

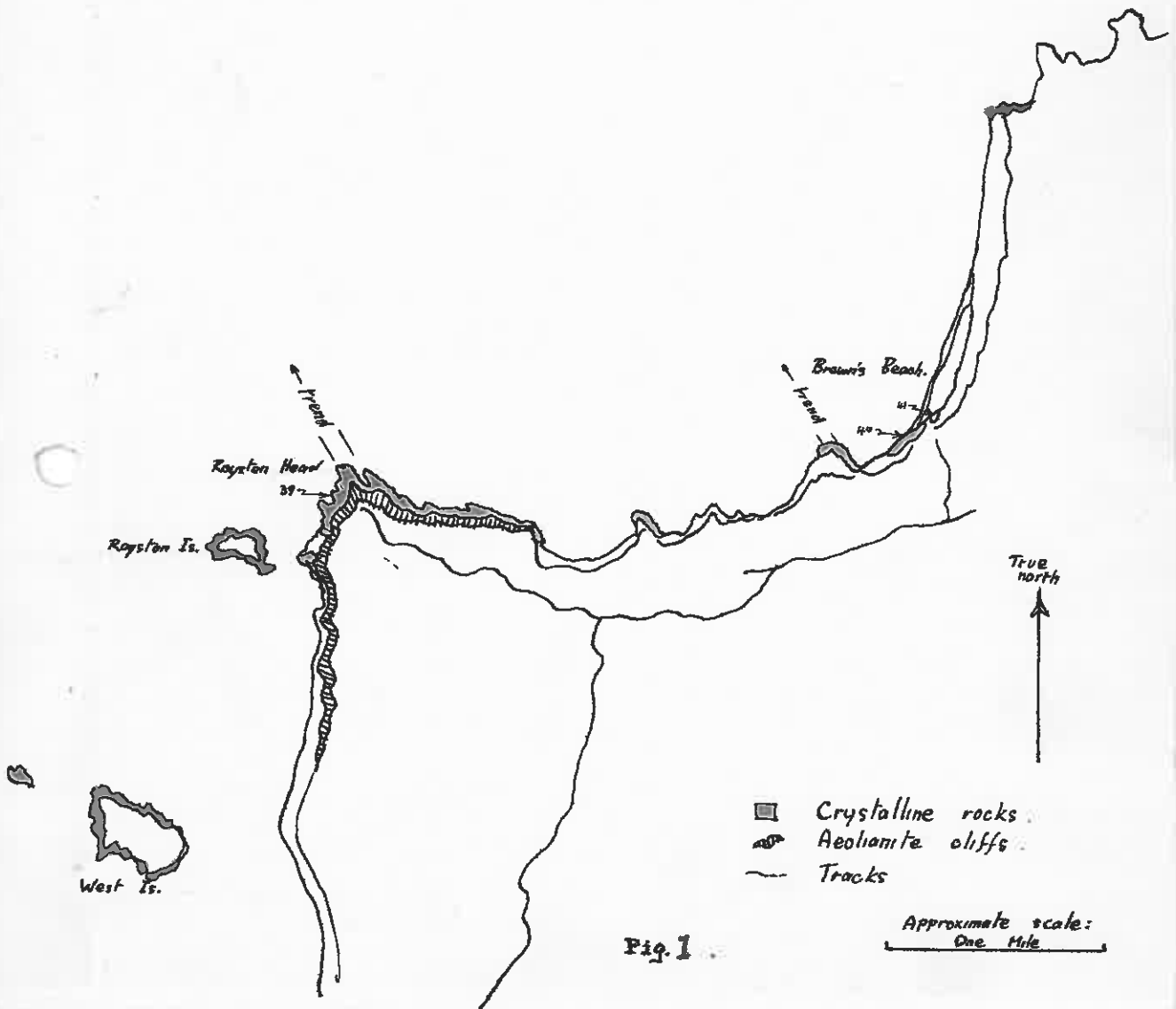
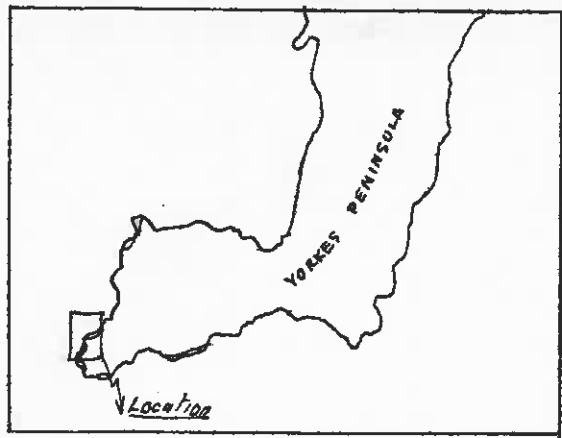
THE CRYSTALLINE ROCKS OF YORKE'S PENINSULA, S.A.I INTRODUCTION:

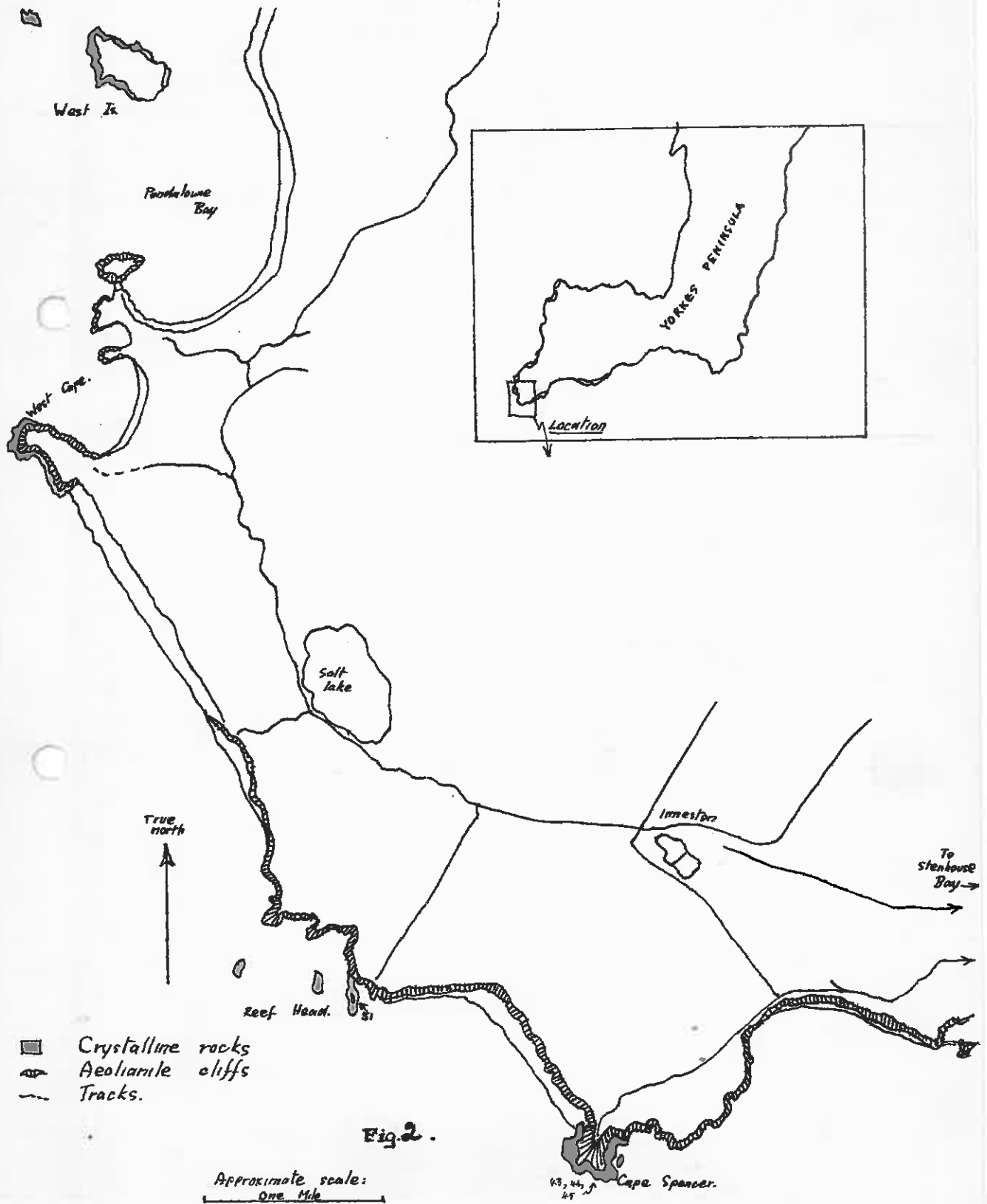
The areas under discussion are situated at the southern end of Yorke's Peninsula, approximately two hundred miles from Adelaide by road. In the three maps, (figures 1, 2 and 3), the positions of these areas are shown and, as may be seen, the crystalline rocks outcrop only along the coastline in a strip up to one hundred yards wide.

Two separate areas were studied. The first, (figures 1 and 2) includes Cape Spencer, the southernmost point on the peninsula, and Pondalowie Bay, a small fishing village. The nearest town is Stenhouse Bay, situated at the eastern extremity of the area, noted for gypsum. This section covers some fifteen miles of coastline. The second area is bordered to the west by Marion Bay and to the east by Foul Bay, (both low-lying areas devoid of outcrops), and includes Point Yorke. In this area crystalline rocks outcrop continuously along the sea cliffs and wave cut platforms for a distance of about seven miles.

Owing to the fact that exposures of the older rocks are limited to this narrow, long strip, only a one dimensional picture is obtained of any regional structure. Thus detailed mapping is irrelevant in this case and correlation over large areas may be impossible. Therefore the area was studied from a chiefly descriptive and petrological view-point, special attention being paid to contact phenomena between the various rock-types.

Aerial photographs from the South Australian Lands Department were used as the basis of the work. From these the maps were drawn and outcrops located. Then the coastline concerned was traversed on foot, working from the nearest tracks accessible to a car. Approximately fifty specimens were collected, representative typical rocks, and from these thirty thin sections were cut and described. In places the trends of the rocks were followed some distance under the sea with the aid of underwater breathing equipment, but generally this facility only widened the strip several yards, as sand covers all deeper rocks.





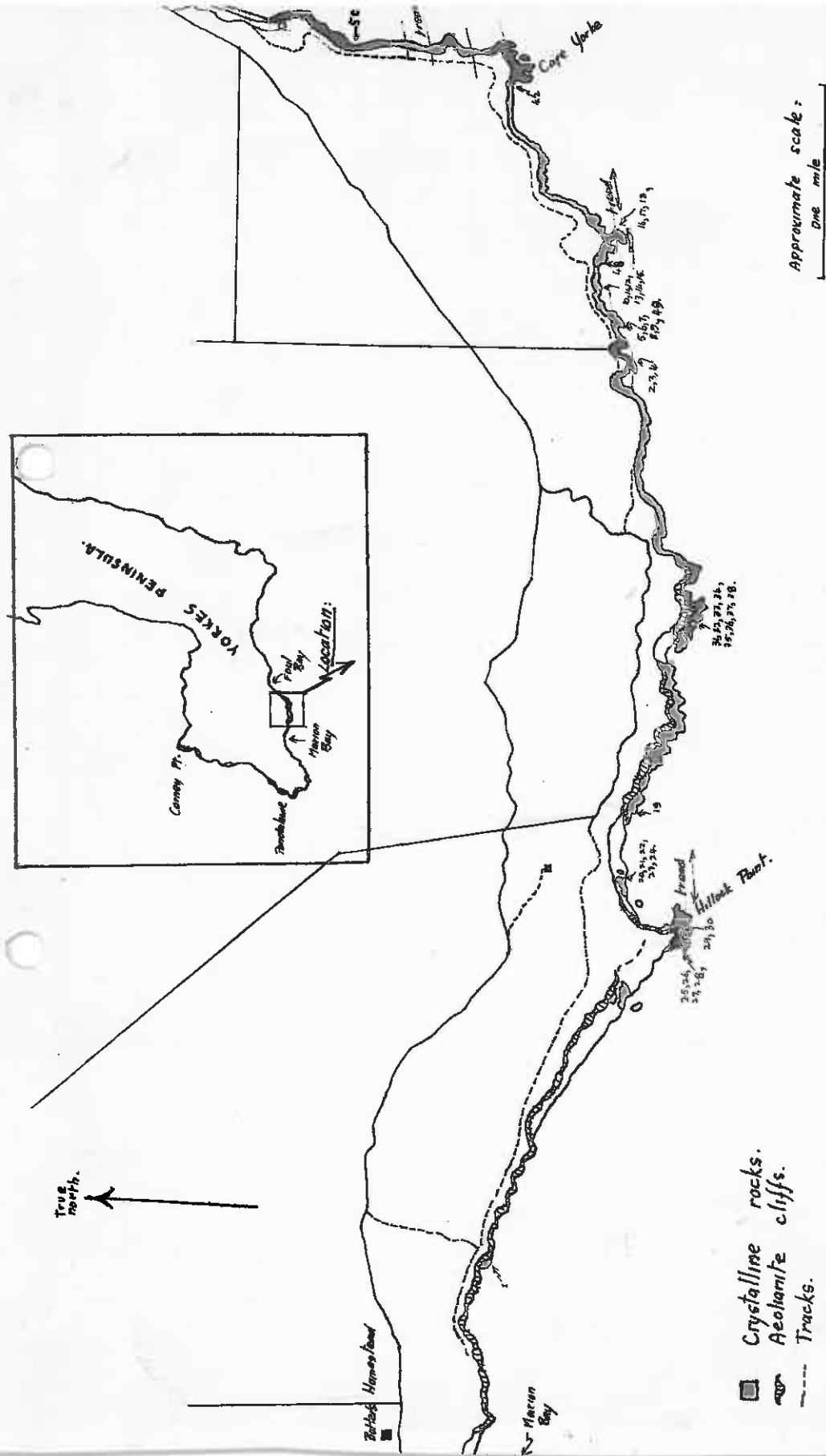


Fig. 3.

~~disposition.~~

A total of twenty days was spent in the areas concerned and the point Yorke section received more attention than the less accessible Pöndalowie district.

LI      SUMMARY AND CONCLUSION:

This report deals with the crystalline rocks of Southern Yorke Peninsula. The Precambrian age of these is considered and the petrography discussed. The rocks are divided into the main varieties, which are as follows:-

- (i) Gneisses:
  - (a) "Grey banded gneiss".
  - (b) "Red gneissic granite".
  - (c) "A<sup>u</sup>gen gneisses".
  - (d) Cape Spencer and Royston Head gneisses.
  - (e) "Dark biotite granite".
- (ii) Amphibolites:
  - (a) Conformable amphibolite bodies.
  - (b) Altered dyke rocks.
- (iii) Pegmatites.

The mineralogy and texture are described where necessary, and structural relations are considered.

The older rocks in the Point Yorke area are described as possible metasediments containing the conformable amphibolite bodies which may represent metamorphosed basic flows or sills. The "red gneissic granite" is shown to have subsequently engulfed these rocks forming migmatites and injection gneisses, and many of the pegmatites of the area are tentatively related on structural evidence to this later activity. Rapikivi<sup>4</sup> type porphyritic granites are common, usually as narrow zones related to intrusive contacts.

The paper is concluded with a discussion concerning similarities between these rocks and rocks of other Precambrian terrains of the world.

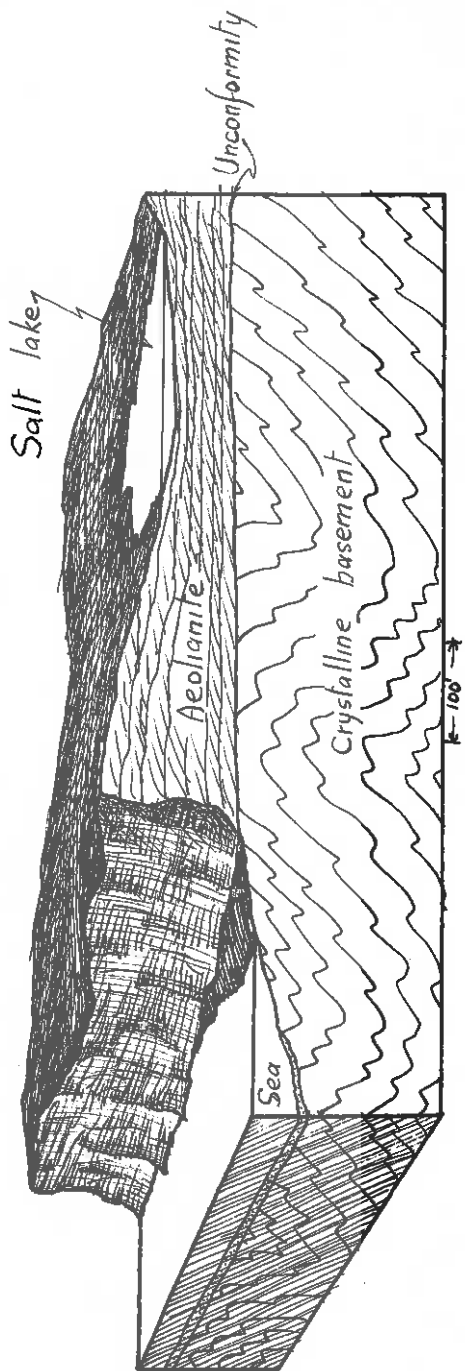


Fig. 4.

111 GEOGRAPHY.

In the areas concerned, the highest points are only a matter of three or four hundred feet above sea-level. The land consists of low-lying salt-pans and low scrub-covered hills. The latter are the remains of Pleistocene sand dunes, subsequently consolidated and capped with kunkar travertine. (fig.4) Where these are dissected by the sea they form cliffs up to two hundred and fifty feet high, (Cape Spencer), and may then be seen to consist of cross bedded wind blown sand, ("aeolianite"), with layers of travertine representing old land surfaces. These hills are overlain along the coast by recent unconsolidated sand dunes.

Beneath this aeolianite, separated of course by an unconformity, lie the crystalline Precambrian rocks. As stated, these are only exposed along the coast line. They have been levelled off to a peneplain under the aeolianite, with a relief of about fifty feet, and <sup>recent</sup> erosion has not cut deep enough to cause outcrops inland.

Rocks of similar age occur to the north in the Moonta district and to the west in the Port Lincoln area. To the south the crystalline basement forms the foundations of the Althorpe Islands and numerous small reefs, in many cases overlain by the same system of aeolianite.

IV. PETROGRAPHY:

The rocks under discussion in the above-mentioned areas are almost certainly of Precambrian (Archaean) age. This assumption is based upon analogies with rocks in adjacent areas, although no direct evidence has been noted. In the Moonta district, about 150 miles to the north, similar rocks are to be seen overlain by proved Cambrian sediments on an eroded platform of the series, and in other parts of the world, notably in the Laurentian of the Canadian Shield, strikingly similar rocks of definite Archaean age exist.

It will be convenient first to describe the various rock types encountered in the areas, and then to discuss relations between these types.

ROCK TYPES.

(i) Gneisses: These are the most widely occurring rocks.

(a) "Grey banded Gneiss": This is perhaps the most conspicuous type in the Point Yorke area. It is typically of a dark grey color, rather rich in hornblende or biotite, and has a type of banded structure which may indicate a sedimentary origin. Distinct bands are frequently traceable over relatively large distances, and simple folded structures recall contorted beds of an originally sedimentary rock.

This is also the rock in which all the conformable amphibolite bodies occur in the Point Yorke area.

Mineralogy: (Slides and specimens A 132/2, 8 and 16). The gneiss appears to be a medium grained equigranular rock consisting chiefly of anhedral microcline, sericitized in places, with fine cross-hatching. Quartz is present as about 5% of the rock and occurs as anhedral grains with undulose extinction due to shearing. Hornblende is a common mineral and is present as small subhedra, whilst biotite is rare. Some bands of this gneiss are epidote-rich, (specimen and slide A132/8), probably due in part to the original composition of the bed if the



rock was sedimentary. The epidote here occurs as one of the major constituents, and in these layers iron ores are notably absent. In one area diopside, as pale green crystals of short prismatic habit is the predominant ferromagnesian mineral; (specimen and slide A 132/16). In some cases, also, sieve-like porphyroblasts of muscovite poecilo-blastically enclose epidote, quartz and feldspar (specimen and slide A 132/12).

(b). "Red gneissic granite": (slide A 132/31).

Next to the "grey banded gneiss", this type is the most prevalent in the Point Yorke area. It grades in texture from almost massive granite (slide and specimen A 132/18) to distinct gneissic granite (slide and specimen A 132/53) but is not banded. Rather, the gneissosity is due to the elongation of quartz and feldspar crystals in the fabric. This rock appears to have intruded the "grey banded gneiss".

Mineralogy: These rocks consist almost entirely of microcline and quartz, with the former slightly predominant. The microcline has granulated borders and is rather sericitized. Fine inclusions, imparting a cloudy appearance to the feldspars in thin section, cause the red colour in the hand specimen. Biotite is typically a very subsidiary mineral and occurs as grains elongated in the ratio of 1 : 4. Apatite is a common accessory.

(c) Augen Gneisses: These are coarse-grained rocks and they occur in all the areas. In the vicinity of Point Yorke they exist as narrow border phases of the "red gneissic granites" and can be directly traced into these. However, larger outcrops do exist (specimen A 132/19 and 25) further west, notably at Hillock Point and Brown's Beach. (specimen and slide A 132/41.)

Mineralogy: The porphyritic microcline crystals often attain an inch in length, and contain inclusions of quartz, plagioclase, apatite and ferromagnesians, due to the weak growth power of this mineral. The borders of these large

subhedral crystals are granulated due to shearing, and myrmekite is common. Oligoclase is the next most prominent mineral, and quartz makes up about 25% of the rock. Also present are biotite, hornblende and accessories of sphene, iron ores, apatite and tourmaline.

On weathering, the large microcline porphyroblasts stand out conspicuously and a directional character is imparted by biotite, which "wraps" around the large feldspars.

(d) Cape Spencer and Royston Head Gneiss:

(Specimen and slide A 132/43, specimen A 132/44, specimen A132/39). This is a grey type of gneiss with a prominent fine foliation due mainly to biotite streaks and also to some pegmatic bands. This gneiss contains conformable amphibolite bodies, and is intruded near Cape Spencer by a fine grained granitic rock. Thus, except for the lack of contrasting layers, this gneiss type has relations similar to the "grey banded gneiss" of the Point Yorke area.

Mineralogy: Typically, larger oligoclase and quartz crystals are set in a rather fine ground mass of quartz, biotite and microcline with accessories of sphene, apatite, tourmaline, ilmenite and magnetite.

(e) Dark Biotite Granite: An interesting exposure occurs in the bay to the east of Hillock Point, where a small outcrop of rather dark rock may be seen. In the hand specimen (A 132/20 and 21) this rock appears to be an even-grained granite with occasional large porphyritic crystals of feldspar and abundant ferromagnesian minerals. In thin section (slide A 132/20) it appears as a rather coarse-grained granitic rock with extensive signs of shearing; (i.e. all the larger crystals have crushed borders, and quartz has undulose extinction). Quartz makes up about 20% of the rock, with microcline and plagioclase (andesine) constituting the feldspars. Biotite is abundant and imparts the dark colour to the rock, whilst hornblende occurs as rare coarse anhedral. Small accessory zircons cause haloes in the biotite.

Viewed in the field, definite directional characters exist in this rock, (Figure 14), caused mainly by drawn out xenoliths and schlieren as well as pegmatites and altered aplite (?) dykes; (slide A 132/24).

Joint planes are numerous, some of which are shear zones along which movement has occurred, resulting in bands up to six inches wide of mylonitic rock. (Specimen and slide A 132/23). These consist chiefly of elongated microcline and plagioclase lenticles (from the original rock) set in a very fine ground mass of elongated biotite and quartz grains.

Particularly notable in this granite are the numerous inclusions, the majority of which seem to be basic amphibolitic rock (specimen and slide A 132/22). Contacts between these and the main body are usually well defined, and a typical inclusion would measure several inches across. They are elongated in the direction of flowage.

The dark xenoliths consist mainly of oligoclase and biotite, with associated masses of granular garnet and chlorite up to 3 mm. across. Epidote is also a common mineral in these rather basic inclusions. On the whole they appear to be xenoliths derived perhaps from basic hornblende schists or amphibolites into which the granite may have intruded.

(ii) Amphibolites : A conspicuous feature of all the crystalline rocks of the area are the black, sometimes dyke-like, bodies of amphibolite which occur commonly in some of the gneisses. These vary in size from small bodies an inch or so wide to relatively large masses of the order of tens of feet across. Two different relations are observed, the impact of which will be discussed later.

(a) Conformable Amphibolite Bodies : These are by far the most common type of amphibolite. They occur throughout the areas described as irregular masses having contacts always conformable with the foliation of the enclosing gneiss.

Specimen and slide A 132/4 is taken from a typical amphibolite of this type. This occurs in the "grey banded gneiss", and both the gneiss and the amphibolite are cut by non-conformable pegmatites up to eight feet across. The rock is black and medium grained, with a slight foliation visible in the field due to mineral elongation. This foliation is parallel to the contacts of the amphibolite and thus to the foliation of the gneiss. Pyrites is visible in the hand specimen, and in thin section the rock is seen to consist mainly of hornblende in anhedral poeciloblastic crystals, with sericitized plagioclase, a little quartz (5%), and sphene. A mineral similar to scapolite has formed later along fine cracks, and accessories are rutile, ilmenite and pyrites. No relict igneous texture is apparent in any of the conformable amphibolite bodies, and their probable origin will be discussed later.

Often epidote is developed in these rocks, imparting a green tinge in the field. This is notable in specimen & slide A 132/15. A thin section of this sample showed a layered structure of epidote-rich portions and darker chlorite layers associated with bunches of minute magnetite octahedra.

(b) Altered Dyke Rocks :

Particularly in the Brown's Beach area, and also at Cape Spencer, dykes of undoubtedly altered basic igneous rocks occur, up to ten feet in width. The dykes are visible for many yards along their length, but they pass under the aeolianite cliffs and out to sea.

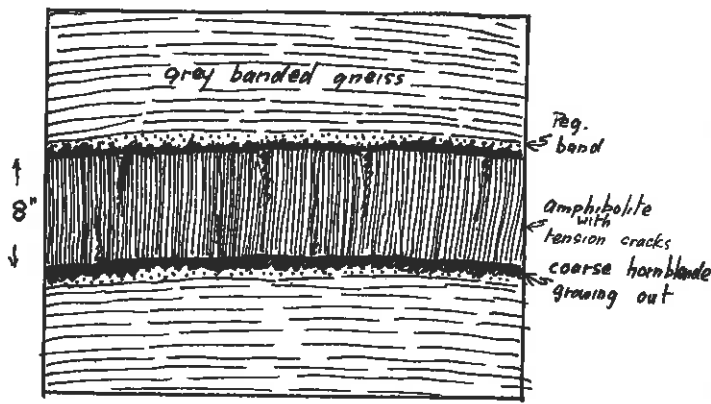
Specimen and slide A 132/40 from Brown's Beach is typical of these. The rock is a fine-grained amphibolite with a definite palimpsest texture indicating its derivation from a basalt-type dyke. In the hand specimen, porphyritic crystals of sericitized feldspar are visible, and numerous small laths of sericitized plagioclase are randomly arranged. In thin section the groundmass is seen to be a granoblastic aggregate of equi-dimensional hornblende and quartz, both recrystallized.

(iii) Pegmatites: These occur as dykes up to twenty feet in width and a hundred yards long. The average size would be a foot wide and several yards in length, and generally they lens out into the country rock. Most of the pegmatites are conformable with the surrounding structure and these typically contain the same minerals as the gneiss in which they occur. (i.e. Segregation pegmatites, products of metamorphism). Usually they consist of a coarse aggregate of reddish feldspar and quartz with individual crystals up to a foot in length. Some variations may be "graphic", and not infrequently large "books" of biotite occur in lenses adjacent to contacts with the country rock. (Some "books" measure five inches across). Muscovite is lacking in these pegmatites, but where the country rock is rich in hornblende (especially in the "dark biotite granite") they contain coarse euhedral hornblende crystals an inch or so across.

Some pegmatites carry a black metallic mineral in rather coarse grains. (Point Yorke and Reef Head). An X-ray determination on a sample from Point Yorke proved it to be ilmenite, and apart from that the monotonous composition of many of the pegmatites <sup>suggests</sup> ~~attests~~ an origin by mineral segregation.

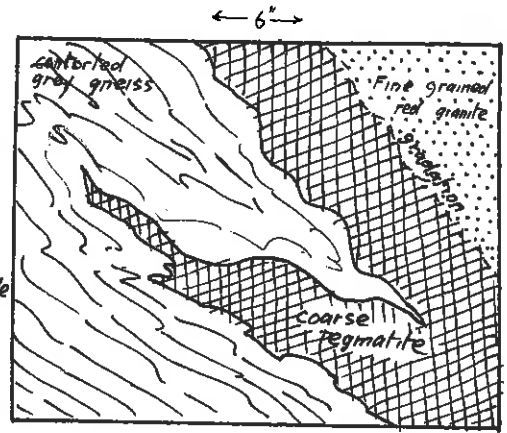
Occuring in minor quantities are non-conformable pegmatites. Some of these, notably one a mile west of Hillock Point, carry tourmaline in small quantities.

Microscopically, microcline is a common constituent of all the pegmatite bodies. (Slide A 132/51 ) ~~not described~~).



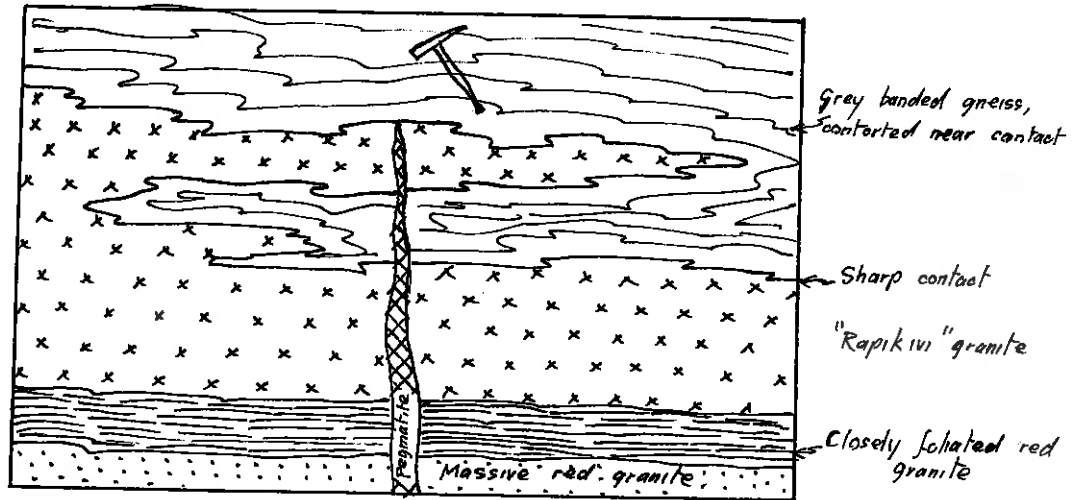
Enlarged portion of amphibolite body in fig. 6.

Fig. 11.



Red granite-grey gneiss contact

Fig. 12.



Plan view of typical contact phenomena between red granite & grey gneiss

Fig. 10.

V. ROCK RELATIONS AND STRUCTURES :

(i) Contact between "grey banded gneiss" and "red gneissic granite :

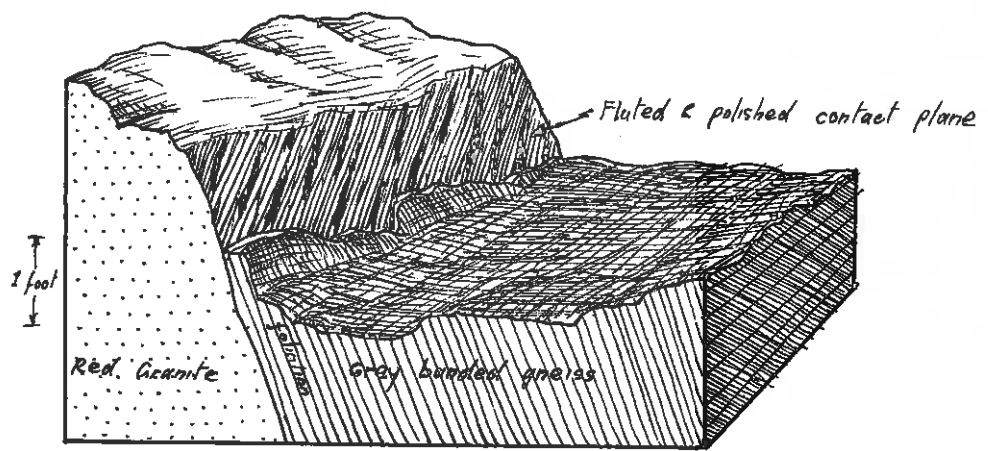
In the Point Yorke section, as previously stated, the most widely occurring rock types are the "grey banded gneiss" and the "red gneissic granite". The former contains all the conformable amphibolites and is the older gneiss of the two. For reasons given, it may be a paragneiss, and wherever contacts are visible between it and the "red granite gneiss" the relative ages are obvious.

Viewed on a large scale, the contacts are conformable with the foliation of the "grey banded gneiss", although minor variations are caused by "tongues" of the granite "licking" into the gneiss. (See figures 10 and 12).

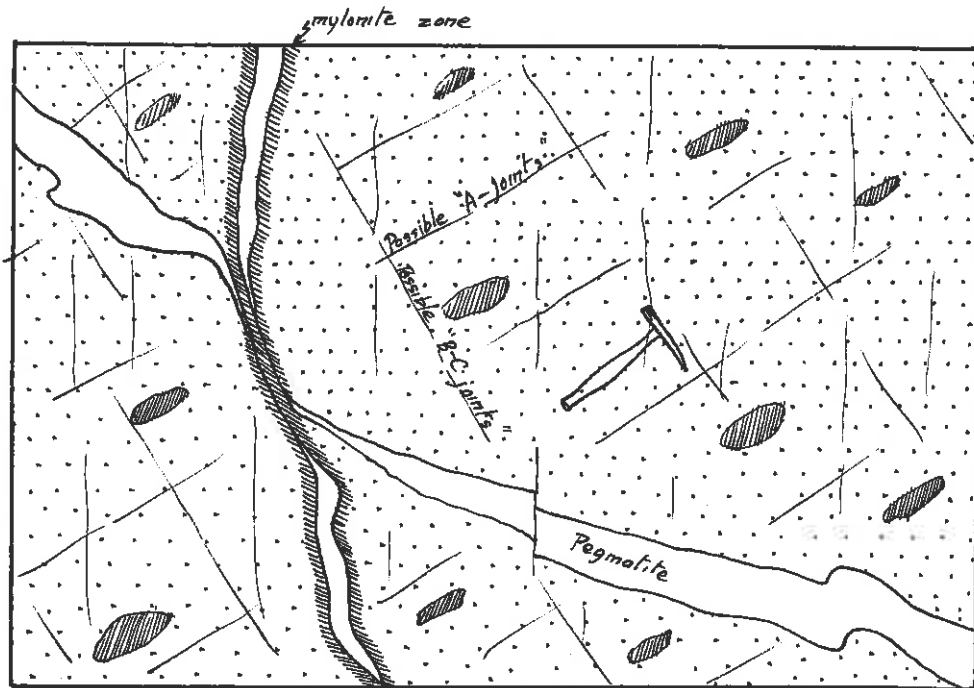
Figure 10 illustrates a series of contact phenomena occurring near Point Yorke. Massive medium-grained red granite passes into a foot-wide band sheared gneissic rock which is separated by a sharp contact from a rather more irregular band of coarse augen gneiss. (All the contacts are parallel to the foliation of the "grey banded gneiss"). The augen-type gneiss is then seen to permeate the grey gneiss along tongues generally along foliation planes.

In figure 12, the fine-grained red granite passes gradationally into coarse pegmatite consisting of feldspar and quartz with occasional biotite books. This pegmatic rock then intruded the grey banded gneiss, which is locally rather contorted.

The "red gneissic granite" contains some evidence of being a plutonic mass. Figure 13 illustrates a contact between this rock and the "grey banded gneiss" some miles west of Point Yorke, and here erosion has removed some of the grey gneiss exposing the fresh contact plane. This is a polished surface and, as illustrated, there are definite parallel grooves reminiscent of those on a glaciated pavement. These run at about  $45^{\circ}$  to the horizontal. Similar phenomena occur wherever the red granite-grey gneiss contacts have been eroded. (The more easily weathered



Block diagram illustrating grooved Red granite - Grey gneiss contact plane  
Fig. 13.



"Dark biotite granite", Hillock Point, with elongated inclusions  
Fig. 14



foliated grey gneiss is removed in slabs, exposing the contact planes). These facts indicate flowage of the granite along the foliation planes of the gneiss, these being the planes of least resistance.

The contacts shown in figures 10 and 12 may represent subsequent granitization of the intruded gneiss after the granite had been emplaced. On crystallization, a continuous flux of volatile material would proceed from the granite into the country rock and, if the latter were suitable, these emanations would react with, and replace, appropriate elements in the gneiss to form the coarse porphyritic feldspars or the pegmatite zone. (Alkali metasomatism). Shearing during this stage may cause the foliated zone shown in fig.10.

(ii) Structure of the "Dark Biotite Granite":

The mineralogy of this rock has been discussed in section IV. It seems to be a minor body as it outcrops only over a small area, and contact details are lacking, due to beach-sand covering.

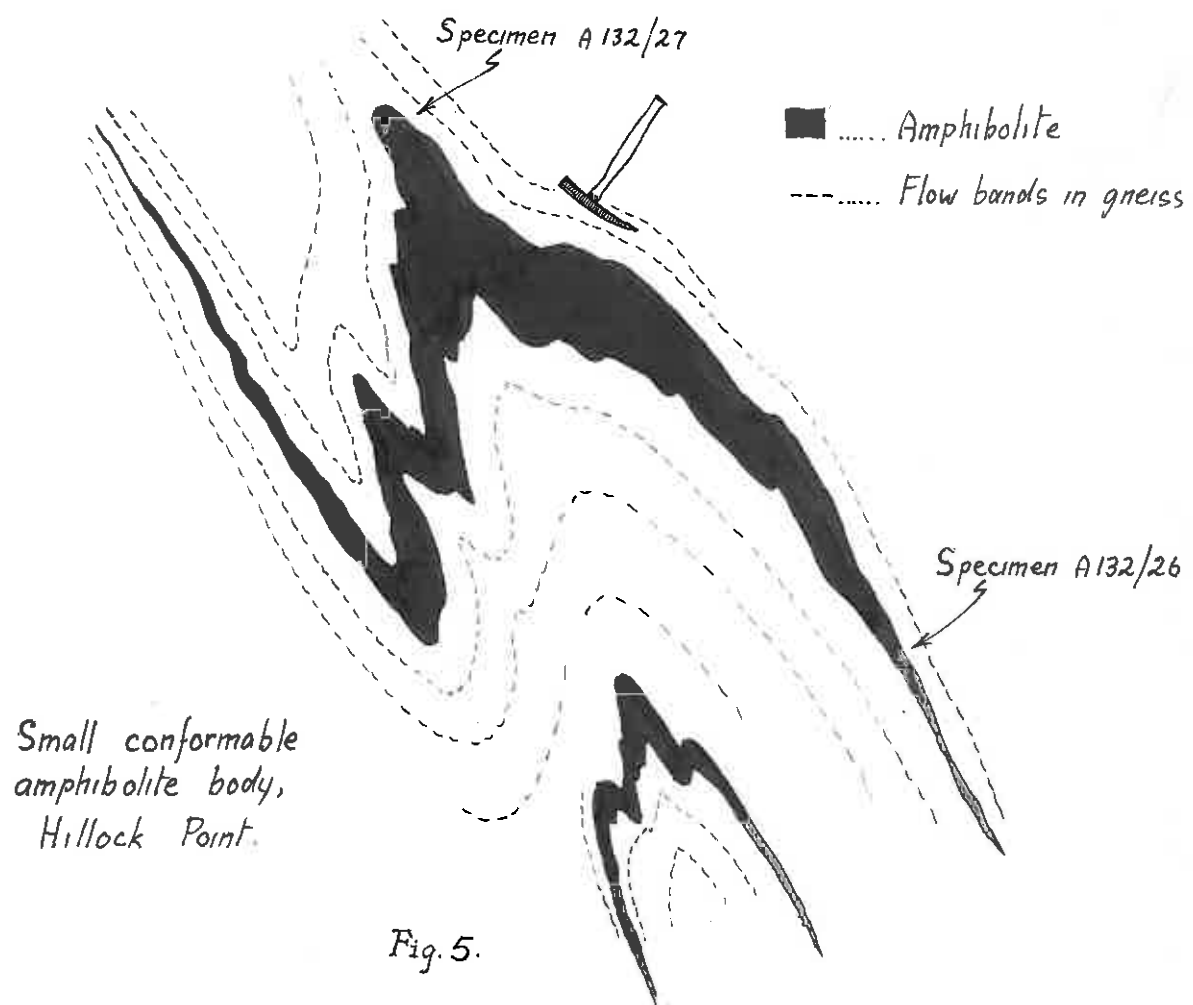
The rock itself is somewhat foliated and this may be accounted for by movement whilst it was still in the plastic state. The inclusions are consistently elongated in about the ratio of 1:4 in the direction of foliation, and sets of joints are visible, both parallel to and normal to the foliation direction. (Figure 14).

Pegmatite bodies cut this "granite" some being displaced several inches by another joint set. Bands of shearing are also common along these joints and in one case a pegmatite body is surrounded on either side by a narrow mylonite zone. (fig. 14).

From these observations it seems that forces caused flowage of this rock whilst it was still in the plastic state, with subsequent elongation and lineation of inclusions.

The sets of joints parallel and normal to the planar structure may have formed by this movement and when on cooling the rock became solid enough to fracture, pegmatites were injected.

Movement may have taken place along the third joint set subsequent to consolidation, and the displacement of some of the pegmatites. The pegmatite in figure 14 which is surrounded by



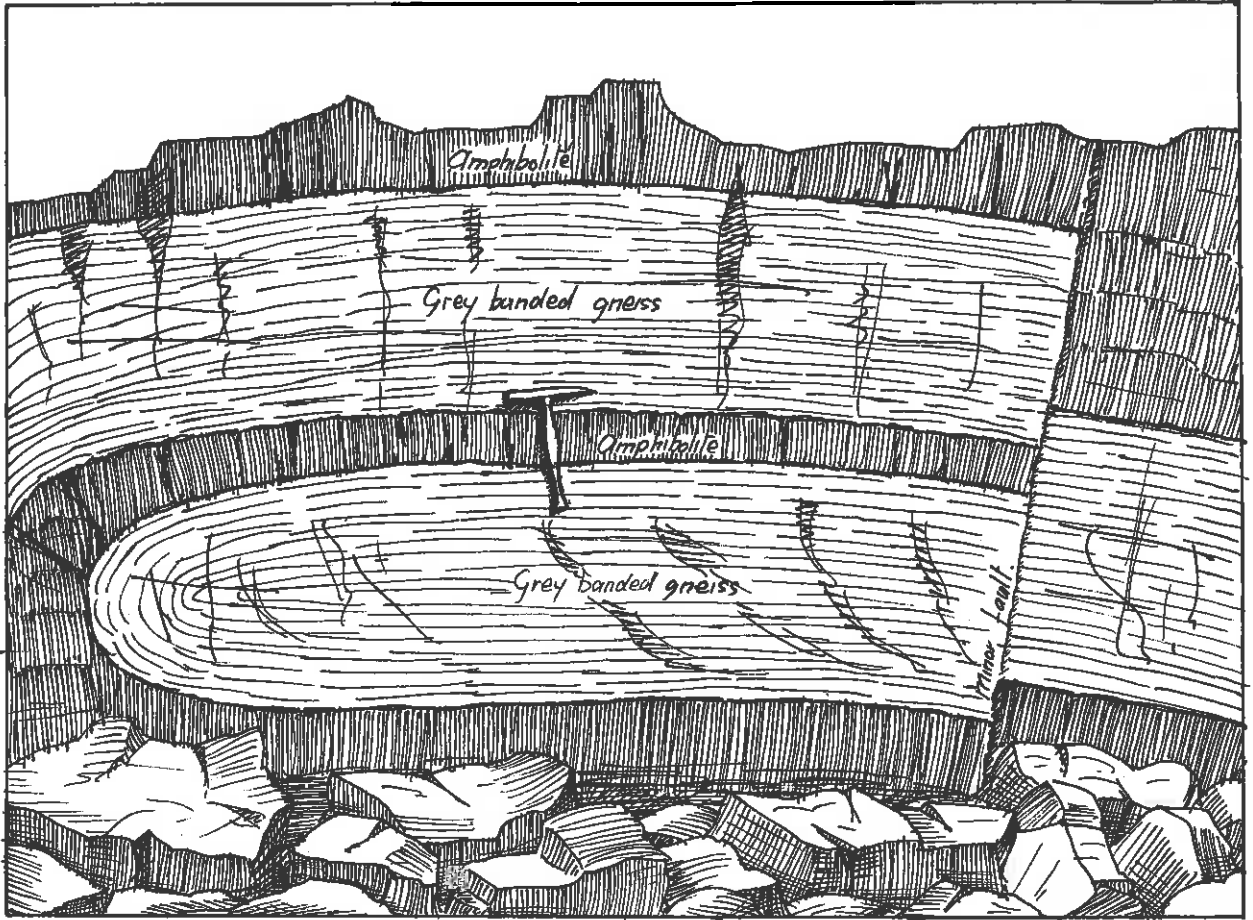
sheared rock probably filled a fissure which opened after the mylonite formed.

(iii) Amphibolite Structures :

(a) Conformable Amphibolite Bodies :

These are the most conspicuous amphibolites of the areas. They occur as lenticular bodies ranging in size from an inch or so to many feet across, and their length is always very much greater than their breadth. Disruption of these by flowage in the gneiss is apparent in some cases, and boudinage similar to that noted by C. E. Tilley<sup>1</sup> at Eyre's Peninsula, occurs. Usually no schistosity is apparent to the eye in the amphibolites, but sometimes it is very conspicuous. When present, it is parallel to the surrounding gneissic foliation and thus to the amphibolite-gneiss contact.

Figure 5 illustrates a typical amphibolite body in the form of a tight fold. (Hillock Point). It seems to be somewhat irregular, but the gneissic foliation follows around the contacts conformably. The prominent foliation present in the limbs of the amphibolite is also parallel to the borders. Specimen A 132/27 was collected from the nose of the fold and, in thin section, it appears as a compact medium-grained equigranular rock with a granoblastic arrangement of hornblende, oligoclase and microcline. Accessories are apatite and epidote. Contrasting with this is the specimen A 132/26, from the sheared limb of the amphibolite. In the hand specimen the rock here appears coarsely foliated, the foliation being mainly due to large porphyroblastic biotites up to half an inch across. In thin section the biotite "books" are seen to be sieve-like, poeciloblastically enclosing feldspar and quartz due to relatively rapid stress - induced growth. Other minerals are a little interstitial quartz, subhedral hornblende, oligoclase and microcline perthite. This amphibolite, then, has been distorted with the enclosing gneiss, and the direction of greatest stress was probably normal to the axial plane of the "fold". Thorough recrystallization during the folding naturally obliterated any signs of cataclastic deformation.



Example of folded conformable amphibolite body with tension cracks, in  
"Grey banded gneiss"

Fig. 6.

Figure 6 is another example of an amphibolite body folded with the gneiss. In this case, the amphibolite is in the "grey banded gneiss" near Point Yorke and an open fold occurs with typical tension cracks. According to Ramberg<sup>2</sup>, the brittleness of rocks in regional metamorphism is a function of the mineral composition. The more basic the rock, the more subject to rupture it is, so the quartz-feldspathic gneisses are very incompetent at a medium or high grade of regional metamorphism. On the other hand the amphibolites are competent. Thus on folding the latter show little ability to yield in a plastic manner, resulting in tension cracks and boudins. Tension cracks may represent "embryonic boudins". On further disruption there may be a migration of the most diffusive material, under the influence of the chemical potential, into the low pressure regions between the ruptures. This would explain the formation of pegmatic material between some amphibolite blocks observed at Yorke's Peninsula.

Figure 11 shows an enlarged portion of figure 6. The amphibolite band here is about eight inches wide, and the foliation is parallel to the gneissic foliation. Bordering the body there are two layers, each about an inch in width, of coarse hornblende. These have smooth contacts on the inner sides, (with the amphibolite), whilst the outer margins are irregular due to hornblende crystals apparently growing into the acid rock. Between each hornblende zone and the gneiss there is a layer about half an inch wide of pegmatic material which has a microscopically sharp contact with the gneiss. The cause of these phenomena will be discussed later when considering quartz and pegmatite veins.

#### Origin of the Conformable Amphibolites:

Analagous amphibolites occur in many areas of exposed "shield" rocks and, as their origin is a controversial subject, it is only possible to give an outline of some of the theories of formation.

C. E. Tilley<sup>1</sup> has studied the Precambrian rocks of Southern Eyre Peninsula. He notes large areas of hornblende and biotite granite gneisses very similar to those of southern Yorke's Peninsula and the Amphibolit  relations are apparently analagous.

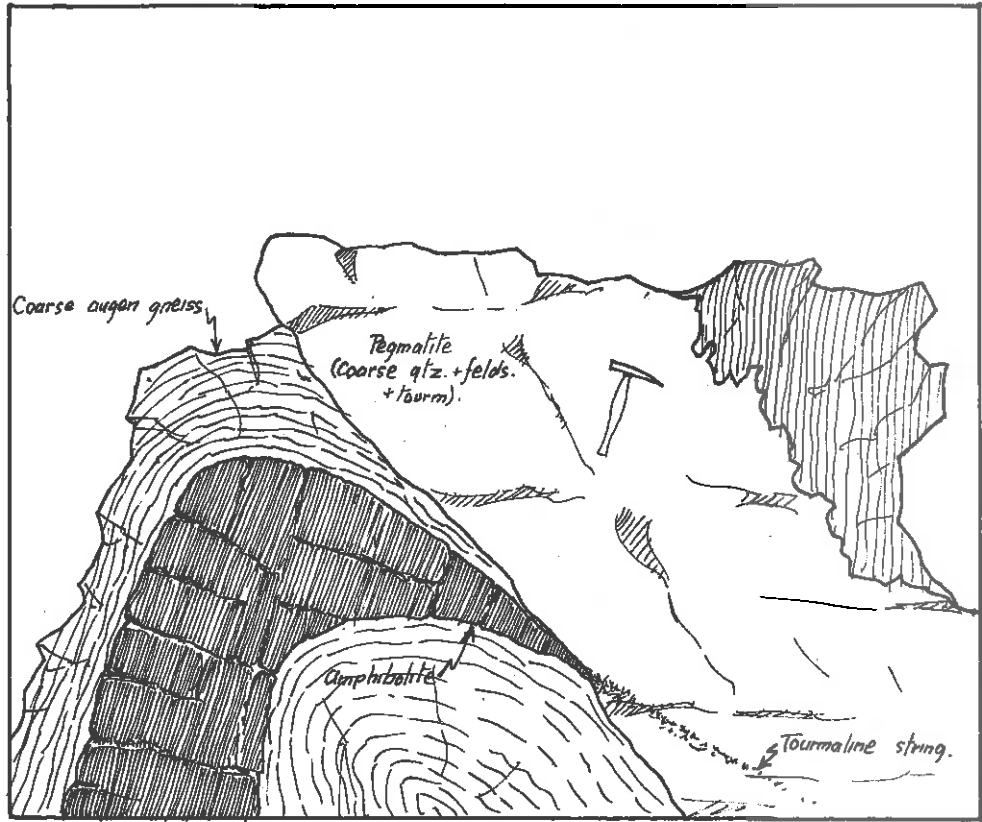
In his paper are described dark basic bands in the gneiss of amphibolite and hornblende schist, some with palimpsest structures and blastoporphyritic and blastophitic textures indicating remnants of metamorphosed igneous rocks of quartz - gabbro and dolerite types. Tilley considers the amphibolite bodies to be either basic segregation products of acid gneisses or earlier consolidated rocks, previously metamorphosed, and engulfed by the later gneisses. The last mentioned origin is favoured by Tilley in the light of textural observation.

In all the conformable amphibolites studied on Yorke's Peninsula, no corresponding evidence could be found of palimpsest structures from original igneous rocks. However, these could easily be obliterated by recrystallization. In fact many of the Port Lincoln type amphibolites were found by Tilley to contain a pyroxene as a major ferromagnesian mineral, whilst on Yorke's Peninsula hornblende is the only representation of the pyroxenes or amphiboles. In this case the Port Lincoln pyroxene may remain from the original igneous rock whilst the hornblende of Yorke's Peninsula represents complete recrystallization and obliteration of original structure.

If the above origin for the amphibolites is true, then the preservation of these basic rocks as "inclusions" in the gneiss would be due to the notable resistance of such rocks to injection and granitization.

According to A. R. Gindy<sup>3</sup>, basic and ultrabasic rocks form the "resistors" that require a great expenditure of material and energy to convert them into granite. That author describes amphibolite bodies in the metamorphosed sedimentary horizons of Trawenagh Bay, Co. Donegal which may be comparable with those observed in Southern Australia. He considers these to be pre-metamorphic intrusions of basic rocks.

Ramberg<sup>2</sup> states that "basification" may produce a minor proportion of amphibolite bodies in intensively altered gneissic complexes. He considers a kind of metasomatism with the formation of basic accumulations either by subtraction of "granitic" or "sialic" elements from the originally less basic



Panoramic sketch of amphibolite-gneiss-pegmatite relations in rock face near Hillock Point.

Fig. 9.

rocks, or by the introduction and fixation of "basic" or "mafic" elements Mg, Ca, Fe, Mn, Ti, etc. But he states that there is by no means any likelihood that the major proportion of the amphibolites in gneissic complexes originated by basification of originally less basic rocks but rather by recrystallization of basic igneous rocks, such as basalt layers and diabase dykes. Perhaps, then, some of the smaller amphibolite bodies of Yorke's Peninsula originated by basification, but it seems improbable that enough basic material would be available to form the larger occurrences. One possible case was noted near Hillack Point where a fairly large conformable amphibolite body was seen to contain remnant "stringers" of gneiss running parallel to its contact for many yards. These "stringers" are only about a quarter of an inch in width but are very persistent and may represent layers of the original acidic rock.

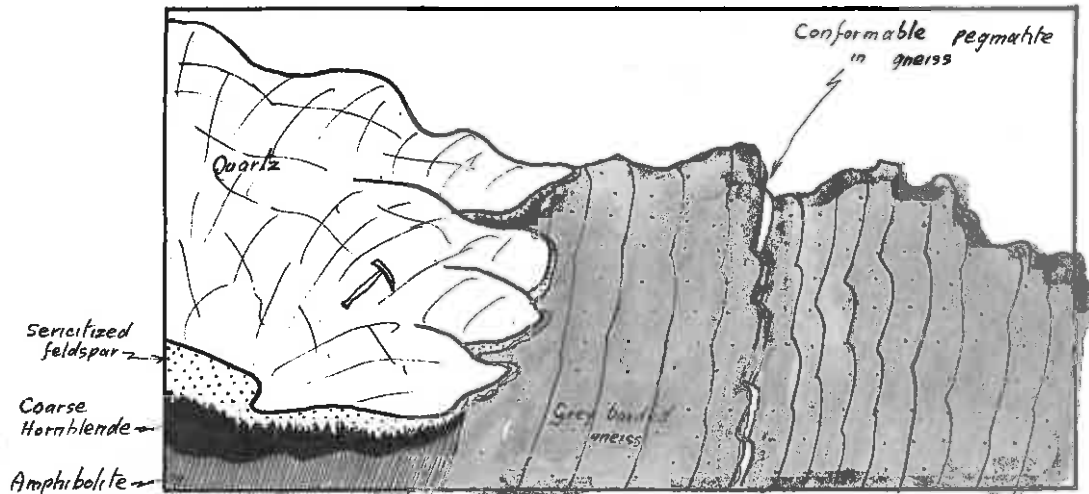
(b) Altered Dyke Rocks: In section IV dealing with petrography, the main structural points of these were considered.

(iv) Pegmatites and Quartz Veins:

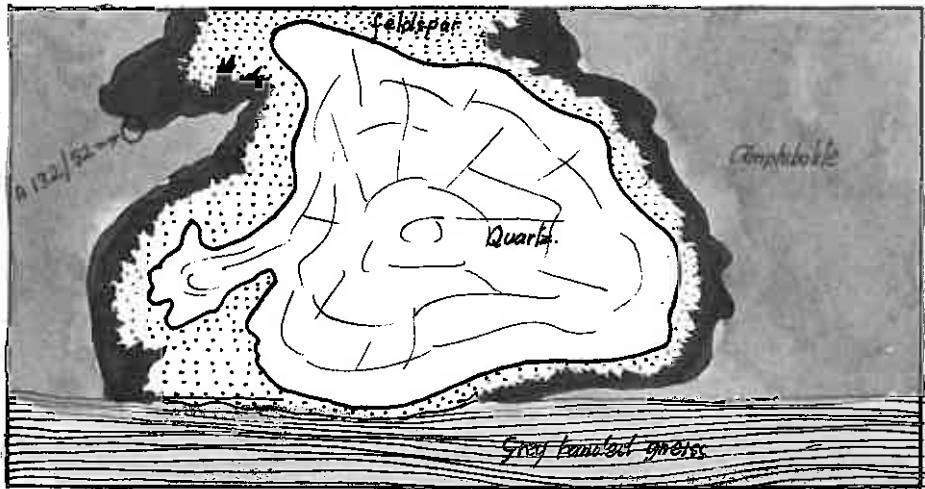
Pegmatite bodies are common in all the areas discussed. As stated in section IV the several types are present. What seem to be "segregation pegmatites" are conformable with the country rock and their similar mineralogy indicates a concentration of material already present in the rock. This fact may account for their rather monotonous mineralogy, that is, the lack of trace minerals.

Figure nine illustrates the only noted pegmatite carrying much tourmaline. In this case the dyke, about five feet in width, cuts non-conformably across folded augen gneiss and amphibolite. It seems to be a non-dilatation body formed largely by the replacement of the country rock because, as seen in the illustration, one limb of the amphibolite body is continued in the pegmatite as a "string" rich in black tourmaline.





Perspective sketch of quartz body & relation to amphibolite.  
Fig. 7.



Plan view of quartz body  
Fig. 8 .

One of the most interesting examples, however, is that of a large mass of quartz several miles west of Point Yorke. (Figures 7 and 8). This seems to be a replacement or non-dilatation body and measures several yards across. It occurs at a contact between the "grey banded gneiss" and a large mass of hornblende schist and is surrounded by a layer of acid feldspar a foot or two wide. Outside this layer, but only within the amphibolite itself, is a zone of very coarse recrystallized hornblende about a foot wide. The hornblende crystals appear to grow into the feldspar layer whilst the contact of the hornblende zone with the amphibolite is smooth.

(Analogous to figure 11). Specimen A 132/52 was collected from the inner edge of the hornblende layer. Macroscopically it appears to consist of coarse columnar anhedral hornblende with minor quartz and feldspar. In thin section, hornblende is seen to constitute 75% of the specimen, being typically anhedral with occasional smaller euhedra. Interstitial quartz is present to the extent of 20%, containing clouds of fine crystalline inclusions, (probably rutile). Sericitized feldspar, probably microcline, is also present. The smooth contact of this hornblende layer with the amphibolite consists of a thin foliated zone of bronze-coloured biotite.

This body of quartz probably formed in situ. Most likely replacement began along a narrow joint in the amphibolite and from this spread into the country rock. To some extent at least this quartz body may then have grown into the matrix of the amphibolite by assimilating any siliceous matter present and pushing away the calco-ferromagnesian minerals. In this manner, as it grew, the hornblende would be "filtered off" from the original amphibolite, (Ramberg<sup>2</sup>), and would remain as a rim abnormally rich in that mineral. However the reason why the main mass of quartz remained so pure is uncertain. It does not contain any feldspathic or ferromagnesian material whatsoever.

Field evidence in every case points to the fact that the major pegmatites were the last rocks to crystallize. They cut across the gneisses and their contained amphibolites and seem to represent the last liquid or volatile portions of the complex.

#### VI    ANALOGOUS ROCKS ELSEWHERE:

The similarities between the Yorke's and Eyre Peninsula complexes have been noted, and these rocks seem to be closely related.

The writer recently visited coastal Eyre's Peninsula, from Port Lincoln to Hall's Bay (seventy miles north-west of Lincoln) and Streaky Bay. The rocks were found to be almost identical in many cases to those on Yorke's Peninsula, consisting of migmatite complexes, associated injection gneisses, intrusive granites and amphibolites. Tilley<sup>1</sup> has described the occurrence of amphibolitized eclogites in these rocks. They are now in the form of garnet amphibolites and ante-date and gneissic granites in which they have been engulfed<sup>(12)</sup>. On Yorke's Peninsula, no amphibolites were found containing garnet, but they may in part represent amphibolitized eclogites.

Also worth mentioning are the similarities between these rocks and rocks of shield areas in other countries.

Macgregor<sup>7</sup> (1951) describes the characteristics of the older rocks of the Central African Shield: "The basement complex of Southern Rhodesia", he writes, "is composed of granites of different ages, enclosing masses of mainly older rocks which were formed at the earth's surface as lavas or sediments. These masses are widely scattered in the granite areas, but they are in the main very similar in their constitution".

Such rocks are also described from the Baltic Shield (J.J.Sederholm<sup>4</sup>) and the Canadian Shield.

It is therefore obvious that similar problems exist in the older rocks of all the shield areas the world over. Thus any research, even though the results may be of a negative character, will aid in solving the problems of the archaean.

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(13)

This specimen is taken from the farthest west outcrop of the Point Yorke area.

MACRO: The rock in this isolated outcrop is a foliated gneiss, rather dark in colour, and pegmatized conformably.

MICRO: The rock is medium grained, the foliation being due to biotite. Felsic layers are also present. The rock appears rather crushed.

MINERALS:

QUARTZ: About 20%. As anhedral with undulose extinction.

MICROCLINE: About 20%. Irregular equidimensional grains.

PLAGIOCLASE: About 20%. Generally as larger crystals, anhedral, and sericitized. Oligoclase.

BIOTITE: In the darker layers along with iron ores and sphene. As laths, elongated 1:3. Pleochroic haloes around inclusions.

HORNBLLENDE: Very subsidiary. Small dark green anhedral in the mafic layers.

SPHENE: An important minor constituent, often as rims around magnetite or ilmenite.

ACCESSORIES: APATITE, MAGNETITE (well-formed relatively large octahedra.)

SUMMARY:

This is a granite gneiss consisting mainly of quartz and microcline with layers of mafic minerals. It is not directly correlable with any other rock as the outcrop is isolated, but it is similar to the other acid gneisses of the area.

ROCK SLIDE DESCRIPTIONS:

A 132 / 2

This specimen is taken from the "grey banded gneiss" which outcrops over much of the Point Yorke area. The gneiss contains conformable amphibolite lenses.

MACRO: Injection gneiss. Prominently banded, pegmatic layers pygmatically folded. Banding is distinct and may be the bedding of an original sedimentary rock. Trend east-west, dip 60°S. Slide cut perpendicular to foliation.

MICRO: A medium grained equigranular gneissic rock.

MINERALS: QUARTZ: About 5%. Anhedral grains with inclusions of apatite. Undulose extinction. Some grains twinned.

MICROCLINE: Sericitized in places. Typical anhedral crystals. Fine cross-hatching. Inclusions of iron ores and abundant apatite. The dominant mineral.

HORNBLLENDE: Present as small, light green, anhedral and sub-hedral crystals, often sieve-like, including iron-ores, sphene and apatite.

BIOTITE: Small rare laths.

ACCESSORIES: APATITE: Abundant laths. SPHENE: Abundant anhedral masses, associated with iron ores.

IRON ORES: Abundant. Magnetite octahedra.

SUMMARY: This gneiss consists chiefly of medium grained microcline anhedra with a little quartz and plentiful hornblende. Accessories are also plentiful, and the foliation of the rock is due to mineral banding. This is a typical example of the "grey banded gneiss."

This specimen is taken from a large conformable amphibolite body in the "grey banded gneiss" A 132/2. Both the gneiss and the amphibolite are cut by non-conformable pegmatite dykes up to eight feet across, consisting of quartz, biotite and feldspar.

MACRO: Pyrites is visible in the hand specimen, which is a black compact medium grained rock.

MICRO: A medium grained, equigranular rock, with no foliation visible.

MINERALS: QUARTZ: About 5%. Anhedral grains, often included in the larger hornblendes.

SPHENE: This is a prominent mineral in this rock. (5%). It occurs as anhedral masses and also as rims around the large iron ores.

HORNBLLENDE: The most abundant mineral. Anhedral sieve-like crystals typically pleochroic.

FELDSPARS: What appears to have been feldspar now exists as masses of tiny crystals, probably sericite. The cores of some are comprised of relatively unaltered plagioclase (uniaxial positive).

SCAPOLITE: Small veins in the rock are filled by a clear mineral with high birefringence. It gives a uniaxial figure with rings, and is probably scapolite.

ACCESSORIES: RUTILE: High relief, small rare red grains

ILMENITE: Large grains. PYRITES: Large grains.

SUMMARY: This amphibolite consists mainly of hornblende, with sericitized feldspar and a little quartz. Sphene is a notable constituent and iron ores are plentiful. No relic igneous texture is visible.

This is a specimen from a pegmatite at Reed Head.

MACRO : A coarse grained light-coloured pegmatic rock, from an ilmenite-bearing dyke.

MICRO : A coarse-grained aggregate consisting chiefly of inequigranular quartz and microcline.

MINERALS:

QUARTZ: Coarse crystals with numerous fine inclusions. sharp extinction.

MICROCLINE: Large anhedral crystals with irregular borders. Somewhat sericitized.

MUSCOVITE: Rare laths.

SUMMARY: Although a single thin section can not possibly be representative<sup>of</sup> a pegmatite, this slide at least indicates that the chief constituents are microcline and quartz. Ilmenite may be present, and also muscovite. Usually biotite is the predominant mica, and it may occur in coarse "books" up to four inches across.



This specimen is from an epidote-rich layer in the "grey banded gneiss" A 132/2.

MACRO: This sample is a medium-grained rock with layers of epidote and layers of red feldspar.

MICRO: A medium-grained equigranular gneissic rock.

MINERALS:

QUARTZ: Common (6 - 8%), as anhedral grains with undulose extinction.

FELDSPAR: Reddish in hand specimen, the red color due to minute inclusions imparting a cloudy effect to the crystals in thin section. Biaxial negative, so probably originally microcline.

EPIDOTE: Plentiful (20%) as anhedral aggregates, richer in alternate (non-feldspathic) layers. Pleochroic in the yellow-greens, and with high relief.

BIOTITE: Present as relatively rare rough-looking masses, with a greenish tinge. Altered.

ACCESSORIES: SPHENE : Iron ores notably absent.

SUMMARY: This rock is a variation in the "grey banded gneiss". It occurs near the latter's contact with a conformable amphibolite body, and consists chiefly of dusty feldspar, quartz and epidote with a little biotite.

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This specimen is taken from a portion of the "grey banded gneiss" which contains visible muscovite.

MACRO: A reddish-grey rock with relatively large muscovite crystals.

MICRO: A granoblastic aggregate of medium-grained quartz and altered feldspar crystals with numerous large sieve-like crystals of muscovite and masses of altered biotite.

MINERALS: MUSCOVITE: Large sieve-like porphyroblasts, enclosing apatite, quartz and feldspar.

BIOTITE: Irregular altered greenish masses.

MICROCLINE: 30%. This is the predominant mineral. Sericitized.

QUARTZ: 15%.

ACCESSORIES: APATITE: Plentiful laths.

IRON ORES: Some magnetite octahedra.

SUMMARY: This rock consists mainly of an aggregate of quartz and microcline with some biotite. Large muscovite porphyroblasts appear to have been the last mineral to form.

This specimen was collected from an outcrop two miles west of Point Yorke in an area rich in epidote.

MACRO: The specimen, an epidote amphibolite, is a dark rock with a green tinge. A banding of ferromagnesian and epidote-rich layers is visible, and the slide is cut perpendicular to this.

MICRO: A medium grained rock consisting largely of epidote, opaque minerals, and secondary veins of quartz.

MINERALS: QUARTZ: Small rare anhedral grains, somewhat sheared. Also filling veinlets.

EPIDOTE: The most abundant mineral. Pleochroic from light yellow to greenish. Occurs in definite layers or bands, about 3 mm. wide.

CHLORITE: Green, relatively high relief. Occurs as irregular masses. This mineral contains many fine aggregates of opaque iron ore, and constitutes the darker bands of the rock.

ACCESSORIES: MAGNETITE: Fine abundant octahedra, as masses, in the chlorite.

SUMMARY: The rock is apparently in the epidote-amphibolite facies. Epidote and chlorite form the lighter and darker bands respectively, the chlorite containing aggregates of fine magnetite octahedra.

This is a specimen from one of the lighter layers in the "grey banded gneiss."

MACRO: A light pinkish rock with large porphyroblasts of hornblende. A finer green ferromagnesian mineral is also present in some layers.

MICRO: A medium-grained rock consisting of an aggregate of somewhat elongated quartz and feldspar crystals with ferromagnesian minerals concentrated in layers.

MINERALS: DIOPSIDE: This occurs as a major constituent. It is present as small pale green crystals of short prismatic habit, rather high relief, and with 90 degree cleavages.

PLAGIOCLASE: 20%. This is present as rather altered anhedral.

QUARTZ: 20%.

ACCESSORIES: MAGNETITE: Small octahedra.

SPHENE: anhedral to sub-hedral crystals.

APATITE: Small prisms.

SUMMARY: This is a variation of the "grey banded gneiss" in which the major ferromagnesian mineral is not hornblende but diopside.

This specimen was collected from an area largely injected by granitic material.

This specimen is taken from coarse augen gneiss east of Hillock Point. The rock is foliated and contains pegmatite veins parallel to the foliation.

MACRO: A reddish coarse-grained rock with visible feldspar augen. Feldspathic and mafic layers contribute to the foliation.

MICRO: A sheared altered rock consisting mainly of microcline and quartz.

MINERALS:

MICROCLINE: The most abundant constituent, present as anhedral crystals of varying sizes. The crystal edges are crushed, and the crystals are sericitized.

QUARTZ: About 25%. This occurs as irregular masses, elongated parallel to the foliation, and also as myrmekite. Crushed areas contain finely granulated quartz.

ORTHOCLASE: Sub-hedral crystals of this mineral are present, often sericitized.

BIOTITE: Numerous flakes, elongated 4 : 1 parallel to the foliation. About 8 % of the rock is composed of this mineral

ACCESSORIES: APATITE: IRON ORES: (rare)

SUMMARY: A typical metamorphic gneiss.

This specimen is from a granitic gneiss near Hillock Point, containing streaked out xenoliths of dark rock (see figure //4 .) One light-coloured xenolith, very much elongated, was also observed. Occasional large porphyritic feldspar crystals,  $\frac{1}{4}$  inch or so across, are present. The rock appears to be a granite near the edge of the magma chamber, as flowage and jointing is prevalent. Pegmatite dykes, some carrying e<sup>h</sup>edral hornblende crystals up to an inch across, seem to follow some of the joints, and these are often displaced by later movement along a perpendicular joint system.

MACRO: A dark sheared granite.

ICRO: A fairly coarse rock, showing signs of shearing.

MINERALS:

QUARTZ: This makes up 15 to 20% of the rock, and occurs as large anhedral with undulose extinction. Dusty inclusions are common.

MICROCINE: Present as large irregular crystals with myrmekite borders.

PLAGIOCLASE: Average extinction angle  $20^{\circ}$  corresponding to andesine. Sericitized.

ORTHOCLASE: Sim. to microcline. Sericitized.

HORNBLLENDE: As coarse anhedral. Not plentiful.

BIOTITE: Plentiful as large dark brown masses, very pleochroic, altering to chloritic material

Pleochroic haloes around small inclusions are common.

ACCESSORIES: Apatite; tourmaline: Greenish grains, high relief. SPHENE: Not plentiful. IRON ORES: rare.

ZIRCONS: Cause haloes in biotite.

SUMMARY:

This rock appears to be a sheared granite. The rock itself is very altered and the presence of drawn out xenoliths indicate flowage. Most of the larger crystals in the rock (the feldspars notably) have been crushed, and extinction is very shadowy. The composing minerals are mainly microcline, plagioclase and biotite with a little hornblende and accessories.

This specimen is a typical elongated dark xenolith from the granite A 132 / 20. This xenolith was of the order of six inches across, and contact with the granite was fairly sharp. Veining with granitic material is present.

MACRO: A dark medium to fine grained rock with visible garnet.

MICRO: A back-ground of biotite (imparting a foliation), feldspar, and sericitized material, over which there are relatively large skeletal masses of chlorite associated with granular garnet masses.

MINERALS:

QUARTZ: A subsidiary mineral in the xenolith.

PLAGIOCLASE: Oligoclase, as fine sub-hedral crystals, sericitized.

BIOTITE: This mineral constitutes 20% of the rock, and occurs as relatively fine elongated flakes. Haloes.

CHLORITE: This is associated with the garnet. It exists as fibrous aggregates, with typical berlin blue interference. Pleochroic haloes are numerous in the chlorite.

GARNET: Granular masses of garnet, up to 3 mm across, occur intergrown with, and in the centres of, masses of chlorite.

EPIDOTE: This occurs throughout as scattered crystals constituting about 15% of the rock.

ACCESSORIES: APATITE,

SUMMARY:

This specimen contains a rather varied mineral assemblage, consisting of Biotite, plagioclase, chlorite, garnet and epidote with a little quartz. This is the only occurrence of garnet found by the author in the Southern Yorkes Peninsula area.

This specimen comes from a narrow zone (4 to 6 inches wide) a mylonitic rock traversing the granite (specimen A 132 / 20). As may be seen in figure 14, this zone is associated with a joint plane.

MACRO: The rock consists of layers rich in crushed feldspar crystals and foliated layers of fine micaceous material giving an "augen" appearance.

MICRO: An intensely sheared rock in which the fine foliated biotites wrap around crushed and broken feldspar crystals.

MINERALS:

QUARTZ: About 30%. Small crushed grains in the fine groundmass, elongate 3 : 1.

MICROCLINE: Large augen-like crystals, some with carlsbad twinning. Crushed borders.

PLAGIOCLASE: Large augen-like crystals, also crushed. Composition probably oligoclase to andesine.

BIOTITE: Fine elongated crystals imparting the foliation to the rock along with the quartz. Altering to chloritic material in places.

ACCESSORIES: SPHENE (common), APATITE.

SUMMARY:

This has all the characters of a mylonite associated with movement of the granitic rock along a joint-plane. The porphyroblastic minerals (feldspars) are probably the original ones from the granite, and they have been crushed and rolled out, whilst the fine groundmass has been recrystallized.



A specimen from an apparently aplitic dyke cutting the granite A 132 / 20. This dyke follows a joint, is about 18 inches wide, and has a reddish colour.

MACRO: A reddish, medium-grained rock with visible epidote.

MICRO: An altered and sheared aplitic rock, medium grained.

MINERALS: PLAGIOCLASE: Subhedral crystals, with the composition of a basic andesine. The plagioclase is completely filled with dusty inclusions, and often contains epidote grains.

ORTHOCLASE: The dominant mineral. Usually as large sub-hedral crystals with carlsbad twinning. Included by "dust." All the crystals have crushed granulated borders.

*microcline* PERTHITE: Present as small crystals.

MICROCLINE: Relatively large anhedral, crushed and sericitized.

QUARTZ: About 20%. Present interstitially and also in myrmekite throughout. Very sheared and crushed and included with apatite particles.

EPIDOTE: Anhedral grains throughout.

BIOTITE: This appears to be altered, and it exists as green masses, pleochroic from dark green to light green. Apparently altering to epidote.

ACCESSORIES: APATITE: Plentiful. Iron ores are absent.

SUMMARY: This has the characters of a crushed and altered dyke rock of aplitic character. The main minerals are orthoclase, microcline, plagioclase and quartz with epidote as a minor constituent.

This specimen is from the "limb" of a small folded conformable amphibolite body in gneiss at Hillcock Point. (See figure 5 ). The limb of the body showed evidence of stress as exemplified by large flaky biotites.

MACRO: A dark amphibolitic rock with large biotite "books" up to  $\frac{1}{2}$  inch across.

MICRO: A coarse-grained foliated rock with abundant sub-hedral hornblende, large biotite "books," a little interstitial quartz and some feldspar.

MINERALS: QUARTZ: Mainly interstitial, but also as larger grains with undulose extinction. About 8%.

HORNBLLENDE: Fresh sub-hedral crystals. Often sieve-like, with quartz inclusions.

BIOTITE: Occurs in large "books" with pleochroic haloes around zircon inclusions. Also sieve-like inclusions of feldspar and quartz.

PLAGIOCLASE: Relatively small subhedral laths, with the composition of oligoclase.

ORTHOCLASE: Relatively small anhedral, often with carlsbad twinning. Dusty inclusions.

PERTHITE: Small anhedral masses.

ACCESSORIES: APATITE, ZIRCON, SPHENE, EPIDOTE, Iron ores absent.

SUMMARY: This specimen has undergone shearing, and the stress-induced growth of the biotite is typified by its sieve-like structure, enclosing other minerals. Compare this specimen with A 132 / 27.

This is a specimen from the same amphibolite body as A 132 / 26.

MACRO: A dark, compact, medium-grained rock, from the nose of the fold.

MICRO: An equigranular, medium grained amphibolite with granoblastic texture.

MINERALS: HORNBLLENDE: Lighter green than the hornblende from the limb of the body. It is the predominant mineral, making up 50% of the rock. Anhedral to subhedral. Pleochroic haloes abundant around inclusions.

PLAGIOCLASE: Composition oligoclase. This occurs as relatively rare anhedral grains.

ORTHOCLASE: Equidimensional grains, often sericitized.

SPHENE: More abundant than in A 132 / 26. Associated with rare iron ores, and also as granular masses throughout.

ACCESSORIES: EPIDOTE , APATITE, and SCAPOLITE in thin veins.

SUMMARY:

This specimen is not as sheared as A 132 / 26, as exemplified by its granoblastic texture and mineralogy. The main minerals, namely hornblende and plagioclase, are typical of a plagioclase-amphibolite.

This specimen is from an outcrop of the younger red granite, from a pegmatite contact ( see figure 12). The granite near the contact with "grey banded gneiss" appears to grade into pegmatite and then engulf the grey gneiss (A 132 / 32).

MACRO: The specimen is a compact medium to coarse grained reddish rock, somewhat gneissic in places, and poor in dark minerals.

MICRO: A rather sheared-looking aggregate of quartz and feldspar, the edges of the microcline crystals being granulated by crushing.

MINERALS:

QUARTZ: Anhedral equidimensional relatively unshredded grains, 25%.

MICROCLINE: About 40%. Irregular anhedral masses, sericitized and included by "dust". Granulated borders.

BIOTITE: Very subsidiary. The few visible grains are elongated in the ratio 1:4.

ACCESSORIES: APATITE:

SUMMARY: This rock is typical of the red granite gneiss which is younger than the darker gneisses and amphibolites and engulfs them. In some locations this rock is distinctly gneissic and in others it appears to be massive. The main minerals in this widely occurring red gneiss are quartz and microcline.

This rock is a variation of the "grey banded gneiss".

MACRO: A schisty variation of the "grey banded gneiss" from near a conformable pegmatite. Biotite imparts a schistosity to the rock, and feldspathic bands are present.

MICRO: A rather fine to medium-grained granoblastic aggregate of quartz, microcline and plagioclase with plentiful biotite flakes and a little hornblende. Extremely well formed magnetite octahedra are plentiful.

MINERALS: QUARTZ: About 5%. Equidimensional anhedral grains with crushed borders. Myrmekite is common.

PLAGIOCLASE: Present in small amounts as subhedral laths. Low extinction angle.

BIOTITE: A light-coloured (iron poor) variety. Frequent pleochroic haloes are present, some very perfect with several rings due to the different penetrating powers of the radiations.

HORNBLLENDE: Scattered small anhedral.

ACCESSORIES: ZIRCON , APATITE (plentiful),

MAGNETITE (plentiful, well formed octahedra).

SUMMARY:

This is a variation of the "grey banded gneiss."

This specimen was taken from a dolerite dyke near Brown's Beach.

MACRO: A dark fine-grained rock. Relict laths of altered plagioclase are macroscopically visible, and several porphyritic crystals of what may be altered plagioclase occur.

MICRO: A fine-grained rock consisting of fine-grained equigranular hornblende and plagioclase with sericitized laths of plagioclase throughout.

MINERALS: HORNBLLENDE : This constitutes 40% of the rock, and is typically pleochroic, equigranular and anhedral. The grain size is rather fine, and it appears to be a secondary mineral replacing the original pyroxene of the dolerite.

QUARTZ: Small rare grains. No signs of shearing are present, so it is probably of late crystallization.

FELDSPARS: These consist of two types :  
(i) Intensely sericitized laths and  
(ii) Unaltered crystals of probably later formation due to metamorphism.

In an attempt to distinguish these two types, accurate measurements of extinction angles were made with the aid of the "Universal Stage." In case (i) above, some crystals with relatively unaltered cores were selected. No measurements were possible with the larger porphyritic crystals.

The results indicated that both types of plagioclase had compositions averaging  $Ab_{49} An_{51} \pm 2$ . (i.e. Basic andesine or acidic labradorite). This may indicate that equilibrium was attained during metamorphism as far as the plagioclase was concerned, and <sup>that</sup> the recrystallized plagioclase did not differ greatly in composition from the original. (Assuming the relatively un~~altered~~<sup>original</sup> altered cores of the laths to represent the igneous plagioclase composition).

ACCESSORIES: Iron ore (rare), apatite.

SUMMARY: This rock, considering its field relations and texture, appears to be a metamorphosed dolerite. The palimpsest structure of the altered plagioclase laths is typically igneous, and subsequent recrystallization has resulted in the formation of hornblende and plagioclase.

This specimen is taken from typical coarse gneiss outcropping at Brown's Beach near Pondalowie. The rock is in many respects similar to that found in places in the Point Yorke area where it is related to the contact between the red gneissic granite and the engulfed grey banded gneiss.

MACRO: A coarse rock with porphyritic feldspar an inch across. In the hand specimen the rock appears to be a non-foliated granite, but in the field foliation is visible. Biotite and hornblende visibly constitute the mafic portions.

MICRO: A coarse rock with evidences of shearing and alteration.

MINERALS: PLAGIOCLASE: This constitutes about 30% of the rock and is the most abundant mineral. The extinction angle averages 8 to 10°, corresponding to the composition of oligoclase. The crystals are anhedral and sericitized.

MICROCLINE: The large porphyritic crystals are microcline, and these contain inclusions of quartz, plagioclase, apatite and ferromagnesian. The crystal borders are somewhat granulated, and myrmekite is common at contacts. The crystals are somewhat sericitized.

QUARTZ: Irregular anhedral masses constituting about 25% of the rock. Minute inclusions are common, consisting mainly of apatite.

BIOTITE: The most common ferromagnesian mineral. Pleochroic halos around minute zircons are prevalent.

HORNBLLENDE: Irregular anhedral masses.

ACCESSORIES: SPHENE: Common, as sub-hedral masses throughout. IRON ORES: Often rimmed with sphene.

APATITE: Numerous small laths, very common.

TOURMALINE: Brown pleochroic prisms

SUMMARY: This rock has all the characters of a coarse porphyritic granite, somewhat foliated.

This rock is typical of the Cape Spencer gneiss. It is a grey gneissic rock with a prominent fine foliation caused by biotite flakes and pegmatic layers. This gneiss is also cut by non-conformable pegmatites. Two types of amphibolite relations are observed in the area, the usual conformable bodies and also the apparently younger cross cutting dykes up to a foot wide. Cross cutting aplitic dykes are common, and these have very sharp borders. The gneiss grades conformably into an apparently younger more homogeneous granitic rock from which the later acid dykes seem to originate.

MACRO: A grey medium grained gneiss with streaky biotite layers.

MICRO: Larger feldspar and quartz crystals are set in a granoblastic groundmass of rather fine feldspar, quartz and biotite crystals.

MINERALS: PLAGIOCLASE: Oligoclase. This mineral occurs as relatively coarse sub-hedral crystalloblasts, and is rare in the finer groundmass.

MICROCLINE: An important constituent of the finer groundmass. Typically rounded anhedral.

QUARTZ: Present as one or two larger masses and also as 25% of the groundmass. The larger masses contain dusty inclusions.

BIOTITE: This is a prominent mineral, and it occurs in layers imparting a foliation to the rock. Pleochroic haloes occur.

ACCESSORIES: SPHENE: Common as relatively large sub-hedral masses, often around ilmenite grains.

APATITE: This is a very common accessory mineral.

TOURMALINE: One or two prisms, brown and pleochroic, are present. ILMENITE: MAGNETITE: As small

octahedra.

SUMMARY: This rock consists of what is apparently an injection gneiss.



This specimen was taken from the coarse hornblende layer (up to a foot in width) that exists between the amphibolite and the pegmatic quartz mass illustrated in figure 8 .

MACRO: Coarsely crystalline hornblende in columnar aggregates, growing from the foliated outer amphibolite body into the feldspar layer around the large quartz mass.

MICRO: Sub-hedral to euhedral hornblende crystals growing into feldspar and quartz.

MINERALS: HORNBLLENDE: This constitutes about 75% of the specimen, and consists of coarse subhedral crystals with occasional smaller euhedral crystals.

QUARTZ: About 20%. This is in relatively large interstitial masses and contains clouds of fine crystalline inclusions, probably rutile needles.

FELDSPAR: Sericitized feldspar, probably microcline (optically biaxial negative), exists in the portion of the slide near the amphibolite itself.

BIOTITE: This occurs commonly in the foliated layer at the amphibolite contact, a little of which is included in this slide.

ACCESSORIES: SPHENE IRON ORES:

SUMMARY: This unusual rock is related to the intrusion of a siliceous pegmatite body into the amphibolite, causing a recrystallization of hornblende from the amphibolite at the contact.