FOURTH ANNUAL REPORT ML 29494

2016

Title holder: Dehne McLaughlin

Operator: Dehne McLaughlin

Name of Project: Malbunka Project

Reporting Period: From 21st December 2015 to 20th December 2016.

Author: Dehne McLaughlin

Date of compilation: October 2016

Target Commodity: Mineral specimens of the copper carbonate azurite in the form of discs and aggregations trade named as “azurite suns”.

Relevant Map Sheet: Henbury Australia 1:250,000 Geological Series Sheet SG 53-1.

INTRODUCTION and HISTORY

ML 29494 (the Malbunka Project-"the project") was preceded by EL 9874. EL 9874, consisting of two blocks, was granted on the 12th August 2008 by the NTG following application in 1996 and 1998 to the NTG and following appropriate approvals by the Central Land Council. EL 9874 was surrendered on 11 June 2013 and was accompanied by a Final Report dated 5th August 2013.

The grant of ML 29494 took effect on 21 December 2012 by the NTG following the Central Land Council giving its consent to Grant of ML 29494 in July 2012 and after the Honourable Jenny Mackland MP consented to the grant on 20th September 2012, under section 45(b) of the Aboriginal Land Rights (Northern Territory) Act 1976. The grant is for 10 years.

The Director of Mining Compliance (Peter Waggitt) approved the fourth Mine Management Plan (MMP) for the project on the 22nd December 2015 following submission of an annual review MMP in October 2015. The project MMP authorisation number is 0734-01. The scheduled on site mining field season commenced 23rd April 2016.

ML 29494 is a unique type of tenement in that the economic commodity sought is valued for its scientific and collector value. I.e. specimens of circular blue azurite, often collected on a background matrix of near white kaolin and referred to as "azurite suns". Marketing is carried out via mineral shows in Australia, overseas and by e communications. The underground mining operation is a cut above fossicking but is still very small scale and was a type of activity originally covered by mineral claims until the demise of mineral claims in 2012.

Mining work at the mine site in the 2016 reporting period commenced on the 23rd April 2016 and the program was completed on 10th July 2016. A fly camp was maintained on the old waste rock dump opposite the adit entrance to the mine for the period and was occupied 7 times for 6 nights at a time. Four day breaks were taken in Alice Springs to replenish fuel, water and food, repair equipment, box potential mineral specimens for transport and recover from the stresses of manual labour. Rain impeded access in May and time was spent at the Mud Tank zircon field.

The core mine site activity in 2016 was focused on driving forward and wider in the Down Dip Drive mineralisation parallel to the anticlinal axis (See Plan 1). This known location of specimen production in the down dip tunnel parallel to the anticlinal axis, was not mined in 2015 due to a reduction in time available to miners. This was an important change in mining direction in 2016 as the Up Dip Drive in 2015 was demonstrating a fall in specimen quality and quantity with detrimental calcareous coatings over distorted azurite discs across 2 metres of the drive face.

The Down Dip Drive was advanced 2.2 metres in 2016 across an average 5 metre working face. This involved 5 sequential cuts of an average horizontal distance of ~0.44 metres comprising hammering out solid rock using a large electric jackhammer to create a vertical working face, removal of waste rock, undercutting of the mineralised area, sampling of specimens and removal of excess waste rock during specimen collecting. The Adit Drive was opened up towards the end of the mining campaign based on a reinterpretation of the geology in the Down Dip Drive. This work combined with the Down Dip Drive mining has changed the ore reserve estimates. A total of $25M^3$ was mined consisting of waste rock and hanging wall kaolinite containing azurite.

The Project was visited by two NTG Geological Survey staff , Nigel Donnellan and Jay Carter in late June 2016 (See Photo 7).

Location and Access

ML 29494 is located 14 kilometres south east of Areyonga (Utju) community along a 4 wheel drive standard track for much of its length within the Ltalatuma Aboriginal Land Trust. The Central Land Council (CLC) is provided a Work Program of the mining season actions. Permits are sought at this time as required under the Agreement. Key traditional Aboriginal owners of the ML are advised by the CLC of our entry to the land and at times a courtesy call is made by the writer and his wife to senior land owners at Hermannsburg before entering the land.

The office manager at the Utju/Areyonga Council is advised of entry to the land and departure from the EL, so Council is aware of Project activities in the valley at any time. Map 1 at the back of the report shows the location of the ML in relation to Utju and Map 2 provides a Google map of the ML. The north east corner post or datum post of the ML is located at latitude 24^{0} 07^{1} 35.7^{11} and Longitude 132^{0} 22^{1} 59.9^{11}. The dimensions of the ML are 183 x 120 metres, totalling 2.2 hectares in area. The adit entrance is located on Map 2. **Plan 1** at the back of the Report is an updated true scale diagram of the underground layout of the adit and the current drives from the exploration sampling decline that is the subject of current mining activity.

Mineral Lease History

A Mineral Claim was pegged over the azurite containing formation exposed in the adit at the end of the field season in 2010 in EL 9874 for the purposes of producing specimens in known zones of high quality and to further exploration in the adit. This Mineral Claim (MCA28231) was advertised by Minerals and Energy in February 2011.

Under transition provisions of the 2011 Mineral Titles Act, reapplication for a ML was required and the original mineral claim area was advertised in relevant newspapers as Mineral Lease 29494 on Friday 22nd June 2012.

A Section 46 ALRA consultation was conducted by the CLC at the exploration site in June 2012. Commensurate with instructions traditional Aboriginal owners the CLC approved a draft Deed for the mining of ML 29494. The then NTG Department of Resources was notified of the outcome of this meeting. A draft Deed under the Aboriginal Land Rights (Northern Territory) Act (ALRA) was forwarded to the relevant Federal Minster for her consideration. An ALRA Section 46 application to the CLC was also forwarded to the NTG.

The grant of ML 29494 by the NTG took effect on 21 December 2012 following the Central Land Council giving its consent to Grant of ML 29494 in July 2012 and after the Honourable Jenny Mackland MP consented to the grant on 20th September 2012, under section 45(b) of the Aboriginal Land Rights (Northern Territory) Act 1976.

Map 1 shows the 14k access track from near Areyonga to the ML 29494. This track is across Aboriginal Land and is controlled by the NT *Aboriginal Land Act* and the Commonwealth ALRA. The road into Areyonga and from Hermannsburg is also controlled by this two tier legislative system and penalties apply to those who are found without valid permits.

PHOTO 1. June 2016 view looking north east showing anticlinal cusp, dry creek bed and fly camp on top of old waste rock dump. Third truck and sleeping tent is Professor Ray Grant and wife. Photo: Dehne McLaughlin.

The Operator under his Section 46 Deed is also required to apply for permits for him and workers at the commencement of the annual winter work program. The restrictions on travel across Aboriginal land (Ltalatuma Aboriginal Land Trust) and the rough nature of portions of the access track to the ML, are a serious deterrent for unauthorised people who wish to enter the ML. There are multiple signs at the turnoff from the Merinnie Loop Road to Areyonga advising of the need for a permit and applicable penalties, as well laws with penalties for bringing alcohol into the area. ML 29494 is a dry camp. The mine site camp is still vulnerable to theft as experienced in 2016 and precautions have been set in place.

The DME Mining Environmental Compliance Branch of the Department of Mines and Energy requested in its review of the 2016 EMP that additional photos be provided of the base of Waste Rock Dump (WRD) in relation to the creek channel. See Photo 1.

ML 29494 contains two of the main five habitat systems in Central Australia, namely the Desert Rangers and Associated Foothills of the Gardiner Range and to a lesser extent, Riverine Woodlands. Map 2, the Google air photo of the ML and Photo 1, shows individual upper story trees by the creek watercourse and on steep rocky ridges. *Acacia aneura* grow on hill sides. Alongside the narrow creek, upper story *Eucalyptus camaldulensis* and *Corymbia aparrerinja* (i.e. the Ghost Gum) are present, typical of the Riverine Woodland habitat.

Soils containing organic carbon and clay are shallow and are dominated by broken rock fragments and large rock outcrops. Small drainage channels have a red quartz sand component resulting from erosion of the dominant sandstone lithologies in the ML area.

In respect of hydrology and water supply, the project within ML 29494 is located in the arid Central Australian environment. The mineralisation high up in the side of the hill within the adit is located above the water table. This is proved by rains in past years that have caused water to run along the floor of the adit down the adit length to the end of the drive, where it eventually soaks away to a lower level. Note that the adit does not drain out into the surface environment. The floor of the adit slopes gently downwards at 5 degrees following the slope of the footwall sandstone and the dipping east north east anticlinal cusp.

The creek bed beside the adit as seen in Photo 1, which is topographically much lower than the adit, does not retain water after rain. The creek flowed the length of the valley in June 2010 during a significant upstream thunderstorm. There was a local flow in 2013 but the water did not reach more than 3 kilometres downstream. No groundwater has been observed in the form of springs, in the adit or from bores in the region. There are no bores in ML 29494 or the surrendered surrounding EL. All water for the project is bought in from Alice Springs by two 4WD vehicles in 10 and 20 litre containers 160 litres at a time for each field expedition.

Fire is by far the most significant agent of environmental impact in the vicinity of the mine followed by feral animal impacts.

Photo 2. An azurite sun cluster on 27 cm wide plate from 2014 mining. Photo Dehne McLaughlin.

The old waste rock dump was measured up during the 2013 field season to gain a perspective on old (up to early 1970s) and new waste rock volumes from EL 9874 and ML 29494 activities in view of speculation from the Mining Environmental Compliance Branch of the Department of Mines and Energy that waste rock from the Project was dominating previous mine volumes. A volume of 6,326m^3 was calculated for the old WRD. This rock has two sources. Firstly, waste rock has come from the initial quarrying of the side of the hill with a large bull dozer (D7?)

where the previous miners created a bench from which to commence tunnelling on the kaolinite lens containing visible azurite. The second, lesser source, was waste rock from the adit excavation placed over the quarried waste rock. Photo 1 illustrates the physical size of the old WRD.

The $23M^3$ of mined rock placed on the WRD, from 2013 mining, allowing for an expansion factor of 40%, would have added $32M^3$ of rock to the WRD. I.e. 0.5% of the volume of the WRD. Hence waste rock placement from the mining operation will continue to use the top of the old WRD and avoid any need to go beyond the old WRD footprint. Approximately $25M^3$ of waste rock was mined in 2016 and most of this was placed on the WRD with lesser amounts left as backfill against the right hand side of the Up Dip Drive face.

Map 1 showing the underground workings has been upgraded for this annual report.

1. GEOLOGICAL SETTING AND MINING HISTORY AND EXPLORATION/MINING RATIONALE.

Unique geological circumstances have come together at the Malbunka Copper Mine to produce the azurite suns. The mine is located in the Namatjira Formation (also referred to as the Eninta Sandstone). Now included as Arumbera Sandstone (Edgoose 2013). The formation is a mixed carbonate and clastic sequence with sandstone, carbonate mudstone and shale and has a very limited extent in the Gardiner Range anticline which is part of the Amadeus Basin. The Amadeus Basin succession is a sequence of marine and terrestrial sediments deposited from the late Precambrian to the Devonian. It was uplifted starting in the late Devonian and faulted and folded in a major compressional event i.e. the Alice Springs Orogeny. Some authors such as Dyson, advise halo tectonics was active early in the basin history before and during Cambrian deposition of the Arumbera Sandstone. This understanding of the basin is supported by current research and field data at the azurite mine. Current drafting I have presented in a research paper in respect of addressing time constraints on the azurite mineralisation is:

"*Our field and laboratory studies demonstrate that the structural preparation and deposition of the copper carbonate happened at a depth adequate enough to provide an anticlinal structure and cap to create an overpressure environment in consolidating sediments undergoing dewatering.*

The deposition of the copper carbonates in a classic anticlinal environment at depth subject to an overpressure environment during sedimentary dewatering may not fit into the current orogenic history of the Amadeus Basin. It is difficult to expect the conditions described for mineralization to wait 100 to 200Ma for the Devonian Alice Springs Orogeny to fold and fault the Arumbera sandstone. We consider our field evidence and research demonstrates that folding and basinal fluid flows associated with salt tectonics was already occurring during sedimentary pile consolidation. Girardi notes that Lindsay 1987 attributed pervasive seismite structures throughout the Arumbera sandstone from seismic shaking due to tectonic movement from a large bounding normal fault on the southern flank of the Amadeus Basin. ie the depositional regime was dramatically active.

Furthermore, Dyson et al (2005) says

"that the earliest onset of salt tectonics in the Amadeus basin …influenced sedimentation from the base of the Aralka formation to the Arumbera Sandstone in the Benstead mini basin".

These authors make a case for the onset of syn-depositional diapirism for the basin in general at least as early as 700Ma when it was contemporaneous with the deposition of the Arumbera Formation.

Later uplift during later orgoneny/s following deposition of the copper mineralization in the Arumbera Sandstone only served to exhume the deposit. Hence mineralization occurred in the early Cambrian corresponding with the end of the Petermann Orogeny as illustrated in the Stratigraphic succession of the Amadeus Basin shown in Figure 23.2 of Edgoose CJ (2013).

Hence the above noted cupiferous nature of the Arumbera Sandstone throughout the Amadeus Basin points to a dynamic copper enrichment event in these sediments that in respect of potential significant concentrations of copper can be targeted using several lithologies (sandstone and clay) and antiforms. Salt withdrawal structures such as diapirs can be assumed due to the prevalence of a high volume of salt minerals in the Gillen Member across the basin".

The Namatjira Formation is labelled late Precambrian to early Cambrian age and the lateral equivalent of the Arumbera Sandstone, as described by Warren (1995). The Arumbera Sandstone is part of the east-west trending anticlines in the basin, often complexed by thrusting. Erosion along the crest of anticlines leaves long valleys bounded by anticlinal limbs. This geomorphological arrangement is anomalous in relation to uniformitarian expectations and suggests a hydrological planation event not observed under current global weathering processes.

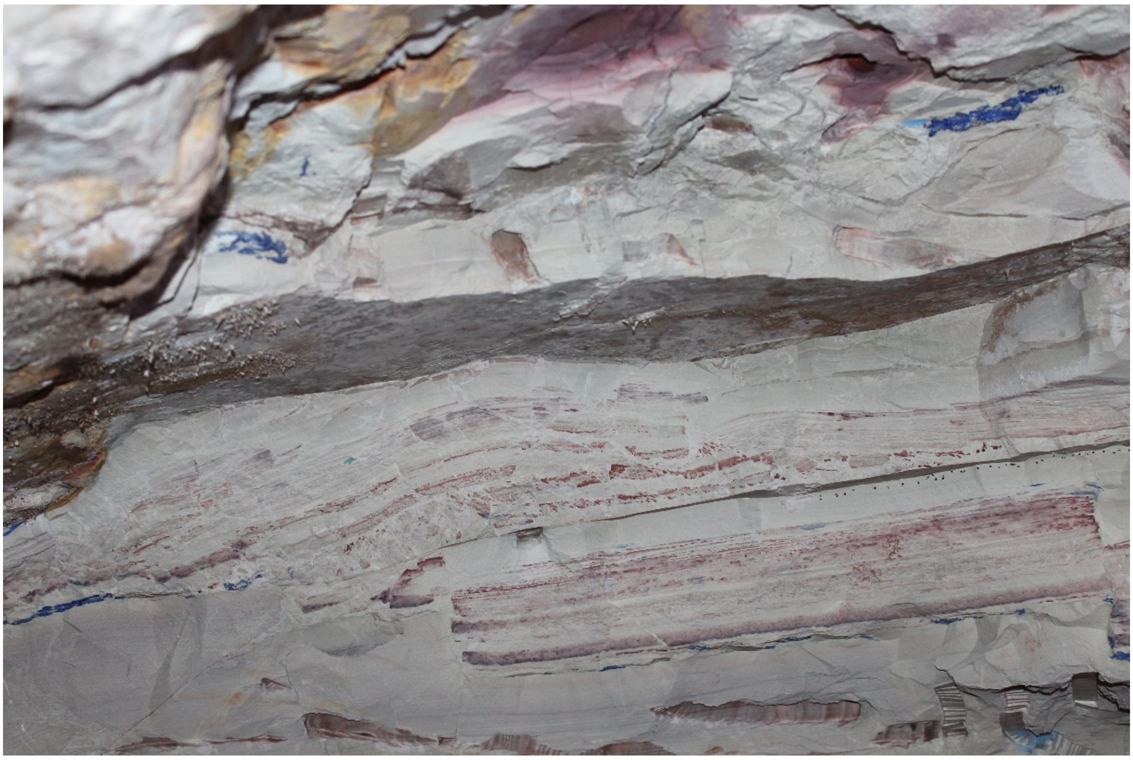


PHOTO 2X showing visible thrust plane and thrusting of a sandstone lens within the kaolinite with a measured 66cm shortening of the sandstone. A second visible thrust plane is present in the hanging wall face.

See Map 3 Google air photo.

Photo 2A. Sandstone seismites below a thrust faulted contact. Thrust direction is from RHS of picture to LHS as determined from clean underground exposures of the thrust shown in Photo 4. Photo-Dehne McLaughlin**.**

The arkose that forms one of Australia's natural monuments, Ayers Rock (Uluru), 180 kilometres to the south west of the mine, is said to be the equivalent of the Arumbera Sandstone (Laurie et al 1991).

The Gardiner Range longitudinal thrust fault of about 50 miles extent, passes just north of the mine and appears dramatically in large brecciated outcrops in the creek by the trackside west of the mine. Dyson et al advise: "*A seismic section through the Gardiner Range Anticline …showed a major thrust with over 5 km and 20 km of vertical and horizontal displacement respectively*." The Amadeus Basin sequence, based on 1985 deep profile seismic work, is a maximum 10 kilometres thick and overlays multiple complexes of metamorphic rocks of the Arunta Block. (Warren 1995). Thrusting is pervasive in the mine and in the vicinity of the Project as it is normal for boulders in creek beds near the mine to express slickenside surfaces.

The Arumbera Sandstone is copper bearing over a wide area. In Ellery Creek about 100 km from the mine, outcrops of the Arumbera contain traces of malachite, covellite, chalcocite, and possibly chalcopyrite and cuprite (*Freeman, Shaw, and Offe 1987*). *Laurie, Nicoll, and Shergold (1991)* reference kaolinite in the Arumbera Sandstone Sandstone in their 70 page field notes but make no association with the copper mineralization other than to point out the Arumbera Sandstone is cupriferous. Also, Cambrian petroleum reservoirs, particularly in the Arumbera Sandstone, have been an exploration target in the eastern Amadeus Basin (*Marshall et al 2005*), Uranium deposits have been found close to Alice Springs in roll front type deposits up sequence from the Arumbera Sandstone. It is postulated that basin brines driven by halotectonics are the source of the copper. Recent research is giving substance to this linkage.

Thin sections of the sandstone carried out for the writer, indicate the quartz grains were deposited in a turbulent environment with a short travel time (but not necessarily short distance), indicated by the lack of rounding of the grains (the whole basin can be interpreted in catastrophic terms). Authigenic overgrowth of the quartz grains is not evident in thin sections. Identifying the fine groundmass is difficult in the thin section and macro observations are more helpful in showing that kaolinite forms a part of the sandstone matrix.

At the mine the azurite suns are found in a limited and heavily faulted kaolinite lens up to 2.5 metres thick bounded below and above by grey clay rich sandstone. The sandstone as seen in Photo 2A exhibits recumbent folds and flow structures commonly encountered in Arumbers sandstone across the basin.

The kaolinite rich lens exhibits soft sediment deformation features such as sandstone and clay injectites, complex injectites (Photo 3A ,3B and 3C) and hydraulic fracturing. The clay lens has the appearance of a channel deposit and the kaolinite shows bedding structures. The kaolinite is not the original clay deposited on the sandstone as the precursor clay has been altered by hydrothermal fluids. Underground, the lens thins to the northeast at the end of the adit 42 metres in to less than 1 metre[1] and thins down to less than 2 metres southward down the blue fern decline (a decline commenced in 2009 and now forming the locus from which new mining drives have been extended).

The lens does not outcrop to the east or south in the side of the hill, indicating its limited extent. However, 2016 mining in the Adit Drive suggests the lens may not outcrop to the east simply because it continues underground down dip along the cusp of the anticline. The overlying sandstone, as viewed along the ceiling inside the adit, has slumped and down faulted in many places into the kaolinite lens forcing the kaolinite to flow into channels and corners in the sandstone. The shape of the lens is complicated by numerous small scale faults and thrusting as seen in Photo 4 that shows a horst and graben structure due to shock deformation of the clay where the kaolinite has behaved as a thixatropic substance. The hanging wall contact of the clay/sandstone lens with the silicified sandstone is defined by one or more thrust planes eg Photo 2X.

This kaolinite lens is located in the crest of an anticline, labelled the Gardiner Range Anticline in Cook (1968). The anticline containing the adit, dips gently to the north east. The central pillar at the entrance to the adit sits within the anticlinal crest and the adit heads east, ending slightly off centre of the anticlinal crest in the south limb of the anticline.

[1] This is correct but 2016 mining showed that this was not an azurite mineralisation constraint. See below for further analysis.

2016 mining in the Down Dip Drive (DDD) and in the Adit Drive (AD) demonstrated that sandstone lenses in the kaolinite lens thickened over a short distance. An injectite bed opened up in 2014 in the DDD (See Photo 3C) thickened in the DDD over the short new tunnel distance of 2.4 metres and was encountered in the Adit Drive towards the end of the 2016 mining campaign. Azurite mineralisation was strong in both drive faces and Lo, L1, L2 and L3 azurite layers were present. Atacamite, malachite and chrysocolla mineralisation increased dramatically in the injectites in the Adit Drive. See Photo 3 below…………………………………………………

Photo 3. Malachite and Atacamite in vugs surrounded by a chrysocolla rim. From Adit Drive Trip 7. Photo width is 14cms.

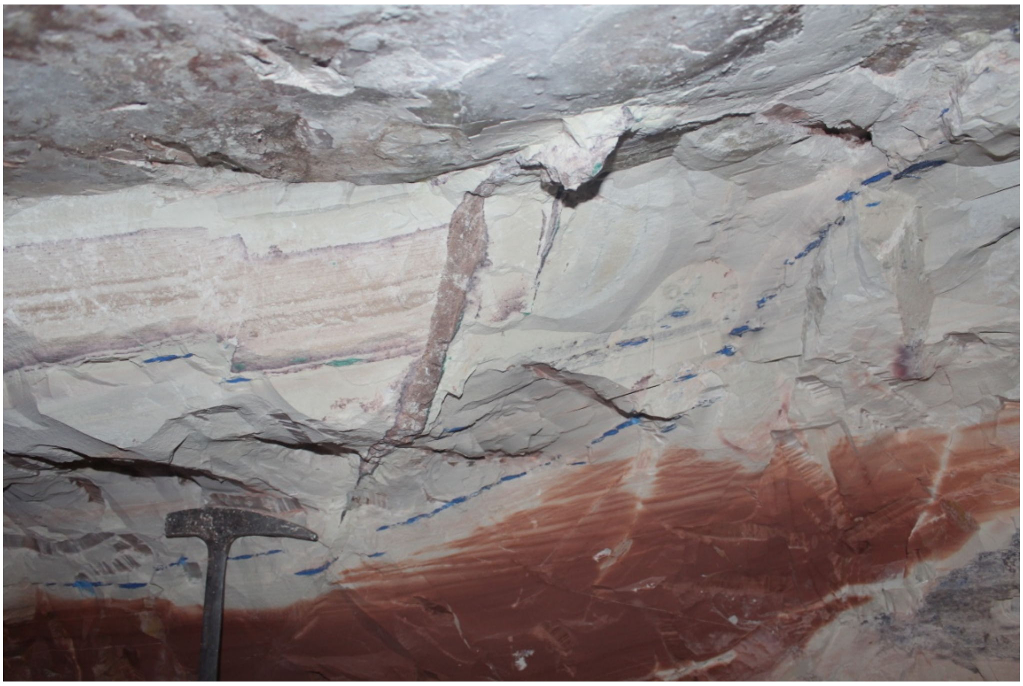


PHOTO 3A. Sandstone injectite penetrating into kaolinite along micro faulted sandstone bed observed in 2015 field season.

PHOTO 3B. Clay injectite streamers penetrating clay in 3D and preceding azurite and malachite mineralisation.

See Photo 3C for latest injectite exposures.

Copper mineralization, mainly in the form of azurite suns and minor malachite is evident in bedding planes, soft sediment flow planes, vertical fractures and to the side of vertical fractures in the kaolinite. The azurite is at its highest concentration within 30 cms of the upper sandstone in a series of up to five horizontal thin layers. In the layer closest to the upper sandstone large diameter azurite specimens are found, sometimes in direct contact with the sandstone (the L3 layer). Ceiling channels created by bulging of the sandstone into the kaolinite along the strike of the anticline can contain three dimensional nodules of quality crystalline azurite. Azurite suns and nodules are found occasionally in the lower sandstone and as large (< 25 cm) light blue discs in iron oxide rich kaolinite near the floor.

PHOTO 3C. Spectacular 15cm wide lens of brecciated sandstone and kaolinite that stratigraphically underlies the main kaolinite lens in the DD Drive.

Hence, copper bearing fluids penetrated in volume into the upper and lower layers of the kaolinite lens but of lesser volume into the central portions where the kaolinite is at its thickest. The off white colour of the kaolinite in the azurite rich portions of the mineralized bed is due to micro (x200) particles of iron oxide and lesser micro azurite in the rock (Australian Museum SEM and petrologic thin section work for the author). Higher concentrations of iron oxide discolours the kaolinite for at least two thirds of the bed's vertical height. Atacamite and chrysocolla are present in sandstone above and below the kaolinite. The atacamite is found in fractures and joints in the sandstone.

Photo 4. Two metre high 2013 drive face showing, red and white kaolinite, thrusting (thrust plane is black line) and compression structures. Blue azurite can be seen in seams close to hanging wall (L3 layer). Drive face is up and parallel to anticlinal axis dip. Photo Dehne McLaughlin.

An enigma exists in the kaolinite, namely the pervasiveness of plentiful 20 to 40 micron size euhedral tourmaline crystals in solid extracts from white (bleached) and red kaolin. Combined with the X10/seawater ratio of boron in the fluid inclusion study, an explanation of the kaolin formation and the azurite appear to be a part of the same geological processes that gave rise to both. Until 2013, theorising copper mineralisation pathways to the kaolin lens have been a frustration in respect of explaining how tourmaline mineralisation and copper oxide minerals arrived at their current location. Diagnetic tourmaline from the mine has been mounted and subject to SEM study by Erik Melchiorre and will be covered in the above advised 2016 publication.

Field work in 2013 inside ML29494 delineated an ~1 metre wide near vertical crush/fault zone containing malachite and possible cuprite/tenorite infilling spaces between fist size blocks of sandstone in outcrop immediately below the south end of the WRD. This mineralised structure appears to have been a suitable conduit for conveying copper mineralisation into the kaolin in the cusp of the anticline. In the 2015 report I advised "*There remains an issue as to whether the oxide minerals in the fault were originally in sulphide form. This will be matter for further research. Detection of the fault helps explains the presence of large boulders containing copper oxides in the creek just below the WRD*".

Photo 5. Copper oxides cementing spaces in brecciated sandstone in fault detected in 2013. Photo Dehne McLaughlin

The Department was advised in the 2013 annual report in an extract from an e mail from the writer to DR Melchiorre that:

"The Fluid Inclusion study does support the theory that copper mineralisation is associated with oil field type formation fluids, driven in this case by halotectonics. Boron is plentiful as brines from salt formations have mingled forcefully with overlying formation water as salt withdrawal produced the regional folding, thrusting and heavily brecciated faults now seen at the mine and within 3 k of the mine. The fault melange 3 k near the mine is a fault marked on the Geological map for the area and clearly exposed in the main creek bed draining the valley.

If the tourmaline was postulated to be the source of the boron in the fluid inclusions, the copper mineral depositing fluid would have had to corrode the micro tourmaline in the clays. I saw no evidence of corrosion of tourmaline in the separations I did earlier this year.

A more likely scenario which we have discussed previously is that the mine fault was initially the conduit for the initial injection of hot boron rich fluids into the clay lens giving rise to tourmaline and kaolin, followed by a temperature drop favourable to copper oxide mineralisation. I see the small scale structural deformation (faulting and thrusting-up to 1 foot dislocations) in the kaolin lens as a part of the larger structural picture of anticline formation, faulting and thrusting event that is driving fluids into the mine fault and scavenging copper from the sedimentary pile. Copper minerals preferentially concentrate in the small scale deformed areas within 1 metre of the hanging wall. Azurite occupies fault joints and bedding/slip plains, as in the attached photo. I have azurite specimens that have been split/dragged/dislocated during crystallisation by small scale faulting of the type you see in the attached photo. I.e. fluid injection, mineralisation and faulting were a part of the same overall event. You can see *somewhat why I maintain a complex but one frame "movement picture" of the large and small events we are trying to piece together. "*

The above hypothetical model has moved forward as the question over high temperatures needed for tourmaline formation now has some answers.

2015 to 2016 STRUCTURAL ANALYSIS in RELATION TO GEOLOGY AND MINERALOGY with accompanying photos. (extracted from paper to be published in 2016-2017 by major authors Eric Melchiorre and Dehne McLaughlin and others).

"Copper carbonate minerals at Malbunka have been divided into three groupings for the purpose of this study. The most common occurrence of azurite is a discoidal form, comprised of numerous small flat crystals of azurite arranged in radial and concentric forms. These disks occupy bedding planes, relic thrust fault planes, and joints in the white and less commonly in the red kaolinite-dominated clay host rock. These disks occasionally display inter-bedding relicts of the original clay host. Dark blue azurite disks are relatively free of solid-phase mineral inclusions, but do contain fluid inclusions. The colour of the light blue azurite disks is caused by incorporation of fine white clay interstitial to micro-azurite crystals during crystallization.

Azurite is also noted in lesser abundance as more equant or spheroidal crystal clusters. These clusters form from the radial growth of terminated azurite crystals from a central nucleation point. These clusters of azurite crystals are quite similar to the azurite disks, with the exception being coarser crystal size and more 3-dimensional form. Malachite is much less common, and is found as either finely-crystalline masses often with a lobate spheroidal to discoidal form, or rarely as pseudomorphous replacements of azurite. The observed paragenetic sequence is microcrystalline azurite disks, followed by azurite crystal cluster nodules, followed by malachite.

The clay-rich sandstone which forms both the upper and lower boundary of the azurite-bearing clay, and even the clay bed itself, contain abundant sediment deformation features such as recumbent folds, slumping, micro-faulting, and flow structures (Figure 7) that may be injectites or seismites caused by earthquake shock during sedimentation (e.g., Shi, Du, and Gong 2007). Many of these soft sediment injection structures are difficult to see in the field, due to a lack of contrast between the shades of off-white clay involved. (but see Photo 3B).

There is ample evidence that copper bearing fluids penetrated into the upper and lower layers of the kaolinite lens next to the sandstone, and to a lesser extent into the central thickest part of the kaolinite (Figure 7c). Azurite disks and other forms of copper carbonate are observed forming directly adjacent to fluid flow structures. Thrust planes are common in the hanging wall area of the kaolinite lens where imbrication structures are evident over distances of several meters. Thrusting preceded copper mineralisation and continued after the mineralising event, which along with the injectite events, demonstrates the dynamic environment under which most of the mineralisation took place.

4.1.1 Injectites

Three distinct over-pressure events, characterized by injectite structures, have been identified within the kaolinite lens (Figure 7). These events followed shock induced sediment slumping of sandstone and kaolinite (Figure 7a). The first event was characterised by eruption of streamers of white clay into higher levels of the kaolinite lens. Injectites from this event are difficult to see in the field, due to the lack of contrast in the off-white layers but upon lab cleaning become quite clear. (Figure 7b).

The second event is characterised by hydraulic fracturing of the kaolinite close to the hanging wall and the opening of vertical fractures in the clay followed closely by crystallisation of azurite (Figure 7c). Azurite cementation of hydraulically-fractured kaolinite is also noted (Figure 7d).

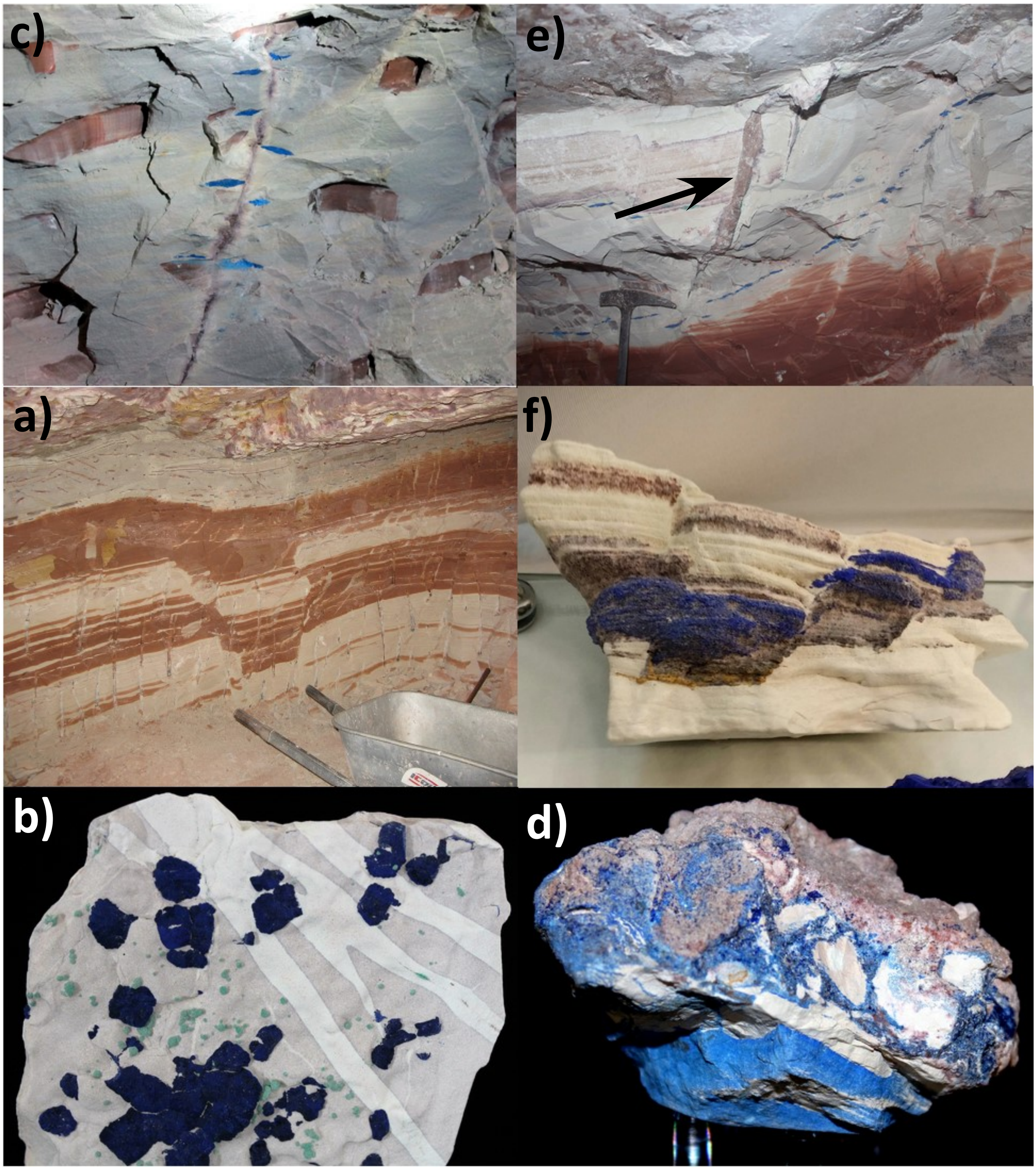
The third event consists of sandstone injectites penetrating into the kaolinite from the hanging wall (Figure 7e). Injectites associated with this event deform pre-existing azurite which has crystallised in the plane of relic thrust faults (Figure 7e, note azurite layer offset by the injectite near the tip of the pick). Late-stage micro faulting occurs during this phase (Figure 7f). Malachite is present along the edge of the sandstone injectite, suggesting formation late in the paragenetic sequence.

Structures associated with these events indicate that fluid pressures built up and were released explosively at least three times within the deposit. If the structures were purely a response to shearing or compressional forces, the kaolinite would have flowed and smeared like plasticine and not formed sharp vertical contacts with randomly-oriented clay and sandstone fragment inclusions. The hydraulic overpressure events required to produce these structures within a sedimentary sequence are not near surface phenomena suggesting azurite formation is not related to passive near surface copper sulphide oxidation events that normally precede azurite crystallisation.

These types of injection structures may be seismites, which record seismic activity associated with basin dewatering and compaction (e.g., Seilacher, 1969). These same structures are noted for deep sediments within petroleum basins around the world (e.g., Thompson et al., 2007; Kane, 2010).

4.1.2 Resemblance to fossils

The possibility of the azurite disks representing Ediacaran fauna (Figure 6) has been discounted by field evidence. While the rocks at the Malbunka deposit are of appropriate age, the form of the proposed fauna represented (Dickinsonia costata and Aspidella terranovica) is inconsistent with the azurite disks. For example, while D. costata is often of appropriate size, it commonly displays an elongate form with bilateral symmetry unlike the uniformly round azurite disks. Similarly, A. terranovica has superficial features that are similar to the azurite disks, such as concentric rings and centripetal rays. The inferred remnant of a holdfast stalk (e.g., MacGabhann, 2007) on *A. terranovica, evident as a raised central pimple, is also present on some azurite disks. However, the size of most A. terranovica specimens is much smaller than the azurite disks, at only 0.4 to 1 cm (e.g., Narbonne, 2005). Population densities for these fauna are also inconsistent with observed densities of azurite disks (Figure 2d). These is also structural evidence that the azurite disks are not fossils, namely that they are occasionally observed to incorporate relict bedding structures, and cross-cut bedding along joints. And while an Ediacaran organism, Arumberia banksi, has been reported for local rocks interpreted to be the lateral equivalents of the Namatjira Formation (Glaessner and Walter, 1975), it was later re-interpreted as having formed from the action of currents on a cohesive muddy substrate (McIlroy and Walter, 1997)."*



2. MINERALOGY

Azurite. $Cu_3(CO_3)_2(OH)_2$ Azurite is the most common copper mineral found at the mine. Light to deep blue suns normally from 2.5 to 12 cms in diameter and rarely reaching 11 inches in diameter have crystallized in the white kaolinite host rock. Azurite pieces are also prolific through the waste rock dump. The most ascetic specimens are those where the azurite suns are found sitting adjacent to each other and distributed evenly across the matrix. The sharp contrast of azure blue against the off white kaolinite matrix can be alien to collectors, as the level of contrast is rarely encountered in natural geological systems. Light blue suns owe their colour to incorporation of fine white clay between micro azurite crystals during crystallisation.

The challenging question is why is the discoidal habit persistent through the deposit? Sullivan (1979) notes that; "*Several experts have expressed the opinion that they are azurite replacements of a form of marine life or algae*....."

Warren and Shaw (1995) advises that; *"The lower Arumbera sandstone has yielded specimens of the soft bodied Ediacarian fauna and there is a diversity of trace fossils in the upper Arumbera Sandstone."*.

Some fossil dealers in Australia, 32 years on from Sullivan's note, maintain the azurite is replacing fossil material and market purchased specimens as such. Horizontal malachite strings potentially replacing fossil burrows have been noted from one section of the mine in a clay-quartz matrix. Laurie et al (1991) notes there have been 30 ichnospecies exhibiting horizontal and vertical burrowing found in the Arumbera Sandstone.

The writer's view (*Grant and McLaughlin 2012*) is the discoidal form of azurite, also recently noted in malachite, are concretionary growth structures arising from low temperature hydrothermal activity. They are the equivalent to the concretions found at many other localities in Australia and overseas, except that they have grown outwards along preferred planar structures in the kaolinite matrix or between the sandstone and kaolinite. Other global azurite concretion localities are mainly in kaolinite fault gouge with no planar structures hence the rounded form. Supporting evidence for the concretionary growth is the concentric growth features in specimens, the linear deformations in the faces of the suns due to growth expansion in a constricted space, triple point junctions where growing suns have met each other, the location of suns in vertical joints and bedding replacement by azurite nodules in small sandstone lenses within the kaolinite.

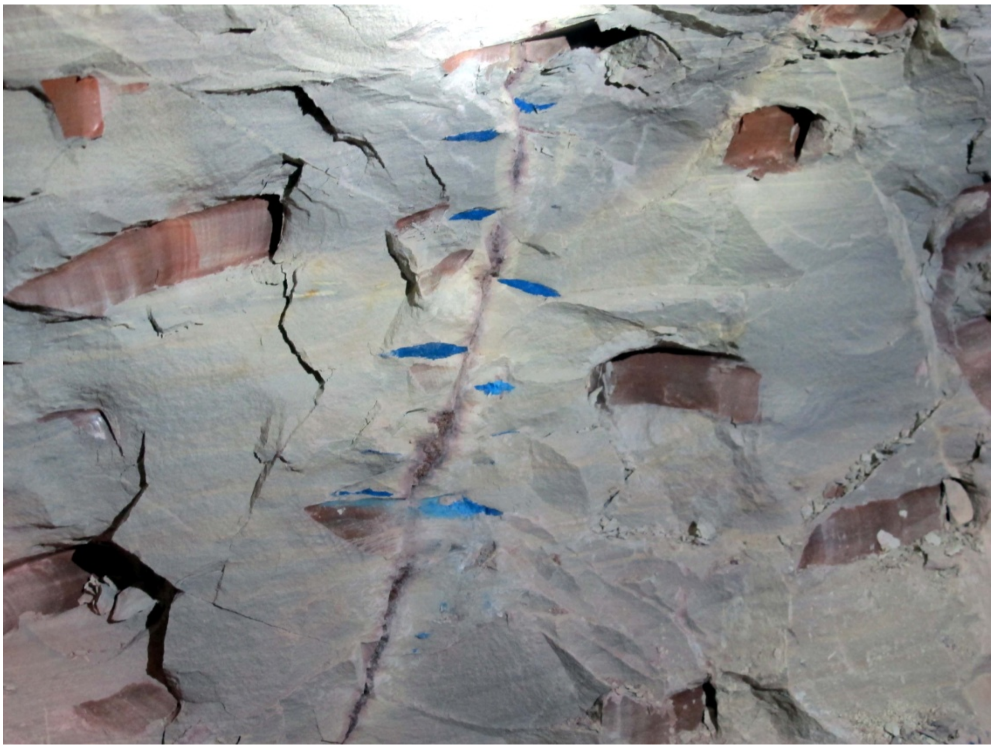


Photo 6. Near vertical fracture 5mm wide with fringe bleaching (hydrothermal alteration) and associated copper carbonate discs to 6cm in cross section. Photo Dehne McLaughlin.

The relationship between past hydrothermal activity and the spatial distribution of the azurite into layers, channels and beside bleached vertical fractures, negates the fossil replacement proposition. E.g. see photo 6 above. This type of field evidence forms a part of the argument that we are dealing with "primary" azurite formation, not the standard passive downward oxidation-leaching-deposition of azurite associated directly with copper sulphide ore bodies.

Occasional azurite "balls" have been found in discordant areas during exploration in 2011 in a semi circular joint in the decline. This joint that was discordant to the standard mine horizontal azurite layers of L1, L2 and L3, produced a range of high quality azurite ball specimens. The reason the azurite balls formed is there were no preferred bedding or slip planes to physically constrain 3D growth of the azurite. However, given the dominance of the discoidal form in the mine, why weren't curved discs formed in curved joint?

The genesis of the azurite suns has some parallels with the flat pyrite discs from black shale within the Illinois coal measures. Unlike the pyrite suns, the azurite suns and matrix are stable under atmospheric conditions. Twenty five year old azurite in kaolinite matrix specimens even in a tropical climate show no evident deterioration of the azurite or the kaolinite (Writers observations).

Our latest research suggests the discoidal form of the azurite is related to the response of the crystallising azurite under high hydraulic pressures.

Atacamite. Cu2Cl(OH)3 Although prolific in the upper and lower sandstone, atacamite is only found as fine crystals and small crystal tufts. Crystallization space in sandstone joints and fractures in injectite lens limits the size of the crystals-see Photo 3. At the start of the project before new waste rock was placed, atacamite was common on the highest part of the waste rock dump as the lower sandstone, rich in atacamite was the last rock mined in quantity from the end of the adit when 1960s exploration ceased. The specimens were remarkably preserved, indicating the stability of this mineral phase in a semi-arid environment.

Chrysocolla. Cu,Al)2H2Si2O5(OH)4•n(H2O)

This blue green mineral shown in Photo 3 above has only been seen in sandstone mixed with atacamite at the end of the adit both in sandstone underlying the kaolinite and in the floor of the bottom of the adit extended by exploration in 2009-2010 and in 2016. It is proposed that the chrysocolla formation is a result of oxidation of higher positioned azurite due to current ground water oxidation, dissolution and precipitation. Maybe.

PHOTO 7. NTG officers, Nigel Donnellan and Jay Carter with Dehne McLaughlin visit mine site in June 2016. Photo: Professor Ray Grant.

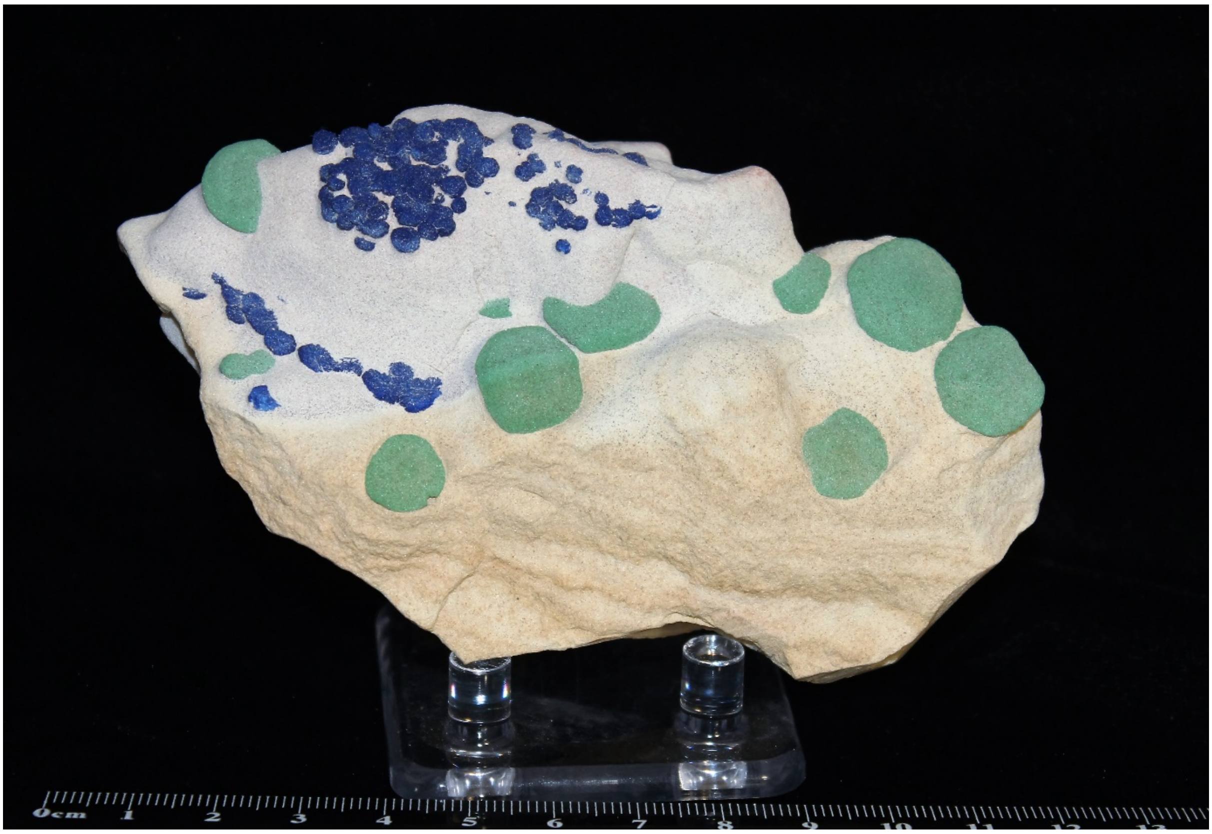


PHOTO 8. Primary malachite crystallising beside azurite. Published photo 2012 and 2016 pending. D McLaughlin.

Malachite. $Cu_2(CO_3)(OH)_2$ Three types of occurrences of malachite have been found. One is the replacement of azurite as in well known malachite after azurite psuedomorphs (rare at the mine so far), the second is small disks of malachite which are closely associated with azurite disks and do not appear to be an alteration of azurite (seen in down dip face). They are a primary expression. The third type is where groundwater has altered azurite and produced reaction rims degrading the host azurite and is common at the end of the main adit. Mining has ceased in this area in 2011 and recommenced in 2016. See Photo 8.

Calcite. Calcite occurs as grey coatings and micro spheres over azurite and along planes in the kaolinite in the right hand side of UDD face as of 2015 mining. Also occurs as white encrustations in the same area of mine.

Baryte. Occurs as small sharp off white crystals (<1mm) on azurite in the Adit Drive.

5 RESOURCES AND RESERVE ESTIMATION. A 2016 REVISION.

The extent of the resource target (high quality mineral specimens of azurite) is immediately defined firstly by the extent of the kaolin lens described above. The kaolin lens maybe contained within the ML and appears to be defined in the underground workings in 3 out of 4 directions. Auger drilling would be a useless tool to define the azurite resource within the kaolin. In small scale operations following esoteric collector values, actual mining is the most economic way of determining the extent of the resource. In 2015 I advised that

"The resource deteriorates in quality at the end of the adit, to the north of the adit wall and down dip after 9 metres from the old adit drive. Quality specimens potentially remain within the south dipping limb of the anticline within 7-9 metres of the anticlinal axis".

And

"the two open east-west faces are still producing quality mineral specimens and there may be at least 2 years of production remaining in these faces. The up dip drive is predictable, but the down dip drive less so. The longevity of the down dip drive depends on the kaolin lens remaining at least 1.8 metres thick. Thinning of the kaolin lens would require footwall removal of hard silicified sandstone and impact on the economics of the project. Further mining in 2014 will improve projections" .

My 2014 report advised *"Mining in 2014 showed there was a potential 12 metres left in the up dip mining drive and 9 metres potential in the down dip face. There is good reason to assume the up dip face will maintain high specimen quality. The down dip face has a lower level of predictability due to an oxidation front that may cut across the mineralised area and potential thinning of the kaolinite lens. Nevertheless reserves have improved based on the above measurements to at least 4 years and perhaps 5 years in the high quality specimen zones. In 2015 it is planned to expose a small part of the floor in the up dip drive to see if azurite mineralisation has permeated the footwall kaolinite".*

Mining in 2015 in the up dip drive exposed extensive detrimental calcification over much of the azurite suns.

Of the main L3 azurite bearing formation. L3 is the main commercial layer of azurite mineralisation near and at the hanging wall and any detriment in this layer affects the economics of the Project. Under a microscope the carbonate occurs as micro balls sitting on the azurite and often enveloping complete azurite suns. This is not good for commercial objectives as the carbonate is not easily removed without damaging the natural lustre of the azurite. Floor testing was postponed due to time and labour shortages. Reserves did not look good in 2015. A maximum of 2 years.

DRILLING TESTS in 2016

In 2016 floor testing or footwall reserve estimation was carried out in the up the UDD and the DDD by using a one metre auger drill powered by a 1000 watt Makita hammer tool. In the UDD there was no footwall sandstone azurite mineralisation encountered. Only kaolinite. The DDD was no different. It was expected that sandstone footwall would be encountered by less than 0.7 metres in both areas. The best explanation so far is that the kaolinite and its enclosed sandstone lenses had both thickened and/or were down faulted in these thickened areas of the mine. Down faulting is favoured as there are numerous faults exposed in the mine. The major visible fault runs back from the Adit Drive and for much of its distance has a down throw of 0.5 metres. The 0.5 metres of fault face that preceded mineralisation has acted as an area where azurite has concentrated before the copper rich fluids penetrated under the fault to deposit additional azurite in the kaolinite down the south limb of the anticline.

Floor testing in the Adit Drive development area suggested that sandstone footwall was close to the operating mining floor just above a lens of injectite material.

The Adit Drive was re-entered after a gap of 5 years as DDD mining located slightly down dip along the anticlinal south limb showed strong azurite mineralisation and thickening of sandstone beds within the kaolinite lens. The important lesson learnt from the DDD was that sandstone that had been encountered in the Adit Drive did not constitute footwall sandstone but was a part of the clay/sandstone lens. Despite the historic concern with oxidation of the azurite in the Adit Drive down the anticlinal crest, development showed there were areas rich in unaltered azurite worth pursuing. Testing of the Adit Drive southern wall towards the 0.5 metre down faulted area also showed good quality azurite. The azurite hue is lighter than the royal blue of the DDD mining faces but still has a high lustre.

Current proven reserves support an additional 3 years of mining with probable reserves of an additional 3 years. All these reserves are in the DDD and the Adit Drive area as pictured in the Plan 1 mine map.

Possible mineral specimen reserves are quite substantial if it is proven that mineralisation continues down the anticlinal crest to the east and kaolinite remains as a host rock in the cusp of the anticline. The formula is quite simple. Pathways for copper bearing fluids forced into the anticlinal crest with kaolinite host rock = azurite. The area of brecciation pictured in Photo 5 is not necessarily the only fault zone connected to copper oxide mineralisation in the ML. Map 2 shows a quarry area outside of the ML to the east of the adit that yields brecciated rock with copper oxides. It is quite possible the ML is underlain by a linear feature containing brecciated rock near to the anticlinal crest that acted as a conduit for copper bearing solutions that runs under or beside the length of the current Adit Drive to the vicinity of the quarry. This is also the view of several geologists who visited the site during the year. Although these type of projections do not make the Malbunka Project a potential industrial metal source, these extrapolations suggest a longer potential mine life for mineral specimens than originally projected at the completion of the exploration phase. The ML eastern boundary is well placed to allow legal access to any underground extensions of the mineralisation.

Hence 2017 mining is focused on extending the Adit Drive to see what happens to the mineralisation, the thickness of the host kaolinite and the structural characteristics of the associated sediments.

6 MINING

Mining is carried out using electric driven hammer drills driven by two small hand carried Honda 2KW generator. The generators also run two 40 litre Engel fridges at the fly camp.

A heavy 20kg Makita electric hammer is used to break up the drive face and waste rock is shovelled into wheel barrows for removal to the WRD. Once a vertical face is prepared, the kaolinite within 0.5 metre of the hanging wall is undercut by smaller specialised power tools to a slot depth up to 45 cms. This action creates a working bench on which to commence dropping down slabs of overhanging azurite bearing rock. This is specimen collection time and some care is needed to ensure specimens are not damaged during layer dropping. Specimens are preferably mined with matrix providing a backing to the azurite suns. Matrix type specimens sell better and travel better. A dedicated smaller set of hammer tools and wedges are used to mine the mineral specimens. Potential specimen material is sorted according to fragility and packed for transport by vehicle back to Alice Springs. Maximum size pieces mined are up to 70 by 45 cms.

Mine stability is maintained by leaving pillars to support the sides of drives and by placing timbers with spreaders in key locations. Square setting is not required.

Photo 8. Mining in 2014 at 90 degrees to the up dip drive showing support posts and spreaders. This area used for waste rock backfill in 2015. Photo. Dehne McLaughlin

At the mine and Alice Springs base accommodation, specimens are sorted into delicate specimens requiring truck/4WD transport and the more robust specimen material is boxed for freighting by removalists. At the end of the field season all the freight boxes are sent with a removalist to the Hobart processing base. Specimen preparation back in Hobart consists of using chisels to remove enclosing kaolin and water jet tools set at a range of impact strengths for the finer work. Specimen preparation is time consuming.

MINING IN 2016

The 2016 mining season (Trip 1) commenced by cutting a face in the DDD for the purpose of mineral specimen collection as the UDD had proved disappointing by the end of 2015 work.

There was field evidence in the UDD that solutions carrying copper had had problems in penetrating into the kaolinite in the area of the L1 and L3 layers. Hanging wall slumping and hanging wall sandstone injectites as depicted below in Photo 8A may have played a role in impeding fluid flow.

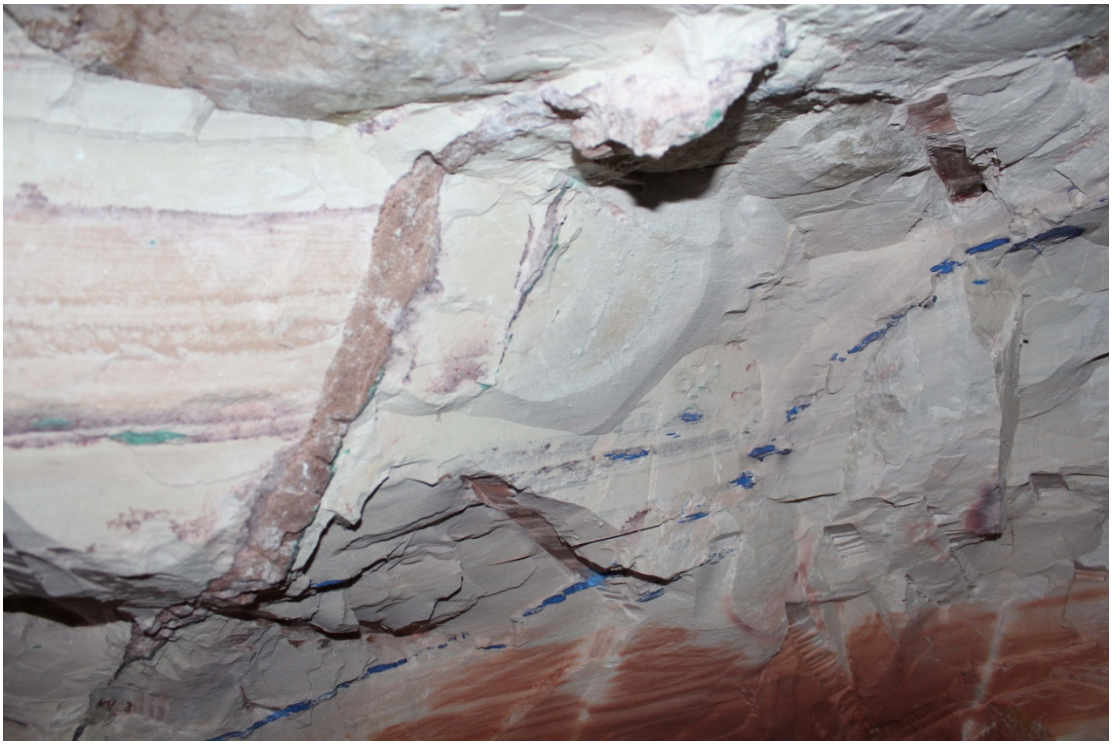


Photo 8A. Sandstone injectite penetrating into kaolinite. Structures here channel azurite mineralisation into a downward slope away from typical horizontal penetration.

There were 5 “cuts” of ~ 0.5 metres totalling 2.22 metres made into the DDD and quality azurite specimen material was collected.

Overall, approximately 25 cubic metres of waste rock was mined from the drives. Most of this rock was placed by wheel barrow on the WRD.

Azurite pigment material was collected in 2016 as in 2015. Prior to 2014 much of the low quality and broken azurite pieces went to waste rock or to storage in the mine. This material is extracted and washed for sale into the azurite pigment market. Production was 300kg in 2014 and in 2015 was down to ~130Kg due to L1 and L2 depletion in the UDD. Production in 2016 was 200kg. The pigment is used to restore old art works that used azurite as the blue base in medieval art works and Egyptian art works. It is also used by modern artists who work only in naturally derived paints. The sales of the azurite pigment material has helped mine economics. The mine is not worth working purely for the pigment material but forms a valuable by product.

7. EXPENDITURES

The grant of ML 29494 does not carry expenditure provisions or the need to make future projections. However, 2016 mining costs (both Admissible Expenditure and Real Costs) were similar to costs reported in the first annual report of ~$40,000.

The Malbunka project was operated out of Alice Springs over May, June and late July 2016. Mining and camp gear and two vehicles were ferried from Hobart to Melbourne. Seven field expeditions over May to July were conducted over 7 day periods. Eight day mine work schedules have been reduced to a maximum of 7 due to health impacts. Alice Springs is the location where laundering of mining clothes takes place, physical recovery from the labour of hand mining, cleaning and repair of field equipment, purchasing of new equipment, generator and vehicle fuel and food purchased for the following expedition, mailing obligations (eg timely bill paying), e mail and hard mail comms and specimen sample unpacking of mined material and repackaging for transport to Hobart.

The 2013 report provides numbers typical of 2016 mining costs. These numbers do not include overseas and Australian marketing costs of approximately $20,000.

The core activity comprised driving on the DDD and the Adit Drive on azurite sun mineralisation parallel to the anticlinal axis as illustrated in Plan 1. Working face driving, waste rock management, hammer drill undercutting, specimen collecting and packaging for transport were core activities.

2017 COMMITTMENTS

It is planned to operate the project again out of Alice Springs over May to July in 2017 and it is expected Admissible Expenditure and Real Costs will be similar to 2015 and 2016. Ie ~$40,000.

8. CONCLUSIONS

Although the Malbunka project is mining a relatively very small volume of copper mineralisation from a limited stratabound deposit, it is important for the Department to note that the copper mineralisation in ML 29494 potentially relates to classic models of large scale copper mineralisation. I reproduce the abstract to our coming paper:

The Malbunka copper deposit, located about 220 km west of Alice Springs, in the Northern Territory of Australia, may be a rare example of primary formation of copper carbonate mineralization. This deposit consists of unusual azurite disks up to 25 cm diameter, and lesser amounts of secondary azurite crystals and malachite. Carbon isotope values of the copper carbonate minerals are consistent with formation from groundwater-dissolved inorganic carbon. Oxygen isotope thermometry formation temperature estimates are 5 to 16°C above ambient temperatures, suggesting the copper carbonates formed at a depth between 0.3 and 1.6 kilometers in the Amadeus Basin. Azurite fluid inclusion waters are rich in boron, chlorine, and other elements suggestive of dilute oil basin formation fluids. In addition, presence of euhedral tourmaline with strong chemical zonation suggest that this was a low temperature diagenetic setting. The strong correlation of structures associated with hydraulic fracturing and rich copper carbonate mineralization suggest a strongly compartmentalized overpressure environment. It is proposed that copper carbonates of the Malbunka deposit formed when deep, copper-rich formation fluids were released upward by overpressure-induced failure of basin sediments, permitting mixing with carbonate-rich fluids above. This work bears directly upon exploration for a new type of primary copper deposit, through understanding of the conditions of genesis.

A revision of the Management Plan for the 2016 season is in progress. The MMP covers a wide range of environmental matters not covered in this specialist Annual Report.

The economics of the project have improved with the development of an azurite pigment market in 2014, thereby dramatically reducing the volume of broken and poor quality azurite that previously went into waste rock. However, mining the deposit for azurite pigment alone is not economic.

Mine reserves of specimen grade azurite are more optimistic than reported to DME in 2015. Mining in 2017 in the Adit Drive face will be important for assessing increases to the ore reserves and the production of mineral specimens. Floor testing by drilling in 2016 may have been an economic means of testing for footwall mineralisation but only served to demonstrate the elusiveness of the footwall in the parts of the mine amenable to testing. While hanging wall mineralisation has an optimistic future, the potential of the footwall in the south limb of the anticline still remains an enigma.

Dehne McLaughlin 20 October 2016

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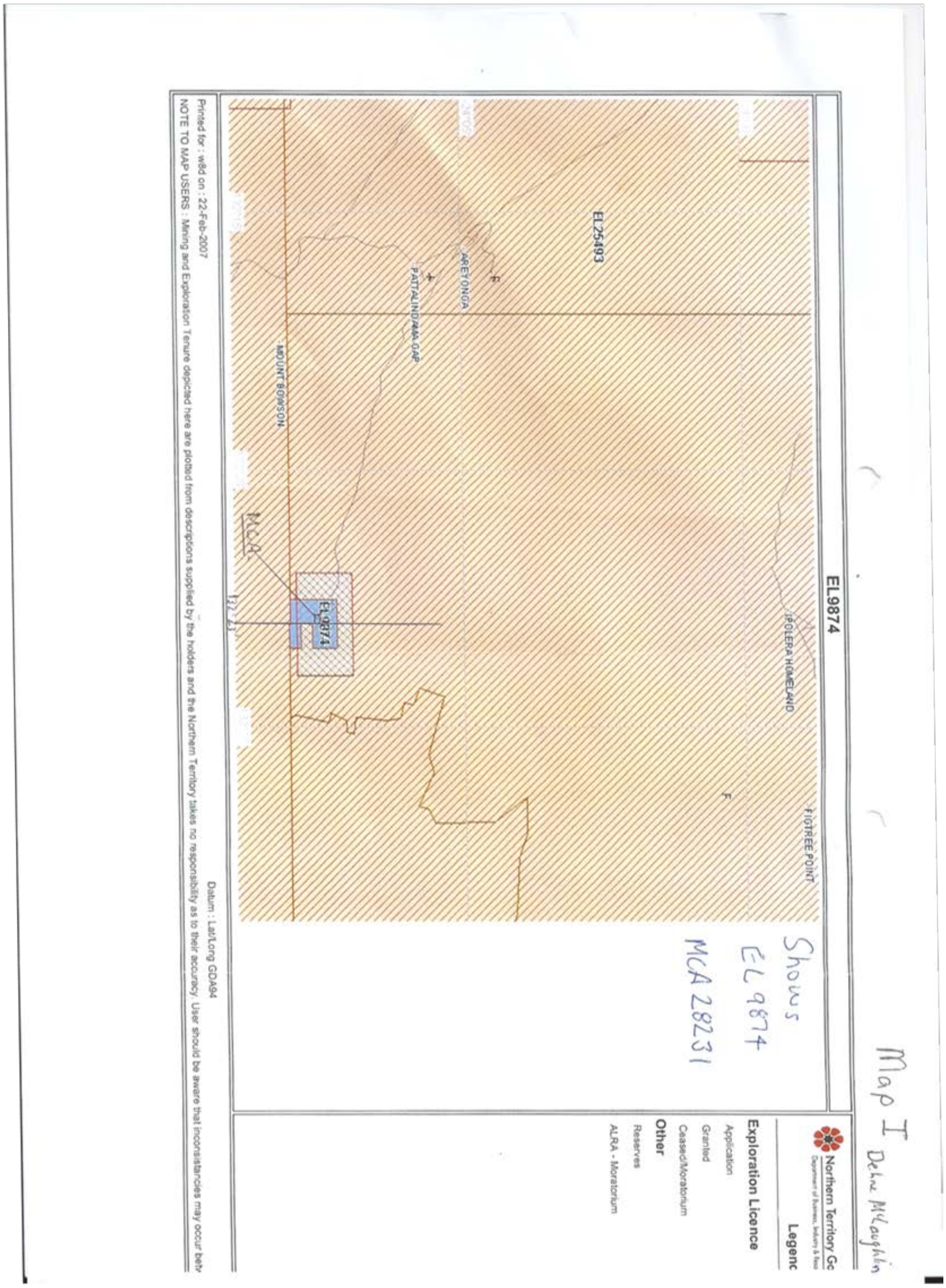
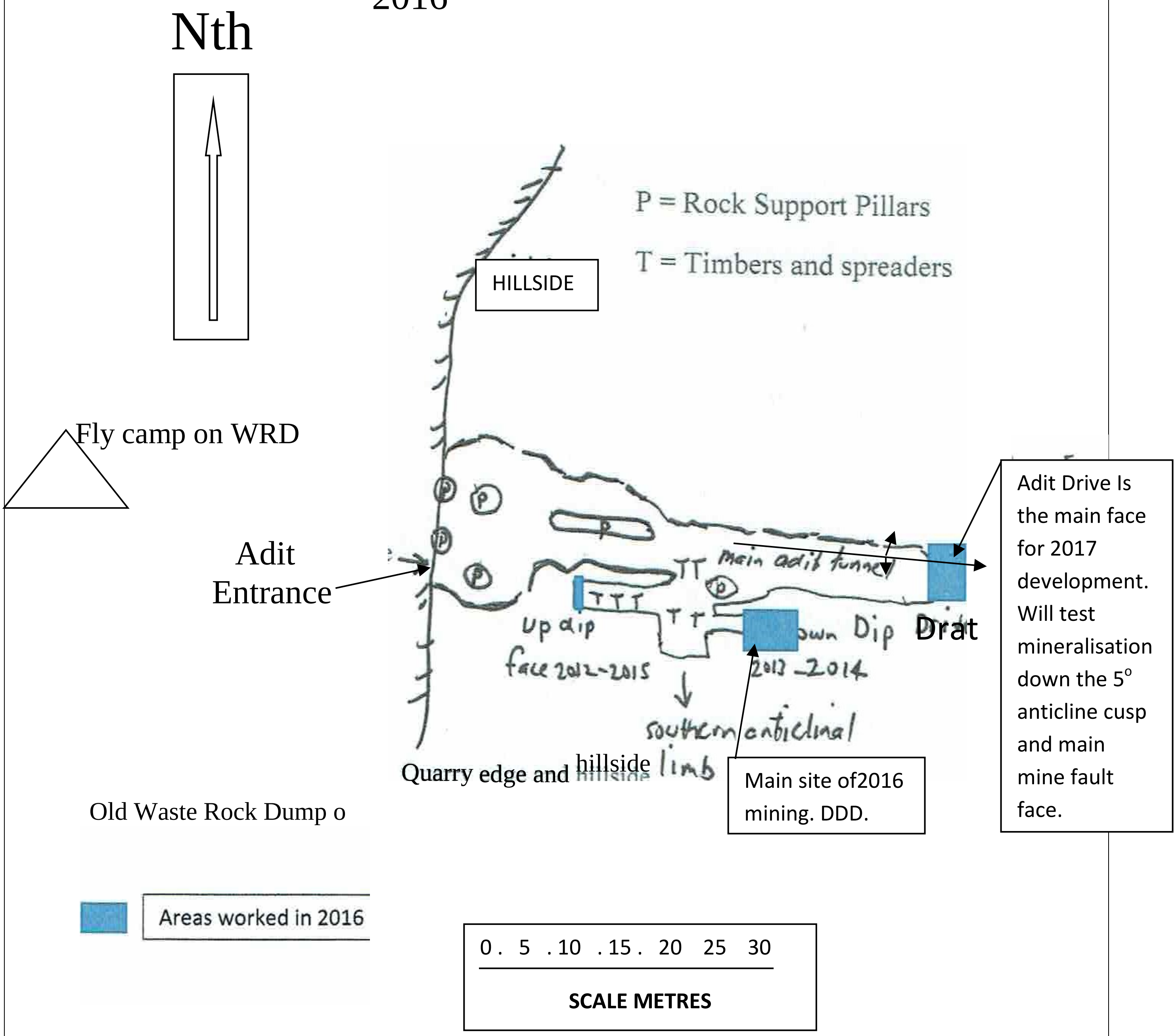


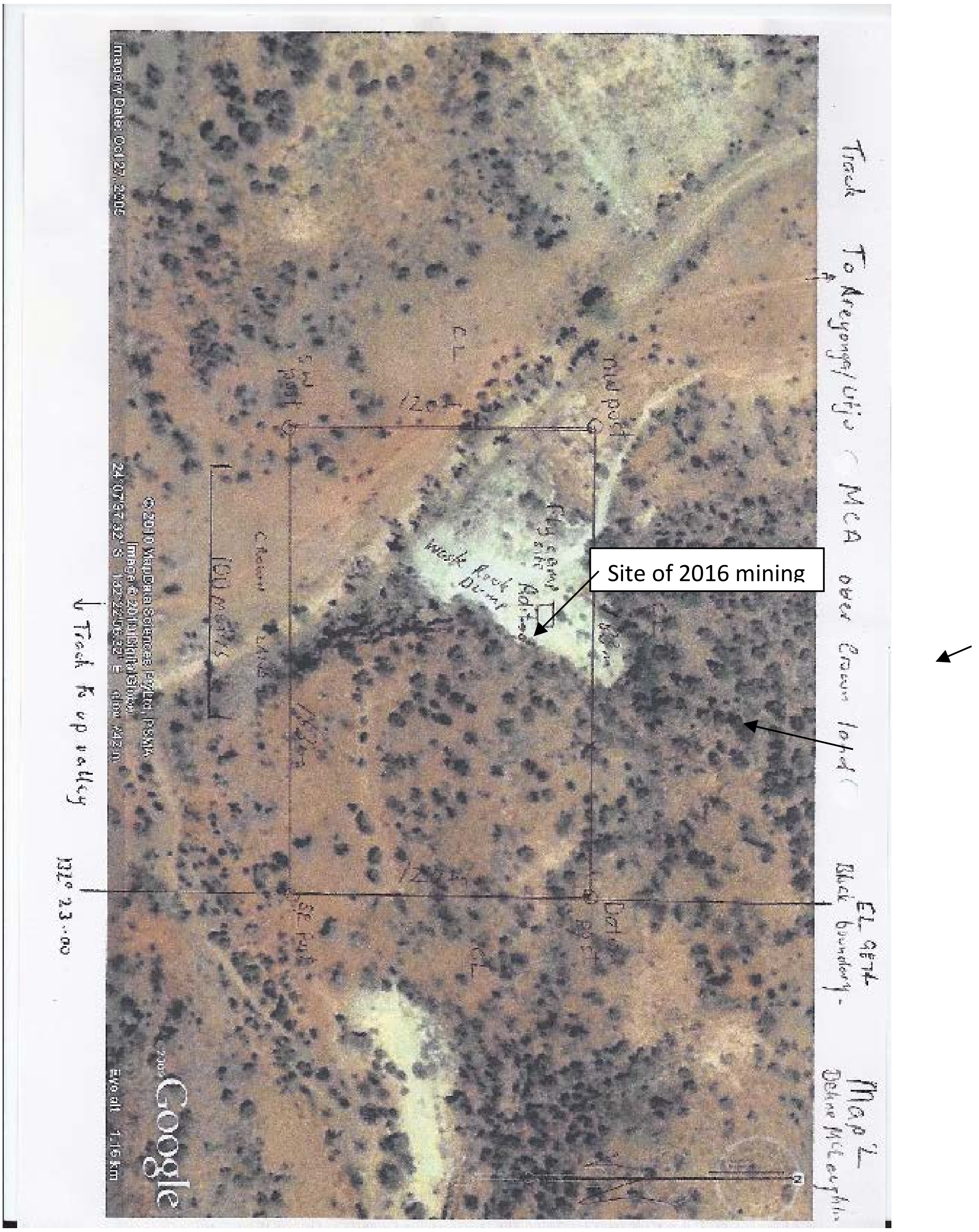
MAP 1. Location of the original EL 9874 and ML 29494 (MCA 28231) in relation to Areyonga community (UTJU) as provided on Departmental maps.

PLAN 1. Updated Map of Underground Workings showing areas where drives were developed in 2015 and 2016. The up dip drive was worked in 2015. The main face worked in 2016 was the down dip drive with renewed development in the Adit Drive.

PLAN 1 ML 29494 MAP REVISION 2016

Plan of Adit and underground development in 2016





MAP 2. Google air photo map of ML29494 boundaries, waste rock dump and fly camp location opposite adit entrance. North is across the page following the ML boundaries. All Google photos are from Google's free site. For scale, the north-south boundary lines are 120 metres long. Previous Crown Land is now Aboriginal Land as of 2012 grant.

MAP 3. A Google map showing location of the mine site waste rock dump (WRD) in ML 29494 within folded rocks of the Amadeus Basin. Anticlinal closure is interesting from a petroleum exploration perspective and structural control of diapiric related copper deposits.