A GEOLOGICAL RECONNAISSANCE OF PORTIONS OF COUNTIES STANLEY, BURRA, LIGHT AND EYRE.

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INTRODUCTION.

The area under consideration is portion of Counties Stanley, Burra, Light and Eyre, and is situated to the south and south west of the Town of Burra. It lies between Farrell Flat to the west, Robertstown to the east, Waterloo to the south, and the northern boundary lies about 10 miles south of Burra. The main road from Adelaide to Burra runs approximately through the centre of the area.

Initially this work was undertaken as a Geological interpretation of aerial photographs, from which the base map was drawn. The interpretation of the Geology was limited to a delineation of the outstanding ridges by means of trend lines, all running in a north-south direction, details of this work being contained in a separate report on the photo interpretation which is appended.

It was realized after this work was completed that it would be necessary to check many features in the field and with this in view, a brief reconnaissance of the whole area was made.

It must be emphasized that owing to the limited time available, every portion of the area could not be visited. However, by a combination of information gathered in the field, with interpretation from the air photos, a regional picture of the Geology of the area can be presented.

The authors wish to acknowledge assistance provided by Professor Sir Douglas Mawson, with regards to research grants and transport facilities, also to both Sir Douglas Mawson and Professor E. A. Rudd for numerous suggestions.

GEOGRAPHY.

The topography of the area is relatively simple, and consists of a series of long, parallel and almost straight ridges running north and south. In the western and southern parts these ridges are low, rising only a few hundred feet above the valley floors, but in the north eastern section, the country becomes more rugged. The valleys are broard, and in parts are filled with deep alluvial soil. They are in general under cultivation or used for grazing.

The drainage, by virtue of the topography is also relatively simple. A major water channel runs nearly down the centre of each valley, and with the smaller feeding channels running out from the rises, forms a typical trellis drainage pattern. Near the centre of the area, this drainage feeds two small lagoons, whilst on the eastern side, most of the flow is into the Burra Creek towards the north, and straight out to the Murray Plains towards the south. The Burra Creek is a semipermanent stream, which has in many places become deeply incised in order to reach the level of the Murray Plains to the east.

VEGETATION.

The western two thirds of the area contains sparse natural vegetation, being largely under cultivation. Eucalyptus obliqua, and E. odorata are two common types however. Towards the eastern side, in the region north of Robertstown, thick natural vegetation is prominent in the more calcareous country, and the following species were found in this region: Eucalyptus oleosa, E. ? odorata, E. ? calcicultrix, Melaleuca sp., Acacia sp., Beyeria leschenaultii, Callitris glauca, and Callitris propinqua. The last named was notable in its distinct preference for the limestone beds themselves.

ROCK EXPOSURES.

In general, the rock exposures throughout the area are poor, with the exception of those in the quartzite, which outcrops prominently along the ridges. In most cases, it was necessary to follow along a creek which had cut through the soil and outwash material, and had exposed the bedrock in places. Numerous quarries from which road filling had been obtained were also utilized.

No attempt was made to map the beds in the immediate vicinity of Robertstown, as the exposures are poor, and it was found impossible to follow any of the beds found in the time available. This area has been extensively cultivated, and at the present time is mostly under crop.

STRATIGRAPHY.

A section continued to the west of this area, i.e. running north of Riverton, across an area mapped by A. F. Wilson (unpublished) shows that the tillite must be the lower Glacial horizon of the Adelaide System.

He obtained the following succession passing downwards. (Personal communication):

(Shale-sandstone group.
(Lower Tillite (including quartzite-sandstone group).
(Calcareous shales and slates.
(Dolomites and Limestones (equivalent to Beaumont dolomites).
(Slates etc.
(Thick Quartzite.
(Dolomites (equivalent to Torrens Dolomites of Adelaide region).
(Slates etc.
(Ilmenitic Basal series.

It would thus seem that the extensive limestone dolomite series would be the equivalent of the Beaumont dolomite in the Adelaide region, and of the dolomite-magnesite series in the Copley region, described by D. Mawson (1).+ This seems probable in view of the high magnesia content of some of the bands.

A Generalized Stratigraphic succession is appended.

\+ All references at end of paper.

PETROGRAPHY.+

1. The Limestone Group:

Dickinson (2) has recognised four zones in this Group. They are: The Upper Limestone, banded Dolomite, Calcareous Shale zone, and Lower Limestones. He uses the banded dolomite as a marker bed.

(a) The Lower Limestones: These are characteristically hard, dense, medium grained recrystallized rocks, in many places appearing as sugary marble. Some are of finer grain size, and all are either pure white, or very pale pink. Interbedded calcareous shales, of a soft and friable nature occur in the upper portions of this bed, below the dolomite. The limestones are severely contorted and crenulated, often the troughs of the crenulations being filled either with quartz or calcite. In places where it is most severely contorted and recrystallized, the development of Talc was noticed (Specimen 141). Specimens of this lower limestone submitted are Nos. 36 and 36A, the latter being a coarse granular crushed marble from within the fault zone (see Faulting). In addition, specimens of brecciated and crushed limestones from No.1 and No.2 asbestos localities are submitted (No.36B).

(b) Dolomite: The dolomite band is conspicuous by virtue of its dark blue colour, and dense fine grained nature. It often shows a fine white banding. At all places where the dolomite was seen, it was severely contorted, but would be of the order of 200-300 feet thick. Magnesite has been extensively gathered from the soil overlying the dolomite, where it occurs in modular residual form. (Spec.51 and 99A)

(c) The Upper Limestones: These are indistinguishable macroscopically from the Lower Limestones, and consist of pink and white recrystallized marbles in the main. In parts these limestones were very cherty, especially in the vicinity of loc. 34 (Spec.34).

+ Note: Specimen numbers are also locality numbers and are shown on the accompanying map.

Upper Limestone (cont.)

Typical specimens of the Upper Limestones submitted are Nos.44, 44A, 45.

Nos.43 and 62 occur near the junction of the Upper Limestones and overlying calcareous shales, and may be dolomitic.

The thickness of the limestone group as a whole is of the order of 2000 ft.

A notable feature of the group is the occurrence of crocidolite asbestos in certain places in the vicinity of Robertstown. This is the subject of a separate paper.

2. The Calcareous Shale Group.

These are indistinguishable from shales in other parts of the section, except that in parts their calcareous nature is shown by the presence of abundant Travertine in the overlying soil. They are typically blue coloured, well bedded rocks, and in parts are much more slaty than shaley, being very hard and dense (Spec.33,40). This group contains lenticular dolomitic or calcareous beds, also some hard arenaceous bands (Spec.64). Calcareous bands were observed near loc.40, also just east of loc.64, but were not mapped in detail. In the higher region north of Black Springs, these shales have been folded into an anticlinal structure pitching south. The south pitch is shown up by the convergence to the south of outcrops of minor quartzite bands within the shales.

In general this group has been mapped entirely as shales, and no detailed mapping has been done on them. Near Manoora, some shaley quartzite and micaceous sandstone were found in a quarry at loc.1. At loc.2, a well bedded floury type of rock was found, which under the lens appears to consist of very small quartz grains.

These rocks presumably lie within the shale group, although their extent was not mapped.

The Calcareous Shale group is overlain by the Tillite, into which it grades, the only definition in places being the presence or absence of erratics.

3. The Quartzite-Sandstone Group.

This group was selected as a marker, as it lies either immediately below, or very close to the base of the tillite, and particularly in the central and western parts of the area, forms prominent ridges, which can be followed for considerable distances.

It is shown on the map as one definite band, but really consists of at least three distinct bands. The lower one is a hard quartzite, and the middle one a more friable fluvio-glacial sandstone, somewhat felspathic. In some places, (eg. loc. and spec.10) the prominent ridge is made up of the sandstone, whereas in other places, (eg.loc.20) the ridge consists of a hard silicified quartzite.

This quartzite is light coloured, very dense and fine grained, and shows very little bedding. In some places it appears somewhat darker, being a fairly dark grey, but this change is purely local. Throughout the whole area, it has been extensively quarried for use as a road metal. Specimens No.21 and 77. In addition, coarse interglacial grits were found, as lenticular bands, and these have been numbered 55B, 55C and 77A.

In many places, especially near loc.20, there was observed a very coarse pebbly quartzite which graded into the tillite. Near loc.55, several rather coarse felspathic grit bands were observed, which were separated by tillite, whereas in other places, similar bands were separated by thin beds of shale, thus proving the variable nature of these sandstone-quartzite beds.

Near loc.17 there was a major quartzite band 120 ft. thick, separated by approximately 100 ft. of shale, which was overlain by a second quartzite band about 60 ft. thick. At loc.5 an outcrop of a felspathic sandstone was measured, but the dip of the bed could not be determined accurately, so assuming a dip of 60^{o}, the calculated thickness would be 190 ft.

It is considered that these quartzites are extremely lenticular in character.

4. Tillite:

This bed is not as prominent as the quartzite, as it erodes much more easily, but no trouble was experienced in locating it, by reference to the quartzite. On the western side of the area, it appears to contain fewer and smaller erratics, while retaining a typical tillitic appearance. However, on the eastern side, the erratics are larger (up to 2 ft. long), and many show striations. They are of quartzite, gneisses, shales, limestones etc., but the majority are quartzite.

An apparent amomaly occurs near loc.70, where the tillite directly overlies the calcareous shale group with no intervening quartzite sandstone group. However, a series of quartzites and grits interbedded with the tillite was found, and is assumed to be of the quartzite-sandstone group, although of later deposition than elsewhere. This is quite possible, considering the lenticular nature of the quartzites.

The tillite is probably of the order of 2000-3000 ft. thick, but counting the lenticular quartzite-sandstone group, and also the possibility of mother of till occurring above the tillite proper, the whole thickness could be of the order of 5000 ft.

Specimens submitted are: Tillite; 21A, 27, 54, 69 and 70.
Striated Erratics; 70, 95 and 105. ? Sheared Tillite 87, 103-105.

5. Shale-Sandstone Group.

These rocks overlie the tillite, and, as a whole, are fine grained argillaceous shales, often showing distinct bedding. In parts they have been transformed to a slate, with excellent slaty cleavage, especially near loc.7 and 8. The group contains minor sandstones and quartzites, probably of a lenticular nature, and often showing current bedding. At loc.13. the slates with interbedded quartzites were tightly folded. At loc.12. a white floury type of rock was observed, rather similar to that at loc.2, though at a different horizon.

The group is of the order of 5000 ft. (+) thick. Spec.52 is a grey coloured, very finely bedded shale, which resembles a varve type of rock. Spec.11 is a finely bedded shale.

6. Igneous Rocks.

The only igneous rocks met with in the area were at Nos.1 and 2 asbestos localities, and Bright asbestos locality. At No.1 asbestos locality, there are 2 shallow costeens, from which have been taken samples of crocidolite. In these costeens there are greenish coloured rocks, with a doleritic texture, and consisting of albite felspar, green biotite, and some crocidolite. In addition, some rocks composed almost entirely of Tourmaline were found here, and appear to be related to the dolerites. Similar rocks occur at asbestos loc. No.2 .

At the Bright asbestos loc., there is a rock consisting mostly of green biotite, which was called a chlorite schist by Dickinson (5) in his report on that field. This rock is possibly of igneous origin.

These rocks together with the crocidolite asbestos, are the subject of a separate paper.

7. Recent Deposits.

Recent deposits, mainly conglomerates, are particularly evident in the eastern part of the area. In several of the larger creeks, quite thick patches of Recent conglomerate are found. Some may be earlier, i.e. Pleistocene, but the only basis for age determination is the fact that they are found chiefly in creeks feeding into the old Murravian Gulf area.

No.40A is a highly ferruginous conglomerate found in small depressions in a creek feeding into Burra Creek.

No.123 is a coarse, light coloured calcareous (?) conglomerate found in considerable quantity in a creek just north east of Robertstown.

No.117 is a typical Chara limestone, found in some quantity in a creek north of Robertstown.

Magnesite occurrences throughout the limestone area may also be classed as Recent. These have been worked in several places, and occur as typical modules in the soil overlying more magnesic beds.

GEOLOGIC STRUCTURE:

1. Folding.

The series described above, viz. limestone, calcareous shales, quartzite-sandstones, tillite, and shale-sandstone group is a conformable one, and has been thrown into a series of anticlines and synclines apparently by an approximately east-west compressive stress.

The major synclinal structure on the far western section of the map (see section AB) shows no pitch direction by convergence of the limb outcrops, but a folded structure which occurred in the shale-sandstone group near Waterloo, was located from the air photographs. This was examined in the field, and the bedding was found to be nearly horizontal, but showed a slight pitch (approx.3^{o}) to the south.

Near locality 13, a rather complicated and severely contorted area occurs, and this was not mapped in detail owing to the limited time available, also as it does not appear to affect the regional structure at all.

Along both limbs of this syncline on the map will be seen numerous dip symbols, with no angle of dip recorded. This occurred where no bedding could be found in the quartzites, but the direction of dip was determined by topographic evidence such as tongueing of beds down a valley etc.

The anticline immediately to the east of this syncline at locality 19 showed a pitch of 15^{o} to the north. This was observed by taking the dip of the bedding on a cleavage surface. However, in his work further south, Robinson shows there that this same anticline pitches south. In the most northerly part of this anticline (see section CD) there is an abrupt change of topography (just north of the pipeline) from the usual broard valleys, to a series of high hills, almost as high as the quartzite ridges themselves. In this area, the calcareous shale group can be seen to be folded into an anticline, the south pitch of which is shown clearly by the convergence to the south of outcrops of minor quartzite bands within the calcareous slate group.

Thus it seems that the pitch reading obtained at loc.19 would be anomalous, although several changes of pitch are very likely to occur throughout the area.

The syncline immediately to the east again of this anticline, (see section CD) appears, by the convergent outcrops of the quartzite limb of the fold, to be pitching to the south.

Hence it would appear that in the western portion of the area, the major structure is syncline, anticline, and syncline, pitching to the south in general, but probably with changes of pitch which were not actually mapped.

The cleavage of the two shale groups in general appears to be dipping from 60° to a steep angle to the west, and this figure (60°) has been used throughout the area in constructing sections which show the probable structure. The folds are assymmetrical, also shown by the dips of the limbs, with their axes inclined to the west at an angle 60°.

Eastwards, the limestone belt is reached, and the structure of this group was mainly interpreted from the stratigraphy rather than actual mapping. The calcareous shales overlie the limestones, and are portion of the eastern limb of the prominent south pitching syncline.

Underlying these, and still dipping to the west are both finely and coarsely granular marbles, until a point is reached within the limestone belt where there has been intense crushing and shearing, made evident by brecciation of the limestones, and injection of quartz and in places of doleritic-looking igneous rocks. Beyond this fault, the marbles, including the dolomite, are intensely contorted, some coarsely granular marbles often containing talc.

Near the upper contact of these with the slates, they appear more definitely to be dipping now to the east, and the overlying calcareous shales are definitely dipping east.

Thus it would seem reasonable to assume tha structure shown by section E-F, i.e. an anticline which has been faulted down its axis, the downthrow side being to the west. The stratigraphic downthrow would be approximately 5000 ft.

This interpretation coincides fairly well with that made by Dickinson (2) further north in the same limestone belt.

Beyond the limestones and calcareous shales, a considerable thickness of tillite is found before passing into any quartzite. Although on the rest of the map, the quartzite-sandstone group is shown as one definite bed underlying the tillite, this is not really the case in many places, as it is certain that there are at least three bands of sandstones or quartzites, and that these bands are probably very lenticular in nature. It is extremely probable, even in the western portion of the area, that the quartzites in places have lensed into the tillite,- this was found to be so near loc.55., though it was considered better to show them as a definite bed.

In the small area between loc.70 and 77, the quartzites were not mapped in detail, but from the air photographs and from later field observations shown on the map, they can be seen to be part of a synclinal fold, which, from the nature of its converging limbs, pitches to the north. The nose of this fold appears to be extremely broken, and much vein quartz, and rocks resembling sheared tillite were found in this region.

To the east of the glacial beds are calcareous shales with minor quartzites, dipping again to the west. These are underlain by limestones similar to the others, and containing asbestos (in Hundred of Bright) like the more westerly limestone.

2. Faults.

The major fault in the area is that in the limestones. In the more northerly part of the area, near loc.36, the fault is evidenced by severe crushing and brecciation of the limestones, also by the conspicuous presence of vein quartz.

Further south, at No.1 asbestos locality, the limestones are very contorted and brecciated, and it is assumed that the major fault passes through this locality. Further east, the limestones (including the dolomite) are very contorted, but not brecciated as in the fault zone.

Going south even further to the No.2 asbestos locality, again the limestones are severely crushed and brecciated, with similar igneous-looking rocks (associated with the asbestos) to those at the No.1 locality.

The stratigraphic downthrow would be of the order of 5000 ft., the downthrow side being to the west of the fault. It is thus a strike fault, and possibly represents a break developed along the axial plane of the anticline.

Because of the occurrence of rocks of igneous appearance associated with, and apparently the cause of the asbestos, it is assumed that some igneous action was associated with this faulting, at least locally. The faulting probably took place during the Mid Cambrian orogenic activity which also produced the folding.

South of here is another fault which was mapped by virtue of a strong outcrop of fault breccia. The significance of this fault however, is not known, as this more southern portion of the area appears to be very broken up, and would require very detailed mapping.

At the Bright asbestos locality, the limestones are very crushed and brecciated, similarly to the more western ones, and there could possibly be another major fault here, accompanied by (?) igenous action which is assumed to have produced the asbestos.

Another major fault is probably represented by the scarp between the higher country and the Murravian plains, and this scarp can be traced on aerial photographs, although it was only observed at one place just east of the Bright asbestos locality. This would probably be a later fault, taking place in the Pliocene period of block faulting.

In the western portion of the area, several breaks in the quartzites were detected from aerial photographs. One just north east of Manoora was examined, and although no concrete evidence of faulting could be found, there was a definite displacement of the more northerly quartzite to the east. Again, near Porter's Lagoon, a similar displacement was seen to occur, where a whole segment immediately east of the lagoon could be seen to be displaced to the east. Two faults have been postulated here, although again no definite evidence could be found, but south of the lower postulated fault, the eastern limb of the fold appears to be dragged somewhat to the west. This faulting, if correct, may have some bearing on the origin of the lagoon.

Numerous other breaks similar to those above have been detected from the photographs, and marked in on the map, but have not been examined in the field.

Because of the general steep dip of the quartzites, it would take a fairly large vertical displacement to apparently shift them to the east, and hence it is thought that these breaks may be oblique slip faults, the displaced portions in almost every case slipping to the east.

This may have been caused during the period of compression when the beds were folded, the more competent quartzites rupturing in favourable places, rather than be folded.

At the nose of the north pitching syncline which occurs to the north east of Robertstown, there are numerous ridges of white vein quartz, and some rocks resembling sheared tillite, which indicate that the nose of the fold is severely broken. The fact that the quartzite there cannot be traced completely round the nose seems to corroborate this.

A generalized section across the whole area in an east-west direction has been drawn to approximately ½ scale (i.e. approx. 2 miles to the inch).

From the nature of the folding of the area, it would appear that the main compressive thrust came from the west, and that possibly a decollement type of folding occurred upon an ancient resistant basement block.

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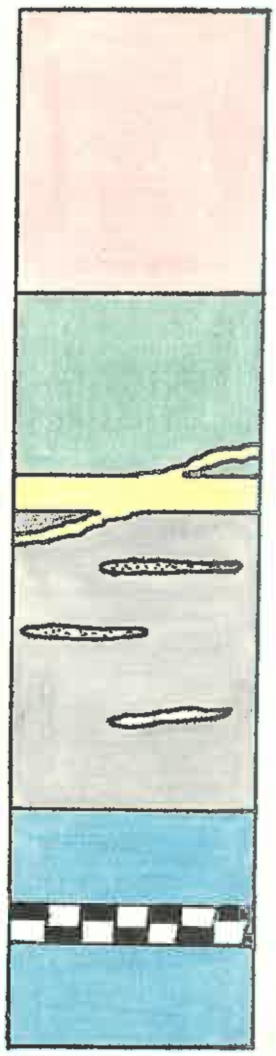
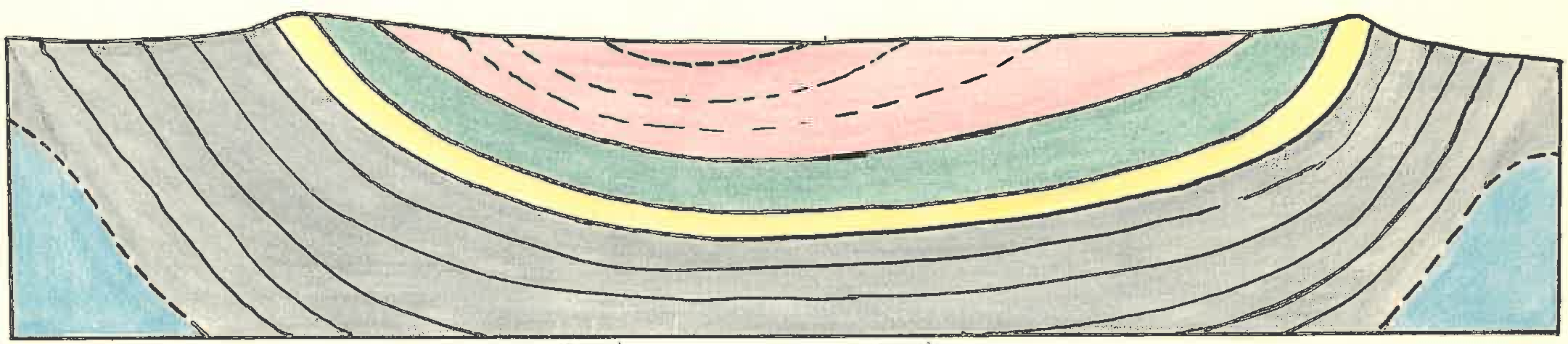
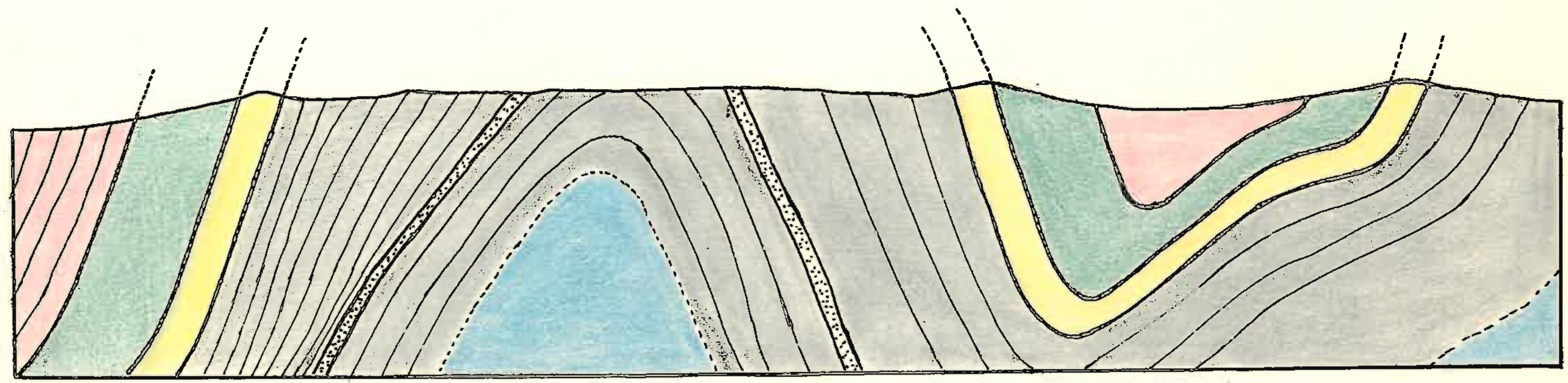
STRATIGRAPHIC COLUMN





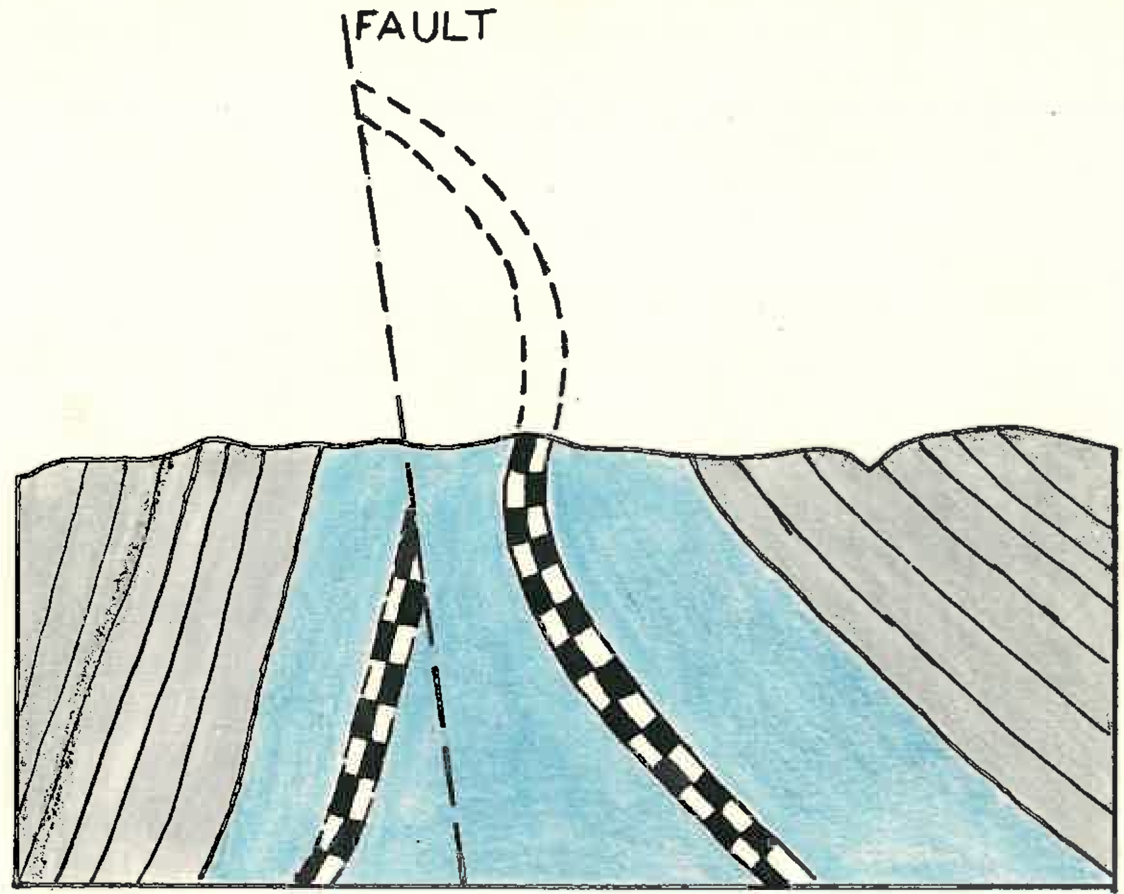
SECTION A-B

HOR SCALE 2IN=1MILE



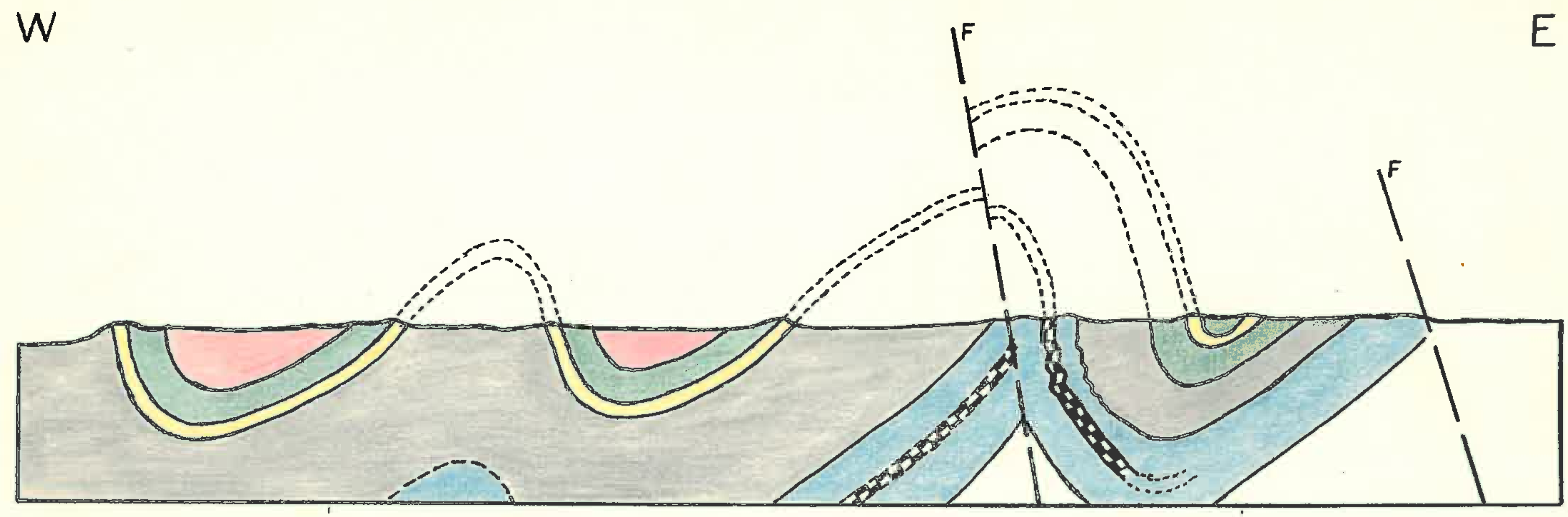
SECTION C-D

HOR SCALE 2 IN = 1 MILE



SECTION E-F

SCALE (HOR) 2 IN = 1 MILE



GENERALIZED E-W SECTION ACROSS THE AREA
SHOWING PROBABLE REGIONAL STRUCTURE

APPROX SCALE 1 IN. = 2 MILES.

APPENDIX.

REPORT ON PHOTO INTERPRETATION OF THE AREA.

INTRODUCTION.

As mentioned in the preceding paper, the base map of the area was drawn from a series of Aerial Photographs, after which some interpretation of the geology of the area was made from the photographs.

The following is a discussion of this work, and was drawn up before any field work on the area was contemplated.

It will be noted that the interpretation does not agree, in some cases, with facts later found in the field, however it has been left in the form in which originally written.

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REPORT ON PHOTO-INTERPRETATION.

LOCATION. The area examined is a rectangular block bounded by the towns, Manoora, Merildin and Farrell Flat on its Western Side, the block running east to the "The Gums" Station.

Portions of the Counties Stanley, Burra, Light and Eyre are included.

TOPOGRAPHY. The area in its Western portion consists of a series of roughly parallel high ridges, separated by wide valleys, with an approximate N-S trend. These ridges are a series of synclines and anticlines, the ridges being of harder rocks, the valleys in between being of softer rocks which have yielded more readily to erosion.

Due to this parallel arrangement of the hard and soft rocks which have been repeated by folding, the typical trellis-like drainage pattern is very well shown, streams only cutting through the harder bands of quartzite, sandstone etc. on very rare occasions.

In its Eastern portion, the area consists mainly of a flat plain, the main drainage through this being the Burra Creek to the north, and Spring Hut Ck. to the south.

GEOLOGY. An attempt was made to join this area on to Robinson's area to the south (being a portion of County Light) (unpublished) and to Dickinson's area to the north.

Robinson found the following succession of beds:-

(1) Calcareous shale (2) Arenaceous shale (3) Quartzites and Grits (4) Fluvioglacial Sandstone (5) Tillite, above the tillite being shales and slates (possibly of the Tapleys Hill horizon).

The main structures of Robinson's area were found to closely agree with those of the area described above, as interpreted from aerial photographs. However, an assumption was made that the quartzites, grits and fluvioglacial sandstone would be the beds most resistant to erosion and that these would constitute the highest portions of the ridges. It was also assumed that the tillite would be more resistant than the various shales but less resistant than the quartzites etc. Thus the tillite would probably occupy the lower foothills leading up to the high ridges. It was realized that this was not an infallible assumption, some high points on the area possibly being due to structural control, but it would probably hold good in general.

Some boundaries between different coloured beds could be detected, but often could not be traced very far because of cultivation or thick scrub. Thus it should be realized that boundaries between the beds remain very approximate until these and thicknesses can be checked in the field.

Passing north from say Waterloo or Manoora, it is found that the syncline which is most easterly on Robinson's map, (and down which runs Brady's Creek), gradually converges, but before quite doing so, is cut off by Dickinson's Kooringa Fault, just south of the Burra. This means that the syncline is pitching to the south. On the whole, the dip of the sediments on the ridges is fairly steep, which means that the beds are fairly tightly folded.

The large anticline which occurs on Robinson's map, immediately to the west of the above syncline, can be traced northward without a break, until a small section of the western limb appears to be displaced slightly to the east. Two faults have been postulated here, although actual displacement of the beds cannot be seen. These faults (if they actually exist), may have some connection with the origin of Porter's Lagoon which is situated just to the west of the displaced portion. Similarly, further south, in the centre of this anticline is another smaller lagoon which may have some connection with Robinson's postulated fault. This fault was shown by him as running down the centre of the anticline, as deduced from field evidence (crushing etc.), but no evidence for the fault could be deduced from the aerial photographs possibly because the so-called fault is parallel to the strike of the beds. This anticline is shown by him as converging to the south. This is further evidence that the major folds pitch to the south. Just north of Porter's Lagoon, the western limb of this anticline is tightly folded into an anticline and syncline, both of these having a pitch to the south. This minor syncline may even be slightly overturned. The western limb of the syncline immediately to the west of the above anticline, appears to be fairly well unbroken, except in one place, just north-west of Waterloo, where a minor break in the ridge occurs. A small fault has here been postulated. The softer shales in the region of Waterloo show, very conspicuously, a synclinal structure which also pitches to the south.

In the northern part of the described area, an attempt was made to tie-in with Dickinson's map of the Burra region, but due to the fact that he used a different nomenclature for beds from Robinson, this was rather difficult. However, Robinson's nomenclature has been adhered to. The structure as interpreted from aerial photographs was essentially the same as that found by Dickinson. The large converging syncline described above, was clearly seen to be cut off by the Kooringa Fault, which was traced in a south-easterly direction, roughly parallel to the Burra Creek. However, the southern extent of this fault was not clearly shown by the photographs, although it is suspected that it probably runs almost to Robertstown. The limestone-dolomite beds could be traced southward from Burra for some distance, but thick scrub necessitated the boundaries being put in very roughly. However, this belt probably runs down to the vicinity of Robertstown, as marbles containing crocidolite are known near this town.

The dome structure at Princess Royal Mine, as shown on Dickinson's map, could be clearly seen, with a pocket of the limestone in the centre.

The tillite (No.3 in Dickinson's legend), which occurs east of Burra, was roughly dotted in and made to follow approximately the trend of the limestone belt, although this is purely hypothetical and field evidence would be required to justify this inclusion.

The structures a few miles north of Robertstown, appear to be complex, and no attempt was made to put these onto paper, without some field observations being made first.

Just east of Robertstown, the plains begin and a large fault would be postulated as separating the last high ridge from the plains.

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