THIRD ANNUAL REPORT ML 29494

2015

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Operator: Dehne McLaughlin

Name of Project: Malbunka Project

Reporting Period: From 21st December 2014 to 20th December 2015.

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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.

ABSTRACT/INTRODUCTION

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 third Mine Management Plan (MMP) for the project on the 3rd January 2015 following submission of an annual review MMP in 31st October 2014. The project MMP authorisation number is 0734-01. The scheduled mining field season commenced mid May 2015.

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 commenced on the 6th May 2015 and a program completed on 13th July 2015. A fly camp was maintained on the old waste rock dump opposite the adit entrance to the mine for the period and was occupied 6 times for periods of 4 to 7 days. 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. Two weeks were taken off from mining to attend an unexpected family funeral in Gove in May.

The core mine site activity in 2015 was focused on continuing to drive on the up dip face in mineralisation parallel to the anticlinal axis. The second location of specimen production in the down dip tunnel parallel to the anticlinal axis was not continued in 2015 due to a reduction in time available to miners.

The up dip drive face was advanced 2.4 metres in 2015 across an average 5 metre working face. This involved 5 sequential cuts of an average horizontal distance of ~0.47 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. A total of $25M^3$ was mined consisting of waste rock and hanging wall kaolinite containing azurite.

Research took an important step forward when the writer fortuitously linked up with Dr Barbara Dutrow at Tucson Arizona, USA, in February 2014. Dr Dutrow and others have published papers on the formation of authigenic tourmaline at temperatures less than 150 degrees C in diapiric salt domes (pdf papers attached in 2014 report to DME in e mail with that 2014 report). This USA research has strengthened the argument based on field and fluid inclusion study (high boron in azurite inclusions) that the micro tourmalines in the matrix and the copper mineralisation are closely related. The hyper saline diapiric model for copper mineralisation in the Amadeus Basin starts to have substance. Dr Melchiorre of California State University is currently exploring analytical techniques to identify the ubiquitous micro tourmaline species found in the white and red kaolinite. Dr Melchiorre‘s 2014 research submission to fund 4 student workers to visit the mine to take detailed samples and carry out mapping etc with a view to advancing knowledge of the genesis of this unusual copper deposit were unsuccessful as the relevant grant body sort a strong component of economic petroleum geology in applications. This was despite the fact the ML is overlain by a petroleum exploration application.

Funding is available via other sources to carry out tourmaline species analysis but there have been problems of mounting these micro crystals of ~ 30 microns.

Reserve estimates have had to be revised from the 2014 estimation of 2 to 4-5 years downwards due to silicification covering important azurite specimens in the L3 layer in the main up dip drive. A maximum 2 years of reserves is currently projected. The extent and impact of silicification will be investigated in 2016. Specimen volume also decreased across the mining face in L1 and L2 layers.

The Mineral Production Return for the 2014-2015 Financial Year was submitted in July 2015. A new market in the natural pigment business has been found that purchases below specimen grade azurite, thereby assisting the economics of this borderline project.

The Central Land Council and traditional Aboriginal owners visited the mine site on 17th June 2015 and discussed the project future.

1. **LOCATION, TITLE HISTORY, ACCESS, HYDROLOGY AND PHYSIOGRAPHY**.

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** is a 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.

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 2015 view looking north east showing adit entrance in anticlinal cusp, dry creek bed and fly camp on top of old waste rock dump. 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.

One of the 2015 recommendations of the Mining Environmental Compliance Branch of the Department of Mines and Energy was that there be a sign erected at the mine entrance advising against entry to the workings. This was done by pictorial and written means using a standard commercial industry sign.

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 2015 but most of this was stored underground as backfill in the main up dip drive. Hence relative percentages of new to old waste rock placed outside the underground workings on the old WRD footprint are ~1% as of September 2015 taking into account 2013 and 2014 mining.

2. 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). 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.

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 plantation event not observed in modern times.

See Map 3 Google air photo.

Photo 3. Sandstone seismites below a thrust faulted contact. Thrust direction is from RHS of picture to LHS. 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 so pervasive in the vicinity of the Project that 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, 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 but heavily faulted kaolinite lens up to 2.5 metres thick bounded below and above by grey clay rich sandstone containing plentiful soft sediment deformation features such as recumberent folds, sandstone injectites (Photo 3A) and flow structures that are interpreted as seismites caused by earthquake shock during sedimentation *(Shi 2007).* The 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 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 are being extended). The lens does not outcrop to the east or south in the side of the hill, indicating its limited extent. The overlying sandstone, as viewed along the ceiling inside the adit, has slumped in many places into the kaolinite lens forcing the kaolinite to flow into channels and corners in the sandstone slumps. Slumping is complicated by numerous micro faults as seen in Photo 4.

This kaolinite lens is at 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.

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

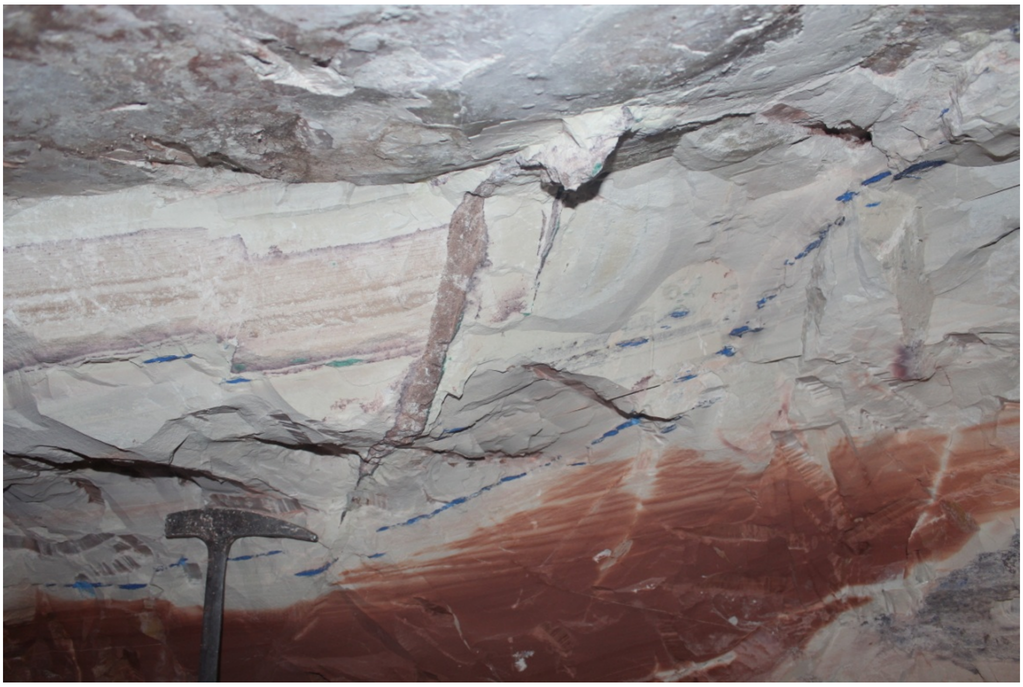


PHOTO 3A. Sandstone injectite penetrating into kaolinite along micro faulted sandstone bed observed in 2015 field season.

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.

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, still the subject of study, 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 ration of boron in the fluid inclusion study, an explanation of the kaolin formation and the azurite may be 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.

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. 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 kaolinite-tourmaline-copper oxide enigma has moved an important step forward with the discovery of recent papers on the formation of diagenetic micro tourmalines in the Gulf of Mexico (attached to report email). The writer met with one of the authors, Dr Barbara Dutrow in Tucson, USA in February 2014, and was advised that their research provided temperatures as low as 150 degrees centigrade for the crystallisation of dravite composition tourmaline from diapiric samples.

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.

3. MINERALOGY

Azurite. Cu3(CO3)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.

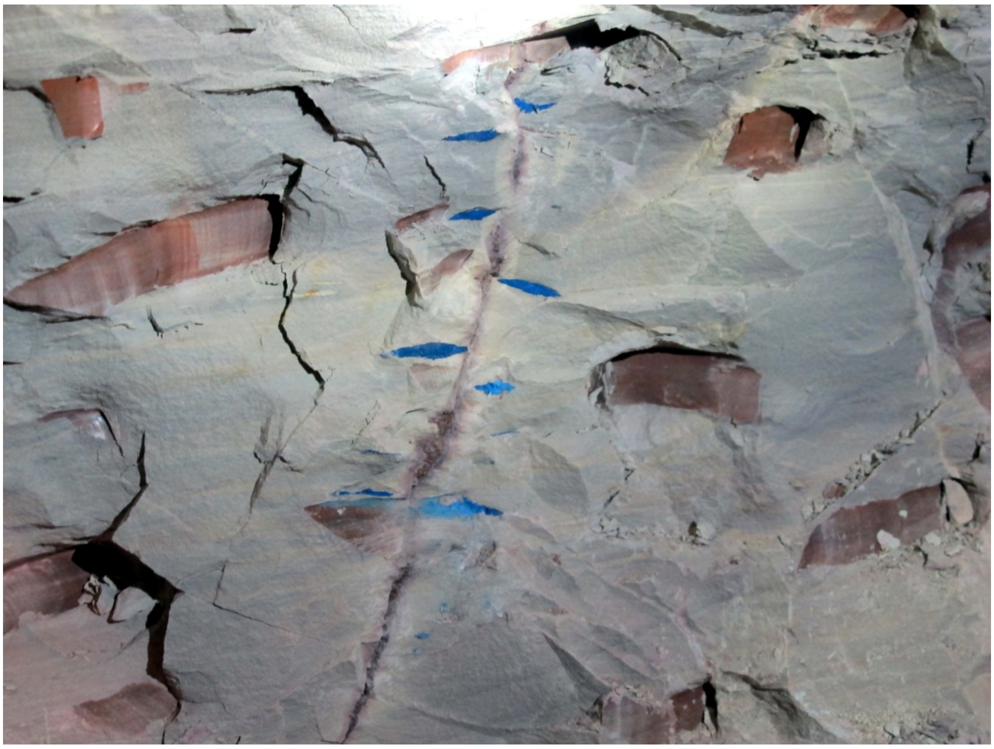


Photo 6. Near vertical fracture 5mm wide with fringe bleaching (hydrothermal alteration) and associated copper carbonate discs to 6cm in cross section. Photo Dehne McLaughlin.

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).

However, the azurite suns differ to the pyrite suns in that the pyrite suns have their chemical constituents provided from the black shale matrix they occur in whereas the azurite suns have had their primary cations introduced from outside the host rock.

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 limits the size of the crystals. 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 7 below 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. 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.

Malachite. Cu2(CO3)(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), 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.

PHOTO 7. Atacamite, chrysocolla and azurite in sandstone and kaolinite containing soft sediment deformation structures. Located at end of main adit drive. Photo-Dehne McLaughlin

5 RESOURCES AND RESERVE ESTIMATION

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 is contained within the ML and is adequately defined in the underground workings. 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. 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.

The two current drives in Plan 1 that parallel the anticlinal axis have defined the outer southern edge of economic mineralisation. In 2013, it was advised;

"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".*

However, mining in 2015 in the up dip drive exposed extensive silicification 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 silica occurs as micro balls of silica sitting on the azurite and often enveloping complete azurite suns. This is not good for commercial objectives as the silica is not easily removed without damaging the natural lustre of the azurite. Floor testing was postponed due to time and labour shortages.

6 MINING

Mining is carried out using electric driven hammer drills driven by a small hand carried Honda 2KW generator. The generator also runs 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 2015

The 2015 mining season (Trip 1) commenced by cutting a face in the up dip drive for the purpose of mineral specimen collection.

The work done in 2014 to commence an air link between the up dip drive and the main adit was completed during a short 4 day trip (Trip 2) in 2015. The purpose of the cross tunnel was to:

1. Drive towards the main adit to improve air circulation by creating an opening into the main adit from the up dip tunnel;
2. Create a short cut safety route to the main adit; and

3. Follow high quality azurite suns exposed in the right hand side of the drive during 2013 mining. These suns occur in above a thrust plane and below the hanging wall sandstone in a position where the kaolinite host for the azurite has thickened , allowing some matrix to be extracted with some of the specimens.

Most of our effort (my wife and I) went into driving on the up dip face which we advanced by 2.37 metres. Plan 1 has been revised to show the current status of underground works.

In 2014 we noted an improvement in overall quality and quantity of azurite mineralisation in the up dip tunnel.

"Despite advancing the main up dip face by only 0.9 metres in 2014 (most time was spent on the cross cut and the down dip tunnel), it was noted there was an improvement in the overall quality and quantity of azurite mineralisation. As we are mining towards the source of the former mineralising fluids, that stands to reason. Higher azurite concentrations, in comparison to lower pillar content 30 metres into the adit, can be observed in the support pillars at the mine entrance".

The 2015 mining showed the opposite, with a decline in the volume and quality of azurite in the L1 and L2 layers which had an impact on specimen and azurite pigment production. The L3 layer near the hanging wall was still rich but many of the azurite suns of potential specimen quality had grown into the hanging wall face making it difficult to retain the white kaolin matrix backing the specimens.

There was field evidence 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.

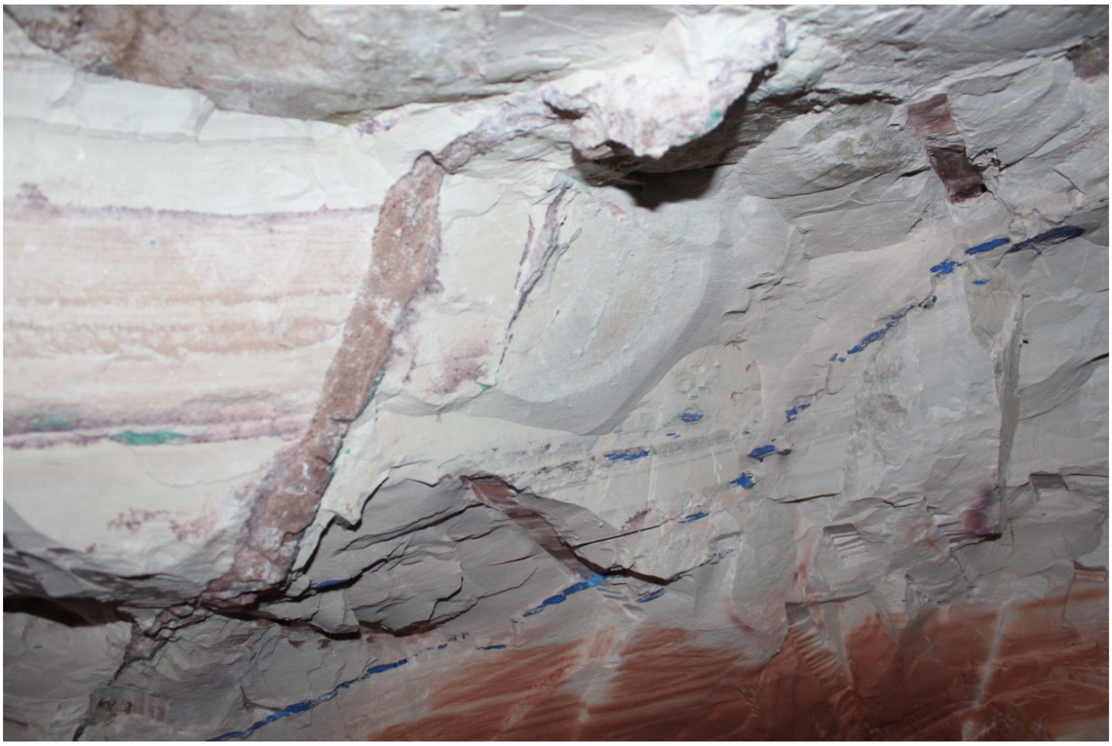


Photo 8A. Sandstone injectite penetrating into kaolinite. Structures here channel azurite mineralisation into a downward slope away from typical horizontal penetration.

In addition to the above trends in L1 and L2, in the last metre of driving the L3 layer at the hanging wall in the right half of the working face had various degrees of silicification, often covering azurite suns, destroying their specimen value. The silica consisted mainly of sheets or micro balls of silica sitting on the azurite. The silica introduction may be related to excess silica associated with the silicified rim around the kaolinite lens. The last mineralising event at the mine is the silicification of the sandstone hanging and footwall to a depth of several centimetres, accompanied by atacamite mineralisation. 2016 mining will indicate how pervasive this zone is and will have an effect on the future mining of the up dip tunnel.

Overall, approximately 25 cubic metres of waste rock was mined from the drives. Most of this rock was used as underground backfill in a part of the excavation created while driving a cross tunnel from the up dip tunnel to the main adit in 2014.

Azurite pigment material was collected in 2015 as in 2014. 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. 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, 2015 mining costs (both Admissible Expenditure and Real Costs) were similar to 2013 and 2014 costs reported in the first annual report ~$40,000.

The Malbunka project was operated out of Alice Springs over May, June and late July 2015. Mining and camp gear and two vehicles were ferried from Hobart to Melbourne. Six field expeditions over May to July were conducted over 4 to 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 2015 mining costs. These numbers do not include overseas and Australian marketing costs of approximately $20,000.

Thirty seven days were spent on the ground on ML 29494 between May and late July 2015 as compared to 49 in 2014. Funeral attendance at Gove and family issues plus Executor matters reduced field time. The core activity comprised driving on the up dip tunnel 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.

2016 COMMITTMENTS

It is planned to run the project again out of Alice Springs over May to July in 2016 and it is expected Admissible Expenditure and Real Costs will be similar to 2014 and 2015. Ie ~$40,000.

8. CONCLUSIONS

Although the Malbunka project is mining a relatively very small volume of copper mineralisation from a limited stratabound "uneconomic" 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. Ie salt removal driven diapiric copper deposits.

Although his first grant application failed, Dr Eric Melchiorre is still committed to finding alternate funding for field research. The Dutrow and Henry research on low temperature tourmalines has relied on drill core samples but here in ML 29494 a tourmaline/copper system is exposed for study. Tourmaline speciation work is ongoing.

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 less optimistic than reported to DME in 2014. Mining in 2016 in both the up and down dip faces will be important for assessing the future of the project.

Dehne McLaughlin 30 October 2015

BIBLIOGRAPHY

Burne, W. 2003. *A Geological Perspective on the Art of Albert Namatjira*, The Australian Geologist, Newsletter No 129.

Cook, P.J. 1968. *Henbury, NT 1:250,000 Geological Series-Explanatory Notes,* Bureau of Mineral Resources Geology and Geophysics, Canberra.

Dyson, I. A., Marshall, T. R. 2005. *Neoproterozoic salt nappe complexes and salt withdrawal mini-basins in the Amadeus Basin,* Proceedings Central Australian Basin Symposium, NTG, Darwin.

Freeman, M.J. Shaw, R.D., and Offe, L.A. 1987. A Field Guide to Geological Localities in the Alice Springs Region, Northern Territory Geological Survey, Technical Report GS 87/9

Grant, R., McLaughlin D. 2012. Azurite Suns from the Malbunka Copper Mine, Northern Territory Australia, Rocks and Minerals, Vol 87, No 6, 490-500.

Grant, R. 1989. The Blue Ball Mine, Gila County, Arizona, The Mineralogical Record, Vol 20, 447-450.

Marshall, T. R., Dyson, I. A., and Keyu, L. 2005. *Petroleum systems in the Amadeus Basin Central Australia. Were they all oil prone?* Central Australian Basin Symposium, NTG, Darwin.

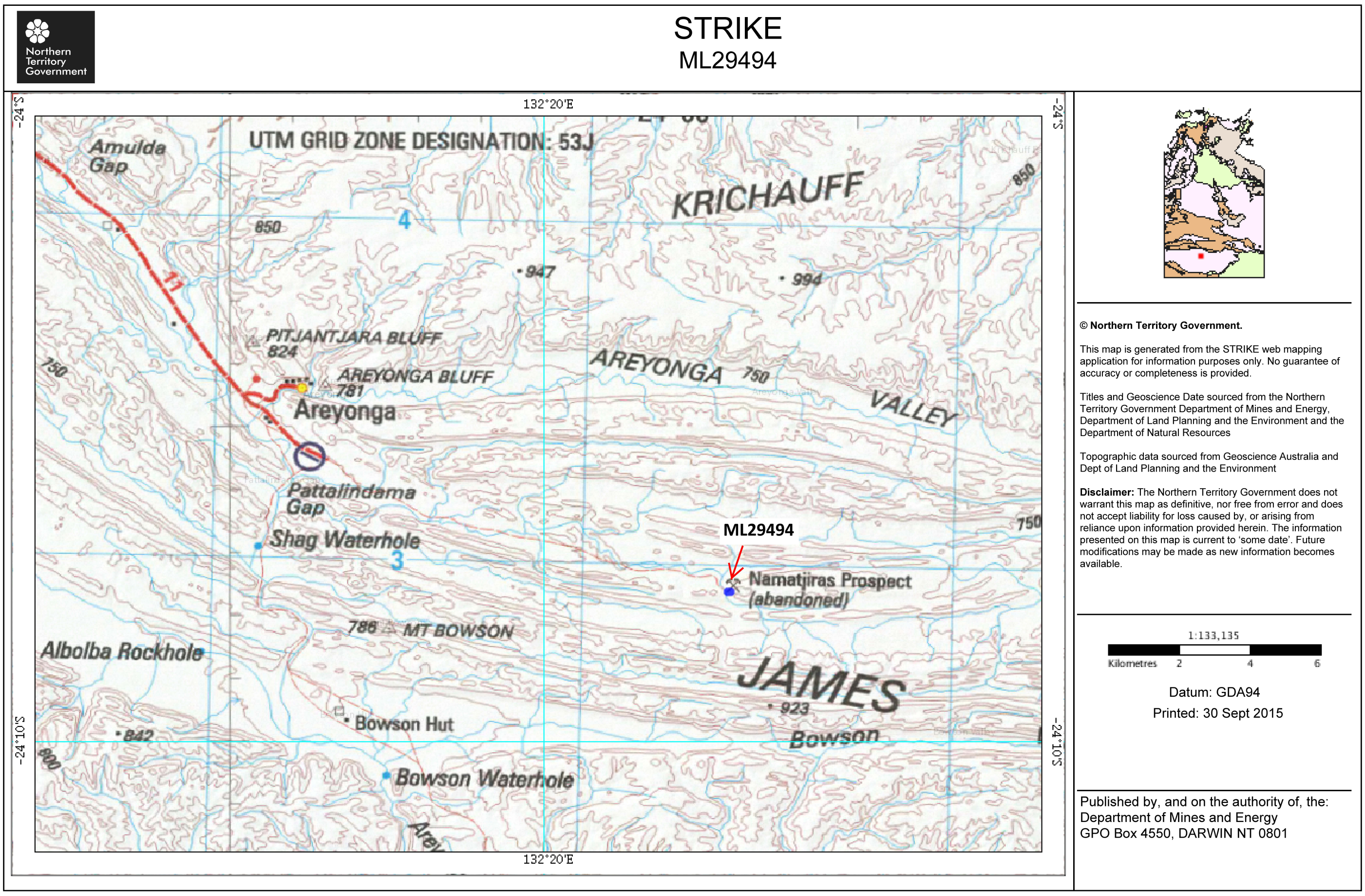
Laurie, J. R., Nicoll, R. S. and Shergold, J. H. (compilers) 1991**.** *Ordovician siliciclastics and carbonates of the Amadeus Basin, Northern Territory*: Sixth International Symposium on the Ordovician System, Guidebook for Field Excursion 2. Bureau of Mineral Resources, Geology and Geophysics, Record 1991/49, 74p.

Ranford, L.C., Cook, P.J., and Wells, A.T. 1966. The geology of the central part of the Amadeus Basin, Northern Territory, Bur. Miner. Resour.Aust. Rep.86.

Shi, G.R., Du, Y.S., and Gong, Y. M. 2007. *Soft-sediment deformation structures interpreted as seismite from the Middle Permian of the southern Sydney Basin, southeastern Australia.* Australian Journal of Earth Sciences, Vol 54, No. 6, pp 861-874.

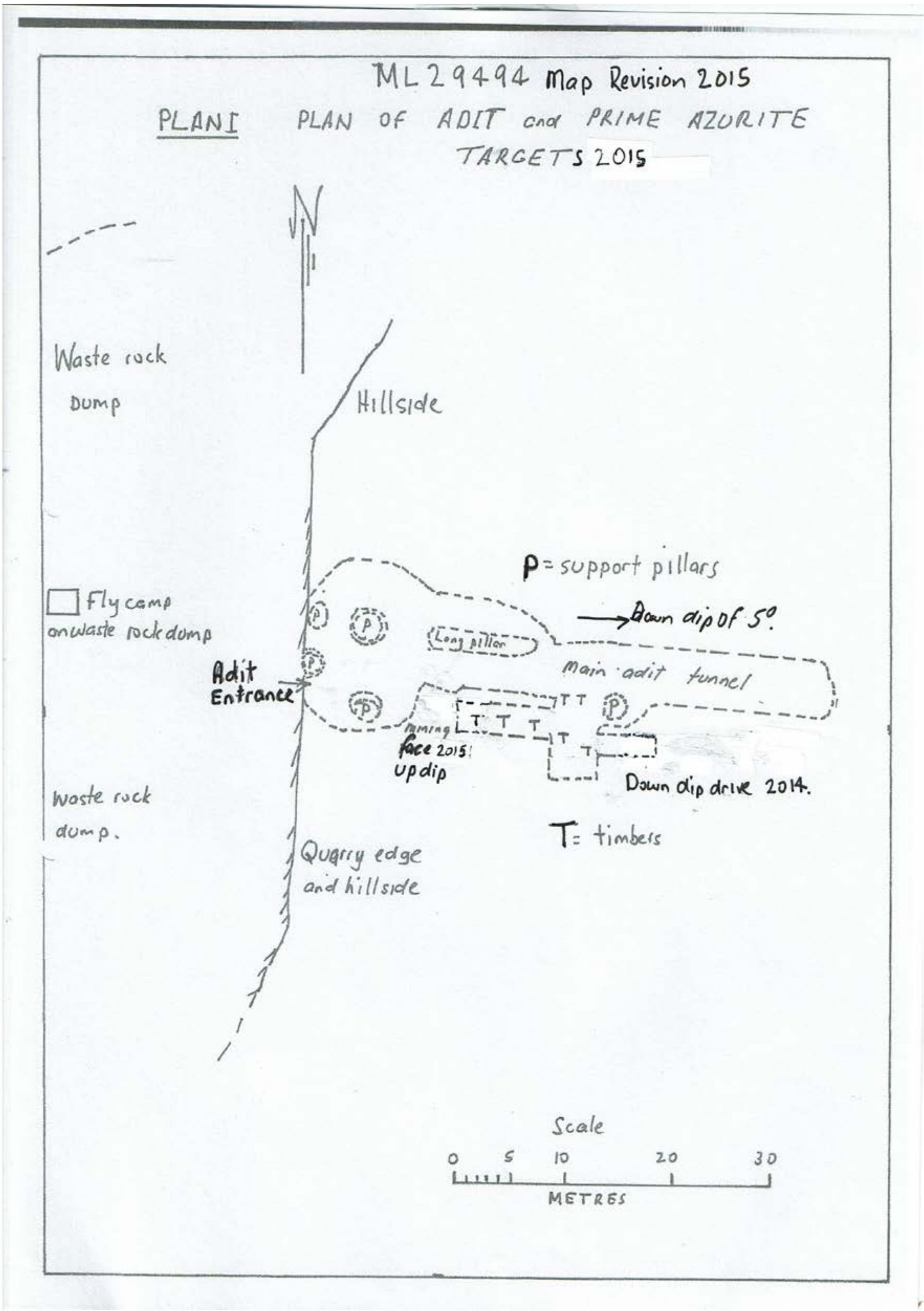
Sullivan, B. 1979. *Letter from Europe*, The Mineralogical Record, March-April, page 121-124.

Warren, R.G. and Shaw, R.D. 1995. *Hermannsburg Northern Territory 1:250 000 Geological Map Series Explanatory Notes*, NT Geological Survey.



MAP 1. Location of in relation to Areyonga community (UTJU) as p rovided on Departmental maps.

PLAN 1. Updated Map of Underground Workings showing areas where drives were developed in 2014 and 2015. The update face was worked in 2015. No work on down dip face.



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.