, the Kurinelli Zone, Arafura Resources financed infill flying at 200 metres line spacing prior to the granting of AC 74. The data for this airborne survey is available from the NTGS.

**Summary of Phase 1 (September – December 2004)**

Systematic regional and local geochemical soil sampling was completed over the Kurinelli Zone in September 2004 (Goulevitch 2005). A total of 821 samples were collected from 782 regional sites spaced 500 metres apart on lines also spaced 500 metres apart. An area of approximately 200 square kilometres was covered by the survey. No samples were collected from within exclusion zones around Aboriginal sacred sites advised by the Central Land Council or from within granted mineral claims, and priority applications for mineral claims, held by unrelated parties.
Two soil size fractions were collected at each site. A -80# fraction which was subsequently analysed for Cu, Pb, Zn, Co and Ni; and a -2 millimetres fraction which was analysed for low level Au, Pt and Pd.

Numerous elevated gold values were obtained. From the 782 sites sampled,

- 149 sites (19%) returned a value of 2 ppb Au or more;
- 39 sites (5%) returned a value of 5 ppb or more;
- 14 sites (1.8%) returned a value of 10 ppb Au or more;
- the highest value was 234.5 ppb Au at site 137180;
- the second highest value was 40.5 ppb Au; and
- 437 samples returned less than the detection level of 1 ppb.

Results of 10 ppb and more appear to be distinctly anomalous, and results of 3-10 ppb Au appear to be possibly anomalous. The results define a coherent zone of elevated gold-in-soil covering an area of about 25-35 square kilometres. Elevated levels of gold-in-soil surround all known areas of past gold mining activity and a halo of 1-2 ppb Au surrounds the bulk of the higher results.

The zone of elevated gold includes several areas which are considered anomalous. The largest of these is approximately 6 kilometres long and up to 2.5 kilometres wide. This anomalous zone envelops Arafura’s granted mineral claims in the area (MCCs 950-953).

Resampling in December, 2004, at and around the site of the highest value, returned results between 5-38 ppb Au and while this work has not reproduced the original result (291/178 ppb Au), the overall Au level around the site (average 13.5 ppb Au) fully supports the broad zone of gold anomalism defined in the initial sampling and it is entirely consistent with the adjacent results from that initial sampling.

Geological reconnaissance in the vicinity of sample site 137180 has located an array of ferruginous quartz veins, a chip sample from which returned gold assays of 0.36 and 0.44 g/t Au. This appears to represent the first demonstrated occurrence of hard-rock gold mineralisation at Kurinelli well removed from massive quartz reefs which are the source of nuggetty gold recovered over the past 15-20 years using metal detectors.

Overall, the 2004 soil sampling programme at Kurinelli has been successful both in defining a broad area of basement gold anomalism, and thus significantly reducing the area of the Kurinelli Zone that can be considered prospective for basement gold mineralisation (from about 200 square kilometres down to 25-35 square kilometres); and also in identifying several specific targets within that reduced area for the next phase of follow-up investigation.

Peak Pt and Pd values of 3 and 4 ppb respectively were obtained from different samples and while these do not appear anomalous, limited follow-up sampling around the respective sites is probably justified.

Peak results for base metals were:

- Cu – 101 ppm - average 16 ppm excluding 14 samples below DL of 1 ppm;
- Pb – 31 ppm - average 10 ppm excluding 403 samples below DL of 5 ppm;
- Zn – 71 ppm - average 19 ppm excluding 5 samples below DL of 1 ppm;
- Ni – 76 ppm - average 25 ppm excluding 1 sample below DL of 2 ppm;
- Co – 49 ppm - average 11 ppm excluding 175 samples below DL of 2 ppm;.

None of the base metal results appear anomalous.

Summary of Phase 2A – 2D results (April 2005 – July 2006)
Results of Phases 2A-2D soil sampling are reported in Goulevitch (2005) and Hussey (2006). These soil sampling programs confirm the presence of a significant gold-in-soils geochemical anomaly at Kurinelli, with the main anomalous zone being about 2.5 x 6 kilometres. This zone corresponds to basement areas of historic mining and colluvial/elluvial zones worked by prospectors with metal detectors in the past 20 or so years. The results characterise and better define the gold-in-soil geochemical anomaly zone at Kurinelli and appear to support the validity of the sampling protocols employed at Kurinelli by Arafura.

Numerous elevated gold values were obtained in Phases 2A-2D. Of the 2592 sites sampled:

- 2,242 sites (86.5%) returned a value of 2 ppb Au or more;
- 1,477 sites (57.0%) returned a value of 5 ppb or more;
- 785 sites (30.3%) returned a value of 10 ppb Au or more;
- 29 sites (1.1%) returned a value of 200 ppb Au or more;
- the highest value was 5,020 ppb Au;
- the second highest value was 4,020 ppb Au; and
- 211 samples returned values less than the detection level of 1 ppb, all of which were collected in Phase 2A.

These results of Phase 2B, 2C and 2D are encouraging and additional soil sampling and testing is recommended across the remainder of the anomalous zone.

**Summary of Phase 3A (May – July 2006)**

A total of 3,597 metres in 57 slimline reverse-circulation percussion drill holes (Phase 3A) were completed in AC 74. Phase 3A was targeted to test the extent of the Au-in-soils geochemical anomalism identified by detailed (25 x 50 metre-spaced) soil sampling programmes within phases 2B and 2C.

The results of Phase 3A are reported in Hussey (2007). No wide coherent zones of economic gold mineralisation were identified in Phase 3A. Despite this, numerous anomalous gold intercepts were identified at depth, with the following 2-metre composite results:

- maximum 2-metre intercept was 6.77 ppm Au from 44 metres in KNRC019
- 9 x 2-metre intercepts were above 1.0 ppm Au
- 19 x 2-metre intercepts were above 0.5 ppm Au
- best individual assay was 47.2 ppm Au in a 1 metre sample in KNRC019

The drill testing of anomalous Au-in-soil zones was considered generally successful with anomalous Au mineralisation identified at depth in more than half of the exploration holes. This suggests that most of the gold in the soil profile is probably locally derived, particularly in the western parts. Results in the southeast were disappointing and suggest that some of the Au may be transported.

**2007 Soil Sampling program (Phase 2E)**

A significant NE trending Au-in-soil regional geochemical anomaly was identified to the NE of the 2006 RC drill testing area in earlier soil sampling programs. A follow up 25 x 50m soil sampling program was designed to test and better constrain the previously identified Au-in-soil anomalism in this area.

In July – August 2007, at total of 2,635 soil samples (Phase 2E) were collected over the previously identified NE trending gold-in-soil regional geochemical anomaly. Sampling techniques and methodology are consistent with those used in past soil sampling programs at Kurinelli. Details of sample locations and assays are reported in Dixon and Hussey (2008).
Results of Phase 2E indicated a NE trending zone of anomalous results along a strike length of 2km.

- highest average gold-in-soil assay was 2.51ppm Au
- 16 sample sites returned average gold-in-soil assays >100 ppb Au
- about 20% of sample sites produced anomalous gold-in-soil assay results (>10ppb Au)

Work completed in 2009

All of Arafura’s exploration data was collated into a GIS (Hussey 2010), and reports and assay data were presented to potential JV partners.

Geological interpretation of the magnetic data reveals a number linear magnetic lows and fault zones (Figure 3) that extend under regolith cover from outcropping mineralised occurrences. Hence, these magnetic features have the potential to host mineralised quartz veins along strike of known mineralisation (see Figures 3 and 4). A number of companies have been approached to explore AC74 using this geological interpretation, however to date none have accepted the JV offer.

This change in exploration focus came about largely because areas of transported material are indicated on the regional geological map (Figure 4) and satellite imagery. Hence it was considered that the gold-in-soil assay method was probably not the most effective tool to test the underlying bedrock for gold mineralisation in all areas of Kurinelli. It is also important to note that the structurally-controlled gold-mineralised quartz veins were observed during fieldwork associated with 2006 RC drilling. Surface outcrops and nearby drill intersections indicated associated alteration halos (±chlorite±sericite±pyrite) which along with the structurally-controlled quartz±carbonate±gold veins are likely to form distinct linear magnetic lows, particularly in the gabbro.

The desktop review of Arafura’s exploration data also shows that systematic -2mm gold-in-soil assays may not always effectively evaluate the gold potential of the underlying bedrock in AC74. In particular, it means that some areas may have not been effectively sterilised by regional soil sampling programs. This interpretation re-opens areas for exploration activities, previously thought to be sterilised and of limited exploration potential.

This desktop review suggests linear magnetic low (gold exploration target zones) should be evaluated and alternative exploration strategies should be adopted in areas with transported regolith.

Summary of work completed on MCCs 950-953

Arafura collected and assayed a total of 5,662 -2mm gold-in-soil geochemical samples from the B/C soil horizon in six separate sampling phases in 2004-2007 (Figures 4-7, Goulevitch 2005, Hussey, 2006, Dixon and Hussey 2008). This exploration activity demonstrated significant gold-in-soils geochemical anomalous in parts of the project area with a total of 1,165 sites (~21%) yielding average Au values of 10 ppb or more, and 65 sites yielding 100 ppb or more. The highest average gold-in-soil value was 5,020 ppb and occurs on MCC950. The major gold-in-soil geochemical anomaly has been followed up with detailed infill sampling to better define the anomaly which covers an area of 2.5km x 6 km and encompasses MCCs 950-953. A total of 131 soil sampling sites on MCCs 950-953 were tested (Figures 4-7) however it should be noted that most of the area was disturbed by surface mining in the 1980s-90s prior to this sampling and the results are likely to be smeared and questionable.

Four gold-in-soil geochemical anomalies were targeted for RC exploration drilling on MCC 950. All assay results from the drilling on MCC 950 were 0.03 ppm Au or less (Hussey 2007). Unfortunately, no economically significant gold mineralisation was identified in the Kurinelli project area with the best 2-metre composite RC sample being 6.77 ppm Au from 44 metres in KNRC019 and only 19x2-metre composites yielding average Au assays of 0.5 ppm or more (Table 2). Follow up assaying identified the best individual one-metre average Au result of 11.7 ppm Au (Hussey 2007). The low proportion of
quartz recovered suggests that the intersected mineralised veins are narrow.
Figure 6. Enlargement of Figure 5 showing -2mm gold-in-soils assay values gridded using inverse distance squared method. High values are represented by the hotter colours.
Figure 7. Enlargement of Figure 5 showing -2mm gold-in-soils assay values gridded using inverse distance squared method. High values are represented by the hotter colours. The location of the 2006 RC drill collars is indicated by filled yellow circles.
Table 2. Location of 2006 RC drill collars on MCC950.

<table>
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<th>Hole Name</th>
<th>MGA94_E</th>
<th>MGA94_N</th>
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Total 274

RECOMMENDATIONS

Arafura's exploration program demonstrated the presence of narrow quartz vein-hosted gold mineralisation at depth in the Kurinelli project area. Unfortunately no economically significant gold mineralisation was encountered in the 2006 drilling program and a number of surface targets proved unsuccessful when drill tested. This was certainly the case for all four targets on MCC 950. The exploration drilling on MCC 950 proved to be very disappointing with a maximum composited two-metres assay of 0.03 ppm gold. The presence of exclusion zones over parts of MCCs 950-953 and the lack of significant gold discoveries at depth downgrades these leases and it is recommended that Arafura surrender them.
REFERENCES


McGILVRAY T, 2006. Results of Phase 2 soil sampling programmes, 2005 AC 74 Kurinelli Northern Territory, Australia. *Arafura Resources NL unpublished report ARU-06/001.*

Open File Company Reports held by the NT Geological Survey (From Drummond, 2001)