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REPORTS ON

PHOTOGEOLOGICAL STUDIES

OF

EXPLORATION LICENCES

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BY

L.G. SMITH & COMPANY

PHOTO INTERPRETATION SPECIALISTS

PERTH W.A. 1983
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PHOTOGEOLICAL STUDY
OF
EXPLORATION LICENCE 1656
FOR
W.J. & E.E. FISHER
ON BEHALF OF
W. R. GRACE AUSTRALIA LTD.

PERTH. W.A. 1983

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SUMMARY

EL 1656 covers an area of approximately four hundred and eighty square kilometres in a reverse "L" shape extending from Adelaide River townsite to Luckie Hill on the Batchelor 1:100,000 map sheet.

The rocks consist of the Early Proterozoic South Alligator Group, represented by the Mount Bonnie Formation with a possible outcrop of the Gerowie Tuff, and the Finnis River Group, represented by the Burrell Creek Formation. These are variously covered by Cainozoic to Quaternary scree and Quaternary aluminium.

The rocks are folded into broad open folds and small upright to overturned folds with an unknown relationship. Both have northerly trending axes. Faults are long, northerly trending and their movement is generally east-side-up and usually north.

There are no recorded metal occurrences in the E.L. The photo interpretation has indicated one promising area and several areas which should be prospected.

The difficulty in distinguishing arkose from greywackes, and indeed of positively identifying some outcrops on the aerial photographs means that these maps and reports are provisional until confirmed by field checking.
CONCLUSIONS AND RECOMMENDATIONS

1. It appears that the northern part of E.L. 1656 consists of Burrell Creek Formation conglomerates and sandstones. This must be confirmed by field checking before any action is taken regarding title to the area.

2. There are plenty of quartz veins which should be sampled, particularly those along the large faults.

3. The most prospective area for gold, using photogeological criteria based on my 1982 work, is that just east of Ricebowl Waterhole. This should be inspected and sampled.
INTRODUCTION

E.L. 1656 lies on the Batchelor-Hayes Creek 1:100,000 Geological Map, which forms part of the Pine Creek 1:250,000 Map Sheet.

The E.L. has an area of one hundred and thirtyfive (135) square minutes and consists of a lower block, approximately twentyfive (25) kilometres east-west by twelve and a half (12½) kilometres north-south and an adjoining block on the northern side of its eastern portion, which is nine (9) kilometres east-west by fifteen (15) kilometres north-south. It extends approximately from Adelaide River townsite in its lower south western corner to just north of Luckie Hill, but does not include the Upper Adelaide River Experimental Station.

Some parts of the E.L. are well served by roads and tracks, but others would appear to have difficult ground access.

E.L. 1656 is covered by the photogeological study of parts of the Batchelor and Reynolds River 1:100,000 map sheets in the Adelaide River region, which was carried out in 1983 by L.G. Smith & Co.

Aerial photographs used in the study were the CAG 1:25,000 colour series flown in 1973. The photographs relevant to this E.L. are all Batchelor Sheet photos, listed below:

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The photogeological study produced fifteen map sheets at photo scale and of these, maps 3, 5, 6 and 7 contain E.L. 1656.

This E.L. has not received any ground inspection by the writer, and the photogeological interpretation is therefore subject to change.
METHOD

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces, giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where their information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources".

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
COMMENTS ON PHOTOINTERPRETATION

There are problems in distinguishing some of the rock types on the aerial photos. In particular, greywackes and arkoses seem to be identical and hence many outcrops carry an "either-or" label on the maps, e.g., Bfb.g or Eso.a", representing Burrell Creek greywackes or Mount Bonnie arkoses. Field inspection is needed to resolve this.

Pale-coloured outcrops in the northers area have been interpreted as quartz sandstones and conglomerates, belonging to the Burrell Creek Formation and labelled "E.fb.c.ss". In some cases, low-lying indistinct outcrops could not be assigned to any unit, as they may be shales of either formation, arkose or accumulations of scree, labelled "Bfb.s, Eso.s.a. or Czs" respectively.

Where a symbol is bracketed, e.g. "Eso.s(a)", the outcrop is thought to consist of shale with minor arkose, assigned to the Mount Bonnie (Eso) Formation.

Where shales and tuffs appear to be present, they are designated "Eso.s.t.", and quartz veins are represented as isolated "q" symbols.

Any outcrop labelled "Eso.s" could equally well be labelled "Bfb.s" as the shales of each Formation are identical. In some cases the shales are labelled with an isolated "s".

The presence of strong banding has been interpreted to indicate banded iron formations, (hence a "b" label), but may simply represent strongly banded shales or interbanded shales and either arkoses, greywackes or sandstones. Again, field inspection would resolve this.
PHYSIOGRAPHY

The E.L. comprises isolated individual hills and sets of hills with random orientation, sometimes surrounded by scree and subcrop, in extensive alluvial plains.

Howley Creek, a large tributary of the Margaret River, runs northerly then north-easterly through the eastern part of the E.L., and the Adelaide River runs north-easterly from the south-western corner to the centre of the northern edge of the E.L.
STRATIGRAPHY

The rocks in E.L. 1656 consist of the Early Proterozoic South Alligator Group and Finnis River Group flanked by scree and subcrop labelled Czs, all within alluvial plains Qa. The South Alligator Group comprises Koolpin Formation Bsk, Gerowie Tuff Bsg and is topped by the transitional Mount Bonnie Formation Bso. The Finnis River Group comprises only Burrell Creek Formation, Efd.

In E.L. 1656 the Koolpin Formation does not appear to be present, so the oldest rocks belong to the Gerowie Tuff. This Formation only occurs in the central part of the G.L., just north of Whitestone Creek and east of Pell Landing Ground on map number six and photo number 4/1200 (it is possible that this outcrop has been misidentified and it may be a pale-coloured unit of the Burrell Creek Formation. This would fit in much better with the overall rock distribution pattern). The remaining Proterozoic rocks in the E.L. are divided between the transitional Mount Bonnie Formation and the overlying Burrell Creek Formation, with the latter occupying the northern block and the northern and western edges of the southern block.

The Mount Bonnie Formation is dominated by arkose, tuffaceous shale and shales, with minor tuff, greywacke (both feldspathic and calcareous) banded iron formation and rare conglomerate bands.

The Burrell Creek Formation is dominated by greywacke, usually massive feldspathic lithic greywacke, but also calcareous "tombstone" greywacke, and shale which may be identical with some of the shales of the Mount Bonnie Formation. Minor components of the Burrell Creek Formation include siltstone, slate, quartz pebble conglomerate and rare dacite pebble to boulder conglomerate.

The contact between these two Formations is transitional and gradational. The uppermost boundary of the Mount Bonnie Formation is taken as being the last appearance of volcanic components, i.e., tuff or arkose, as the Mount Bonnie Formation is characteristically tuffaceous. Obviously then, there can be no distinct photogeological boundary between these Formations. A further complication lies in
the fact that some of the arkoses and some of the greywacke are photogeologically almost identical, and the writer has done insufficient field mapping in the Pine Creek Geosyncline to be able to differentiate these two rock types from these aerial photographs. In many cases on the maps, the rocks have an either-or label, which can be quickly resolved by ground checking. The writer suspects that most of these "Bfb.g or Bso.a" rocks are in fact greywackes of the Burrell Creek Formation.
STRUCTURE

A Folding

At least two stages of folding can be discerned on the photo-geological maps.

a) The stratigraphic distribution of the rocks suggests that there is a set of broad open folds with northerly trending axes, provided, of course, that the photogeological identification of Formations is correct.

The outcrop which is interpreted to be Gerowie Tuff, east of Pell Landing Ground, must occupy an anticlinal structure (if the interpretation is correct). The rocks around Smokey Creek, south of Pell Landing Ground, are interpreted as Burrell Creek Formation and must therefore occupy a syncline. Further east, if the Burrell Creek Formation does extend south to Mount Kepller, then another syncline must exist here, and east of the E.L. boundary, an anticline is interpreted at John's Hill.

If the identification of the Formations is correct, and if, in fact, the lower boundary of the Burrell Creek Formation runs north easterly from Adelaide River townsite and passes between Wild Horse Hill and John's Hill, then the evidence for the northerly-trending broad open folds disappears and the rock distributions may be explained by north easterly-trending folds or faults - not very likely.

b) Numerous small folds can be seen on the aerial photographs. Due to the steep dips in this area, it is impossible to decide, on the photos, whether the folds are anticlines or synclines. An estimate of dip direction has been made in most cases and a fold axis drawn, but the only reliable part of the symbol, $\sigma$ or $\phi$, is the direction of the fold axis. It is quite likely that the dip directions guessed from the photos, are the reverse of those mapped on the ground, and field checking must be done to clarify this. Most of the fold axes have a northerly strike direction,
but west of Ricebowl Waterhole the axes strike northeasterly. Some of the northerly trending axes in this area may be overturned.

Between Mount Carr and Ricebowl Waterhole is an outcrop showing well developed bedding contrasts which is very tightly folded along northerly axes, the half-wavelength of the folds appearing to be about one hundred metres, at most. It is quite likely that this tight folding is very widespread but cannot be recognized on the photos or outcrops of poor bedding contrast.
B. Faulting

The longest faults in the E.L. are northerly trending. Some have a transcurrent east-side-north movement of about a kilometre, but others have no discernible transcurrent movement, mainly due to lack of marker beds.

The faults are recognized as structural discontinuities and may be normal vertical or thrust faults.

The most distinctive of these long faults is the Mount Shoobridge fault, which extends for about forty kilometres. It is represented by quartz veins along most of its length, and usually marks a distinct stratigraphic discontinuity. It is affected by small transcurrent faults. It appears to throw the east side up.

There are three long faults, almost parallel to the Mount Shoobridge fault, to the west of Mount Foelsche. The movement on the easternmost of these is indiscernible, the middle ore is west-side-north and the western one is east-side-north.

There may well be a long fault along the course of the Adelaide River, as this seems to mark a stratigraphic discontinuity. The movement on this may be south eastern-side-north east.

The apparent east-side-north-and-up movement on most of these faults may reinforce the appearance of broad folds, described earlier, and certainly reflects the influence of the intrusion of the younger Burnside and Margaret Granites to the south east of the E.L.

Since the rocks generally appear to be younging to the north and west across the E.L., the appearance of the much older Rum Jungle and Waterhouse Complexes to the northwest of the E.L. must be caused by anticlinal folding, up-faulting and possible reactivation of these complexes.
1. There are no old gold mines recorded on the published geological map within the boundaries of EL 1656.

2. Possibilities for gold occurrences lie within the quartz veins, especially those along major faults such as the Mount Shoobridge Fault.

3. Gold may occur as detrital minerals within the sandstones and conglomerates of the Burrell Creek Formation, but would probably not be sufficiently concentrated to form an economic deposit.

4. Areas worthy of being prospected were selected from the aerial photos on the basis of the presence of either (a) distinguishable quartz veins or (b) alteration zones or (c) folding within appropriate stratigraphy.

The best of these is an area east of Ricebowl Waterhole running southwards to Mount Tymn, which shows appropriate stratigraphy.

The best of these is an area east of Ricebowl Waterhole running southwards to Mount Tymn, which shows appropriate folding and appears to be an alteration zone. This is on the western half of photo number 7/1494 and is on map sheet six.

On photo number 6/1440, on the western half, is an area showing folding, but the stratigraphy may not be appropriate. This is on map sheet six.

On the eastern half of photo number 6/1434 the rocks appear to be tuffaceous and may be altered, but definite folding cannot be seen. This straddles map sheets six and seven.

Both of these areas are worth inspecting, but they may not contain bonanzas.

On the southern part of photo 4/1204 is a large linear pale area which may be either a quartz vein, within arkose, or
conglomerate within shale. The structure is indeterminate and the stratigraphy uncertain, but it is worth inspecting "just in case". This is in the northwestern corner of map sheet seven.

On the northern part of photo 3/1281, near Wild Horse Hill on map three, is a folded pale coloured area. Although it is probably comprised of sandstone and conglomerate of the Burrell Creek Formation, it is worth inspecting in case it is quartz veins in arkose. Wild Horse Hill itself, on photo 3/1282, has exactly the same circumstances. Similar circumstances also apply to an area north of Wild Horse Hill, on photo 2/1158 on map sheet three.

In summary then, the only positively good area in EL 1656, identified from the aerial photos, is that from near Ricebowl Waterhole south to Mount Tymn. There are other areas which should be inspected and sampled, in case of photogeological error, but they all have second priority.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE 2473

FOR

W. J. & E. E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH W.A. 1983

[Signature]
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SUMMARY

EL 2473 now contains mainly early Proterozoic rocks, as the plateau capped with Cretaceous rocks has been excised. The stratigraphy of the early Proterozoic rocks is confused, as the Burrell Creek Formation arkoses and shales and Mount Bonnie Formation greywackes and shales are very photogeologically similar in this area.

Sandstones and conglomerates in the EL are ascribed to the Burrell Creek Formation. The rocks appear to be part of a limb of an anticlinorium and have tight local folds. Both long and short local faults are present.

A zone of well folded rocks showing numerous quartz veins appears to be stratigraphically different from its surroundings and may be a horst or inlier of Mount Bonnie Formation within Burrell Creek Formation. This zone extends from east of Ricebowl Waterhole in the north to south-west of Mount Darwent in the south and shows the right photogeological criteria for gold deposits. It should be extensively prospected.

RECOMMENDATIONS

The zone of faulted, and folded rocks with numerous quartz veins, which runs from east of Ricebowl Waterhole southwards through Mount Tymn to southwest of Mount Darwent, should be thoroughly investigated.
INTRODUCTION

EL 2473 is an oblong shaped block, southeast of Adelaide River townsitie, and is crossed by the old and new Stuart Highways and the North Australia Railway. Landmarks include Mt Tymn and Mt Darwent. The EL before reduct- ion, had an area of seventy four square minutes i.e. about two hundred and fifty square kilometres, being approximately nine kilometres wide by twenty eight kilometres long. A block of four square kilometres is excised from the EL west of Mount Tymn. The southern half of the EL has been dropped since 17 October 1982.

EL 2473 is covered by the photogeological study carried out in 1983 by L.G. Smith & Co. over parts of the Batchelor and Reynolds River 1:100,000 map sheets (both being part of the Pine Creek 1:250,000 map sheet). The study resulted in fifteen maps being produced at photo scale and of these, maps ten and fourteen cover EL 2473. Photos used in the study were the CAG 1:25,000 colour series flown in 1973, and those covering this EL are:

- Batchelor Run 7 Numbers 1492 - 1495
- Batchelor Run 8 Numbers 1565 - 1570
- Batchelor Run 9 Numbers 1626 - 1630
- Batchelor Run 10 Numbers 1710 - 1712
- Batchelor Run 11 Numbers 2642 - 2644

The part of the EL which has been dropped is covered by the following photos:

- Batchelor Run 10 Number 1713
- Batchelor Run 11 Numbers 2640 - 2642
- Batchelor Run 12 Numbers 2526 - 2530
- Batchelor Run 13 Numbers 2489 - 2493

The small block which is excised lies on photos Batchelor Run 8, numbers 1567 and 1568.
METHOD

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on EL's 2362 and 2361 in 1982. The published geological map was also used as a reference and where the information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY

The EL contains part of the broad flood plain of Burrell Creek along most of its western margin. The plain, which has an average elevation of sixty metres, terminates in the southern one-third of the EL, in well dissected hills rising sharply to a plateau at an elevation of about two hundred and fifty metres. The plateau occupies most of the southern quarter of the EL. The remainder of the area consists of low hills with a north–northwesterly linearity. Mount Darwent, in the central eastern part, rises to one hundred and seventy six metres from a plain at an average elevation of sixty metres.

STRATIGRAPHY

The early Proterozoic stratigraphy of the area is confused. I suspect that both Mount Bonnie Formation (Bso) and Burrell Reek Formation (Bfb) rocks are present, but it is impossible to distinguish them photo-geologically in this area without ground inspection. These rocks in the southern part of the EL seem to have affinities with the Burrell Creek Formation and are labelled Bfb.g., and in the northeastern part of the EL some odd looking outcrops are interpreted to be sandstones and conglomerates of the Burrell Creek Formation, (Bfb.ss or Bfb.c.) (by correlation with the published map). In the remaining areas, the rocks have an "either/or" symbol. The plateau in the southern part of the EL is capped with Cretaceous sandy rocks of the Petrel Formation, Kp. (There are no Tolner Group rocks outcropping in this EL.) The surface of the plateau is flat, and appears to have been indurated and probably lateritised. Plains and low hills of consolidated sand and probable laterite occur in the southwestern corner of the EL, where a road leaves the old Stuart Highway and runs west to Daly River. These are labelled "Czs" and "Czl" respectively.

The alluvium between all the hills and in the floodplain of Burrell Creek is labelled "Ca" as it all has the same appearance.
The exception of all this is Mount Darwent, which has photogeological affinities with Mount Paqualin, and is also not dissimilar to the Stray Creek sandstone band on EL 2475. Now, Mount Paqualin is composed of Koolpin Formation (probably shale and siltstone) which appears to have been mapped on the ground. Mount Darwent, on the published map, is ascribed to Burrell Creek Formation greywacke, but only has a photogeological symbol. This hill should be mapped, as I doubt if it is Burrell Creek Formation. I have labelled it "Bfb or Bts", just to draw attention to it. The whole band of rocks running north - northwest from Mount Darwent through Mount Tymn differs from their surroundings and may not be Burrell Creek Formation.

**STRUCTURE**

A. **Folding**

There are numerous tight folds with north - northwesterly trending axes within the early Proterozoic rocks. Although no larger fold can be seen, the rock distribution on adjoining map sheets indicates that this EL may cover the limb of a very large fold, going from synclinal to the west of the EL to anticlinal in the east.

The overlying rocks appear to be gently dipping layers.

B. **Faulting**

The major faults crossing EL 2473 trend northwesterly in the southern part of the EL and northeasterly in the northern part, nearly all with west-side-north movement. As some members of each set terminate some members of the other set, where the two lots meet in the centre of the EL, it appears that the two sets of faults may be contemporaneous and may be a conjugate system, or be caused by the same sub-surface disturbance.

An unrelated fault, offset by a northeasterly trending fault, is a curved, southeast to east trending fault with a north-side-east movement. The movement is small and this fault does not appear to have very much effect on the rocks.
The zone of rocks running from Mount Darwent to beyond Mount Tymn is bounded by strike-slip north–northwesterly faults and may prove to be a horst (or graben) once the stratigraphy is sorted out. Certainly these rocks differ from the surrounding ones. The line of the western-most of these faults is marked by quartz veins.

Other strong developments of quartz veins may also reflect local fault lines.

Some linear white areas, which look like quartz veins but are in host rocks interpreted to be sandstones or conglomerates, (Bfd.c. or Btb.ss) may simply represent strike ridges within these pale coloured rocks.

METAL OCCURRENCES

The published map records two old gold mines at Mount Tymn.

The right photogeological criteria for gold mineralization are to be found in an almost north–south zone extending from Mount Tymn on map ten northwards to near Ricebown Waterhole on map six, and southwards across the Stuart Highway to an area southwest of Mount Darwent on map fourteen. This zone contains numerous quartz veins, is faulted and folded, and may represent a horst or inlier of Mount Bonnie Formation rocks within the Burrell Creek Formation. The zone is flanked east and west by rocks interpreted to be sandstone, shales and conglomerates of Burrell Creek Formation. Photos covering the zone are 7/1494, 8/1567, 9/1628, 10/1711 and 11/2642. This whole zone is worth prospecting, particularly the central part of it around Mount Tymn.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE 2474

FOR

W.J. & E.E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH, W.A. 1983
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SUMMARY:

EL 2474 is irregularly shaped and lies south of Adelaide River townsite, between Burrell Creek and the valley of the Adelaide River.

It covers rocks of the Finiss River Group, Tolmer Group, Daly River Group and Petrel Formation, together with sand, laterite and alluvium. The rocks of the Finiss River Group are relatively tightly folded and are steeply dipping, whereas the remaining rocks lie in variously gently dipping flat sheets. The usual dip direction is westwards.

Some long northerly to north-easterly faults, both obvious and inferred, cross the EL and the usual direction of movement is west-side-north. One north-westerly fault throws its south-westerly side down bringing upper Tolmer Group rocks and Daly River Group rocks down to the present outcrop level.

No obvious areas of gold mineralization can be seen on the photos. The only possibilities for gold would be in the isolated quartz veins or associated with one or more of the unconformities.
CONCLUSIONS:

The only possibilities for gold mineralization appear to be the unconformities, either for fossil placer deposits or as traps for rising hydrothermal fluids.

There are some isolated quartz veins in the central part of the eastern edge of the EL.

No prospective photogeological structure was seen within this EL.
RECOMMENDATIONS:

1. A stream sediment sampling program on the streams draining the unconformities would establish the presence or absence of gold associated with the unconformities.

2. Sample the quartz veins (most of which appear to be accessible from the old Stuart Highway).
INTRODUCTION:

EL 2474 occupies an area of forty-five square minutes in the vicinity of Robin Falls, south of Adelaide River townsite. The old Stuart Highway runs through the eastern edge, and the Adelaide River runs through the south-western corner of the main block of the EL. The northern edge of the main block is approximately twelve kilometres south of Adelaide River townsite. The main block of EL 2474 is approximately nine kilometres wide by eleven kilometres long. On the eastern end of the northern side and running northwards is a smaller block two kilometres wide and eleven kilometres long, and on the eastern half of the southern side is a block five kilometres square.

The EL lies on the Batchelor-Hayes Creek 1:100,000 map sheet which is part of the Pine Creek 1:250,000 map sheet. It is covered by the photogeological study of the Adelaide River region carried in 1983 by L.G. Smith & Co. Aerial photographs used in the study were the CAG 1:25,000 colour series flown in 1973. The photographs relevant to this EL are:

Batchelor Run 7  Numbers 1491 - 1492
Batchelor Run 8  Number 1570
Batchelor Run 9  Number 1625
Batchelor Run 10  Numbers 1714 - 1716
Reynolds River Run 10E  Number 1717
Batchelor Run 11  Numbers 2637 - 2640
Reynolds River Run 11E  Number 2636
Batchelor Run 12  Numbers 2530 - 2535
Batchelor Run 13  Numbers 2486 - 2488

The photogeological study produced fifteen maps at photo scale and of these, EL 2474 occupies parts of maps nine, ten, thirteen and fourteen.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where the information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY:

The north-eastern block of EL 2474 contains the alluvial plain of Burrell Creek, with a few isolated low hills of shale.

The eastern side of the main block of EL 2474 contains the southern end of this alluvial plain and the headwaters of Burrell Creek. The remainder of the EL contains an extensive high plateau, at an average elevation of two hundred and forty metres, which drops away steeply on all sides to valleys at about eighty metres elevation. The two south-western corners contain the headwaters of the Adelaide River (main branch) and all of the short streams on the western side of the plateau are tributaries of the Adelaide River.
STRATIGRAPHY:

The oldest rock units in the EL appear to be the early Proterozoic Burrell Creek Formation rocks of the Finiss River Group. (It is possible that some of the shaley hills are inliers of the underlying transitional Mount Bonnie Formation of the South Alligator Group.)

Unconformably overlying these rocks and forming the bulk of the plateau are rocks of the late Proterozoic Tolmer Group. The lowermost member, the Depot Creek Sandstone, forms much of the northern, eastern and southern parts of the plateau. The western edge is composed of the overlying Stray Creek Sandstone. The alluvium in the plain containing the Adelaide River, on the western margin of the EL, probably covers Hinde Creek Dolomite which is the next unit up in the Tolmer Group.

The plain in the far south-western corner of the EL contains areas of markedly different rocks. These have been assigned to the unconformably overlying Daly River Group, which is lower Palaeozoic. By comparison with the published map, these rocks are assigned to the Tindall Limestone €mt and to the overlying Jinduchin Formation €Olj. These rocks appear to have cappings of sand or laterite in most cases.
The central part of the plateau is capped by the unconformably overlying Petrel Formation, which is Cretaceous. This may in turn have been lateritised. The Petrel Formation also occurs in the southern and south-eastern parts of the EL, mainly as mesas or eroded sandy caps on low hills. There is a recognizable colour variation within the Petrel Formation on the photos covering the southern area but this has not been delineated. It probably reflects a grainsize or induration variation within the Formation.

On the south-eastern part of the EL, the Burrell Creek Formation rocks have a sandy capping which is a remnant from one of the unconformities above, but it is almost impossible to decide, on the photos, whether the capping is a remnant of the Depot Creek Sandstone or the Petrel Formation. The rocks have been given an "either or" label in this case.

Consolidated sand and undistinguishable laterite have been labelled "Czs" and "Czl" respectively, while alluvium has been labelled "Qa".
STRUCTURE:

A. Folding

The overall structure within the Burrell Creek Formation in this EL is essentially a north-south synclinorium, probably south-plunging, with numerous tight folds with parallel north-south axes on the limbs. In fact only the eastern limb with its tight folds is visible beneath the cover rocks and this is in the eastern part of EL 2474. The dips are steep within the Burrell Creek Formation so it is very likely that the photo-interpreted dip directions are the reverse of the actual dip directions.

The valley of Burrell Creek is in an anticlinal position but is is probably faulted. The occasional outcrops there of shaley rocks are probably Burrell Creek Formation, although they could be inliers of Mount Bonnie Formation. (The two shales are generally identical.)

The remaining rocks in the EL are in the form of sheets of rocks dipping variously gently westwards, and locally south-westwards. Their outcrop distribution is governed by the extent of the headward erosion of the streams.
B. Faulting

The central part of the EL is crossed by numerous north-easterly trending faults, most of which have west-side-north movement. These are obscured by the Cretaceous rocks, but certainly affect the Proterozoic rocks. In the south-western part of the EL is a long north-westerly trending fault which displaces the Tolmer Group and probably also displaces the Daly River Group. (It is partly obscured by Cretaceous rocks.) Its movement is west-side-down. It probably extends west of the EL across the valley of the Adelaide River along a major stream course, and may be the reason why upper Tolmer Group rocks outcrop there.

The valley of Burrell Creek only has one long inferred fault marked on the map but probably contains two - one on either side.
METAL OCCURRENCES:

There are no mineral deposits marked on the published map for this area, and no prospective areas within early Proterozoic rocks were distinguished on the aerial photographs. There are a couple of isolated quartz veins in the central part of the eastern margin. The only possibility for mineralization appears to be unconformity-related mineralization, and there is plenty of scope for this.

A stream sediment sampling programme which covers all streams draining the unconformities would confirm or deny this possibility.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE 2475

FOR

W.J. & E.E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH. W.A. 1983
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SUMMARY:

The EL comprises rocks of the Burrell Creek Formation, with some possible inliers of Mount Bonnie Formation, folded into a broad open probably anticline plunging south with superimposed small folds plunging south or south south-east. Unconformably overlying this, with a faulted western margin, is the Tolmer Group, the dolomite member of which probably underlies the broad, alluvial valley of the Adelaide River. The Tolmer Group is capped with Cretaceous rocks. The major north north-easterly trending fault which crosses EL 2475 cuts all other features, including the earlier northerly faults, and is accompanied by parallel and conjugate faults.

There are numerous quartz veins in the south-western part of the EL.
RECOMMENDATIONS:

1. Check whether the steepness of the dips in the Burrell Creek Formation has produced photogeological reversal of dip directions on the maps.

2. Sample the quartz veins and the folded area on photo 9E/1619.

3. It may be worth carrying out a stream sediment sampling program on streams draining the unconformity of the Depot Creek Sandstone on the Burrell Creek Formation.
INTRODUCTION:

EL 2475 lies on the western edge of the Batchelor 1:100,000 map sheet which is part of the Pine Creek 1:250,000 sheet.

It occupies an oblong of fifty square minutes, or one hundred and seventy square kilometres, to the south-west of Adelaide River townsite. It consists of a main block which is nine kilometres wide by seventeen kilometres long with an adjoining block on its north-eastern side which is two kilometres wide by eight kilometres long. The EL is crossed by the Adelaide River and contains the junction of the West Branch with the main branch. There are no roads in the area, so access is difficult.

EL 2475 is covered by the photogeological study of parts of the Batchelor and Reynolds River map sheets in the Adelaide River region which was carried out in 1983 by L.G. Smith & Co. This study produced fifteen map sheets at photo scale and of these, EL 2475 occupies parts of Batchelor sheets nine and thirteen. Aerial photographs used in the study were the CAG 1:25,000 colour series flown in 1973. The photographs which cover this EL are;
Reynolds River Run 7E Numbers 1484 - 1488
Reynolds River Run 8E Numbers 1573 - 1578
Reynolds River Run 9E Numbers 1617 - 1622
Reynolds River Run 10E Numbers 1718 - 1721
and, Reynolds River Run 11E Numbers 2631 - 2635
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where the information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources.".

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY:

The EL is strongly dissected, with valleys at an average elevation of sixty to eighty metres and hills at elevations of one hundred to two hundred metres. The south-eastern portion of the EL contains the broad valley of the Adelaide River (main branch) which rises steeply to a plateau of 220 (two hundred and twenty) metres elevation on its eastern and north-eastern sides.

The western portion of the EL contains linear hills and valleys trending in a north-westerly direction.
STRATIGRAPHY:

Although most of the early Proterozoic rocks in the EL appear to belong to the Burrell Creek Formation of the Finnis River Group, there is a possibility that some of the shaley members may be inliers of the older Mount Bonnie Formation of the South Alligator Group. These latter rocks are transitional into and photogeologically similar to the Burrell Creek Formation, so that their presence can only be determined by ground inspection.

Unconformably overlying the Burrell Creek Formation in the south-eastern part of the EL is the late Proterozoic Tolmer Group. This unconformity is faulted for most of its length within EL 2475, so that the second-oldest member of the Tolmer Group, the Stray Creek Sandstone, is in contact with the Burrell Creek Formation along most of the western edge of the valley of the Adelaide River. The oldest member of the Tolmer Group, the Depot Creek Sandstone, is in its normal position in the north-eastern part of the EL. The Stray Creek Sandstone dips relatively steeply down into the broad, alluvium filled valley of the Adelaide River, which contains a few isolated hills of the succeeding member of the Tolmer Group, the Hinde Creek Dolomite. It is very likely that this whole valley is underlain by the dolomite. The youngest member of the Tolmer Group, the Waterbag Creek Formation, exists on the western side of the floor of the valley just south of this EL.
The Tolmer Group is unconformably overlain by the Cretaceous Petrel Formation, which is a flat-lying sandy sheet. It caps Tolmer Group rocks on the plateau in the south-eastern portion of the EL, and its erosion products or eroded remnants form thin layers of sand on Tolmer Group rocks elsewhere. The Petrel Formation may have been lateritised.

Sand, scree and probable subcrop have all been included in the label "Czs". Alluvium is represented by "Qa".

Where a thin remnant of a younger rock can be seen to lie on older rocks, two labels have been used, eg "\(\text{Rtd}^{\partial}\)".
STRUCTURE:

A. Folding

The northern part of EL 2475 is dominated by a broad open fold, which is probably a south-plunging anticline, in Burrell Creek Formation rocks. Superimposed upon, but probably contemporaneous with, this fold are numerous small tight folds, most of which have north-south axes but a few, on the western side, have north-westerly axes. These fold axes are parallel to the strike of the surrounding rocks. The folding seems to disappear in the southern part of the EL but this may be due to the presence of more uniform rock types or to the apparent marked increase in the number of faults.

The apparent shallow syncline in the Tolmer Group on the eastern side of the EL may be caused (or accentuated) by faulting rather than folding. These rocks dip uniformly westwards, except in the vicinity of faults, but have a very steeply east-dipping western margin whose western edge is faulted against the Burrell Creek Formation.

The foregoing description of the folding is based on rock distribution and on the recognition of fold hinges. The actual directions of the dips of the rocks are probably the
reverse of those shown on the photogeological map in all places where the dips are steep. (In other words, in all of the Burrell Creek Formation, local folds shown as anticlines are probably synclines, and vice versa. The plunge directions would also be reversed. This is a function of photointerpretation, and should be confirmed by field checking.)

It is possible that the south-plunging anticline in the northern part of the EL may be reflecting the presence of a buried granitic intrusion.

B. Faulting

The major fault crossing EL 2475 trends in a north-north-easterly direction and has a movement of west-side-north and up. It is a composite fault, however, and the movement can differ locally. This fault is accompanied by numerous splays and conjugate faults, usually in a north northwesterly direction, and by short parallel faults. Some of the faults which are marked on the map in the southern part of the EL can be inferred to continue into the northern part but they are not particularly obvious. Some of these may ultimately continue as local folds.

The north-south fault along the western edge of the Tolmer Group has a movement of east-side-north and down and is cut by the major fault.
METAL OCCURRENCES:

The Adelaide River uranium deposit occurs in the north-eastern corner of the EL within Burrell Creek Formation conglomerates and greywackes.

For gold, many isolated quartz veins exist within the EL, becoming very numerous in the south western corner. Most of these quartz veins have a northerly orientation.

A promising fold exists on Reynolds River photo 9E/1619, on the southern part. This is in the south-western section of Batchelor map nine and is just south of the central western part of the EL. The host rocks have a photogeological affinity with arkose, but in fact they are probably greywacke. This is well worth sampling.

The unconformity of the Tolmer Group upon the Burrell Creek Formation, ie the base of the Depot Creek Sandstone, is worthy of investigation for fossil placer deposits or as a trap for hydrothermal fluids ascending from below. A stream sediment sampling program in streams draining this unconformity could be worthwhile.
REPORT ON

PHOTOGEOLICAL STUDY

OF

EXPLORATION LICENCE 2477

FOR

W. J. & E. E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH W.A. 1983
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SUMMARY

EL 2477 is shaped like an inverted 'L' and contains rocks of both the Mount Bonnie Formation and the Burrell Creek Formation which are photogeologically quite similar.

The structure is dominated by faulting, as the Mount Shoobridge Fault and its associated fractures lies along the eastern margin of the southern limb of the EL.

Small local folding is plentiful but the only recognizable large fold is a probable syncline, in the southern limb, whose axial plane strikes and plunges northerly. This fold is modified by the faulting.

There are two areas worth prospecting within the EL but neither appears to be identical with 'Bundey 1'. Another area to the south of the southern limb of this EL is also worth prospecting.
RECOMMENDATIONS

There are two areas within and one without this EL which are worth prospecting:

1. The quartz veins in either altered or mylonitised rocks along the Mount Shoobridge Fault, on the eastern margin of the southern limb of EL 2477 below the junction with ELA 4066. This is on photo 9/1631.

2. A folded area of possibly altered Burrell Creek Formation rocks on the boundary of EL 2477 and EL 2473 is photogeologically similar to an old gold mine east of 'Bundey 1'. This is on the central western edge of photo 9/1631.

3. Two areas of a folded 'altered shale' and possibly tuff or arkose occur in greywacke on the central western half of photo 12/2524 and on 12/2525, well south of the southern limb of EL 2477.
INTRODUCTION

EL 2477 has the shape of a half 'T' and lies some fifteen kilometres east south-east of Adelaide River townsite. Its southern end is crossed by the North Australia Railway and the headwaters of Gunn Creek. There may be a station track into the area, but it is otherwise devoid of access tracks.

EL 2477 has an area of twenty-four square minutes. The upper oblong is approximately eleven kilometres wide by four kilometres long and the lower oblong, which adjoins the western end of the southern side of the upper, is also approximately eleven kilometres long by four kilometres wide.

This EL is covered by part of the photogeological study carried out in 1983 by L.G. Smith & Co and occupies parts of Batchelor maps eleven and fifteen of that study. Aerial photographs used were the CAG 1:25,000 colour series flown in 1973 and the following Batchelor photos cover EL 2477:

Run 7      numbers 1496 - 1500
Run 8      numbers 1560 - 1565
Run 9      numbers 1630 - 1632
Run 10     numbers 1708 - 1710

No field checking has been carried out by the writer and hence this report and its maps should be regarded as provisional.
METH0D:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where the information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY

The north-south limb of EL 2477 is composed of generally linear isolated hills with a north-south orientation, except at the southern end where some of the hills trend east-westerly. The hills are separated by alluvium and the ephemeral streams form some of the tributaries of Gunn Creek.

The east-west limb contains a broad alluvial plain in its central portion. This plain is crossed by Gunn Creek, Bridge Creek and Howley Creek and some of their tributaries. The eastern end of this limb contains low shaley patches of outcrop, with random orientation, rising to hills of arkose on the eastern margin. The low outcrops are often separated by sand, rather than by alluvium or mud, at the very eastern end.
STRATIGRAPHY

The stratigraphy within EL 2477 is, at once, simple but complicated. Only two Formations are present - the Mount Bonnie Formation of the South Alligator Group and the Burrell Creek Formation of the Finiss River Group, designated Pso and 2fb respectively on the map. Now, the Mount Bonnie Formation is transitional from the underlying Gerowie Tuff into the Burrell Creek Formation, and there is no well-defined lower boundary of the Burrell Creek Formation, the contact being gradational. For ground mapping purposes, the base of the Burrell Creek Formation (or the top of the Mount Bonnie Formation) is taken to be the last appearance of tuffaceous material, and this can be rather difficult to pick up on aerial photographs. To complicate matters, the red shales in both Formations are identical, and further, some of the greywackes of the Burrell Creek Formation are photogeologically very similar to some of the arkoses of the Mount Bonnie Formation. This leads to a considerable amount of 'either - or' labelling on the map. The writer is confident that photogeological recognition of large amounts of tuff and of large amounts of conglomerate or sandstone is reasonably accurate, but it can be seen that detailed field checking is required to positively label some of the rock units.
In so far as rock affinities can be estimated, I think that the bulk of EL 2477 contains Mount Bonnie Formation arkoses and shales, with Burrell Creek Formation rocks in the centre of the north-south limb and at, and south of, its southern margin.

Some consolidated sand, Czs, occurs between outcrops in the north-eastern corner, otherwise the hills are separated by a blanket of alluvium, Qa.
STRUCTURE

A. Folding:

The north-south limb of EL 2477 contains a northerly-plunging syncline which has been modified by faulting. The core of the syncline is sandstone and conglomerate, assigned to the Burrell Creek Formation although rare conglomerates can be found in the Mount Bonnie Formation. This is cut off by a fault near the area common to the two limbs, and above this fault and along the east-west limb are only small local folds.

B. Faulting:

The dominant structures within EL 2477 are faults. The north-south trending Mount Shoobridge Fault runs along the eastern margin of the north-south limb and is itself subject to faulting. The movement on the Mount Shoobridge Fault is west-side-down and it appears to be a normal fault. Towards the top of the north-south limb of EL 2477, the Mount Shoobridge Fault veers away to the north north-west, probably as a result of a minor structural disturbance. The fault is brought back to its same north-south line by a north-easterly fault which moves north-side-east and up, appearing to bring probably Mount Bonnie Formation rocks to the surface in the
area of EL 2477 common to both limbs. Numerous small north-easterly and easterly faults affect the rocks in the common area.

Near the bottom of the southern limb of EL 2477, a north-easterly-trending fault is inferred to bring the north side up, otherwise all rocks in this limb would be Burrell Creek Formation.

Numerous small faults in the rocks, at the eastern end of the northern limb of EL 2477, have easterly or north-easterly trends and various directions of movement.

There are numerous isolated quartz veins.
METAL OCCURRENCES

No old gold mines are recorded within this EL. Although there are no areas identical with 'Bundey 1', there are some areas which should be prospected.

1. The quartz veins along the Mount Shoobridge Fault should be sampled, particularly those below the junction with ELA 4066 on photo 9/1631 as some of the host rocks here appear to be altered. (They may simply be mylonitised; nevertheless they are worth a look.)

2. On the central western edge of the same photo (9/1631), on the boundary of EL 2477 with EL 2473, is a folded outcrop which appears to be altered and has photogeological similarities with the old gold mine east of 'Bundey 1' which I inspected in 1982.

3. Well to the south of EL 2477, in the headwaters of Bridge Creek on the central part of photos 12/2525 and 12/2524 are some rocks which may be tuffaceous and folded. The eastern outcrops are on the Mount Shoobridge Fault and the western outcrops appear to be in a 'window' in greywackes. They are labelled "Bfb.s (altered)" on the map.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE 3320

FOR

W. J. & E. E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH W.A. 1983

L. G. Smith
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SUMMARY

EL 3320 consists of early Proterozoic rocks of the South Alligator Group, mainly Mount Bonnie Formation with the slight possibility of a few southern outcrops belonging to the underlying Gerowie Tuff. These outcrops are separated by broad low valleys and plains filled with consolidated sand or alluvium.

The Proterozoic rocks are folded into a central syncline with two flanking anticlines, the axial planes of which appear to plunge in a northerly direction. Superimposed on these large folds are a number of local folds with north-south axes and a half-wavelength of about one kilometre. At the western end of the EL, in the anticline or anticlinorium, the small folds become close and intense, with every long ridge possibly representing an anticlinal axis.

There are numerous faults, ranging from a long one along McCallum Creek with east-side-north movement to short north-easterly and northerly ones (mostly in the western half of the EL) with variable movements.
Two areas contain probably folded tuffaceous rocks: one on photo 8/1560 and one on photo 8/1556, just west of the photo-centre in each case. These areas each have a slight similarity to 'Bundey 1' and are worth prospecting.
RECOMMENDATIONS

The two areas described under 'Metal Occurrences' are worth prospecting.
INTRODUCTION

EL 3320 lies some twenty-three kilometres east south-east of Adelaide River townsite, on the Batchelor 1:100,000 map sheet. The EL is crossed by McCallum Creek and by part of the road to Ban Ban Springs Station from Mount Ringwood Station. The EL adjoins the southern margin of EL 2362 and has an area of twenty-one square minutes, being oblong, with a width (east-west) of approximately thirteen kilometres and a length (north-south) of approximately five-and-a-half kilometres.

EL 3320 is covered by part of the photogeological study of the Adelaide River region carried out in 1983 by L.G. Smith & Co, and occupies parts of Batchelor maps eleven and twelve (at photo scale) of that study. Aerial photographs used were the CAG 1:25,000 colour series flown in 1973 and the photos relevant to this EL were all Batchelor photos, as follows:

Run 7 numbers 1500 - 1506
Run 8 numbers 1555 - 1560

No field checking has been done by the writer and hence this report and its maps should be regarded as provisional.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where the information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources".

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY

EL 3320 is composed dominantly of low-lying hills and groups of hills, separated by sandy alluvium. Its north-western corner contains a big group of relatively high rugged hills, up to 160 metres high compared with a plain level of about 60 metres. The eastern part of the EL contains the black soil plain of McCallum Creek and its tributaries, with the north-eastern margin just touching a group of isolated high hills. (The road from Mount Ringwood Station to Ban Ban Springs Station runs through this black soil plain.)
STRATIGRAPHY

Most, if not all, of the rocks within EL 3320 belong to the early Proterozoic Mount Bonnie Formation of the South Alligator Group. The dominant rock type is arkose, with minor shale, rare tuff and very rare banded iron formation and greywacke. In general, the more shaley areas form the lowest hills, although there are exceptions to this. Some of the greywacke occurs as isolated 'tombstones' amongst the alluvium and this is very difficult to pick out on the aerial photographs. Tuffs are present, but are generally shaley and so are assigned to the Mount Bonnie Formation rather than to the underlying unit, the Gerowie Tuff. The published map does indicate the presence of Gerowie Tuff along the southern margin of the EL, but the only outcrop which may have the photogeological characteristics of Gerowie Tuff is the one immediately north of the junction of ELs 4066 and 3642. The remaining outcrops look more like arkose. In the north-eastern corner of the EL, a relatively high hill with a very pale colour could be interpreted as Gerowie Tuff (and is on the published map). Field inspection in 1982 revealed that the rocks here were white-weathering grey tuffaceous shales of Mount Bonnie Formation affinities. Just north of this hill was well-developed banded iron formation with minor tuff, chert and shale, all belonging to the Mount Bonnie Formation.
The high hills in the north-western corner appear to be dominantly arkose, with minor tuff, shale and incipient banded iron formation.

The valleys between the hills are generally filled with consolidated sand, Czs, with minor alluvium, Qa.
STRUCTURE

A. Folding

An examination of the distribution of the rocks suggests that a large syncline, with an axis plunging just east of north, occupies the central part of EL 3320, with flanking anticlines (both plunging north) on the western end and eastern margin. Superimposed upon these folds are the small 'skin folds', with half-wavelengths of about one kilometre, visible on the photos. The axes of these folds trend north-south. At the western end of the EL, the folding within the anticline (or, rather, anticlinorium) may be very intense, with every long high ridge possibly representing an anticlinal axis, trending north-easterly to northerly.

B. Faulting

There appears to be a long, north north-westerly-trending fault along the valley of McCallum Creek, dragging it east-side-north.

The folds are cut by numerous easterly and north-easterly trending faults with small variable displacements. These faults are more numerous in the apparently intensely folded anticlinorium at the western end of the EL.
Most of the faults, caused by the disruption of the rocks due to the intrusion of the Burnside Granite, appear to have died out before they reach EL 3320.

It is possible that the central syncline is bounded by a pair of strike-slip faults along its limbs.

C. Dykes

A north-south trending dolerite dyke occurs in the north-western part of the EL, on photo 7/1500, north-east and south-east of the photo centre.
METAL OCCURRENCES

There are no old mines in this area, according to the published map.

Two outcrops almost fulfill the photogeological criteria for mineralization. One of these is on photo 8/1560, just west of the photo centre and straddling the boundary of ELs 3320 and 4066. The rocks are folded and appear to consist of arkose and shale. The second of these is west of the road to Ban Ban Springs on photo 8/1556, again just west of the centre of the photo. The rocks appear to be poorly outcropping tuffs and arkoses with very indistinct bedding, which may indicate that they are altered. They may not have sufficient structured complexity to form good host rocks for an orebody, nevertheless they are worth inspecting.
REPORT ON
PHOTOGEOLOGICAL STUDY
OF
EXPLORATION LICENCE 3565
FOR
W. J. & E. E. FISHER
ON BEHALF OF
W. R. GRACE AUSTRALIA LTD.

PERTH. W.A. 1983

[Signature]
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SUMMARY:

EL3565 contains a linear belt of north-south-striking rocks of the Proterozoic South Alligator Group, arranged in a south-plunging, west-dipping anticline. Old gold mines are located on the anticlinal axis in possible saddle reef situations.
RECOMMENDATIONS:

1. Field inspection to distinguish Koolpin Formation from Zamu Dolerite, and to check that the Gerowie Tuff outcrops are indeed siliceous tuff.

2. Investigation of the old gold occurrences and of the quartz veins in the Gerowie Tuff.
INTRODUCTION:

E.L. 3565 lies on the Batchelor-Hayes Creek 1:100,000 Geological Map which forms part of the Pine Creek 1:250,000 Map Sheet.

The E.L. has an area of four square minutes, is approximately seven kilometres long by two kilometres wide, and extends approximately from Mount Paqualin in the north to the old Bridge Creek Gold Mine in the south. The E.L. lies across the North Australia Railway and its southern end is near the Stuart Highway, so ground access should not be too difficult.

E.L. 3565 is covered by the photogeological study of parts of the Batchelor and Reynolds River 1:100,000 map sheets in the Adelaide River region, which was carried out in 1983 by L.G. Smith & Co.

Aerial photographs used in the study were the CAG 1:25,000 colour series flown in 1973. The photographs relevant to this E.L. are all Batchelor Sheet photos, being Run 10 Number 1706, Run 11 Numbers 2647 and 2648 and Run 12 Number 2522.
The photogeological study in 1983 resulted in fifteen map sheets at photo scale and of these, maps 15 and 11 contain E.L. 3565.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where their information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources.".

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
GEOLOGY:

Physiography:

The E.L. comprises a set of hills which are strike-ridges, aligned in a northerly direction surrounded by flat, sandy to muddy plains with occasional patches of low outcrop. The major streams run northerly through the mud flats.

Stratigraphy:

The rocks in the E.L. consist of the Early Proterozoic South Alligator Group, comprising the Koolpin Formation, Esk, overlain by the Gerowie Tuff, Esg, (which may have a shaley facies) overlain in turn by the Mount Bonnie Formation, Eso. The Zamu Dolerite Edz, intrudes the Koolpin Formation. The rocks are generally flanked by areas of scree and subcrop, labelled Czs, and this is covered by Quaternary Alluvium, Qa, in the muddy plains.

A few white patches which may be quartz veins were delineated, mainly in Gerowie Tuff.

Where some photogeological confusion exists, the rocks have been double labelled - e.g. "Esk or Edz".
Structure:

A central linear belt of Koolpin Formation runs through the E.L. in a northerly direction, culminating in Mount Paqualin. This belt is intruded by the Zamu Dolerite at various levels, and is flanked on both eastern and western sides by the Gerowie Tuff which occupies a pair of linear belts which are northerly-tending strike ridges. The major structure in E.L. 3565 is hence anticlinal. Since there appears to be an overall westerly dip, the anticlinal axis must dip west and it has a northerly strike. The apparent disappearance of the Koolpin Formation to the south may indicate a southerly plunge of the anticlinal axis.
RESULTS OF PHOTOGEOLOGY:

There was general agreement with the published geological map in this E.L. Most of the few discrepancies in this E.L. could readily be resolved by ground inspection.

Problems arise because the dolerite in some areas, particularly around the Burnside Granite, seems to have a very similar weathering pattern to the ferruginous member of the Koolpin Formation, $Bsk_c$, and the writer has not seen these rocks in this area.

The divisions of the Koolpin Formation are less obvious away from the Burnside Granite, so that although photogeological boundaries within this Formation can still be detected, the correlations are less obvious. In a few places, and particularly in E.L. 3565, a boundary is drawn between two photogeological units both labelled $Bsk$. This indicates that two distinct members of the Koolpin Formation are present but they cannot be correlated with $Bsk$ or $Esk$ with certainty.

Further problems arise with the Gerowie Tuff, which may be a shaley facies in this area. Although there is a distinct photogeological boundary around the Gerowie Tuff
in some places, corresponding with the published geology, in others the photointerpretation suggests a similarity to the shaley and tuffaceous component of the Mount Bonnie Formation. Those outcrops which, on the photos, can be correlated with mapped and measured Gerowie Tuff are very pale coloured, distinct hills, and these are represented as sg and coloured orange on my photogeological maps. All others which are similar but not identical are ascribed to Eso, Mount Bonnie Formation, although these outcrops on my maps carry an orange stripe representing considerable tuffaceous component amongst the shales. (It may be recalled that field checking of the photogeology of E.L. 2362 in 1982 revealed that a pale coloured hill which looked like weathered Gerowie Tuff from a distance was actually tuffaceous shale, and therefore mapped as Eso, although photointerpretation would have ascribed it to Esg.).
METAL OCCURRENCES:

1. The old Bridge Creek gold mine lies at the southernmost extremity (within E.L. 3565) of the Koolpin Formation and its accompanying dolerite, where these finally disappear beneath the overlying Gerowie Tuff in the "nose" of the anticline. This may correspond to a saddle-reef situation on the contact, in which case this occurrence of gold is worth pursuing.

On the published geological map, there are other old gold mines further south and south east in the same structural situation and mainly on contacts in this same belt of rocks, outside this E.L., and there is one old gold mine just north of Mount Paqualin, also in the same structural setting.

Breaks in the continuity of outcrop of this remarkably linear belt of rocks may indicate unobtrusive cross-cutting structural disturbances whose intersections with the anticlinal axis would be worthy of investigation for gold.
METAL OCCURRENCES - continued

2. The quartz veins in the Gerowie Tuff are parallel to the anticlinal axis but may not be coincident with it. Nevertheless they are worth sampling.

3. Immediately adjacent to Mount Paqualin, but probably just outside this E.L. on its eastern side is a folded outcrop of probably Gerowie Tuff, on photo B10/1705. This may be worth investigating if title can be obtained.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE 3569

FOR

W.J. & E.E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH. W.A. 1983
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SUMMARY:

EL 3569 is composed of early Proterozoic Burrell Creek Formation rocks which have been folded along north-south axes and intruded by granite. Unconformably overlying these is the late Proterozoic Tolmer Group, and this unconformity is gently folded and strongly faulted. Unconformably overlying these rocks to the south of the EL are Lower Proterozoic rocks, and unconformably overlying all of them are Cretaceous rocks, currently being eroded. The Cretaceous rocks appear to have been lateritized.

Quartz veins are scattered sparsely throughout the EL but become very plentiful at the eastern edge. Their host rocks are interpreted to be Burrell Creek Formation greywackes, but these are worth investigating in case of misinterpretation.
RECOMMENDATIONS:

1. Check the host rocks, and sample the quartz veins, on the eastern edge of the EL, particularly those on photos 8E/1579 and 11E/2632 and 2633.

2. Check whether the dips are so steep in the Burrell Creek Formation that the photointerpreted folds should be reversed.

3. Check whether "Efsl" is a shaley and slatey facies of the Burrell Creek Formation or is a (peneplained) inlier of Mount Bonnie Formation.
INTRODUCTION:

EL 3569 lies on the Reynolds River 1:100,000 Map Sheet which forms part of the Pine Creek 1:250,000 Map Sheet.

The EL has an area of one hundred square minutes, and comprises a control block which is approximately fifteen kilometres wide by nineteen kilometres long, with an adjoining north-western block which is approximately nine kilometres long by five kilometres wide and an adjoining south-eastern block which is approximately two kilometres long by eight kilometres wide.

The north-western part of the EL is crossed by the East Branch of the Reynolds River and the south-eastern part of the central block is crossed by the West Branch of the Adelaide River. Other major streams within the EL are Red Bank Creek and Mistake Creek. The road from Stapleton to Daly River Police Station traverses the central part of the EL from north to south, but the area is otherwise inaccessible.

EL 3569 is covered by the Reynolds River section of the photogeological study of the Adelaide River region which was carried out in 1983 by L.G. Smith & Co. Aerial photographs used in the study were the CAG 1:25,000 colour series flown
in 1973. The photographs relevant to this EL are all Reynolds River photos, being Run 7E numbers 1474 to 1484,
Run 8E numbers 1578 to 1588,
Run 9E numbers 1608 to 1617,
Run 10E numbers 1721 to 1728,
and Run 11E numbers 2624 to 2636.

The photogeological study in 1983 produced fifteen map sheets at photo scale and five of these cover EL 3569, namely Reynolds River maps eleven, twelve, fifteen and sixteen, and part of Batchelor map thirteen.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where this information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY:

The EL contains a hilly plateau in its western portion, surrounded by well-dissected hills. In its eastern portion many of the hills have a linear trend, usually in a northerly direction.

The large streams which cross the EL occupy narrow valleys but some of their tributaries form network drainage systems on the plateau. Just to the west of the EL is a broad open plain occupied by the main Reynolds River, and to the south of the EL is another broad open plain occupied by the headwaters of the West Branch of the Adelaide River. The main branch of the Adelaide River runs up the eastern side of the EL.
STRATIGRAPHY:

There are no obvious outcrops of South Alligator Group rocks within this EL.

The dominant rock type is the Burrell Creek Formation of the Finniss River Group, which contains mostly greywackes. Those few horizons which appear to be shaley are photogeological possibilities for the presence of Mount Bonnie Formation rocks, but even so, these are labelled Efb s and Efb s1, signifying respectively shales and banded shales or slates, tentatively assigned to the Burrell Creek Formation. Other areas which depart from the standard appearance of Burrell Creek Formation rocks are labelled "Czs" Efb, where the rocks appear to have a sandy capping or are not the normal greywackes, in which case they may also be Mount Bonnie Formation rocks. Field checking is required to sort this out.

Unconformably overlying the Burrell Creek Formation are rocks of the late Proterozoic Tolmer Group. The lowest member, the Depot Creek Sandstone Etd and the overlying Stray Creek Sandstone Ets are both widespread along the East Branch of the Reynolds River in the west of the EL.
In the east of the southern part of the EL, the Tolmer Group again appears, with the Stray Creek Sandstone Ets flanking the broad valley of the main branch of the Adelaide River. This valley is probably formed within the overlying Hinde Creek Dolomite Etw, as there are a few isolated hills of the dolomite protruding through the alluvium in the valley.

South of the EL but still within this valley, some isolated higher hills are formed of the uppermost unit, the Waterbag Creek Formation Etw. These hills are capped with, and preserved from erosion by Cretaceous rocks, probably the Petrel Formation.

Lower Proterozoic rocks of the Daly River Group unconformably overlie the Tolmer Group south of the easternmost part of this EL but are not recognised within the EL.

Cretaceous rocks are widespread as erosion remnants unconformably overlying all of the other rocks. Although there are some apparent photogeological variations within the Cretaceous rocks, they have not been subdivided in this study, as the rocks have the overall appearance of a dominantly sandy unit. Many of the outcrops of Cretaceous rocks are mesaform, and it is likely that the flat tops are the products of laterisation. These mesas are being eroded and the rocks redistributed by the present weathering cycle.

Thin covers or remnants of Cretaceous sand or later laterite are widespread throughout the EL, and many of the drainage systems contain deposits of sand and laterite as terraces.
STRUCTURE:

A. Folding

The EL comprises a central block of Burrell Creek Formation rocks, flanked east, west and south by overlying Tolmer Group and other younger rocks. Hence the overall structure within the EL is a central anticline with flanking synclines, all with south-plunging south-trending axes. (This assumes an initially flat unconformity of the Tolmer Group on the Burrell Creek Formation.) The overall "younging" of the rocks to the south and south-east probably represents crustal downwarping and thickening.

Within the Burrell Creek Formation, two types of folding appear to be present. These are broad open shallow folds and small tight local folds, all with southerly-trending axes. These folds may be either contemporaneous or the smaller folds may be superimposed on the larger ones. Dips within the Burrell Creek Formation are very steep, which means that the directions of the dips may be the reverse of their photointerpreted directions, ie my photointerpreted anticlines may be synclines and vice versa. If this is the case, then the plunge directions of these folds must also be reversed but the positions of the fold axes would not be affected. Ground inspection is required to resolve this.
The unconformably overlying Tolmer Group is generally composed of shallowly-dipping sheets. The synclines at both the western and south-eastern extremities of the EL can be shown to exist by the distribution of the Tolmer Group rocks and these folds are strongly accentuated by both strike-slip and axial planer faulting.

The unconformably overlying Cretaceous rocks do not appear to have been folded.

B. Faulting

The dominant faults are the long, persistent north-easterly to north north-easterly faults which generally have a west-side-north movement. These cut shorter north north-westerly trending faults which appear to have similar but shorter movement.

The north north-easterly fault along the Reynolds River East Branch and tributaries has opposite directions of movement at its northern and southern ends, probably indicating that its main movement is in fact vertical. This fault is almost axial planer to a south-plunging syncline within the Tolmer Group.
IGNEOUS ACTIVITY:

The early Proterozoic rocks have been intruded by granite, labelled Ege on the map. Photos covering the granite are Reynolds River 11E/2626 and 2627. This granite displaces Burrell Creek Formation rocks but does not appear to have caused major structural disturbances. No associated quartz veins are visible on the photographs, although isolated scattered quartz veins do occur within the EL.
METAL OCCURRENCES:

The writer does not know of any metal occurrences, in the form of old or current mines, within EL 3569. Isolated quartz veins do exist, but are generally parallel to faults. In the eastern part of the EL the quartz veins become very plentiful, as seen on photos 8E/1579 and particularly 11E/2632 and 2633. Although both of these areas contain tight folding, the host rocks appear to be greywackes. The area is worth inspecting, though, in case the host rocks are the photogeologically similar arkoses.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE EL 3642

FOR

W. J. & E. E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH W.A. 1983

J J Smith
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SUMMARY

This small area contains a mature landscape underlain by early Proterozoic rocks of the South Alligator Group, the oldest unit of which, the Koolpin Formation, is extensively intruded by dolerite sills. It is difficult to distinguish the ferruginous member of the Koolpin Formation from the dolerite as both are dark rocks weathering to a red soil. The overlying Gerowie Tuff is scarce to almost absent, and is probably represented here as a shaley facies, which by definition would be incorporated into the further overlying and transitional Mount Bonnie Formation. (It is possible that the Gerowie Tuff may have been faulted out, though.)

The distribution of the South Alligator Group rocks is governed by the intrusion of the Burnside Granite immediately to the south. Near the granite, the rocks are crumpled and locally faulted, but generally dip outwards and away from the granite. There is the expected stratigraphic gradation of the oldest rocks (the Koolpin Formation) in the south near the granite and the youngest rocks, the Mount Bonnie Formation in the north of the EL, modified by north-south (radial to the granite) faulting but only slightly affected by folding.

There is only one outcrop worth prospecting on photogeological grounds and it would not appear to be a high priority target.
RECOMMENDATIONS

The area should be field checked as photogeological identification of the rock units here is very difficult and the writer is not confident of the correlations made.

The only area worth prospecting on photogeological grounds is on photo 9/1639, north north-east of the photo centre. It is only slightly similar to Bundey 1, though.
INTRODUCTION

EL 3642 is a small oblong lying some thirty-three kilometres east south-east of Adelaide River townsite. It lies just west of McCallum Creek and north of the Burnside Granite, has an area of six square minutes and is approximately five-and-a-half kilometres wide by four kilometres deep.

There are no known tracks into this area but it is not far west of the road from Mount Ringwood Station to Ban Ban Springs Station.

EL 3642 lies in the centre of Batchelor map twelve, of the fifteen maps produced by the photogeological study of the Adelaide River region done in 1983 by L.G. Smith & Co. The maps were at photoscale, ie approximately 1:25,000. The photos used were the CAG 1:25,000 colour series flown in 1973 and those relevant to this area were:

Batchelor Run 8 numbers 1556 - 1558
Batchelor Run 9 numbers 1638 - 1640

As the writer has not visited this area, its report and maps must be regarded as provisional.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where the information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY

EL 3642 consists of a mature landscape with low rounded hills and broad valleys containing undersize stream channels.
STRATIGRAPHY

The early Proterozoic rocks within EL 3642 comprise the South Alligator Group: (from oldest to youngest) the Koolpin Formation $E_{sk}$, Gerowie Tuff $E_{sg}$ and Mount Bonnie Formation $E_{so}$.

The north-western, northern, north-eastern and eastern portions of the EL contain rocks interpreted as Mount Bonnie Formation, and the southern and south-western portions contain Koolpin Formation rocks. The central and western area, which logically should contain the intervening Gerowie Tuff, appears to contain mainly Koolpin Formation, with a few rocks carrying an 'either-or' label. The Gerowie Tuff here may be absent, unrecognized or a shaley facies, which would be included in the Mount Bonnie Formation. The unit could be faulted out, but I think that its presence as a shaley facies is the most logical explanation.

The Koolpin Formation contains rocks which weather to a bright red sand. These rocks may be either dolerite sills or the ferruginous member of the Koolpin Formation, $E_{skc}$. It is very difficult to distinguish these two on the aerial photographs and field inspection is essential to confirm the outcrop labels, as indeed it is for this whole area.
The Mount Bonnie Formation contains tuff, arkose and shale. If either banded iron formation or chert are present, they are too small to be detected on the photos.

The valleys contain consolidated sand Czs and the stream channels and some of the black soil plains of the tributaries of McCallum Creek (to the east) are filled with alluvium, Qa.
STRUCTURE

Structure within EL 3642 is dominated by the disruption due to the intrusion of the Burnside Granite. The rocks are crumpled, so that their overall northerly dip (outwards and away from the granite) is modified by local crumpling in the southern part of the area. This grades into the northern part, where the overall pattern of large open folds with superimposed local folds reasserts itself. A synclinal axis, plunging north north-easterly, touches the north-west corner of the area and an anticlinal axis, plunging northerly, occupies the north-eastern section.

Faulting is plentiful. Northerly-trending faults with variable movement are almost radial out from the granite in this area. It is highly likely that northerly to north-easterly-trending normal faults (ie, north-side-down) occur in this area, but as they would have stike-slip movement, their presence is difficult to detect. (This may explain the apparent absence of much of the Gerowie Tuff unit. It is possible that a fault runs north-easterly along the valley of the main stream in the EL, which is about the position where some of the Gerowie Tuff should outcrop.)
METAL OCCURRENCES

There are no old mines noted on the published map for this area.

Although folded tuffaceous rocks do occur within this EL, they do not appear to have the photogeological characteristics of Bundey 1.

An area of 'Eso or Esk' in the south-eastern corner of the EL may be worth prospecting. This is on photo 9/1639 and is north north-east of the photo centre.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE EL 3643

FOR

W. J. & E. E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH W.A. 1983

L. J. Smith
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SUMMARY

EL 3643 is over folded and faulted rocks of the South Alligator Group. Koolpin Formation rocks occur in the south-eastern and probably central part, the overlying possible Gerowie Tuff occurs in the south-western part, and in the north-western corner is Mount Bonnie Formation. Just south of and underlying the Mount Bonnie Formation, in an anticlinal situation, are pale rocks which, from a distance, look like Gerowie Tuff but on inspection prove to be white-weathering tuffaceous shale and hence belong to the Mount Bonnie Formation. It is suggested that the apparent lack of outcrops of Gerowie Tuff in this area may be due to its presence as a shaley facies which by definition must be ascribed to Mount Bonnie Formation. The southern anticline which appears to contain Gerowie Tuff may also prove to belong to the Mount Bonnie Formation, on inspection.

A large north-westerly-trending fault, along the creek through the southern part of the EL, drags its eastern side up and northwards. Other smaller faults are present.

The eastern side of the EL covers part of the Margaret Granite, which tilts the adjacent rocks outwards and away.
The only part of this EL which may be worth prospecting, on photogeological grounds, is that part of apparent Mount Bonnie Formation just north of its contact with Koolpin Formation in the centre of the area, along the bottom of photo 7/1506.
INTRODUCTION

EL 3643 lies some forty kilometres east of Adelaide River townsite, just east of McCallum Creek and its south-western corner is crossed by the road from Mount Ringwood Station to Ban Ban Springs Station. The EL is oblong, with an area of eight square minutes and is approximately seven-and-a-half kilometres long by four kilometres wide.

This EL is covered by the photogeological study of the Adelaide River region carried out in 1983 by L.G. Smith & Co and occupies the north-eastern corner of Batchelor map twelve (at photo scale) produced by the study. Aerial photographs used were the CAG 1:25,000 colour series flown in 1973 and those relevant to this area were:

Batchelor Run 7 numbers 1706 - 1708
Batchelor Run 8 number 1555
Batchelor Run 9 numbers 1641 - 1642

Unfortunately Run 8 did not extend far enough eastward to cover this area, so there is an information gap in the centre of the EL.

Only the northern edge of EL 3643 has been visited by the writer (in 1982) so that the interpretation of the remainder of the area must be regarded as provisional, as must this report.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where the information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY

The western two-thirds of EL 3643 comprises relatively high ridges trending variously north-easterly or north-westerly. A north-westerly trending stream cuts these ridges in the central western part of the EL, and debouches onto the black soil plain of McCallum Creek. The eastern one-third of EL 3643 is very low-lying, with the sandy plains of the Margaret Granite, rimmed by hills or arkose, in the north-eastern corner and low hills of the Koolpin Formation in the south-eastern corner.
STRATIGRAPHY

The sedimentary rocks within this EL belong to the early Proterozoic South Alligator Group, ranging from the oldest unit, the Koolpin Formation Esk, through probable Gerowie Tuff Esq to the youngest unit, the Mount Bonnie Formation Eso.

The Koolpin Formation appears to occupy the south-eastern corner and possibly the central-eastern part of the area. The central-western and southern parts of EL 3643 contain rocks ranging in colour from almost white to reddish-brown. The very pale ones, which are on the southern and eastern side, probably belong to the Gerowie Tuff, which is in its correct stratigraphic position, while the brown ones may belong to the Gerowie Tuff but are more likely to belong to the overlying Mount Bonnie Formation.

The rocks in the north-western corner and northern edge were visited by the writer in 1982 and were confirmed to belong to the Mount Bonnie Formation. The outer or northern rim of these rocks is composed of banded iron formation and shale, with some tuff and greywacke. South of this is white-weathering grey tuffaceous shale, and banded iron formation. From a distance, the pale-coloured hills had the appearance
of Gerowie Tuff, and are represented as such on the published map, but on inspection they proved to consist of tuffaceous shale. This could, of course, represent a facies variation of the Gerowie Tuff in this area. The southern part of this set of hills passes into red-weathering Koolpin Formation and its dolerite sills.

A few isolated hills of arkose, belonging to the Mount Bonnie Formation, occur in the north-eastern corner.

These hills are separated by consolidated sand Czs with some alluvium, Qa.
STRUCTURE

A. Folding

Both the northern and southern groups of rocks are folded into anticlines, although the northern group contains a central syncline as well. There is a superimposed overall tilting to the west, probably caused by the upwelling of the Margaret Granite on the eastern side of the area.

B. Faulting

A large fault along the north-westerly trending stream through the centre of the EL moves its eastern side up and northwards, dragging Koolpin Formation north to the central part of the area. Numerous smaller faults appear to be present but the lack of photos over the central part hampers the interpretation.
IGNEOUS ACTIVITY

The Margaret Granite intrudes rocks in the north-eastern corner of this EL and occurs over a wide area east of this EL. It gently tilts the surrounding rocks outwards and away. It is so covered with sand that its recognition as a granite is difficult. On the ground, it was noticed that the anthills formed on the granite were pink, as distinct from anthills elsewhere which were grey or yellow. This 'prospecting tool' could be a useful field indicator of the presence of near-surface buried granites.

The faulting and tilting from the Burnside Granite to the south appears to have very little impact on this area.

The Koolpin Formation is intruded by dolerite sills, which are similar in appearance and weathering products to the ferruginous member of the Koolpin.
METAL OCCURRENCES

There are no old mines recorded on the published map in this area.

The only place where there may be a chance of mineralization, on photogeological grounds, is in the folded tuffaceous shale near its contact with the Koolpin Formation in the centre of the EL, on the bottom of photo 7/1506. It is not all that similar to Bundey 1, though.
REPORT ON
PHOTOGEOLICAL STUDY
OF
EXPLORATION LICENCE 3677
FOR
W.J. & E.E. FISHER
ON BEHALF OF
W. R. GRACE AUSTRALIA LTD.

PERTH. W.A. 1983
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SUMMARY:

EL 3677 comprises folded and faulted early Proterozoic rocks, which probably belong to the Burrell Creek Formation, unconformably overlain by the lowest part of the late Proterozoic Tolmer Group - the Depot Creek Sandstone, unconformably overlain in turn by the Cretaceous Petrel Group which has been eroded and probably lateritised.

In the eastern part of the EL, most of these rocks disappear beneath the alluvial plains of Burrell Creek, and this disappearance may be due to folding or to the effect of faulting.

Two places, worthy of prospecting for gold, have been selected.
RECOMMENDATIONS:

There are two areas on EL 3677 which should be checked for the occurrence of gold. One is the vicinity of the George Creek uranium mine and the other is the folded area in the central western part of the northern part of the EL.

In both cases, the rock types are interpreted to be Burrell Creek Formation with a thin capping of probably Depot Creek Sandstone (or laterite!).
INTRODUCTION:

EL 3677 lies on the Batchelor-Hayes Creek 1:100,000 Geological Map which forms part of the Pine Creek 1:250,000 Map Sheet.

The EL is south of Adelaide River townsite and covers the vicinity of the George Creek Mine. The EL has an area of nine square minutes, or approximately twenty-five square kilometres. Its shape is square, with a side of approximately five kilometres. It is crossed by the old Stuart Highway.

EL 3677 is covered by the photogeological study carried out in 1983 by L.G. Smith & Co over parts of the Batchelor and Reynolds River 1:100,000 map sheets. Aerial photographs used in the study were the CAG 1:25,000 colour series flown in 1973. Photographs which cover this EL are Batchelor Run 8 numbers 1570 to 1572, Batchelor Run 9 numbers 1623 to 1625, Reynolds River Run 8E number 1573 and Reynolds River Run 9E number 1622.

The 1983 photogeological study produced fifteen map sheets at photo scale and of these, maps numbered (Batchelor) nine and ten contain EL 3677.

No field checking of this area has been done by the writer and hence this report and map should be regarded as provisional.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where their information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY:

The EL contains considerable topographic variation, from the low, isolated hills within the alluvial plains of Burrell Creek and its tributaries in the eastern portion, at an average elevation of sixty metres, to two plateaux in the western portion, the lower at an average elevation of one hundred and sixty metres and the higher, in the south western corner, at an average elevation of two hundred metres. This topographic change comprises strongly dissected hills and valleys occupying a strip about three kilometres wide.
STRATIGRAPHY:

EL 3677 contains rocks of many different ages. The oldest are the early Proterozoic Finniss River Group rocks of the Burrell Creek Formation. (It is possible that some rocks of the underlying Mount Bonnie Formation of the South Alligator Group may be present along the Old Stuart Highway in the eastern portion of the EL. As these rocks are transitional into the Burrell Creek Formation, their presence may be difficult to prove on the ground. The two Formations are photogeologically identical in this area.)

Unconformably overlying the Burrell Creek Formation, and forming a plateau in the western half of the EL is the Late Proterozoic Tolmer Group, probably represented here by its lowest formation, the Depot Creek Sandstone member of the Buldiga Sandstone. Recognition of this rock type is difficult because this plateau is covered with erosion products from a higher plateau comprising unconformably overlying Cretaceous rocks, probably the Petrel Formation, which appear to be dominantly sandstone.

The very flat surface of the Cretaceous rocks with cliffs at its plateau edges indicate that induration, probably lateritization, has effected these rocks. It is quite likely that the
Tolmer Group rocks have also been slightly lateritised in this area, as they too occupy a cliff-bounded plateau here.

Along the northern part of the EL, some of the Burrell Creek Formation rocks lose their distinctive bedding planes. This is probably due to the presence of a thin cap of either of the overlying younger rocks or to local lateritization. It could also be due to a local facies change or to the presence of an alteration zone.

The low isolated hills in the eastern part of the EL are photogeologically indeterminate sand or subcrop, labelled Czs, which also could be Mount Bonnie Formation rocks. These are surrounded by alluvium, Qa.
STRUCTURE:

The dips of the early Proterozoic rocks are so steep that they are steeper than the slopes of the hillsides. In this situation, photointerpreted dips are usually in the opposite direction of the actual dips and this has happened in the photointerpretation of EL 3677.

The rocks are folded into several small northerly trending and plunging folds, which I have interpreted to be, from east to west, syncline, anticline, syncline, anticline. Because of the steepness of the dips, as mentioned above, these are probably anticline, syncline, anticline, syncline on the ground, and this is confirmed by dip measurements on the published map. The folds on the eastern side are faulted by north-northwesterly trending axial planes and strike-slip faults.

The southwestern part of the EL is covered by the two unconformities mentioned in stratigraphy.

In the eastern part of the EL is an extensive alluvial plain crossed by Burrell Creek. The sudden disappearance of all but a few isolated hills of the Porterozoic rocks may be due to downfolding but is more likely to be due to the presence of one or more large faults or a fault zone as shown on map number ten. The position of this fault may be closer to that of the old Stuart Highway than where it is shown on the map.
COMMENTS ON PHOTOGEOLOGY:

The presence of several unconformities in this EL makes labelling of outcrops difficult. I have tried to resolve this problem by using double labels, eg "Et1" indicating Depot Creek Sandstone overlying Burrell Creek Formation.

Despite the photogeological similarity of Burrell Creek Formation greywackes with Mount Bonnie Formation arkoses, I think that all of the early Proterozoic rocks in this EL belong to one Formation and I have opted for Burrell Creek Formation. This should be confirmed or otherwise by field checking.

Although I suspect that extensive lateritization has occurred, I have generally omitted its "Czl" symbol from the maps for purpose of clarity. In fact, most of the outcrops labelled "Kp" should probably be labelled "Czl".

In one place, the ferruginous part of the Depot Creek Sandstone looks like laterite, so the label reads "Czl or Et1". In any case, this may be just a very thin capping of something on top of the Burrell Creek Formation.
METAL OCCURRENCES:

The only metal occurrence within EL 3677 on the published geological map is the George Creek uranium mine. This is located within the Burrell Creek Formation, on a contact between probable greywacke and shale, and there may be a very thin capping of the overlying Tolmer Group rocks present, i.e. the uranium is probably concentrated at the unconformity. There is no reason why gold may not also be concentrated, either hydrothermally or mechanically, at or on this unconformity, and the rocks in the vicinity of the uranium mine should be sampled for gold.

An area worth prospecting is in the central western part of the northern section of the EL, where there is a large fold and where the bedding of the rocks disappears. (This is on photo number 8/1572, in the central southern part of the photo.) The disappearance of the bedding could be due to the presence of an alteration zone accompanying mineralization, but it is more likely to be due to a thin capping of overlying rocks. The host rocks are interpreted to be Burrell Creek Formation, which downgrades the priority of the area, but allowance must be made for the fact that Burrell Creek Formation greywackes and Mount Bonnie Formation arkoses can look very similar on aerial photographs.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE 3678

FOR

W. J. & E. E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH W.A. 1983
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SUMMARY

EL 3678 is twelve square minutes in area and lies due west of Adelaide River townsite, near Stapleton. It is very hilly and contains tributaries of two main creek systems, Stapleton Creek and Snake Creek.

The early Proterozoic rocks, which may be either Mt Bonnie Formation arkoses and shales or Burrell Creek Formation greywackes and shales, are folded into a north-plunging synclinorium. The rocks in the north-western part of the area, which is much less hilly than the remainder, may be either Mt Bonnie Formation or may be the early Proterozoic indistinguishable sequence capped by either late Proterozoic Depot Creek Sandstone or Cretaceous rocks or laterite.

Quartz veins in this area trend northerly to north-westerly and are well worth sampling.
RECOMMENDATIONS

1. The quartz veins should be sampled.

2. It is important to check whether the host rocks of the quartz veins are Mt Bonnie Formation or Burrell Creek Formation.
INTRODUCTION

EL 3678 occupies an area of twelve square minutes on the western edge of the Batchelor 1:100,000 geological map sheet. The EL lies between four and eleven kilometres due west of Adelaide River townsite, near Stapleton, and is an oblong seven kilometres wide (east-west) by four kilometres long (north-south). It is covered by the photogeological study of the Adelaide River area carried out in 1983 by L.G. Smith & Co. Aerial photographs used in the study were the CAG 1:25,000 colour series flown in 1973 and the photos relevant to this area are Batchelor Run Six, numbers 1443 - 1446, and Reynolds River Run Seven E, numbers 1484 - 1487. The area is on map number five of the eleven Batchelor maps produced by the photogeological study. As the area has not been checked on the ground by the writer, the photointerpretation map and this report must be regarded as provisional.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where this information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY

The area is generally very hilly, but in the north-west corner subsides to broad low rises with northerly-trending wide valleys of the headwaters of Stapleton Creek. The eastern part contains the north-easterly trending headwaters of Snake Creek.
STRATIGRAPHY

The early Proterozoic stratigraphy of this area is confused. The rocks are either Burrell Creek Formation grey-washes and shales of the Finniss River Group or are Mt Bonnie Formation arkoses and shales of the South Alligator Group. These two Formations are photogeologically indistinguishable, hence most of these rocks in this area are labelled 'Efb.g.s or Eso.a.s' and should be checked on the ground for absolute verification.

In the centre of the southern part of the area is a set of strongly banded rocks labelled 'Efb.sl'. These are distinctly different from the other early Proterozoic rocks, in that they are finely banded, but they appear to belong to the same sequence.

Unconformably overlying the early Proterozoic rocks is a thin capping, which may be an outlier of the late Proterozoic Depot Creek Sandstone, Etd, or may be Cretaceous Petrel Formation Sandstones. There is a faint possibility that it could be thin laterite, too.

In the north-western part of the area is a set of rocks with 'lumpy' texture on the photographs, overlain to the
north-west by a set of 'smooth' unbedded rocks. These latter may be the Cretaceous cap, and the former may be eroded outliers of Depot Creek Sandstone overlying Burrell Creek Formation or Mt Bonnie Formation. The valleys contain alluvium, Qa.

It can be seen that extensive field checking is required in this area, as the Proterozoic rocks are stratigraphically and photogeologically confused.
STRUCTURE

The rocks within EL 3678 form a synclinorium plunging northwards. Numerous very small north-plunging anticlines and synclines are superimposed on the major structure and must be either contemporaneous with it or, more likely, later than it.

There is a smaller, north-westerly trending anticline (or south-easterly trending syncline) in the south-western corner of the area. The dips of the rocks are steep, hence the photointerpreted dip directions may be the reverse of the actual dip directions.

It is suspected that there is some strike-slip faulting, concentric with the granite to the north-west. (Although this granite is represented as Archaean, and although the rocks become very much older very quickly going towards the granite, the concentric distribution of the rocks around the granite indicates that the granite may have been reactivated.)
METAL OCCURRENCES

The published map records an abandoned copper mine on a tributary of Stapleton Creek in the north-western corner of the area. It may or may not be coincidental that there is a large basic intrusion nearby, but outside this area. The host rocks for the copper are interpreted to be Mount Bonnie Formation, probably arkose.

Numerous quartz veins in the southern part of the area have a northerly to north-westerly trend. These are worth sampling if their host rock is Mount Bonnie Formation.
REPORT ON

PHOTOGEOLOGICAL STUDY

OF

EXPLORATION LICENCE 4066

FOR

W. J. & E. E. FISHER

ON BEHALF OF

W. R. GRACE AUSTRALIA LTD.

PERTH W.A. 1983

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SUMMARY

EL 4066 comprises Proterozoic rocks of the South Alligator Group folded into a large anticline in the west and a syncline in the east, and affected by the updoming of sediments by the Burnside Granite in the south-eastern corner. Small local folds are plentiful and may be later. A major fault, the Mount Shoobridge Fault, lies along or just outside the western margin, and smaller faults are plentiful within EL 4066.

The overall strike is northerly except where the Burnside Granite intrusion produces a north-easterly strike.

A broad zone in the centre and central west of the EL is worth prospecting, and targets are present within two different host Formations. Saddle reefs may occur in the Koolpin Formation where it is folded into an anticline, near Mount Paqualin. Saddle reefs and/or quartz veins may carry gold in tuffaceous shale of probable Mount Bonnie Formation, some of which is outside this area.
RECOMMENDATIONS

1. A broad zone within EL 4066 is worth prospecting. This zone extends from Mount Paqualin north-eastwards to the south-western corner of EL 3320, and comprises two distinct targets:

   (a) Saddle reefs in possible tuffaceous bands within the anticlinal Koolpin Formation, similar to the old mine.

   (b) Quartz veins and saddle reefs within local anticlines of an overall synclinorium of shaley Gerowie Tuff and/or tuffaceous Mount Bonnie Formation.

   Some of the latter targets lie outside this area.

2. The quartz veins along the Mount Shoobridge Fault are worth sampling.
INTRODUCTION

EL 4066 lies approximately twenty-one kilometres east south-east of Adelaide River townsite on the Batchelor 1:100,000 map sheet and its western side is crossed by Howley Creek. The EL has an area of twenty-six square minutes and comprises a central block approximately twelve-and-a-half kilometres wide (east-west) by three-and-a-half kilometres long (north-south), with adjoining smaller blocks on both the northern and southern sides. On the western half of the northern side is a block approximately seven-and-a-half kilometres wide (east-west) by two kilometres long (north-south). On the southern side, approximately two kilometres in from the western edge, are two adjoining blocks, and another block is on the eastern end of the southern side, with a gap of approximately two kilometres between them. The two adjoining blocks are both approximately two kilometres wide, the western one being approximately five-and-a-half kilometres long and the eastern one being approximately four kilometres long. The other block is approximately five kilometres wide (east-west) by two kilometres long (north-south).

EL 4066 is covered by the photogeological interpretation of the Adelaide River region carried out in 1983 by L.G. Smith & Co. Photos used in this study were the CAG 1:25,000 colour
series flown in 1973. EL 4066 is covered by the following photos:

Run 8  numbers 1560 - 1564
Run 9  numbers 1632 - 1637
Run 10 numbers 1706, 1707

Fifteen map sheets at photo scale were produced and of these, EL 4066 occupies parts of Batchelor maps eleven, twelve and fifteen.

Access to and within the EL is very limited. There appears to be a station track which may run discontinuously from Mount Ringwood Station towards Mount Paqualin, and a north-south fence line cuts across the centre of the EL.

As the writer has not visited the area, the photo-interpretation, its maps and this report must be regarded as provisional.
METHOD:

The photogeological study was carried out using a Wild-Heerbrugg ST4 Mirror Stereoscope with additional eyepieces giving three times magnification.

The various photogeological units established for this area were compared with known photogeological units resulting from my work on E.L.'s 2362 and 2361 in 1982. The published geological map was also used as a reference and where the information was transferred to my map it has been distinguished by a subscript "B", representing "Bureau of Mineral Resources."

The photogeological information was compiled onto transparent (double clear) base maps which were enlargements to photo scale of existing topographical maps.
PHYSIOGRAPHY

EL 4066 contains the broad alluvial plain of Bridge Creek on its western margin but otherwise consists of low isolated linear hills and groups of hills separated by broad sandy or muddy valleys. The watercourses of both Bridge and Howley Creek are marked by lines of thick vegetation.
STRATIGRAPHY

The oldest rocks in EL 4066 are the Koolpin Formation rocks of the South Alligator Group, which occur both in the south-eastern corner and in the south-western block, in the vicinity of Howley Creek. These rocks are heavily intruded by dolerite, and it is photogeologically very difficult to distinguish between the dolerite and the massive ironstone (Esk_2), particularly as both produce red soils as weathering products. These rocks are overlain by Gerowie Tuff or its shaley equivalent. In the south-western block the Koolpin Formation Esk which runs northwards from Mount Paqualin is flanked on both the eastern and western sides by rocks interpreted as probable Gerowie Tuff Eso, which agrees with the published map. In the south-eastern corner the rocks appear to be more likely a shaley equivalent of the Gerowie Tuff, as photoidentification does not positively indicate Gerowie Tuff. By definition, the shaley equivalent would belong to the Mount Bonnie Formation Eso which is transitional between the Gerowie Tuff and the greywackes, shales and sandstones of the overlying Burrell Creek Formation Ffb. Hence the Mount Bonnie Formation may be, in part, a lateral distal equivalent of Gerowie Tuff as well as overlying it.

The central, northern and north-eastern parts of EL 4066 all contain Mount Bonnie Formation, and no rocks which could
be positively ascribed to Burrell Creek Formation were identified within this area. It should be noted, however, that arkoses of the Mount Bonnie Formation (Rso.a) and grey-wackes of the Burrell Creek Formation (Rfb.g) are photo-geologically very similar, and that some of the red shales of both Formations are identical, so the apparent absence of Burrell Creek Formation rocks from this EL is not definite.

The western margin of EL 4066 contains a few isolated outcrops which appear to be arkose with minor shale, with affinities therefore with the Mount Bonnie Formation.

A thick layer of sand (or subcrop) Czs lies between most of the hills, except in the alluvial plain of Bridge Creek. This sand is similar to that overlying the Burnside Granite to the south-east.

Alluvium and black soil, Qa, is generally restricted to the plain containing Bridge Creek and Gunn Creek, in the western part of EL 4066, and to part of the valley containing Howley Creek and its larger tributaries.
STRUCTURE

A. Folding:

There is an overall westerly dip throughout EL 4066, with only local reversals and variations due to small local folds, in general. The distribution of the rocks within the area does outline two large folds, though: an anticline just west of the centre and a syncline just east of the centre. The anticline, which has a core of Koolpin Formation at its southern end, trends north north-easterly from Mount Paqualin towards 'Bundey 1', and is offset by faults. The possible northward plunge of the west-dipping anticlinal axis, indicated by the disappearance of the Koolpin Formation beneath possible Gerowie Tuff or probable Mount Bonnie Formation, is accentuated by faulting.

The existence of the large syncline is not immediately obvious until two things are recognised:

(a) the dip reversals in the centre of the EL are not a function of the small local folding, and
(b) the reappearance of the Koolpin Formation in the south eastern corner implies uptilting there. This is accentuated by the outward tilting of rocks affected by the intrusion of the Burnside Granite.
The axis of the syncline trends north north-easterly and appears to plunge northerly. It is composed almost entirely of Mount Bonnie Formation rocks.

B. Faulting:

The south-eastern corner of EL 4066 is affected by faults associated with the disruption caused by the intrusion of the Burnside Granite, to the south-east.

The centre and western parts of the area contain both easterly and north-easterly trending faults, most of the latter having a north-side-west movement. The main easterly fault has a north-side down and -east movement, cutting off the northern end of the Koolpin Formation and bringing Mount Bonnie Formation down against it.

The western margin of this EL may just touch the longest fault in the whole area, the north-south Mount Shoobridge Fault. The line of this fault is marked by quartz veins and is occasionally offset by smaller faults generally moving north-side-west. It is difficult to work out movement on the Mount Shoobridge Fault in this EL, but overall it appears to be west-side-down, probably bringing Burrell Creek Formation rocks into contact with Mount Bonnie Formation rocks.
Structural Sketch of EL 4066
IGNEOUS ACTIVITY

The Burnside Granite, which has intruded rocks to the south-east of EL 4066, has affected the distribution and attitude of the rocks up into the eastern part of the EL and modifies the effect of the large folds, so it is probably later than the large folding. The granite causes its surrounding rocks to be tilted outwards and away and some blocks have moved outwards by faulting. The attitude of the Koolpin Formation in the south-eastern corner of the EL reflects the granite intrusion.

Dolerite only appears to intrude the Koolpin Formation.
METAL OCCURRENCES

The geological map of the Batchelor 1:100,000 sheet records an old gold mine just north of Mount Paqualin, within Koolpin Formation rocks and apparently on the anticlinal axis. This may indicate a saddle reef type of occurrence. On the photo (number B10/1707) the position of the mine shows up as a gap or saddle in the ridge of Koolpin Formation which runs north through Mount Paqualin. There is no obvious local structural disturbance here.

Some folded outcrops of probably shaley tuff lie in a zone through the centre of the EL, with the most photogeologically prospective areas lying just outside the EL.
(a) On the boundary of EL 4066 and EL 3320, on photo 8/1560 is a low-lying hill just west of the photocentre. It is interpreted to be altered arkose and shale, and two BMR measurements of dip indicate an anticlinal structure.
(b) Immediately south, on the south-western corner of EL 3320 but mainly within EL 4066 is an area of folded rocks which may be more tuffaceous but less altered than the first outcrop.
(c) South-west of this, in the western half of photo 9/1635, Gerowie Tuff passes eastwards into folded tuffaceous shale of the Mount Bonnie Formation, which lies in a gap outside EL 4066. (It may correspond to EL 2697.)
(d) South of this, in the centre of photo 10/1705, are two folded outcrops of probable tuffaceous shale and arkose. (The eastern ore is crossed by a north-south fence.) These would be almost on the axis of a large syncline judging by rock distribution, and both outcrops contain local folds which may be anticlinal. They appear to lie on ELs 2697, 3323 and probably 3471.
W.R. GRACE AUSTRALIA LTD.

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REPORTS ON

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OF

EXPLORATION LICENCES

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BY

L.G. SMITH & COMPANY

PHOTO INTERPRETATION SPECIALISTS

PERTH W.A. 1983
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Geological Key

to
Photo Interpretation Maps
1:25,000

Qa
Qs
Czs, CzL
Kp, Km
E0, Em
Btw, Bts, (Bth)
Btd
Pfb
Ps0
Esg
PsK a,b,c, etc.
Ppa,w
Ppd

\[ \text{Refer to Text (Volume 1)} \]

Bm
Bx
A

Pdz
Bgb,c,e,...

Alluvium
Loose sand
Scree, consolidated sand (includes sub-crops)
? Cretaceous flat cap of sediments
? Cambrian
Lower Proterozoic sediments
Palaeozoic
Proterozoic
Tolmer Group: sandstones (dolomite)
basal quartzites
Burrell Creek Formation
South Alligator Group: Mt. Bonnie
Gerowie Tuff
Koolpin
Basic intrusives
Granites