THE STRUCTURAL GEOLOGY

OF THE

RAPID BAY – SECOND VALLEY AREA, SOUTH AUSTRALIA

A. C. KIRK, B.Sc.

School of Geology,

University of Adelaide.

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ABSTRACT

The area is structurally homogeneous with respect to a single fold axis.

The style of folding is recumbent, with the axial plane dipping gently to the east. It is postulated that the anticlines close to the south, in accord with the regional anticlinorium. Extensive thrust faulting has accompanied this folding.

There is some evidence for a second, minor period of deformation superposed on the first.

The pressure exerted during the intense folding of the area is thought to be the dominant cause of metamorphism, with only relatively low temperatures involved. The rocks contain low grade mineral assemblages, and are assigned to the quartz-albite-epidote-biotite subfacies of the greenschist facies.

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FIGURES

I. INTRODUCTION :

Preliminary work in the Rapid Bay - Second Valley area was commenced in 1962, on the suggestion of Dr. J. Talbot. The majority of material presented in this report was completed in 1963 under the supervision of Dr. B. Daily.

The objective in mapping was to determine the structure - stratigraphy relationships with the possibility of applying this further knowledge to elucidate the geology of the Mount Rapid - Rapid Bay region.

1. Location

The area is approximately sixty (60) miles from Adelaide by road. The area investigated is defined roughly by the coast to the north-west, the Delamere - Rapid Bay road to the south-west, Delamere - Second Valley road to the south-east, and the road from the Second Valley township to jetty in the north-east.

As shown on the locality map (Fig. 1) the area covers approximately 7 square miles.

2. Physiography

Topographical features of the Permian glaciation can still be recognised in the occurrence of broad U-shaped valleys, but the present cycle of erosion

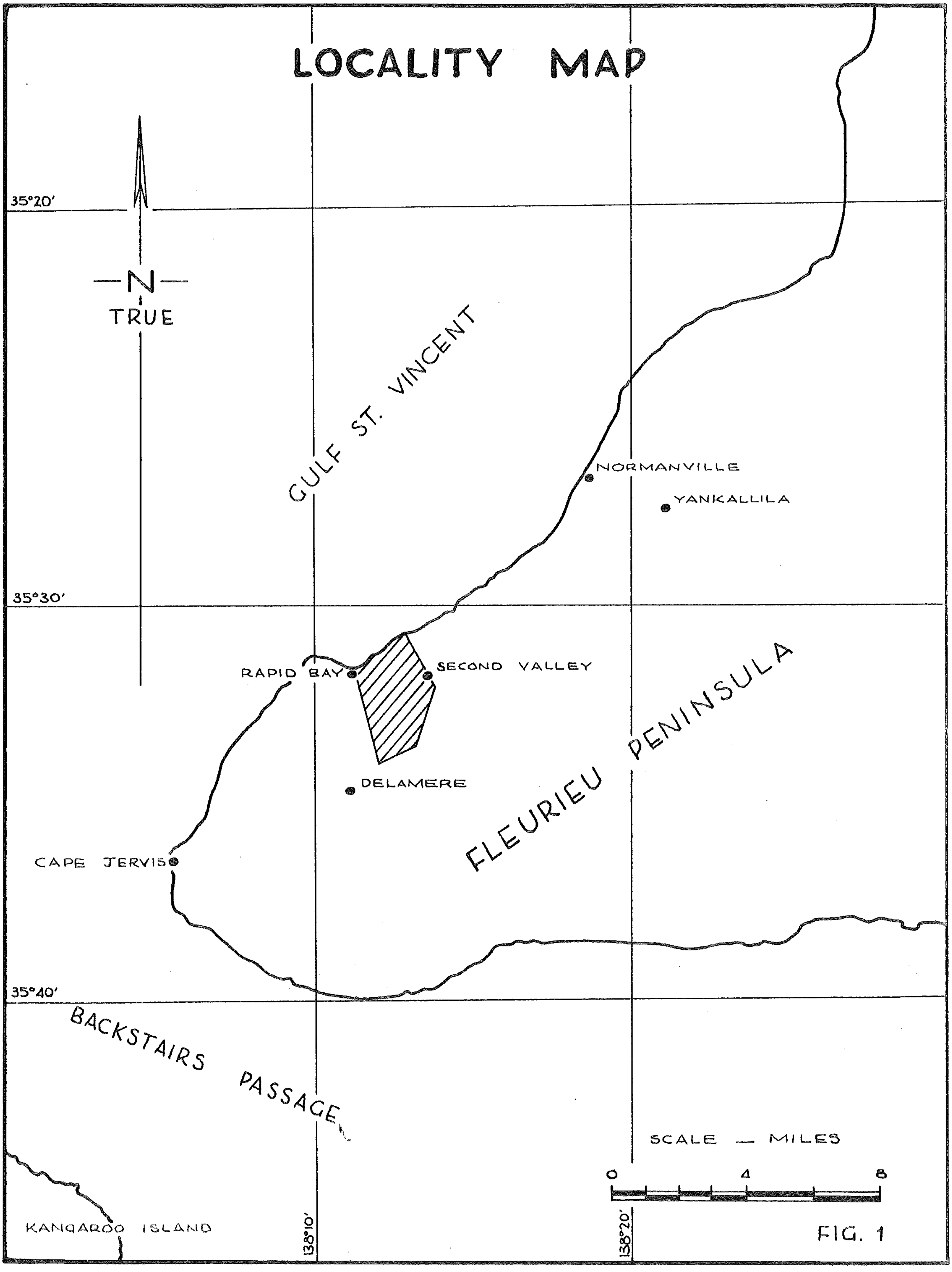

LOCALITY MAP
N
TRUE
35°20'
35°30'
35°40'
GULF ST. VINCENT
NORMANVILLE
YANKALLILA
RAPID BAY
SECOND VALLEY
DELAMERE
FLEURIEU PENINSULA
CAPE JERVIS
BACKSTAIRS PASSAGE
KANGAROO ISLAND
138°10'
138°20'
SCALE — MILES
0
4
8

FIG. 1

has been dominant in forming the semi-mature topography now seen in the area. This present cycle of erosion is the result of the uplift of the Pre-Tertiary peneplain during Tertiary and Quaternary times.

Smooth, elongate ridges and generally steep V-shaped valleys running parallel to the coast are characteristic of a greater part of the area. A long ridge, near the Rapid Bay road, running normal to the coast, divides the drainage system of the area into two distinct parts. All minor streams, apart from those near the coast, run parallel to the strike of the rocks and to the coast; these streams have not been controlled by any Pre-Tertiary land features. The main rivers, the River Yattagolinga and River Parananacooka, cut across the strike of the rocks and run normal to the coast. In the case of the River Yattagolinga it is clear that an old stream channel, cut through a thin cover of soft Permian sediments into the more resistant older rocks, is being rejuvenated by the present erosion cycle. The River Yattagolinga is therefore an example of an entrenched stream, and is not thought to mark the position of a fault, although this could be an additional feature.

Outcrop is good along the River Yattagolinga and its steep valley sides until about 1½ miles from the coast, where the river becomes a meandering stream in a broad valley.

Streams oblique to strike, predominantly those on the south-west side of the long dividing ridge, generally show good outcrop.

For the rest of the area, outcrop is scattered.

The coastal cliffs, running approximately parallel to strike, show the best outcrop but are extremely steep and unsafe to climb. The Second Valley jetty area was useful as the cliffs are partly accessible and show a section approximately normal to the strike.

3. Mapping method

Field observations were plotted onto transparent overlays covering aerial photographs of scale 1" to 20 chains. The data was then compiled onto a base map of the same scale, or for more detailed mapping to a scale of 1" to 10 chns.

4. Recent investigations

Of the recent contributions on the geology of the north-western district of the Fleurieu Peninsula, the most important are those by Dr. B. Daily (1963), R.D. Drayton (1962) and W.C. Leslie (1962).

Leslie did not [illegible]

Leslie, working in the Delamere region, was able to demonstrate in Stockyard Creek a straight stratigraphic sequence from Heatherdale Shales (Upper Cambrian) to a Brighton Limestone Equivalent and Tapley Hill Slate Equivalent (Sturt Group of the Adelaide Supergroup), in what was previously thought to be an overturned sequence (Campana, Wilson and Whittle, 1955).

This Brighton Limestone Equivalent outcropping in Stockyard Creek was mapped north, along strike, by Drayton, into No Where Else Creek of the Rapid Bay area. Drayton, by postulating an anticline closing to the north-east (note this is against the regional picture of a south-west closure for anticlines), equates this Brighton Limestone Equivalent of No Where Else Creek with the Mount Rapid limestone and by further folding to the Rapid Bay limestone. The style of folding involved is recumbent.

Daily, although generally accepting Drayton's interpretation, discusses the possibility of faulting causing this north-east closure, and a straight overturned sequence from the Mount Rapid limestone to the Rapid Bay limestone.

Possibility of faulting also recognised by Drayton

II. STRATIGRAPHY :

1. General

The possibility of correlating distinct lithological divisions in the Delamere marble with units of the Cambrian sequence, as established by Abele and McGowran (1959) for the Sellick Hill area, was first realised by B. Daily in 1962. He recognised the metamorphic equivalents of 5 of these units in the Delamere region, and conclusively established their

Cambrian age by the discovery of hyolithids, scanty gastropod remains, and worm castings in the beds predicted to be fossiliferous by comparison with the Lower Cambrian section of Sellick Hill.

The base of the Cambrian is defined by the lowest known occurrence of hyolithids. In Stockyard Creek, where this work was carried out, the Cambrian conformably overlies Pre-Cambrian rocks.

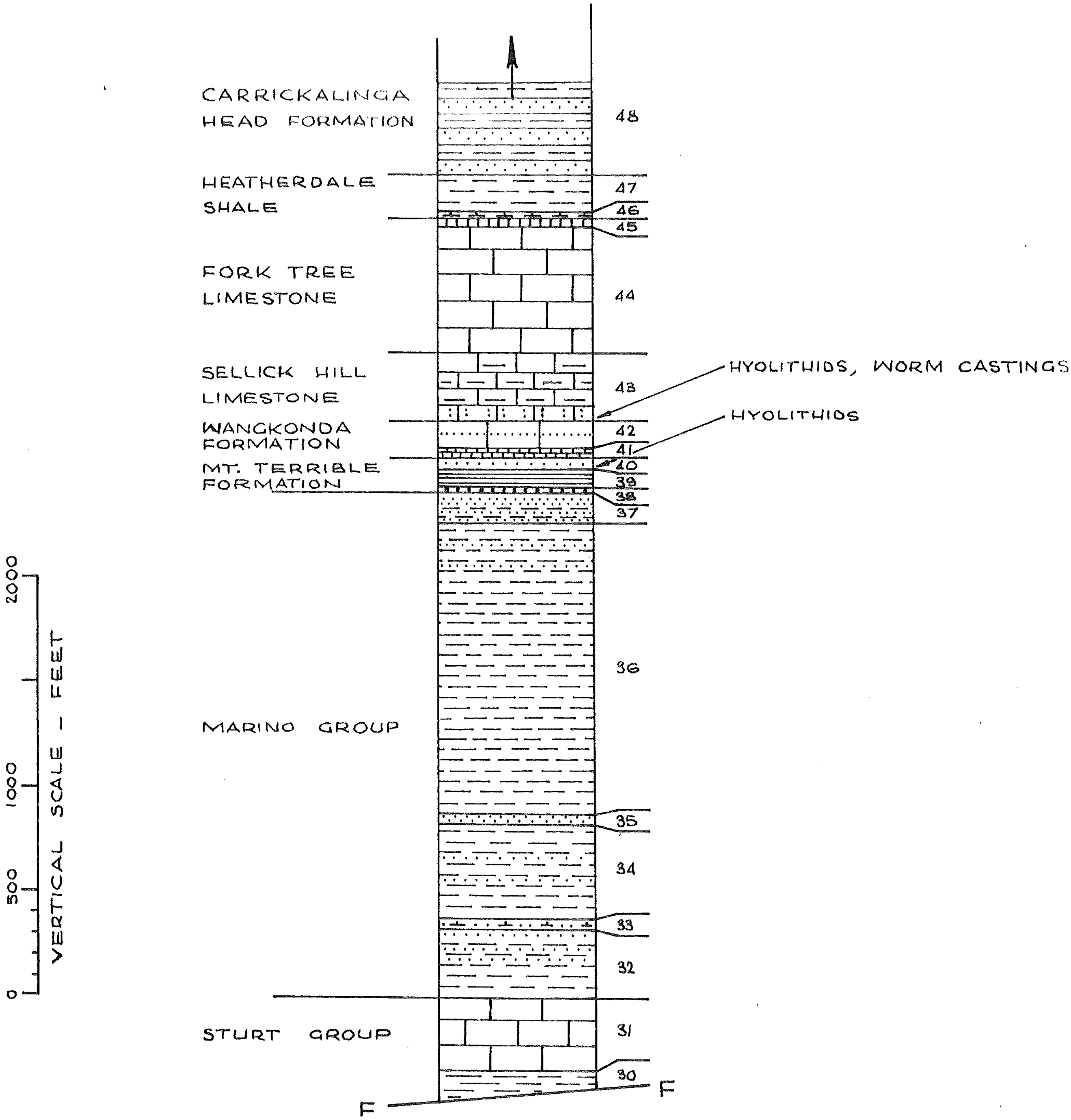
On extending investigations to the Pre-Cambrian, the equivalents of several of the rock-stratigraphic divisions of the Adelaide "System" could be distinguished. A stratigraphic sequence from a Tapley Hill Slate Equivalent to the base of the Cambrian was established.

Metamorphism of the area is low grade (Greenschist facies). There are no great lithological changes caused by the crystallisation of new minerals, apart from the abundance of micas, therefore it is possible to correlate metamorphic units in the area with the unmetamorphosed units of the type section.

In accordance with Daily's proposed terminology for the Cambrian and Pre-Cambrian succession of the Fleurieu Peninsula, rock-stratigraphic terms, namely Marino and Sturt Groups of the Adelaide Supergroup, will be used.

Mapping of the Rapid Bay - Second Valley area required a knowledge of the established stratigraphy for the Cambrian and Pre-Cambrian of Stockyard Creek. A brief review of this work will be given; for a detailed account see Daily (1963) and Leslie (1962).

STRATIGRAPHIC COLUMN
STOCKYARD CREEK, DELAMERE



(AFTER B. DAILY, FIG. 1, 1963)

FIG. 2

2. The Cambrian - Proterozoic Sequence of the Delamere Region

The stratigraphy of this area was established from the sequence shown in Stockyard Creek. The results are summarised in Fig. 2 (after Daily, 1963).

Sturt Group Unit 30, the lowest member of the Sturt Group exposed in Stockyard Creek, is a calcareous sequence of finely laminated black phyllites truncated by a fault at the base. These beds have been correlated with the Tapley Hill slates. In the tectonically developed tension gashes concentrations of calcite, quartz and muscovite are prominent.

These beds grade up into the flaggy limestone of the lower Brighton Limestone Equivalent (unit 31). In the lower parts this limestone is quite argillaceous, but the upper parts contain marble bands. The marbles vary in colour from cream to a banded light blue-grey. A buff coloured dolomite band occurs near the top.

Marino Group The boundary, established with some difficulty, between the Sturt and Marino Groups is marked by a 350 ft. sequence of calcareous, finely laminated dark coloured siltstones with quartzites strongly developed near the top (unit 32). Above this is a band of 'gritty marble'. This (unit 33) distinctly feldspathic rock, consisting of lensing marble bands in a coarse calcareous sandstone, is tentatively correlated with the Hallet Arkose of the Adelaide region. Then follow more siltstone beds (unit 34), with minor quartzite bands. A massive quartzite (unit 35) is overlain by a thick sequence of phyllites. The phyllites are strongly lineated, with magnetite crystals developed in parts of the sequence. Unit 37, the uppermost unit of the Marino Group, consists of lenticular siltstones and shales interbedded with quartzites; there are several beds of massive clean quartzites.

Mount Terrible Formation "This new name is proposed for a sequence of dominantly clastic rocks above the Marino Group and below the Wangkonda Limestone. The name is taken from the rise called Mount Terrible, 4 miles south-west of Willunga" (B. Daily, 1963).

The lowermost unit (unit 38) of this formation, a 5ft. thick massive arkose band, is overlain by grey phyllites containing thin bands of calcareous sandstone. Twelve feet above the base of the uppermost unit, a fine to coarse grained calcareous sandstone, is a 3-4 inch band containing abundant hyolithids and scanty gastropod remains. The Cambrian-Precambrian boundary, at present defined by the lowest known occurrence of fossils in the area, is therefore placed immediately below this hyolithid band.

Wangkonda Limestone (Marble phase) The base is a mottled blue-grey argillaceous limestone (unit 41). Above this is a massive blue-grey marble which grades into a pink marble at the top; this unit (unit 42) is split by a 12 ft. thick sandstone band.

Sellick Hill Limestone Unit 43. Lenses of sandstone in the basal portion of this formation contain worm castings and numerous hyolithids. Dominantly a banded and mottled argillaceous limestone.

Fork Tree Limestone (Marble phase) The lower member (unit 44) is a massive light coloured marble, becoming banded in the upper parts. Near the base it is characteristically a coarsely-crystalline (saccharoidal) pure marble. The upper member (unit 45) is a massive argillaceous limestone.

Heatherdale Shale (Phyllite phase) A dark nodular phyllite; the nodules are calcareous in the lower member and carbonaceous and phosphatic in the upper member.

Carrickalinga Head Formation Unit 48. Consists of alternating bands of phyllites and greywackes. At present accepted as the lowermost unit of the Kanmantoo Group.

3. Environment of Deposition

Evidence for a shallow water origin and probable paralic environment for the Marino Group sediments is the prominence of current bedding, the lenticular nature of the ripple marked uppermost unit and the mudcracks in the siltstone of the lower units and the uppermost unit.

The Mount Terrible Formation lies conformably on the Marino Group. However, it does suggest a new cycle of deposition. After the shallow water, paralic environment of the Marino Group there is a transgression, culminating in the full-marine conditions of the lower Cambrian. The calcareous-clastic sequence of the Mount Terrible Formation is therefore interpreted as a transgressive unit.

III. PETROLOGY OF THE CAMBRIAN - PROTEROZOIC SEQUENCE OF RAPID BAY - SECOND VALLEY :

A detailed knowledge of the Stockyard Creek sequence has been of major importance in field mapping. Essentially the structural interpretation of the area depends upon the nature of the stratigraphic correlations. Therefore the following account of the Cambrian - Proterozoic rocks is not a detailed lithological study (they are little different from the Delamere region) but is comprised of descriptions on which field correlations can be based.

Where the petrography is significant, this has also been included.

A stratigraphic position cannot generally be assigned from the isolated outcrop of a bed, but must be made from a consideration of the relationship of the bed to the surrounding rock types. This is often difficult because of the poor outcrop.

Plate 1 is essentially a fact map showing the proposed stratigraphy of the area (the coloured portions have generally been restricted to actual areas of outcrop). Plate 2 is a structural interpretation based on the stratigraphy.

<u>1. Sturt Group</u>

<u>Tapley Hill Slate Equivalent</u> Restricted in outcrop to the coastal sections. A non-calcareous black silty phyllite (micas not prominently developed). It is finely laminated and possesses a good cleavage parallel to the bedding.

<u>Brighton Limestone Equivalent</u> The lower parts are a blue-grey shaley limestone, exhibiting a prominent cleavage that is parallel to the axial planes of the folds. This limestone is generally micaceous to some extent, and in parts (particularly specimens A 248/14 and 50b — for location and description see Appendix) the micas are an essential mineral and

impart a peculiar linear feature to the rock that is inconsistent with the B′-lineation for the area, however, not enough is known to comment fully on the significance of this feature, but it is oblique to the bedding-foliation planes and probably represents incipient strain-slip cleavage related to a B″-fold axis (see Pl. 9, Figs. 1&2, and discussion p. 29).

A massive crystalline marble forms the upper phase of this limestone sequence. The marble varies in colour from pink-white to a mottled and banded blue-grey and white; the banding probably represents original bedding. Where the marble contains impurities, for example micas and very small quartz grains, these are concentrated into layers that are parallel to the overall banding. Thin folded bands of micas are relatively common.

The upper boundary of the Sturt Group is difficult to define. Because of the need to have some feature by which it can be approximately recognised in the field the author places it above the dolomite or interbedded dolomite and shale which generally overlies the marble bed. This unit, if it occurs (for example at locations O/1.5 and E/14.1), is characterised by thin beds of pale buff dolomite that are frequently interbedded with dark coloured shales. Location N/1 is a more massive outcrop of dolomite belonging to the same unit. A very siliceous dolomite occurs at location L.9/4.1 (not shown on Plate 1) and N.5/2.5; the dolomite outcrop at L.9/4.1 shows "flow" structures developed around prominent lenses of quartz.

2. Marino Group

Grey siltstone, phyllite and shale These beds are dark coloured and are often slightly calcareous. They are usually finely laminated and current bedded, but no conclusive facings have been discovered. All laminae grade imperceptibly into one another or are lensed out by weakly developed tension gashes. These tension gashes in association with the prominent cleavage parallel to the bedding impart a slightly blocky nature to the rock.

All the rock types of this unit are micaceous to varying degrees. Thin section studies show an overall preferred orientation for the micas which is probably parallel to the original bedding. Specimen A 248/43 shows sorting of the grains of quartz, mica and calcite producing a rough banding on grain size, the micas are far more prominent in the finer grain size bands and their preferred orientation is parallel to the banding.

The most characteristic feature of these rocks is their finely laminated appearance.

Sandy to gritty feldspathic marble Pink-white to blue-grey in colour and distinguished from the marble phase of the Brighton Limestone Equivalent by the presence of larger sandy to gritty particles. In the most striking occurrences (for example locations K.8/6.9 and N/11) large quartz (to 1cm.) and feldspar (to about 5mm.) grains stand out on the weathered surfaces. Generally the size of these grains is of the order of 1-2mms. The grains are subrounded and the sandy ones in particular often occur as bands in a slightly sandy marble matrix (Fig. 3, p. 24, from location K7/7.9 shows two such sandy bands). Equally as common the grains are scattered throughout a marble matrix (A248/7).

There appears to be only one band of the very gritty marble, but there are several bands of the sandy marble. All are quite feldspathic. The sandy marble bands are interbedded with sandstones and siltstones.

<u>Sandstone, quartzitic sandstone and siltstone</u> Detailed petrographic studies have been carried out on numerous specimens from this unit with the objective of trying to find some distinctive feature that might help in differentiating this unit from the Upper Marino Group quartzites. Although more specimens are needed before presenting any definite conclusions it would appear that compared to the Upper Marino quartzites the Lower Marino sandstones and quartzites are richer in biotite and contain a higher percentage of feldspar (compare A248/31a, 17, 20a, 35 with A248/19, 71, 73a). For this reason the quartzite around location G/11 (A248/31a is from this band) has been correlated with the Lower Marino sandstones. A248/31a shows extensive

recrystallisation and a pronounced orientation of the elongate quartz grains that is parallel to the preferred orientation of the biotite (Pl.4, Fig.1). The Upper Marino quartzites are just as extensively recrystallised but not lineated (Pl.4, Fig.2), however, this is of no significance as they have not undergone the same intense deformation. The lineated specimens come from highly deformed areas.

The only conclusive facing for the whole area was observed in a sandstone band of this unit (A 248/17 from location H.8/11.1 comes from this band). The sandstones are generally current bedded, but only in this one instance could a facing be established.

What dir? Restricted to this unit is a thin bed (about 1 ft. thick) showing graded bedding (for example, at locations H.2/6.5 and H.6/14.8). The lower part of this bed contains well rounded, elongate grains of quartz and feldspar (up to 2mm.) in a fine grained silty matrix (A248/67).

Several specimens of sandstone from this unit show on their weathered surfaces numerous, closely spaced, small "tension gashes" that give a lineation that is oblique to the bedding; this feature could possibly be of similar origin to the B"-lineation previously mentioned in the limestones.

<u>Grey-green phyllite</u> Very fine grained phyllites, in which the micas and quartz are generally in approximately

equal proportions (A 248/64, 68, 72). Strong preferred orientation of the micas. These rocks possess a well developed cleavage that is parallel to the axial plane of the folds and to the bedding. Magnetite is always an accessory mineral (up to about 5% of the whole) and at several locations (particularly H.2/10.3) small octahedra of magnetite are prominent on weathered surfaces.

This unit does contain harder silty bands, and several of these have been found to contain actinolite, chlorite and epidote (A 248/6c, 68).

Massive to flaggy quartzite These beds have been found to contain less feldspar than the Lower Marino sandstones and quartzites and little or no biotite (A 248/71, 73a). Muscovite is generally present in small amounts (3-10%). For these reasons only has the sandstone band around location F/10 (A248/19 is from this band) been correlated with the Upper Marino quartzites. A 248/19 does contain a small amount of biotite (about 2% biotite-muscovite), however, a more extensive study of the Upper Marino quartzites may show that they do in fact contain some biotite. Also, A248/19 is only one specimen from the sandstone band. This therefore points out an area for further study. The present statement is only a hypothesis involving an extremely tentative correlation.

The colour change in the quartzites from dark blue-grey in the south to pale pink-white in the north is only a weathering effect as there is no significant change in composition (compare A248/71 with A248/73a).

This quartzite unit consists of four to five bands interbedded with fine grained siltstones.

3. Mount Terrible Formation

This consists of calcareous, fine grained to gritty sandstones. Occasional interbedded siltstones are observed.

Hyolithids have been found in a sandstone band near the top of this unit, thus establishing the lower Cambrian boundary.

4. Cambrian Sequence

The Cambrian marbles conformably overlie the Mount Terrible Formation and the Cambrian sequence, including the upper parts of the Mount Terrible Formation, is the same as for the Delamere area. There are no noticeable facie changes parallel to the strike of the beds.

IV. PETROGRAPHY AND GRADE OF METAMORPHISM:

A detailed petrographic study of 60 selected specimens from the area has been completed. In this section it is proposed to discuss the various aspects that are indicative of the grade of metamorphism attained by the rocks and to comment on their original composition.

Feldspars are prominent in the Lower Marino sandstones and quartzites. Plagioclase (albite, composition about An_{6-8}) is in far greater proportions than potassium feldspar (there is generally only a small percentage of orthoclase, perthite or microcline present). The feldspars are commonly sericitised. Numerous grains of chequer or chess-board albite (Schachbrettalbit) have been observed (for example, A 248/27, see Pl.5, Fig. 1). It is not clear whether this is detrital chequer-albite or detrital albite (possibly secondary after potassium feldspar?) in which the chequer pattern has developed subsequent to deposition (Starkey, J., 1959). Two possible origins for chequer-albite have been stated, namely metasomatism of potassium feldspar to sodium feldspar and deformation. If it is of metamorphic origin, then it can be postulated as having formed during the deformation of the area, as no metasomatic effects have been recorded. The presence of chequer-albite can therefore be taken as a possible indication of forces causing metamorphism. Deformed twin lamellae are not uncommon in the plagioclases (for example, A 248/20a), and it is thought that this deformation is not original but developed at the time of metamorphism.

Inclusions of plagioclase and quartz in microcline (Pl. 5, Fig. 2) and myrmekitic structures (Pl. 6, Fig. 1) are two definite detrital features.

Secondary feldspar growth is commonly observed (A 248/27, 51), where clear secondary plagioclase surrounds highly altered original detrital plagioclase. The quartz grains throughout the more arenaceous rocks generally show recrystallisation of grain boundaries. Pl. Fig. (A 248/31a) shows a strong linear arrangement of this recrystallised quartz. These features are indicative of forces being a dominant feature of metamorphism.

A 248/20a, although containing about 3% calcite, a small amount of chlorite and 40% quartz, does not contain epidote. With the composition available it might have been expected that some epidote would form

calcite + chlorite + silica $\rightleftharpoons$ actinolite + clinozoisite + CO_2 + H_2O.

This has not occurred. It is highly likely therefore that the chlorite present is retrograde from biotite and not an original mineral. It is also possible that the pressures involved during metamorphism were too great to allow the development of epidote.

From a study of specimens A 248/6c, 63, 64, 72 some idea of the original composition of the rocks can be obtained. It is thought that the greater proportion of biotite present in the area is of metamorphic origin. Throughout all the thin sections it was noted that the biotite is generally smaller in size than the quartz and feldspar grains; if it is of sedimentary origin it would be expected to be larger than the quartz and feldspar (from considerations of sorting and settling).

Pl. 7, Fig. 1 (A 248/64) shows a strong preferred orientation of small grains (< 0.1 mm.) of biotite and muscovite flowing around weakly orientated large grains (up to 0.5 mm.) of biotite. There is a distinct difference in grain size between the 'porphyroblasts' and matrix. In Pl. 7, Fig. 2 (A 248/72) there is no such distinction, the micas simply vary in size from small (< 0.1 mm) to large (up to 0.4 mm.) grains. It is therefore thought that the larger biotite grains of A 248/64 are true porphyroblasts of metamorphic origin and do not represent relict sedimentary biotite grains. This view is further supported from a study of A 248/6c and 63 (Pl. Fig. illustrates A 248/63). Distinct porphyroblasts (up to 2-3 mm.) of actinolite, that are definitely metamorphic in origin, are scattered through a fine grained matrix. In these specimens (A 248/6c, 63, 64, 72) the porphyroblasts, although generally exhibiting a very weak preferred orientation, do tend to reflect a diverse orientation, this is probably due to their post-tectonic growth.

Paratectonic crystallisation is also definitely indicated by rotation of inclusions of limonite in porphyroblasts of quartz and sericite (A 248/10). The quartz grains of the more arenaceous rocks occasionally show a weak undulose extinction, never a prominent feature, probably due to later faulting movements not related to the folding.

From the mineral assemblages the rocks of the area can be classified as belonging to the quartz-albite-epidote-biotite subfacies of the greenschist facies.

The biotite present is a green-brown variety, epidote is very rare, and therefore it is possible to limit the grade of metamorphism to low quartz-albite-epidote-biotite subfacies.

Development of actinolite (and epidote) means that locally the necessary prerequisite minerals have been available and P_{CO_2} has been low enough for the reaction

$$\text{calcite} + \text{chlorite} + \text{quartz} \rightleftharpoons \text{actinolite} + \text{clinozoisite} + CO_2 + H_2O$$

to have proceeded from left to right.

However, the pressure exerted during the intense folding of the area is thought to be the dominant cause of metamorphism, with only relatively low temperatures involved.

V. STRUCTURE :

1. Mesoscopic Structural Elements

Bedding-foliation planes, S The most prominent planar structures of the area. In the more competent rocks the bedding surfaces (S) are distinguished by lithological boundaries, which are, without doubt, original bedding surfaces. These bedding surfaces are parallel with the foliation planes developed in the less competent, and therefore more noticeably metamorphosed, phyllites; the phyllites show true mimetic bedding plane foliation.

No distinction in the field measurements has therefore been made between bedding planes and foliation planes, and both have been ascribed the same symbol S.

The banding in the marbles is a more difficult problem, particularly in the thick sequence of Cambrian marbles. Again it appears that recrystallisation is mimetic after bedding. Where the marble contains sandy or gritty bands, then there is no doubt about the bedding surfaces. In the massive marbles definite banding, having the same dip as the surrounding bedding (and axial planes), occurs; the banding can therefore be reasonably taken as *an indication* of the original sedimentary bedding.

<u>Folds and fold axes B′</u> Most conspicuous in the sandy to gritty marble, and to a lesser extent in the dolomite and marble phases of the Brighton Limestone Equivalent.

Fig. 3 (p. 24) illustrates observed fold profiles in a sandy marble from location K.7/7.9. The quartz grains are predominantly concentrated into sandy bands in a white-pink marble.

Throughout the area in the less competent rocks (the marbles and limestones) the folds are characterised by generally attenuated limbs and thickened crests, the overall shape, according to Ramsay's terminology, is Z or M shaped. A cliff section (observed from the sea) to the south of the Second Valley jetty shows distinct

FOLD PROFILES OF GRITTY BANDS
IN AN IMPURE MARBLE,
RAPID BAY – SECOND VALLEY
FOLD AXES ; BEARING 147°/PLUNGE 30°

FIELD SKETCH
NATURAL SCALE

FIG. 3

M-shaped folds; this has important applications in the validity of the structural interpretation presented in this paper. In the interbedded dolomite-shale sequence near the Second Valley jetty, extreme attenuation and shearing of the fold limbs is observed, and exceptional thickening and thinning of the bands has occurred.

The area has suffered tight similar folding. Folding has continued to such an extent that the bedding has been transposed into the cleavage.

The axial planes of the folds dip gently toward the east; the fold axes, B′, all plunge at approximately 30° in a direction 147°. Their axial planes will give a subhorizontal trace in the profile plane and therefore according to the definition of a plunging recumbent fold by Naha (1959), the folds can be correctly described as recumbent.

<u>Axial plane cleavage, S_1</u> These are most noticeably displayed by the limestones and phyllites. Consistently throughout the area it was found that S_1 is usually parallel to S, and hence their relationship is of no assistance in determining the superposition of the beds. In some phyllitic beds the cleavage is at a very small angle to the bedding.

<u>Lineations</u> A strong lineation is a prominent mesoscopic feature of the area, especially in the

phyllites and marbles. The visible lineation is defined by the following features -

(i) Axes of small scale folds. These minor folds have monoclinic symmetry, that is, one plane of symmetry normal to the fold axis and to the lineation. The lineation thus parallels the b fabric axis and is by definition a B′(=b)-lineation. A second, minor, B″-lineation is noted.

(ii) Preferred orientation of the micas. Also an elongation of quartz and calcite grains subparallel to the preferred orientation of the micas; this feature is not commonly measureable in the field and is far more important on a microscopic scale. Again, the lineation is a B′-lineation.

(iii) In the phyllites, when the axial plane cleavage (S_1) does intersect the foliation planes (S) at a small angle, a fine striping is developed on the rock surfaces. This lineation parallels the axes of the folds.

(iv) Where slickenslides have occurred in the more competent sandstones and quartzites, a lineation has been produced. This lineation appears to have no relationship to the fold movement -

in all cases plunging to the west on slickenslide surfaces striking north - south (approximately) and dipping west.

<u>Joints</u> Generally not a prominent field feature, however, in the greywacke beds above the Cambrian limestones jointing is strongly developed. A statistical analysis carried out by R.D. Drayton (1962), on greywackes of the Rapid Bay area, showed that the jointing is related to the fault pattern.

Quartz - mica - calcite filled joints, elongate down bedding dip, in the lower siltstones of the Mannio Group, probably represent tension joints normal to B′. In the same stratigraphic unit minor amounts of specularite occur in poorly developed joint planes.

<u>Faults</u> Faulting on a small scale is not particularly important; minor displacements are most noticeable in the sandstone and quartzite beds.

<u>Fold axes, B″</u> Extremely rare, and their significance is uncertain. Only two readings from the phyllites and two from the Cambrian limestones have been noted. It is possible that a closer search will reveal more. These four readings have been plotted in Fig. 4 (p. 30) and they are quite distinct from the plots of the B′- lineations.

Minor crenulations have been observed on the S-planes of some of the phyllites and they are thought to be the result of a second, minor period of folding with axis B". The Brighton Limestone Equivalent of location G.7/13.5 shows a linear feature oblique to the bedding planes (s) and to the established B'-lineations. This may well be related to the B"-lineations of the phyllite.

No statistical analysis of the B"-lineations was undertaken during this present investigation.

2. Microscopic Structure

Folds related to the B'-fold axis and features presumably related to the B"-fold axis have been observed in several of the thin sections examined.

<u>B'-fold axes</u> A 248/46a (location M.8/5.2) shows folding related to the B' fold axis. (Pl. 8, Fig. 1). Biotite rich bands show that the rock has been folded by slip parallel to the axial plane of the fold. The result is tightly appressed folds, causing extensive shortening normal to the axial plane.

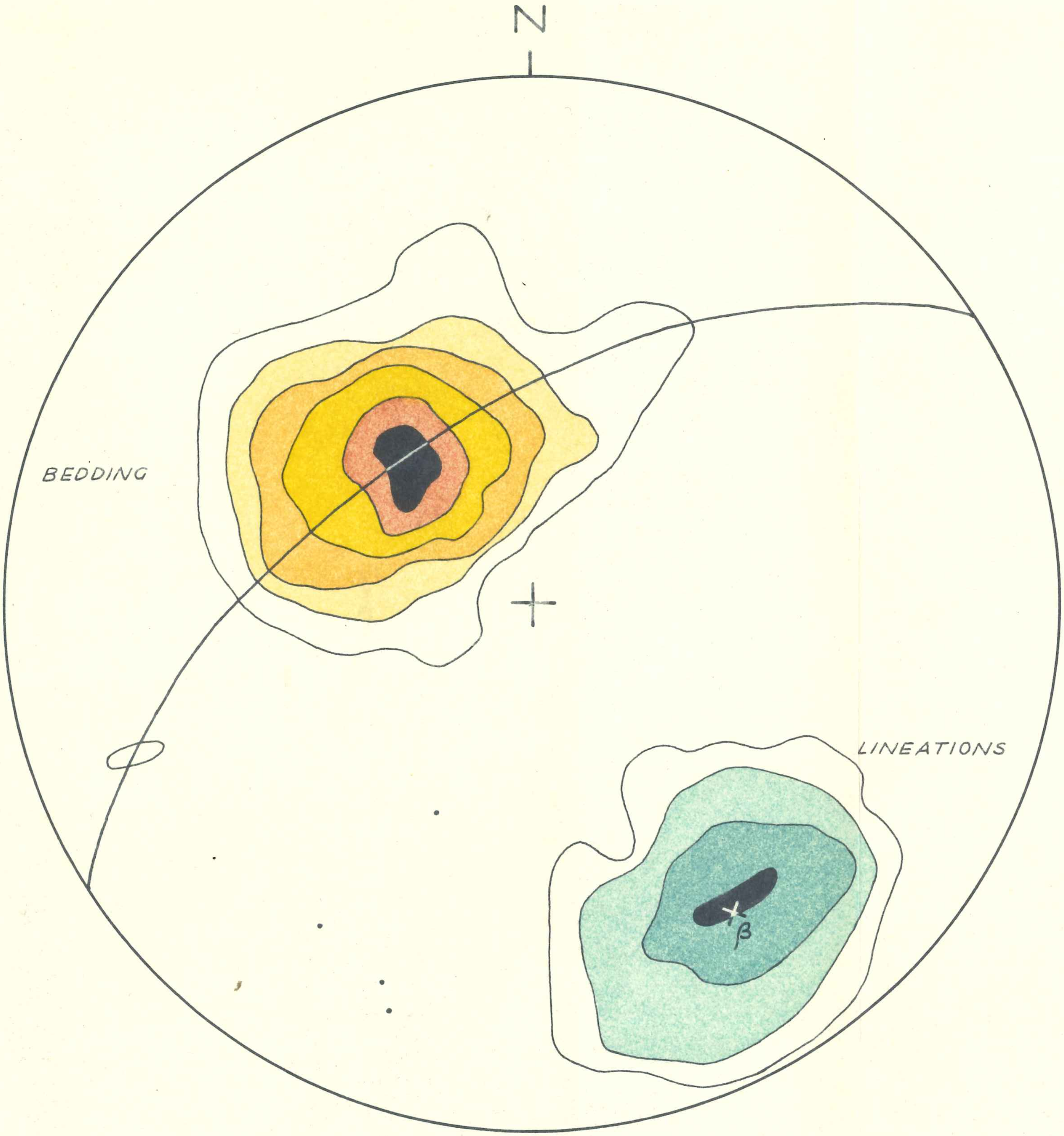
This style of folding, related to the B' folds is not uncommon. A248/53 (a shaley limestone from location M.4/4.6) and A 248/38 (a fine grained siltstone from location K/5.2) also show tightly appressed folding. Again it is presumably the original bedding that is being folded by slip along a cleavage developed parallel to the bedding. It is also possible that these small scale structures have first undergone concentric folding, followed by similar folding.

<u>B″-fold axes</u> The lineation observed in A 248/14,50b (Pl. 9, Figs. 1 & 2) that is inconsistent with the B′-lineation direction is thought to be due to a second, minor period of folding. This lineation, oblique to the bedding or foliation planes, is therefore postulated as representing incipient strain-slip cleavage related to the B″ fold axis.

A 248/68 (location J.2/14.9) shows a definite, but weak development of strain-slip cleavage producing a weak B″-lineation. (Pl. 8, Fig. 2) This crenulation cleavage, at a high angle to the foliation plane or the original bedding, is further evidence for a second, minor period of deformation.

3. Macroscopic Geometry

<u>B′-fold axes</u> Fig. 4 (p. 30) shows an equal area projection of 175 bedding poles and 64 lineation poles from the area; all plotting is on the lower hemisphere. The single maximum within the girdle of bedding poles (π S plots) suggests that either the intensity of folding is relatively slight so that the



CONTOURED EQUAL AREA PROJECTION OF POLES OF BEDDING AND LINEATIONS FOR THE RAPID BAY – SECOND VALLEY AREA
175 BEDDING POLES ; CONTOURS ½ - 2 - 5 - 10 - 20 - 30 % PER 1 % AREA
64 LINEATIONS ; CONTOURS 1 - 3 - 12 - 36 % PER 1 % AREA
DOTS (.) REPRESENT B''-AXES. X REPRESENTS β-AXIS OBTAINED FROM BEDDING POLE ANALYSIS

FIG. 4

rocks form a uniformly dipping sheet, or that the area is recumbently folded. This maximum indicates that most bedding planes dip at about 30° to the east. The bedding poles lying within a single girdle indicate that the area is homogeneous on a macroscopic scale.

The statistically determined macroscopic fold axis from the πS surface is given by β in Fig. 4. β plunges at approximately 30° towards 147°, and represents the axis of folding that has affected S throughout the area. However, β cannot be determined precisely, as there is some spread in the πS girdle. β in fact plunges between 26 - 30°, varying in direction from 140 - 150°.

More noticeably, the variation of the fold axis is indicated by the spread in the statistical maximum of the B′-lineation plots. In general it can be concluded that the B′-maximum coincides with the β-maximum. This agreement between β and B′ is further evidence for the homogeneity of the area, and as the macroscopic structure follows the pattern of the mesoscopic structures, the macro-fold style is recumbent.

The statistical analysis also demonstrates the reliability of the minor structures as indicators of the major structural properties.

Drayton (1962), by preparation of separate equal area projections for πS in the limestone and in other rocks of the Rapid Bay area, has shown that the statistical results are not due to a large number of readings in any one formation.

<u>B″-fold axes</u> Not all the lineations measured in the field coincide with the B′-maximum. The dots in Fig. 4 represent B″-lineations observed as crenulations in phyllites and tight folds in limestones (?). Their significance is uncertain, and can only be guessed at. They may be the result of a later development of strain-slip cleavage‡. A careful examination of these features at the present time was considered unwarranted as they appear to be of minor importance and have no effect on the overall macroscopic geometry.

Within the faulted zone (location M.3/18.1) a lineation reading plots far from the B′-maximum. The faulting, in this instance, has caused a minor inhomogeneity. However, on a macroscopic scale the area can correctly be considered as homogeneous.

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‡ It is possible that the features observed in the limestones are due to inhomogeneous flow.

Summary The area is structurally homogeneous with respect to a single fold axis which plunges gently in a direction 140-150°. The macroscopic geometry shows a single symmetry plane normal to the fold axis. According to Sanders symmetry concept the large scale folds therefore possess monoclinic symmetry.

Minor inhomogeneities, caused by a second fold axis, B″, and faulting are noted.

A statistical analysis of the adjacent Rapid Bay-Delamere area has shown that the large scale folding has monoclinic symmetry, with fold axis plunging at 25° in the direction 150° (Drayton and Leslie, 1962). B. Robinson (1962), mapping the homogeneous region from Second Valley to Little Gorge, has described a fold axis plunging at 30° in the direction 140°. Therefore it is reasonable to say that the whole area from Delamere to Little Gorge is essentially structurally homogeneous.

4. Macro-scale Faulting

There appears to be two closely allied stages of faulting, one of which is definitely associated with the folding.

Extensive thrust faulting, presumably parallel to the axial plane of the folds, accompanied the folding. This explains the decrease in thickness of particularly the phyllites of the Upper Marino sequence in the south-east part of the area (for example, around location L/15). Thrust faulting is also postulated to cause the omission of part of the overturned Sturt - Marino sequence of location G.7/13.2. More substantial evidence for this type of faulting is displayed in adjacent areas to the north. In the Congeratinga River possible Upper Proterozoic quartzites and sandstones overly upper-tillite beds, and in a creek near Little Gorge Kanmantoo rocks overly Archaean on a thrust plane.

What evidence

Following the thrust faulting, a dominantly north-west - south-east transverse fault system developed as a later stage of the same period of faulting. The magnitude of movement along these faults varies. All are right-hand faults. Field evidence for accurately establishing the position, or existence, of these faults is tentative. The major east-west fault is inferred from the apparent break in sequence across the alluvial flat, but there is admittedly little evidence for it faulting the sequence of grey-green phyllites, unless the incipient development of the strain-slip cleavage is related to this period of faulting.

Drayton discussed the possibility of the aeromagnetic data being indicative of a major fault with left-hand movement. There is no field evidence for such a postulated fault. Field work has shown that the magnetic anomaly follows the trend of the Marinoan phyllites rich in magnetite. The aeromagnetic data simply agrees with the trend of the units inferred from the style of folding.

5. Discussion

Poor outcrop is a major problem of the area. All hinge regions of the folds are covered by Quaternary alluvium or masked by no outcrop, this means that the form of the major folds indicated from the geometrical analysis and stratigraphical mapping can only be interpretted from the data available.

Although the author, using detailed mapping of the Rapid Bay - Second Valley area as a basis (in conjunction with speculative interpretations of mapping by other authors in adjacent areas), prefers to accept the idea of anticlines closing to the south on the slender evidence available, it is by no means an entirely satisfactory hypothesis. At present it simply seems to be the solution that best fits the available data.

A profile (drawn perpendicular to the fold axis) for the area does not help in the final interpretation, as folds or faults can essentially be drawn where they are wanted. An idea of the form of the transverse profile can be oblained by placing Plate 1 on a flat surface and looking down onto it at an angle of approximately 30° in the direction of approximately 150°. Drawing the actual profile is unwarranted as no additional information is shown because data is not available to allow topographic corrections to be made.

Because of the difficulties mentioned, the method of attack has been to map lithological units and then attempt to correlate them with the known stratigraphy of the general area. From the stratigraphic picture (Pl. 1) a structural map (Pl. 2) was drawn.

Thrust faulting is a prominent feature. In the area around location H/13, where the lower limestone phase of the Brighton Limestone Equivalent overlies an established overturned sequence of Lower Marino sandstone and quartzitic sandstone, an explanation is offered on the basis of thrust faulting. The limestone has been thrust over the underlying overturned fold limb causing the omission of at least parts of the Brighton Limestone Equivalent and possibly the Tapley Hill Equivalent. R. George (Honours Thesis, 1963) has been able to demonstrate more convincingly the overthrust along the axial plane faults of the area immediately south of the Talisker Mine, see Fig. 5, p. 37 (included by permission of R. George, this section will appear as Fig. 2 in his Honours Thesis).

The faulting near Rapid Bay is not related to the folding, and the outcrop of limestone of location D/12, is tentatively correlated with the proposed Cambrian limestone of Rapid Bay. Similarly, along with meager stratigraphic and petrographic evidence, the quartzite bed of location F.3/10 is correlated with the Upper Marino Group quartzites. The proximity of

GENERALIZED GEOLOGICAL CROSS-SECTION OF THE TALISKER MINE AREA

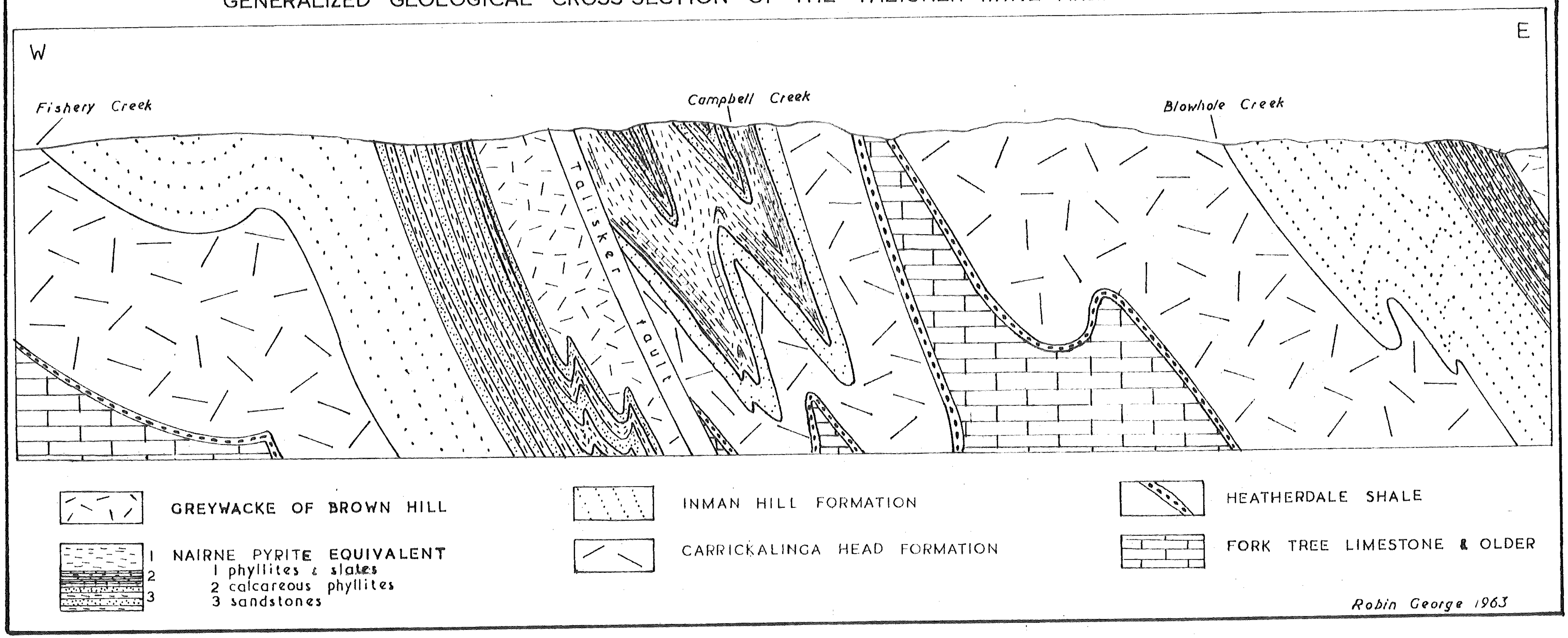


FIG. 5

Upper Marino to Lower Marino quartzites and sandstones (location F/9.7) and postulated Cambrian limestone to gritty marble (location D/12.5) must be explained. It is known that folding often greatly attenuates beds, and that the amount of thrust faulting in the area is unknown. These two facts could possibly be important in what amounts to a tremendous thinning of the grey-green phyllites. (This problem is even greater when considering the Cambrian age of the Rapid Bay limestone, see Pl. 3, because here, if Drayton's mapping is to be accepted, a gritty marble band occurs extremely close to the proposed Cambrian limestone boundary.) In making these correlations an assumption, that greater movement has taken place along this main north-west – south-east fault in the north-west of the area than in the south-east, must be accepted. This is a reasonable assumption. The folding of the immediate Rapid Bay region is very compressed and probably thrust faulted, therefore the amount of movement required is not as great as may appear from the structural map.

Returning to a discussion of location H/13. The sequence to the south-east of the postulated fault is dipping east and facing east (that is, right way up – from stratigraphy) and is the east limb of a major anticline; the sequence to the north-west of the fault is dipping to the east but facing west (that is, overturned – from current bedding) and is the overturned west limb of the same major anticline.

From stratigraphical mapping and the structural interpretation it is implied that the anticline closes to the south. This is in accord with the regional anticlinorium.

The only mesoscopic features of use in determining the superposition of the beds are the minor Z and S shaped folds. If the recumbent anticline closes to the south, then the small scale folds observed in the interbedded dolomite and shale of the Second Valley jetty area (location 0/1.5) indicate that the beds are overturned. This agrees with the interpretted macroscopic structure for that area, as these beds are on the east limb of a syncline they will be overturned. The rocks outcropping along the coast from the Second Valley jetty to Rapid Bay are right way up and are on the west limb of the same syncline. Note that the style of folding shown on the coast (location M.3/2.4) is greatly simplified in Plates 2 and 3. It is known that for this location the fold style is distinctly M shaped. However, because of the proposed structure of this area, it is unlikely that the sandstone of location M.5/2.4 is on the same limb of the fold as the sandstone at location M.7/1.7.

A statistical analysis has shown that the small scale structures are reliable as indicators of the major structure. However, at three localities (L.5/5, L/4.8 and M/4.8) the Z shaped folds infer that the beds are right way up on what, from the structural interpretation, should be the overturned limb of an anticline. This discrepancy could possibly be explained by minor thrust faulting not observed in the field.

Plate 2 illustrates that the structural interpretation is largely based on M shaped folding. Field observations strongly support this interpretation. Not only is this style of folding commonly shown by the profiles of sandy bands in relatively thin beds of marble and limestone, but also, on a much larger scale, by folds in coastal cliff sections. Tight M shaped folding of what are either pale buff dolomite or sandstone beds (up to 2-3 ft. thick) in grey shale is seen in a cliff section (approximately location M.3/2.4). A more complex but similar style of folding is shown by thin quartzite bands in the black phyllites of the cliffs immediately north of Rapid Bay (location F.5/6.2).

Fig. 6(b) (p. 43) illustrates the relationship of the style of folding to outcrop pattern. The anticlinal structure closes to the south. This is the orientation of the major anticline postulated for the area. The attitude of the axial plane gives some indication of the direction of the active forces. Tilting of the axial plane over to the north-west is in agreement with the thrust movement of faulting, where the forces are coming from the south-east and going to the north-west (see further discussion, Part 6 of this section).

Therefore, the present interpretation is that the area has been recumbently folded, with the anticlines closing to the south. But this is still extremely tentative. There is not one indisputable piece of evidence to support this conclusion. It is purely an interpretation based on stratigraphical mapping by the author. It is one possible interpretation of the area.

The Second Valley jetty area (location O/1.5) is still incompletely understood; the stratigraphical and structural relationship stated for this area is one of perhaps several possible interpretations. Also it is known that the mapping around locations Q/18 and K.5/18.7 needs revising as this work was carried out during the early stages of the survey with only a limited knowledge of the stratigraphy.

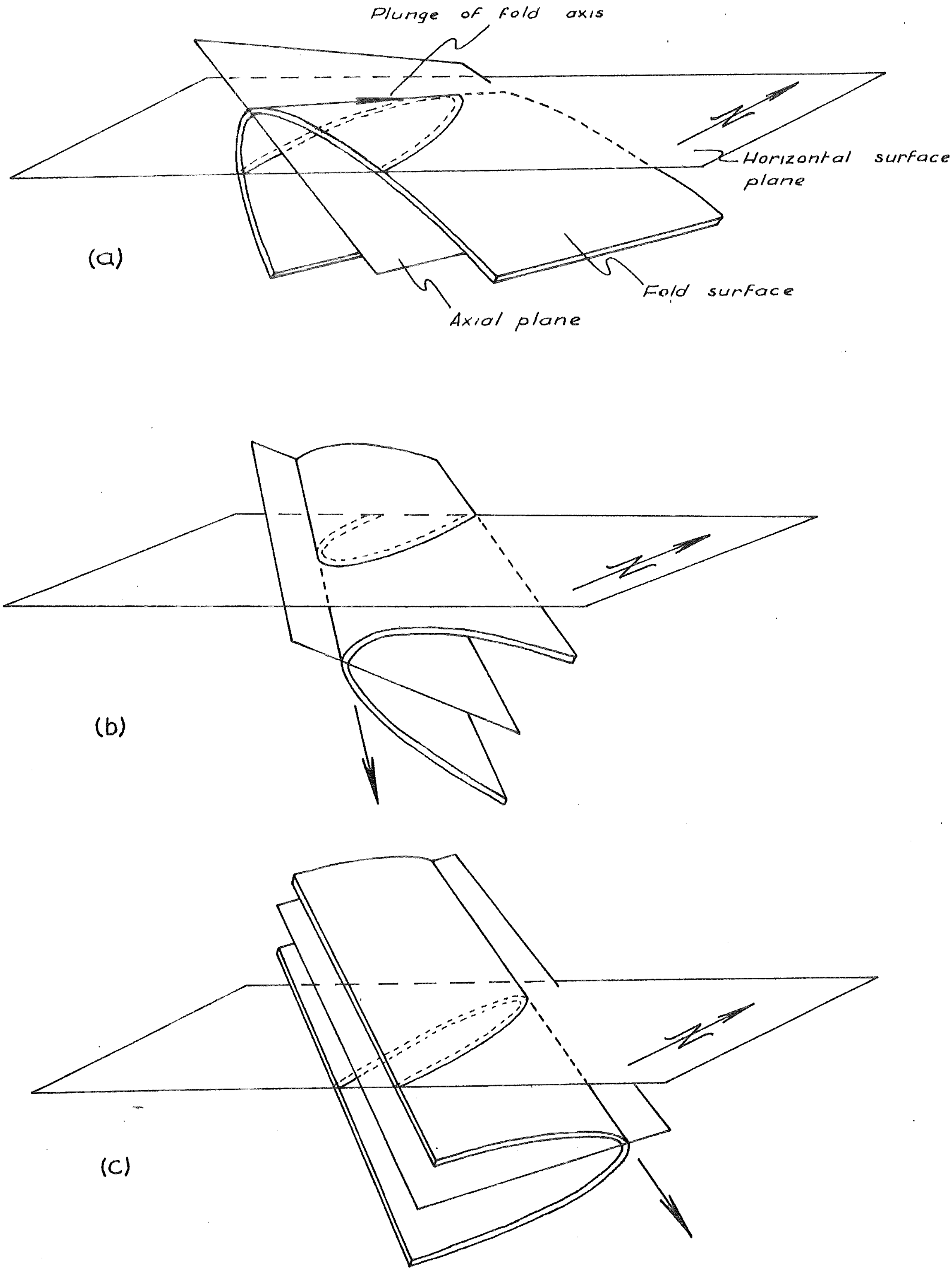
A more rigorous structural analysis on a meso- and macro-scale could possibly help in providing a more satisfactory solution to the area. This analysis would necessarily have to be detailed. It may be possible to delineate small, significant areas of inhomogeneity that have a bearing on the structural picture. An indication of this has been the few B''- lineation readings not in agreement with the overall macroscopic geometry. Dr. J. Talbot (personal communication) has observed several types of folds in the intensively deformed Second Valley jetty area. There are lineations at an angle to the prominent fold axes and "kinks" of folds of several types, namely, vertical axial surfaces and a few odd ripples normal to this.

6. Dynamics

The forces causing deformation of the area are postulated as coming from the south-east and moving towards the north-west. The attitude of the axial plane should be in agreement with this movement pattern. Fig. 6(a) (p. 43) shows the established fold form of the coastal region to the south of the Talisker mine. R. George has clearly demonstrated an anticlinal fold closing to the north, with axial plane dipping steeply to the east and fold axis plunging north. If a north-west force acts on this orientation then the result may be as illustrated in Fig. 6 (b); this is the attitude proposed for the Rapid Bay area. However, it is possible for the structure shown in Fig. 6 (c) to result from the same application of forces, but this alternative appears less acceptable.

Not enough is known about the movement picture and resultant structures to establish a definite dynamic interpretation for the area.

RELATION OF FOLD FORM TO OUTCROP PATTERN



FOR EXPLANATION OF FIGS. SEE TEXT

FIG. 6

VI. A REINTERPRETATION OF THE STRUCTURAL GEOLOGY OF THE RAPID BAY AREA :

Drayton (1962) mapped the region west of the Rapid Bay - Delamere road, and essentially his interpretation was recumbent folding with the anticlines closing to the north. This inferred that the Mount Rapid marble was equivalent to the Brighton Limestone stratigraphic unit. The Rapid Bay marble was therefore tentatively correlated with the upper parts of the Sturt Group of the Adelaide Supergroup.

This interpretation was based on Leslie's (1962) mapping of the limestone of Starfish Hill which was stratigraphically determined as being the top of the Sturt Group. This prominent limestone - marble band was traced into the Mount Rapid area.

The Mount Rapid marble is probably equivalent to the Brighton Limestone. But field observations in the Rapid Bay - Second Valley area do not agree with the Proterozoic age of the Rapid Bay marble. For a Proterozoic age of the marble on the present mapping, a reversal of plunge, compared to that of the Rapid Bay area, is required in the Second Valley area. This does not exist.

Drayton states of the Mount Rapid area "although the evidence of the right section and style of folding suggests the marble formations are the limbs of a recumbent fold, it is not possible to prove it" and "the right section shows it is possible for faulting to have produced the structure".

On the basis of the mapping presented in this report it seems more reasonable to accept the possibility of faulting producing the structure. This fault is simply a continuation of the inferred thrust fault from location H/13 of Plate 2. Faulting explains the 'bringing together' of the limestone bands.

The style of folding involved is recumbent, as suggested from stratigraphy and structure, but with the anticlines closing to the south and not to the north as previously suggested. (See Plate 3)

If then, it is possible to show an overturned, non-folded, stratigraphic sequence from the Mount Rapid Brighton Limestone Equivalent to the Rapid Bay limestone, a Cambrian age for the Rapid Bay limestone could be established. However, as pointed out by Dr. B. Daily (personal communication) the expected Cambrian limestone units cannot be recognised in the Rapid Bay limestone (they may have been obliterated by the extreme deformation). And hyolithids have not been discovered in the sandstone bands immediately overlying the overturned Cambrian limestone; on this suggested reinterpretation these sandstones are correlated with the Mount Terrible Formation and would therefore be expected to contain hyolithids in the upper parts.

The black phyllite of Rapid Head would be correlated with the Heatherdale Shale unit. No phosphate nodules have been found and the overall phosphate content of the shales has been shown to be less than that of the world average for black shales (I. Pontifex, 1962, unpublished report). However, the matrix of the Heatherdale Shale is known to give this result if phosphate nodules aren't present. Therefore the chemical analysis does not invalidate the proposed correlation. Where are the nodules?

It must be emphasised that this postulated reinterpretation is based on speculation from Drayton's work in the Rapid Bay area. The present writer has not investigated the area to the north of the overturned Brighton Limestone Equivalent bed. Therefore the proposed reinterpretation of the area can serve as nothing more than the presenting of a possibility that is to stand or fall on later field work. One of the major problems with this reinterpretation would be to explain the extreme thinning of certain beds (for example, the grey-green phyllite).

Mr. D. Catley (B.H.P. Geologist) is at present mapping in detail the area surrounding the marble quarries at Rapid Bay. Since R. Drayton mapped this area further outcrop has been exposed by the cutting of roads to drill sites. The results could possibly assist in an understanding of the area.

VII. CONCLUSIONS :

The structure of the area is still not yet satisfactorily explained. Although the present interpretation of recumbent anticlines closing to the south agrees with the regional picture it relies a lot on intensive shearing and folding. It is possible that this occurs, but the extent is unknown.

On the structural interpretation, it is postulated that the Rapid Bay limestone is of Cambrian age. This creates new problems that are only tentatively solved by the thrust faulting considered to have been active in the area.

The true relationship between bedding and foliation is not known with any certainty. Although it is thought that the foliation is truly mimetic after bedding it cannot be proven, for in the petrographic work no axial plane cleavages were observed at an angle to the bedding to allow any conclusions about the nature of the plane along which the micas developed.

From the mineral assemblages the rocks of the area can be classified as belonging to low quartz-albite-epidote-biotite subfacies of the greenschist facies. The pressure exerted during the tight folding of the area is the dominant cause of metamorphism.

ACKNOWLEDGEMENTS

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APPENDIX

SELECTED SLIDE DESCRIPTIONS :

Some 60 thin sections were examined in detail, and the 24 specifically referred to in the text are discussed in the following pages.

In all thin sections studied the biotite is a green-brown variety.

Throughout all the descriptions the plagioclase is to be taken as having the composition of albite, with An_{6-8} The R.I. of the plagioclase present is therefore less than the R.I. of quartz.

The % of individual minerals quoted is a visual estimation.

The K-feldspar estimates are only a general indication of the amount suspected to be present. It is extremely difficult to distinguish between the plagioclase and K-feldspar because the R.I.'s of both are less than the R.I. of quartz.

Generally the biotite and muscovite present have been collectively estimated, as it is difficult in most sections to obtain an accurate estimate of muscovite to biotite. Whether the biotite is dominant or not, is stated.

INDEX TO SLIDE DESCRIPTIONS :

A 248/6c (location J.2/17)

MACRO: Distinct fibrous grains (up to 2mm. length) of actinolite in a dark grey, fine grained, silty matrix.
Very similar to A 248/63.

MICRO: Minerals –

50% quartz: fine grained (≃ 0.1mm.), irregular crystal shape. Prominent matrix mineral.
20% actinolite: large (up to ≃ 3mm.) poikiloblastic porphyroblasts.
20% epidote: irregular grains (av. 0.1mm.), occurring as a matrix mineral.
7% chlorite: small grains (0.1mm.).
3% iron mineral: irregular, small, scattered grains.

Structure – Large porphyroblasts of actinolite in a fine grained matrix. Actinolite shows an overall very weak preferred orientation, this feature is probably due to there post-tectonic crystallisation

Silty, actinolite rich rock.

A 248/7 (location G/12.6)

MACRO: Gritty, feldspathic marble. Quartz and feldspar grains (up to 1mm.) in a fine grained crystalline calcite matrix. Pale dirty-white colour.

MICRO: Minerals –

20% quartz: subrounded (size varies 0.1 – 1mm.), where the original shape is displayed by a ring of inclusions, but generally recrystallised on grain boundaries producing angular shape. A few grains show strong undulose extinction.

12% plagioclase: subrounded (size 0.1 – 1mm.). Highly altered.

8% muscovite: some interstitial grains (slightly <0.1mm.) indicating original clays. Most occurring a sericitic alteration product of plagioclase (much smaller grains, $<< 0.1$ mm.).

60% calcite: recrystallised material.

Structure – Matrix of recrystallised calcite throughout which is scattered numerous grains of quartz and plagioclase.

Gritty marble

A 248/10 (location J.3/11.1)

MACRO: Large (average 2mm.) weathered feldspar grains(?) in a fine grained, silty phyllitic matrix. Weakly foliated and lineated.

MICRO: Minerals –

30% quartz : small (<0.1mm.), recrystallised grains occurring in both the porphyroblasts and the matrix.

35% sericite : developed predominantly in the porphyroblasts as an alteration product of feldspar (large grains, up to 0.1mm). Smaller grains developed in the matrix.

25% biotite : green-brown colour. Generally restricted to the matrix. Small grains (<0.1mm.).

10% limonite : as small inclusions in the porphyroblasts, showing the rotational effect of deformation, and as larger irregular masses in the matrix.

Small grains of tourmaline as an accessory mineral.

Structure –

Porphyroblasts of sericite and quartz in a matrix of biotite and recrystallised quartz (no original feldspar remains in the porphyroblasts). Strong lineation due to the preferred orientation of the biotite and the lens shaped porphyroblasts. Rotation of the porphyroblasts has occurred during deformation.

Knotty phyllite

A 248/14 (location J/13)

MACRO : Fine grained, dark blue-grey rock with white irregular lenses of calcite (about 1mm. in width and varying considerably in length). Micaceous. Lenses of calcite about 20% of whole.

MICRO : Minerals –

28% quartz : small irregular grains (<0.1 mm). Often showing undulose extinction.

20% { biotite : biotite greater proportion than muscovite but
muscovite : difficult to estimate % of each. (There structural features are generally the same and so they can be considered together). Definite preferred orientation and some crenulation of these foliation planes.

10% chlorite : weakly pleochroic, colourless to very pale green. Larger grains than the biotite-muscovite ~ up to 0.1 to 0.2 mm. in length.

40% calcite : large lense shaped grains (approx. 1mm. size), there length is parallel to the biotite orientation but aggregates form lenses that cut across this direction.

2% tourmaline and iron mineral, and very small amount of plagioclase (< 1%).

Structure – Pl. 9, Fig. 1. Strong preferred orientation of micas and crenulations of these foliation planes. Calcite aggregates all approx. parallel, and oblique to the foliation planes. Groundmass equigranular, consisting of quartz, biotite, chlorite, accessories and calcite fragments (0.1mm. in size).

Silty limestone.

A 248/17 (location H·7/11)

MACRO: Fine grained, banded sandstone. Pale buff-pink colour. Current bedding shown by the thin bands of dark material.

MICRO: Minerals –

65% quartz: extensively recrystallised. Small grains (av. < 0.1 mm.)

5% plagioclase: small grains (all < 0.1 mm). Very small grains of sericite prominent as inclusions.

12% biotite: small grains (< 0.1 mm), green-brown variety. Weak preferred orientation.

8% muscovite: slightly larger grains than the biotite, scattered.

5% iron mineral: probably magnetite. Concentrated into layers which show up the current bedded nature of the rock. Generally irregular, small (< 0.1 mm.) grains.

2% tourmaline: occurs with the ?magnetite in the heavy mineral layers.

Structure – Overall a very fine grained rock, matrix of quartz and mica (essentially), with concentrations of the heavy minerals giving the rock a banded structure. The heavy minerals to a lesser extent are scattered throughout.

Current bedded, fine grained sandstone

A 248/19 (location F.4/10.2)

MACRO: Gritty (mainly quartz but some feldspar – av. 1mm, up to 2mm.) pale coloured fine grained sandstone. Weak lineation due to preferred orientation of gritty grains.

MICRO: Minerals –

82% quartz : grains (up to 2mm.) in matrix (av. 0.1mm.). Lens shaped and showing extreme recrystallisation. Inclusions are present. All grains show varying degrees of fracturing and undulose extinction is prominent.

15% plagioclase: subrounded grains (0.2mm. – 2mm), there are larger 'gritty' grains. Small grains (av. <0.1mm) scattered throughout matrix. Altered. Cleavage prominent.

1% orthoclase: microcline (?) and perthite.

2% biotite-muscovite : extremely small crystals (<<0.1mm.) Interstitial. Sericite as alteration of plagioclase.

Approx. 30% grains to 70% matrix. (Matrix may be greater).

Structure – grains of quartz and feldspar in a finely crystallised matrix of dominantly quartz. The quartz grains are generally elongate and have a moderate preferred orientation.

Gritty, fine grained sandstone

A 248/20 a (location J.3/14.2)

MACRO: A feldspathic (up to 2mm.), biotite banded quartzite. Matrix fine grained, crystalline. The rock is poorly sorted.

MICRO: Minerals –

40% quartz: extremely recrystallised. Large variation in grain size, <0.1mm (matrix) to 2mm. (grains interspersed through matrix). Often large crystalline aggregates have formed. Inclusions prominent.

25% plagioclase: vary in grain size (<0.1mm – 2mm.). Subrounded. Myrmekitic textures, deformed twin lamellae and chequer albite observed. R.I. < quartz. Highly altered

10% orthoclase: optically negative, R.I. very similar to plagioclase present. Difficult to identify, generally not as highly altered as the plagioclase.

14% biotite: green-brown. No preferred orientation, rock is roughly banded due to concentrations of biotite (anastomosing concentrations).

3% muscovite: both large grains (approx. 0.1mm.), occurring along with the biotite, and small grains as alteration product of plagioclase.

2% chlorite: difficult to distinguish, weakly pleochroic. Small grains, probably secondary after biotite.

3% calcite: as grains in matrix, and inclusions partly replacing the plagioclase.

3% iron mineral: varying irregular to distinct crystalline shape. Scattered throughout.

A 248/20 a (cont.)

<u>Structure</u> – Large grains of feldspar and quartz (up to 2mm.) in a fine grained matrix (< 0.1 mm) of essentially quartz and micas.
The quartz is extensively recrystallised. Some of the plagioclase grains show thin rims of secondary crystallisation about original detrital grains.

<u>Feldspathic, fine grained quartzite</u>

A 248/27 (location K.2/11.3)

MACRO: Banded, poorly graded, silty sandstone. Gritty in the 'lower' parts. Distinct feldspar grains (to 2mm.), subrounded.

MICRO: Minerals –

45% quartz: larger grains (>.1mm. and up to 1.5mm.) in a fine grained (av. 0.1mm) matrix. Both larger and small grains extensively recrystallised, tending elongate, and with a strong preferred orientation (subparallel to the micas).

25% plagioclase: highly sericitised, particularly on grain boundaries. A few small (<0.1mm) grains scattered throughout, but dominantly as large (up to 2mm.) subrounded grains in matrix. Elongate grains and generally orientated parallel to the long axes of the micas. Chequer albite occurs.

10% (<?) orthoclase: appears less highly altered than plagioclase, and is optically negative. Some perthite.

15% biotite: green-brown. Strong preferred orientation. Size <<0.1mm.

3% muscovite: as alteration product of plagioclase.

2% tourmaline and iron mineral: scattered, small grains.

Structure – Large grains of feldspar and quartz in a fine matrix of quartz and biotite. Poorly graded, some concentration of larger grains, but matrix throughout. Extremely recrystallised, and a strong preferred orientation of the minerals.

Fine grained, poorly graded, feldspathic sandstone.

A 248/31a (location F.2/11.6)

MACRO: Finely crystalline quartzite. Original banding still discernable. Larger grains of quartz and feldspar in fine crystalline matrix. Colour varies due to banding, but overall pale dirty white. Pyrite flecks scattered throughout (1% approx.)

MICRO: Minerals –

65% quartz: extremely recrystallised to lens shaped grains with a very pronounced preferred orientation. Some undulose extinction.

15% plagioclase: subrounded, size varies from 2mm. to small grains (<0.1mm.) as part of matrix. Chequer albite and myrmekitic structures noted. Probably part of this 15% is perthite and microcline (indications of both being present). Sericitised.

10% biotite: green-brown variety. Preferred orientation.

5% muscovite: individual interstitial grains, as well as variety sericite from alteration of plagioclase

3% iron mineral: small irregular grains (<0.1mm) and small veins (about 0.5 mm. in length).

2% tourmaline and zircon (?) as accessories.

Structure – See Pl. 4, Fig. 1. Essentially lenses (0.5–3mm.) of recrystallised quartz in a matrix of finely recrystallised quartz. Strong preferred orientation of particularly the quartz and biotite.

Finely crystalline, banded quartzite

A 248/35 (location F/8.8)

MACRO: Very fine grained sandstone. Thinly banded, pale grey colour.
Band made up of thin irregular lenses of biotite.

MICRO: Minerals –

62% quartz: extremely recrystallised. Crystalline aggregates tend to be elongate and have a preferred orientation subparallel to the micas.

10% plagioclase: extensively altered. Small grains (av. <0.1mm.). Occurring as 'knots' in recrystallised quartz fabric.

20% biotite and muscovite: small flakes (<0.1mm). Strong preferred orientation.

5% iron mineral: irregular, lens shaped masses – length subparallel to general fabric orientation.

3% apatite, zircon and tourmaline. Apatite predominant.

Structure – Matrix of extremely recrystallised quartz with small grains of feldspar and interstitial grains of mica, iron mineral and accessories.
Strong preferred orientation of the quartz, micas and iron mineral.

Poorly banded (thin) recrystallised siltstone

A 248/38 (location K/5.2)

MACRO: Dark grey, fine grained siltstone. Finely banded in parts and folding noted in cut section. Veins of calcite (small) cut across the banding.

MICRO: Minerals –

30% quartz: essentially form the matrix (along with micas). Very fine grained (<0.1mm), but larger grains occurring in the calcite veins were noted. (grains up to 0.7mm.).

50% biotite and muscovite: biotite greater proportions than muscovite but difficult to estimate percentage of each. Probably also some chlorite included in this overall estimation. Strong preferred orientation.

20% calcite: as individual grains in matrix (av. 0.1mm.) or predominantly as aggregates of larger grains (up to 1mm.) making up the calcite lenses (veins).

Structure – The micas have a strong preferred orientation, and thin bands of micas have been folded by slip parallel to this preferred orientation. Form tightly appressed folds. The thin small veins of calcite and quartz cut obliquely across the preferred orientation and disrupt it.

Fine grained siltstone, with calcite veins

A 248/43 (location M.5/6.4)

MACRO: Finely banded, micaceous siltstone. Fine grained, grey colour. Micas well developed on cleavage planes. Banding is irregular. Some lenses of calcite.

MICRO: Minerals –

45% quartz : small grains (<< 0.1mm). Some slightly larger grains occurring with calcite in the calcite veins (few), and in the coarser (still < 0.1mm) calcite and quartz bands.

45% biotite and muscovite : biotite > muscovite and is a green-brown variety. Generally small grains (<< 0.1mm.) but some up to 0.1mm. Strong preferred orientation. Poorly concentrated into bands – prominent in the bands where the quartz grains are very small.

10% calcite : as veins and in the coarser quartz bands. If elongate are orientated parallel to general fabric.

Structure – Generally graded bedded. Sorting is relatively good and each band consists of grains of essentially the same size. Biotite is more prominent in the finer grained bands. The preferred orientation of the micas is parallel to the banding.

Calcareous, micaceous siltstone

A 248/46a (location M.8/5.2)

MACRO: Micaceous, blue-grey limestone. Micas prominent along cleavage planes. Lensing bands (thin) of biotite. A weak development of tension gashes, filled with calcite, normal to the bedding.

MICRO: Minerals –

10% quartz: small irregular grains (<0.1mm.) scattered throughout. If elongate-preferred orientation shown

25% biotite: green-brown variety. Concentrated into bands. Grains, generally < 0.1mm long, with strong preferred orientation – disrupted where calcite veins cut across banding.

15% muscovite: as relatively large grains (up to 0.4mm.) in the calcite rich bands.

50% calcite: grains up to 0.5mm. long in veins, but predominantly small grains (av. 0.1mm.) concentrated into bands. Where elongate, preferred orientation parallel to general fabric.

Structure – Distinct bands of biotite and calcite with quartz scattered throughout and muscovite occurring in the calcite veins. Biotite band show tight appressed folds (Pl. 8, Fig. 1). Tension gashes cause lensing of bands.

Shaley limestone

A 218/46b (location M.8/5.2)

MACRO: Pale-grey and white banded limestone. White bands appear reasonably pure calcite. Micas developed in the silty grey parts.

MICRO: Minerals –

20% quartz: small irregular grains (<0.1mm.) scattered throughout the finer grained calcite bands. Some large grains (1.5mm.) occur in the pure calcite bands.

10% biotite and muscovite: small (<0.1mm) and strong-moderate preferred orientation that is parallel to the calcite bands.

70% calcite: essential matrix mineral (av. 0.1mm.). Larger grains (0.1–0.5mm.) concentrated into bands.

Structure – Matrix of calcite with scattered grains of quartz and biotite. Larger grains of calcite concentrated into bands of almost pure calcite.

Shaley limestone, with calcite bands

A 248/50b (location L.7/4.9)

MACRO: Shaley limestone. Overall banded appearance, but each band obliquely cut by a weak cleavage (see Pl.9, Fig.2) A more prominent, but still weak, cleavage parallel to the bedding.

MICRO: Minerals –

45% quartz: irregular small (av. 0.1mm) grains, slightly recrystallised on some grain boundaries.

15% biotite and muscovite: % biotite > % muscovite. Generally large grains (av. 0.1mm). Strong preferred orientation. Small amount of chlorite.

40% calcite: irregular grains (av. 0.2 mm.), elongate in direction of preferred orientation of micas.

scattered grains of iron mineral.

Structure – Overall 'coarsely' crystalline. Micas concentrated into indistinct bands. Strong preferred orientation of both micas and calcite. The mica show the effects of a weak strain-slip (crenulation) cleavage at an angle to the preferred orientation.

Micaceous limestone

A 248/51 (location L/5.5)

MACRO: Gritty, feldspathic marble. Grains of feldspar and quartz up to 2mm. Pale pink colour.

MICRO: Minerals –

45% quartz: extensively recrystallised. Matrix essentially fine grained quartz (about 0.1mm) with larger grains (up to 2mm) scattered throughout. A lot of the larger quartz 'grains' are made up of aggregates of interlocking smaller quartz grains.

15% plagioclase: occurring as large grains (up to 2mm.), and as a minor constituent of the matrix (0.1mm.). Extensively altered and occasional rims of secondary plagioclase about original, altered detrital grains. Chequer albite and myrmekitic structures observed. Also some bent twin lamellae (not common).

5% microcline: as large grains in the matrix (2-3mm.). Contains inclusions of quartz and plagioclase (Pl. 5, Fig. 2). Correctly termed – microcline-perthite.

2% muscovite: interstitial and as alteration product of plagioclase.

30% calcite: filling up interstitial spaces. Grain size irregular (av. 0.1 – 0.2mm).

3% iron mineral: accessory. Possibly original hematite.

Structure – Essentially grains of feldspar and quartz in a matrix of dominantly quartz. No preferred orientation. % matrix about 30%.

Sandy, feldspathic marble (?)

A 248/53 (location M.4/4.6)

MACRO: Shaley, blue-grey limestone. Banded, dark bands contain concentrations of micas. Cleavage parallel to bedding, and appears that is some minor folding by slip along this cleavage. Calcite veins.

MICRO: Minerals –

30% quartz: small (<0.1mm.) scattered throughout. Some large (1-3mm.) grains in calcite veins.

20% biotite-muscovite: % biotite >> % muscovite. Small (av. 0.1mm). Strong preferred orientation, with suggestion of an extremely weak crenulation cleavage at an angle to the orientation.

50% calcite: irregular grains (av. 0.1mm.) tending lens shaped and orientated parallel to long axis of biotite. Some larger grains in vein.

Structure – Biotite weakly concentrated into band, these bands contain the smaller calcite grains. Poor banding on calcite grain size, and this banding is parallel to the preferred orientation of the biotite. Folding, by slip parallel to the preferred orientation, is noticed.

Shaley limestone

A 248/63 (location J.5/22.7)

MACRO: Dark grey matrix with larger grains (up to about 2mm. in length) of actinolite.

MICRO: Minerals –

45% quartz: small, irregular grains (<0.1mm.). Some larger ones up to 0.1mm.

23% biotite: green-brown variety. Small flakes (av. 0.1mm.). Moderate-weak preferred orientation.

15% muscovite: same size as biotite on average.

5% chlorite: small grains (<0.1mm.).

10% actinolite: large (up to 2mm) poikiloblastic grains. Tending to reflect a diverse orientation, but overall very weak orientation parallel to general fabric.

2% iron mineral: probably magnetite. Small scattered grains.

Structure – Matrix minerals (micas and quartz), have a moderate to weak preferred orientation, with porphyroblasts of actinolite scattered throughout. Diverse orientation of actinolite due to post-tectonic crystallisation.

Silty, actinolite 'phyllite'

A 248/64 (location J.5/22.7)

MACRO: Pale grey, silty phyllite. Matrix very fine micas and quartz with prominent larger dark flakes of mica throughout. Strong preferred orientation of the larger mica flakes.

MICRO: Minerals –

50% quartz: irregular, generally small (<0.1mm.) grains as an essential matrix mineral. Scattered larger grains (up to 0.2mm.) do occur, and there are several quartz veins consisting of these larger grains.

47% micas (dominantly biotite): two distinct grain sizes, matrix (fine, needle like grains <0.1mm.) and larger porphyroblasts (up to 0.5mm.). The porphyroblasts have embayed edges, and contain quartz inclusions.

3% iron mineral: probably magnetite. Irregular grains, small (<<0.1mm – 0.2mm.), and scattered.

Structure – Strong preferred orientation of the matrix biotite and muscovite, flowing around the weakly orientated biotite porphyroblasts. Matrix is composed of micas and quartz.

Phyllite

A 248/67 (location H.7/14.8)

MACRO: Gritty (poorly graded) blue-grey quartzitic siltstone. Prominent rounded feldspar and quartz grains up to 4mm. in length.

MICRO: Minerals –

60% quartz : matrix grains (av. 0.1mm.), and larger grains (≃0.2 – 3mm.) contained in the matrix. Generally subrounded, often showing extreme recrystallisation on grain boundaries. Undulose extinction on some grains.

25% plagioclase: subrounded, and same order of size as for quartz. Extensively altered, rare, thin rim of secondary plagioclase. Chequer albite not uncommon. Some of this 'plagioclase' estimate is probably potassium-feldspar.

10% biotite : green-brown variety. Small (<0.1mm) flakes.

5% calcite : as inclusions in plagioclase and interstitial material in matrix.

Structure – About 20% matrix to 80% 'gritty' grains. Matrix is recrystallised quartz and some biotite and calcite. The large grains are scattered throughout matrix. The thin section examined has come from the more gritty bands of the hand specimen.

Quartzitic, feldspathic sandstone

A 248/68 (location J.2/14.9)

MACRO: Distinctly crenulated phyllite. Cleavage prominent feature, and crenulations developed on cleavage. Extremely fine grained – micaceous. Magnetite common (small octahedra).

MICRO: Minerals –

30% quartz : generally as small grains (< 0.1 mm.). Some larger aggregates forming lenses, elongate in general direction of preferred orientation.

60% biotite and muscovite : small flakes (av. possibly as great as 0.1 mm.). Strong preferred orientation. Impinged upon this preferred orientation is a weak strain-slip cleavage oblique to the orientation.

1% chlorite : note – % biotite > % muscovite >>> % chlorite. Few grains distinguished.

5% magnetite : small (0.1 mm.), well defined crystal shape.

Structure – Overall fine grained with an occasional lens of quartz aggregates. A weak development of strain-slip (crenulation) cleavage at a high angle to the preferred (strong) orientation of the micas.

Phyllite

A 248/71 (location M/23.6)

MACRO: Fine grained, crystalline quartzite. Dark blue-grey.

MICRO: Minerals –

85% quartz: crystalline, average grain size 0.1mm. Inclusions prominent, and an original grain boundary (curved) can occasionally be observed. Some undulose extinction.

8% sericite: small grains (< 0.1mm.), interstitial.

2% feldspar (?): extensively altered. (R.I. < R.I. quartz).

5% iron mineral: scattered, small grains.

Structure – Quartz is extensively recrystallised and constitutes the mass of the rock. Interstitial spaces filled by sericite (originally clay mineral) and iron mineral.

Quartzite

A 248/72 (location K.6/20.2)

MACRO: Pale grey phyllite. Prominent large biotite grains in a fine grained matrix. Similar to A248/64.

MICRO: Minerals –

60% quartz: irregular, small (av. <0.1mm.) grains as an essential matrix mineral. Some grains showing weak undulose extinction.

25% biotite: green-brown variety. Range in grain size from <0.1mm. – 0.4mm. Larger grains more irregular in shape than smaller.

12% muscovite: small grains.

3% iron ~~mineral~~: scattered, small grains.

Structure – Only a moderate-strong preferred orientation of the micas. The larger ones are less strongly orientated than the smaller. No distinct phorphyroblast 'eyes'.

Phyllite

A 248/73a (location P.8/10.3)

MACRO: Pale coloured quartzite. Coarser quartz grains in a finely crystalline matrix. Some feldspar present. Recrystallised quartz occasionally forming veins. Weak orientation of elongate grains.

MICRO: Minerals –

85% quartz : extremely recrystallised. The larger grains have recrystallised boundaries and the small grains form interlocking mosaics. Inclusions.

7% (<?) plagioclase : generally small/subrounded grains (0.1mm), some up to 1mm. Sericitised. Quartz inclusions in a few of the grains.

3% muscovite: grains up to 1mm.

5% iron mineral : scattered, small grains.

Structure – Largely recrystallised quartz with scattered feldspar grains and aggregates of muscovite. No preferred orientation (see Pl. 4, Fig. 2)

Quartzite

EXPLANATION OF PLATES

(Plates 1, 2 and 3 are in pocket)

PLATE 1 Geological map of Rapid Bay - Second Valley

PLATE 2 Structural interpretation of Rapid Bay - Second Valley

PLATE 3 An interpretation of the structural geology of Rapid Bay

PLATE 4

Fig. 1 - Recrystallisation and development of a strong lineation in a quartzite from a highly deformed area (A248/31a). Crossed nicols, x 50.

Fig. 2 - Recrystallisation in a quartzite from a very weakly deformed area (A248/73a). Crossed nicols, x 50.

PLATE 5

Fig. 1 - Chequer albite. Crossed nicols, x100. (A248/27)

Fig. 2 - Microcline containing inclusions of albite and quartz. Crossed nicols, x100. (A 248/51)

PLATE 6

Fig. 1 - Myrmekitic albite (A248/51). Crossed nicols, x100.

Fig. 2 - Poikiloblastic actinolite porphyroblasts in a fine matrix of quartz and micas (A248/63). Plane polarised light, x 150.

PLATE 7

Fig. 1 - A phyllite with distinct porphyroblasts of biotite in a finer grained matrix of biotite, muscovite and quartz. (A 248/64) Plane polarised light, x 150.

Fig. 2 - A phyllite with biotite ranging from general matrix size to larger porphyroblastic grains (A 248/72). Plane polarised light, x 150.

PLATE 8

Fig. 1 - Biotite rich band showing folding by slip parallel to the overall preferred orientation of the constituent grains (A 248/46a). Plane polarised light, x 150.

Fig. 2 - Weak development of strain-slip (crenulation) cleavage at an angle to the strong preferred orientation of the biotite grains (A 248/68). Plane polarised light, x 150.

PLATE 9

Fig. 1 - Development of lenses of calcite at a high angle to the preferred orientation of the biotite and elongate calcite grains (A 248/14). Crossed nicols, x 30.

Fig. 2 - Lineation oblique to the bedding of a micaceous limestone. (The thin section shows a weak strain-slip cleavage parallel to this weak lineation.)

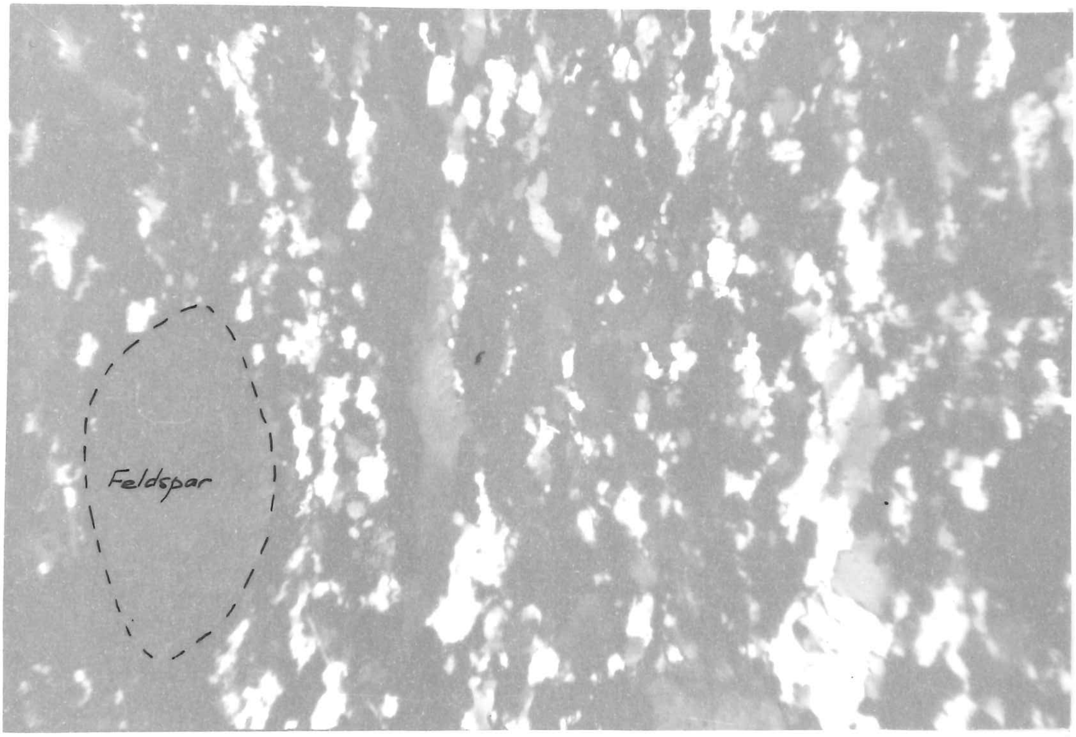


FIG. 1

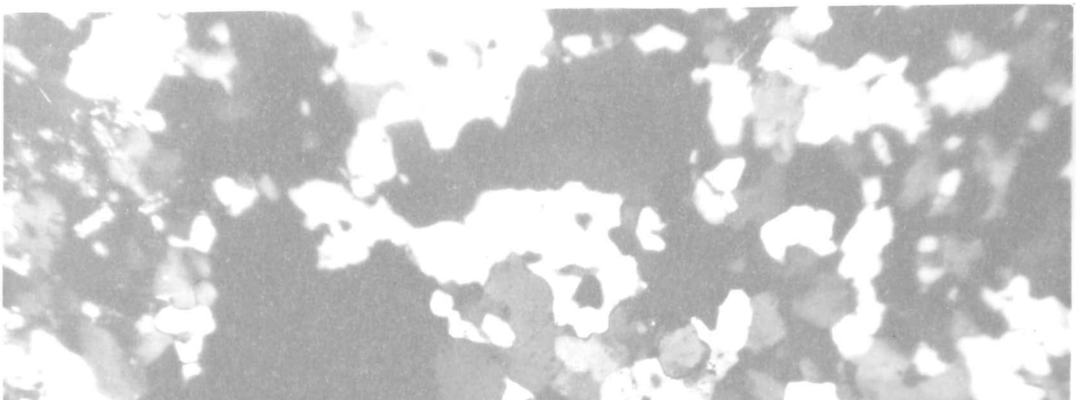


FIG. 2

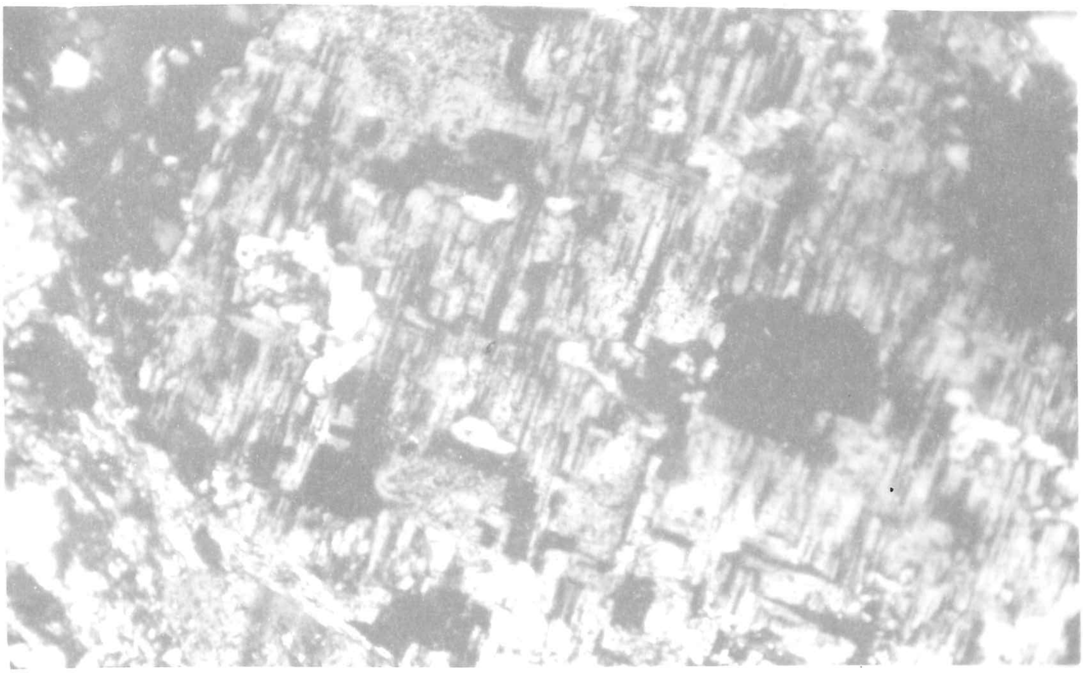


FIG. 1

FIG. 2

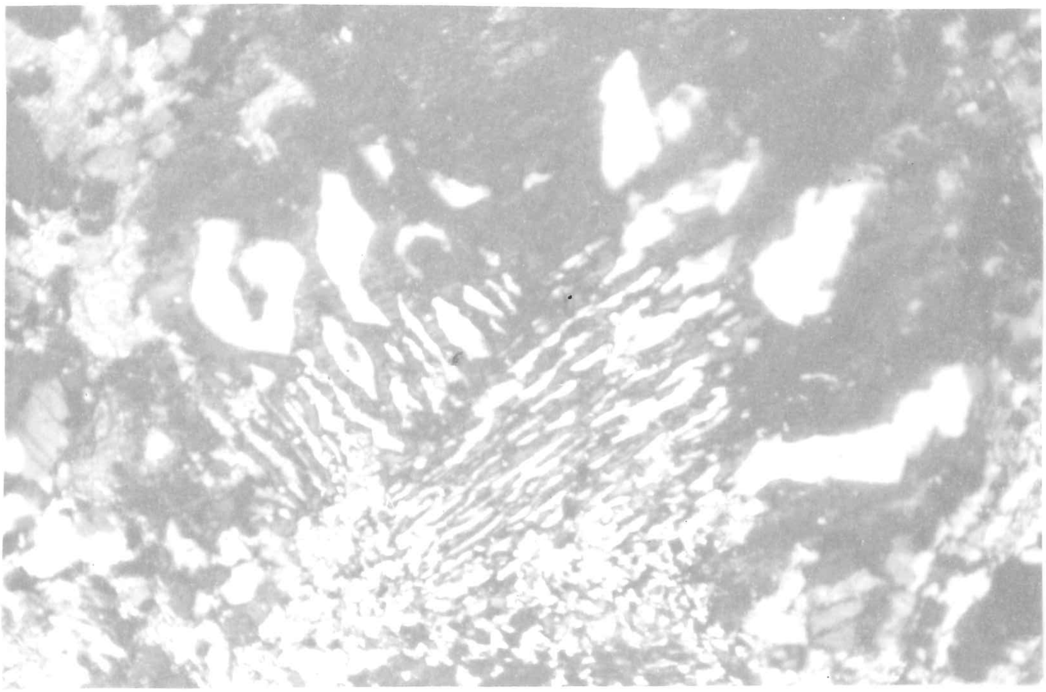


FIG. 1

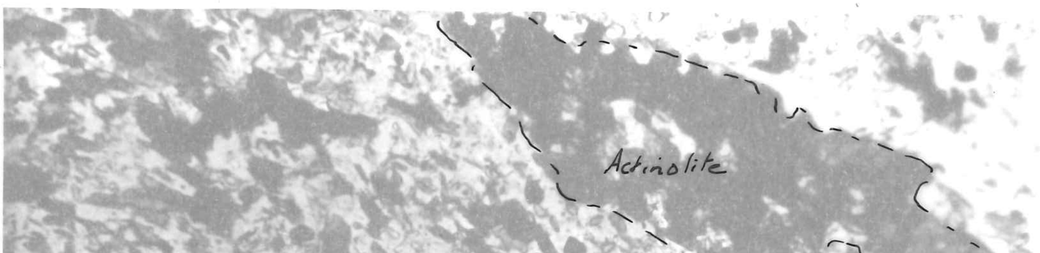


FIG. 2

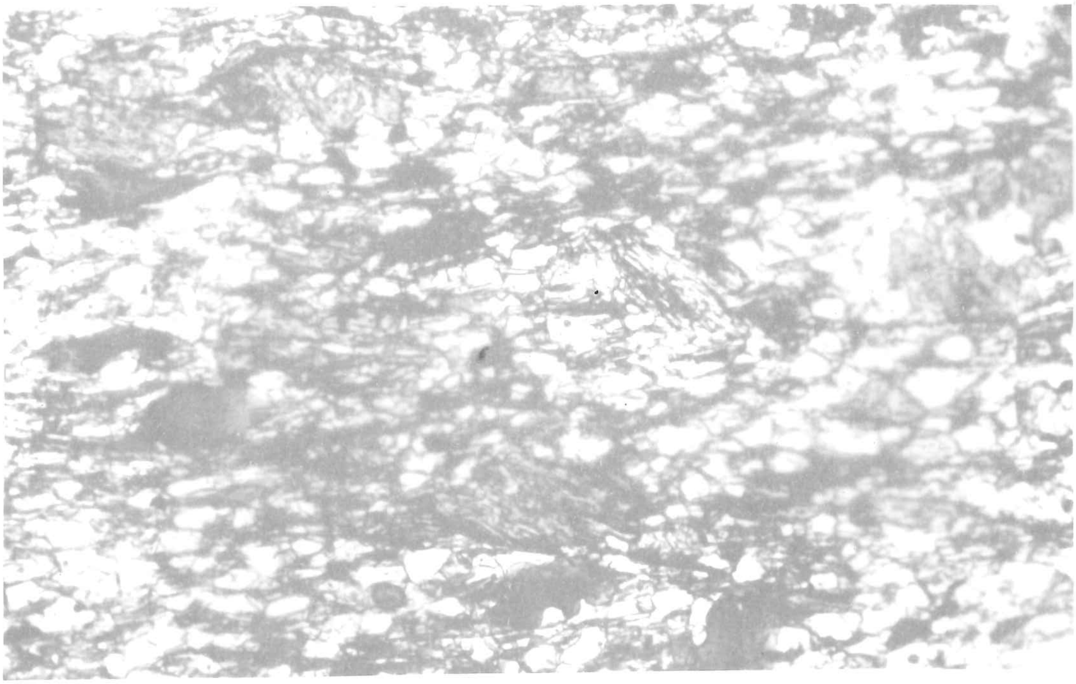


FIG. 1

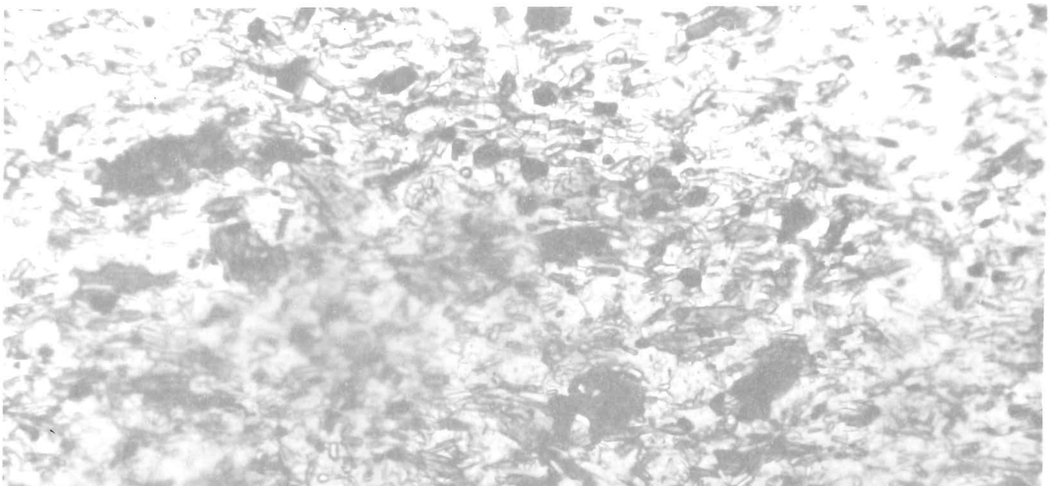


FIG. 2


Biotite rich, folded band.
General preferred orientation direction

FIG. 1

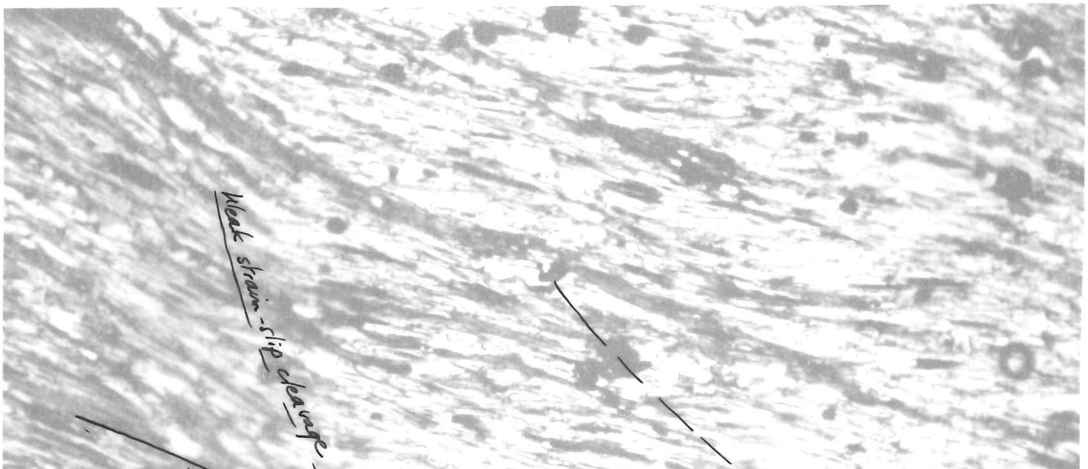

Weak strain-slip cleavage
Preferred orientation

FIG. 2

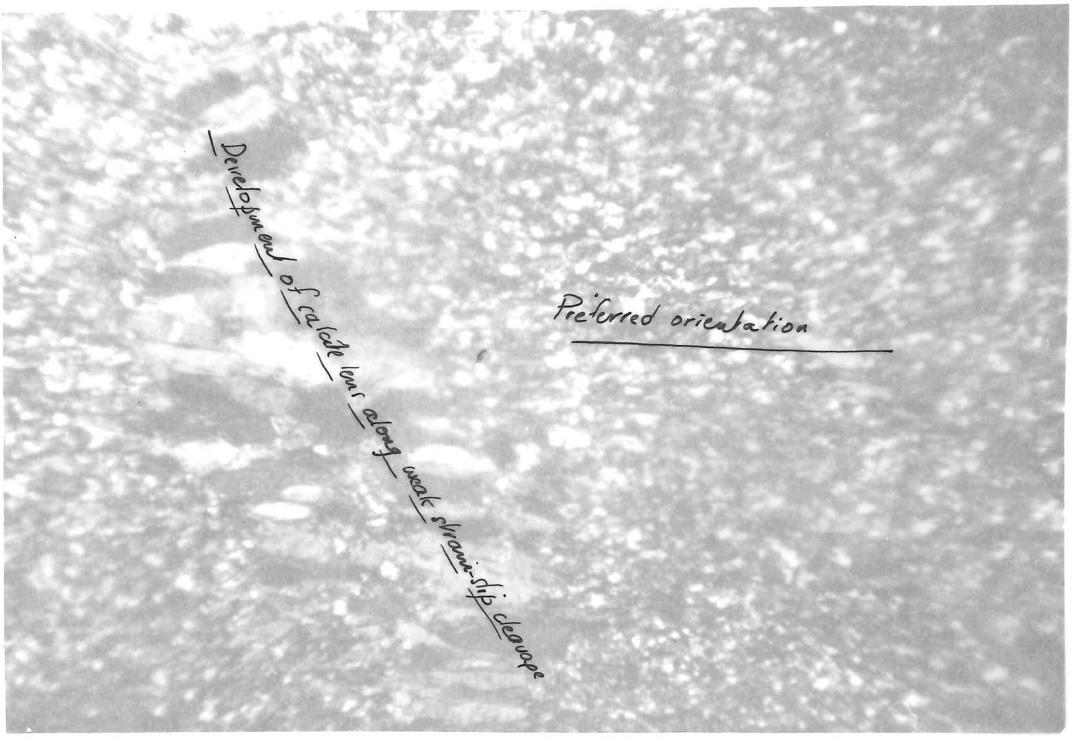

Development of calcite lens along weak strain-slip cleavage
Preferred orientation

FIG. 1

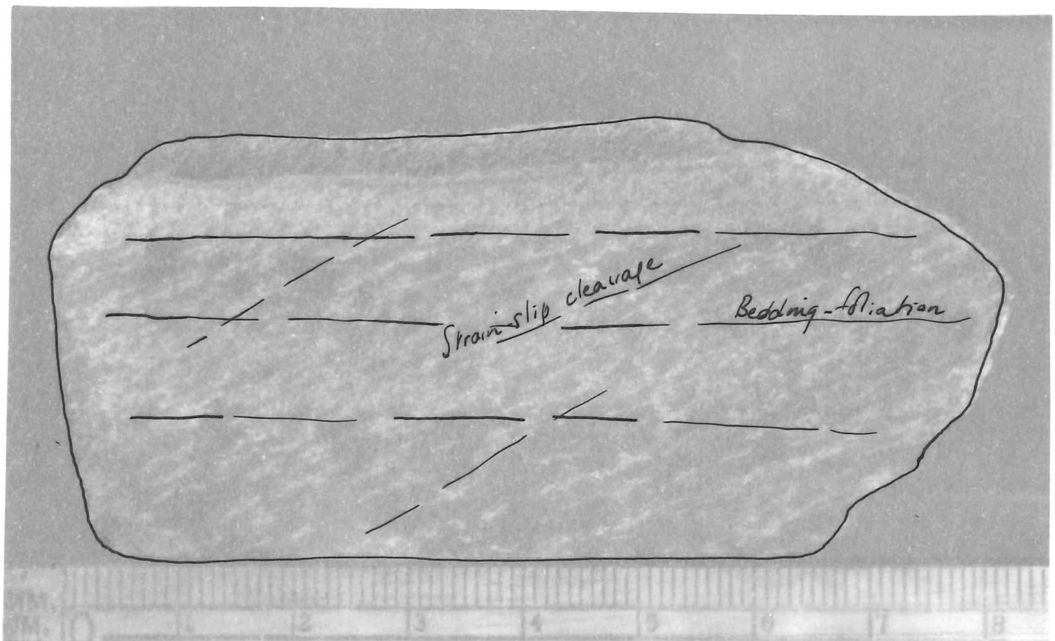
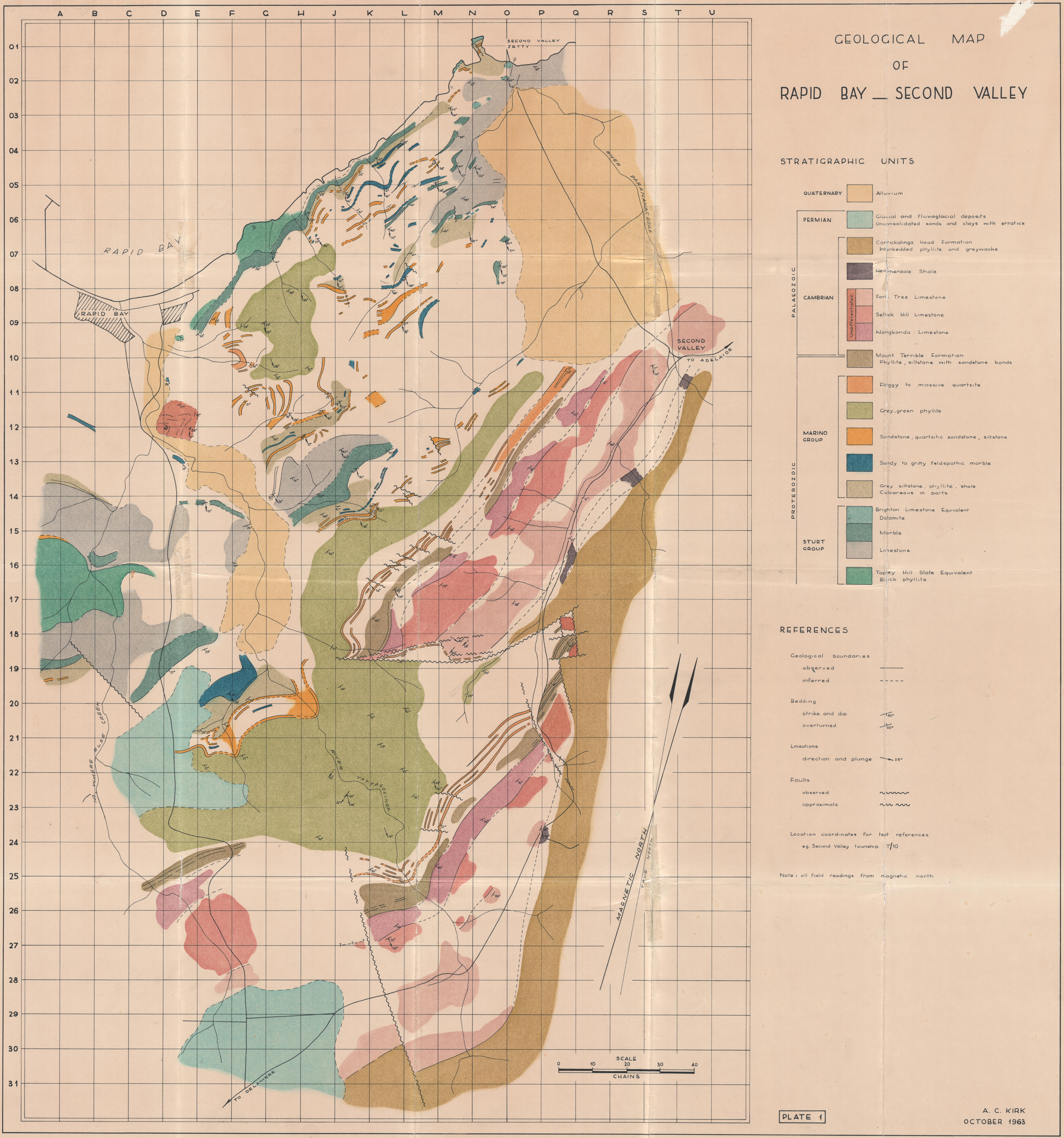
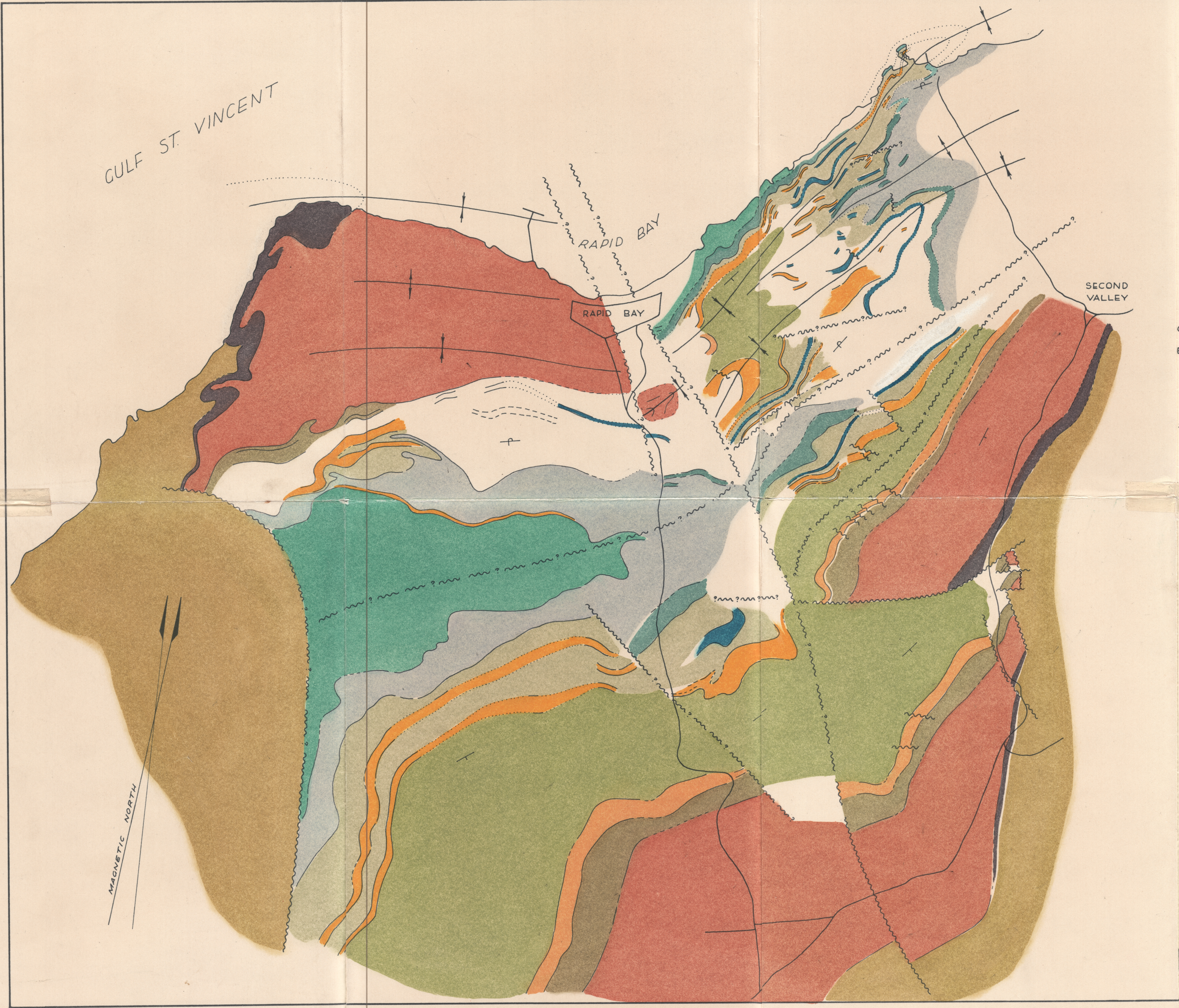

Strain-slip cleavage
Bedding-foliation

FIG. 2


GEOLOGICAL MAP
OF
RAPID BAY — SECOND VALLEY
STRATIGRAPHIC UNITS
QUATERNARY
Alluvium
PALAEOZOIC
PERMIAN
Glacial and fluvioglacial deposits
Unconsolidated sands and clays with erratics
CAMBRIAN
Carrickalinga Head Formation
Interbedded phyllite and greywacke
Heatherdale Shale
Undifferentiated
Fork Tree Limestone
Sellick Hill Limestone
Wangkonda Limestone
Mount Terrible Formation
Phyllite, siltstone with sandstone bands
PROTEROZOIC
MARINO GROUP
Flaggy to massive quartzite
Grey-green phyllite
Sandstone, quartzitic sandstone, siltstone
Sandy to gritty feldspathic marble
Grey siltstone, phyllite, shale
Calcareous in parts
STURT GROUP
Brighton Limestone Equivalent
Dolomite
Marble
Limestone
Tapley Hill Slate Equivalent
Black phyllite
REFERENCES
Geological boundaries
observed
inferred
Bedding
strike and dip 40°
overturned 30°
Lineations
direction and plunge 25°
Faults
observed
approximate
Location coordinates for text references
e.g. Second Valley township T/10
Note: all field readings from magnetic north
SECOND VALLEY JETTY
RAPID BAY
SECOND VALLEY
TO ADELAIDE
RIVER PARANANACOOKA
RIVER YATTAGOLINGA
NO WHERE ELSE CREEK
TO DELAMERE
MAGNETIC NORTH
TRUE NORTH
SCALE
0 10 20 30 40
CHAINS
PLATE 1
A. C. KIRK
OCTOBER 1963

STRUCTURAL INTERPRETATION
OF
RAPID BAY _ SECOND VALLEY
STRATIGRAPHIC UNITS
QUATERNARY
Alluvium
PERMIAN
Glacial and fluvioglacial deposits
Unconsolidated sands and clays with erratics
PALAEOZOIC
CAMBRIAN
Carrickalinga Head Formation
Interbedded phyllite and greywacke
Heatherdale Shale
Undifferentiated
Fork Tree Limestone
Sellick Hill Limestone
Wangkonda Limestone
Mount Terrible Formation
Phyllite, siltstone with sandstone bands
PROTEROZOIC
MARINO GROUP
Flaggy to massive quartzite
Grey-green phyllite
Sandstone, quartzitic sandstone, siltstone
Sandy to gritty feldspathic marble
Grey siltstone phyllite, shale
Calcareous in parts
STURT GROUP
Brighton Limestone Equivalent
Dolomite
Marble
Limestone
Tapley Hill Slate Equivalent
Black phyllite
REFERENCES
Geological boundaries
observed
inferred
Bedding
strike and dip
overturned
Lineations
direction and plunge
Faults
observed
approximate
Location coordinates for text references
e.g. Second Valley township T/10
Note: all field readings from magnetic north
Additional references for structural interpretation
Inferred geological boundaries to give a possible structural interpretation
Trace of axial plane
anticline
syncline
Inferred faults
RAPID BAY
SECOND VALLEY JETTY
SECOND VALLEY
TO ADELAIDE
TO DELAMERE
MAGNETIC NORTH
SCALE
CHAINS
0 10 20 30 40
PLATE 2
A. C. KIRK
OCTOBER 1963

AN INTERPRETATION
OF THE
STRUCTURAL GEOLOGY
OF
RAPID BAY



COMPILED FROM A GEOLOGICAL SURVEY
BY R.D. DRAYTON, W.C. LESLIE AND A.C. KIRK

STRATIGRAPHIC UNITS AND REFERENCES
AS FOR PLATE 2

SCALE
0 20 40 60 80
CHAINS

PLATE 3

A. C. KIRK
OCTOBER, 1963