GEOLOGY OF THE YANKALILLA AREA

I N D E X

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ABSTRACT

This is a discussion of the Geology of the Yankalilla District; of the crystalline and sedimentary rocks. Petrological descriptions are submitted together with some suggestions on the origin of the rocks and their subsequent history. A geological map is appended hereto.

INTRODUCTION :-

1. Location.

The area investigated is at Yankalilla, 47 miles to the south of Adelaide. The western boundary of the area is at the cemetery on the Yankalilla - Victor Harbour Road and extends generally eastward to the vicinity of Moon Hill. At the south the greywackes to the north of Torrens Vale are discussed, while the northern boundary is to the north of Yankalilla a little south of Wattle Flat.

2. Area.

The area is approximately 5 miles by 5 miles and thus is 25 sq. miles.

3. Purpose.

The investigation was undertaken to obtain more information on the nature of the crystalline rocks of this area.

4. Acknowledgements.

The author wishes to express his thanks to Professor Sir Douglas Mawson, and Messrs. A. W. Kleeman and A. F. Wilson for their assistance and advice throughout the year.

GEOGRAPHY :-

1. Relief and Drainage.

The area is dominated by an east-west ridge stretching from its western extension south of the cemetery through Kemmiss Hill and on to Moon Hill. This ridge is the main watershed of the area. South of this main ridge there is a series of parallel ridges running more or less north and south. To the south of the main ridge the area is drained by the Bungala River and its tributaries, to the north the

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GEOGRAPHY (Contd.)

1. Relief and Drainage. (Contd.)

Carrickalinga Creek and its tributaries.

2. Abundance, shape and size of outcrops.

"The crystalline rocks are found continuous from the Grey Spur, westward to the western limits of the Hundred of Encounter Bay by way of Barn Hill, Sugarloaf Hill and Town Hill" (1), and pass into the Hundred of Yankalilla by Moon Hill and Kemmiss Hill. A range of crystalline rocks is found west from Kemmiss Hill to near the main road south-east of Yankallila, just behind the cemetery, where they are sharply cut off.

The greywackes are found as an isolated inlier in sections 1194, 1195, 1196, 1601, 1603 in the Hundred of Yankalilla just south of the Torrens Vale Branch road from the Yankalilla - Victor Harbour main road.

Glacial sands overly practically all the less-elevated portions of the area. However ordinary alluvial deposits due to the weathering of the older crystalline rocks are also found.

3. Relation of outcrops to topography.

The crystalline rocks occupy the steeper portions which are also the most thickly foliated. It is noticeable that the hills covered by thick scrub show outcrops of crystalline rocks, while those which are covered by only a light vegetation show nothing but white glacial sands.

STRATIGRAPHY AND PETROGRAPHY :-

1. The Crystalline Rocks.

a. The quartz, epidote syenite rock.

This is the rock which was originally defined as the "Houghtonian Diorite". Benson stated "that there is little doubt of its origin from the parent magma of the Aldgate - Houghton rocks" (2).

England has also accepted as fact the magmatic origin of this rock - "an outlier of Barossian rock has been intruded by a syenitic magma" (3).

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

1. The Crystalline Rocks (Contd.)

a. The quartz, epidote syenite rock (Contd.)

This rock is found outcropping in sections 1185, 1186, Hundred of Yankalilla. The rocks occur as large boulders and it is uncommon to find them outcropping showing their original dip and strike.

In the hand specimen the rock is greenish, fine to medium-grained, containing green epidote and actinolite and pink feldspar. This rock was examined microscopically in slides P. & Pl. It shows a crystalloblastic, granoblastic texture and contains epidote as the most abundant mineral. Yellowish-green and slightly pleochroic it occurs in irregular formless aggregates with no cleavage. This mineral shows straight extinction: an optic axis figure has an almost straight isogyre, but the sign was determined as negative. Actinolite is an alteration from diopside as a realt of uralitization. The next most abundant mineral it shows small inclusions of epidote and is a bluish-green mineral which is faintly pleochroic, occurring in irregular grains with more or less longitudinal section and corresponding cleavage. Both the relief and the interference colours are lower than the included epidote. The mineral is distinguished from hornblende in that the maximum extinction angle does not exceed 12°. Although diopside has been described in these rocks, none of the slides examined by the author have shown it. The most abundant feldspar is microcline which is intensely clouded by insipient alteration, particularly where it is in close association with the epidote and actinolite. The typical cross-hatching effect is well shown. The plagioclase has also been subjected to insipient alteration and in the majority of cases alteration is too far advanced for any definite properties to be determined. However a biaxial positive figure was obtained and in a section perpendicular to n_y the angle between the cleavage and extinction was found to be 10°, giving the composition as Ab.60 An. 40.

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

1. The Crystalline Rocks

a. The quartz, epidote syenite.rock.

Quartz crystals appear as accessories as also does typical lozenge-shaped sphene and a few scattered grains of ilmenite. There has been some subsequent metamorphism after emplacement or after the original high grade had been reached. This has had a retrograde effect on the original minerals of the rock.

Benson & England appear not to have doubted the magmatic origin of this rock, but there are several factors which tend to suggest a metamorphic origin:-

(i) The obvious banded nature of the rock in the hand specimen.

(ii) The general mineral assemblage which correlates closely with that of the regional metamorphism of a calcareous greywacke.

(iii) The close relationship of the rock to the surrounding schists and gneisses. However it must be admitted that original outcrops showing any bedded nature are almost impossible to discover and there was no actual contact between the syenite and the schists and gneisses discovered.

b. Syenite

This rock occurs within the epidote syenite and is similar to it but for the absence of epidote. In the hand specimen it is a flesh-coloured medium grained rock with predominant feldspar. It would appear if a metamorphic origin is proposed for the epidote syenite rock that this was a place where there was distinct shortage of Ca resulting in no epidote being formed. This rock is described from slide P2. The most abundant mineral is microcline in crystals up to 5 mm. in length. The mineral shows insipient alteration and many inclusions of quartz - in one place these quartz inclusions have a common orientation. The rock also contains quartz and some accessory biotite.

STRATIGRAPHY AND PETROGRAPHY (Contd.)

1. The Crystalline Rocks

c. Sillimanite Schists.

This rock is found in Section 1183 Hundred of Yankalilla in a quarry at the side of the road leading to the refuse dump. In the outcrop the rock is crossed by a great many purple quartz veings. In the hand specimen the rock is a nondescript schistose rock in which no minerals can be distinguished. Slide No. P4 of this rock shows a crystalloblastic, granoblastic texture. The most abundant minerals are quartz and sillimanite. The latter is a colourless mineral with a high relief and one perfect cleavage parallel to the 010 to which the extinction is parallel. The figure is biaxial positive with a moderate axial angle. The slide also shows small longitudinal crystals of biotite and dark, opaque ilmenite. There is an abundance of fine sericitic material which shows that the rock has been affected by retrograde metamorphism. All the sillimanite crystals have been partly affected being surrounded by an alteration product consisting of white mica and quartz. (This is illustrated in the micro-sketch which accompanies this paper) However the abundance of sericitic mica suggests a further source than the sillimanite and this is found in the orthoclase feldspar of high grade regional metamorphism. Although there has not been enough stress at falling temperature to effect a change in the majority of the minerals, the feldspar has been completely broken down. The majority of the sericite occurs as a minute aggregate but there are some portions from which properties can be obtained showing a colourless mineral with a low relief and a strong birefringence. This rock is the result of high grade regional metamorphism. (The sillimanite zone of Tilley). England suggested that the metamorphosing agent was the syenitic magma, but stress does appear as indicated by:-

(i) The presence of sillimanite which is normally a stress mineral.

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

1. The Crystalline Rocks

c. Sillimanite Schists.

(ii) the retrograde effects. These are greatly promoted by stress, and stress inversions from regional metamorphism are seen throughout the area. Diopside to tremolite in the epidote syenite rock; orthoclase to sericite and quartz in the sillimanite schist.

d. Quartz, Feldspar, Garnet Schists.

This rock is found in section 1184 Hundred of Yankalilla, just to the north of the outcrop of epidote syenite rock and surrounds this rock both to the north and to the east. In the hand specimen the rock is schistose containing medium-sized crystals of pink feldspar embedded in a finer grained stressed matrix whose minerals can not be identified. Microcline, the most abundant mineral, shows signs of considerable insipient alteration in these crystals that have not been completely broken down to sericite. Crystals are found up to 3.5 mm. in size. Quartz crystals up to 2 mm. grain size are also found. Prominent, but not tremendously abundant, pink garnet occurs in more or less typical six-sided crystals and is taken as indicative of the grade of metamorphism reached in this area. Epidote is fairly common and although it may be due to the breaking down of plagioclase, its prevalence and mode of occurrence suggest an original mineral. It occurrs as small crystalline green aggregates with a high relief. There is also prominent biotite and ilmenite. Sericite and quartz occur abundantly and closely associated and this association is probably due to the results of retrograde metamorphism upon microcline . Sericite and epidote are also found associated in what were obviously twinned plagioclases. This could be due to two possible causes:-

(i) the breakdown of plagioclase containing K feldspar in solid solution.

(ii) on the breakdown of the microcline there is an excess of K and this has invaded the plagioclase down the twin-planes while it was in the process of breakdown. Thus there is the

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

1. The Crystalline Rocks.

d. Quartz, Feldspar, Garnet Schists.

the formation of sericite and epidote together.

The grade of metamorphism is such that the garnet zone of Tilley has been reached. A difficulty in areal correlation arises in that the garnet zone lies nearer to the epidote syenite rock than does the higher sillimanite zone.

e. Biotite Schists.

A number of various speciments of these rocks were taken for they cover by far the greatest part of the area occupied by the crystalline rocks. These rocks extend from east and north of Eagle Hawk Creek and extend westward through Kemmiss Hill and Moon Hill.

Hand specimen 10 is taken from the side of the road in Section 157 Hundred of Yankalilla; that is to the east of the more highly metamorphosed rocks. In the hand specimen it is a well-defined gneiss with alternating bands of indeterminable dark minerals and flesh-coloured feldspar. This rock has been subjected to considerable crushing effect and many of the original minerals have been broken down. Among the uncrushed minerals is andesine which however has been considerably affected by chemical breakdown. Distinguishable crystals of plagioclase may be seen surrounded by the stress results of other minerals. The maximum extinction angle from the polysynthetic twinning is 22° indicating a composition of $Ab._{60}$ $An._{40}$ (same composition as with epidote syenite rock). There is also a little greatly altered orthoclase which has not completely yielded to retrograde metamorphism. Ilmenite is also present. Among the minerals which have resulted from the crushing, muscovite (sericite) is prominent and shows various stages of recrystallisation. Some of the finest tabular crystals can be determined only under the high power, others are easily distinguished under the medium power while others are found up to 0.5 mm. in length. The sericite is sheared right out

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

1. The Crystalline Rocks

e. Biotite Schists

through the rock and is probably due to the effects on orthoclase of retrograde metamorphism under stress. The larger crystals are then probably due to recrystallization. Occurring in a similar manner to the muscovite is darker pleochroic biotite. Quartz is an original mineral which throughout shows signs of strain, noteably undulose extinction. The grain size varies from very small grains distinguishable only under the medium power to grains of the order of 1 mm.

This rock has obviously suffered considerable retrograde metamorphism under stress. In fact the mineral bands of the gneiss have been almost rolled right out so that the appearance of the hand specimen is almost that of a mylonite. The original metamorphic grade seems to have been the biotite zone of Tilley.

Specimen F was obtained from the northern border of the epidote syenite rock in section 1184 Hundred of Yankalilla. In the hand specimen the rock is medium-grained gneiss with quartz, pink feldspar and dark biotite in alternating bands.

Microscopically this rock is very similar to slide P10 which is discussed above. There is the substantial breakdown of feldspar to sericitic material. The crush minerals surround the resistant minerals in the manner typical of rocks subjected to retrograde metamorphism under stress. This rock borders closely to the epidote syenite rock and so it is apparent that the stresses extend right up into this most highly-metamorphised area. The uncrushed minerals are quartz, microcline, biotite and ilmenite.

From Eagle Hawk Gully another similar rock is taken. In the hand specimen it is a dark schistose rock; the only minerals determinable being the bands of pink feldspar. In microscopic section the composition is predominantly the same as that of the above. It differs in that there is a more intimate admixture of the crush quartz and sericite and also in

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

1. Crystalline Rocks.

e. Biotite Schists

that there are crystals of muscovite comparable in size with that of the biotite crystals (grain size 1.5 mm.). Very little plagioclase is present.

A typical gneiss from the Moon Hill area was also taken (P41). In hand specimen it shows alternating bands of medium grained crystalline feldspar and finely crystalline dark mineral. There are some very thick bands of feldspar. Microscopically the rock is very similar to the above. However there is a noteably greater amount of plagioclase ($Ab._{65}$). The structure of the rock, although it shows signs of stress, does not have the flaser structure of the other rocks. This may be due to the retrograde metamorphism, as well as the grade of metamorphism, becoming less towards the east. There are also large grains of iron ore in the rocks which do not appear in the others. These are connected with the knob of iron ore in the district (see specimen 44). All the district has probably been affected by solutions carrying iron. Also microcline is considerably more abundant than in other specimens. This is connected with the almost total absence of sericite for the retrograde forces have not acquired sufficient force to breakdown the microcline.

All these rocks are probably of the same origin, that is it is considered that these were originally argillaceous sediments which have been subjected to progressively increasing metamorphism towards the west. On decrease of metamorphism the stress did not drop as readily in the region of higher metamorphism, thus greater retrograde effects are found in higher grade rocks to the west than in the lower grade rocks to the east.

2. The Pegmatites

Much of the area of crystalline rocks is cut by quartz rich pegmatites. These are particularly abundant in the Moon Hill district where the pegmatites have the same strike as the schists. Also from observations in the glacial area

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

2. The Pegmatites.

it would seem that much of the glacial sands are underlain by pegmatites. The slide P7 is a typical representative of these pegmatites. Microscopically it is an holocrystalline, hypidiomorphic rock containing colourless quartz free from inclusions. The grain size ranges up to ½ cm. There are some small dusty inclusions of iron ore in some cases and some inclusions of muscovite. The plagioclase is andesine ($Ab._{65}$) showing considerable insipient alteration and inclusion of quartz and muscovite. This mineral has approximately the same grain size as the quartz. Microcline is also common. Other minerals are muscovite, ilmenite and apatite.

The pegmatites are probably the result of quartz rich solutions soaking through the schists. They were probably emplaced at the same time as the stress causing metamorphism was active. This would result in the pegmatites lying parallel to the strike of the schists,

3. The Basic Dykes.

These are found to the east of the line as shown on the map. The general trend of the dykes is north and south, and they are short and discontinuous. In the Moon Hill region these dykes follow the strike of the beds, but they can not be traced over any great distance. The longest was found to be about 200 feet.

In the hand specimen it is a dark, fine-grained rock in which no minerals can be distinguished. Two slides (P6 and P) of basic dykes were inspected; one specimen from Eagle Hawke Creek and another from the Moon Hill district. Microscopically the rock is a holocrystalline, porphyritic rock containing phenocrysts of hornblende and feldspar. The hornblende is that type which is completely altered from augite, i.e., uralite. A green slightly pleochroic mineral, the intense colour tending to obliterate everything including the cleavage. However the typical amphibole cleavage is shown in some sections. The feldspar has a brownish colour in places but is normally colourless.

STRATIGRAPHY AND PETROGRAPHY (Contd.)

3. The Basic Dykes.

The mineral is biaxial positive, has a R.I. greater than balsam and shows some polysynthetic twinning with a maximum symmetrical extinction of 27°. This determines the composition as $Ab._{50}$ $An._{50}$ i.e., labradorite. The ground mass is a felted mass of feldspar and amphibole.

The textures of the minerals indicate that the rock has been affected by considerable stress. It is probable that there was a period of basic intrusions during the period of regional metamorphism.

4. The Greywackes.

These are found in two vicinities but the author doubts if there is any connection between the two.. One is found in Eagle Hawk Creek just near the refuse dump in section 1183 Hundred of Yankalilla. This lies between the glacial sandstone across the creek and the sillimanite schist. The relation of these rocks to the surrounding rocks could not be discovered by the author, all that is certain is that these are definitely bedded sediments occurring in situ in an area between the sillimanite schists and an outcrop of garnet schists.

In the hand specimen the rock is black and fine-grained showing alternating bands of light and dark minerals. The minerals are generally too small to determine in hand specimen, but green epidote and white feldspar can be seen in places.

Microscopically (P5) the rock is a crystallablastic, granoblastic rock. The most abundant mineral is microcline which in contrast to plagioclase of the rock is relatively unaltered. Albite ($Ab._{98}$) also occurs abundantly throughout; the mineral shows polysynthetic twinning with maximum symmetrical extinction up to 18° and has R.I. less than balsam. It is suggested that the albite is due to the breakdown of the medium feldspar to albite and epidote and then recrystallized. There are relics of indeterminable feldspar amoung the small crystals

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

4. The Greywackes.

of epidote. The epidote occurs in various stages of crystallization from small indistinct tabular crystals distinguished only by their high D.R., to green, pleochroic aggregates of a mineral very similar to that of slide Pl. Other minerals are quartz, biotite, ilmenite and apatite.

It is obvious that this rock was originally a greywacke, but it has subsequently been considerably altered. It is suggested that the recrystallizing agent may have been the heat developed during the metamorphism of the district.

The other greywacke of the district is found just south of the branch of the main Victor Harbour road and the Torrens Vale road in sections 190, 1194, 1195, 1601, Hundred of Yankalilla. The outcrop is found as an inlier in a roche moutonne which rises above the glacial sands of this district. This hill is part of a system of hills which has been described by Howchin as the main watershed of the district.

In the hand specimen the rock is dark, fine-grained and shows distinct bedding and cross-bedding. The rock is traversed by numerous quartz veins. Under the microscope the bedding is well shown under low power,,but no individual minerals can be distinguished. On examination with the medium power the rock shows colourless quartz, biotite, muscovite, apatite and ilmenite.

These beds were original sediments and have suffered little subsequent metamorphism. These beds are considered younger than those rocks further north.

5. Iron Ores.

In section 85 Hundred of Myponga there is an outcrop of an iron ore. The outcrop is no more than a small knob but it is apparently of a very high ore grade. The iron ore gives no test for Ti, it is magnetic and has a red-brown streak. The ore is probably a mixture of haematite and magnetite with the former probably predominating. As has been noted above there is a considerable quantity of iron ore

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STRATIGRAPHY AND PETROGRAPHY (Contd.)

5. Iron Ores.

in the surrounding rocks and so it would appear that the region was soaked with iron-bearing solutions. However there was only considerable concentration in one spot and this is seen as the exposure of ore discussed here. The iron ore is thus younger than the surrounding rock. The iron is in no way related to the bedding, cutting it in an irregular manner.

6. Glacial Beds

Loos glacial sands cover the whole area to the south and the north of the crystalline rocks. Howchin states "that the ice crossed the barrier of the Bald Hills, in its passage westward, as is abundantly evident not only from the thick deposits of drift and glaciated stones that occur on the summit of the ridge." This explains the glacial sands to the south of Kemmiss and Moon Hills and it would seem that a similar explanation must hold for the loose glacial sands to the north of the ridge even though no sign of the sands can be seen on the ridge. However on the north side of the ridge a few yards from the crystalline rocks there are a number of granite erratus. Thus the ice must have come to this point which is only a few feet from the peak of the ridge.

Just south of junction of the River Bungala with Eagle Hawk Creek (Wood's Creek of Howchin) in the latter in section 245 Hundred of Yankalilla, hard glacial sandstones outcrop. These sandstones are also found in an old quarry a short distance up the creek. The stone is a white, yellow and grey sandstone that decomposes at the surface but, at depth, is a compact grit-stone. The bedding is indistinct but the stone is strongly jointed and crowded with erratics of great variety. This sandstone rests unconformably on the syenite which is the bed rock of the neighbourhood.

Also in this same section is found a glacial mudstone which has not been previously described. This rock is found a few yards to the west of the above rock. It is a well-bedded

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STRATIGRAPHY AND PETOGRAPHY (Contd.)

6. Glacial Beds

mudstone with the same general dip and direction as the glacial sandstone.

In sections 87, 88 and 89 Hundred of Myponga, as has been mentioned above, are a number of granite erratics covering a considerable area. In the hand specimen this is a medium-grained, equigranular rock consisting of blue opalescent quartz, pink microcline and black biotite. Microscopically (slide P27) the rock is an holocrystalline, hypidiomorphic rock. The predominant mineral is colourless quartz with a grain size varying from large individual crystals up to 3.8 mm. in diameter to aggregates of small crystals. There is also colourless microcline which has been considerably altered to sericite, occurring in large subhedral crystals with a grain size up to 3 mm. The mineral does not show the usual cross-hatching but does have a slightly undulese extinction; carlsbud twins are seen and the extinction is oblique on the 001. Plagioclase occurs very similarly to the microcline and superficially shows the same alteration. It is not as abundant as the microcline, the grain size of the crystals being up to 25 mm. The maximum symmetrical extinction of the plagioclase which has an Rl balsam, is 17^{o} giving the composition as Ab95. The only ferro-magnesian mineral is biotite which is in subhedral crystals scattered throughout the mass and with a grain size up to 1.8 mm. The biotite contains small inclusions of quartz. Apatite is an accessory mineral.

This rock and its slide were compared with those of Port Elliot and they were found to correlate very closely. this points to these granites being erratics of Port Elliot granite and that they have been deposited at this point by the Permo-Carboniferous glaciation.

GEOLOGIC STRUCTURE

1. The Crystalline Rocks and Pegmatites.

These rocks occur as fine to coarser grained schists and gneisses. The epidote syenite rock cutting across the schists. However no actual contact can be found with the schists, it being separated in most places by a band of milky quartz. Also these rocks resemble very closely those at Big Gorge, South of Normanville (England) for which there are definite signs of a sedimentary origin. Also in places the author was able to pick up a general foliation and this was in general the same as the schistosity of the crystalline rocks to the east,

The schists which border on the epidote syenite rock and stretched away to the eastward are sediments which have been metamorphised to varying degrees with the grade decreasing away from the epidote syenite rock. The original sediments were shales which were laid down in Pre-Cambrian times. Since no evidence can be found to the contrary the schistosity is taken to conform with the bedding. In all places where dips were taken the general dip and strike were similar, i.e., the schists dip at approximately 30° south with the strike running east and west. Mr. King had suggested a dome structure for the area, but this would require the dips on either side of the ridge to be in opposite directions and for this there is no evidence. In regard to the origin of the ridge no real evidence of faulting can be demonstrated and so no indication of such can be seen on the map. However from consideration of the sharp contacts of the crystalline rocks with the glacial beds and always at the base of the ridge, it appears that the crystalline rocks are cut off very sharply. Also in Eagle Hawk Creek just after it leaves the Gorge behind Woodvale Station and before it enters the Gorge between the higher and lower grade schists, the well bedded crystalline rocks are seen on the eastern side of the creek and yet on the western side there is nothing but glacial sands. It is felt that if the main Yankalilla-Victor

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GEOLOGIC STRUCTURE (Contd.)

1. The Crystalline Rocks and Pegmatites.

Harbour road did not run along the scarp face of the epidote syenite rock that a fault could be confirmed here. However for all of these surmises no real evidence can be found, but the author feels that the structure of the main crystalline rocks could be as represented in Fig. 1.

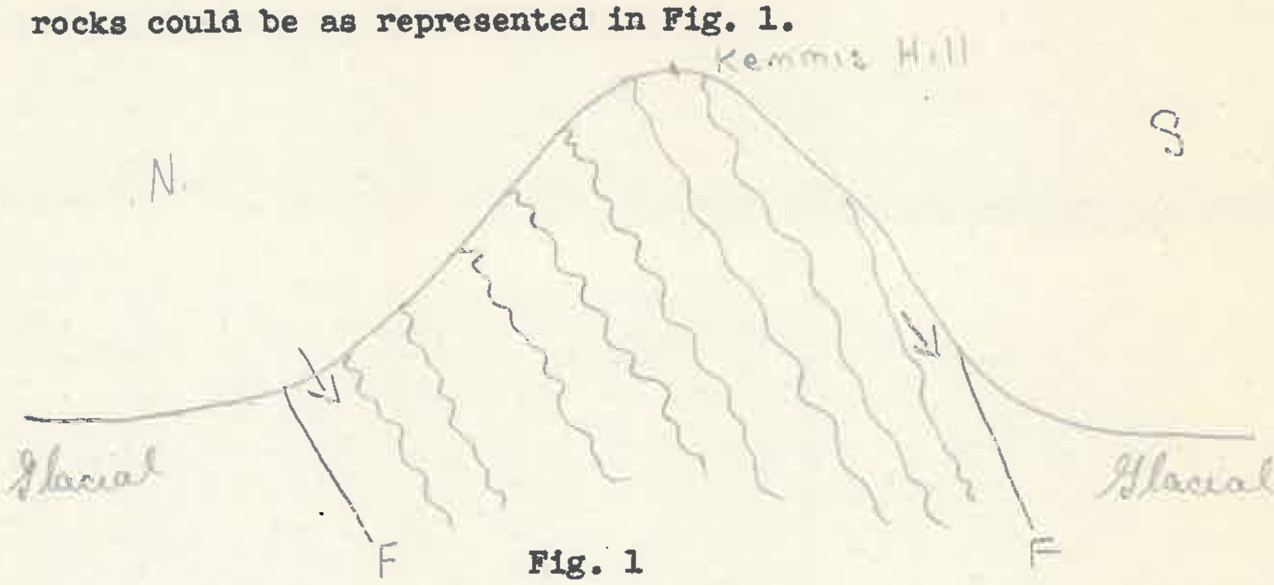

Fig. 1

That is there may be a simple upfaulted ridge with unfolded slightly dipping schists.

2. The Greywackes.

These are well bedded sediments which have not been subjected to an excess of metamorphism. This outcrop occurs as an inlier among the glacial sediments. No reason can be offerred for this outcrop as no sign of faulty or folding is shown. However it is of note that these greywackes show current-bedding of from this current-bedding overturned beds are indicated. This would then correlate these beds with the other greywackes of Fleurieu Peninsula (personal communication Mr. A. F. Wilson). These beds have a definite cleavage in the same direction as the dip. This cleavage is well shown in the quarry at the side of the Torrens Vale road - these beds were apparently at one time quarried for roofing slate.

3. Glacial Beds

The consolidated glacial beds are flat-dipping sandstones and mudstones which dip to the north-east. The sandstone does not show a good bedding but the mudstone is well bedded.

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GEOLOGIC STRUCTURE (Contd.)

3. Glacial Beds

These are simple sediments laid upon a crystalline basement.

GEOLOGICAL HISTORY

The earliest beds of the area were the calcareous greywacke and the argillaceous beds to the east. These were affected by regional metamorphism which increased towards the west resulting in the calcareous greywackes being altered to a rock with an almost igneous appearance. Close to the epidote syenite rock the argillaceous rocks were also raised to the highest grade resulting in the sillimanite and garnet schists of the area. Further to the east the grade was lower resulting in the biotite grade only

Subsequently there was a drop in temperature but no concomitant drop in stress. Thus there has been retrograde metamorphism which as a result of the original higher grade to the west, is more pronounced in this direction. It is probable then that the whole area was subjected to subaerial erosion.

In Permo-Carboniferous time this area was covered by a huge glacier which has left its results in glacial sands, sandstone and mudstone as well as erratics which have been carried from the region of Port Elliot and to the south of there. Although there is no proof of this, it would be that the Kemmiss - Moon Ridge was upfaulted subsequent to the glaciation.

There is an alternative suggestion that what has been postulated above as the region of highest grade regional metamorphism, may have been an original igneous magma. The argillaceous sediments then intruded, would then have been more highly metamorphised nearer the intrusion and the grade would fall off in passing away from it. However this postulation overlooks the fact that there has been considerable stress in the area. Thus the author leans to a metamorphic origin for the whole of the crystalline rocks of the area.

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