The Mt Winter Project-Potential for Hydrocarbon & Helium Exploitation

Commercial In Confidence

A report commissioned by Westmarket Oil & Gas Pty Ltd

By

John Heugh MAAPG, MAusIMM, MPESA, MAIPN, MAWAL

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Mr Heugh is a practising geologist & manager with over 40 years of relevant experience; he is a member of the Petroleum Society of Australia and has been a member of the American Association of Petroleum Geologists for over 30 years.

He is a qualified petroleum reserves and resources evaluator (QPRRE) under the rules of the ASX pursuant to ASX Listing Rules 5.41-5.42.

In relation to prospective resources described in this report, the estimated quantities of petroleum that may potentially be recovered by the application of a future development project(s) relate to undiscovered accumulations. These estimates have both an associated risk of discovery and a risk of development. Further exploration appraisal and evaluation is required to determine the existence of a significant quantity of potentially moveable hydrocarbons.

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Attention :

Messrs. Tony Hamilton & Mark Wallace
Westmarket Oil & Gas Pty Ltd
Unit 26/Level 1, 375 Hay Street,
Subiaco, Western Australia 6008
20.05.12

Amadeus Basin Mt Winter Subsalt Hydrocarbon & Helium Project

OVERVIEW

The Northern Territory (EPA 155) Hydrocarbon & Helium Project, (Mt Winter Project), will facilitate the drill testing of a large & potentially shallow seismically defined Neoproterozoic subsalt basal petroleum & Helium prospect in the Amadeus Basin centred upon the conditional re-entry and deepening of Mt Winter #1, a well drilled in 1981 and reaching TD in 1982.

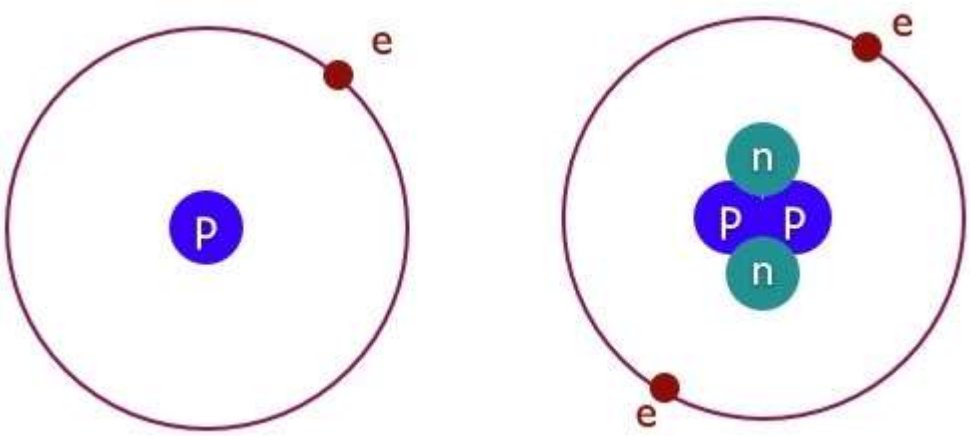
The prospect, within the Mt Winter Project area, has an apparent aerial closure of an estimated 13 km^2 plus, (3,200 acres) with potential to host a TCFG scale resource of gaseous hydrocarbons with high concentrations of Helium, similar to the gas flows tested at Mt Kitty 1 and Magee 1 in the Amadeus Basin of the Northern Territory & probably present in the enormous STO/CTP JV Dukas prospect to the south which remains untested to date.

Overlying salt formations are regarded as being essential to trap Helium in any reasonable concentration during the long geological periods necessary for Helium to be generated by the decay of radiogenic minerals in basement granitoids. Estimates of potentially recoverable hydrocarbons and Helium from the prognosed basal subsalt Heavitree Quartzite in the gaseous state based on reasonable fundamentals with comparative justification at P50 Prospective Recoverable (SPE PMRS) unrisked level are **c.1.5 TCFGE (Trillion Cubic Feet Equivalent) hydrocarbons** and **c.75 BCFG (75 million MCF) Helium** respectively.

Note : The estimated quantities of petroleum that may potentially be recovered by the application of a future development project(s) relate to undiscovered accumulations. These estimates have both an associated risk of discovery and a risk of development. Further exploration appraisal and evaluation is required to determine the existence of a significant quantity of potentially moveable hydrocarbons.

Grade-A (or 99.99% purity) industrial helium was priced at $280/MCF in the BLM August 2018 auction, ("Helium –Macro View Update" February 2019 Published by Edison Investment Research) so a gross "in the ground" value of this quantity of Helium (without reference to extraction costs or NPV calculations) may be in the order of US$20 billion, subject of course to verification of the volumetrics by the proposed exploration and test drilling programme.

Westmarket Oil & Gas Pty Ltd, ("WMOG") has executed a farmin agreement with the owners of Exploration Licence Application EPA 155, Oilco Pty Ltd, an Australian subsidiary of AIM listed Mosman Oil & Gas Limited, (AIM: "MSMN") which will (progressively and conditionally) see reprocessing and analysis of an existing seismic data set, a detailed gravity survey, additional seismic and finally the re-entry of Mt Winter #1 with a TD of 2,650m to be deepened to the subsalt Heavitree Quartzite target horizon, currently anticipated at c.3,000m or so, ie an additional c.350m of drilling.



Hydrogen (left) & Helium (right) Atomic Structure

REGIONAL SETTING

The Amadeus Basin, within the Northern Territory & Western Australia, is a reasonably well known 170,000 km^2 inland frontier basin, part of the Centralian Superbasin, a large intracratonic sedimentary basin which occupied a large area of central, southern and western Australia during much of the Neoproterozoic Era (~830–540 Ma). This superbasin was disrupted by two periods of uplift and mountain building, the latest Neoproterozoic Petermann Orogeny and Palaeozoic Alice Springs Orogeny, to leave remnants including the Amadeus, Georgina, Ngalia, and Officer basins after the breakup of the Rodinian Supercontinent. Almost invariably, where drilled and/or having sufficient seismic to interpret successfully there is a

basal sandstone/clastic unit overlying Mesoproterozoic granitoid basement rocks, in turn overlain by major salt/evaporite sedimentary units-prerequisites for the generation and trapping of Helium.

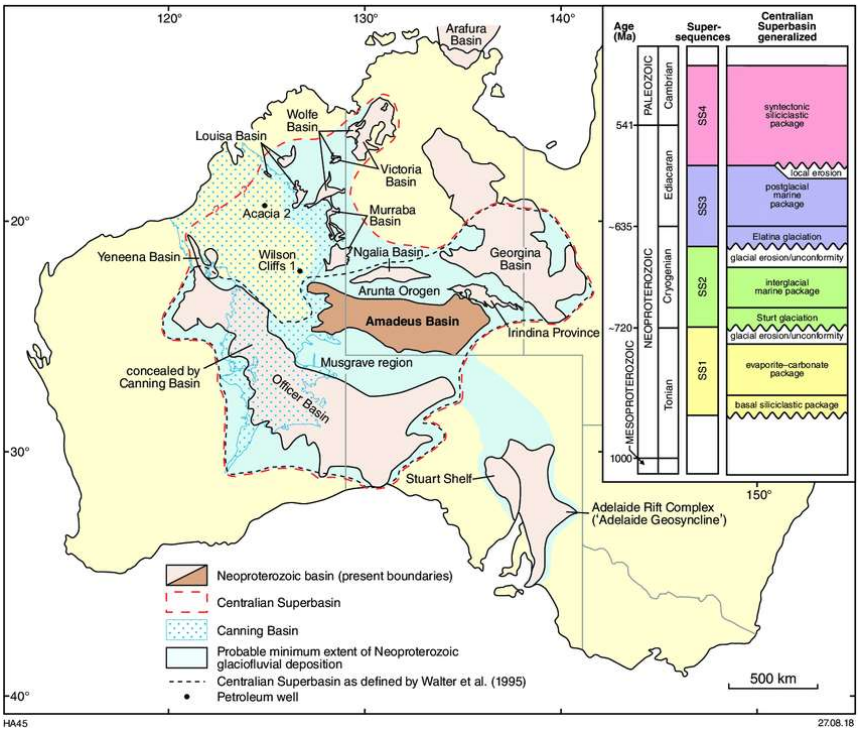


Fig.1 The Amadeus Basin, part of the Neoproterzoic Centralian Superbasin, courtesy www.researchgate.net, after Munson et al; 2013.

Until the drilling of Mt Kitty by Central Petroleum Limited in 2014 and the Santos/Central JV well, Dukas 1 (spudded 2019 currently suspended due to overwhelmingly abnormal high pressure gas just above the main subsalt Heavitree target), all exploration but for Magee #1, 1992, focused on Cambrian to Ordovician targets with two major fields, Mereenie (oil, gas & condensate)and Palm Valley (gas & condensate) exploiting hydrocarbons hosted by the Ordovician Stairway Sandstone & Pacoota Sandstone and other discoveries at Dingo and Orange exploiting older Cambrian and late Neoproterozoic formations.

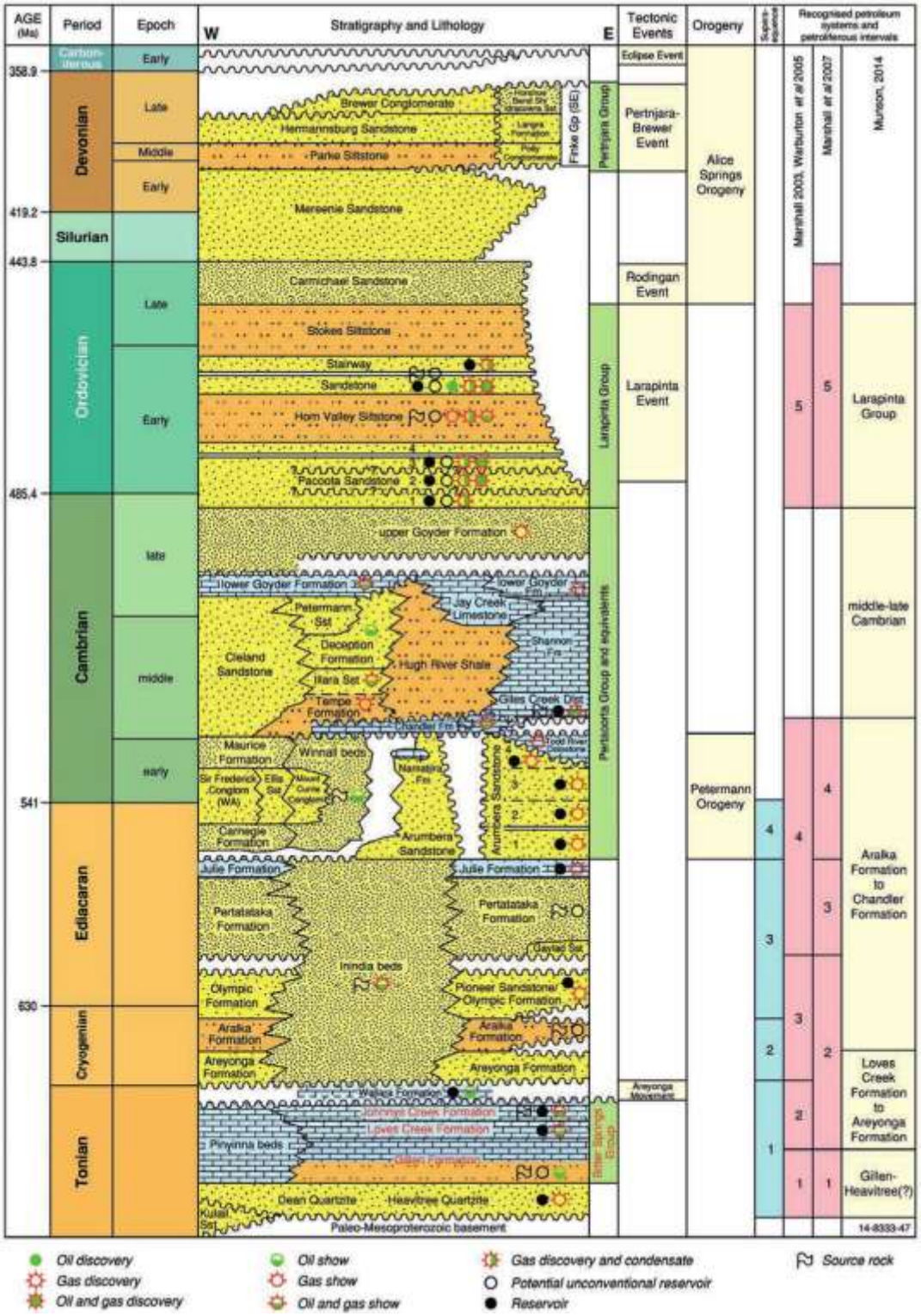


Fig. 2 Stratigraphic Column NT Amadeus Basin showing known hydrocarbon occurrences, (from AGES NTGS 2016).

Note: Mt Winter #1, reached TD of 2,650m in the Gillen Formation of the Bitter Springs group; thought to be close to the targeted Heavitree Quartzite where all known subsalt Helium discoveries have been made in the Amadeus Basin to date.

The Mereenie field, discovered in the 1960s, commenced production in 1987 and has a gross hydrocarbon interval of more than 800m with a gas cap and an oil rim. Ultimate recovery was originally estimated at up to 34 MMBO and 593 BCF of gas. It has produced more than 16 million barrels of oil and condensate since 1984. Palm Valley has produced up to 137 MMCFGD in single wells from fractured Ordovician lithologies and originally had c. 325 BCFG in recoverable gas reserves.

Elements of the Centralian Superbasin relating to sub-salt reservoirs, although of different ages, are similar in general geology to the hugely productive Sichuan and the Ghaba and Fahud salt basins in Oman as well as the Siberian Platform hydrocarbon basins.

Historically, the bulk of the world's Helium has been derived from sub-salt clastic reservoirs sitting on basement granitoids in eight oil and gas fields located on the Four Corners Platform of northwestern New Mexico since 1943. Almost 950 MMCF helium have been produced from reservoirs of Permian, Pennsylvanian, Mississippian, and Devonian age on the Four Corners Platform in San Juan County. The concentration of helium in gases produced from these reservoirs ranges from 3 to 7.5 percent, coupled with a relatively high nitrogen content.

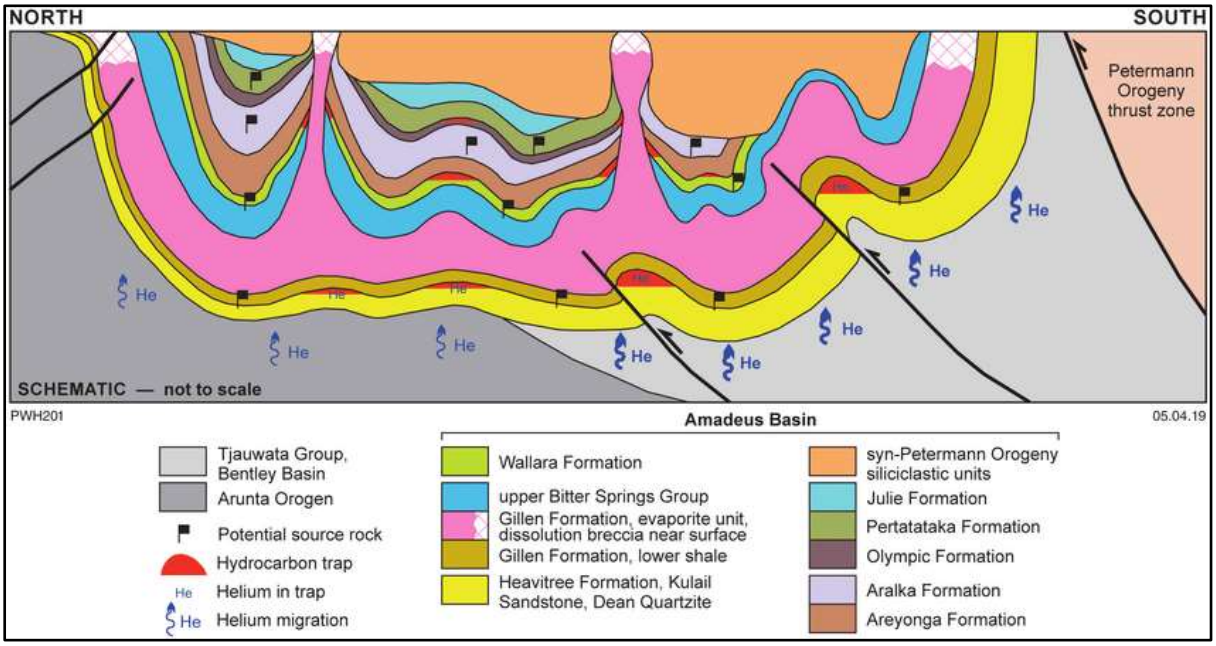


Fig. 3 Schematic Cross Section of the Amadeus Basin North to South-showing Helium formation and entrapment mechanisms (Courtesy GSWA Haines & Allen, Hydrocarbon and Helium prospectivity of the Amadeus and Murraba Basins Sep. 19th, 2019)

In the schematic above, the main reservoir target for Helium & hydrocarbons is the Heavitree Formation overlain by the salt/evaporate Gillen Formation salt seal-the only seal type in nature capable of trapping Helium which as the second lightest element in the periodic table is extremely mobile even when present as the most common form, ie molecular He_4.

Primodial He_4 in the atmosphere was created during the "big bang" but is now created continuously during the natural radioactive decay of heavy radioactive elements (thorium and uranium, although there are other examples), in basement granitic lithologies as the alpha particles emitted by such decay consist of helium-4 nuclei. This radiogenic helium is trapped

with natural gas from which it is extracted commercially by a low-temperature separation process called fractional distillation.

Two wells, Magee 1 and Mt Kitty 1, drilled to basement in the Northern Territory portion of the Amadeus Basin produced gas to surface on test with respectively 6.2% and 9% Helium along with gaseous hydrocarbons and relatively high levels of nitrogen. It is considered axiomatic that the subsalt Helium prospectivity of the Mt Winter project area is remarkably high.

In the Amadeus Basin, within the Northern Territory, the two oldest sedimentary units immediately overlying the Palaeoproterozoic basement granitoids are firstly the Neoproterozoic Heavitree Quartzite overlain by the Bitter Springs Group inclusive of the basal Gillen Formation, a basin-wide unit of dolostone, sandstone, shale (inclusive of an organic rich black shale source rock near its base) and evaporates (salt).

Note : The term “quartzite” usually refers to a highly metamorphosed sandstone but with the Heavitree (Northern Territory Amadeus), Dean (Western Australian Amadeus) Townsend (WA Officer Basin equivalent) Quartzites, the term is mostly a misnomer, porosities of the Heavitree Quartzite have been recorded for example as high as 9% in the Magee 1 well and in the Amadeus Basin it is generally regarded as being between 200 to 1,000m thick and consists locally of mudstone, sandstone and conglomerate with the dominant lithology being a very well sorted well rounded grain quartzose sandstone.

Image (CONCEPTUAL) of a hypersonic aircraft using the new British “SABRE” Helium cooled rocket engine

LOCAL SETTING & HISTORY

Mt Winter 1, 2 and 2A were drilled within the then Oil Permit 178 by ASX Pancontinental Petroleum Limited(“Pancon”) with 8 other joint venturers including the tenement owners, Magellan Petroleum (NT) Pty Ltd; (“Magpet”). A sparse 2D seismic grid with line spacing of c.3 km was acquired in 1981 and analysed before drilling commenced in late 1981.

The nearest wells were Northwest Mereenie #1, 50 km NE and Ochre #1, 63 km to the SE; there were no effective ties but seismic control was partially provided by outcrop to the North, West and South within the permit area at the time.

Regional geological mapping was carried out in the area by the BMR in 1962 and in 1965 the BMR conducted an airborne magnetic & radiometric survey over the region, both on quite coarse survey grids. A seismic survey conducted n 1966 for Magpet indicated a possible culmination in the Mt Winter area. Pancon then shot more seismic, inter alia over the Mt Winter area in 1981. (The Glen Edith Seismic Survey) which showed significant closure at the base of the Pacoota Sandstone and at the top of the Precambrian

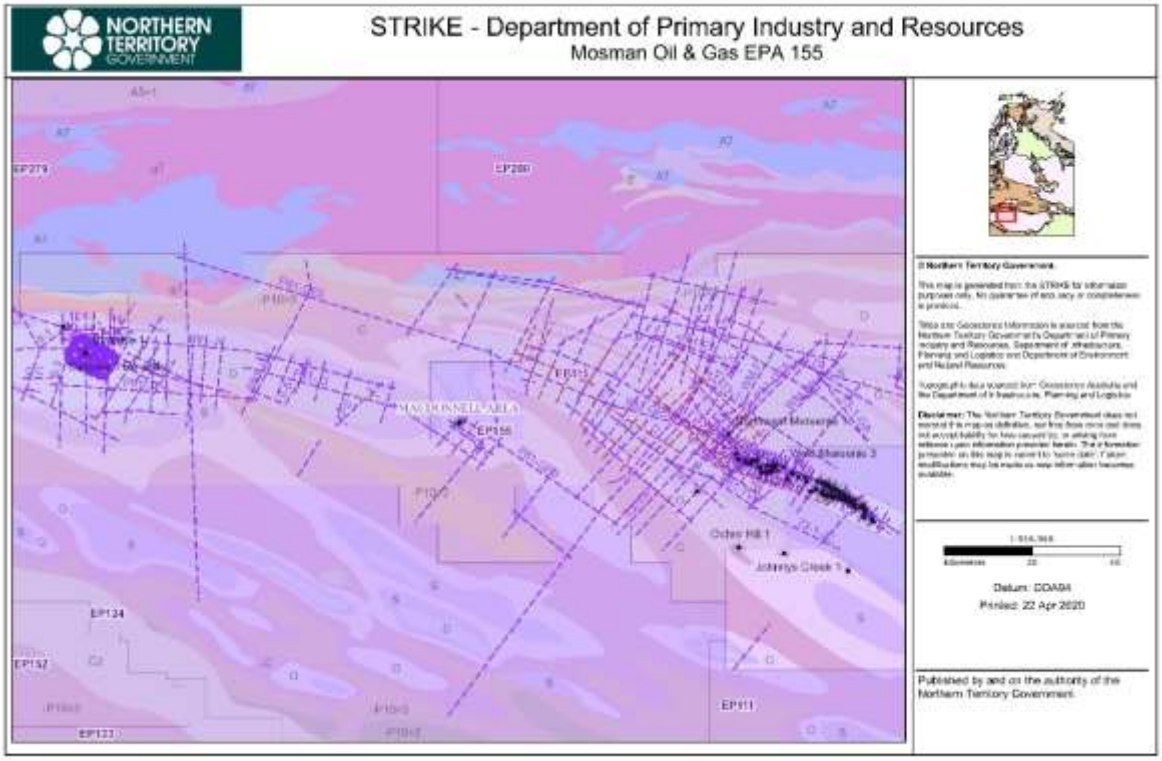


Fig.4 Regional Location of EPA 155 in relation to the Surprise (West) and Mereenie (East) oilfields.

Mt Winter #1 was spudded on November 29th, 1981, reaching its TD of 2,650m RKB in the Gillen Formation of the Neoproterozoic Bitter Springs Group on February 12th, 1982 & was subsequently plugged & abandoned. It is this well that is hoped, subject to independent petroleum engineering advice, will provide a viable conduit by deepening into the Heavitree target zone. Failing this, a new well will be drilled from surface or Mt Winter 2A might be a second candidate for deepening.

The Mt Winter #1 WCR records the drilling of 8.5" open hole from the bottom of the 9&5/8" casing shoe at 1,296m to TD of 2,650m so the deepening of the well to a prognosed c.3,000m may well be feasible, subject to considerations of open hole stability, existing casing integrity and possible directional control issues inferred by three cement plugs set at 1,455-1,515m, 1,250-1,310m and at surface.

Fig.5 Local Geology & Seismic Grid-the Grid is connected to a track leading to a main road so access for additional surveys and drilling should be reasonable.

Several significant oil shows were encountered in Mt Winter #1:

a. The basal Stairway Sandstone 150m-190m (40m) with bright blue white fluroescence and a moderate to fast yellow cut; oil was also reported in the drilling mud over this interval;
b. Sporadic poor shows in the Horn Valley Siltstone source beds;
c. Live oil in sandstones of the Johnny's Creek Beds 1,734m-1,761m (27m); this occurred with common heavy black residual oil exhibiting yellow fluorescence and instant yellow to green cut. Gas up to C_6 (hexane) was also recorded in this interval.

Some comments were made in the Mt Winter #1 WCR that some of the more porous and permeable sections in these intervals may have had oil displaced by drilling fluids further into the formation; a common occurrence when onshore drilling in Australia was dominated by

water gel barites mud types which were frequently overweight. The few recordings of mud weight were in a range approaching 9 ppg, ie definitely moderately overweight for a saline marine formation fluid and possibly heavy enough to displace oil into the formation.

Mt Winter #2, #2A

Mt Winter 2 was spudded in late 1985 by Pancon and drilled to a TD of 142m but hole instability resulted in the well location being shifted laterally 10m to be re-spudded on 19th November, 1985 as Mt Winter #2A. This well reached a TD of 259m on August 18th 1986. Several cores were cut but there are no show descriptions in the WCR, very little information was recorded on this very shallow well. (NTGS GEMIS WCR Mt Winter #2 & #2A Combined)

Although the formation tops do not appear to have been recorded, the well, being so close to Mt Winter #1 would presumably have reached TD in the basal Horn Valley Siltstone or the top Stairway Sandstone. The well was subsequently abandoned with a welded flange and ball plug which also make this well a candidate for re-entry and deepening, again subject to an independent petroleum engineering report.

Amadeus Basin Desert Area

<u>EPA 155 Mt Winter Structure Potential Volumetrics</u>

As previously noted, Mt Winter #1 reached a TD of 2,650m in the Gillen Formation (dominated by salt/evaporate and dolomitic based sediments) after encountering the top of the Bitter Springs Group at 1,683m, ie 967m of drilled Bitter Springs Group sediments. (Mt Winter WCR 1982-NTGS GEMIS)

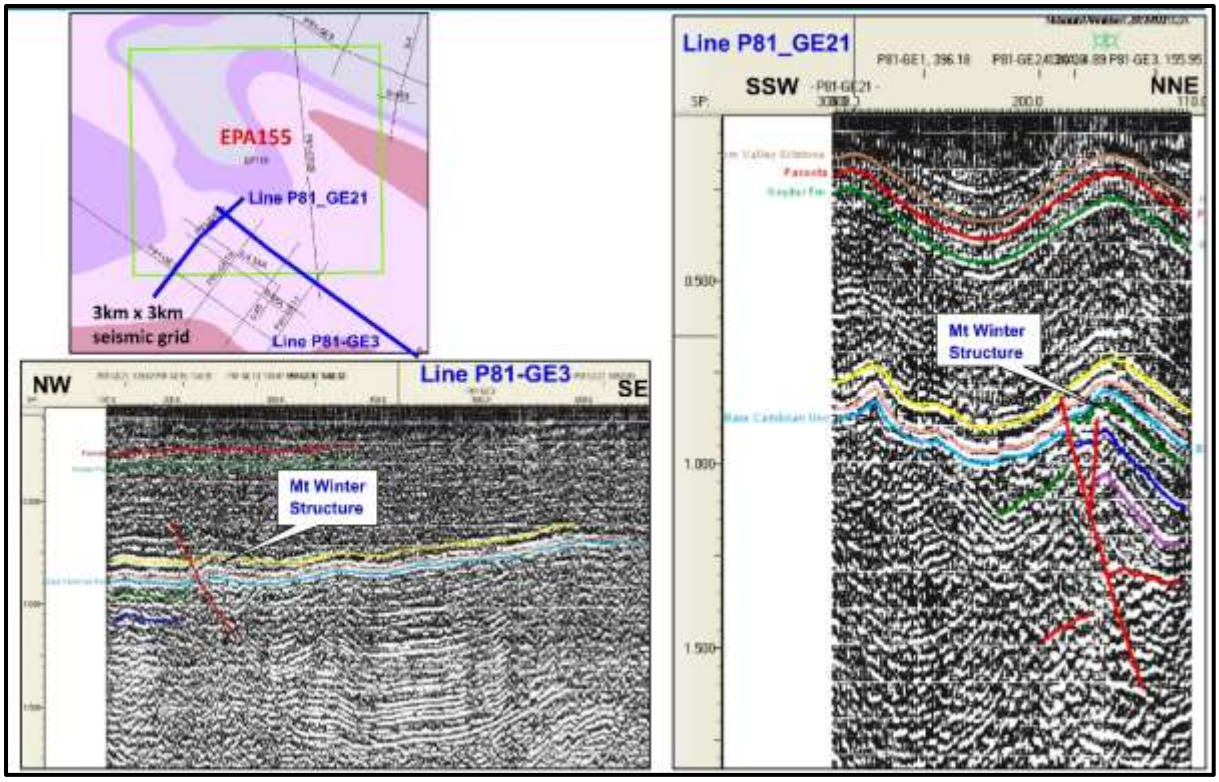


Fig.6 Seismic Slices Through the Mt Winter Structure (Courtesy Mosman Oil & Gas Limited AGES Presentation 2019)-the Heavitree Quartzite & basement horizons are not defined; reprocessing will assist in this but a gravity survey & more modern seismic should enable reasonably good definition.

The maximum thickness known of the Bitter Springs Group thus far in the Amadeus is 1,350m. (Southgate, Kennard and Nicol-1986).

To get to the top of the Heavitree Quartzite subsalt target immediately underlying the Bitter Springs Group from the current TD of Mt Winter #1, if that proves feasible, an additional maximum of 383m of drilling would be anticipated, (subject to the well not being sited over a major salt diaper) ie a TD of some 2,650m+383m ie 3,033m, rounded to 3,000m.

Assuming normal formation pressure gradients at 1.42 psi/m, bottom hole pressure at 3,000m would be 4,260 psi.

A SEEBASE image in the publication “Geology and Mineral Resources of the Northern Territory”, Ahmad & Munson, NTGS Special Report #5, 2013, shows that the Mt Winter 1, 2 & 2A wells are located over a structure known as the Central Ridge and the depth to basement in this location is approximately 2,000m to 4,000m, roughly congruent with the calculations defined from the maximum thickness prognosis above.

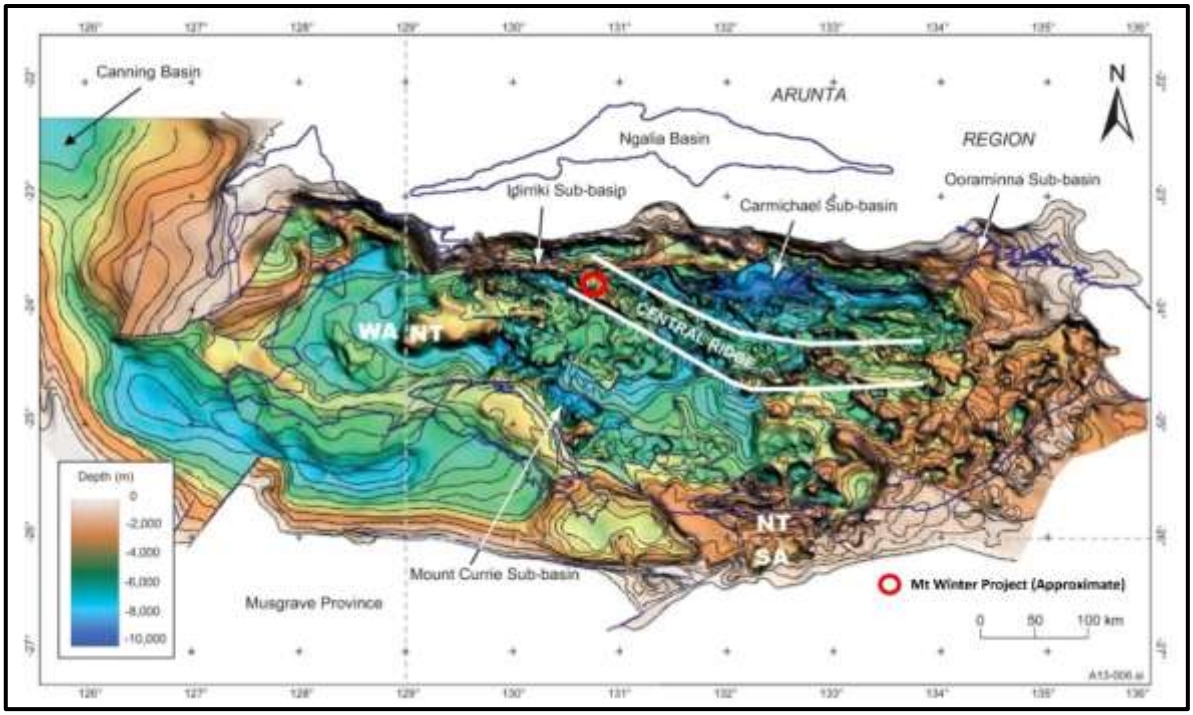


Fig.7 Seebase Image Depth to Basement-Amadeus Basin, (Courtesy NTGS Special Publication #5, Geology & Mineral Resources of the Northern Territory; Ahmad and Munson 2013)

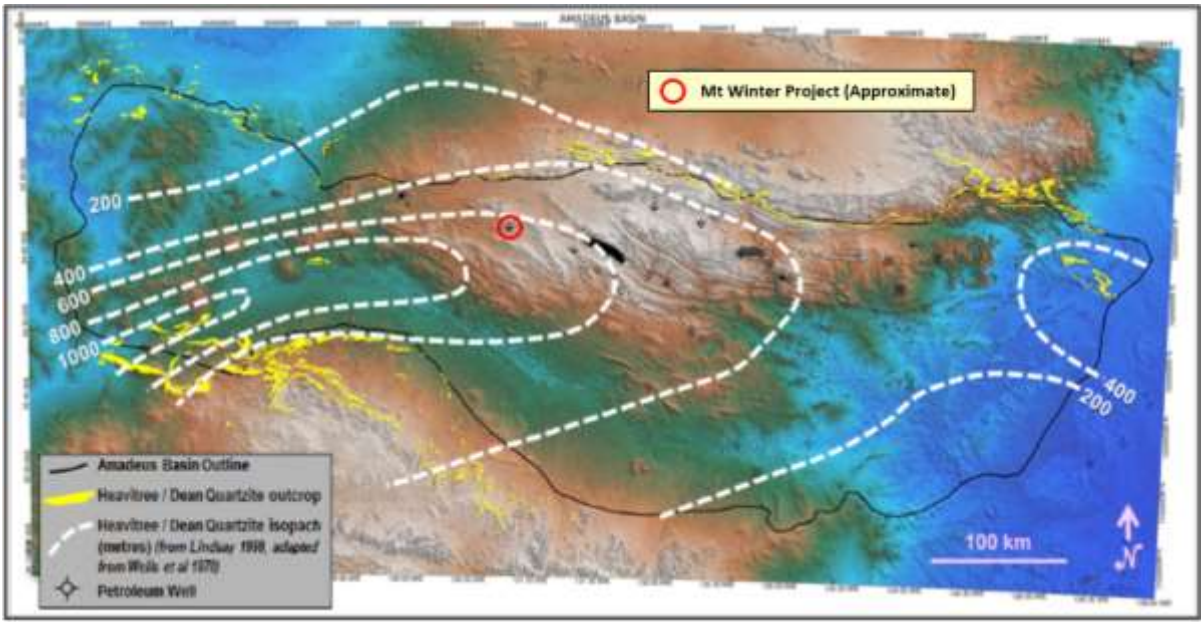


Fig. 8 Isopach (Thickness) Map of the Heavitree Formation, Amadeus Basin, Courtesy SANTOS, 2015

An isopach contour plan of the subsalt Heavitree Quartzite target formation in the Amadeus Basin in a 2015 presentation published by Santos reveals the prognosed approximate thickness of the Heavitree in the Mt Winter well locations to be *over 600m*, but to be conservative, 500m is assumed for the calculations here.

The TD of a new well or a deepened old well to basement then may be estimated at 3,500m at which depth the normal formation pressure would be 4,970 psi.

To calculate the Gas Expansion Factor (GEF) for gas in the Heavitree then we can use the pressure at the midpoint of these two depths (ie top Heavitree & base Heavitree) as a reasonable approximation, ie 4,615 psi resulting in a GEF of 4,615/14.7 or 314.

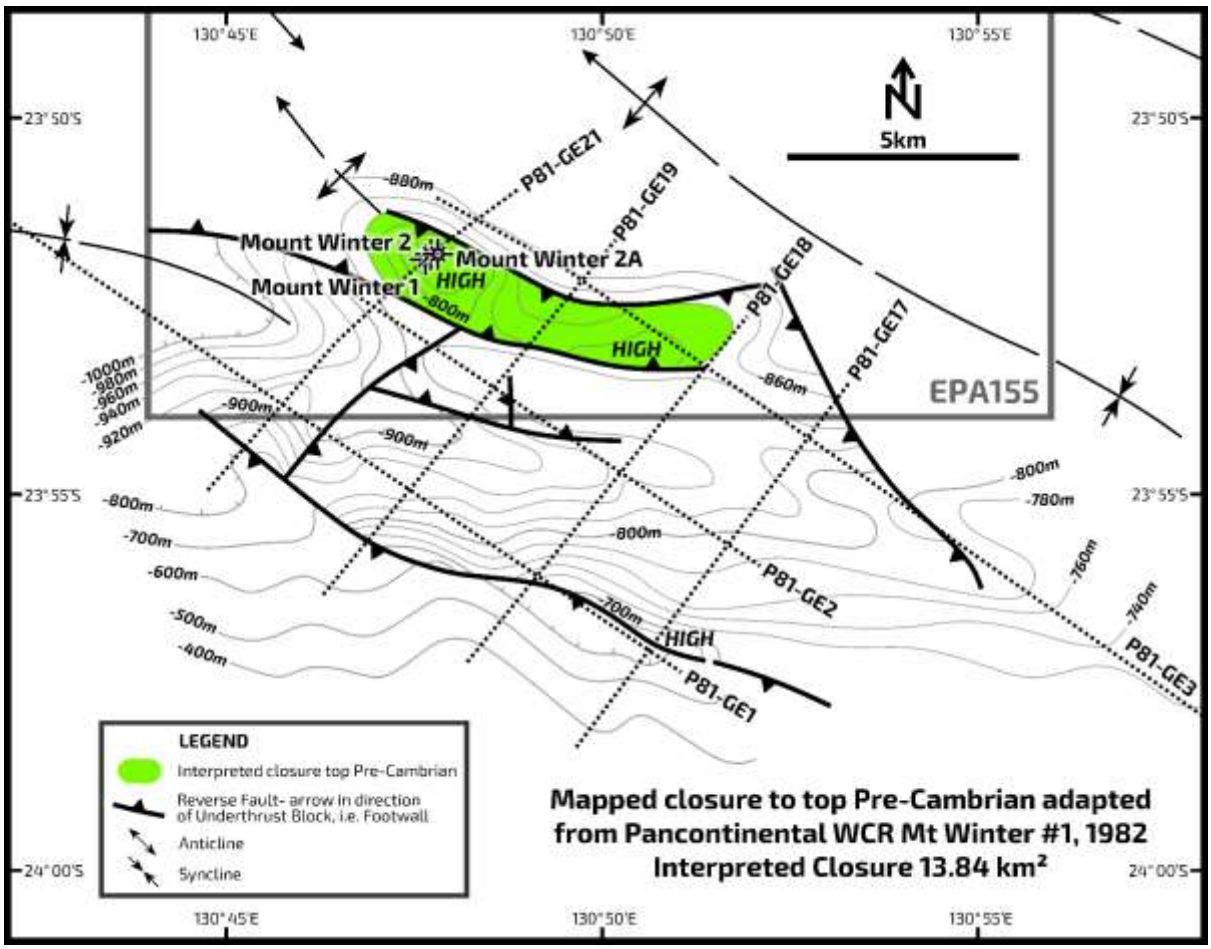


Fig.9 Mapped Closure top Pre-Cambrian 1,485m Measured Depth at Mt Winter #1
(Derived by the author from the 1982 Mt Winter #1 WCR)

The Mt Winter 1 WCR Enclosure #1 has a seismically defined structure at the top of the Pre-Cambrian, ie top of the Proterozoic Areyonga Formation at 1,485m (in Mt Winter #1 measured depth) showing an East West elongated double anticline with four way dip closure truncated to the North and South by two East West trending reverse faults. It is worth noting that the Gillen Member with abundant evaporatic (salt) based sediments would more than likely act as a good plastic seal at these depths to any potential reservoir leakage via these faults.

It will not be known however if this closure continues to basement until the current seismic is reprocessed, a gravity survey completed and new seismic shot and processed but it is fair to say that particularly in the Northern Amadeus Basin, most well defined anticlinal structures continue to basement level and become broader in profile. Presuming this is the case at Mt Winter, then the *minimum* closure would be approximately 13 km^2 or 3,200 acres.

The Heavitree has been reported to have over 9% porosity at the Magee 1 well drilled in 1992 by CRAE (WCR-Gordon Wakeland-King)-this is the only drilled test of the Heavitree to date

as the profile was missing at Mt Kitty and the hydrocarbons and Helium were hosted by fractured basement granite.

The Dukas 1 well in EP 112 spudded in 2019 by Santos, the operator, in the Santos/Central Petroleum Join Venture, is currently suspended awaiting a drilling rig with a 15,000+ psi BOP after encountering gas at 3,700m with a formation pressure of c.9,700 psi, (pers.comm. Exploration Manager, CTP, January 2020 and https://www.asx.com.au/asxpdf/20190813/pdf/447fqmtkcdksyz.pdf), well above normal formation pressure for that depth of c.5,000 psi. *"It is not currently possible to obtain a downhole gas sample for full compositional testing. However, gas recovered to surface with drilling fluids confirms the presence of hydrocarbons and inert <sic> gasses"*. The well has not reached the Heavitree target at the time of writing but should enable another good assessment of the Heavitree porosity and producibility at depth.

For the proposed first well of the Mt Winter project, assumptions based on fundamentals with reasonably comparative justification at various SPE PMRS levels are :

Unrisked Resource Calculations	P10	P50	P90
Area Acres (A)	5,000	3,200	2,000
Height ft. (h)	2,000	1,640	1,200
Porosity (Φ)	9%	5%	3.5%
Water Saturation (Swc)	25%	40%	5o%
;Gas Expansion Factor (GEF)	314	314	314
Helium content (% He)	11%	5%	2.5%
Recovery (% recovery)	85%	70%	60%

At P50 (SPE PMRS) Prospective Recoverable Hydrocarbon level parameters, application of the formula GIIP=43,560*Ah*Φ*(1-Swc)*GEF, results in a GIIP number of 2,153 BCFG with the further application of a conservative 70% recovery factor resulting in c. 1,500 BCFG (1.5 TCFGE-Trillion Cubic Feet of Gas Equivalent) volumetric potential.

Helium concentrations reported at Magee 1 and Mt Kitty 1 wells respectively were 6.2% and 9% and the geology appears very similar at Mt Winter, given the apparent basin wide ubiquity of the Heavitree Formation sitting on granitic basement and in turn being overlain by Gillen Formation salt.

If we assume a reasonably conservative Helium concentration of 5% at P50 level in the Mt Winter Heavitree Formation based on the results from Mt Kitty 1 and Magee 1, then up to 75 BCF of Helium may be potentially recoverable at this location at an estimated P50 Prospective Recoverable Resources level.

Similar calculations lead to recoverable P10 Prospective Recoverable Resources numbers of 7.85 TCFGE and 864 BCF of Helium with P90 numbers of 0.287 TCFGE and 7.2 BCF Helium.

Prospective Recoverable Resources	P10	P50	P90
Gas BCFGE	7,850	1,507	345
Helium BCFG	864	75	8.6

As more certainty emerges from reprocessing of seismic, additional gravity and additional state of the art seismic these necessarily wide ranges will be considerably narrowed.

Note : It is possible that the Heavitree Formation may not be wholly in the "gas window" (variously described as being in the range of 150-200^0 C or 120-180^0 C) and the hydrocarbons

may well be a mix of oil, condensate and gas. A BHT of 57^0 C was recorded in well logs at Mt Winter #1 at TD but this bears very little relationship to the maximum temperature reached by attendant source rocks during the evolution of the current structure; significant unroofing is obviously apparent given the uppermost sequence of the whole of the Carboniferous, Devonian, Silurian and a significant portion of the Ordovician, (the whole of the late Ordovician Carmichael Sandstone and the Stokes Siltstone) are missing.

As well, the quality of the existing processed seismic does not absolutely preclude the Mt Winter wells from being located over a significant salt diaper structure but the reprocessing planned together with a new closely spaced gravity survey and new additional state of the art seismic will determine this with certainty before drilling is commenced.

The Heavitree Formation in Outcrop, Heavitree Gap, Alice Springs-1949, Courtesy Albert Namatjira Estate

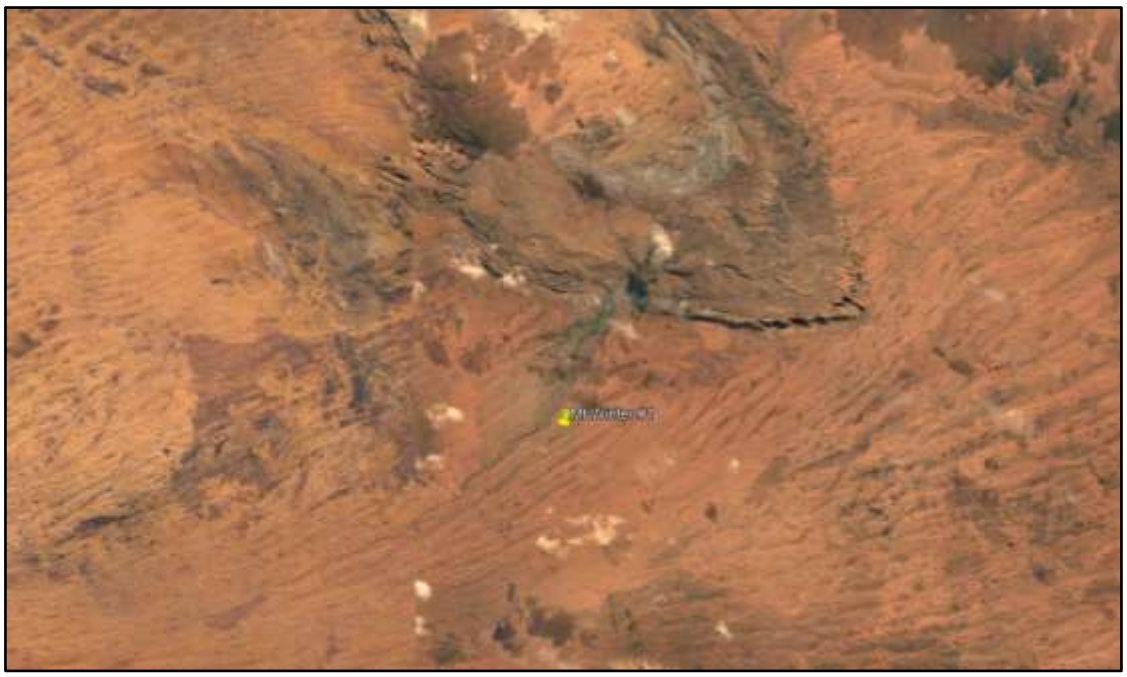
FARMIN PROGRAMME

The agreed farmin programme, initially designed to define depth to basement (ie subsalt Heavitree) and basement structures is summarised as follows :

a. Acquire and reprocess existing seismic from NTGS files; this will focus on broad definition of basement levels; c.AU$50,000
b. Negotiate granting of the permit with sufficient access to perform additional seismic and drilling;c.AU$75,000
c. Plan and execute a gravity survey with closely spaced lines to better define basement structures;c.AU$100,000
d. Acquire an additional 75 line km of state of the art 2D seismic to finesse structural interpretation hopefully with closure in basement draped Heavitree and Gillen salt

horizons, confirm initial seismic analysis and plan the drilling of one well to basement; c.AU$1,500,000

e. Subject to an independent petroleum engineering report confirming cost effective feasibility, re-enter Mt Winter #1 and drill to basement; costs TBA.
f. Test all potentially productive petroleum reservoirs encountered with BH DSTs on the way down; and finally test the Heavitree with a Bottom Hole DST once TD is reached; (alternatively if sufficient fluid samples and pressure readings-MDT eg-warrant the well may be completed as a producer and flow tested subsequently.
g. Complete primarily as a hydrocarbon/Helium production well from the Heavitree if the drilling is successful;
h. Complete with a dual zone DCIP in both the Heavitree and other hydrocarbon reservoir if feasible but with preference given to Heavitree exploitation in the first instance.



General Location Mt Winter #1 Arid Desert Terrain (Google Earth Pro Image)

HYDROCARBON AND HELIUM COMMERCIALISATION

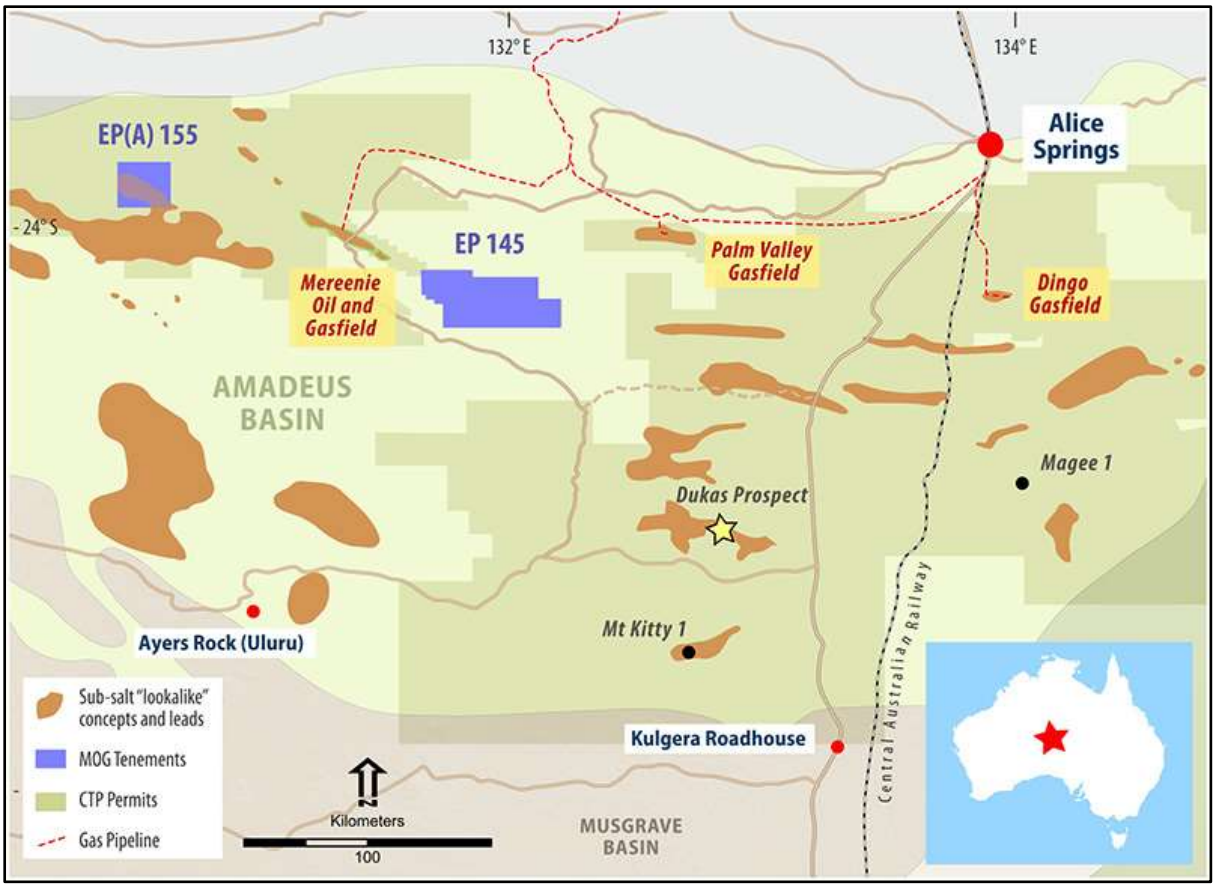


Fig 10 : Mt Winter Project Location (Approximate)-Courtesy Mosman Oil & Gas Limited

The Mt Winter Project is located c.150 km from the western end of the Mereenie gas pipeline (hitherto an oil pipeline also connected the field with Alice Springs but is now de-commissioned) which interconnects with the main Alice Springs to Darwin gas pipeline-the Amadeus Gas Pipeline or "AGP".

Currently, liquid hydrocarbons from Mereenie and recently the Surprise oilfields, both operated by Central Petroleum Limited (ASX "CTP") are trucked to Port Bonython in South Australia for export to overseas refineries.

Any hydrocarbon gas for sale could access the Eastern gas markets via a connection to the Mereenie Gas pipeline, subject to capacity constraints and commercial negotiation. A short 6" c.150 km gas pipeline to Mereenie from the Mt Winter project would cost in the order of AU$45 million.

The AGP is a transmission pipeline extending approximately 1,600 kilometres from gas fields in the Amadeus Basin, in central Australia, to Darwin. It transports natural gas to Darwin, Alice Springs and regional centres, principally to fuel electricity generation. Gas is delivered into the AGP at Palm Valley and Mereenie, and from the Bonaparte Gas Pipeline, at Ban Ban Springs much further to the North.

Construction of the AGP was completed in 1986. Nine locations along the pipelinewere developed as sites for future compressor stations, which could provide additional capacity if the demand for pipeline services were to increase. The first and only AGP compressor station was constructed at Warrego in 1995.

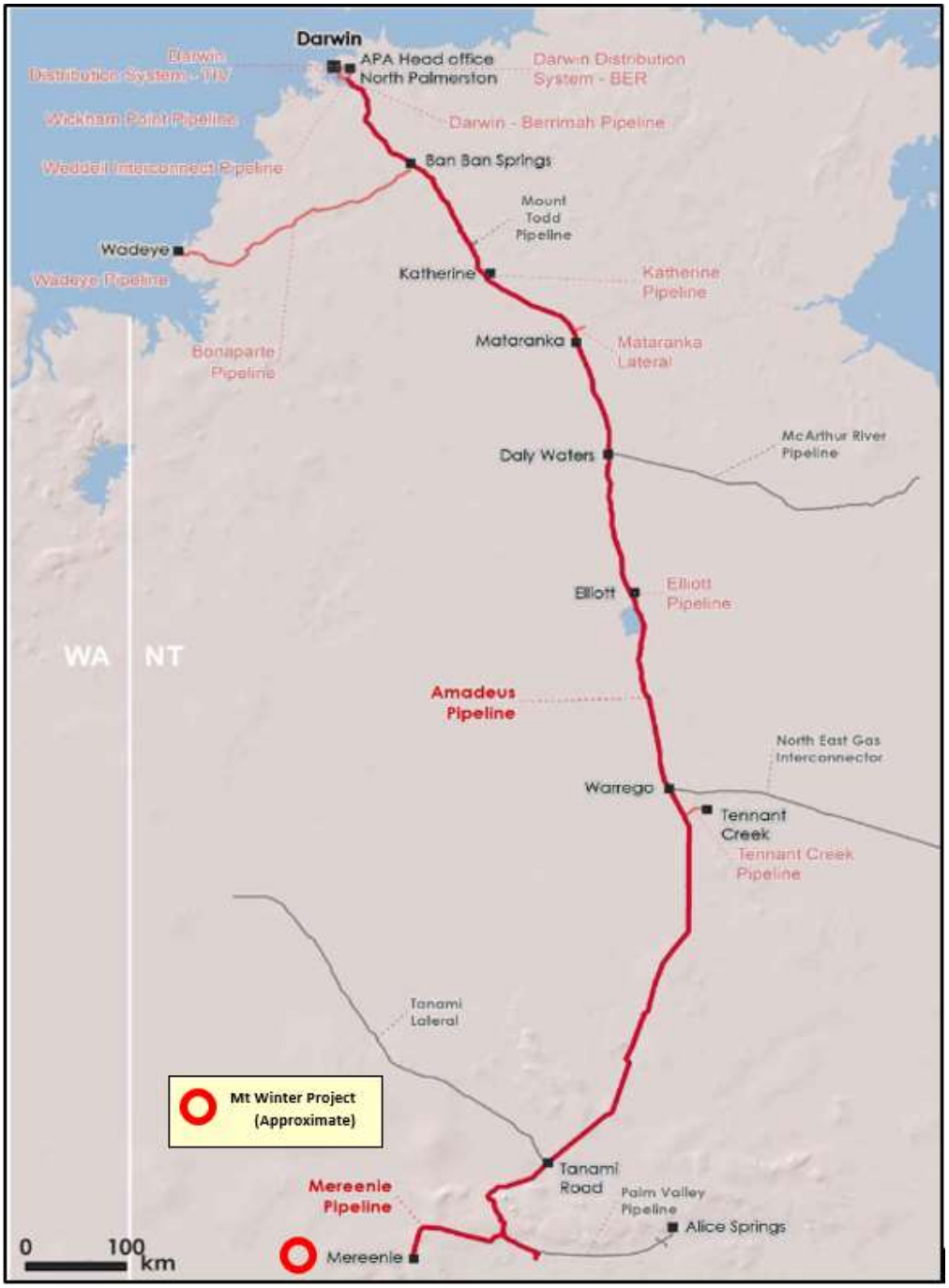


Fig 11 : The Amadeus Gas Pipeline Courtesy of the Amadeus Gas Pipeline, Reference Service Proposal, July 2019 APT Pipelines (NT) Pty Ltd

Although it was originally designed to transport gas from Amadeus Basin gas fields to Darwin, the APG is now multi-directional. Gas can flow north to the interconnection with the Northern Gas Pipeline (or North East Gas Interconnector or "NEGI"), and to Darwin. Gas can flow south, from Ban Springs, to the interconnection with the NEGI, and to Alice Springs for local electricity production via the Palm Valley to the Alice Springs Pipeline. The AGP also interconnects with the McArthur River Pipeline at Daly Waters, and with the Tanami Lateral, at Tanami Road. The McArthur River Pipeline and the Tanami Lateral deliver gas to remote mining operations. Interconnection with the Northern Gas Pipeline, at Warrego, near Tennant Creek, allows gas to flow from the AGP into the Northern Gas Pipeline, and most importantly into Queensland

and the east coast pipeline network via the North East Gas Interconnector ("NEGI"). Commercial operation of the interconnection between the two pipelines commenced in January 2019. About half of the gas now flowing in the AGP is delivered into the Northern Gas Pipeline.

However, it is not necessarily the intention of the operators of the Mt Winter Project to export any hydrocarbons and Helium themselves but preferably to sell the products at the wellhead to industry leading Helium supply companies such as BOC/Linde who would design, install and commission an appropriate nitrogen/hydrocarbon/Helium separation and extraction plant.

Nitrogen could also be utilised in the drilling of petroleum wells in the Amadeus Basin; it can be very effective as a fire & explosion retardant in air/hammer drilling using nitrogen foam and can be injected into producing hydrocarbon resevoirs to significantly improve ultimate production and volume rates (Enhanced Oil Recovery or "EOR" techniques).

A pre-feasibility study commissioned by Central Petroleum Limited and based on the commercial exploitation of subsalt hydrocarbons & Helium from the Heavitree Formation at Mt Kitty and Magee prospects in the Amadeus Basin was released to the ASX on 19th April, 2011. The report by Dr Mike Clark, (METTS) and Dr Duncan Seddon, studied the gas compositions of recorded Heavitree gas from the Magee 1 well and anticipated gas composition of the at the time, yet to be drilled Mt Kitty 1 well and focused on the in-situ separation and extraction in the field of hydrocarbons and Helium into a series of value added products, ie LPG, 99.995% A-grade liquid Helium, and LNG by using a proportion of the dry gases present to provide power to the plant.

A link to this extensive report follows :

***"Preliminary Pre-feasibility Study on Low Volume Commercial Extraction of Helium for Central Petroleum Limited, Dr Michael Clarke (METTS) and Dr Duncan Seddon (Duncan Seddon & Associates)",* CTP 19 April, 2010. Report in full publically announced.**

Follows a link to the relevant announcement with full report appended :

https://www.asx.com.au/asxpdf/20100419/pdf/31pv185mf32s70.pdf

The key conclusions from this 2011 report were based on a modelled 20 MMCFGD production profile and included :

a. Plant costs of c.AU$420 million;
b. Pre-tax revenue of AU$98 to 143 million;
c. A project NPV at an 8% discount rate of between AU$111 to 556 million;
d. 30% CAPEX savings if plant components constructed in SE Asia instead of the USA;

It is not possible of course to accurately predict the composition and quantity of hydrocarbons, Helium and nitrogen at any subsalt reservoirs of the Mt Winter Project but the analogy with Mt Kitty and Magee wells is a reasonable model to work with, (subject to success) given the analogous geology of the Mt Winter Project and the two reservoirs at Mt Kitty and Magee (probably as well as Dukas).

If the gases are similar at Mt Winter Mt Kitty and Magee, then the model proposed by Clarke and Seddon would be a good starting point for pre-feasibility studies; especially as the

products including cryogenically stored Helium, LPG and cryogenically cooled LNG produced by modular plants could all be trucked out to various markets.

In the case of Helium it could be brought to Darwin or Port Bonython in South Australia as an appropriate very high value export product by ship to other ports in Australia or SE Asia.

LPG produced could well be utilised in country mining centres and towns as a portable fuel supply as could LNG which could be converted to CNG for heavy transport fuel such as trucks and trains or used as base load fuel supplies for electrical generation in country centres. The key considerations here are :

1. The gas composition of any successful subsalt reservoir discovery;
2. The size of the resources;
3. The fuel requirements of any separation and extraction plant;
4. The economics of hooking up to an existing gas grid some 150 km away versus the production and export by trucking of liquid products and the attendant complications and expense of liquefaction.

Since the Clarke/Seddon report was produced there have been enormous strides in the successful design of modular gas separation and liquefaction plants as well as readily transportable relatively small trucking containers but early enquiries by Wesmarket indicate that there is strong interest from various international Helium suppliers in the purchase of all product at wellhead and such suppliers taking on the task of such separation, extraction, liquefaction and containerisation of the various product lines potentially available.

A second major development since this report has been the ongoing and significant escalation in both the price of gaseous hydrocarbons and Helium; this trend shows no sign of diminishing.

The economics of in-situ extraction and export versus piping gas into the existing grid can not be definitively arrived at until the Mt Winter Project is far better defined and of course, a successful discovery has been made.

John Heugh BSc(Hons), MAusIMM, CPL, MAAPG, MPESA, MAICD, MAIPN, MAWAL
Consultant Technical/Management Specialist May 2020

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Structural and stratigraphic architecture of Australia's frontier onshore sedimentary basins: the Western Officer and Southern Carnarvon basins, Western Australia
Lidena Carr [A] , Russell Korsch [A] , Arthur Mory [B] , Roger Hocking [B] , Sarah Marshall [A] , Ross Costelloe [A] , Josef Holzschuh [A] and Jenny Maher [A] + Author Affiliations *The APPEA Journal* 52(2) 670-670 https://doi.org/10.1071/AJ11084 Published: 2012

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