CSA Global Pty Ltd
Geological, Mining & Management Consultants to the Global Minerals Industry

ABN 67 077 165 532

Level 1, 47 Burswood Road
Burswood WA 6100
AUSTRALIA

PO Box 139
Burswood WA 6100
AUSTRALIA

Phone: +61 8 9355 1677
Fax: +61 8 9355 1977

Email: csaaus@csaglobal.com

MEMORANDUM

To: David Thomas

Cc:

Date: 25/9/2009

From: Graham M. Jeffress

Re: Fraser Range Project – Regolith/Landform interpretation and Geochemical strategy

---

Introduction

Norseman Gold plc (NGX) holds a number of tenements in the region between Esperance and Balladonia, south of the Dundas Nature Reserve. The tenements cover nearly 1200km^2, and form separate blocks within an area 80km N-S and 60km E-W.

CSA Global is managing exploration for NGX for the Fraser Range Project. As part of the exploration planning, CSA has undertaken a preliminary regolith interpretation of the project area to better inform geochemical sampling strategy and assess the potential for target types such as mineral sands, lignite and palæodrainage/sediment-hosted uranium.

Geology

The region is underlain by Proterozoic metamorphics and granitoids of the Albany Fraser Orogen (AFO). A recent Record by the GSWA (Record 2009/10, Spaggiari et al. 2009) provides a good overview of the regional geology of the project area. The main geological features of the project area are shown in Figure 1.

A lithomagnetic and structural interpretation has been completed for the project area by Isles and Dorling (2009, see Figure 2 and Figure 3). The principal conclusion of their work was that the "Munglinup Gneiss/Biranup Zone/Northern Foreland" terrane represents a metamorphically and structurally reworked margin of the Yilgarn Craton rather than an exotic accreted terrane. This terrane is recognised as the host rocks for most of the important gold systems so far recognised in the AFO, including Tropicana-Havana. This terrane is the preferred target for basement-hosted gold exploration in the project area.

Physiography

The area covered by the tenements comprises flat to gently undulating ground with occasional isolated rocky granitic hills (e.g. Mounts Heywood, Ney and Andrew), low sand dunes and numerous small clay pans. Dense mallee scrub covers most of the area apart from the clay pans and areas cleared by fires. The far southern portions of the project area are covered by agricultural paddocks.

Regions of clay pans and salt lakes are interpreted as remnant palæodrainage systems and, in the south, the former near shore/estuarine areas.

The detailed digital terrain model collected during the Esperance-Balladonia airborne survey in late 2008 and the 9 second DEM of Australia provide an invaluable tool for assessing subtle features in the landscape.

Palæodrainages and palæoshorelines related to Eocene and Miocene sea levels are readily apparent in the DEM (see Figure 4). Hou et al (2008) and Sandiford et al (2009) describe important Eocene (41Ma) shorelines at 300m ASL and Miocene (>15Ma) shorelines around the 220mASL level in the western Eucla Basin. Such features are clearly apparent in the DEM. The current elevations of these palæoshorelines reflect tilting/uplift of the southwest portion Australian continent during the Tertiary (Hou et al., 2008 and Sandiford et al, 2009).

In the NGX project area, the 220m ASL level defines both a palæoshorelines and a series of barrier islands – a setting similar to the present day Peel inlet, south of Perth, or the Coorong in SA.

Erosion of inset-valleys/palæochannels appears to have been focussed in pre-existing depressions and former barrier lagoons. More southerly palæochannels have been more or less completely buried by younger sediments and are not readily apparent on the DEM but have been recognised in past exploration drilling targeting lignite in Eocene palæochannels. Reprocessing of the DEM to highlight subtle elevation differences, together with radiometric data and outcrop patterns provide clues as to the locations of these more southerly palæochannels.

Experience elsewhere in the southern Yilgarn and Gawler cratons suggests that modern channels and 'lines of lakes' tend to bear a close relationship to underlying palæovalleys, though in the northern Yilgarn the palæodrainage thalwegs are often up to several kilometres north from the current day 'line of lakes' due to the regional tilting that has affected the craton.

In the NGX project area the palæodrainages have a more north south orientation so this migration of the thalweg away from the modern drainage line is considered less of an issue. This contention is largely supported by the past drilling, though the holes are mostly widely spaced.

A small number of detailed drill traverses reveal a complex basement topography with rapid changes in elevations (for example see Figure 5 and Figure 6). On this basis broad palæovalley interpretations have been made for the project area, that are consistent with all of the data sets, but which may be inaccurate locally or in detail.

Regolith

The NGX Fraser project area covers an area of complex regolith. Stephens and Grimley (2000) provide an excellent summary of the regolith in the project region. The following précis is largely derived from their report.

The area contains sub-cropping Pre-Cambrian rocks occurring beneath variably preserved and lateritised overlying Mesozoic and Tertiary age sediments beneath a thin cover of aeolian sand and clay.

Regolith consists of a stripped *in situ* laterite profile and saprolite developed on the Pre-Cambrian rocks, that formed in the Mesozoic Era, which is variably overlain by sediments of post-Eocene age. These overlying Cenozoic age sediments have been modified by lateritic weathering processes during the Oligocene and locally partially stripped due to uplift. The soil profile reflects the relatively recent onset of aridity (Late Miocene) and formation of an alkaline upper regolith.

Figure 7 is a schematic regolith section compiled from previous drilling and field observations. It also contains a proposed stratigraphy for the near surface (1-2m) alkaline soil environment.

A brief summary of the timing of regolith processes which have affected the NE section of the Albany Fraser Terrain is listed below:

- Development of a lateritic profile on Pre-Cambrian bedrock during the Mesozoic. This was eroded and stripped to the lower saprolite level in the late Cretaceous. Some of the lateritic material was locally deposited into palæodrainages.
- Deposition of initially freshwater and then marine sediments associated with two Eocene transgressions. This includes the Werillup Formation clays and sands (that are characterised by abundant lignite units near their base) and the Princess Royal Spongolite.
- Weathering and lateritic processes were active post-Eocene, forming thin laterites on the Eocene sediments ($^{40}Ar^{39}Ar$ analysis of Mn-oxides indicates active weathering at 28Ma). This weathering event commonly penetrated the entire cover sequence (depths of up to 25m).
- The onset of a semi-arid to arid climate occurred in the Oligocene and was associated with fall in sea level. Variable erosion of the Eocene lateritic profile occurred at this time, particularly in the Southern Fraser area as a result of localised uplift/tilting. Much of the Eocene profile was eroded, leaving a truncated saprolite.
- Arid conditions became dominant in the Late Oligocene/Early Miocene.
- Semi-arid to arid climatic conditions have persisted from the Late Miocene to the present. This has resulted in the formation and preservation of the present highly alkaline near surface regolith, including a near ubiquitous pedogenic calcrete.

A preliminary desktop interpretation of the regolith in the project area is presented in Figure 10. This interpretation combines areas of mostly shallow basement around areas of outcrop, with palæodrainge features derived from the DEM, radiometrics and drilling.

Radiometrics

Radiometric data collected during the Esperence-Balladonia airborne survey highlight a number of regolith features (see Figure 8). The RGB ternary image of the K, Th, U channels is the most useful image for assessing the regolith.

Palæochannels appears as 'dead" zones radiometrically – areas with very little radiometric response in any channel. Presumably this reflects the blanketing effect of recent alluvium in these broad depressions.

Clay pans and small lakes are generally anomalous in the uranium channel. The region around the NGX project is higher in Thorium revealed by the overall green tint in the ternary image – this is perhaps reflecting a higher monazite content in these granitoids.

Areas of outcrop, generally granitoids of the ?Esperence Supersuite, show as hot spots on the dose (Total count) image. The radiometric high zones are significantly larger in area than the outcrops (Th having larger areas than K) – this is interpreted to be due to erosion and dispersion of the granitoids' feldspars and monazites, rather than broad areas of subcrop, but this point requires ground checking, . Overall the areas interpreted as shallow basement based on drilling have higher radiometric response.

Past Exploration

The area has received little exploration activity in the past due to the location, lack of outcrop and perceived limited prospectivity. Past exploration has focussed on lignite (Eocene brown coals), mineral sands, and latterly Broken Hill type (BHT) style base metals and magnetite iron ore. The discovery of the Tropicana deposit has refocussed attention on the gold potential of the Albany Fraser Orogen.

Previous exploration drilling in and around the project area was captured and depths of cover extracted from the reports. Depths vary significantly, ranging from less than 10m to in excess of 50 (see Figure 9).

Depth of Cover from geophysics

Euler deconvolution solutions for the aeromagnetic data were calculated to provide an estimate of the depth to magnetic basement (DTMB), however the results of this image were contradicted by the known depth from past drilling as so were discounted as a unreliable estimate.

An Input survey was flown by CRAE in 1982 as part of their lignite channel search. Part of the survey covers the NGX tenements and the interpreted channel locations and depth of cover interpretation of the Input survey is consistent with the palaeodrainages interpretation from other techniques.

Past Geochemical Sampling

There has been limited surface geochemical sampling in the project area by past explorers. The northwestern corner of the project area was tested by part of a calcrete sampleing program conducted by BHP looking for BHT deposits, and 100 calcrete sample were collected in the Splinter project area by Azure Minerals; no other surface geochemical sampling was found in the WAMEX data.

The BHP calcrete sampling covers part of the reworked Archaean zone identified by Isles and Dorling (2009) and is of particular interest. There are 2 samples that are greater than the 98th percentile for gold (actual values 13ppb and 12ppb) in the calcrete data. However they are single point anomalies and their Ca contents are also the highest Ca values – levelling Au by Ca, reduces the significance of these samples, but flags four other samples as the highly anomalous. The low levels of Ca and Au recorded for some of these samples means that these results need to be used with caution.

However, the presence of anomalous gold, whether or not it can be directly related to underlying mineralisation, in the area highlighted as of interest by Isles & Dorling (2009), provides encouragement for the prospectivity of this area.

Azure's calcrete sampling returned a maximum assay of 7ppb Au, but most samples were around the 1ppb level. Given the thickness of cover revealed in the drilling at Splinter – cover is commonly >20m thick – these low results are not surprising, and are considered a poor test of basement mineralisation.

Conclusions & Recommendations

- The project area is covered by a complex regolith with multiple episodes of lateritisation and stripping of saprolite profiles that have developed on both the Pre-Cambrian rocks as well as Tertiary sediments.
- Palæoshoreline/s and inset palæovalleys eroded during regressions complicate the regolith story but also provide opportunities for mineral sands, sandstone hosted uranium and possibly lignite. The potential is greatest in the southern licences.
- There is the possibility of gold in the palæochannels, either placer or chemically transported.
- The regolith developed on the Pre-Cambrian basement is reportedly up to 20m thick, and partially stripped leaving depleted saprolite and saprock. Bedrock drilling to sample this material should attempt to reach fresh rock. Sampling should comprise composites downhole as well as selective sampling of redox fronts and the bottom of hole material.
- A reasonably ubiquitous pedogenic calcrete is reported by past explorers developed at around 0.5-1.5m depth in the surficial sandy soils (æolian). This material is considered to be the best surface geochemical sampling medium in those areas where the cover sequence is thin enough.
    - Mallee is the predominant flora in the region – the root systems of mallee reportedly extend to 10-20m depth, so that calcrete is likely to have captured metals transported by the plants from this depth range.
    - Any cover >15m likely precludes the use of surface geochemical sampling.
- The southern licence group is less prospective for gold in the basement and has thicker regolith. Surface sampling is suggested for the lower priority lithomagnetic zones that lie in the interpreted shallow basement areas.

- The thickness of cover and therefore effectiveness of historic calcrete sampling in E63/956 is ambiguous. The DEM and radiometrics suggest the presence of a palæovalley system but two historic drill holes intersected granite a shallow depths (5m & 8m) – this may reflect local highs, as seen on traverses further south at the Splinter project, or it may reflect generally shallower basement.
- The following work programmes are recommended:

1. Infill and repeat calcrete sampling should be undertaken around the anomalous samples collected by BHP. The initial 1km spaced samples should be infilled with 200m spaced samples around the anomalous samples with two repeats taken at and near the original anomalous samples.

   This orientation work is designed to check the reliability of the calcrete sampling in this area and provide confidence in the suitability of this approach.

   If the follow-up samples repeat the anomalous results then calcrete sampling should be completed on 800m x 200m lines across the areas interpreted as shallow basement in E63/956 and E63/957.

2. Complete a series of aircore traverses across the prospective units identified on the lithomagnetic interpretation – this will provide basement samples, information on lithologies to truth the interpretation and also geochemical samples and material for hyperspectrally assessing alteration assemblages present. Additionally, this approach will provide unequivocal evidence on the regolith upon which to base exploration decisions elsewhere in this area.

3. Complete a series of aircore traverses across the interpreted palaeodrainages to assess the location and thickness of the drainages, observe the redox state of the sediments and the amount of sands present, test for mineral sands, lignite and uranium (on site checks with scintillometer and handheld XRF are recommended). Any basal sands/gravels should also be assayed for gold.

Figure 11 shows the areas of proposed calcrete sampling and possible aircore lines.

References

Hou, B., Frakes, L.A., Sandiford, M., Worrall, L.,Keeling, J. & Alley, N.F. (2008): Cenozoic Eucla Basin and associated palæovalleys, southern Australia — Climatic and tectonic influences on landscape evolution, sedimentation and heavy mineral accumulation. Sedimentary Geology, 203, pp112-130.

Isles, D. & Dorling, S. (2009): Assessment of Regional Aeromagnetic Data Albany Fraser Province, WA For Norseman Gold Ltd. Unpublished Southern Geoscience memorandum for CSA Global Pty Ltd.

Sandiford, M., Quigley, M., de Broekert, P. and Jakica, S.(2009): Tectonic framework for the Cenozoic cratonic basins of Australia, Australian Journal of Earth Sciences, 56:1 ,pp5-18.

Spaggiari, C., Bodorkos, S., Barquero-Molina, M., Tyler, I. & Wingate, M. (2009): Interpreted bedrock geology of the South Yilgarn and central Albany-Fraser orogen, WA. GSWA Record 2009/10, 84pp.

Stephens, D. & Grimley, M. (2000): Final Report for Exploration Licences E63/689 and E63/690, and, Annual Report For Exploration Licences E63/687 And E63/688 Southern Fraser Project, WA for The Period Ending 20th July 2000. BHP unpublished report CR9834, GSWA Open file report A61030.

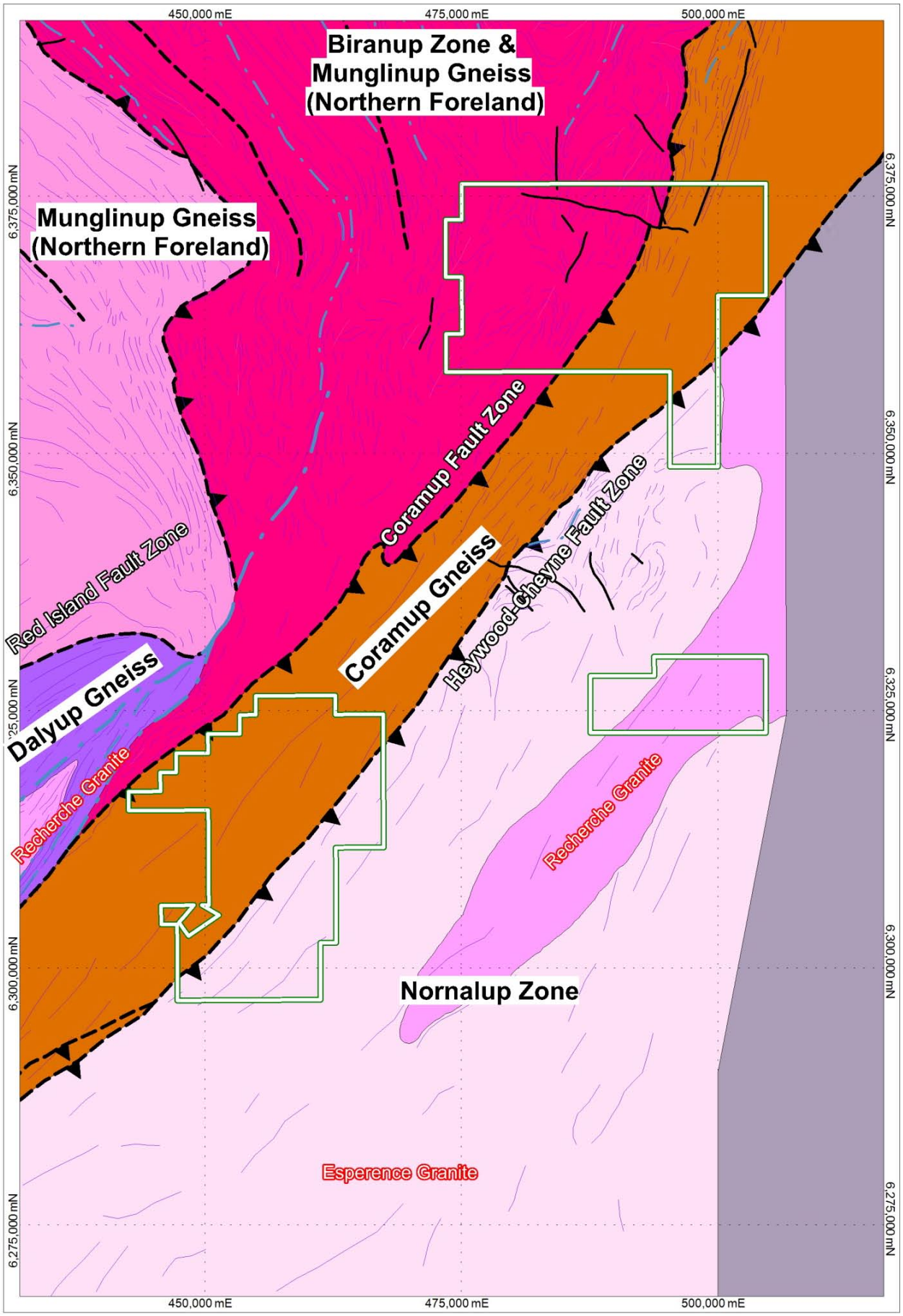

Figure 1: Regional Geology of the Fraser Range Project – Norseman Tenements outlined in green/white – based on GSWA mapping

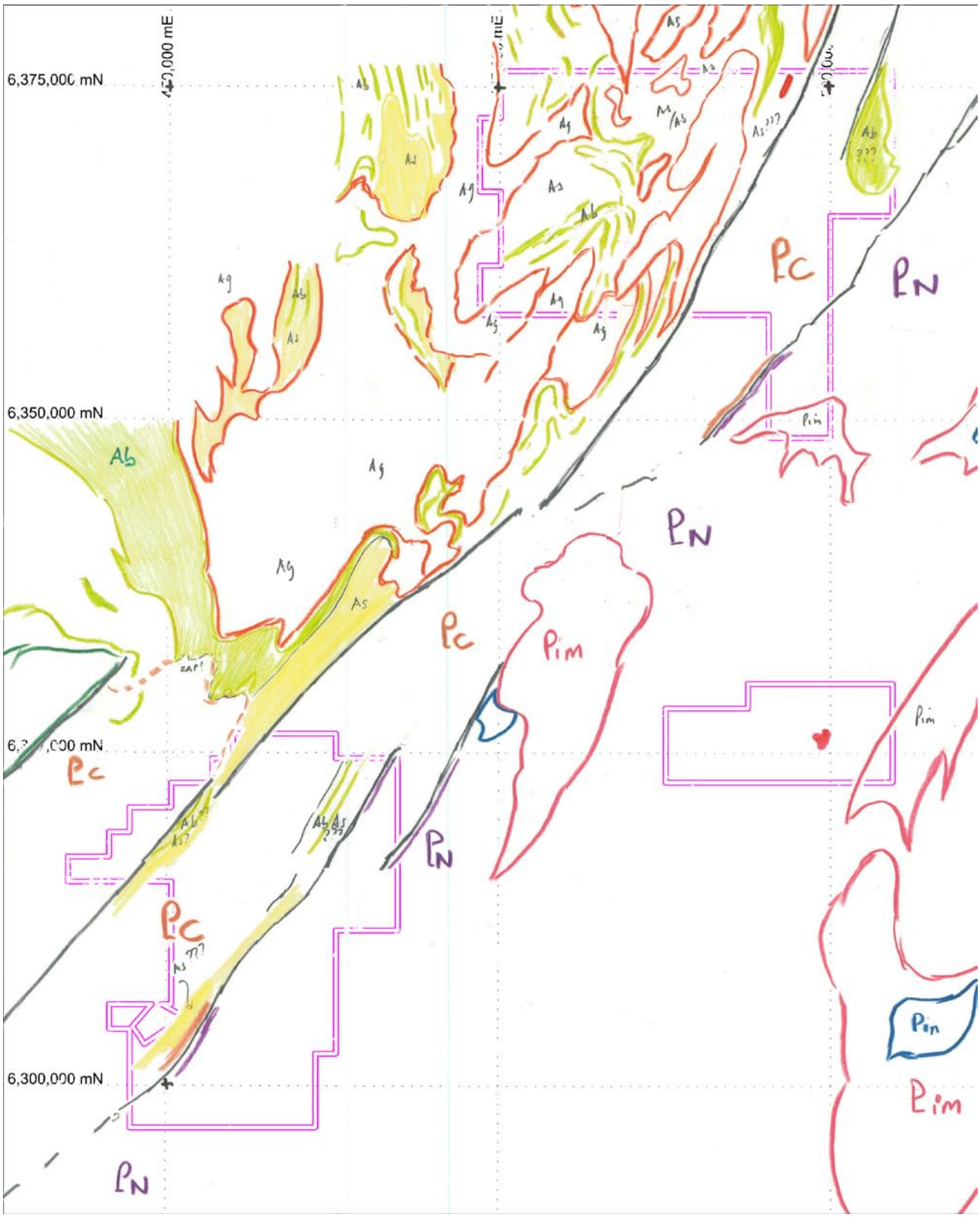

Figure 2: David Isles – Lithomagnetic interpretation.

PN = Nornalup Zone; PC = Coramup Gneiss zone; Dark green outline is Fraser Zone equivalent; Pim = Magnetic Proterozoic intrusives; Ab = Archaean Basalt; As = Archaean sediments; Ag = Archaean granitoids.

Ab/As represent modified greenstone units that are considered the preferred host rocks for gold mineralisation.

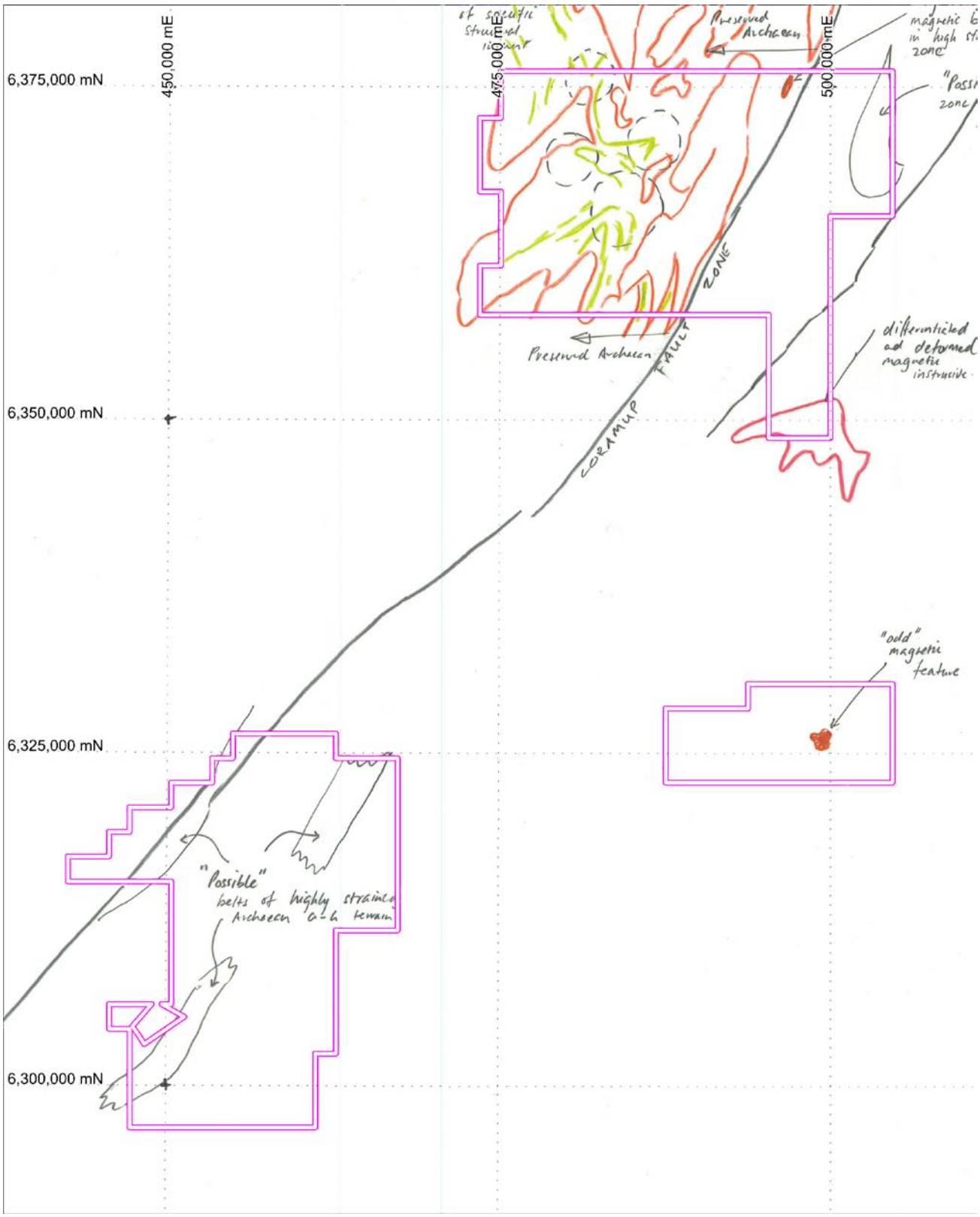

Figure 3: David Isles "Areas of Interest" - targets

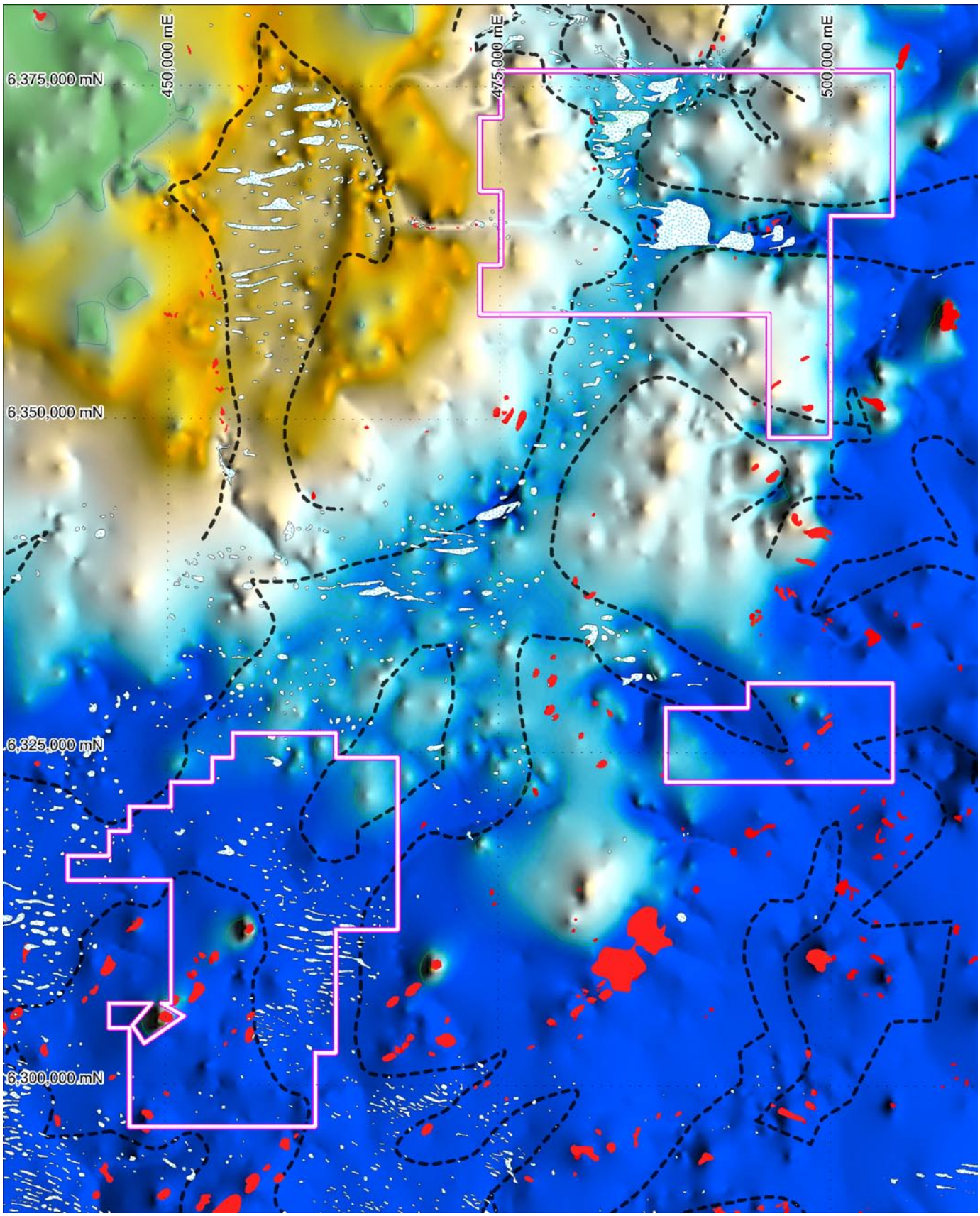

Figure 4: Digital Elevation Model (9sec Aust DEM) for the Fraser Project. Blue areas are less than 220m ASL, Green areas are greater than 300m ASL. Red polygons are rock outcrops, pale blue stippled areas are clay pans and salt lakes, blue dashed lines are interpreted palaeodrainages areas. NGX tenement areas shown in Magenta & white.

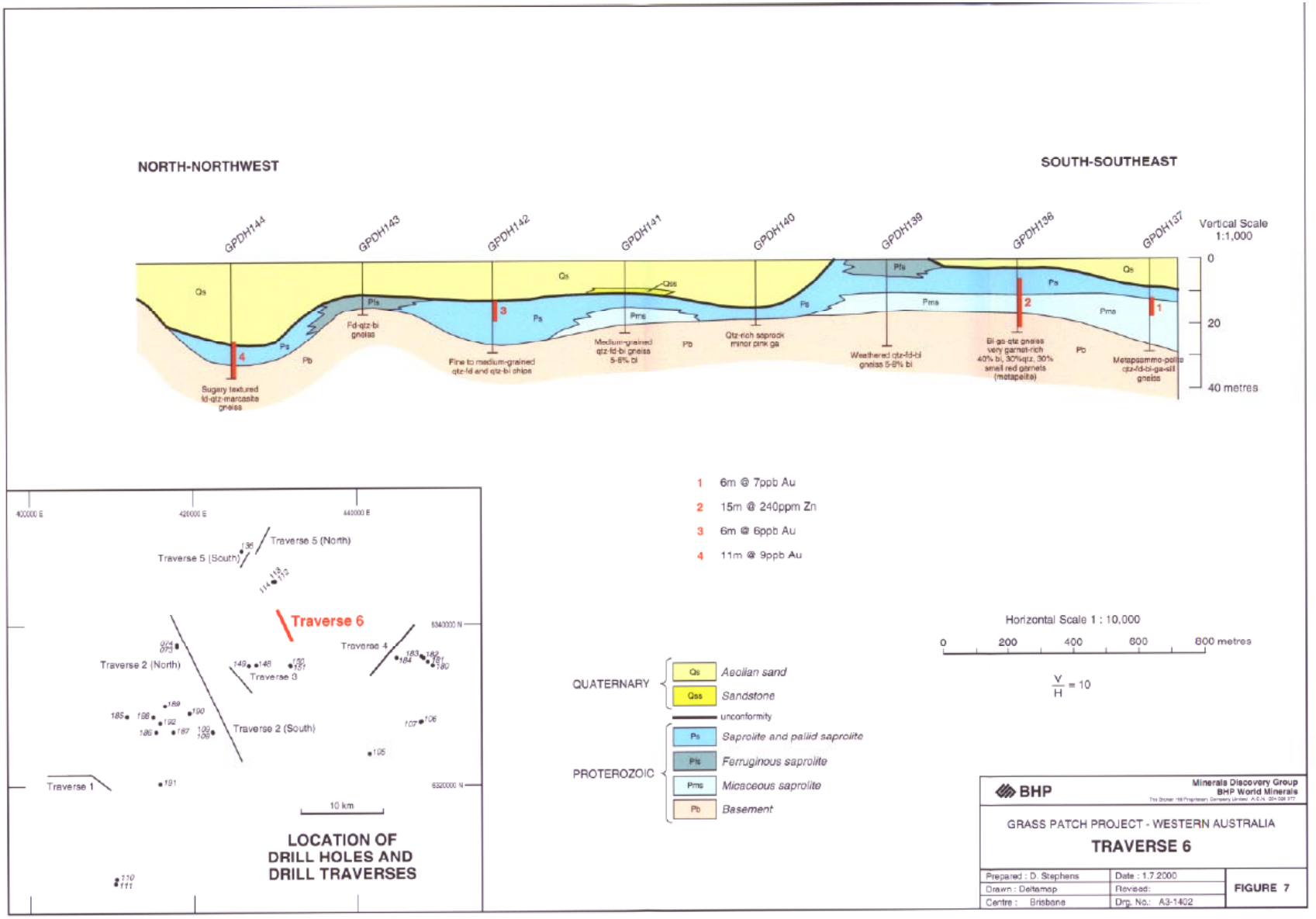

Figure 5: BHP Regolith Profile, from an area just to the west of the NGX Fraser Project, showing the variability of the cover and regolith development in the region

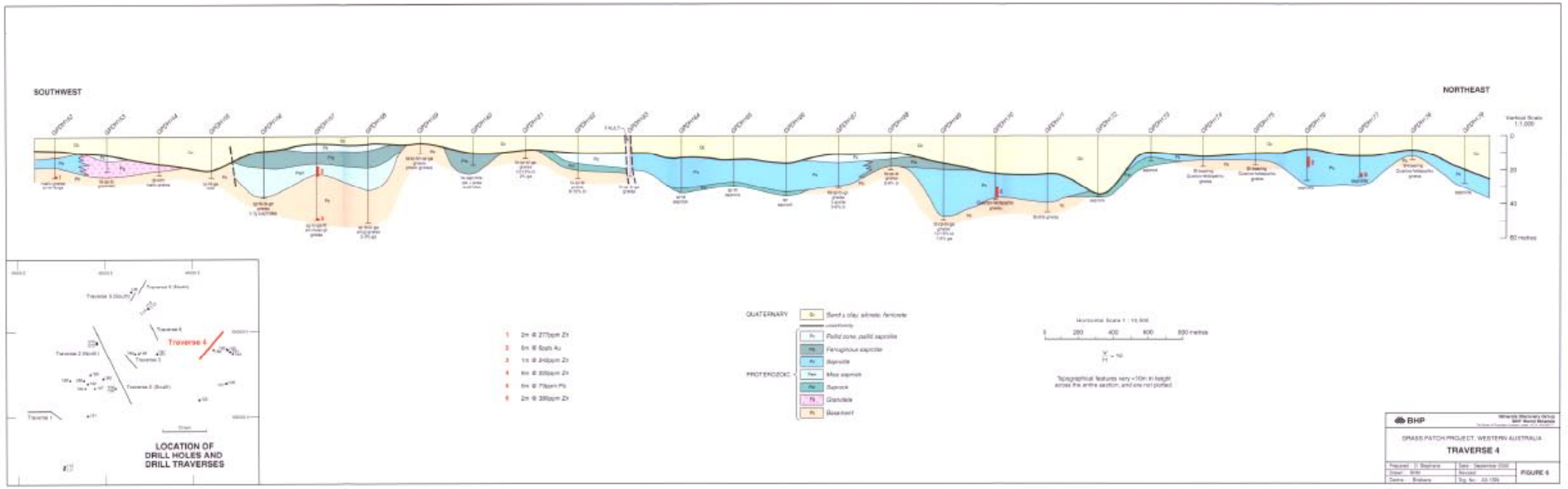

Figure 6: BHP Regolith Profile 2, , from an area just to the west of the NGX Fraser Project, showing the variability of the cover and regolith development in the region

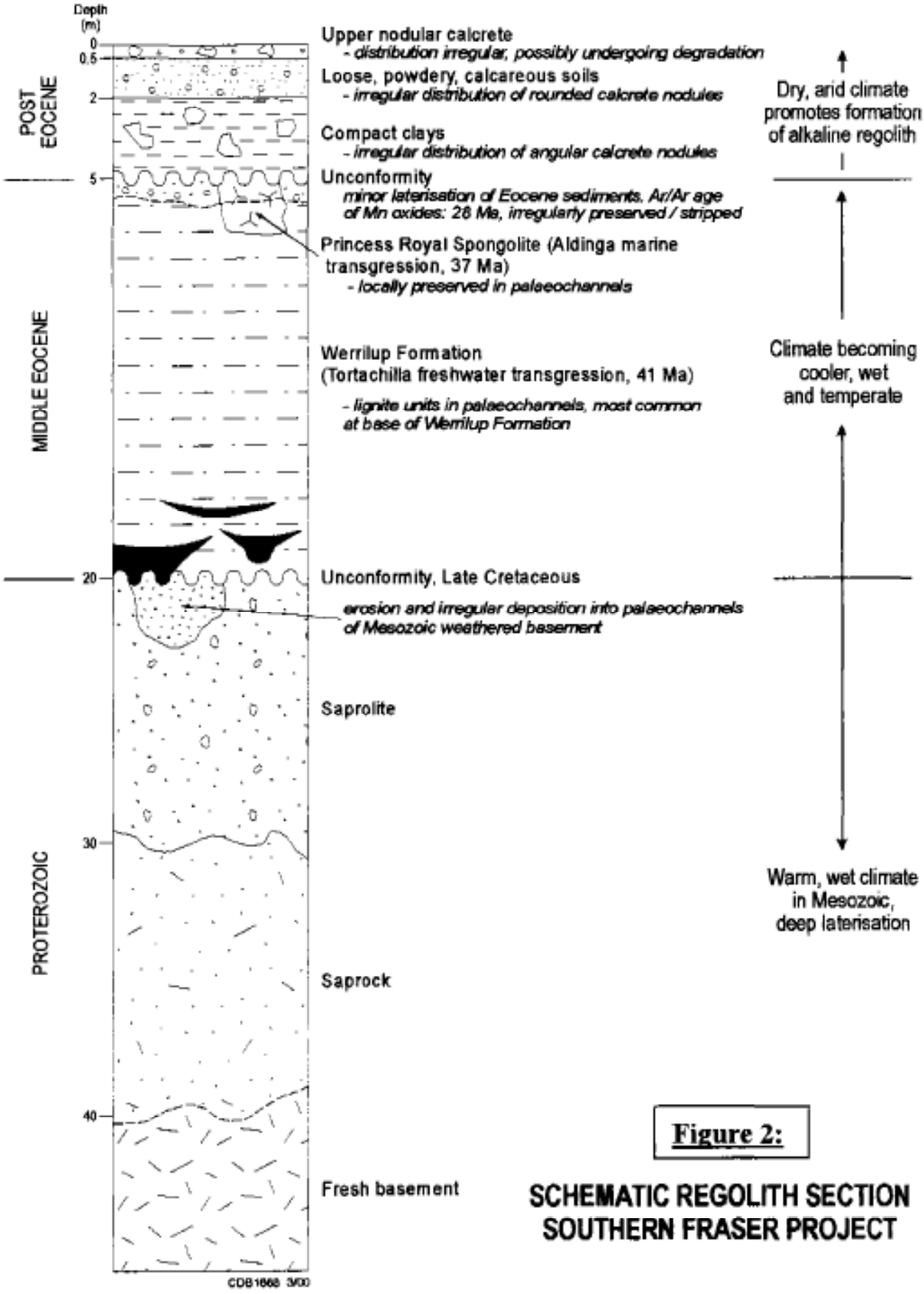

Figure 7: BHP Regolith summary (from Report A61030)

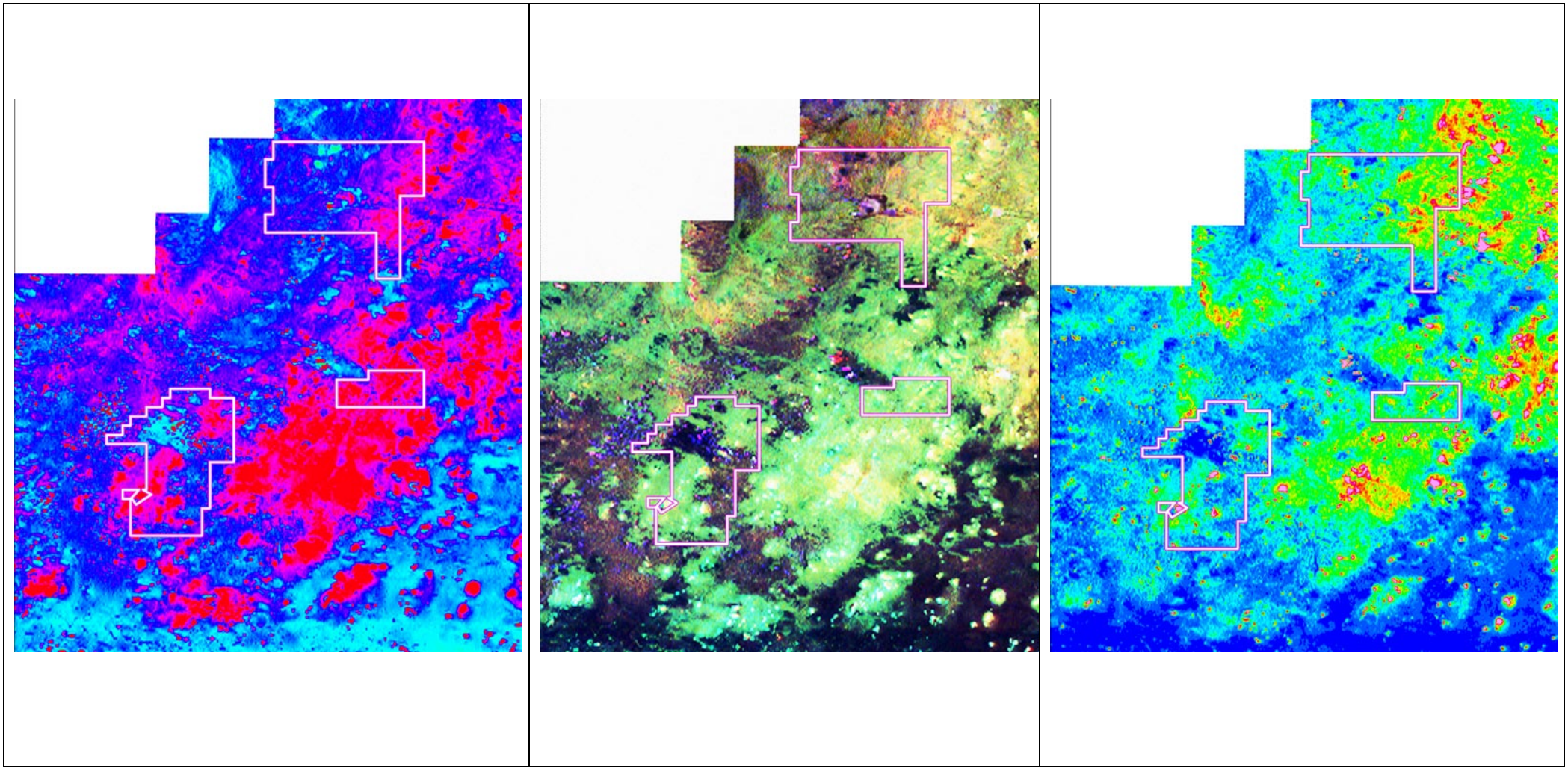

Figure 8: Fraser Project Radiometric images from GSWA Esperence Balladonia surveys, from Left to right: Dose (Total Count), KThU RGG ternary, K

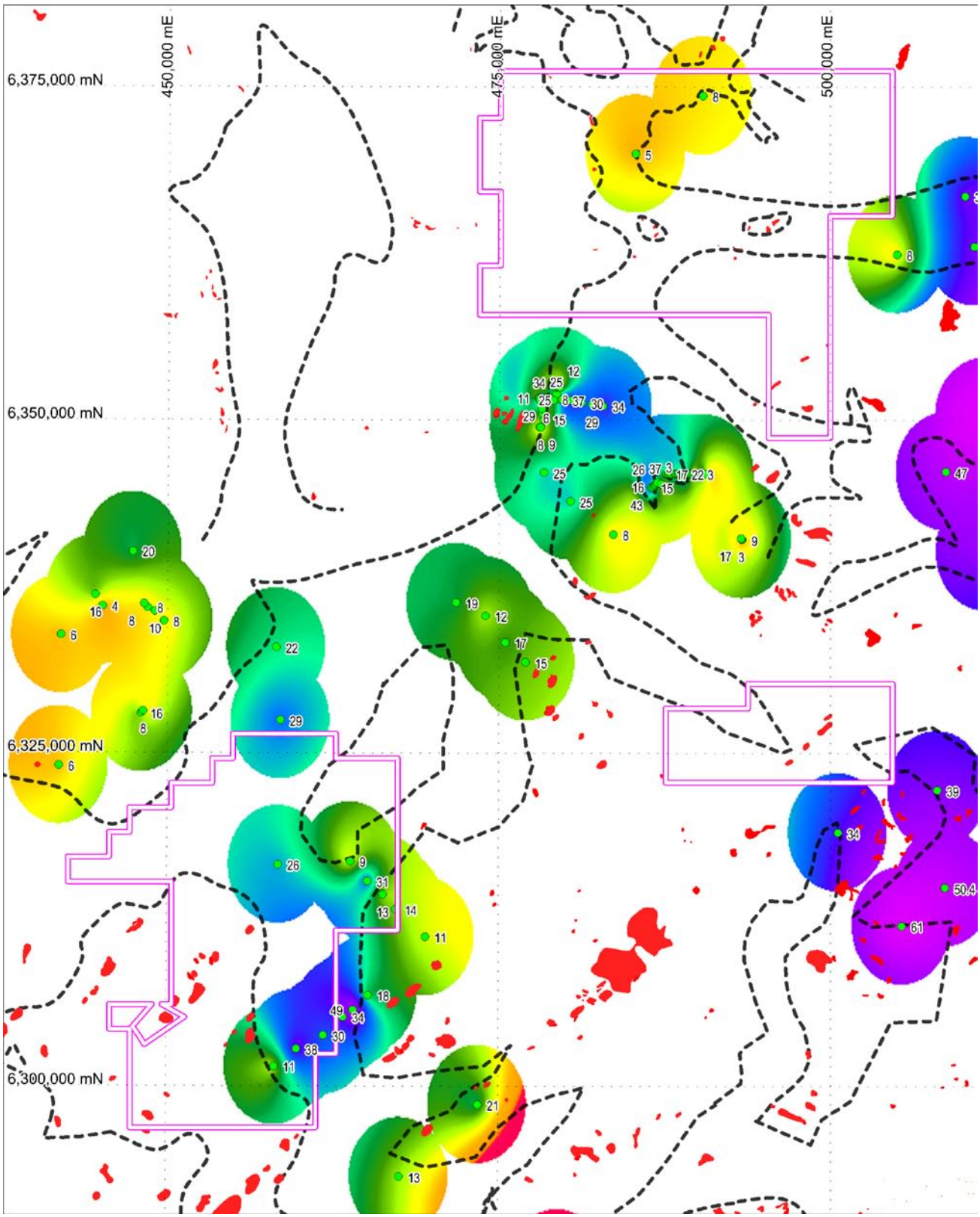

Figure 9: Past Exploration drilling for the Fraser Range Project area (NGX tenement areas in magenta/white). Depth of cover shown for each drill hole – the coloured background is a buffered image of the depth of cover around the drill holes. Yellow/orange are depths of cover less than about 15m (i.e where calcrete sampling may be viable), greens, blues & purples are greater depths. Black pecked lines are the interpreted palaeochannels and the red polygons are outcrops.

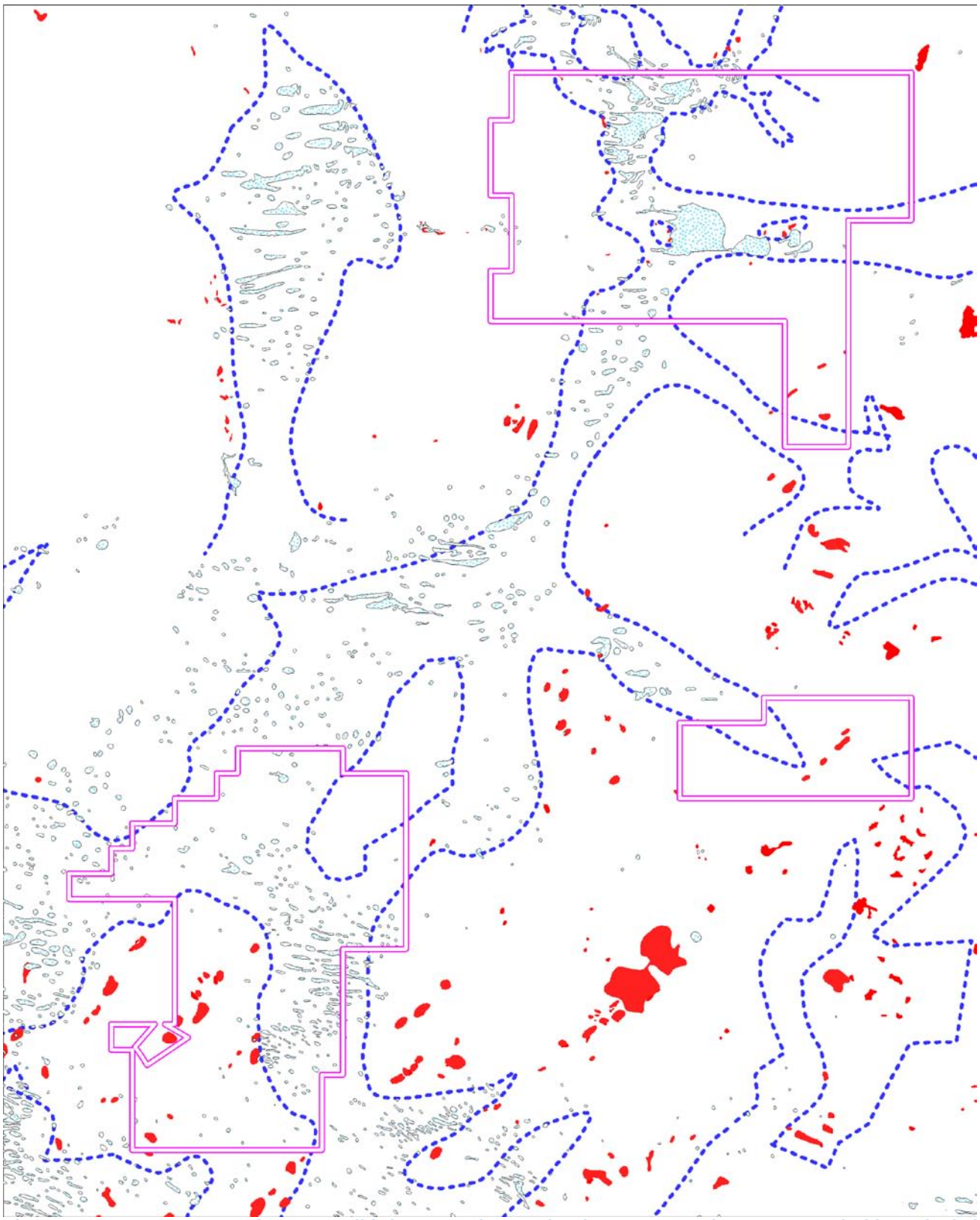

Figure 10: Fraser Range Project - Regolith interpretation. Red polygons are rock outcrops, pale blue stippled areas are clay pans and salt lakes, blue dashed lines are interpreted palaeodrainages areas – zones were depth to basement is too deep for effective surface geochemistry. White areas around the outcrops are aeolian sand and low dunes.

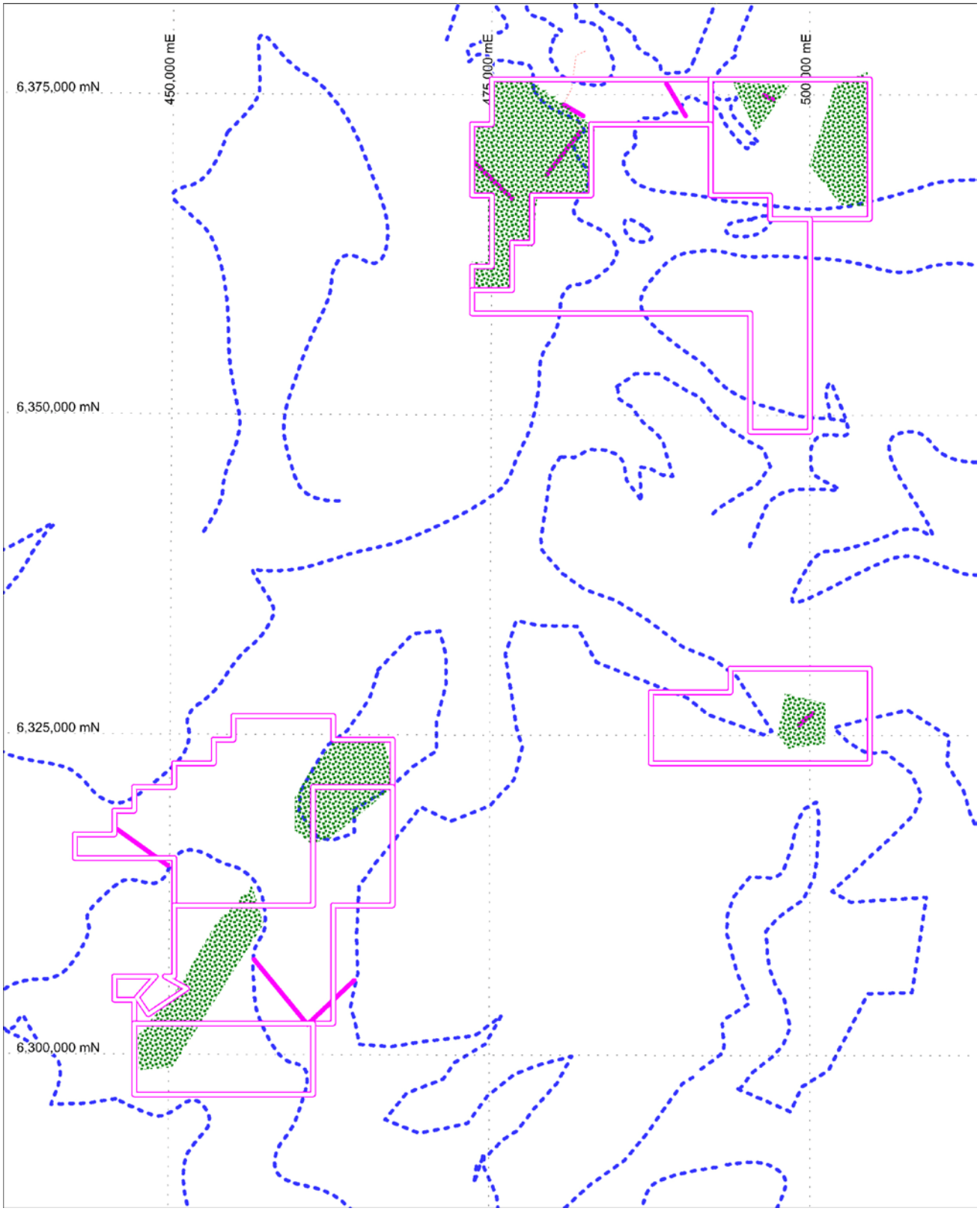

Figure 11: Proposed work. Magenta lines are locations of aircore traverses. Green stippled areas are possible areas for calcrete sampling. Approximately 25km of track/access will be required in the northern licences to complete the drilling. The proposed lines in the southern licences are on existing tracks & cleared lines.