Gawler Craton Excursion

September 21 - 26, 1997

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

GAWLER CRATON EXCURSION GUIDE - SEPTEMBER 21-26 1997

INTRODUCTION

The itinerary chosen allows inspection of Archaean ortho and para gneisses, metabasalt and komatiite; Palaeoproterozoic banded iron formation, syn-Kimban foliated granite, syn-Kararan granites, mineralised Palaeoproterozoic sediments, Mesoproterozoic Hiltaba Suite granites, deformed granite within the Yarlbrinda Shear Zone and a variety of Gawler Range Volcanics, including a possible breccia pipe.

Volume 1 of the Geology of South Australia - The Precambrian (MESA Bulletin 54) published in December 1993 provides comprehensive background reading. More recent work is summarised in the, in press paper, "Tectonic evolution and exploration potential of the Gawler Craton" and geochronology quoted is derived from the draft of MESA Bulletin "Geochronological synthesis of Southern Australia Part II. The Gawler Craton". both of which have been provided to the excursion participants.

Also included with this guide are:
Gawler Range Summary Map (1: 500 000 scale)
KIMBA Explanatory Notes and map (1:250 000 scale)
KINGOONYA Explanatory Notes and map (1: 250 000 scale)
YARDEA and TARCOOLA maps (1:250 000 scale)
(Please note that the CHILDARA and GAIRDNER 1:250 000 map sheets are out of print - the geology for both sheets are summarised however by the Gawler Range Map)

LOCALITY DESCRIPTIONS:

Day 1 Adelaide to Wudinna

Travel from Adelaide to Wudinna. Stay overnight at Gawler Ranges Motel, Wudinna. Stop 1 occurs between Kimba and Wudinna and Stop 2 just northeast of Wudinna.

Stop 1 Wadikkee Rocks - Archaean Carnot Gneisses (582350 m E, 6330000m N)

This excellent outcrop, surrounded by native pine, occurs 57 km west of Kimba on the south side of the main highway to Ceduna. A monument to the explorer Darke may be seen adjacent to the outcrop.

Well exposed banded quartz, feldspar, biotite, garnet gneiss has a vertical foliation trending 020° crosscut by 060° trending shears. Pegmatitic segregations occur both parallel with foliation trends and crosscutting shears. SHRIMP U-Pb zircon geochronology is in progress. The Rb-Sr total rock isochron age of 2428 ± 94 Ma with an IR of 0.706 is typical for the Carnot Gneisses.

Stop 2 Rocla Quarry - Hiltaba Suite granite (550070m E, 6347528 m N)

After arriving at Wudinna proceed through the town to the north eastern edge of the township. Follow the tourist trail (Days Road) northeastwards for 6.7 km. At 549903m E, 6345816 m N turn north, travel 1.7 km to Little Wudinna Rock. An entrance to the Rocla Quarry can be seen immediately to the east. Proceed to the quarry. Excellent exposure of coarse-grained quartz, feldspar, biotite granite can be seen that is very typical of the granite in the Wudinna area. Note the excellent simple twinning in the large K-spar crystals and zoned plagioclase crystals with biotite inclusions. A few plagioclase crystals also have rims. The granite variety quarried here is commercially available as " Desert Rose".

Day 2 Wudinna to Yarlbrinda Hill (west of Kondoolka Station)

Travel from Wudinna to Pygery. Turn northwards (537984m E, 6346164m N) though the small town towards Paney Homestead (not signposted).

Stop 3 Little Pingbong - Kararan Orogeny granite (544116m E, 6367047m N)

The small outcrop occurs at a sharp bend on the Pygery-Paney road approximately 20 km north of Pygery. The outcrop has been mapped on the YARDEA sheet as Archaean Sleaford Complex. The strongly deformed quartz, feldspar, biotite granite has been isoclinally folded with fold limbs locally sheared. Fold axes appear subhorizontal. Foliation trends 135° with steep dip southeast. U-Pb zircon geochronology indicates an emplacement age of 1670 ± 17 Ma with inheritance at 1740 Ma. The deformation is therefore younger than 1670 Ma. The emplacement age (and deformation) is significantly younger than for other syn-Kimban granites on Eyre Peninsula. It is uncertain how many other outcrops locally designated as Sleaford Complex (2450 Ma) are of similar age.

Following a great deal of discussion it has been decided to define a younger orogeny that is now known to effect the central and northwestern parts of the Gawler Craton. The precise age span for the Kararan Orogeny (derived from the Karari Fault) is as yet known poorly but is currently defined as 1670 - 1540 Ma (please refer to the discussion in 'Tectonic history and exploration potential of the Gawler Craton).

Continue northwards to Paney Homestead. The Gawler Range Volcanics (1592 ± 3 Ma) can be seen to be topographically much higher in the landscape than the older gneissic basement to the south.

Stop 4 Paney Rhyolite - Gawler Range Volcanics (559650m E, 6389120m N)

Drive past Paney Homestead and Woolshed to the northeast. Turn east immediately past the Woolshed. After 500m turn north along a poor track. Travel approximately 2.5 km. The characteristic reddish-orange coloured Paney Rhyolite outcrops immediately east of the track.

This unit is part of the Lower Gawler Range Volcanics. These sequences are characteristically varied in composition and have moderate to steep dips. The outcrop is a welded ignimbrite (once consisting of a hot {~ 800-1000 C°} dense cloud of gas charged particles and fragments) with well defined compaction layering (eutaxitic texture) shown by elongate fiamme (flattened hot fragments). Thin sections would show glass shards. Layering can also be seen to be compacted about small bombs ≤ 3 cm. Notice also that layering trending 060° is near vertical and may be overturned.

Return to Woolshed and continue northwards on main road. Travel approximately 2.5 km northwards, outcrop is massive dark purplish-brown porphyritic dacite (Eucarro Dacite) with no free quartz and abundant plagioclase phenocrysts. Outcrop of the phenocryst-rich rhyodacites and dacites occur as bold hills whereas outcrop of phenocryst poor rhyolite is paler in colour (more mafic poor) and more subdued in outcrop (Paney Rhyolite intrudes Eucarro Dacite elsewhere).

Stop 5 Organ pipes west of Kola Hut - Yardea Dacite (553991m E, 6397009m N)

Continue northward on main road to Yardea Homestead. At an east-west trending fence immediately south of Kola Hut turn west (on southern side of fence). Continue west for 1.5 km. Note the bold outcrop of Yardea Dacite and steep joint surfaces (forming water falls after rain). The track turns southwestwards. At the southern end of a deep gully, polygonally jointed Yardea Dacite can be seen well both in plan view and in section. Note the thickness of individual depositional layers shown by undulose cooling surfaces. The photograph on the front cover of MESA Bulletin 54 was taken at this locality. As the site is also a Geological Monument please do not hammer any part of the water fall area. Samples may be collected at the base of the outcrop only.

Texturally the Yardea Dacite contains abundant zoned plagioclase phenocrysts, hornblende/biotite mafic clots, some Kspar and no free quartz. There are also granophyric fragments of dacite and moderately abundant basaltic enclaves. The Yardea Dacite is everywhere massive except at the base where tuffaceous layering is poorly preserved.

Continue northwards from Kola Hut. The road is poor but the scenery very attractive. Note the turn east through the gate north of Chabara Well. Continue northwards across a broad open valley. This valley has been interpreted by Crooks to reflect a major fault (see Gawler Range Bedrock Drilling Project Report - in prep). After arriving at Yardea Homestead, travel west for 1 km and then turn south-west for 4 km along the Yardea - Minnipa Road.

Stop 6 Breccia pipe southwest of Yardea Homestead - Yardea Dacite (546318m E, 6414850m N)

In this locality abundant large enclaves (≤ 10 m) of quartz-rich granophyric k-spar bearing granite occur within red-brown porphyritic Yardea Dacite. Other fragments include reddish-orange fine-grained phenocryst poor rhyolite and grey to black ?basalt The enclaves do not have reaction rims and appear to have equilibrated with Yardea Dacite, that is the fragments have resided in the chamber for some time.

This site was the subject of an Honours Thesis by Andrew Garner from CODES. Surrounding the approximately circular outcrop is a zone of no outcrop, that may represent an altered or fractured zone. Very limited RC drilling by MESA has intersected no anomalous mineralisation.

Return to Yardea Homestead and take westerly road to Hiltaba Homestead. Continue west along main road.

Stop 7 Black dacite - base of Yardea Dacite (531389m E, 6422397m N)

Extensive outcrop of Yardea Dacite can be seen northeast of the main road whereas to the southwest poorer outcrop of Yannabie Rhyodacite occurs. The road parallels the contact between the two stratigraphic units. The base of the Yardea Dacite is characteristically intensely welded, black in colour and has fewer plagioclase phenocrysts and finer grained groundmass, seen elsewhere. The black dacite has been used to delineate the base of the thick Yardea Dacite composite sheet and hence the broad regional structure of this generally massive subhorizontal layer. Rare ignimbritic layering (not seen here) preserves shards and indicates gentle dips northwards.

Continue travelling westwards, proceed past Hiltaba Homestead. Turn westwards towards Kondoolka Homestead. Mount Pollard is 9 km west of the turn off.

Stop 8 Mt Pollard - contact between Hiltaba Suite and Yardea Dacite (500824m E, 6452905m N)

Extensive outcrop of Hiltaba Suite granite occurs both north, south and on the roadway. If you walk up a ramp like slope on the eastern end of Mount Pollard to the lower crest of the hill and then walk northwards a contact between granite and Yardea Dacite can be seen. The medium grained Hiltaba Suite granite has a thin quenched rim and contains small enclaves of Yardea Dacite. Quartz veining in Yardea Dacite is cross cut by granite.

Continue to Kondoolka Homestead. Turn northwest past the Woolshed. Proceed northwesterly for 12 km. Turn southwesterly (following a fence) for 5 km, then travel 3.5 km northwestwards. Yarlbrinda Hill is the large hill to the south.

CAMPSITE DAY 2 The campsite is adjacent to the track immediately north of Yarlbrinda Hill. Firewood may be found in the black oak thicket to the south or in the creek immediately to the east of the camp site.

Day 3 Yarlbrinda Hill to Yerda Outstation

Stop 9 Yarlbrinda Hill - brecciated Kspar granite of unknown age (474903m E, 6465895m N)

This large hill occurs on a subsidiary fault adjacent to the Yarlbrinda Shear Zone. It is the largest known outcrop affected by this fault system. The breccia contains angular fragments of both deformed and undeformed granite. Some fragments have a mylonitic fabric. The breccia is veined by iron oxides and a variably intense fabric orientated parallel to the subsidiary shear zone is apparent at 050°.

Outcrop immediately to the north is undeformed Hiltaba Suite granite. The "Kondoolka batholith" substantially crosscuts the Yarlbrinda Shear Zone, although aeromagnetic data indicates some movement post emplacement.

Return to Kondoolka Homestead and to the main Hiltaba - Kokatha road. Turn north and travel to Kokatha Homestead (approximately two hours travel). Travel 4.5 km northwards towards Kingoonya. Look for the track to North Well to the northwest (marked by steel pipe). Follow the track to the well and trough. Note Hiltaba Suite outcrop. Turn north and then west, following a poor track past more Hiltaba Suite granite. Continue westwards following the poor track, then south, and eastwards towards a black low hill of Archaean basalt (the turn points are all marked by red painted stakes).

Stop 10 Pillowed basalt at "Hornfels Hill" - Archaean Hopeful Hill Basalt (517100m E, 6544500m N)

Small to moderately large pillows can be seen well within the southwestern part of the outcrop. Sections may be equant or tapered indicating that the original sequence may be northwest facing. Pillows have quenched margins and characteristic triple point margins. The pillows consist of turbid partially sericitised plagioclase, hornblende and minor amounts of opaque oxides, epidote and clinopyroxene. Interstitial material is predominantly epidote and andradite with amphibole, pyroxene, plagioclase and chlorite, and traces of apatite and sphene.

Dykes of Glenloth Granite intrude the pillowed basalt. The foliated granite comprises quartz, Kspar, plagioclase and subordinate garnet and epidote. U-Pb zircon geochronology of the granite dykes gave an age of 2460 ± 6 Ma indicating a minimum age of intrusion for the basalts.

To the southeast basal units of the Gawler Range Volcanics (dipping gently southeastwards) are inferred to overlie the Archaean Hopeful Hill Basalt. The basal section of the Gawler Range Volcanics (~ 1590 Ma) in the Kokatha area consists of vesicular basalt and thin interlayered rhyodacitic ignimbrites.

Return to within 1 km of the main road. If we have sufficient time we will take the track heading north to North Well and to the dam approximately 4 km south of Lake Harris. An extensive zone of quartz and quartz veined Lake Gairdner Rhyolite occurs approximately 3 km east of the dam. This zone is coincident with a major east-west fault that appears to form the southern boundary to the Glenloth Granite batholith. We will then return to the main road. Approximately 2 km north of the original turn off we will turn eastwards for 1 km. A zone of low temperature alteration has affected ignimbritic rhyolite (Pac_5)- the upper unit in the Chitanilga Volcanic Complex. The veins are composed of limonite, kaolin, sericite and silica.

Return to the main road. Continue northwards to Kingoonya. Continue westwards through the town for 2 km. Turn south towards a tank on a low hill. Continue southwestwards towards Lake Harris and the Glenloth Goldfield. At the mail box turn south for 2.5 km (the track continues to Yerda Outstation to the southwest) . At the first fence take the poor track to the east on the northern side. Approximately 1.5 km to the east is outcrop of deformed granite and komatiite.

Stop 11 Ferruginised and silicified Archaean Lake Harris Komatiite intruded by Glenloth Granite (513000m E, 6566600m N)

MESA DDH 1 &2 (see enclosed plan) intersected a metamorphosed dunitic to peridotitic flow interpreted to be at least 131m thick. Igneous intrusives assigned to the Glenloth Granite intrude the base of the flow in both holes. U-Pb geochronology for a diorite gave an age of 2499 ± 11 Ma, indicating a minimum age for the komatiite. Additional RC holes confirm a minimum thickness of 600m and strike of 1200m. Regional aeromagnetic data indicates a total thickness of 1000m (likely to include isoclinal folding) and strike length of 25 km.

On the southern edge of a small creek is weathered foliated quartz, feldspar (kaolin) granite. On the northern side of the creek a discordant contact between greenish sheared clayey serpentinite (after komatiite) and the granite can be seen. The regional foliation cuts across this contact. The foliation parallels layering (trending ~060 ° dipping steep north) within the ultramafic which is north facing in DDH 1 &2.

Walk northeastwards towards a low hill of ferruginised ultramafic. This outcrop is the surface expression of the lowest part of the sequence intersected by DDH 2. This zone contains up to 40% of Mg O (geochemistry of the ferruginised capping indicates up to 9000 ppm Ni). Cumulus olivine is still preserved in drill core (although most is metamorphic). East of the ferruginised zone is a small outcrop of silicified ultramafic. A silicified texture indicating remnant cumulus olivine can be recognised. Walk north westwards upsection across strike. A distinctive clayey serpentinite outcrops poorly along the head of the creek. This zone contains MgO values between 27 % rising to 40 % at the edge of the ferruginous zone. Note the site of the diamond drill hole. Evidence for feather quench textures and possible spinifex have been noted within drillcore near the top of the hole.

The process of hydration and conversion of olivine to serpentine exsolves silica and magnetite. Cumulus chromite characteristically is rimmed by secondary magnetite and the recystallised komatiite is veined by chalcedony as well as serpentine and magnetite. Note moderately abundant lag of laminated chalcedonic slabs.

Petrology indicates an amphibolite facies texture rather than a primary igneous texture. Olivine has been predominantly sepentinised and the interstitial glass once quenched clinopyroxene recrystallised to predominantly to tremolite and chlorite and some serpentine. Tremolite (and some talc) is more abundant adjacent to later intrusives and local shears. Rare possible spinifex textures are composed of chlorite after dendritic olivine and interstitial feathery tremolite after quench pyroxene.

Sulphides and opaques include chromite, ilmenite, pentlandite, violarite, mackinawite, millerite, bornite and chalcopyrite. Native copper is also present. Maximum metal values intersected for fresh ultrabasic include: Ni 2500 ppm (≥ 1600 ppm), Cr 1820 ppm (≥ 1345 ppm), Co 100 ppm, Au 10 ppb, Pd 4 ppb, and Pt 6 ppb. $Al_2 O_3$/ $Ti O_3$ values are near chondritic at 16.5 (compared to ~ 20). The Lake Harris Komatiite is less aluminium depleted (or fractionated) than the Munro type and Barberton type komatiites.

Return to the track leading to the Kingoonya - Glenloth Goldfield track. Travel south 5 km to the old house turn west along the fence for 1 km. At the gate near the well turn south. Turn south east approximately 50m from the gate. Travel 2 km along poor track. Excellent outcrop of granite occurs on both sides of the road.

Stop 12 Glenloth Granite (511300m E, 6560600m N)

The Glenloth Granite is a distinctively banded, foliated, quartz, Kspar, plagioclase granite with abundant biotite and amphibole rich enclaves and schlieren (presumed remnant paragneiss). The valley between the northwest trending outcrops represents more intensely sheared granite (locally haematitic) variably hosting gold bearing quartz veins.

Aeromagnetic data shows that the Glenloth Granite batholith is essentially round abutting the Lake Harris Komatiite to the north. The batholith is cut by northwest trending Palaeoproterozoic shears that host mineralisation. It is proposed here that the gneissic banding in the granite has been rotated into parallelism with the Palaeoproterozoic shear zones (refer to detailed aeromagnetic data). The gold mineralisation is interpreted as contemporaneous with Hiltaba

Suite granite intrusion. A large batholith of Hiltaba Suite (at Cooritta Hill) occurs to the south of the Glenloth Granite and is presumed to intrude it at depth.

U-Pb zircon geochronology gave an age of 2436 ± 9 Ma for the Glenloth Granite at this locality. No mineral ages have yet been done to test the concept of Palaeoproterozoic (Kimban) reworking.

Approximately 2 km further south is the Glenloth Battery that processed ore at the turn of the century and during the Depression.

Return to the track and proceed northwards to the mail box. Turn southwest. Proceed 15 km to Yerda Outstation.

CAMPSITE DAY 3 Yerda Outstation

We are guests of North Well Station and MIM. Some showers will be available (especially for those who stoke the "donkey").

Day 4 Yerda to Malbooma

Return to the mailbox intersection, proceed northwards for 10 km, go through gate and turn west for 1.5 km, turn north and travel 5 km to the Kingoonya - Tarcoola main road. Proceed westwards to the Earea Dam Goldfield (seen on the southern side of the road after a sharp southerly bend in the main road).

Continue for a further 9 km. Park on the main road and walk southwards across the Transcontinental Railway line.

Stop 13 Kenella Gneiss (491700m E, 6586350m N)

Good outcrop of massive foliated quartz-feldspar Kenella Gneiss. The protolith here may have been a syntectonic sill or acid volcanics. The outcrop is typically poorly compositionally layered .There is however a subtle variation from outcrop to outcrop with bulk composition varying from Kspar dominant to plagioclase dominant. This massive style of outcrop is very typical for the Kenella Gneiss from here towards to the large lake system to the north. Further south the gneiss becomes increasingly deformed.

The steep foliation trends 120° and is crosscut by a inferred Palaeoproterozoic shear at approximately 045°. Note that the Archaean fabric has been rotated into parallelism with the narrow sinistral shear zone. A basic dyke has intruded the shear zone and is sheared on the margins. Elsewhere porphyritic dykes assigned to the Gawler Range Volcanics cross cut the mafic dykes at approximately 90°.

Return to the main road. Travel east back to the Earea Dam Goldfield. Travel south along the western side of fence adjacent to the goldfield. Continue around South Lake and travel along the poor bush track southwards for approximately 5 km. Stop on the low hill immediately north of the Hiltaba Suite granite.

Stop 14 Mylonite - sheared limb of macroscopic Archaean (SD $_2$) fold (495600m E, 657 8000m N)

Rodded quartz feldspar mylonite with subhorizontal stretching lineations occur west of the north-south track. East of the road stretching lineations are very steep. Note also Archaean gabbroic boudans within mylonitic Kenella Gneiss east of the track.

From aeromagnetic data this outcrop occurs on the sheared northern limb of an Archaean Sleafordian macroscopic SD $_2$ fold that also deforms the Hopeful Hill Basalt and nearby iron formation that outcrops to the southwest.

Retrace route northwards stop approximately 1.5 km south of South Lake. Brief stop at moderately deformed quartz, feldspar, garnet gneiss intermediate in strain between Stop 13 and Stop 14. Both plagioclase dominant and kspar lithologies occur on this low hill as well as a concordant Palaeoproterozoic amphibolitic dyke.

Stop on low hill immediately south of the lake. Travel westwards for 50m.

Stop 15 South Lake Gabbro (496850m E, 6582650m N)

First of many boudins of metagabbro comprising granular plagioclase(partially sericitised), clinopyroxene, some secondary amphibole and accessory sphene. The basic body is interpreted to have intruded the Kenella Gneiss prior to Sleafordian deformation. Quartz, feldspar veinlets that cut the body are foliated.

The host Kenella Gneiss is here very pegmatitic (quartz, feldspar, garnet) and locally discordant. The coarse grained pegmatites are interpreted to have been emplaced during peak metamorphism.

Travel along the ridge of the hill for a further 300m. On the northern edge of the hill are thin well layered calcsilicates that occasionally preserve isoclinal folds. These sediments are composed of quartz, plagioclase, clinopyroxene ± sillimanite and some secondary amphibole. These rocks are by definition included within the meta-sedimentary Christie Gneiss and are structurally concordant with the Kenella Gneiss.

Nearby is a thin, characteristically northwest trending, Gawler Range Volcanic dyke. These dykes vary from undeformed to moderately strongly deformed, presumably due to variable strain on emplacement.

Return to the main road and travel west to the Wilgena Station turn off. Continue west for an additional 7 km. Turn north towards Wilgena Hill. After 1 km follow track around the western side of the old railway dam. Go through the gate and turn along track to the east. Travel for 2.5 km to the base of the outcrop. Park at the base and climb the rough track to the summit.

Stop 16 Palaeoproterozoic banded iron formation Wilgena Hill Jaspilite (472750m E, 6603000m N)

The 700m thick jaspilite is not exposed at the structural base and has an eroded structural top. The northwest trending sequence dips 60 ° northeast but facing has not been established. The outcrop may be a faulted limb of a synform or antiform.

Zones of no outcrop may indicate less resistant lithologies eg. carbonate. Quartz sandstones (containing detrital tourmaline) occur as interbeds north of Peela Well. Jaspilitic correlatives occur at Giffens Well near Bulgunnia Homestead, at Hawksnest near Twins Station and near Kingoonya. There is no direct indication of depositional age. ~~Economic reserves~~ of magnetite ore occur at Hawksnest. Inferred/indicated Resource

Adjacent to the western edge of the outcrop Tarcoola Formation (Fabian Quartzite Member) is faulted against the jaspilite. Abundant jaspilitic fragments occur elsewhere in basal Tarcoola Formation (~ 1650 Ma - Peela Conglomerate Member). Near Kingoonya abundant jaspilitic fragments occur in the Labyrinth Formation which has an interbedded rhyolite dated by U-Pb geochronology at 1723 ±10 Ma. The jaspilite therefore has a minimum age of 1720 Ma.

The jaspilite is very fine grained and finely laminated with thin microbands (0.1-1.0 mm) of black iron oxides alternating with red chert laminae. Mesobands vary between 10-50 mm thick. In thin section relict microscopic spheres may represent a colloidal origin whereas filaments may be remnant very primitive life forms.

The low grade jaspilite preserves soft sediment deformation (predominantly boudins) as well small scale folding. Intersecting crenulations on the bedding surface produces small domes 1-2 cm in length. Rare small circular structures have been interpreted as dewatering structures.

Return to the main road and turn west to Tarcoola. On arrival please refuel. Additional ice can be obtained from the Wilgena Hotel at Tarcoola. Turn right after the hotel and visit the Grenfell office on the western side of the street. Core from the Peserverance Prospect will be available for inspection.

Stop 17 Perseverance prospect Tarcoola Goldfield (455300m E, 6602600m N)

Following inspection of the drill core we will make a brief visit to the main outcrop west of the township. The first stop is outcrop of basal Peela Conglomerate Member with abundant jaspilitic fragments and anomalous copper. Bony quartzites, trending approximately east-west and dipping south, (with interbedded silty claystone and carbonaceous siltstone) can be seen outcropping along the spine of the hill.

The Perseverance Prospect near the western end of the main hill, occurs within a northeast trending fault system. Mineralisation occurs both in sediments and granite. Relationships between the granite (to the north- inferred Hiltaba Suite) and the sediments (to the south) are not seen here in outcrop.

Geochronology of diamond drill core has established that Hiltaba Suite occurs adjacent to the old Perseverance Shaft (U-Pb zircon age of 1578 ± 7 Ma. It is uncertain if the granite within the goldfield represents multiphase Hiltaba Suite plutons with associated gold mineralisation (often with sheared contacts with the sediments ~ 1650 Ma old) or includes older poorly deformed Palaeoproterozoic granite.

Return to the township and turn west. Travel to Malbooma Outstation approximately 40 km west of Tarcoola. The turn off south to the outstation is almost opposite to the sign posted main road northwards to Commonwealth Hill Station. Travel 100m and turn southwards near the large communications tower. Continue southwards past the old homestead. The campsite is on the right.

CAMPSITE DAY 4 Malbooma Outstation - Kychering granite

Stop 18 Hiltaba Suite - Kychering granite (421500m E, 6604125m N)

Opposite the outstation undulose flow banding can be seen in the porphyritic Kspar rich granite. In comparison to the Tarcoola granite which is inferred to be associated with gold mineralisation only one small mine occurs in Tarcoola Formation west of the Malbooma Outstation. The Tarcoola granite is richer in total iron, richer in Ba and Ce but poorer in Rb in comparison to Kychering (refer table 5.7 and diagram 5.13 Bulletin 54).

Day 5 Malbooma to Glendambo

Return to the main road and turn westwards towards Wynbring. Travel approximately 65 km to Wynbring. The large bare outcrop can be seen clearly north of the main road.

Stop 19 Kararan Orogeny granite (Ifould Complex) - Wynbring Rocks (360000m E, 6619100m N)

The grey porphyritic granite is foliated trending approximately 070°. Both vertical and moderately steep northerly dips are shown by the feldspar laths. The shallower fabric or fracture appears younger. A few mafic enclaves occur within the granite. U-Pb zircon geochronology gives an emplacement age of 1669 ± 10 Ma (Teasdale *et al* in prep), younger than normally accepted for syn-Kimban granites defined from eastern Eyre Peninsula.

Regional aeromagnetic data indicates that the Wynbring granite is discordant in part, to components of the Fowler Orogenic Belt, inferring ductile deformation older than 1670 Ma.

Return to the gate in the vermin proof fence just south of the Wynbring outcrop, turn west along the fence for 3.5 km. The vermin proof fence then trends north. Go through the gate (immediately to the west of the corner) and turn north along the vermin proof. Continue for 26 km until you reach an adjoining east-west vermin proof fence and gate (Mt Christie corner gate). The outcrop to the east is Christie Gneiss and must be reached climbing over the fence.

Stop 20 Christie Gneiss - paragneiss outcrop south of Mt Christie (356800m E, 6644700m N)

Although weathered an excellent outcrop of Christie Gneiss. The north trending gneiss is well banded with distinctive coarse pegmatitic quartz, Kspar, plagioclase ± cordierite and garnet interlayered with finer darker layers of plagioclase, hypersthene (partially retrogressed during the Kimban Orogeny to biotite), diopside (partially retrogressed to hornblende) and quartz. The characteristic very coarse garnets are partially retrogressed to chlorite and when weathered consist of iron oxides. The pegmatitic layers are considered to have developed during peak metamorphism from a layered sedimentary sequence. Rb-Sr geochronology of these pegmatitic layers (from the Mount Christie drillcore) and finer Kspar rich interlayers within banded iron formation gave an age of 2417 ± 59 Ma, a minimum age for Sleafordian peak metamorphism. Note SHRIMP zircon analyses are in progress.

The outcrop also contains a few small boudins of metabasic (presumed basalt). On the northern side of the outcrop, a few open small scale SD_3 folds can be seen. Note also small scale Palaeoproterozoic shearing (trending approximately northeasterly) rotating Archaean layering to the northeast.

Continue northwards towards Mount Christie, which can be seen in the distance. Turn though a gate in the vermin proof fence and proceed to the foot of the outcrop.

Stop 21 Mount Christie - small scale D_2 and D_3 folds within banded iron formation 357200m E, 6646450m N)

Mount Christie is part of the steeply west dipping limb of the Mulgathing Antiform. The banded iron formation has been folded by both isoclinal SD_2 and more open SD_3 folds which are coaxial at this locality. The subhorizontal axes plunge more steeply on the northern and southern parts of the main outcrop due to Proterozoic shearing.

MESA has drilled two diamond holes through the outcrop. The finely banded iron formation comprises quartz, magnetite, diopside and hypersthene. Thin interlayers of feldspar and carbonate with accessory garnet, clinopyroxene and olivine also occur. The iron formation is structurally underlain by banded coarse-grained quartz, plagioclase, Kspar, cordierite, garnet gneiss.

Follow the track eastwards (it crosses the southern end of Mount Christie) x km to George Hill.

Stop 22 George Hill - intermediate size D_3 fold (359700m E, 6644080m N)

Banded iron formation has been folded in a north plunging synform. The fold wavelength is approximately 50m wide. Examination of the southwest part of the hinge indicates small isoclinal folds (SD_2) within the limb of a more open intermediate size (SD_3) fold. Note the coarse-grained iron oxides.

Continue southerly along the poor track for approximately 2.5 km. Go through the gate and turn eastwards for 7 km along a fence to Burden Tank (green). Travel 5.5 km southeast along a straight road. Turn northeast for 11 km passing a large stone water tank and then northerly for 1.5 km to Durkin Outstation (recently demolished). Please refer to the location maps for the route between Durkin to West Well (to the north) and Stop 22 west of West Well.

Stop 23 Mulgathing Antiform *SD* - part of northerly closure (377400m E, 6664600m N)

Small outcrop of banded iron formation, dipping gently northwards, part of the northern closure of the Mulgathing Antiform (refer fig 3.5 in Bulletin 54). Daly believes the ore shoots at Challenger occur within hinges of similar small scale SD_3 folds.

Retrace the route until reaching the main east-west track to Mulgathing Station. Follow eastwards to Mulgathing Rocks.

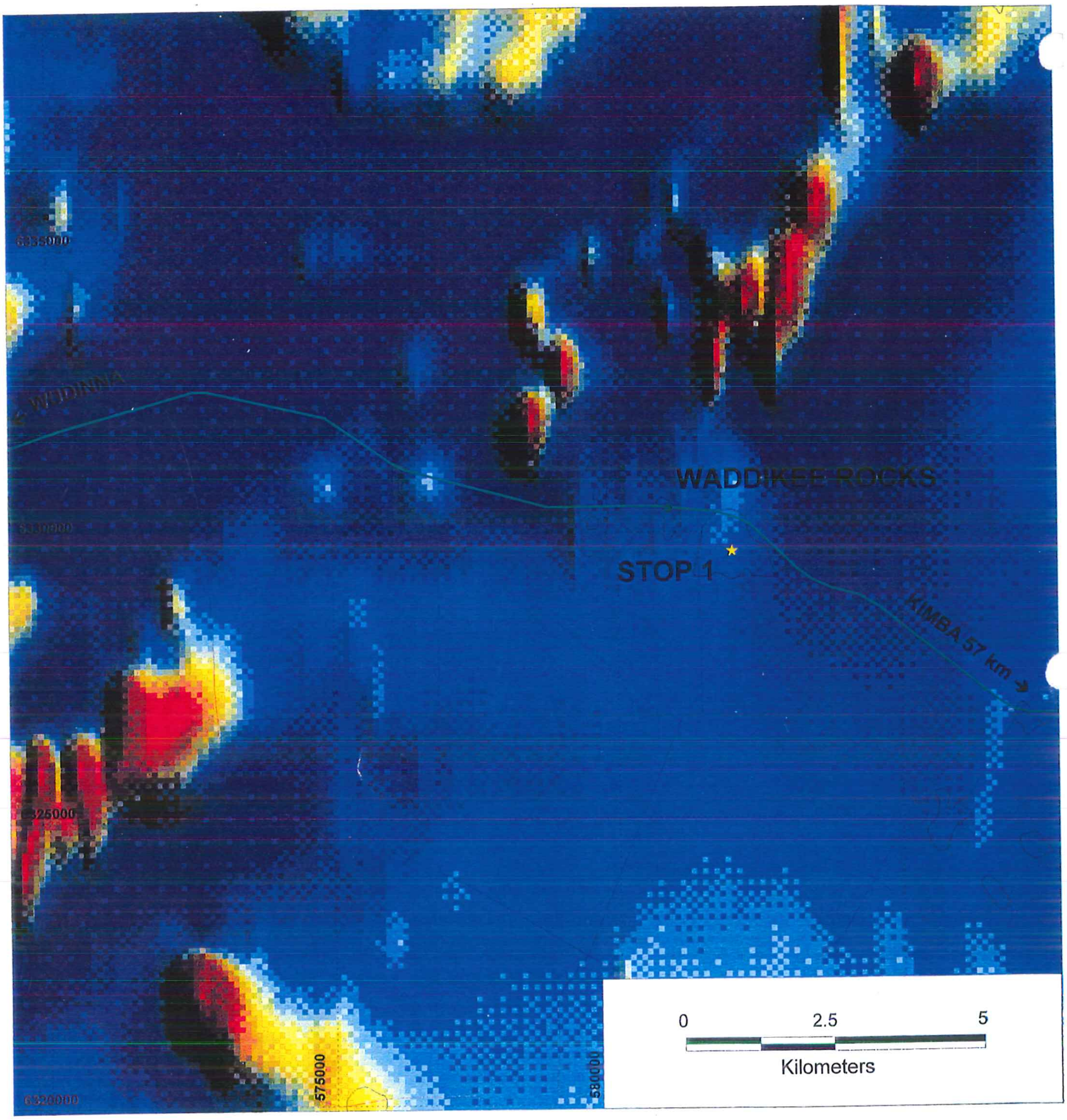
Stop 24 Symons Granite - Mulgathing Rocks (400300m E, 6653900m N)

Excellent outcrop of pinkish, foliated granite containing abundant quartz, coarse Kspar, and a low percentage of plagioclase and biotite. Small biotite rich enclaves are also present. Narrow high strain zones rich in biotite occur irregularly. The Symonds Granite is a homogenous batholith of considerable size and for this reason was formerly named (from the paddock name used by Mulgathing Station). Contact with local Archaean gneiss is not seen but the northeasterly fabric of the Symonds Granite is consistently discordant to northerly trending Archaean gneiss, near Mulgathing Homestead.

U-Pb zircon geochronology gives an emplacement age of 1684 ± 10 Ma considered to be contemporaneous with the Palaeoproterozoic Kimban Orogeny.

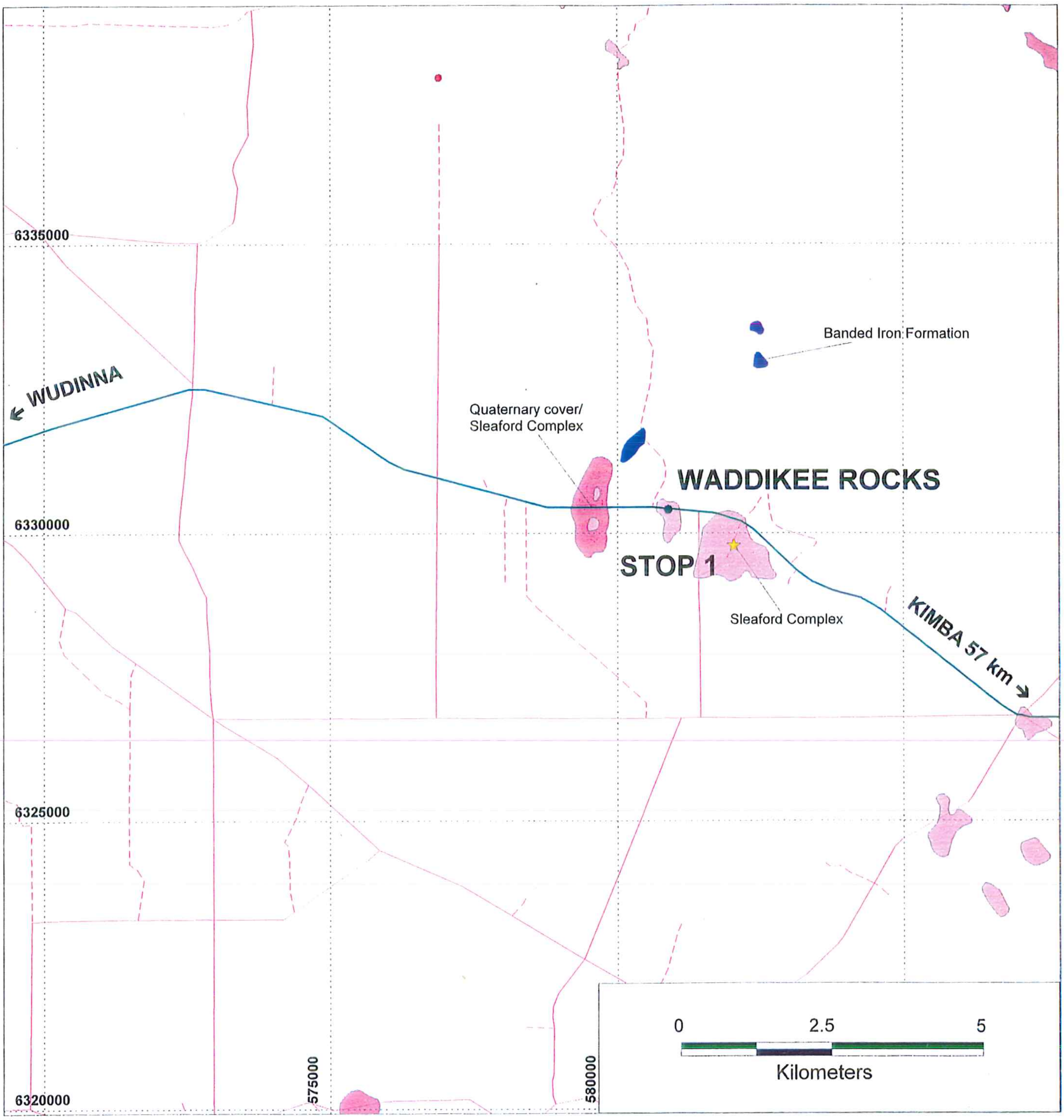
Continue eastwards towards Mulgathing Station. Drive slowly past and veer right towards the woolshed and continue eastwards through the grid. The main road turns briefly north then continues eastwards across the TARCOOLA map sheet (crossing the north-south Tarcoola-Alice Springs Railway) to Bulgunnia Homestead . Drive slowly through the homestead. Approximately 30 km east of Bulgunnia, the sealed Coober Pedy - Port Augusta road is reached. Turn south and continue to **Glendambo Hotel/Motel** (the drive from Mulgathing Homestead to Glendambo is estimated to take three hours).

Day 6 Travel from Glendambo to Adelaide



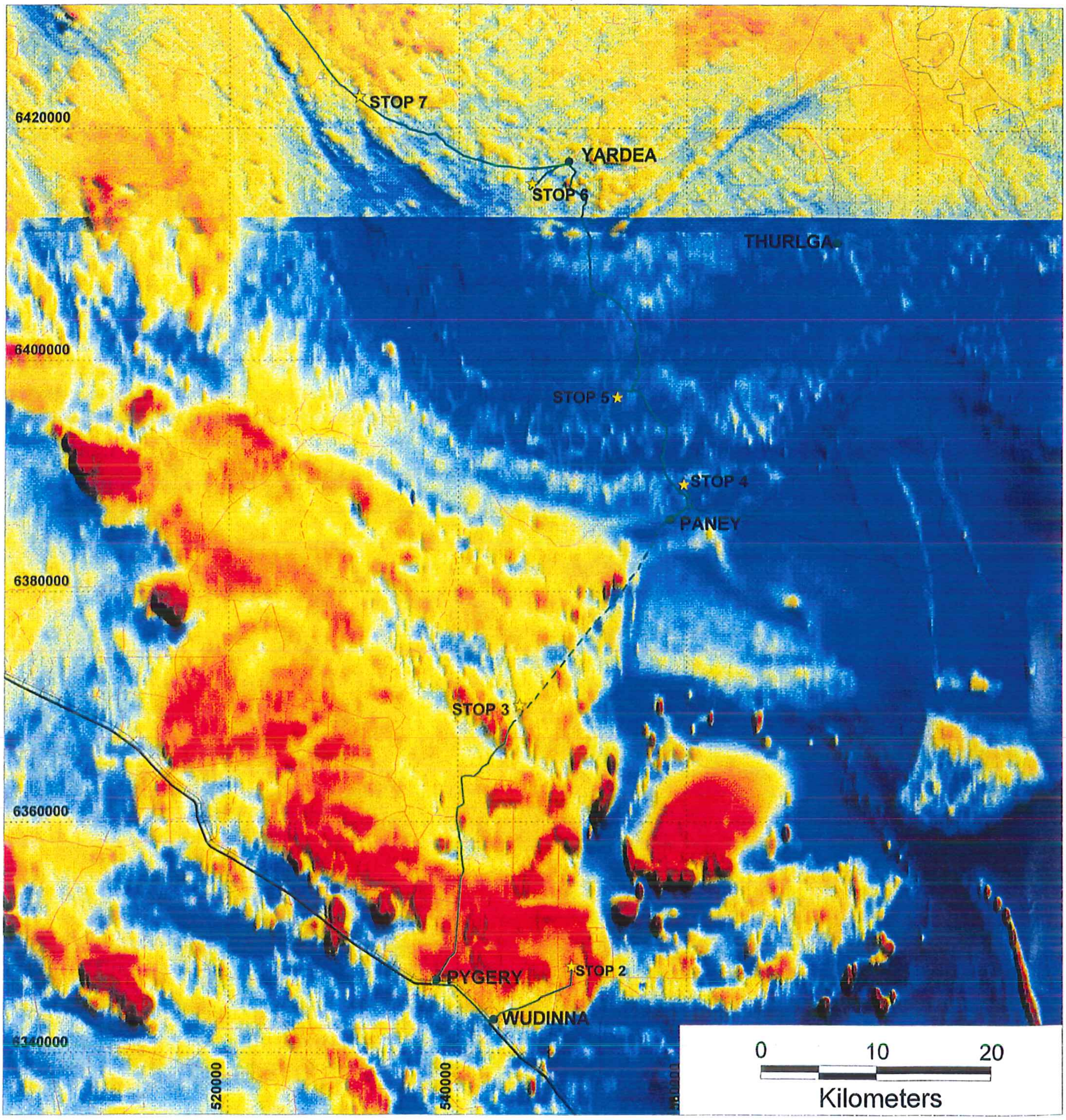
STOP 1 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOP 1 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



Day 2 (Scale 1:500 000)

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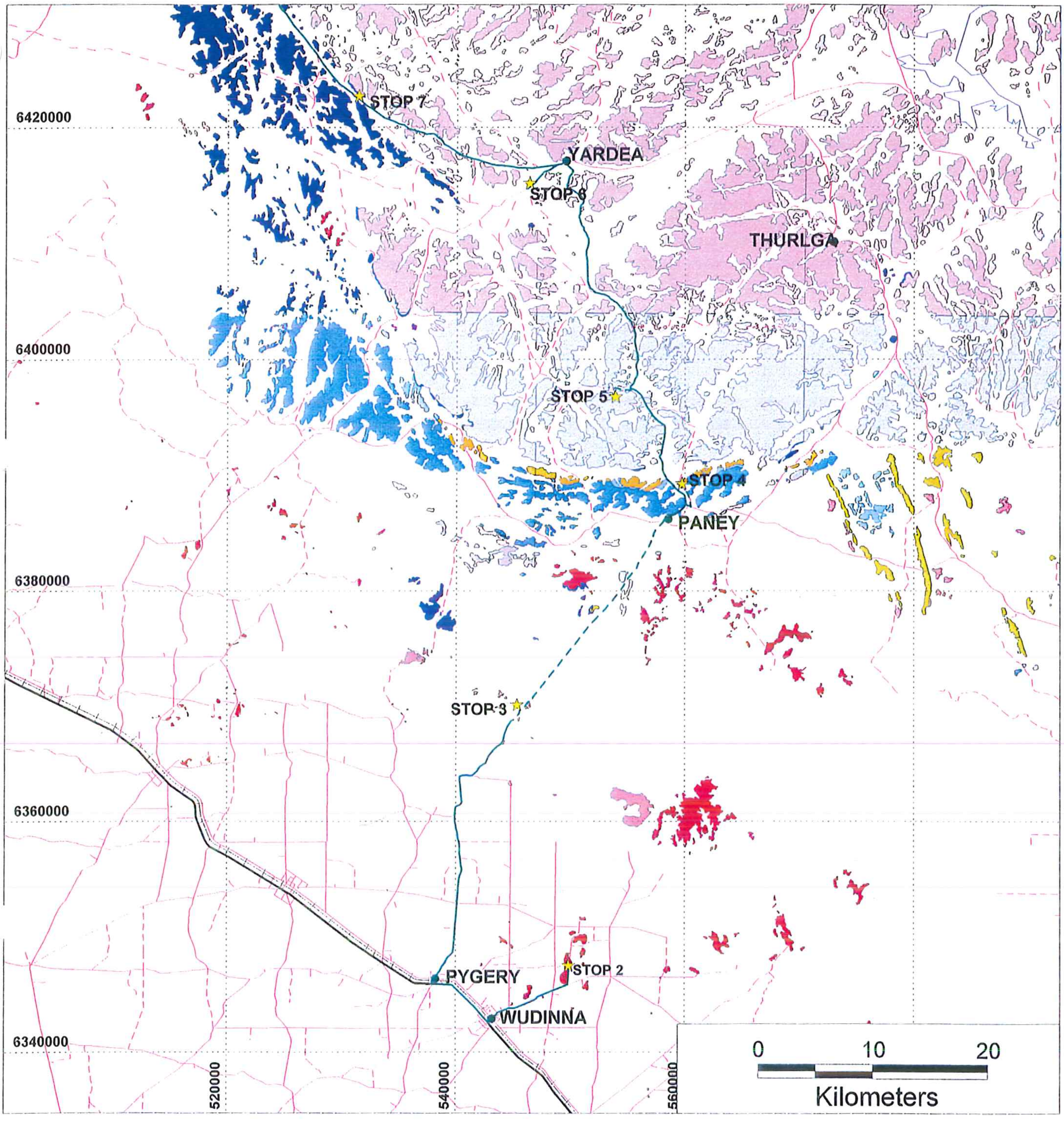
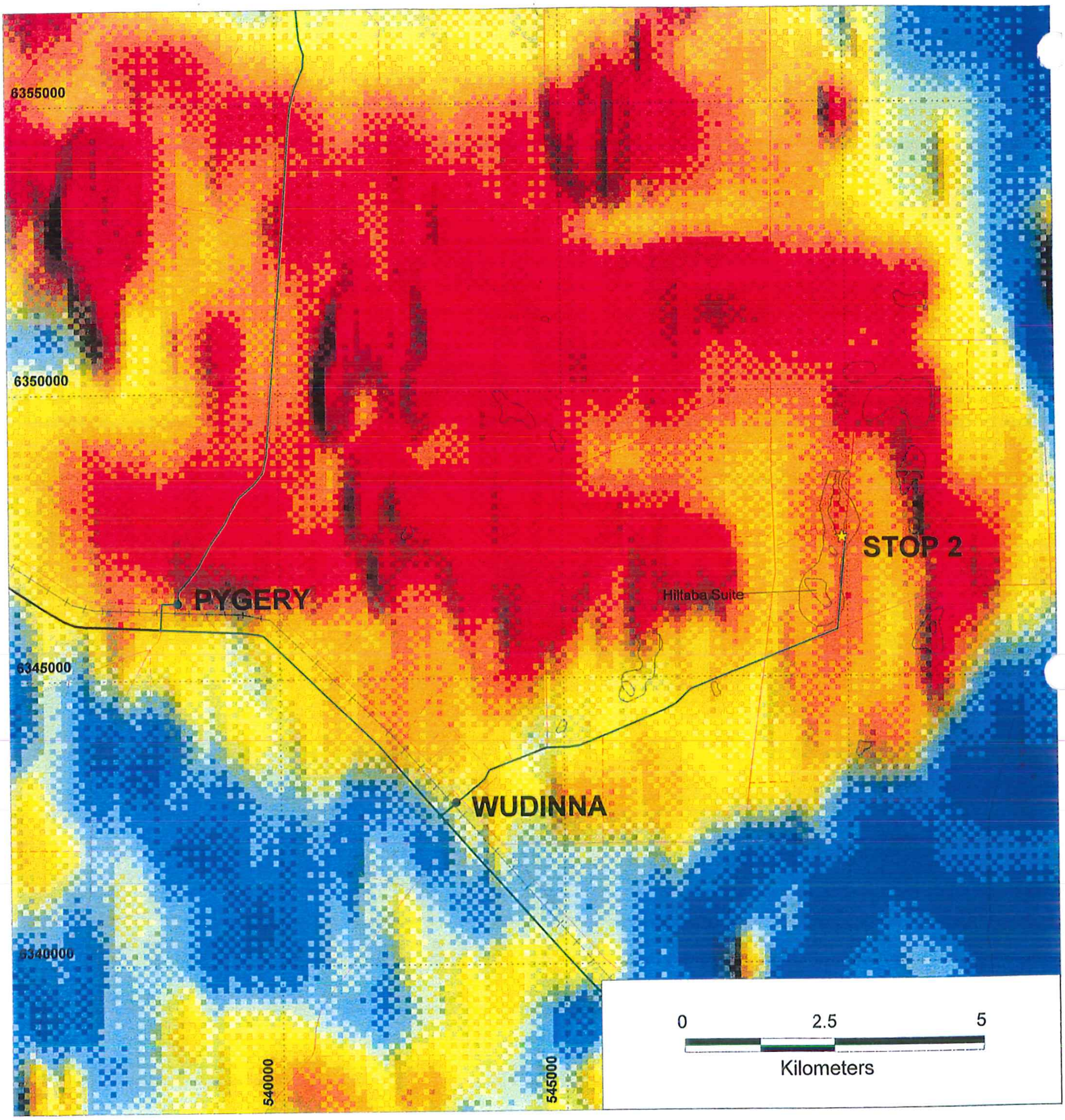


Day 2 (Scale 1:500 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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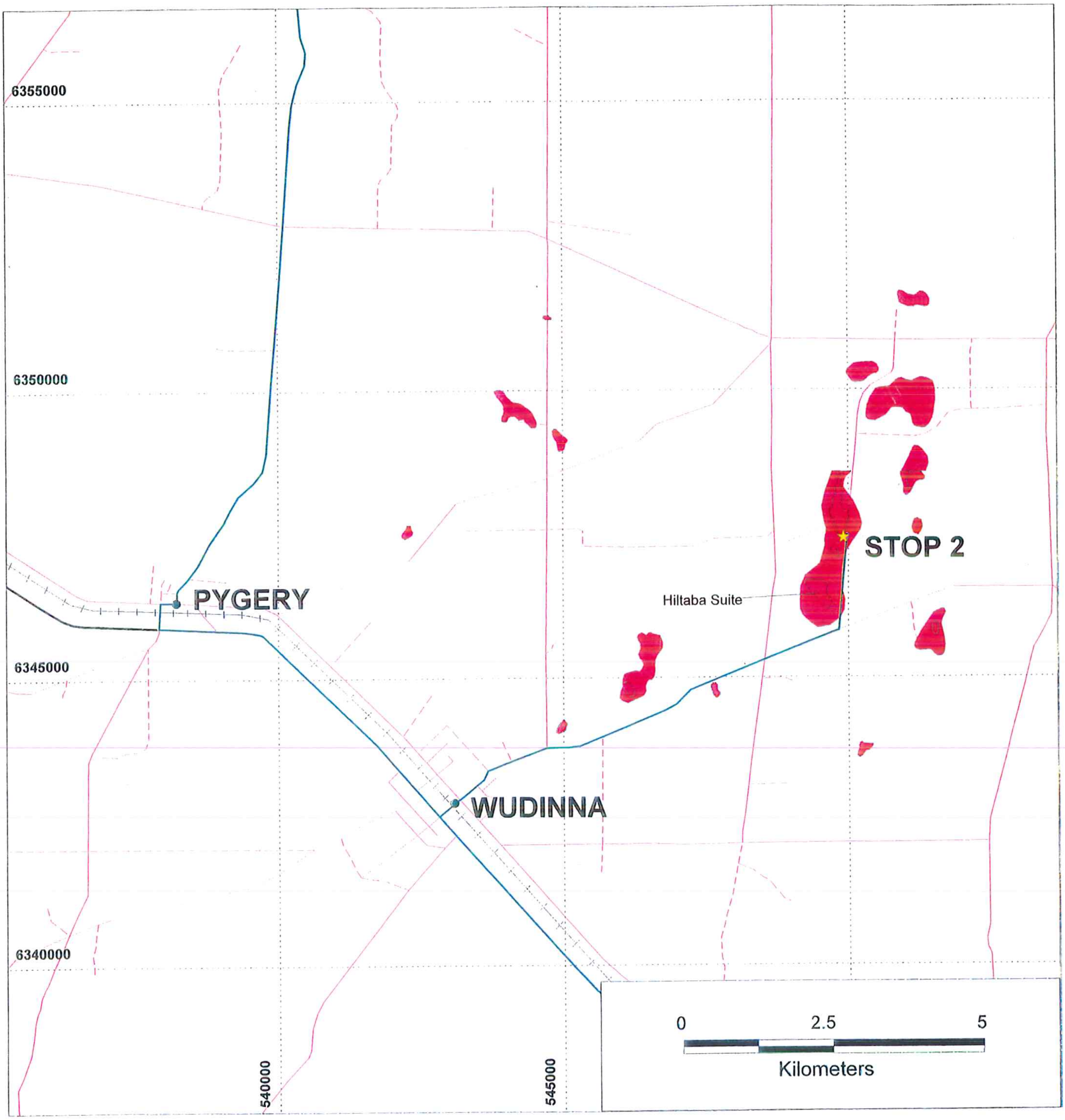

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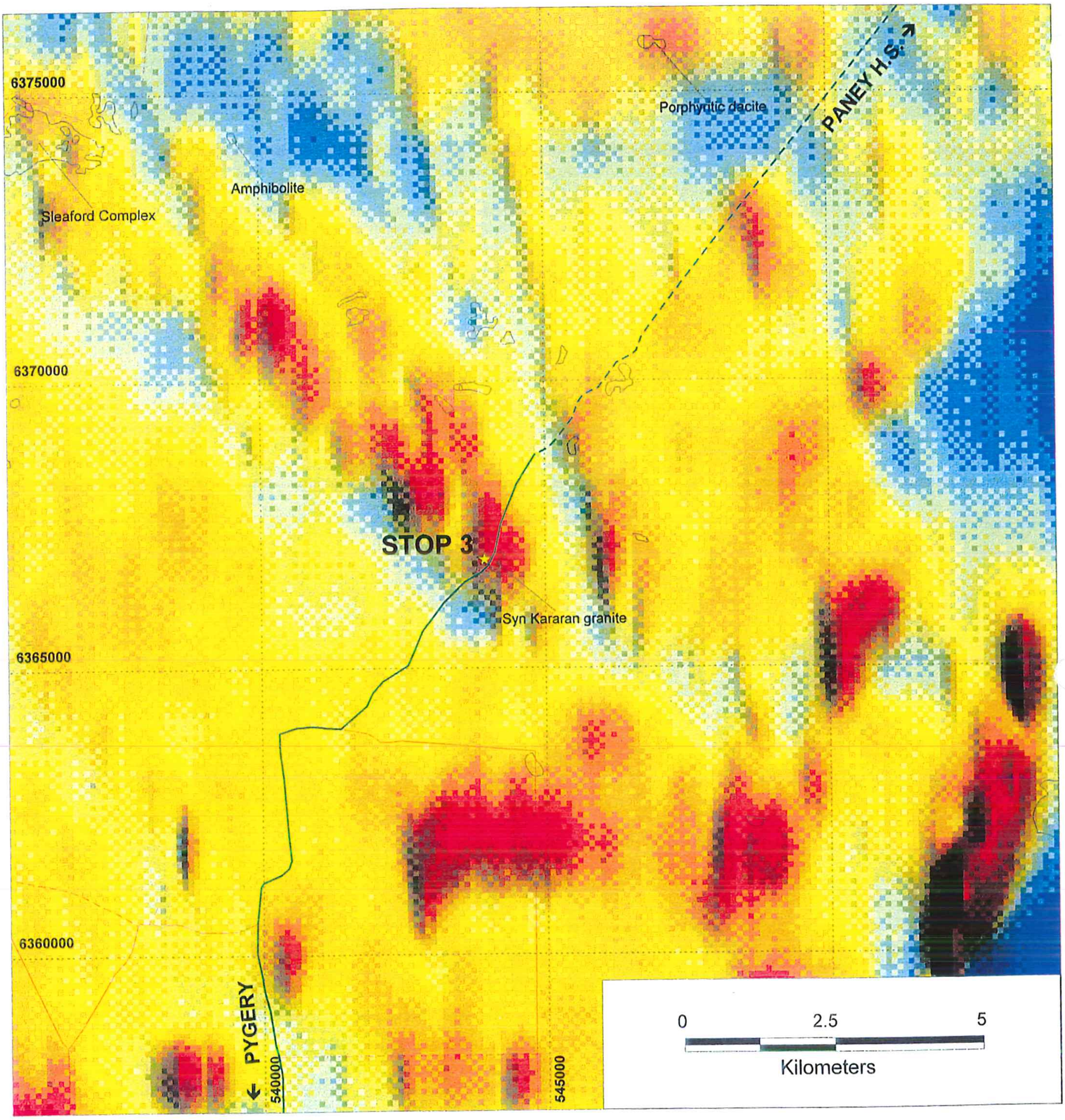

STOP 3 (Scale 1:100 000)

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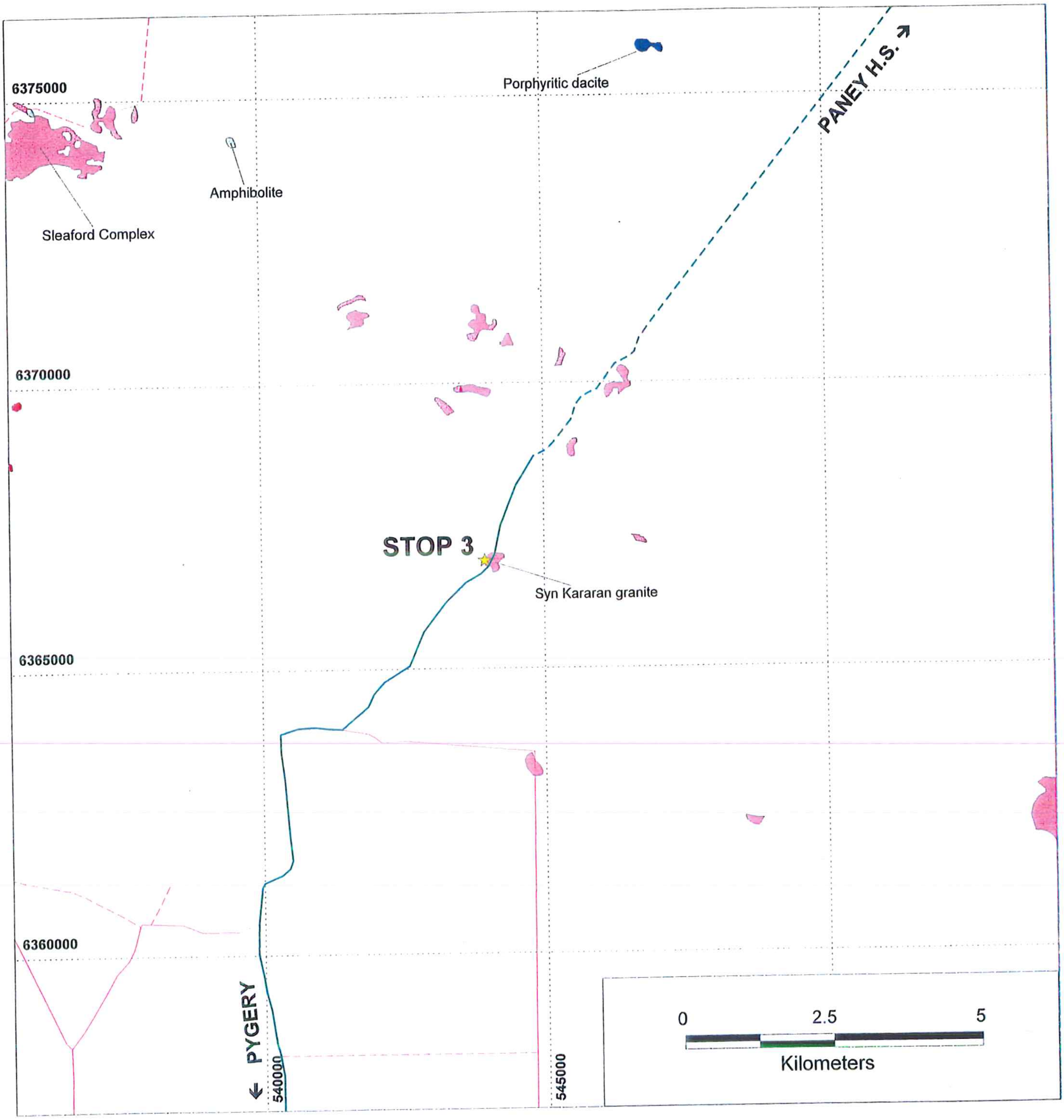
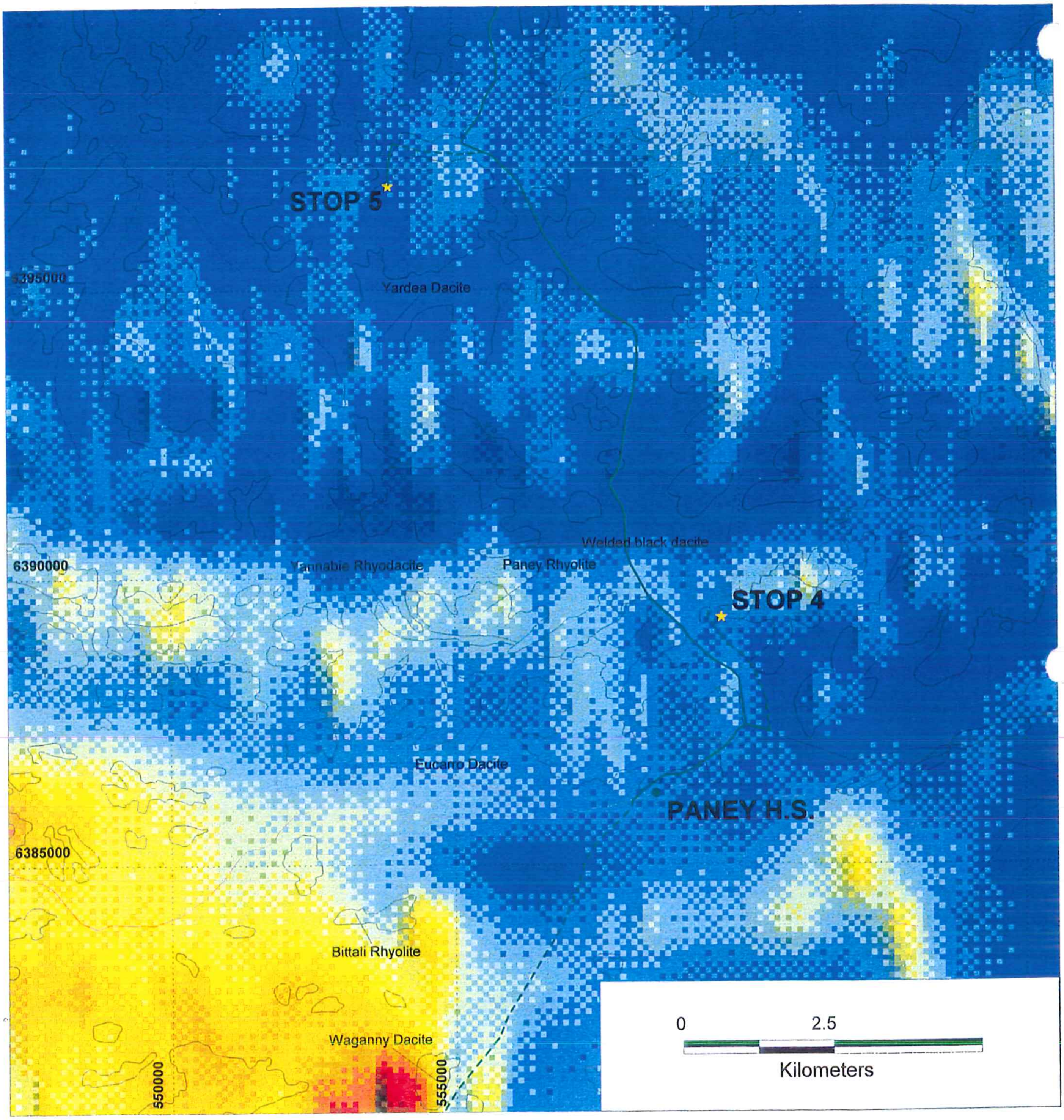


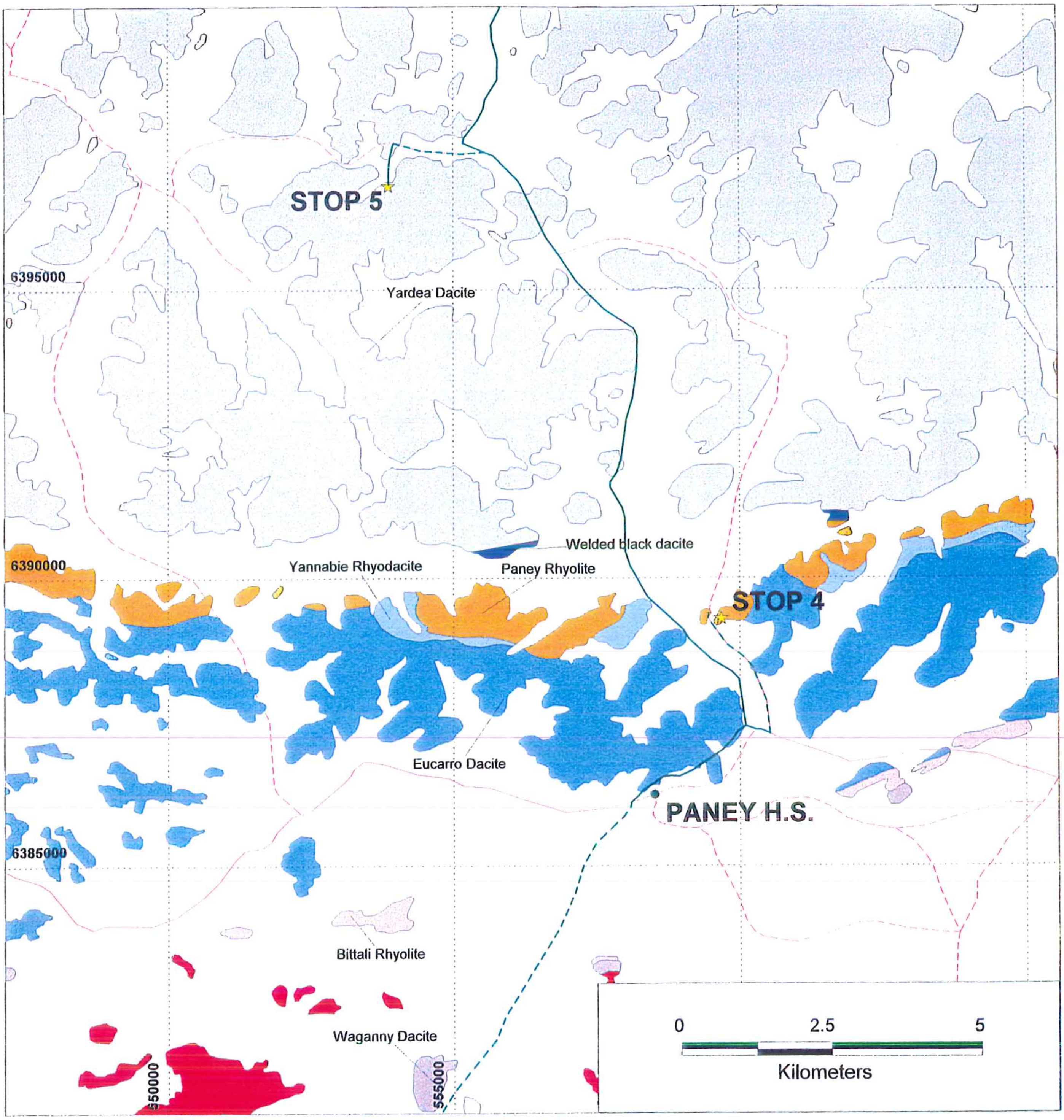
STOP 3 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



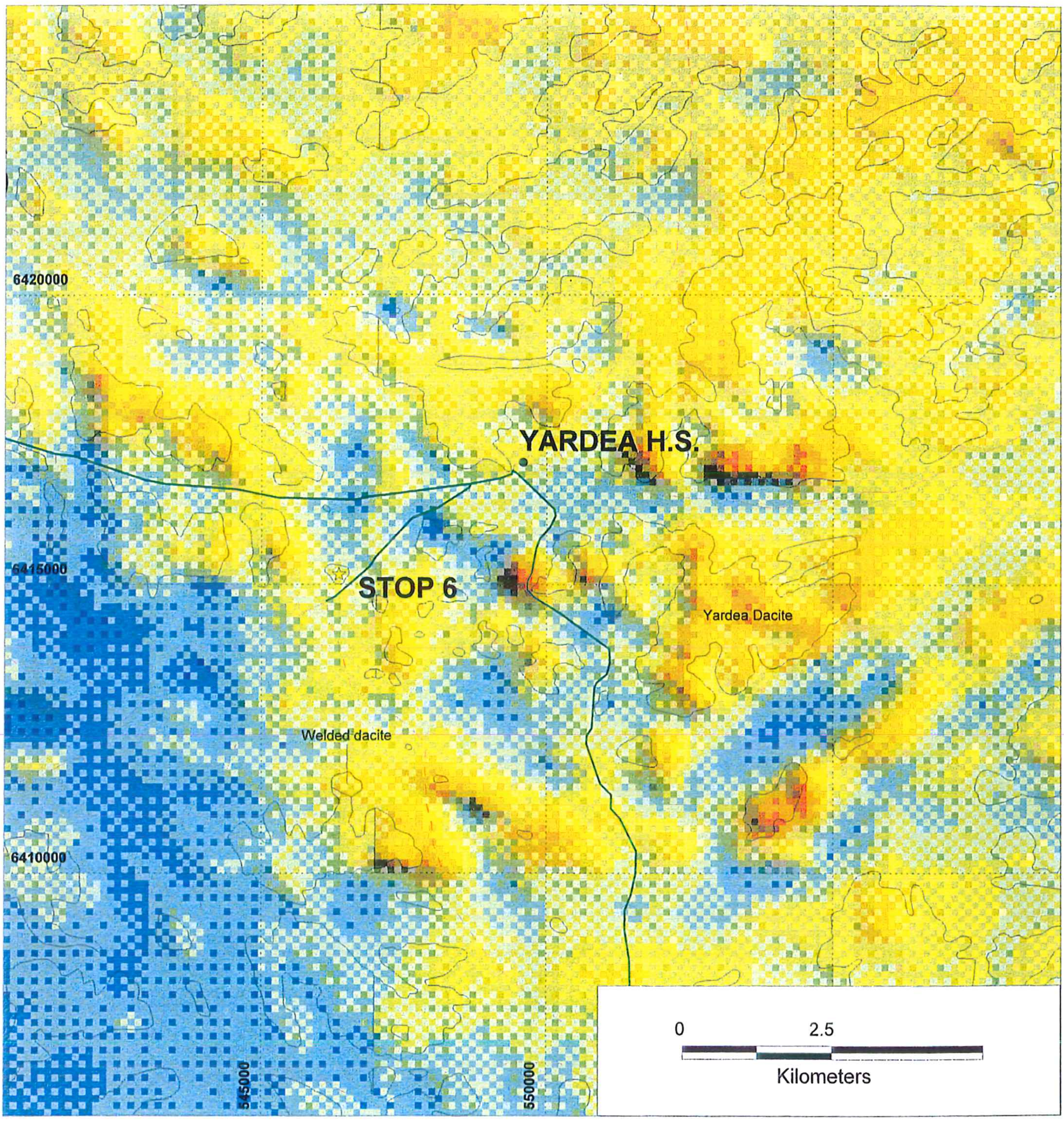
STOPS 4 + 5 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOPS 4 + 5 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOP 6 (Scale 1:100 000)

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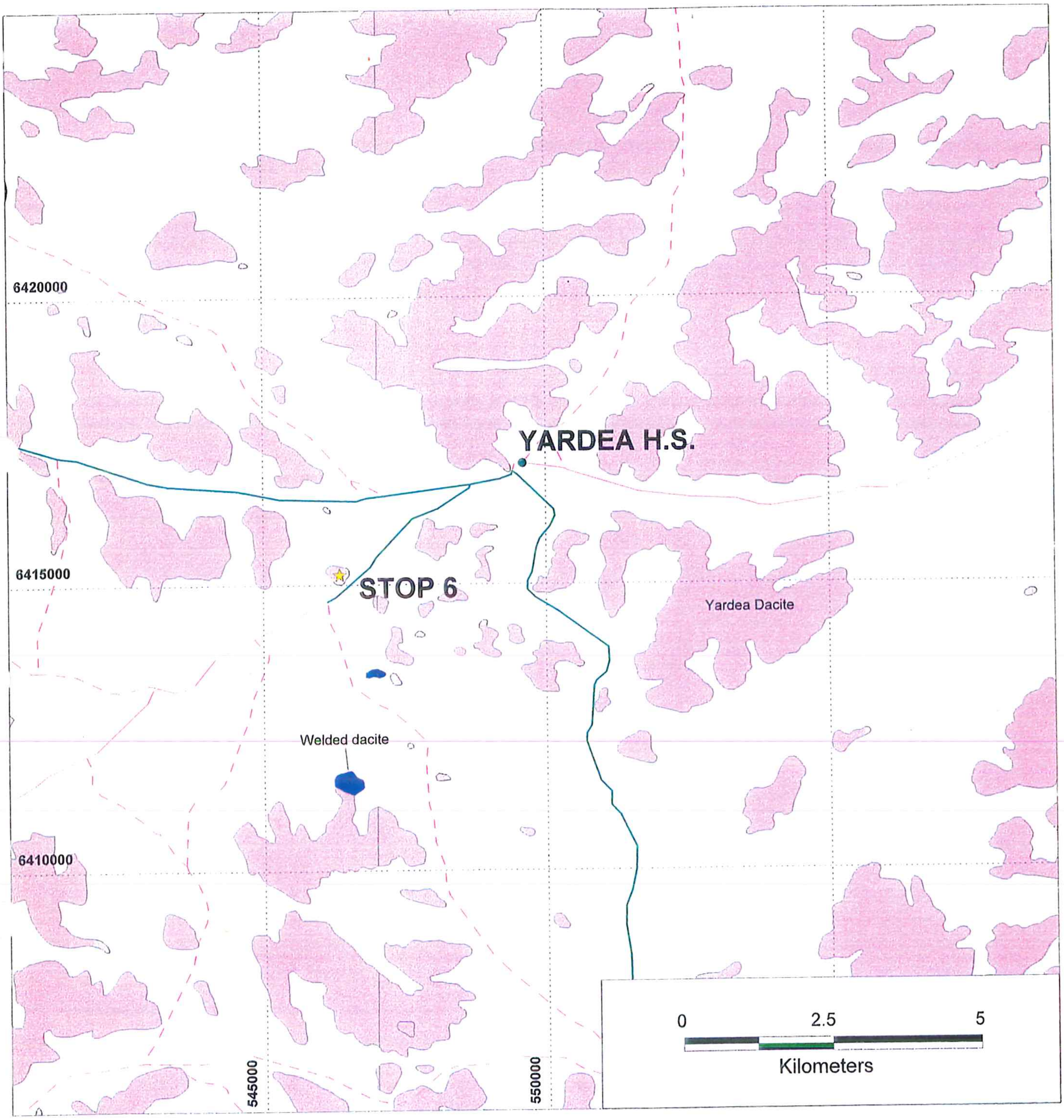
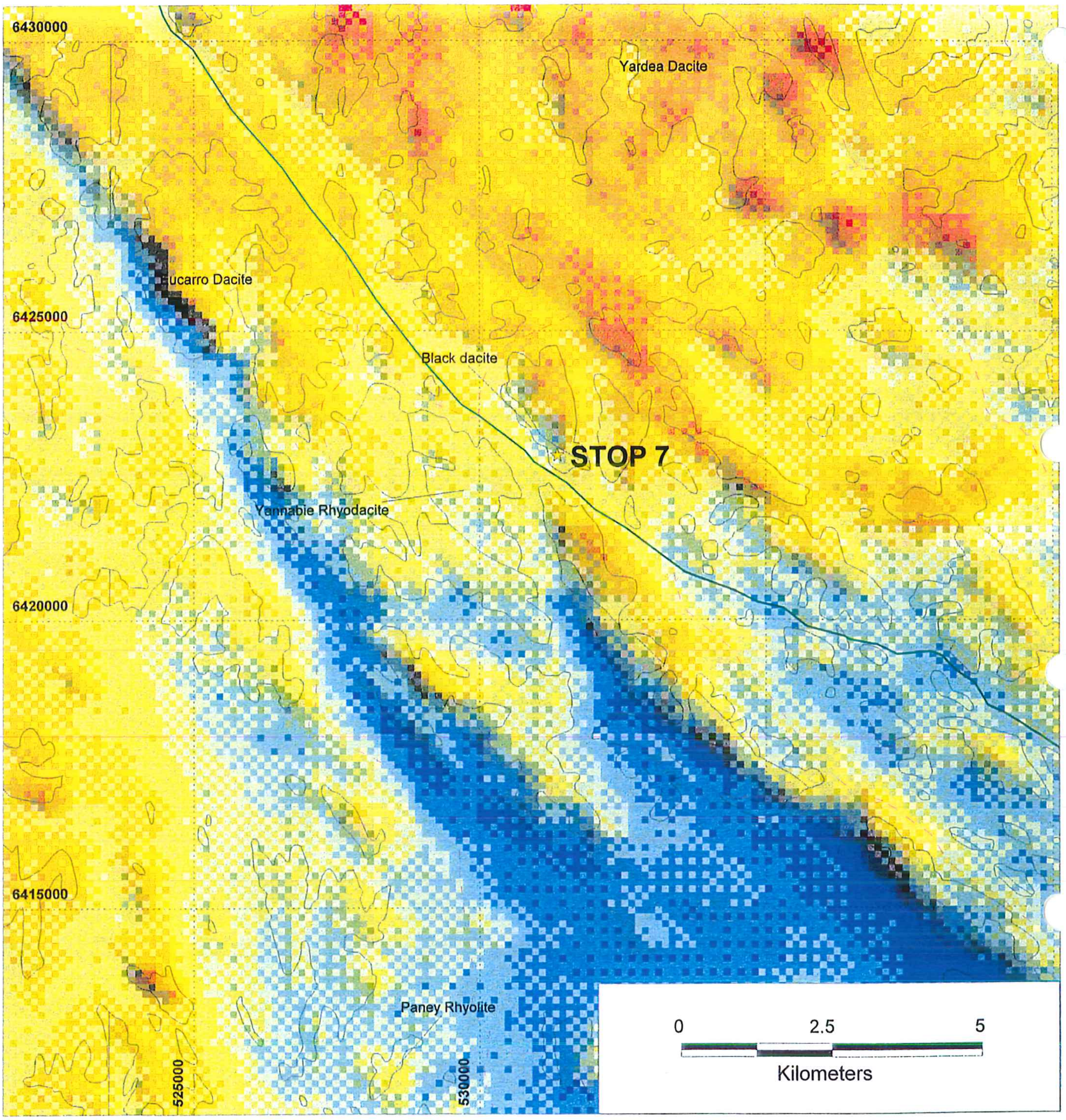


STOP 6 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOP 7 (Scale 1:100 000)

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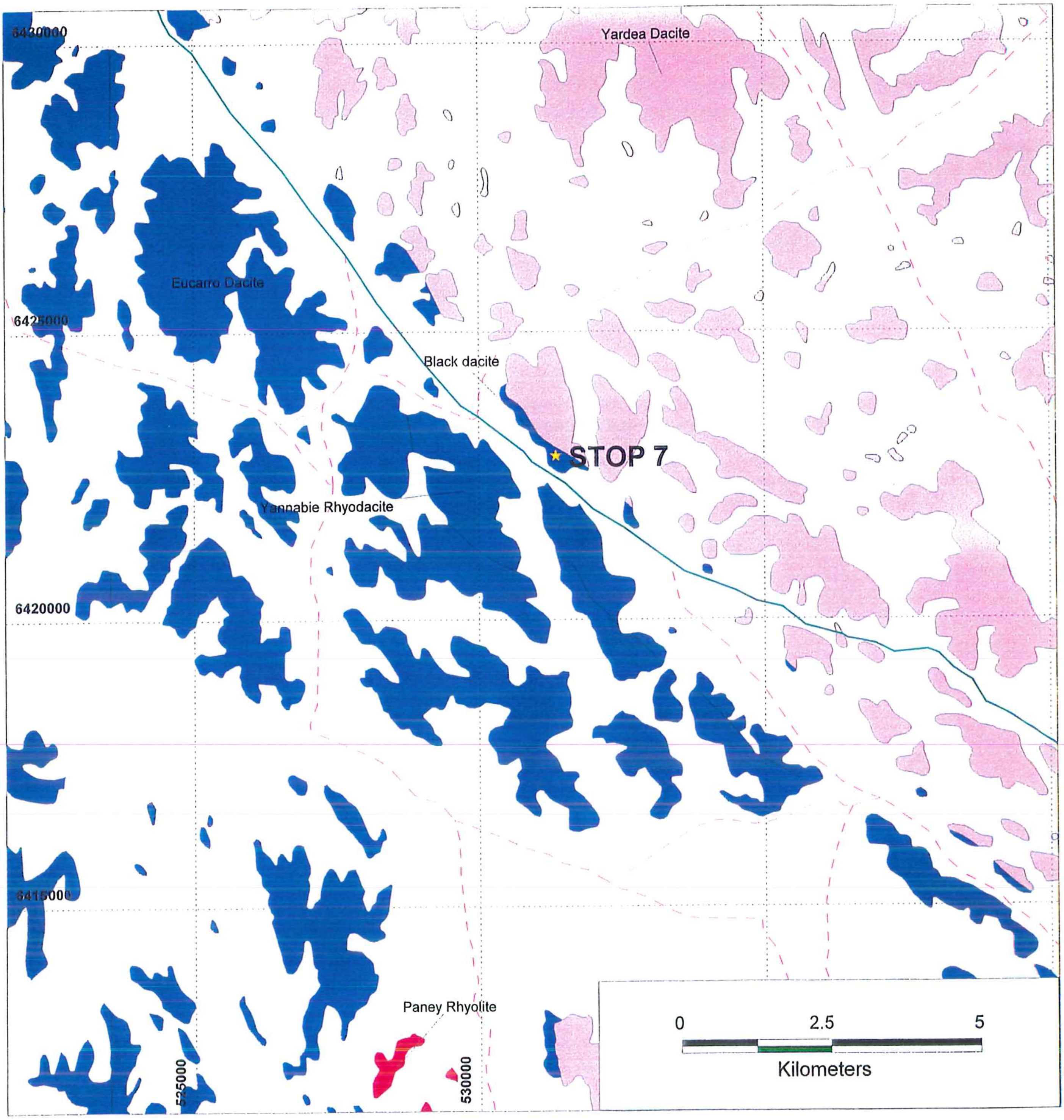
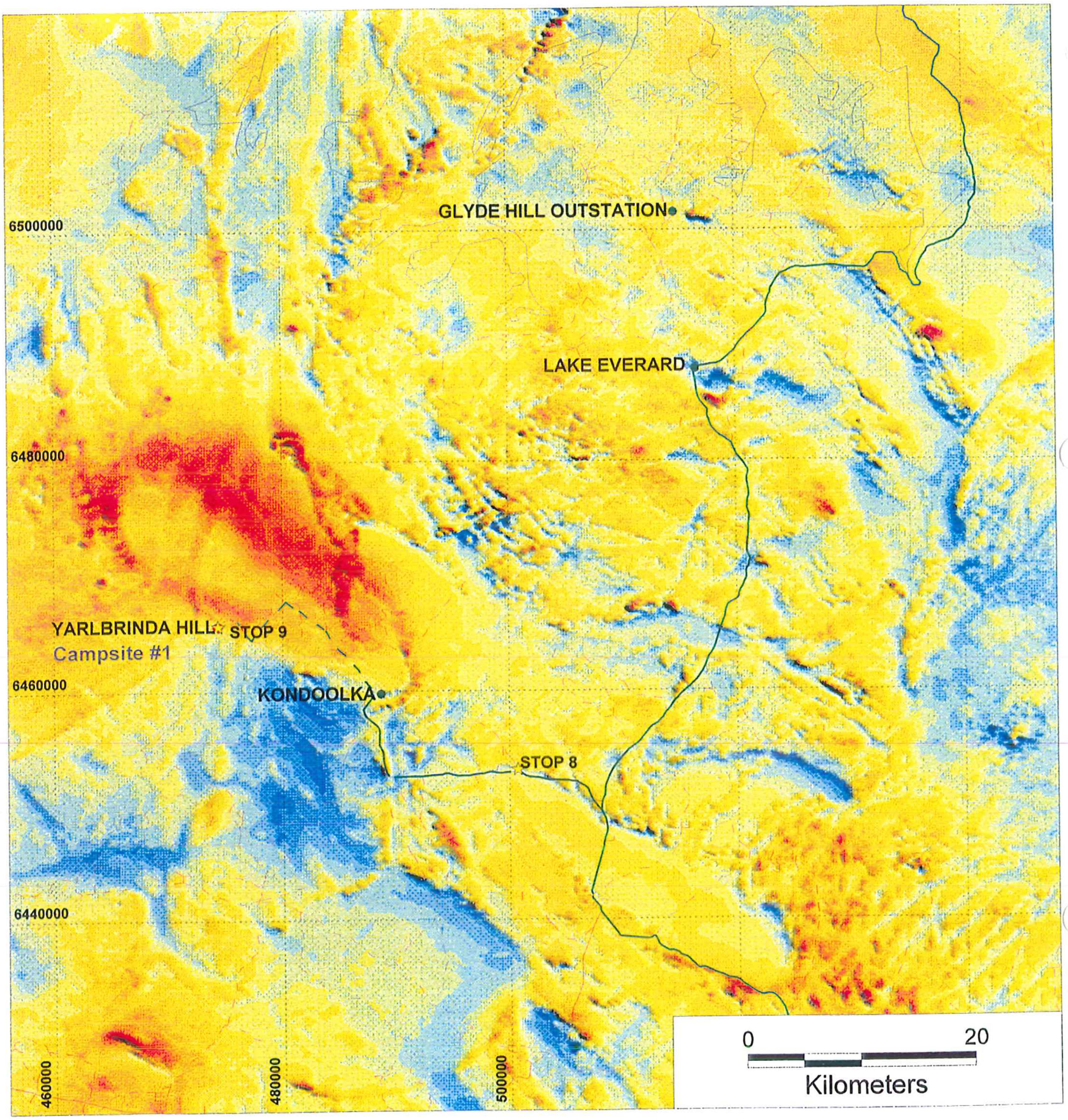


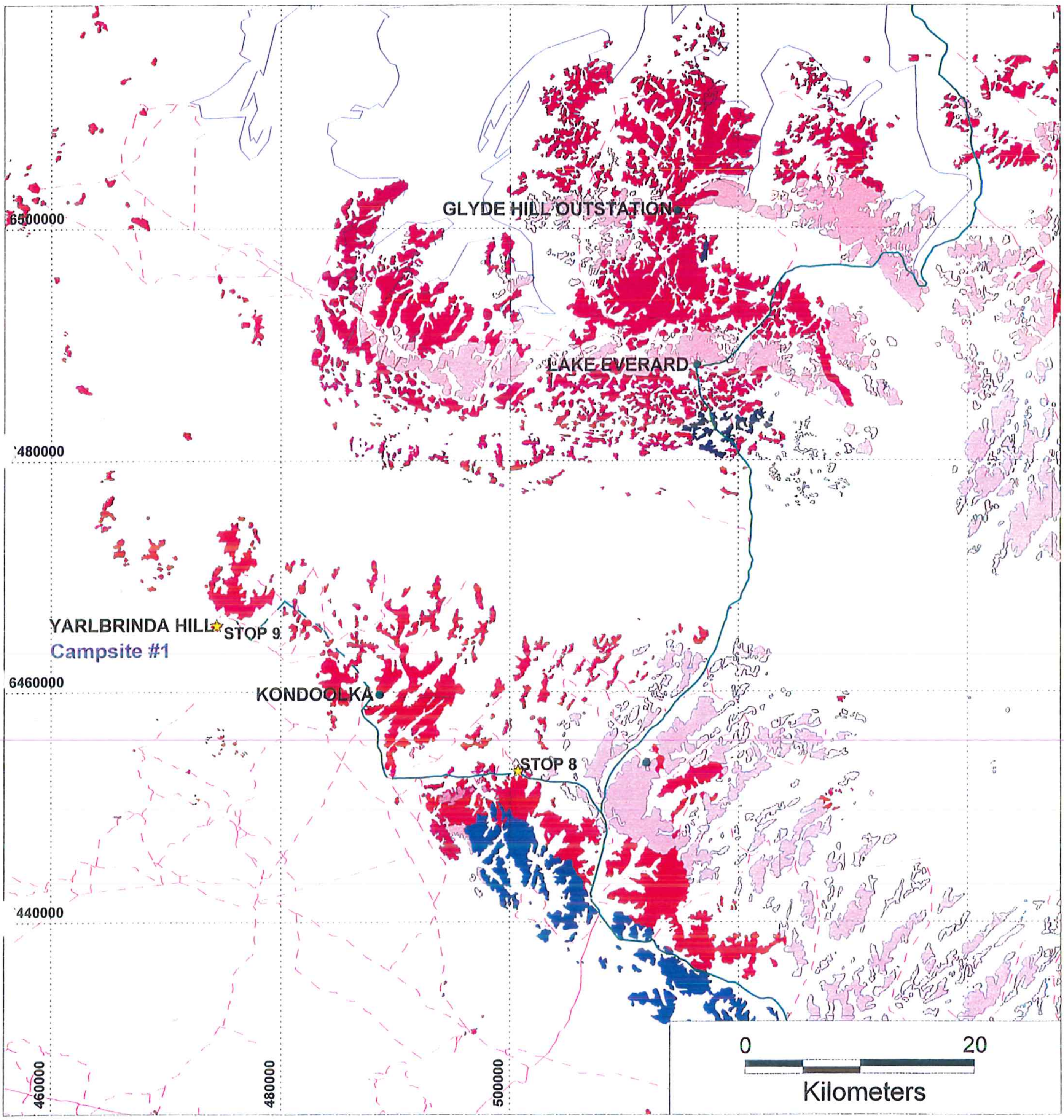
STOP 7 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



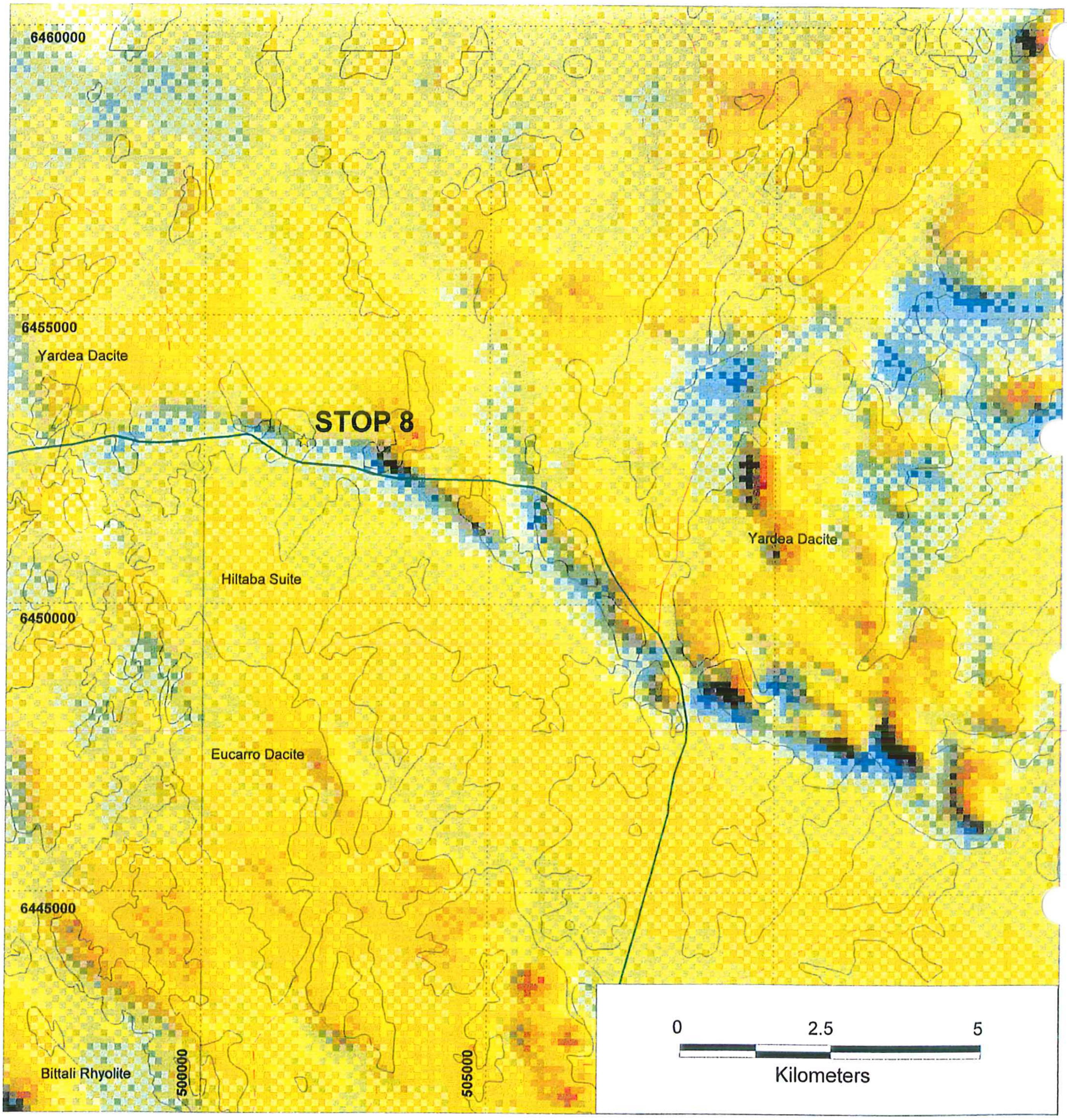
Days 2 and 3 (Scale 1:500 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



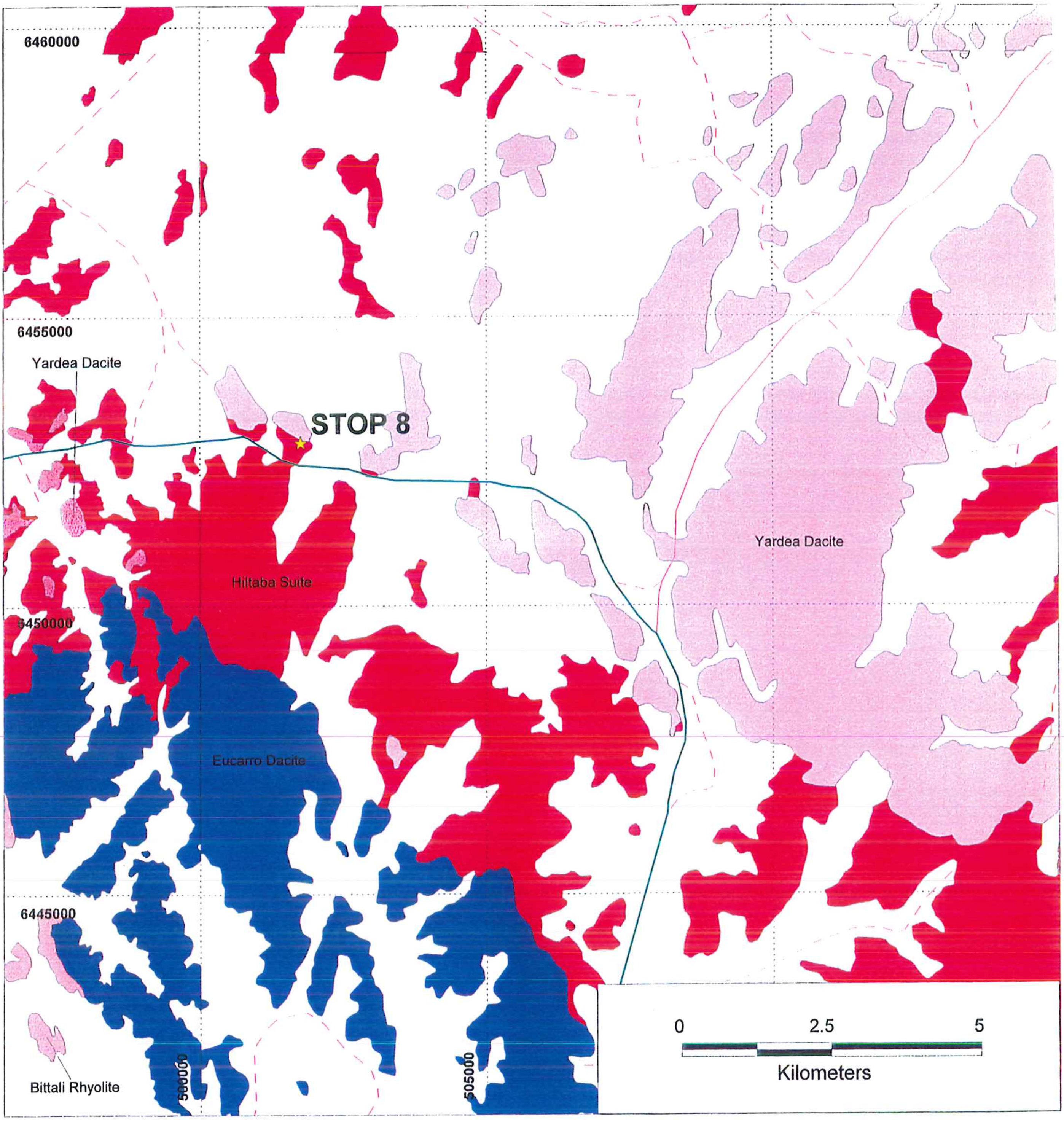
Days 2 and 3 (Scale 1:500 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



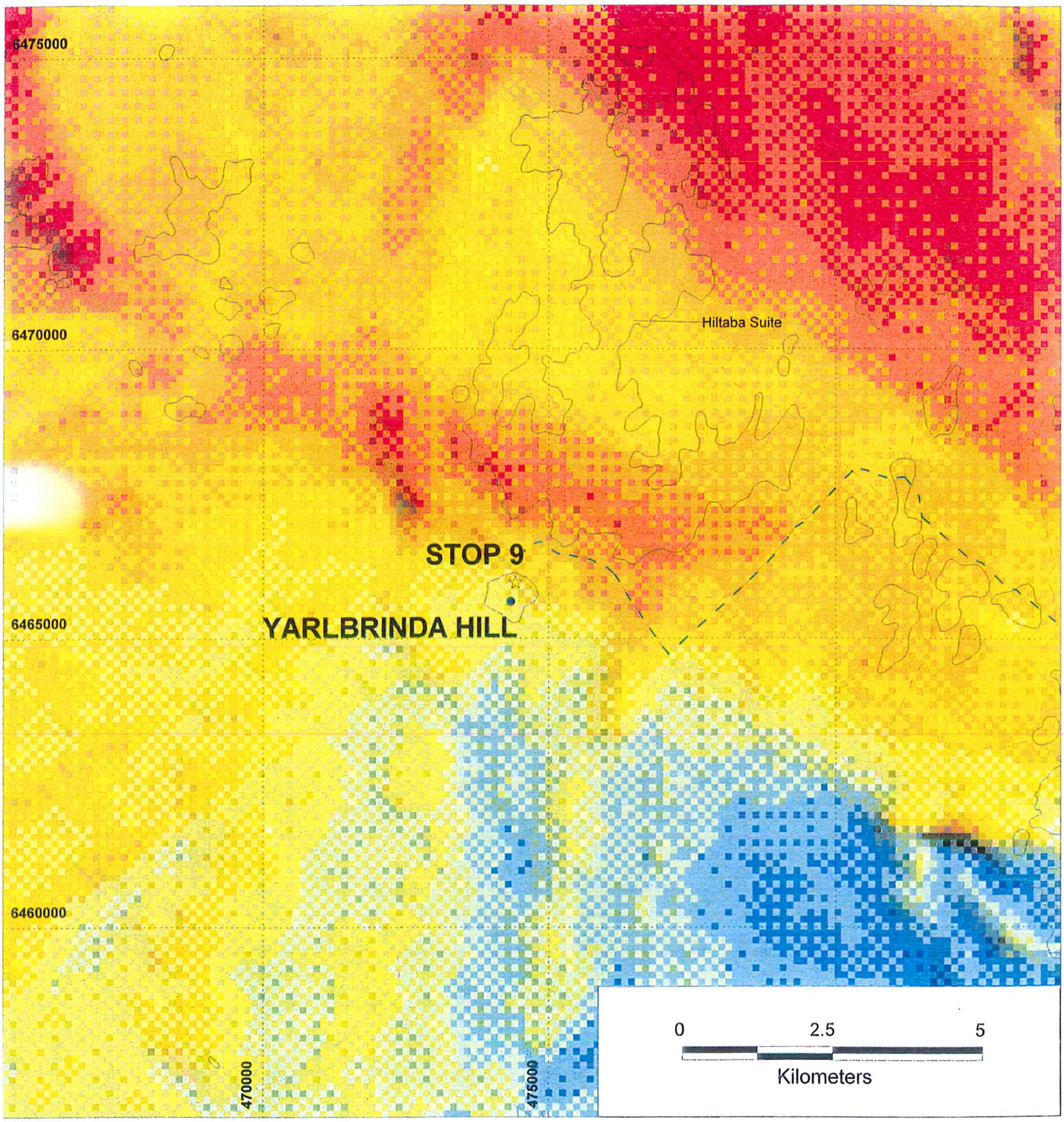
STOP 8 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOP 8 (Scale 1:100 000)

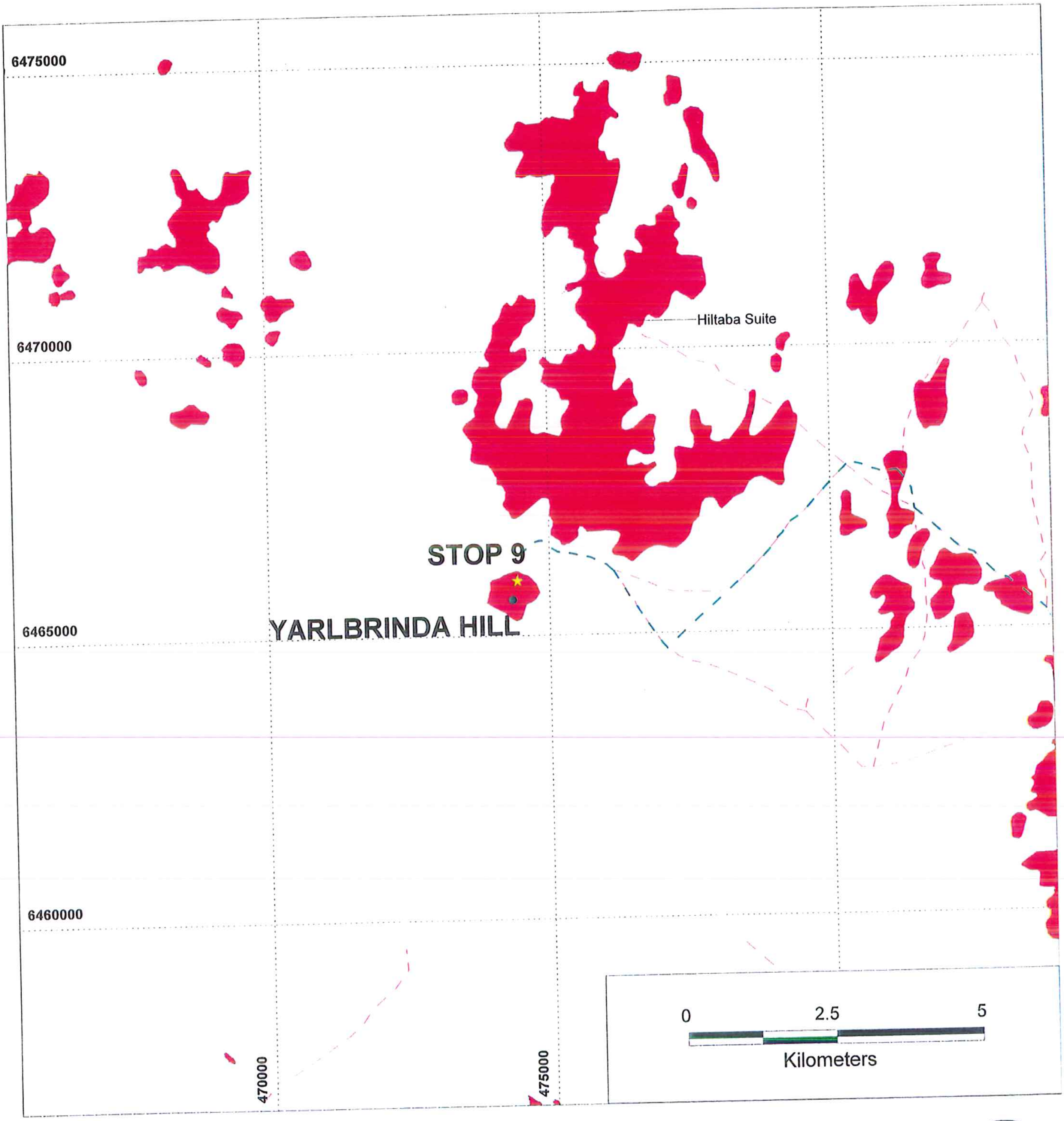
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOP 9 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

SOUTH AUSTRALIA



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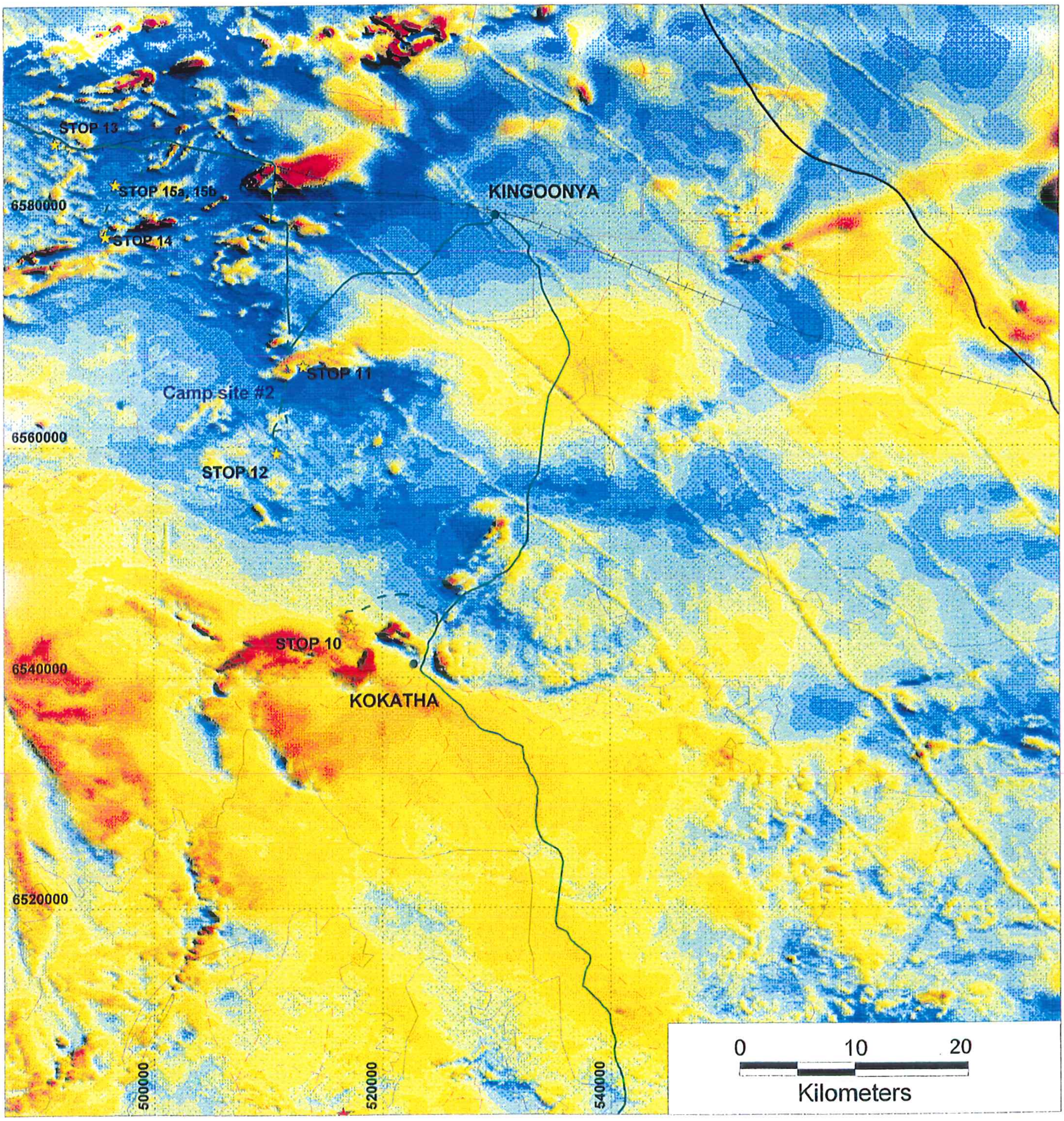
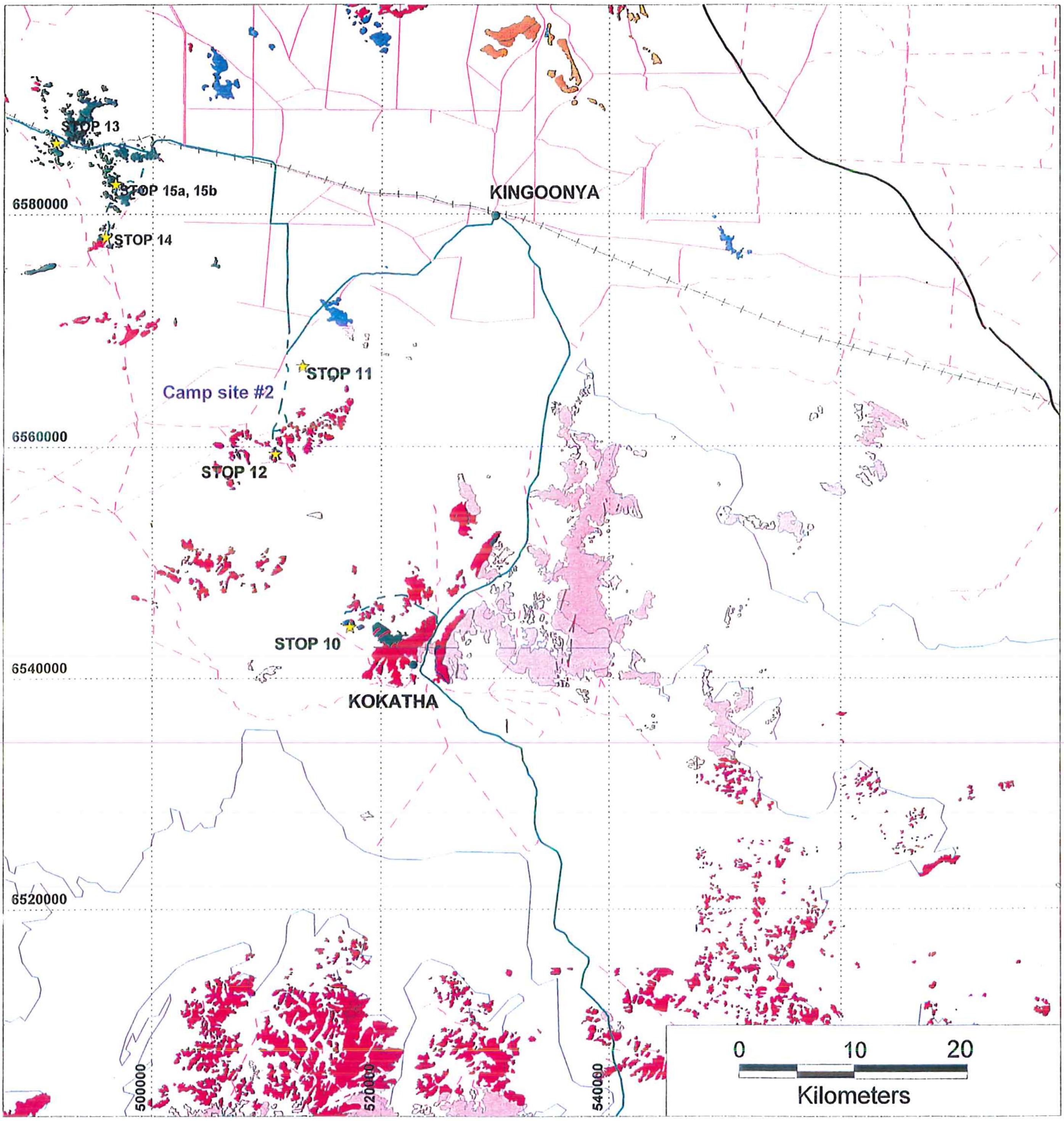
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



Day 3 (Scale 1:500 000)

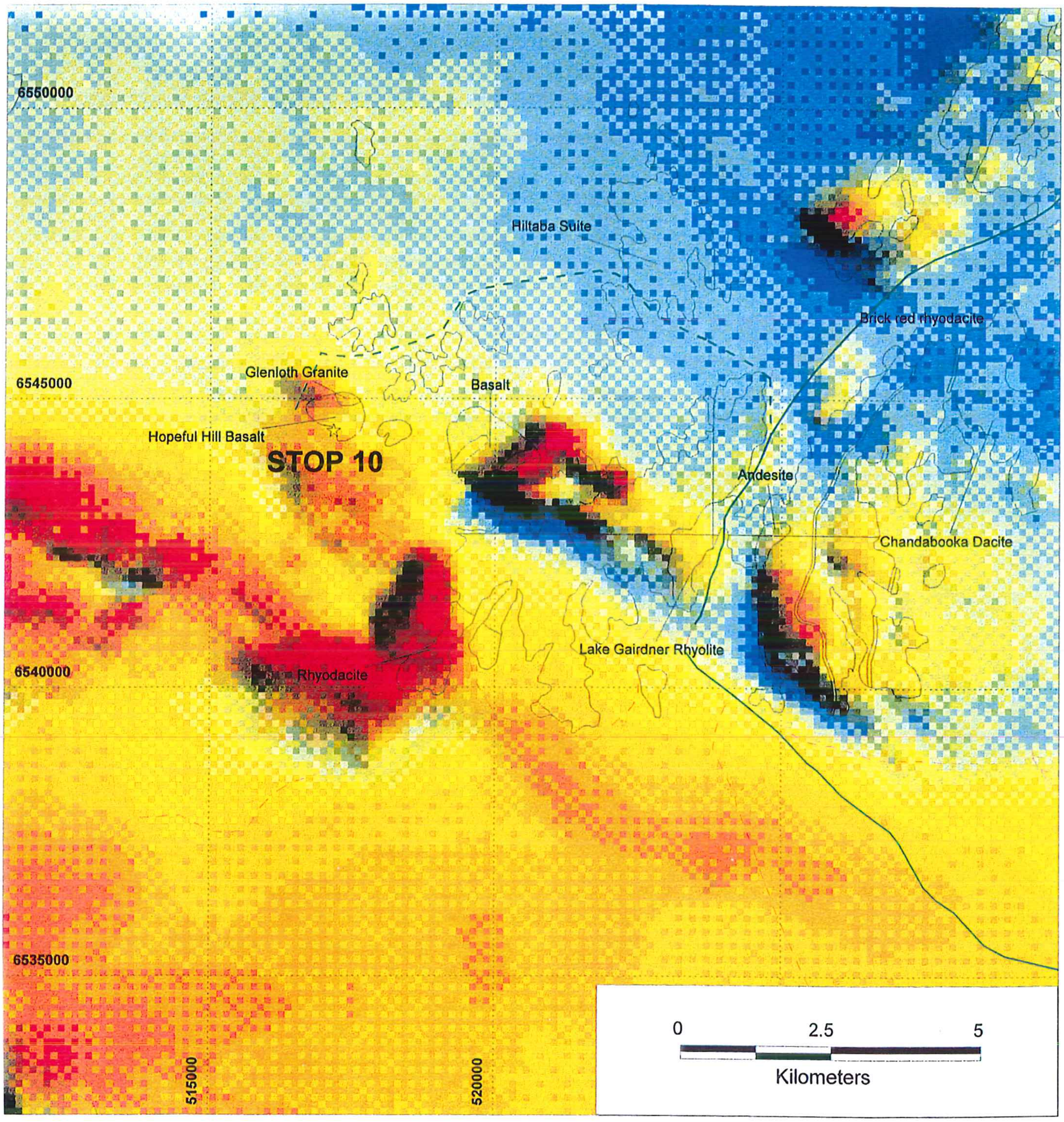
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



Day 3 (Scale 1:500 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA

SOUTH AUSTRALIA



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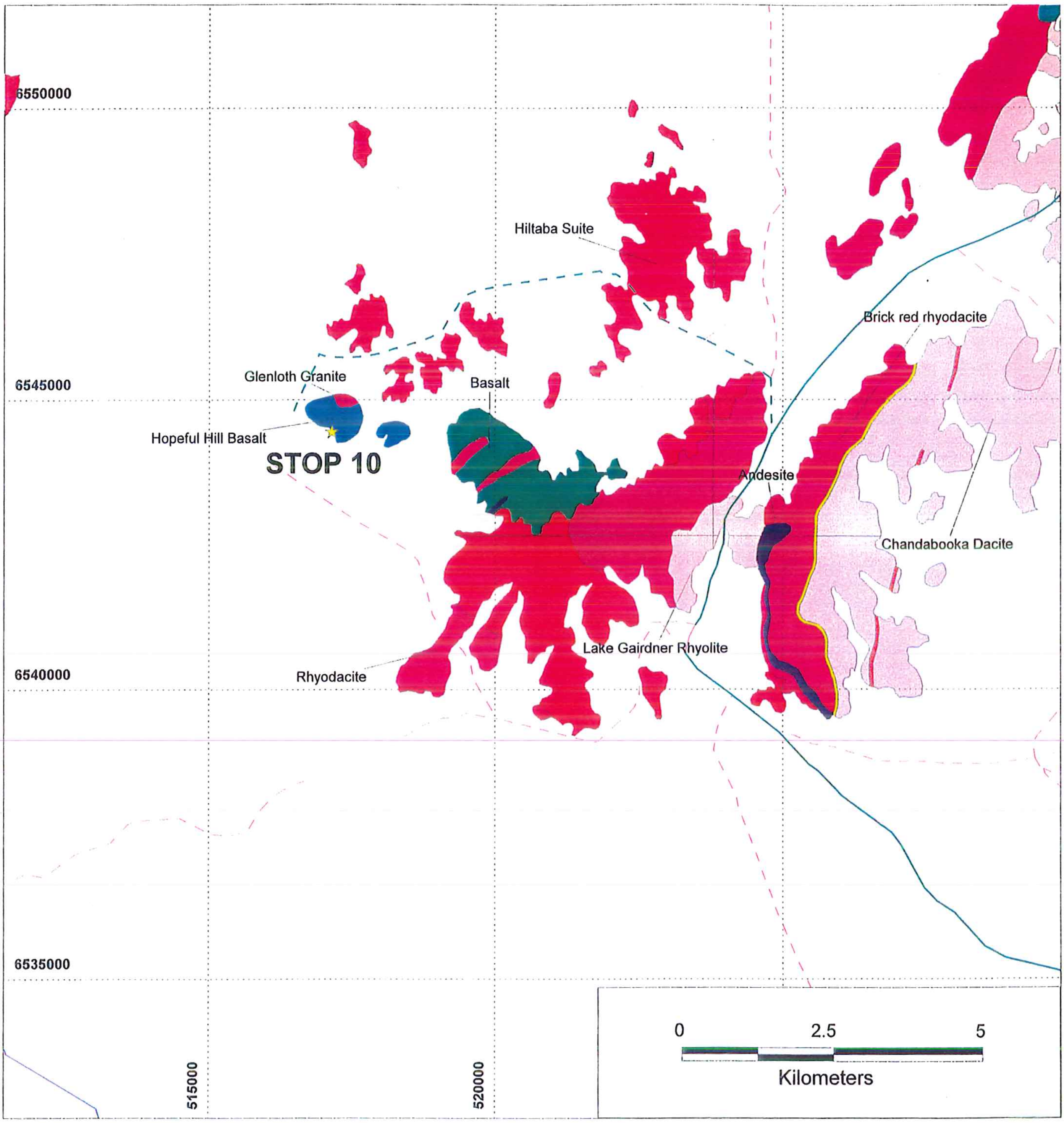
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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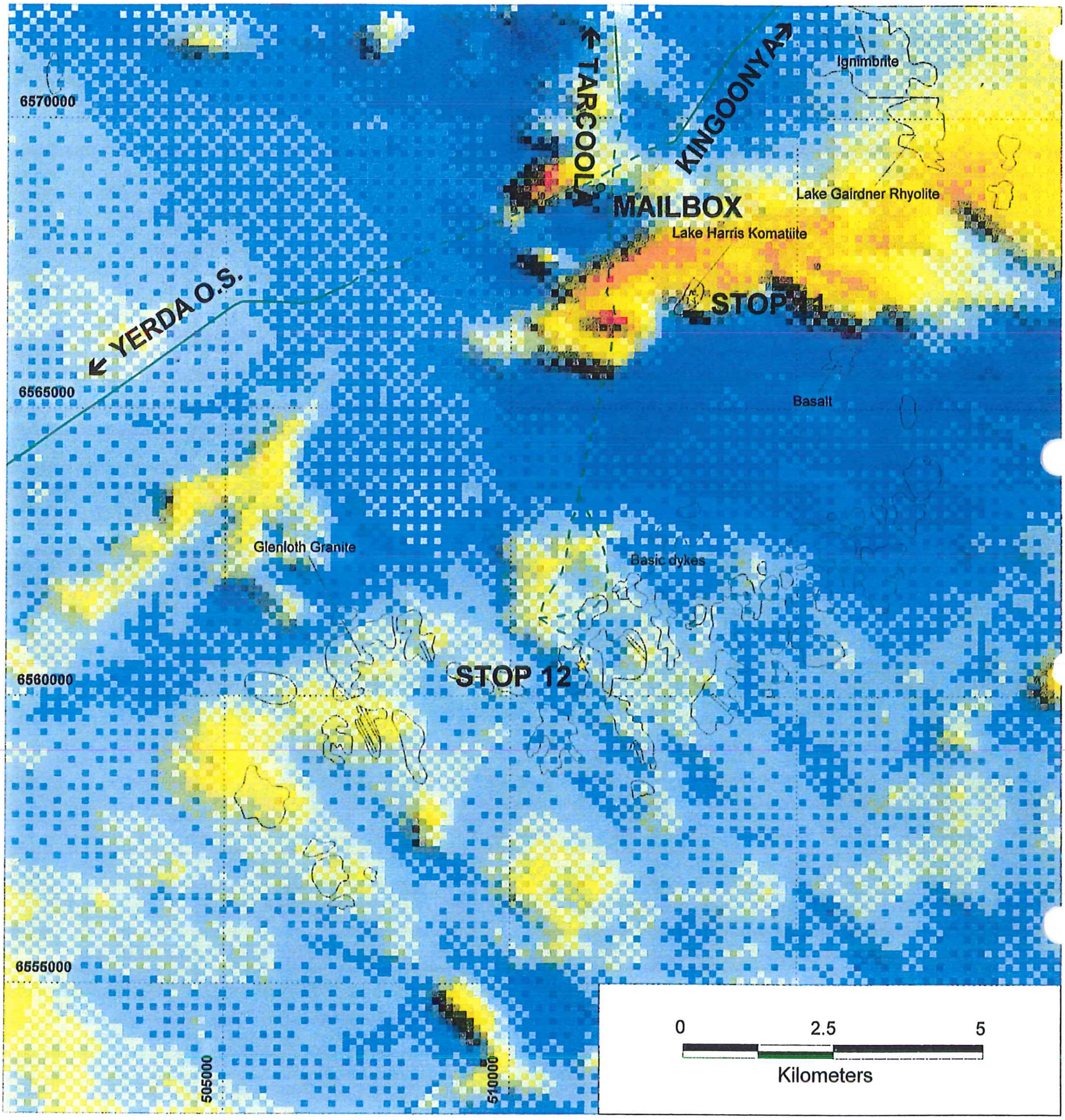
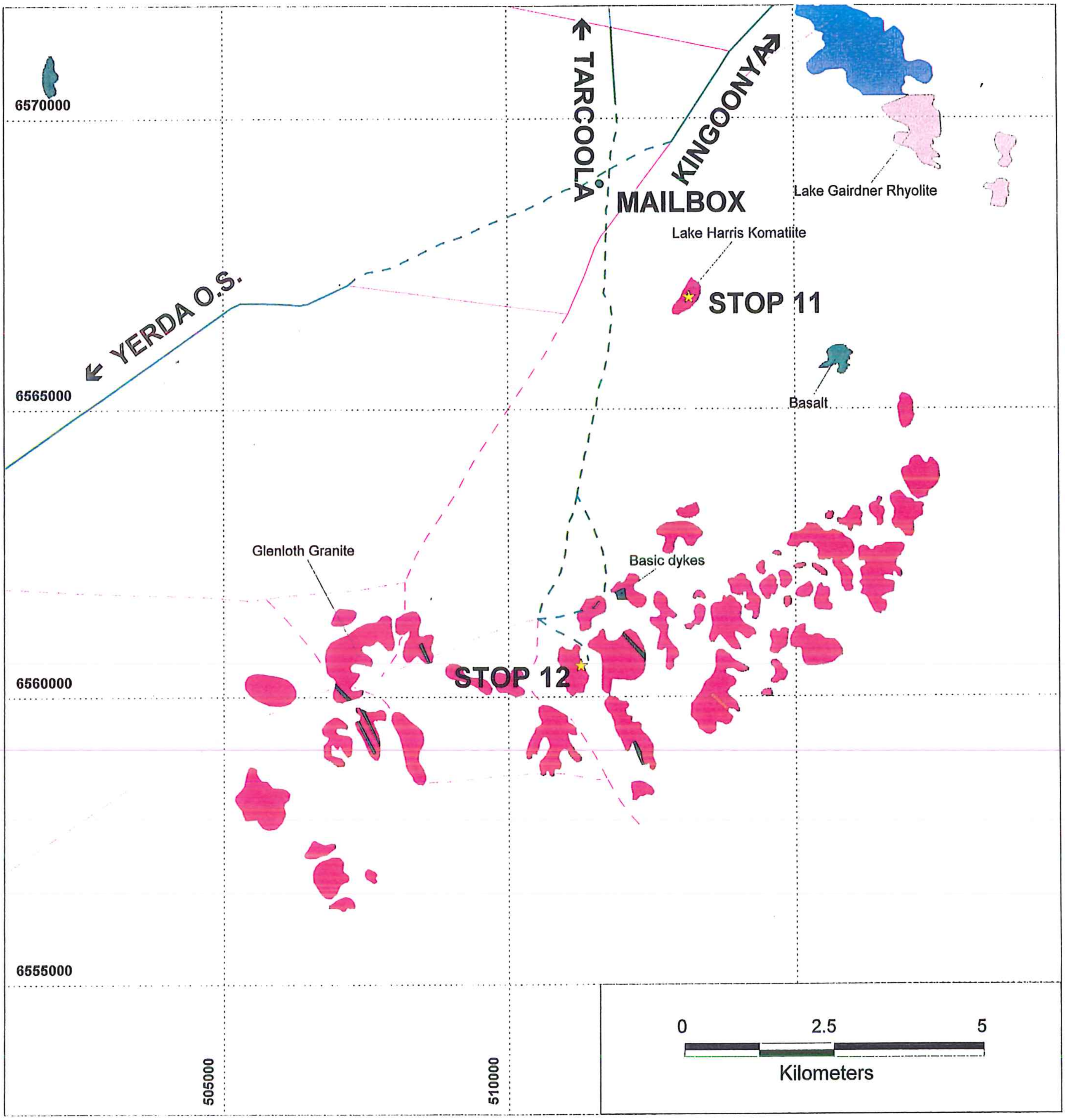


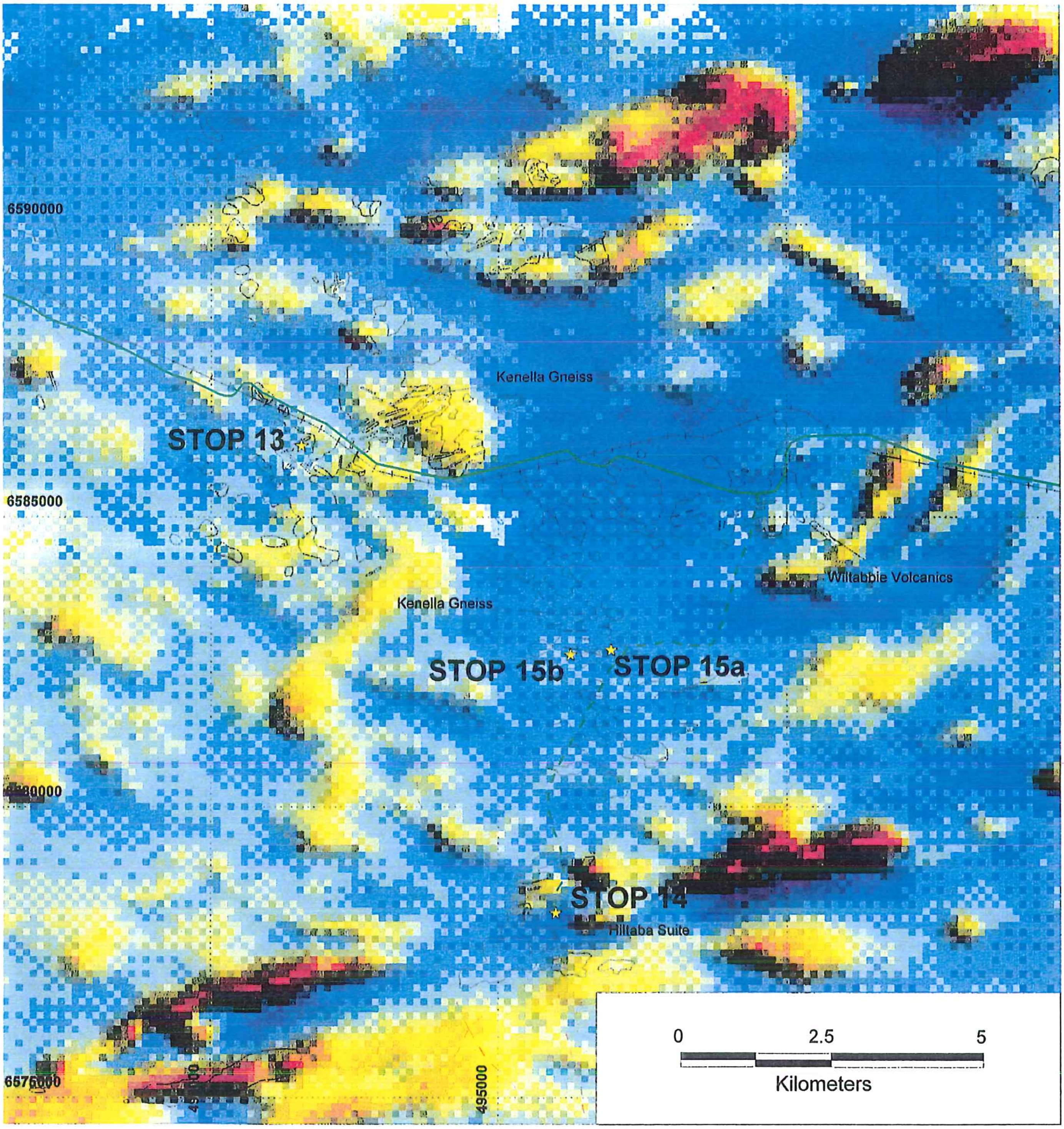
STOPS 11 + 12 (Scale 1:100 000)

MINES and ENERGY
SOUTH AUSTRALIA



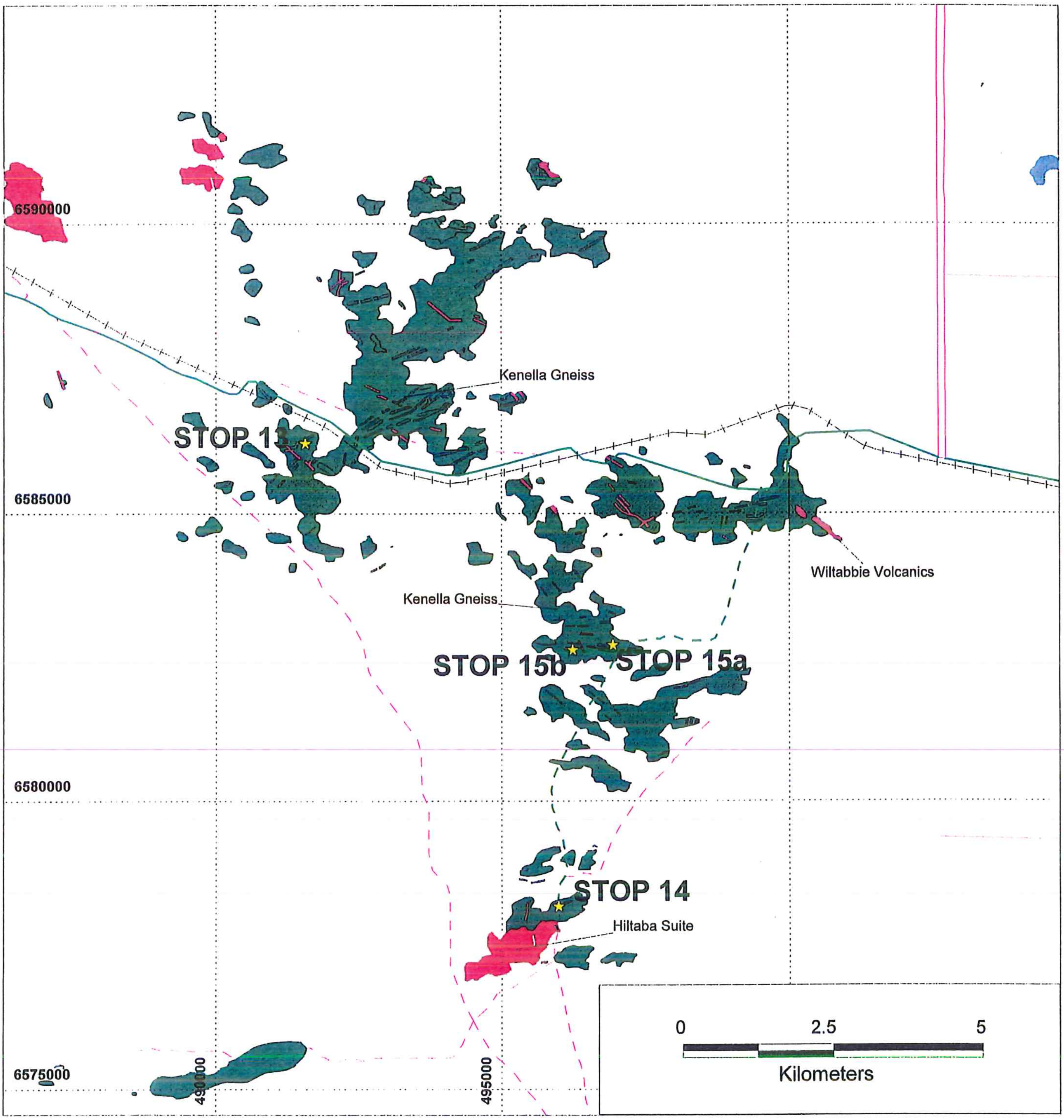
STOPS 11 + 12 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



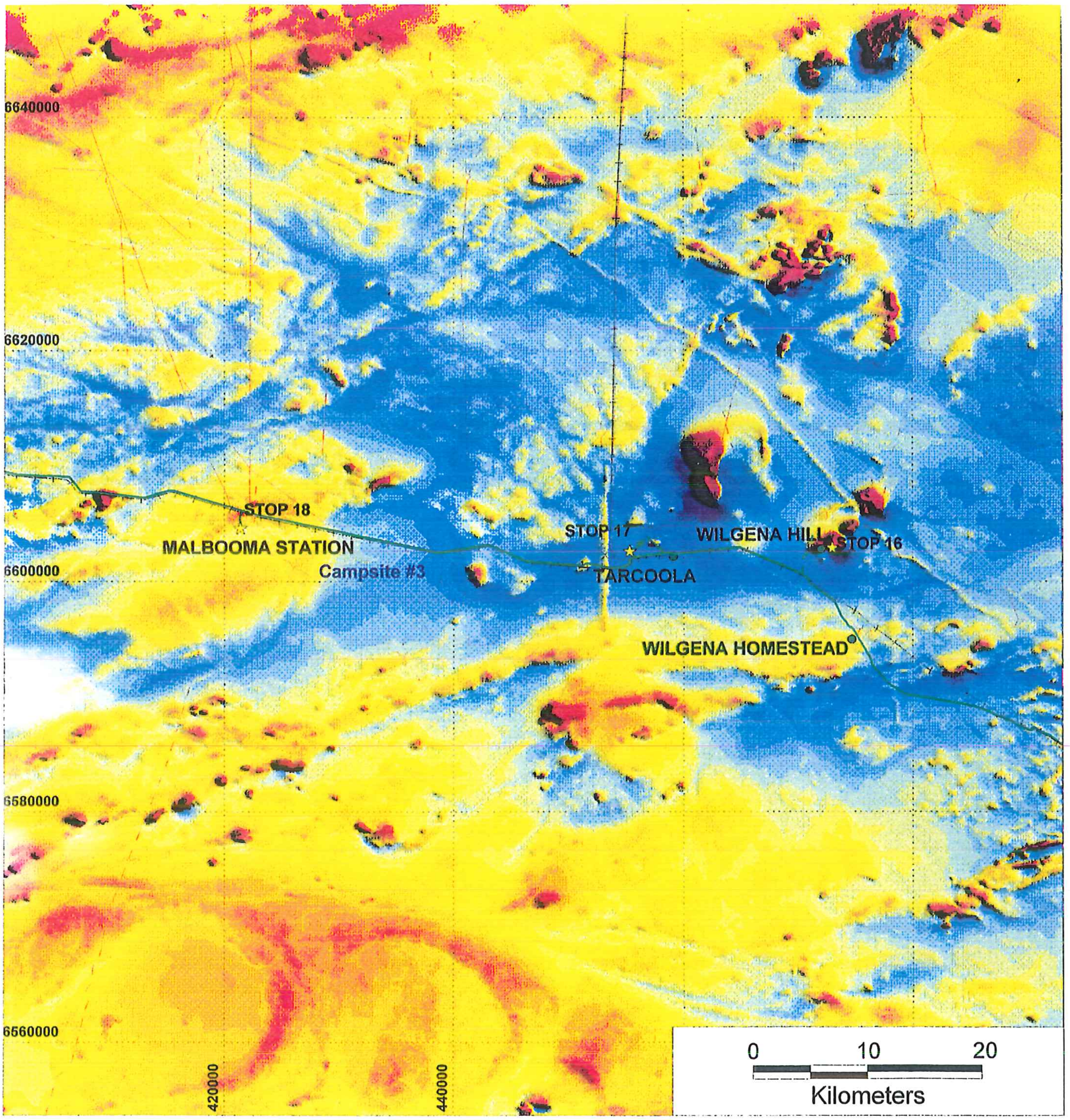
STOPS 13, 14 + 15 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



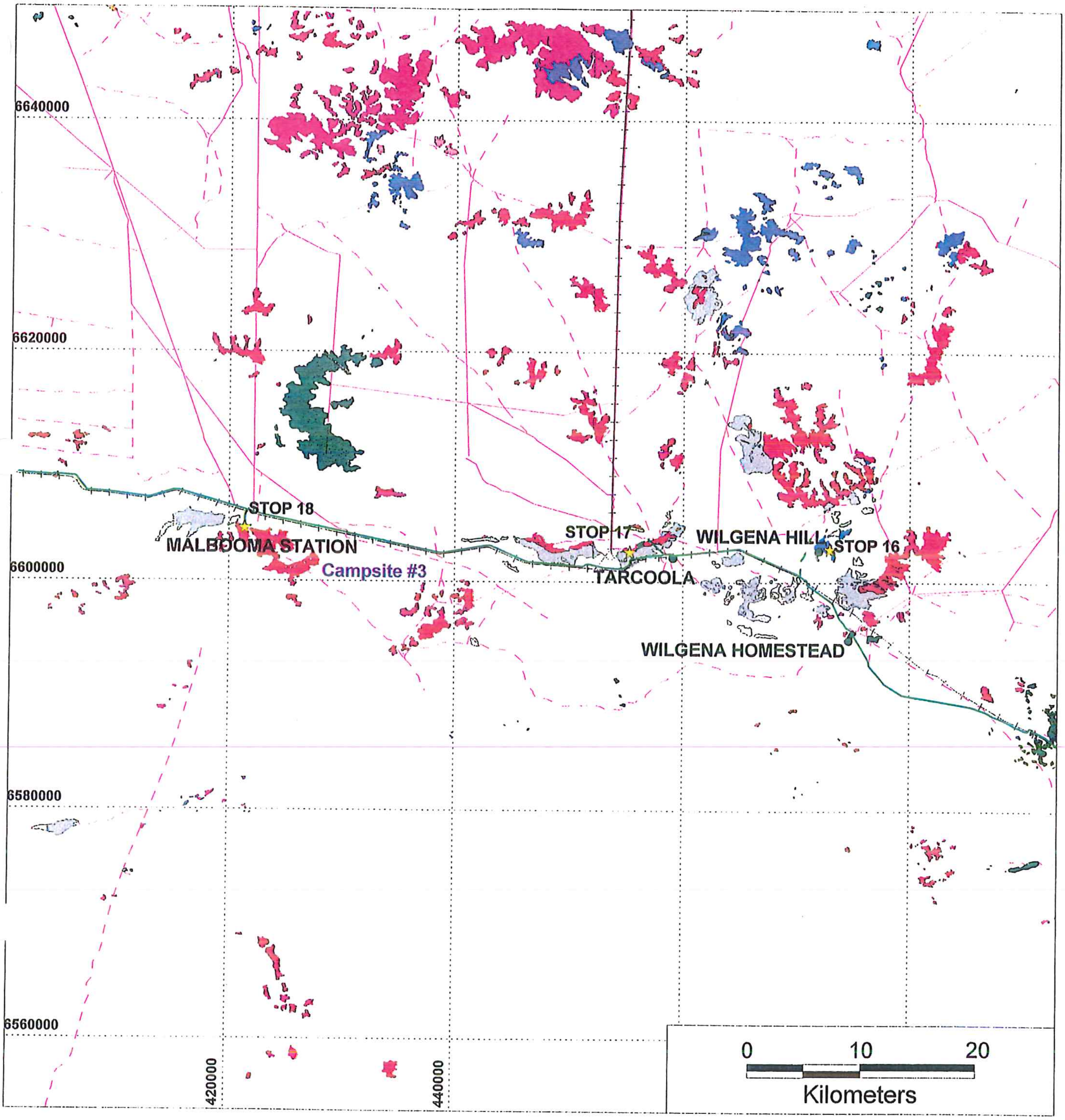
STOPS 13, 14 + 15 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



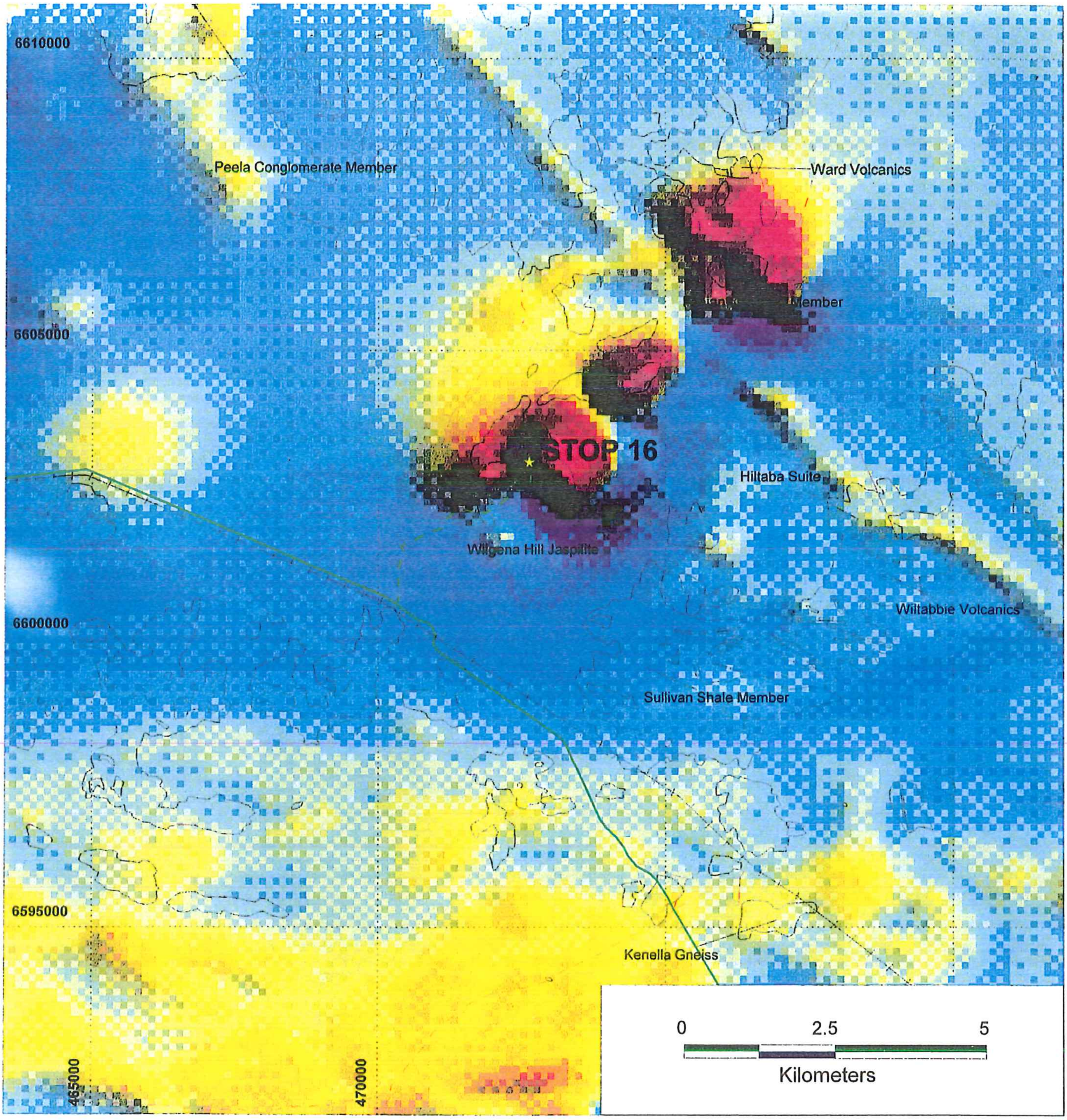
Day 4 (Scale 1:500 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



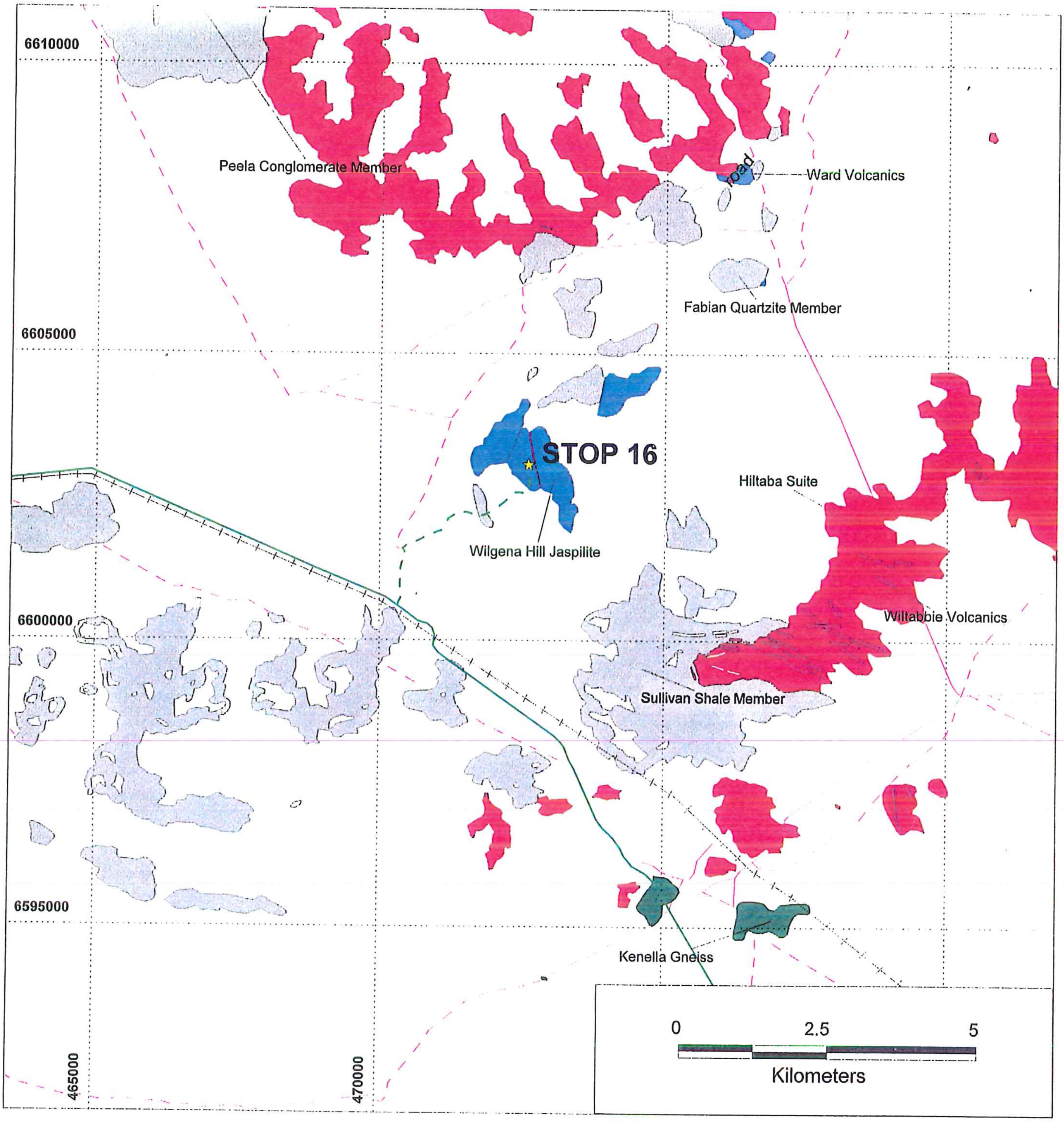
Day 4 (Scale 1:500 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOP 16

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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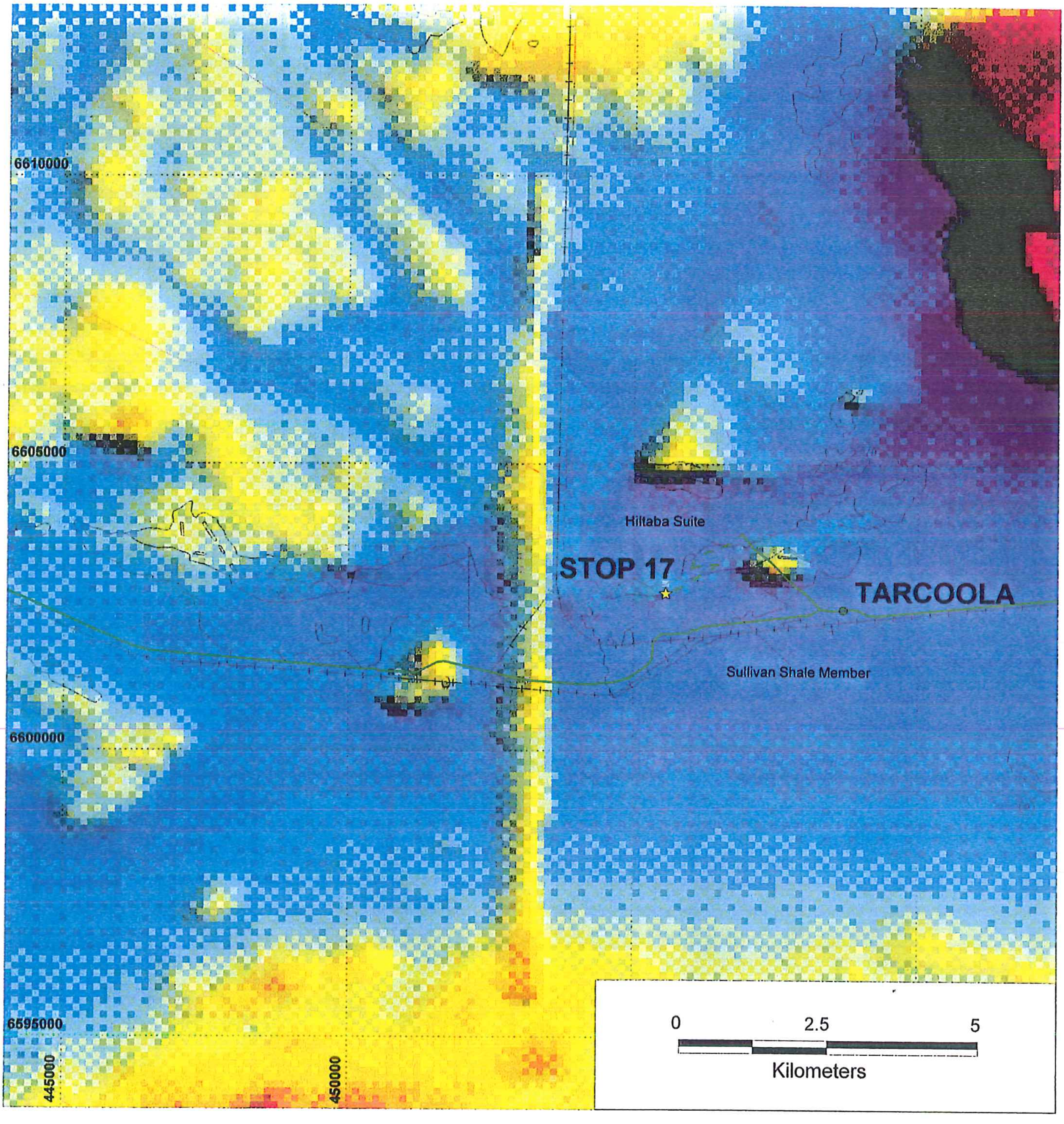
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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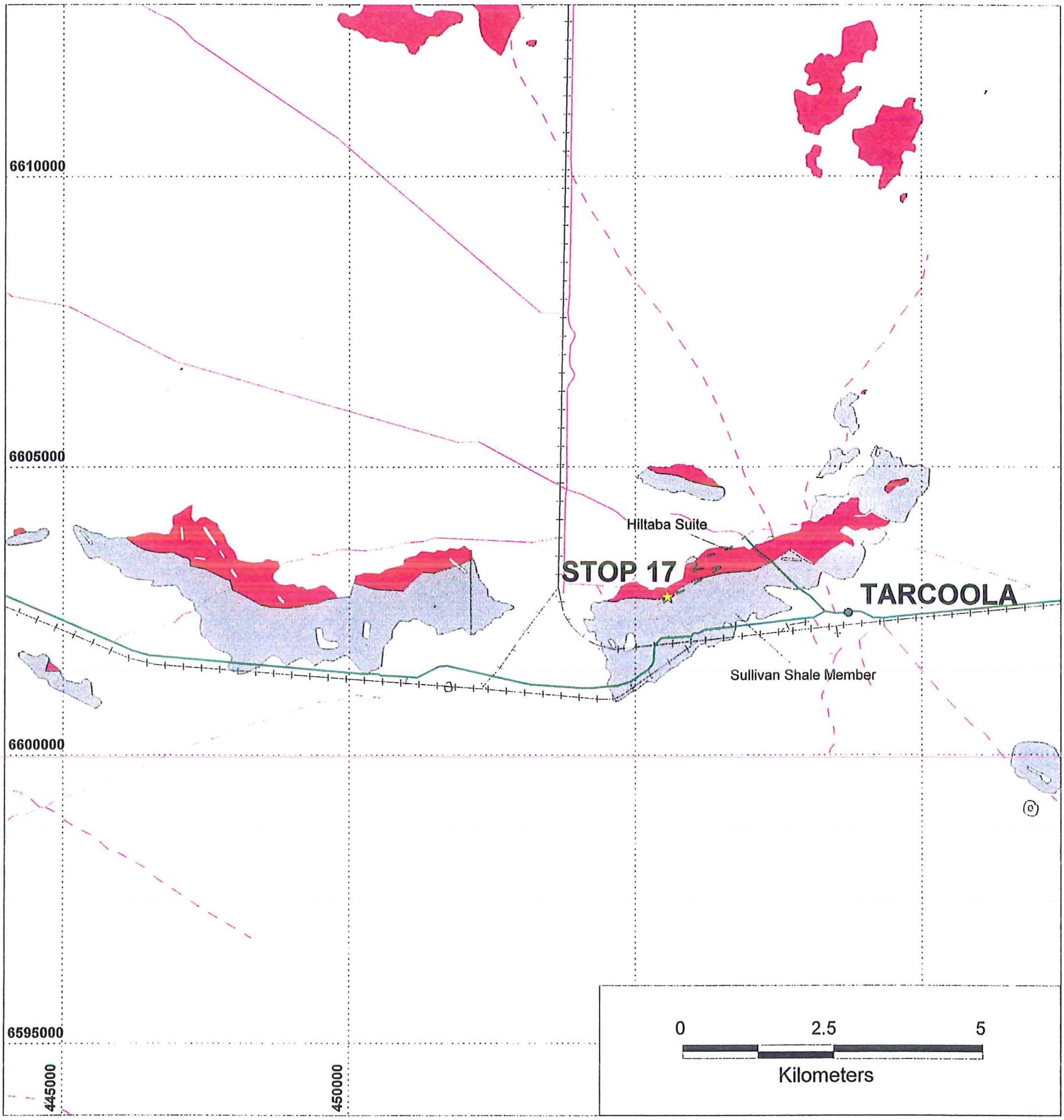

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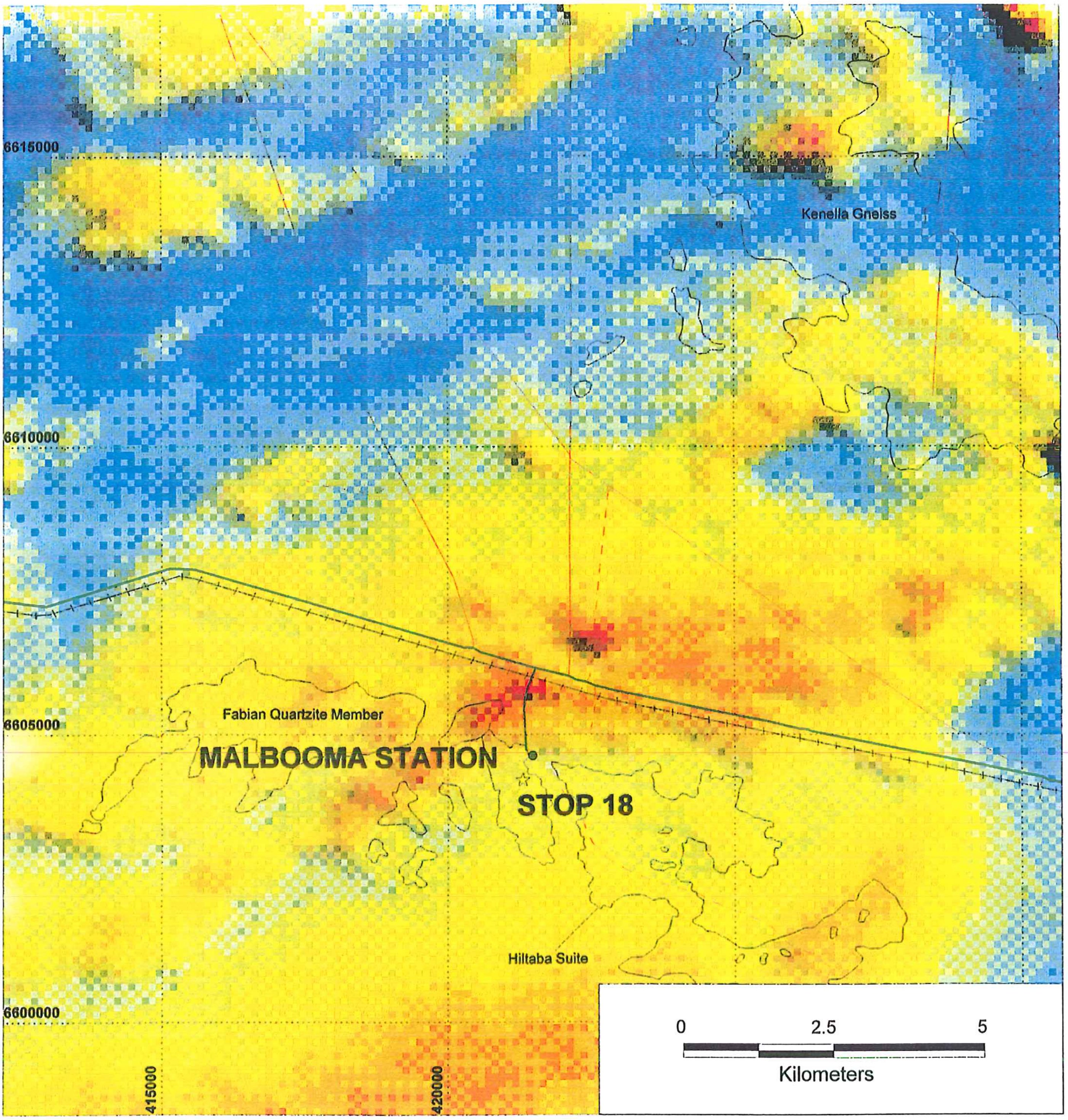
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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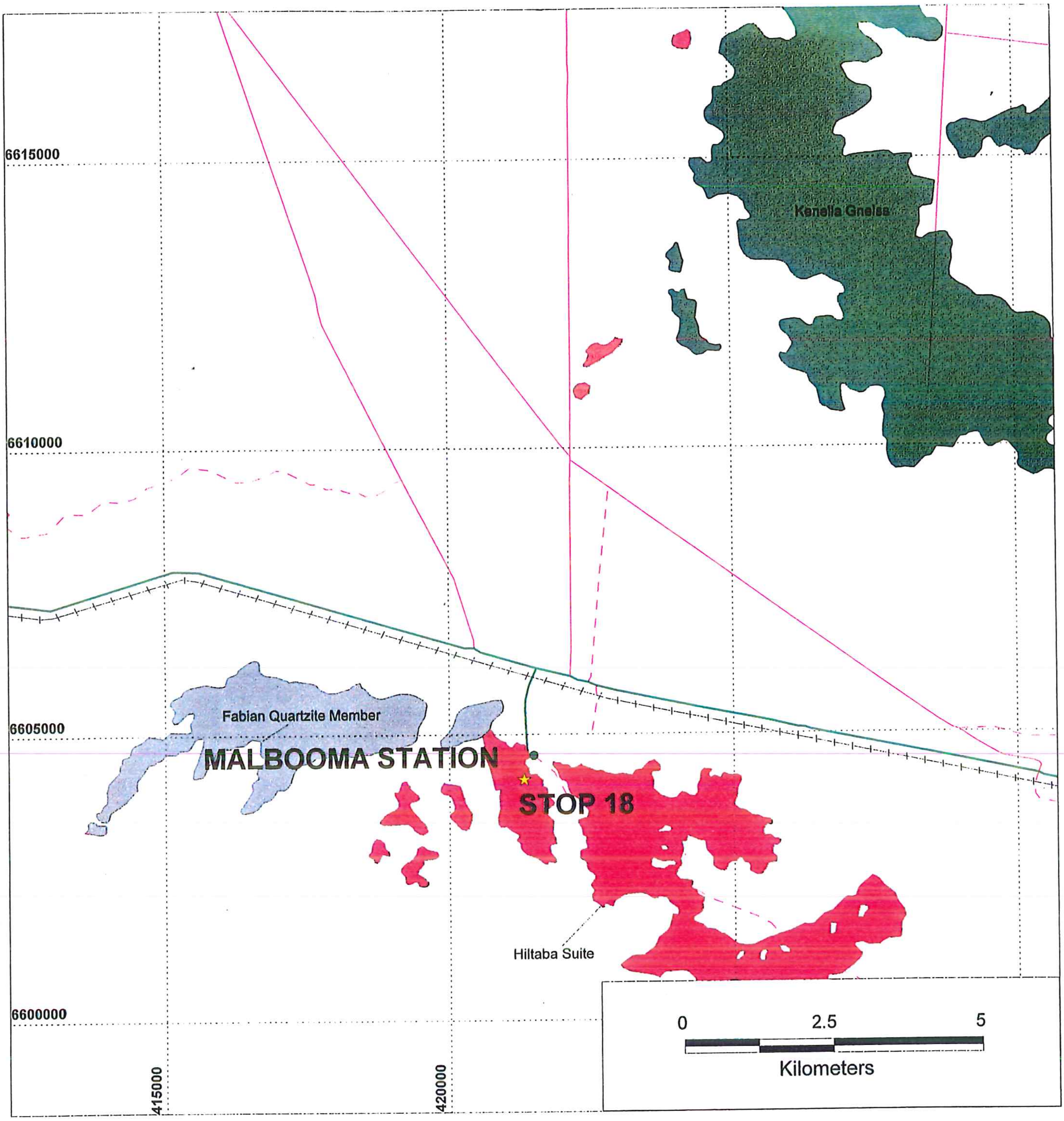

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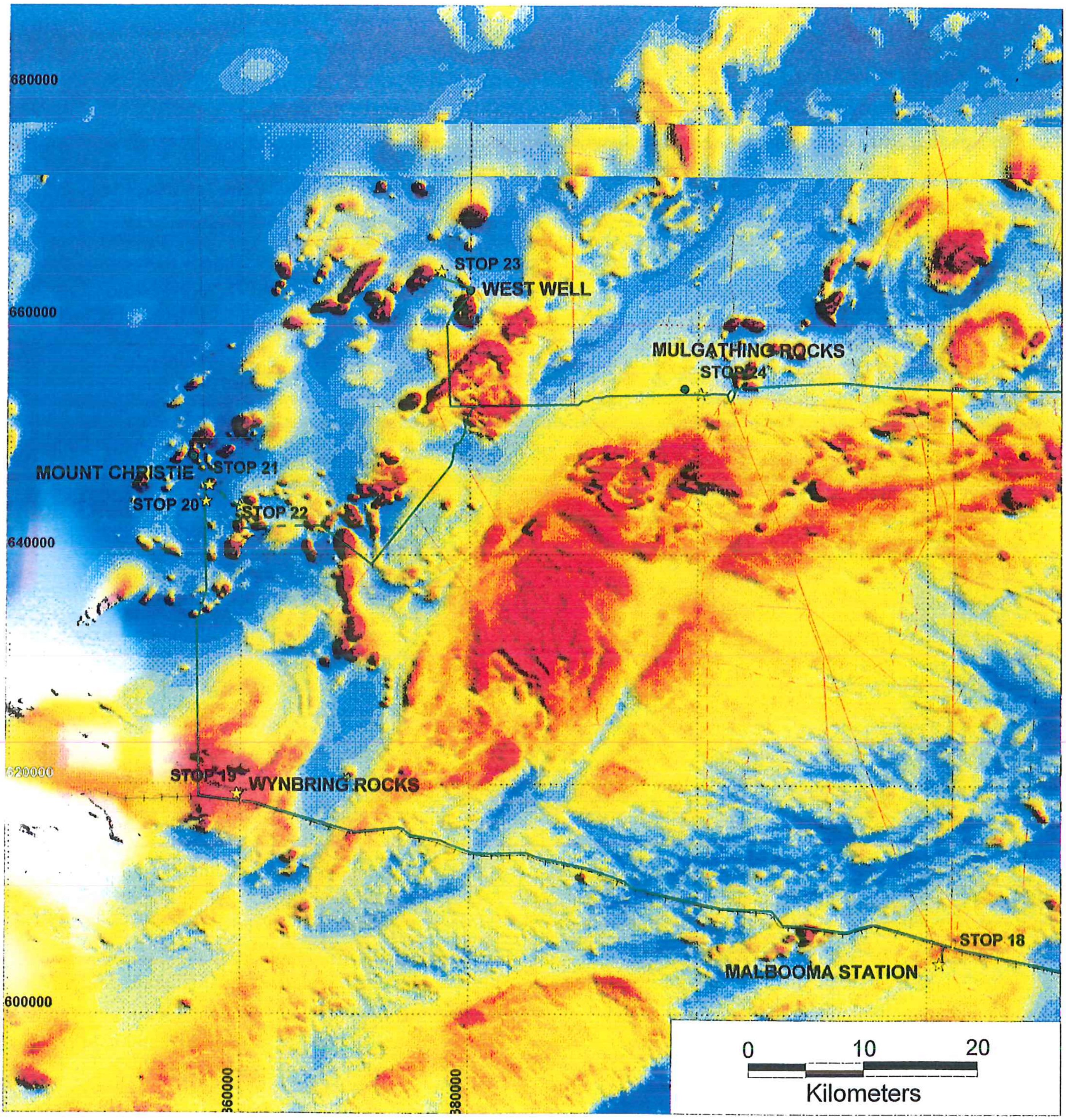
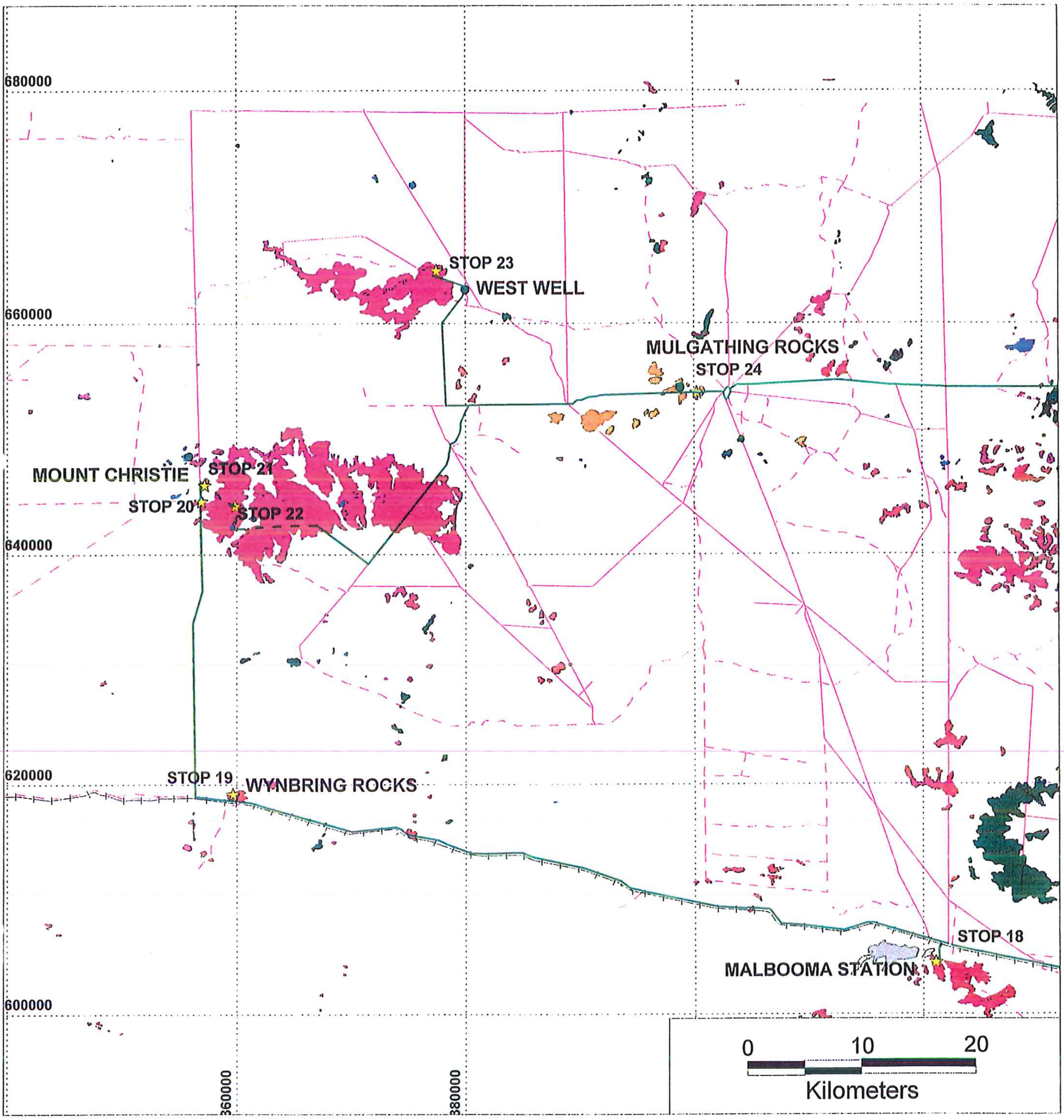
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



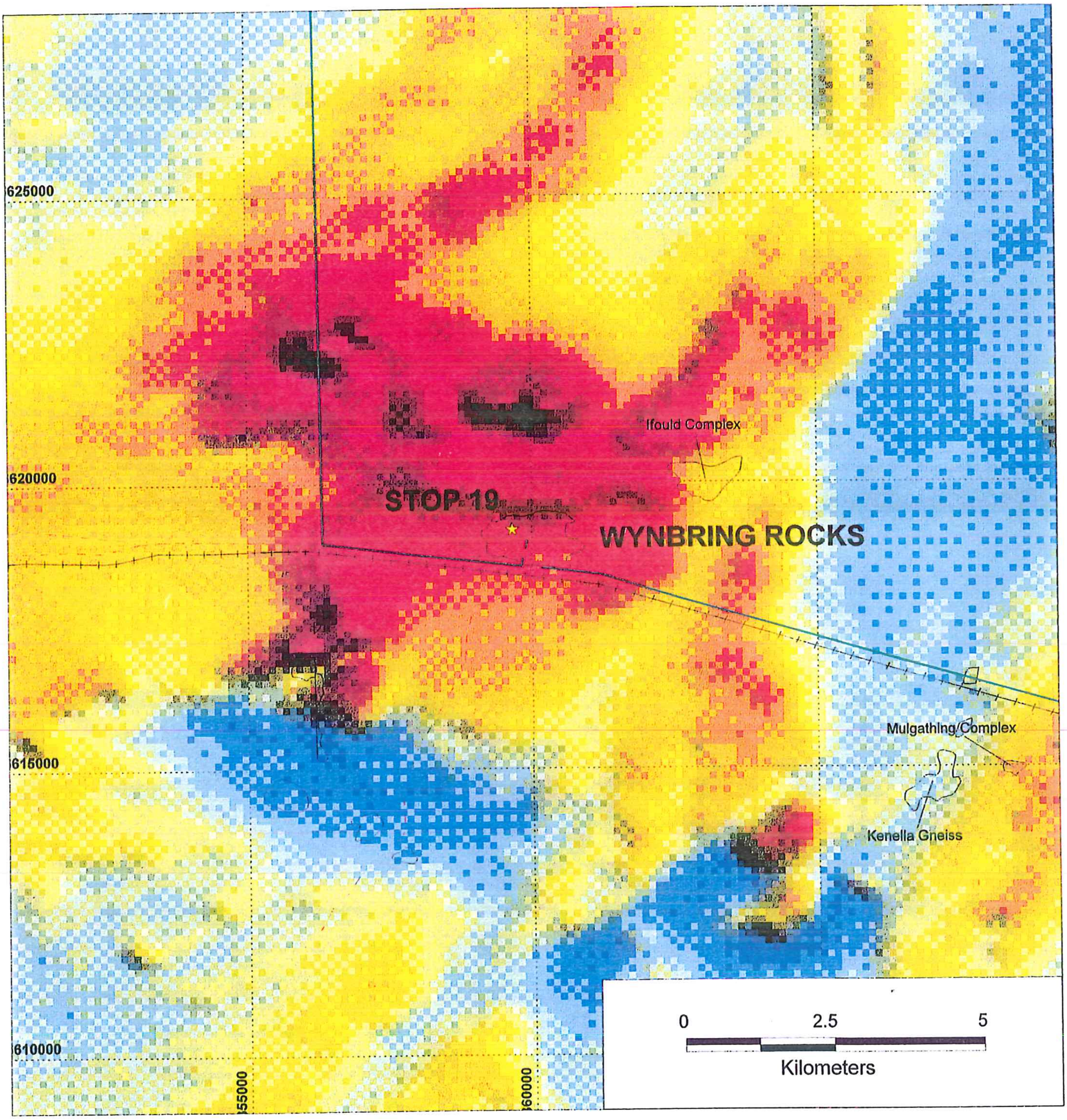
Day 5 (Scale 1:500 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



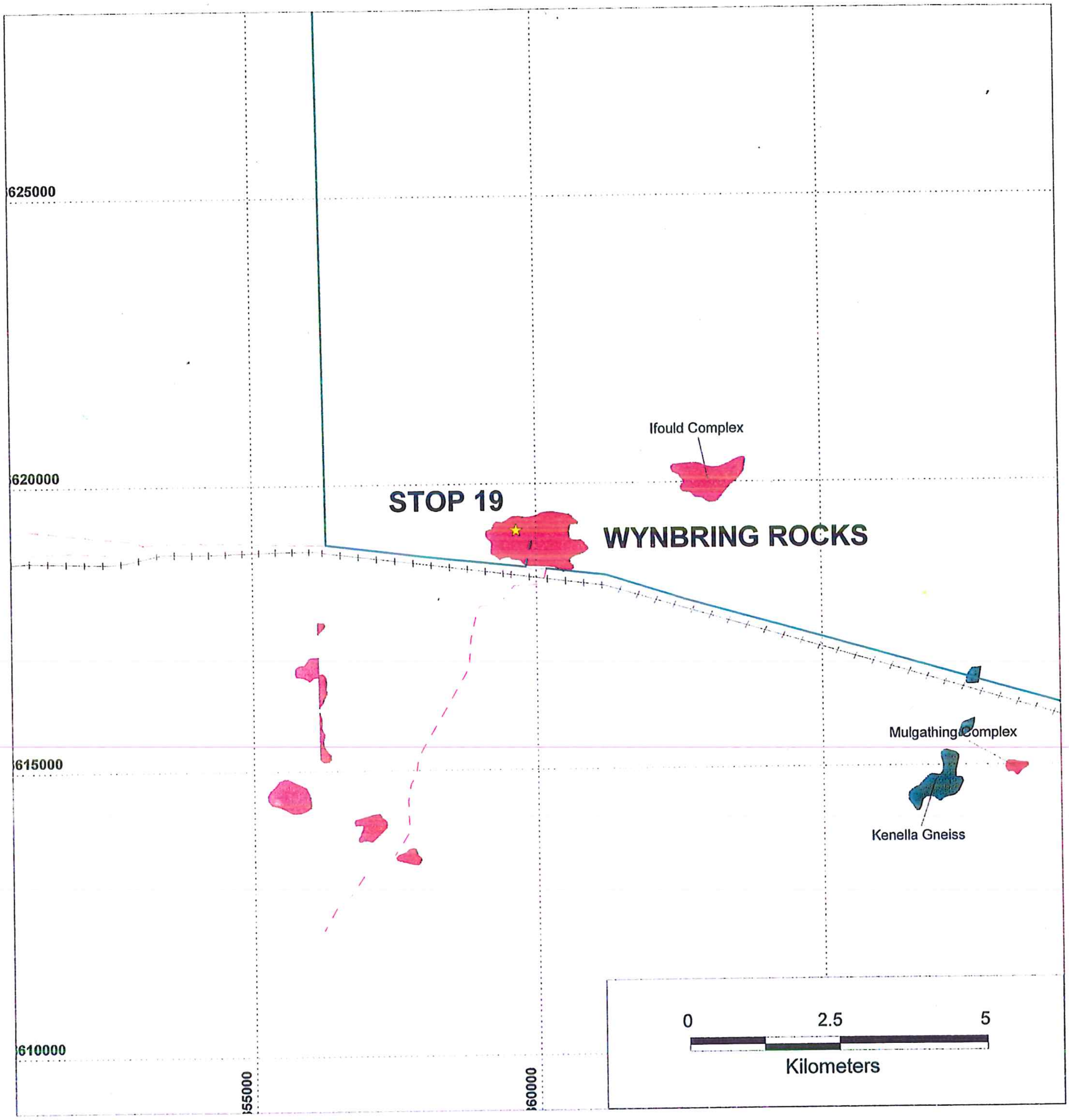
Day 5 (Scale 1:500 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOP 19 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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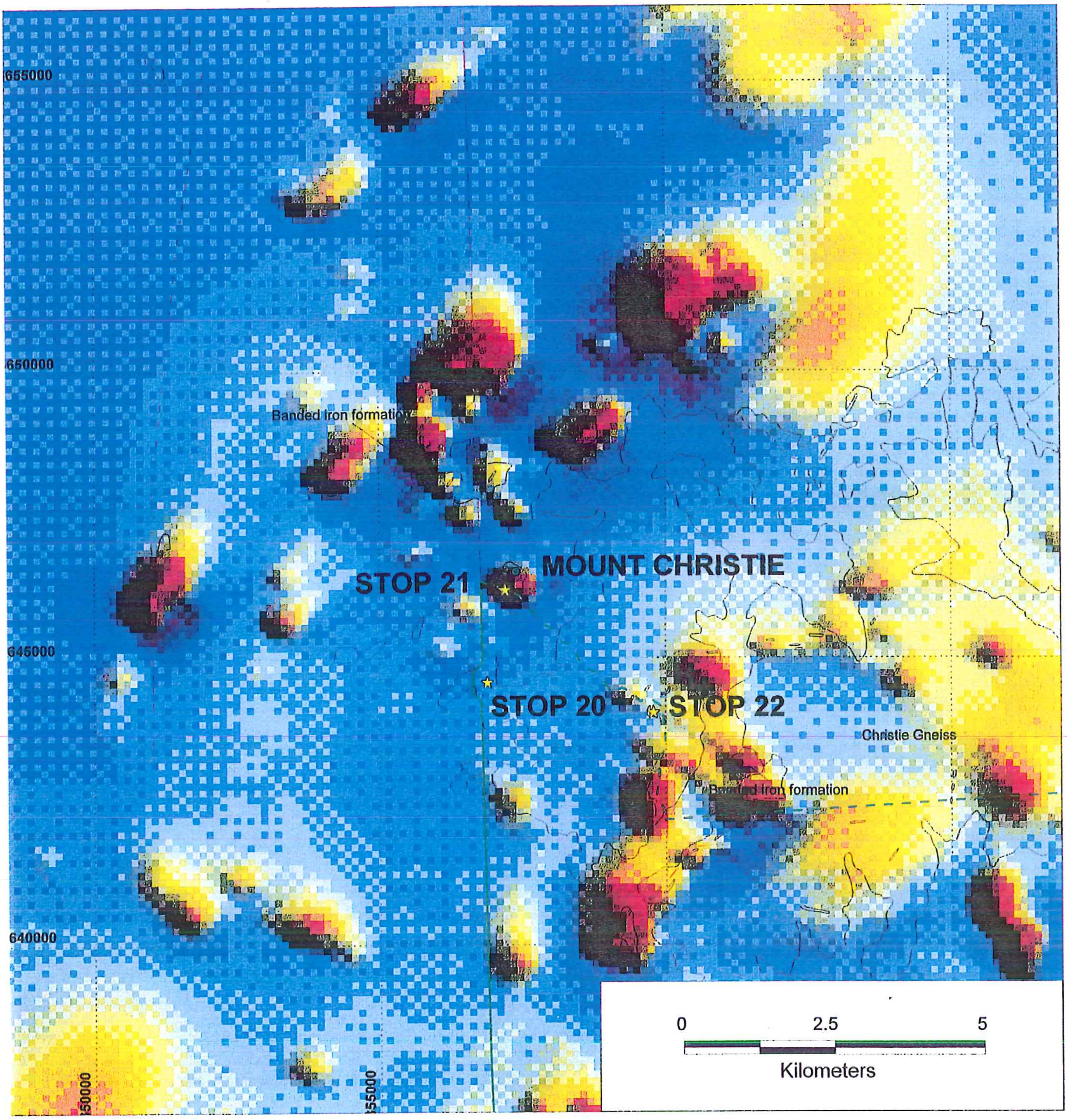
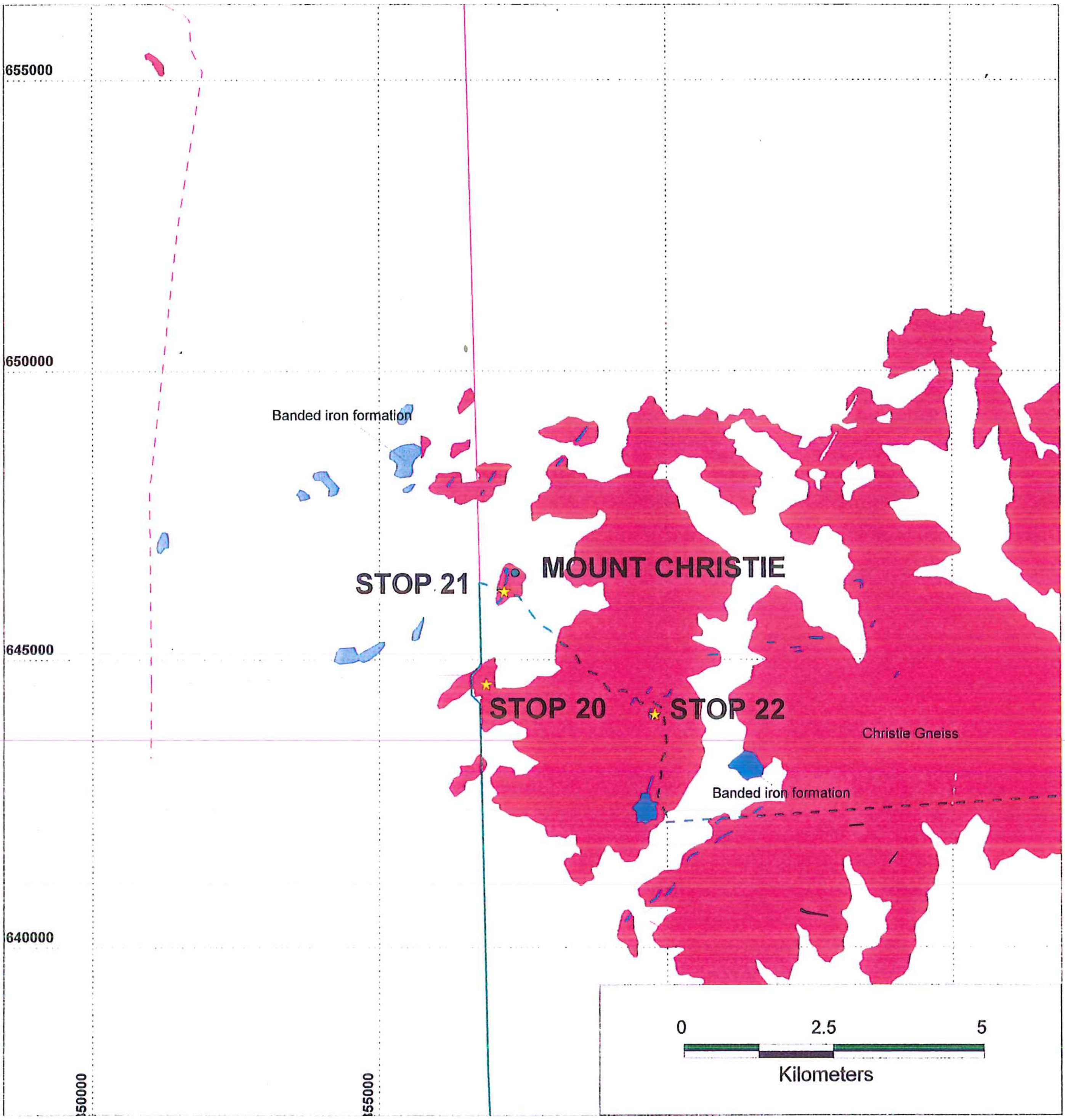
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



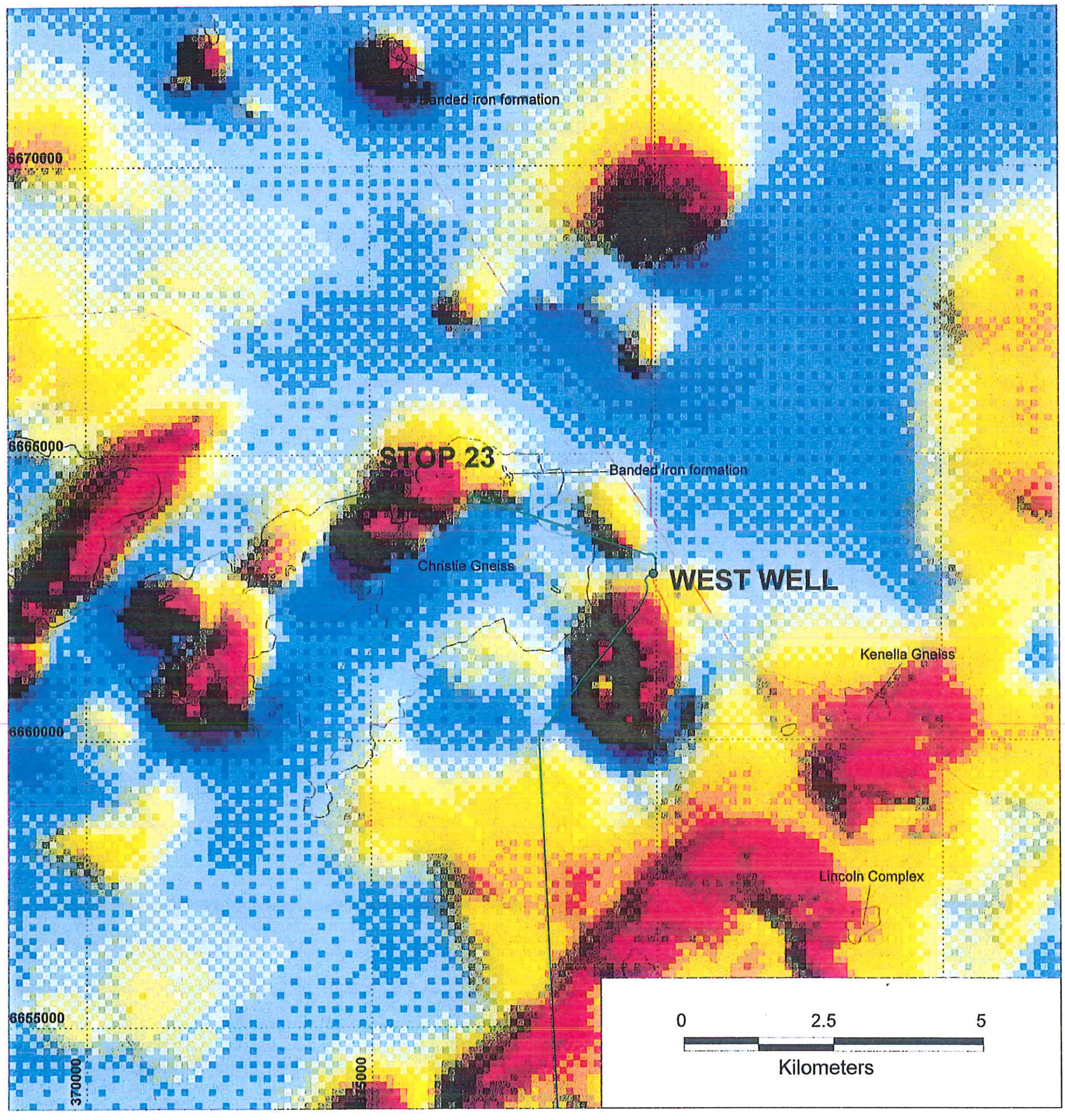
STOPS 20, 21 + 22 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



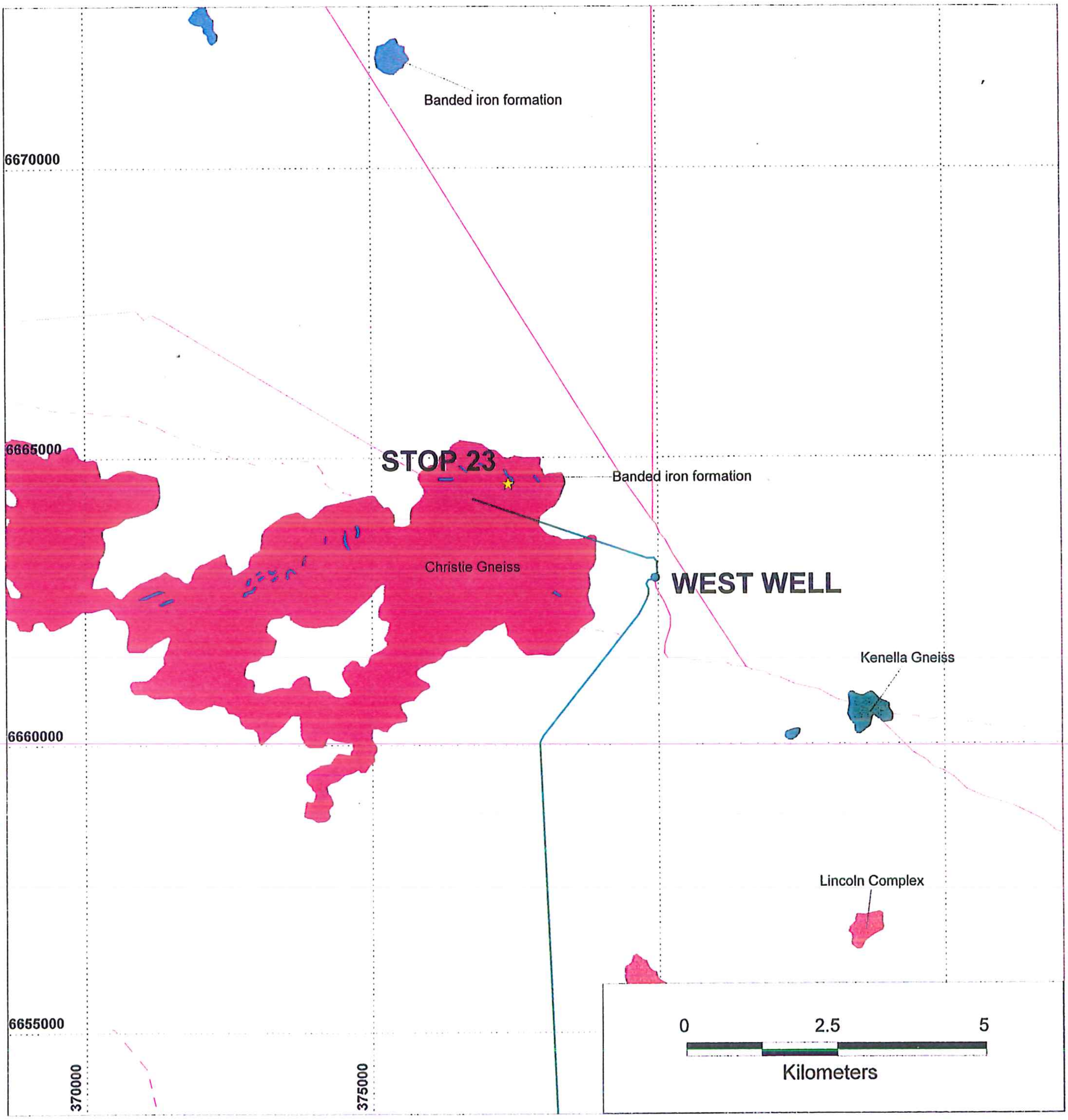
STOPS 20, 21 + 22 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



STOP 23 (Scale 1:100 000)

MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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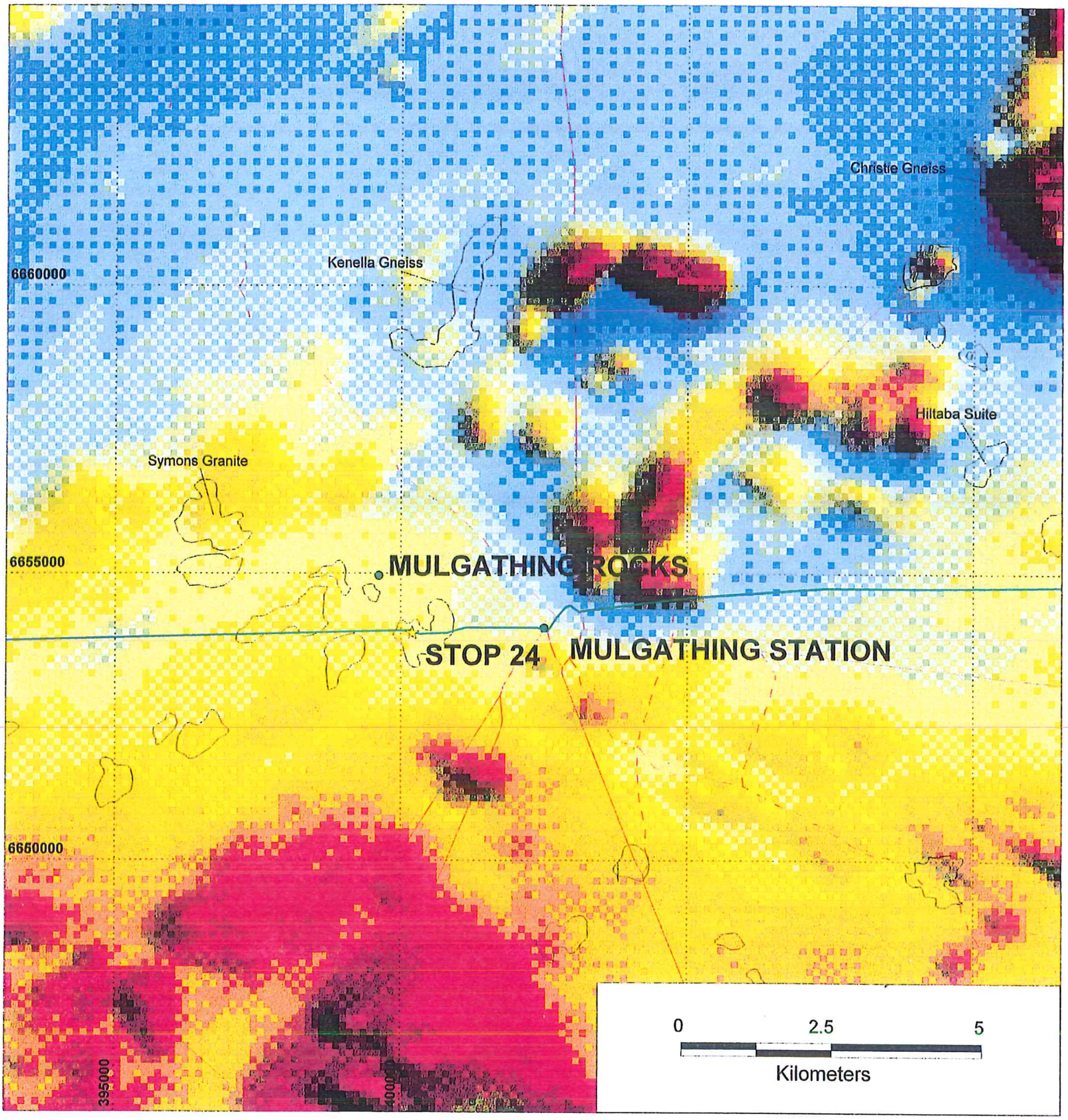
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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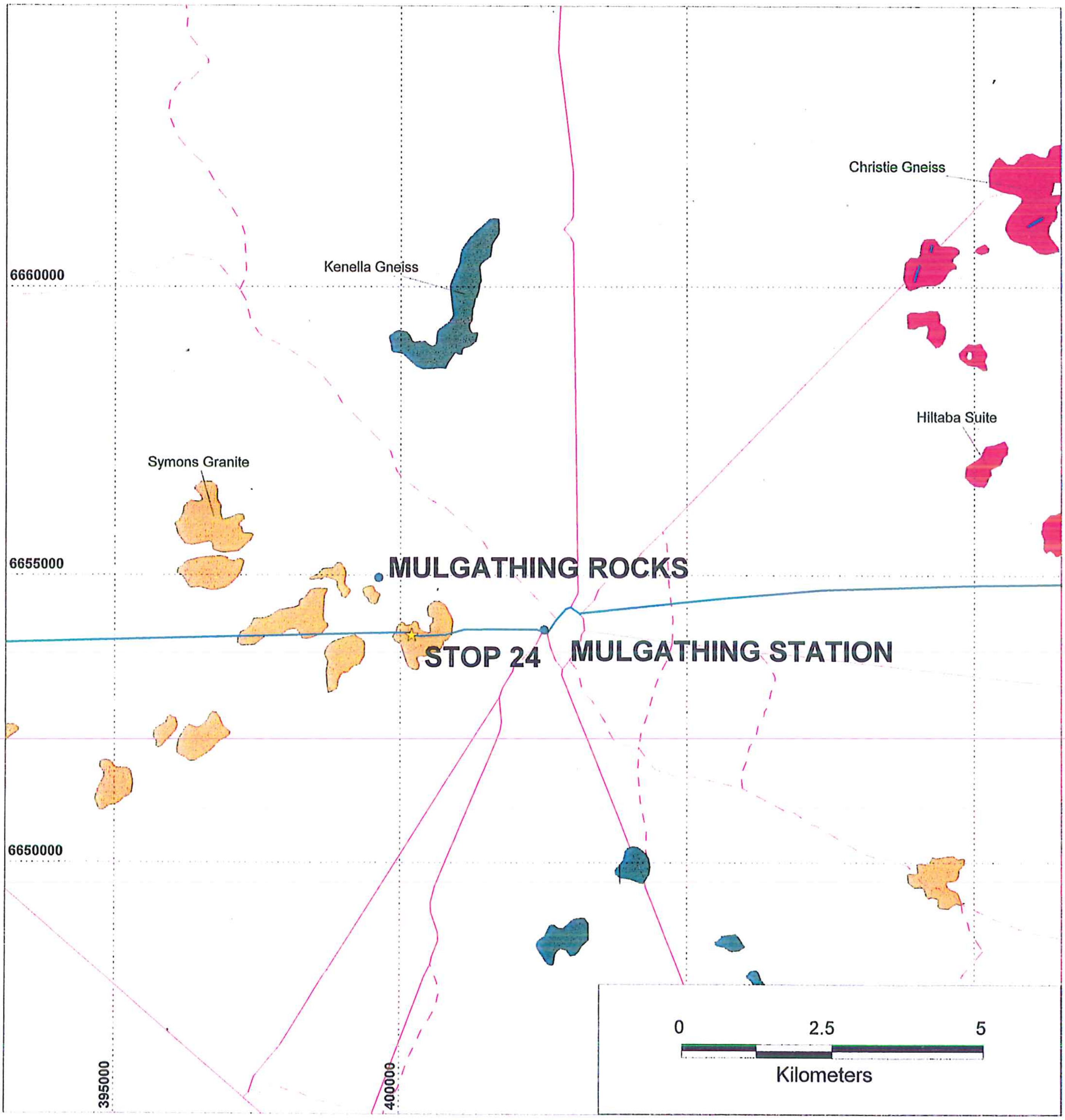
MINES and ENERGY RESOURCES SOUTH AUSTRALIA



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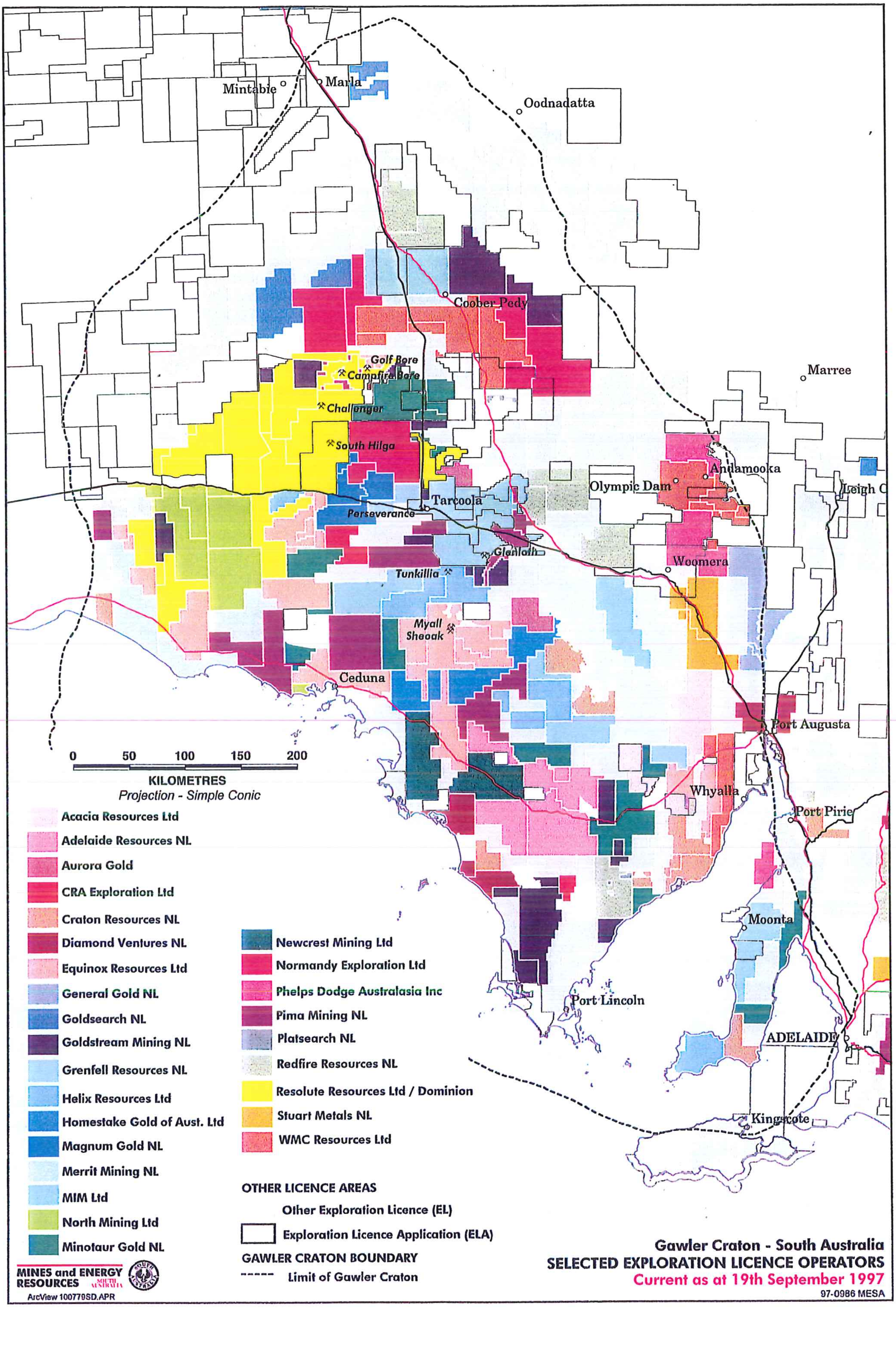
MINES and ENERGY RESOURCES SOUTH AUSTRALIA


Mintabie
Marla
Oodnadatta
Coober Pedy
Marree
Golf Bore
Campfire Bore
Challenger
South Hilga
Andamooka
Olympic Dam
Leigh C
Tarcoola
Perseverance
Glenloth
Tunkillia
Woomera
Myall Sheoak
Ceduna
Port Augusta
Whyalla
Port Pirie
Moonta
Port Lincoln
ADELAIDE
Kingscote
0 50 100 150 200
KILOMETRES
Projection - Simple Conic
Acacia Resources Ltd
Adelaide Resources NL
Aurora Gold
CRA Exploration Ltd
Craton Resources NL
Diamond Ventures NL
Equinox Resources Ltd
General Gold NL
Goldsearch NL
Goldstream Mining NL
Grenfell Resources NL
Helix Resources Ltd
Homestake Gold of Aust. Ltd
Magnum Gold NL
Merrit Mining NL
MIM Ltd
North Mining Ltd
Minotaur Gold NL
Newcrest Mining Ltd
Normandy Exploration Ltd
Phelps Dodge Australasia Inc
Pima Mining NL
Platsearch NL
Redfire Resources NL
Resolute Resources Ltd / Dominion
Stuart Metals NL
WMC Resources Ltd
OTHER LICENCE AREAS
Other Exploration Licence (EL)
Exploration Licence Application (ELA)
GAWLER CRATON BOUNDARY
Limit of Gawler Craton
MINES and ENERGY RESOURCES SOUTH AUSTRALIA
ArcView 100779SD.APR
Gawler Craton - South Australia
SELECTED EXPLORATION LICENCE OPERATORS
Current as at 19th September 1997
97-0986 MESA