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1. GENERAL INTRODUCTION

1. Programme

The area to be surveyed during the southern spring of 1974 lay within the Bowman Coast on the east side of the Antarctic Peninsula, between latitudes 68° 10′ S and 68° 35′ S. Specifically the area included the southern side of the Joerg peninsula and the whole of the peninsula to the south, for convenience called the Rock Pile Peaks peninsula, both extensions into the Larsen Ice Shelf. Depots had been laid at the end of the previous summer season by aeroplane at Ptolemy Nunatak and Three-Slice Nunatak, to the southwest and north of the work area respectively.

It was intended for Anckorn (geologist) and myself, with our two dog teams, to survey the area on our way to the Three-Slice Nunatak depot, where we were to rendezvous with the aeroplanes at the end of October and be flown further south to the summer work area. Unfortunately almost continual bad weather severely restricted the programme, and a crevasse accident, in which my sledge was badly damaged and one of my dogs killed, forced us to join up with a survey unit who were travelling through the area. As a result only four days geology was completed. Details of the journey can be found in the first part of the travel report for sledge Romeo, K9/1974/T.

2. Work done

Very little work was actually carried out in the area (see above section), and even when weather allowed only two stations could be established in the mostly inaccessible terrain. However, binocular and photo-geology

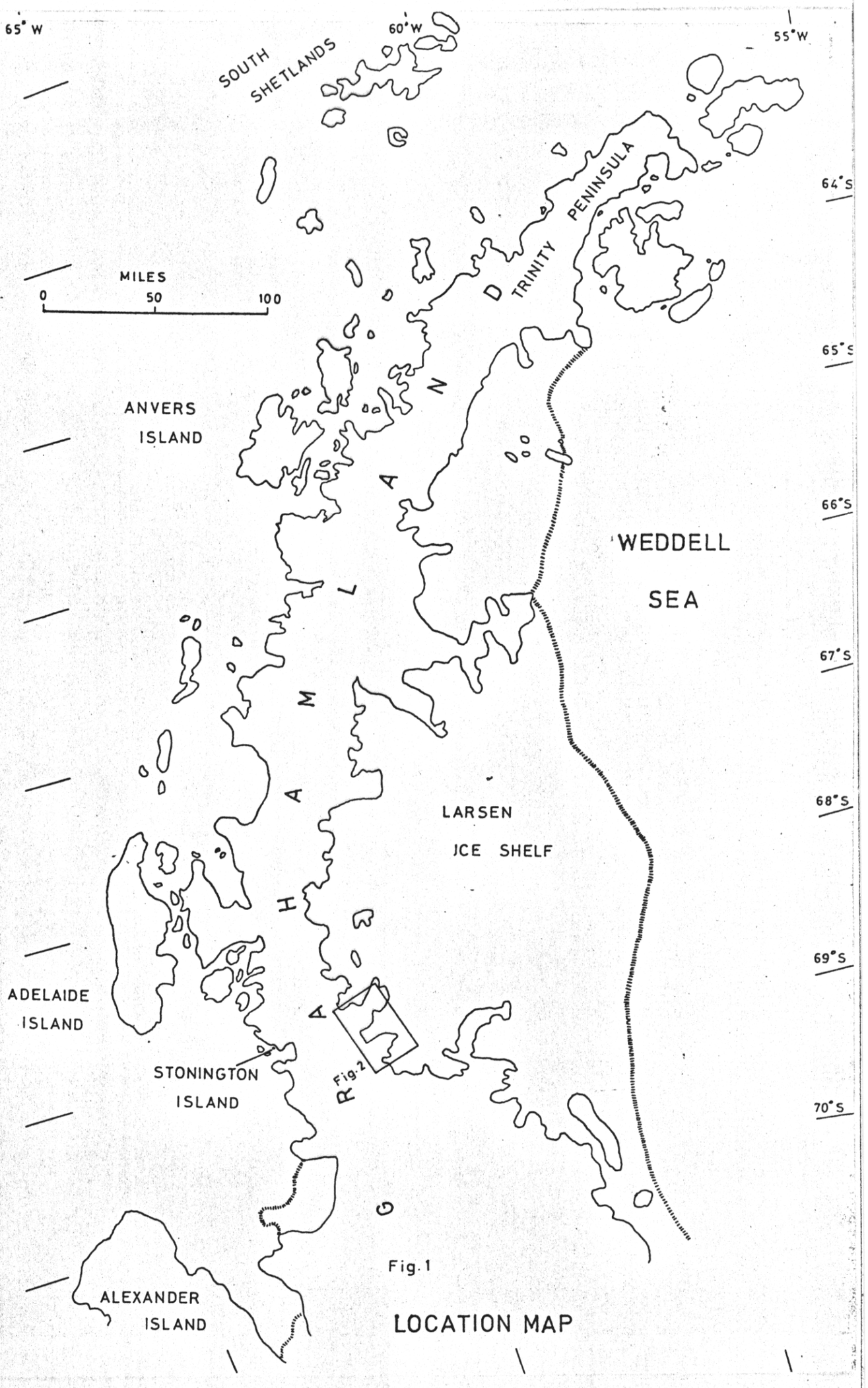


Fig. 1

LOCATION MAP

of the central and northern parts of the Rock Pile Peaks peninsula and the southern side of the Joerg peninsula was completed, although hampered by fresh falls of snow. Later in the season the same area was visited by a geophysics team who also experienced accessibility problems but were able to collect a few additional specimens.

3. Mapping

The area covered lies in the northeast part of the D.O.S. 1:200,000 sheet no. W 68/64 published in 1963. The detail on the map proved to be most inadequate and misleading and fortunately some of the time spent on base preparing for the trip was employed im making copies of the U.S.Navy Trimetrogon aerial photographs for the region (runs 1812 and 1818), which proved invaluable in the field. The maps in this report use the coastal outline and the main features from the D.O.S. map with the rock exposures sketched in approximately from the aerial photographs. Plane-tabling equipment was carried with the unit but was not used in the adverse weather conditions.

4. Exposure and Accessibility

Generally the exposure was good and mostly in the form of extensive faces in the headwalls of cirques and flanking the glaciers entering the Larsen Ice Shelf. Similar exposures occur at the junction between the 'land mass' and the Ice Shelf, and in these instances are very often surrounded by disturbed areas of crevassing. On the peninsulas themselves many of the exposures are rendered inaccessible by their occurrence high up on near vertical faces, where they are guarded both by large bergschrunds

and ice cornices. The only easily accessible outcrops occur on isolated, low ridges and nunataks alongside the main passes across each peninsula.

5. Previous work

The proposed area had not previously been visited by geologists, although Knowles during the United States Antarctic Services Expedition of 1939-1941 described "slate.....along the Weddell Coast for at least 90 miles from latitude 68°S to 69°30'S." Thomson, after surveying Crabeater Ridge in 1965,had intended working in the area but ran into bad weather and crevassing off Periphery Point and was then forced to abandon the attempt due to lack of food. The northern side of the Joerg peninsula has been described in some detail by Stubbs, however (Geology of parts of the Foyn and Bowman coasts, Graham Land, PhD. thesis Birmingham University, 1968), and the area south of Mobiloil Inlet by Fraser and Grimley (The geology of parts of the Bowman and Wilkins coasts, Antarctic Peninsula, B.A.S. Scientific Report, 67, 1972).

2. GEOLOGY

Due to the paucity of material collected and the unique situation of having the thin sections of the rocks available at the time of writing this report, the first part of this section will describe the specimens collected. A tentative summary of the geology of the area will then be given using the results of the binocular and photo-geology work in conjunction with the report on the area to the north by Stubbs. The position of the stations referred to in the

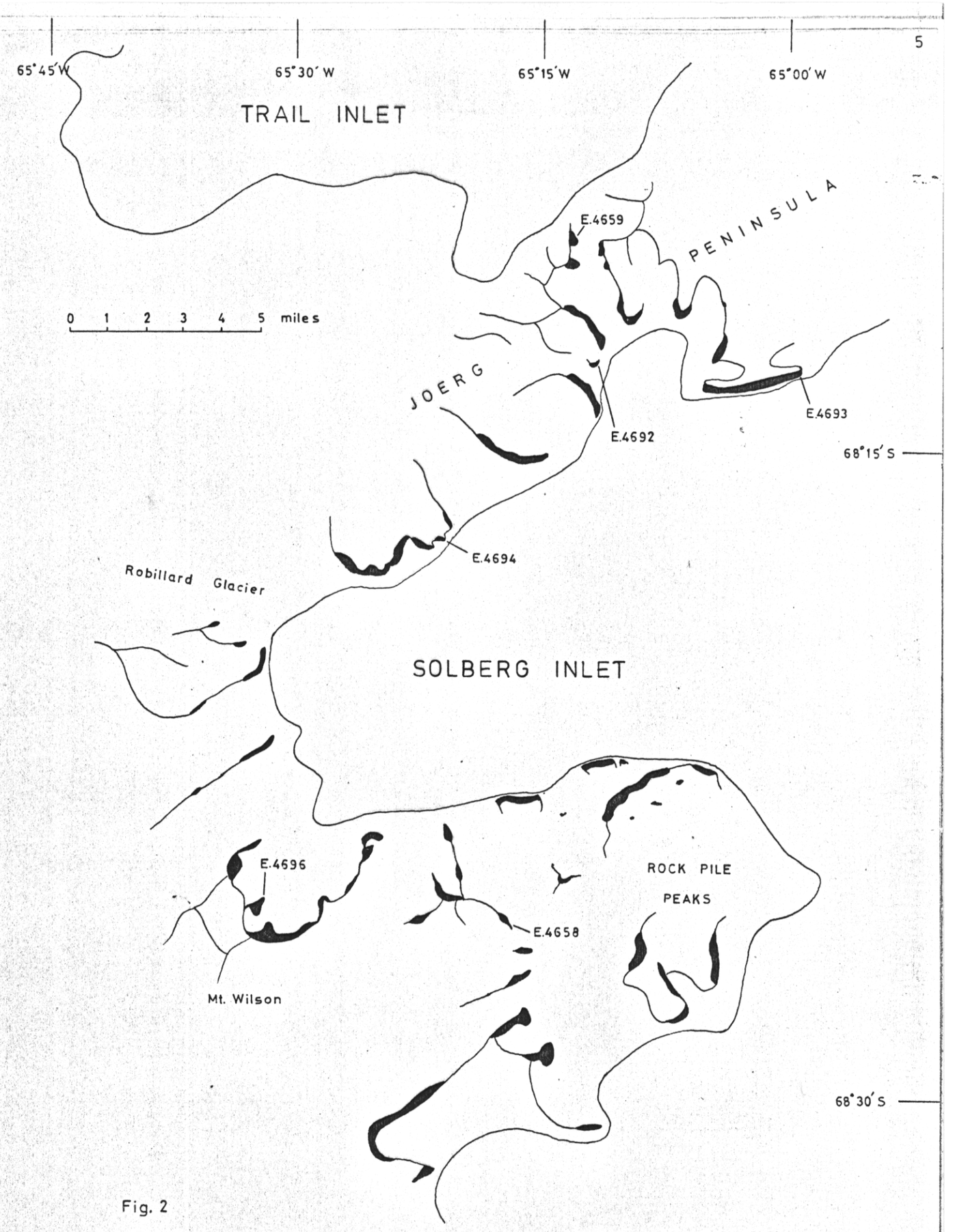


Fig. 2

ROCK OUTCROP

AND STATION MAP

text can be found in Fig. 2.

1. Individual descriptions

a. Gneisses

Gneisses appear to be the predominant rock type in the west of the area and were encountered at the following stations:

E.4658 Granite augen gneiss

Location : (68°26′S, 65°18′W). Exposed rock on the summit of a small nunatak (site of Spiro survey station) in the northwest of the pass across the Rock Pile Peaks peninsula. (Photo. P1). The majority of the rock on the nunatak is in situ but a smaller, lower outcrop on the ridge to the west is composed predominantly of scree.

Field description : A very coarse grained feldspar-quartz-biotite gneiss having an overall pale red colour, with patchy development of an augen texture and small rounded mafic pods (up to 15mm. x 10mm.). A predominantly mesocratic rock with white-pink feldspar and quartz aggregates (as augens up to 20mm. across) in a finer grained matrix of quartz, feldspar and biotite, the orientation of the latter imparting a faint fabric to the rock which dips towards 344° magnetic. The large feldspar crystals appear fractured in hand specimen.

The outcrop is riddled with pegmatite veins from 2cms. to 6cms. in width and having a general trend of 304° magnetic and sharp contacts with the gneiss. These pinkish veins vary in texture and contain tiny mafic crystals and iron minerals, the latter with associated red-brown staining.

Included in the gneiss are rounded xenoliths (up to 20cms. across) of fine to medium grained basic, porphyritic material (Photo. P2), with phenocrysts (from 3mm. to 15mm. across) of quartz and feldspar. A few partially assimilated xenoliths of medium grained felsic material with small biotites were also evident. The outcrop exhibited weak jointing with strikes of 275° magnetic.

Petrography : A granite augen gneiss (signifying mineral composition and not origin) with, locally, development of an augen texture. A sub-idioblastic to xenoblastic texture with large perthite, plagioclase and microcline crystals, some fractured, in an interlocking mosaic of inequi-dimensional quartz and biotite, the former displaying strain extinction and possessing lobate and dentate boundaries.

The feldspar occurs predominantly as large anhedral flame and string microcline perthites and microclines. The few subhedral to anhedral plagioclase feldspars, An_{25-38}, are mostly fractured (with infillings of biotite and quartz) with disruption and bending of the twin lamellae, and several exhibit faint zoning superimposed by polysynthetic albite twinning. Occasional Carlsbad twinning is evident and together with the perthites the plagioclase feldspars show partial sericitization. All the feldspars contain inclusions of quartz, epidote and biotite, and the perthite is often poikilitic to plagioclase feldspar.

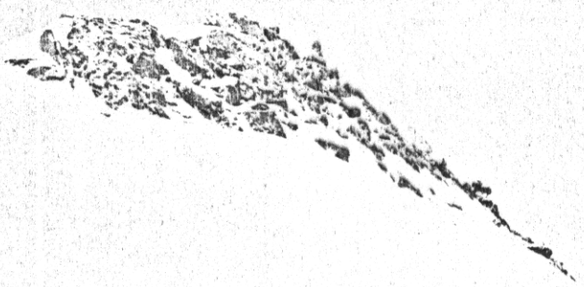
The quartz occurs as an anhedral inter-

locking mosaic between the feldspar augens with some crystals up to 3mm. across, but the majority smaller than 1mm.. The crystals appear to be randomly orientated except in the two instances where, in the company of the biotite, a faint foliation is evident bordering a microcline augen, and almost all exhibit strain extinction. The quartz is frequently found as inclusions within the feldspars but is itself only poikilitic to small iron ore minerals with which it also forms symplectic intergrowths. A few small myrmekite crystals of quartz and perthite or plagioclase are also apparent.

The biotite (pleochroic scheme α=pale straw, $\beta=\gamma$=dark brown to dark green) occurs as large polycrystalline aggregates up to 2mm. across and as small flakes rimming the feldspar augens. The clusters of anhedral to subhedral biotites, displaying bent cleavages, are in some instances marginally replaced by a pale green chlorite and include small zircons with associated pleochroic haloes. Numerous colourless, low birefringence, high relief minerals with euhedral to subhedral, hexagonal or prismatic forms occur within the biotites and feldspars and could be a form of ?epidote. Iron ore is seen as minute grains within the biotite and quartz, and accessory minerals include a single corroded augite crystal, ragged sphene and a platey and fibrous pale green chlorite.

E.4659 Granite gneiss

Location : (68° 12′ S, 65° 13′ W). An isolated outcrop across a snow covered nunatak on the northwest side of the



P1
Outcrop at Spiro survey station. (station E.4658)

P2
Mafic xenolith in gneiss of station E.4658.

P3
Station E.4659 showing the dark rafts of 'xenolithic material'.

Hemingway Pass running through the Joerg peninsula (Photo. P3).

Field description : A coarse grained feldspar-quartz-biotite gneiss of overall reddish-brown colour and fairly uniform texture with local development of pink feldspar augens, up to 10mm. across, exhibiting much fracturing. The outcrop is cut by several steeply dipping, fine to medium grained, mid-grey bands or rafts possessing a foliated appearance and a micaceous sheen.

Petrography : A granite gneiss displaying a xenoblastic texture with large, anhedral, banded and interpenetrant perthites and microcline perthites in a finer grained ground mass of microcline, microcline perthite, quartz, biotite and iron ore. Occasional plagioclase feldspars, An_{25}, with lamellar twinning and patchy zoning are evident but have undergone varying degrees of sericitization. The microcline and microcline perthite crystals in the granoblastic polygonal ground mass display curved and cuspate borders with other feldspars and quartz. Several of the augens are fractured with infillings of quartz and some perthites have embayed margins to anhedral myrmekite crystals. The perthites contain poikilitic inclusions of anhedral quartz, biotite and microcline and show patchy alteration to very fine grained sericite.

Quartz is seen rarely as large aggregates of strained crystals up to 2mm. across with lobate borders, otherwise as small grains in an interlocking mosaic with the microcline and microcline perthite. Biotite (pleochroic scheme α=pale straw, $\beta=\gamma$=dark brown-green) occurs as

numerous small plates, some displaying bent cleavages, and in large clusters containing inclusions of subhedral zircon often with pleochroic haloes. The biotites (average length of 0.5mm.) show the only evidence of a fabric in the rock where they form around the large feldspar augens. Iron ore is fairly common occurring as large irregular masses with embayed margins, included by microcline, and possessing a thin rimming of biotite and fibrous tremolite. Small subhedral to euhedral inclusions of iron ore are evident within the perthites and microclines. Accessory minerals include a few ragged sphene and zircon crystals and a small amount of muscovite mica associated with the biotite.

This gneiss differs from that at station E.4658 in having a more granoblastic texture, being a true granite gneiss rather than an augen gneiss. There is less evidence of strain in the minerals, the quartz showing only feeble strain extinction and the biotites forming a faint orientational fabric. Microcline occurs predominantly in the interstitial mosaic, whereas it was almost absent from the groundmass in the augen gneiss, and there is an increase in iron ore and biotite content. Very few accessory minerals are present in the granite gneiss and the apatite and epidote found at station E.4658 were not present in the thin sections examined.

E.4692 Augen biotite gneiss

Location : (68° 14′ S, 65° 11′ W). A detached outcrop on the

snow slope beneath an isolated cliff face on the western side of the southern entrance to the Hemingway Pass.

Field description : A coarse grained biotite gneiss with small augens (up to 2cm.x 1cm.) of pinkish white feldspar and quartz in a strongly foliated matrix of biotite, feldspar and quartz. The outcrop contains several lenses or rafts (up to 2ft. x 1ft.) of fine to medium grained, grey rock with a micaceous sheen and conspicuous pyrite crystals.

Petrography : An augen biotite gneiss with large augens of interlocking quartz and plagioclase feldspar in a foliated matrix composed chiefly of biotite, epidote(clinozoisite) and quartz. The augens, over 4mm. across, exhibit lobate but more commonly curved borders between the plagioclase and quartz components, the latter displaying strain extinction. The plagioclase, An_{28-38}, exhibits albite and pericline twinning, slightly deformed in some crystals, and shows partial sericitization. Small myrmekitic intergrowths with quartz can be seen at the margins of the rare perthites. Several monomineralic augens are also evident in thin section comprising of elongated quartz crystals only one grain in width but several in length.

Biotites (pleochroic scheme α =pale straw, β =dark brown, γ =orange brown) occur as bent crystals in the flowing groundmass around the augens and are associated with subhedral to anhedral, fractured, prismatic crystals of clinozoisite and rare fibrous penninite. Small randomly

orientated anhedral quartz grains are also present in the matrix. The biotites show marginal alteration to a pale green chlorite and numerous penninite needles occur within the biotites. Accessories include small fibrous growths of prehnite, zircon, a little muscovite associated with the biotites and included in the quartz, and a few subhedral orthopyroxenes.

E.4694

Location : (68°17′S,65°21′W). Exposure at the foot of a cliff face on the northern side of Solberg Inlet approximately 7mls. southwest of Hemingway Pass.

Field description : A very coarse grained biotite gneiss with large crystals up to 5cms. in length of a yellowish-pink feldspar. The overall mesocratic colour of the rock is due to the high biotite content in the quart and feldspar matrix. A slight foliation is evident in the parallel orientation of the large feldspars and the micas.

Petrography : Blastoporphyritic texture with large plagioclase feldspar, quartz and microcline crystals set in a matrix of biotite, quartz and feldspar with accessory iron ore, chlorite and sphene.

The plagioclase feldspars have compositions from An_{10-17} and are seen as lamellar twinned anhedral crystals often showing signs of distortion, and as untwinned crystals with heavy sericitization and partial alteration to microcline. The large microclines (up to 4mm. across) are the predominant porphyroblasts with curved self boundaries and fractures infilled by fine

grained calcite, which is also evident as a marginal alteration product of the anhedral crystals. Myrmekitic intergrowths are seen where the microcline porphyroblasts border the quartz of the groundmass. The large quartz porphyroblasts occur as recrystallized aggregates of interlocked, strained, quart grains with lobate and cuspate borders.

The inequidimensional groundmass is composed predominantly of biotite (pleochroic scheme α=straw, $\beta=\gamma$=dark brown) showing a degree of foliation around the porphyroblasts and also bent cleavages, with small anhedral strained quartz, microcline, plagioclase feldspar, iron ore, sphene and an optically positive ?apatite. Pale green chlorite is also evident and the groundmass components are frequently found infilling fractures in the porphyroblasts. The largest of the irregular shaped iron ore masses in the groundmass are poikilitic to small quartz.

b. Sedimentary rocks

A quartzite was found at one locality and is believed to be of a sedimentary origin. This aspect is described in a later section.

E.4693

Location : (68° 13′ S, 65° 00′ W). From the base of the eastern corner of an extensive cliff face bordering the northern margin of Solberg Inlet, approximately 3mls. east of the southern entrance to the Hemingway Pass.

Field description : A very fine grained, massive, pale

grey-purple quartzite (almost marble-like in appearance) composing the whole of the cliff face. Much quartz veining up to 5mm. across containing a pale to dark green mineral, which also coats the joint surfaces, is evident.

Petrography : A very fine grained rock, average grain size 0.1mm. - 0.2mm., composed essentially of flattened, strained quartz with very fine interstitial biotite (red-brown colour) and sericite in varying amounts throughout the rock. The section is crossed by several thin veins comprising of large anhedral quartz (up to 1.5mm. across) with cuspate borders, exhibiting strain extinction, with finer interstitial quartz and fibrous penninite. Thinner monomineralic veins are also seen and appear to be associated with a concentration of biotite fron the host rock. Accessory minerals include a few small isolated grains of iron ore, sphene and chlorite. A faint fabric is imparted to the section by the direction of flattening of the quartz in the host rock and the feeble orientation of the biotite and chlorite. Several thin fractures cut the rock, passing through the quartz grains rather than interstitially, and have been partly infilled by chlorite and penninite.

c. Xenolithic material

Rafts or lenses of fine to medium grained grey material occur widespread throughout the gneisses examined and samples from the following stations were obtained :

E.4692

Location and Field description) see gneiss section

Petrography : Hemigranoblastic texture with quartz and plagioclase feldspar randomly orientated within a fabric of orientated biotites and a small amount of iron ore. The quartz, frequently showing signs of strain extinction, and the plagioclase, having composition An_{47-54}, vary in size up to 0.5mm. and are present in approximately equal proportions. The biotite (pleochroic scheme α=straw, β=brown-green, γ=orange brown) is poikilitic to small quartzes. Sphene occurs as a rare accessory mineral together with an optically positive ?apatite.

E.4696

Location : (68° 25′ S, 65° 33′ W). From the foot of a ridge running into a large cirque on the northern side of Mt. Wilson, in the southwest corner of Solberg Inlet.

Field description : fine grained, dark grey rock possessing a micaceous sheen and occurring as lenses within the host granite gneiss.

Petrography : The thin section shows two distinct components of the rock having a fairly uniform and gradational contact.

One constituent exhibits a finer grained texture of anhedral quartz, invariably strained, and albite, the latter showing lamellar twinning which is seen to be slightly deformed in some crystals. The quartz predominates (average grain size of 0.3mm.) and there is an apparently random orientation of the crystals. Biotite

(pleochroic scheme α =straw, $\beta = \gamma$=dark brown) often reaches 0.6mm. in length and the ragged subhedral to anhedral laths do not show any signs of bent cleavages. The biotites are interstitial to the quartz and often occur as inclusions in the quartz and feldspar.

The coarser grained component (with average grain size 0.7mm.) has a granoblastic polygonal texture and contains a much higher proportion of micas and the appearance of haematite (black with blood-red edge colourations). Small muscovite crystals less than 0.1mm. in length are also evident, associated with the biotite, and the albite/quartz ratio is greater than in the fine grained component. The contact between the two components appears to be fairly gradational and is marked by a concentration of biotites. A small peppering of iron ore is seen in the coarser component, frequently included in the muscovite, and in places the biotite shows marginal alteration to a pale green chlorite.

2. General geology

A general geological summary of the area is completely impossible based on the few specimens available. A tentative geology was hoped to be described using information from the binocular and photogeology results, but in the course of investigation the author found that without specimen control the interpretation of the results proved very debatable and it is felt that any conclusions would be highly unsatisfactory and unreliable.

However, the lithologies encountered are

compared to those found by Stubbs further north and certain geological features of the remaining area commented on and possible explanations for them put forward. Several photographs and pan-rounds are included purely for reference purposes in case the area is the site of further geological investigations.

The various gneisses described in the previous section closely resemble the textural subdivisions of the biotite gneisses on the northern side of the Joerg peninsula. They differ from the granite gneisses of Tonkin Island and the western Joerg peninsula in that : the plagioclase feldspars have oligoclase-andesine compositions as compared to the albite-oligoclase compositions of the granite gneisses; zoning is often displayed by the plagioclase feldspars; and muscovite is absent but microcline is common. The microcline content and plagioclase feldspar composition also distinguish the specimens collected from Stubbs' more calcic granodiorite gneisses of western and eastern Joerg peninsula.

The biotite gneisses described by Stubbs are banded composite gneisses comprising "alternations of closely foliated biotite gneiss and gneisses which contain varying proportions of quartz, biotite, plagioclase and potash feldspar, having textures transitional from augen gneiss to porphyoblastic gneiss". Their mineral assemblage and especially the plagioclase compositions are very similar to the gneisses collected from stations E.4658, E.4659, E.4692 and E.4694 (the latter is an exception in that it has a more sodic plagioclase feldspar composition, but in all other respects resembles the others), and their textures

Table 1.

MODAL ANALYSES OF GNEISSOSE ROCKS AND 'XENOLITHIC MATERIAL'

	1	2	3	4	5	6	7
Quartz	23.6	6.0	41.8	29.6	33.8	36.6	31.0
Microcline £	50.6	62.1	2.9	12.3	-	-	-
Plagioclase	20.7	22.5	14.8	37.1	31.2	23.0	33.2
Muscovite	@	@	@	-	-	-	@
Biotite	4.8	8.5	24.3	20.4	31.2	39.6	35.4
Iron ore	0.2	0.6	0.2	0.6	3.8	0.8	0.6
Apatite	@	-	-	@	@	@	@
Sphene	@	@	-	@	-	@	-
Epidote	@	-	13.4	-	-	-	-
Chlorite	@	@	@	@	-	-	@
Zircon	@	@	@	-	-	-	-
Plagioclase composition	An 25-38	An 25	An 28-38	An 10-17	An 9-49	An 1-13	An 3-10

£ Includes perthite and microperthite
@ Present but not recorded

KEY :

Gneisses	'Xenolithic material'
1. E.4658.1	5. E.4659.2
2. E.4659.1	6. E.4692.2
3. E.4692.1	7. E.4696.1
4. E.4694.1	

are transitional between the last two of Stubbs' three textural subdivisions : veined, augen and porphyroblastic biotite gneisses. (The modal analyses for the rocks collected can be found in Table 1.)

The dominant feature noticed in the field was the reddish brown colour of the rock and the specimen of gneiss from Spiro nunatak (E.4658) is regarded as being typical of the rock on the western half of the Rock Pile Peaks peninsula. Similarly the reddish rock forming the extensive faces bordering the Hemingway Pass on the Joerg peninsula is considered to be equivalent to the gneiss found at station E.4659. The dark patches and discontinuous bands, in these latter exposures particularly, are regarded as being rafts or xenoliths of material similar to that found as fine grained biotite gneiss lenses in the gneisses as stations E.4659, E.4692 and E.4696.

The large scale banding in the gneisses on the northern side of the Joerg peninsula appears similar to, and on the same scale as, that observed in the area to the south, although the discontinuous banding or rafts on the southern side of the Joerg peninsula are not described further north.

No xenolithic material has been described by Stubbs in the gneisses and it is possible that the rafts of this material are textural variations of the banded biotite gneiss. However he describes folded, discontinuous rafts of hypersthene metagabbro in adamellite to the south of Daspit Glacier which resembles the xenolithic material above in appearance but not composition.

The large sub-horizontal raft which is seen

at the top of the western wall bordering the Hemingway Pass resembles the epidiorite sill described by Stubbs on the northern side of the peninsula and could conceivably be the westward extension of this concordant intrusion.

The sedimentary rocks of Three Slice Nunatak at the eastern end of the Joerg peninsula are described by Stubbs as having a red-weathered coating, but this cannot be confused with the reddish-brown colour of the gneisses described above as the present author, who also visited the Three Slice Nunatak sediments found their rust-red to bottle green colouration quite distinctive and unlike the colour of the rocks seen to the south.

The fine grained quartzite found at station E.4693 is reported to be typical of the whole cliff face but no contact was observed between it and the reddish rock with rafts at the extreme western end of the outcrop. This quartzite is regarded as a metasediment and akin to the sediments found by Stubbs on the northern side of the Joerg peninsula. No intrusive body was recorded in the vicinity of the quartzite and it has undergone only low-grade regional metamorphism. As such it is very similar to the regionally metamorphosed sandstones from the western Joerg but quite unlike the cataclastically and thermally metamorphosed sediments described from the eastern Joerg and Three Slice Nunatak. Similar penninite veins to the ones found at station E.4693 have been recorded from the eastern Joerg sediments however.

Binocular geology showed the existence of large, dark-coloured 'bodies' within reddish host rock on the northern and western margins of the low Rock Pile Peaks

Fig 3

TENTATIVE GEOLOGICAL MAP

massif. Although there was much snow cover the 'bodies' appeared fairly distinctive and the aerial photographs of the area show definite colour contrasts less hampered by snow cover. It is thought that the 'body' occurring in the cliff face on the eastern side of the pass across the Rock Pile Peaks massif is of a basic intrusive origin, especially as it appears to disrupt the banding in the country rock and have satellitic sill-like extensions concordant with the banding.

The dark rock cropping out on the north and northeast coast of the Rock Pile Peaks massif has a similar appearance but with the absence of satellitic extensions and banding in the host rock, and its identity proves the biggest problem. The only positive evidence available is that a geophysics station at site K (see aerial photographs in Appendix) was situated on 'shale' presumably equivalent to the metasediments exposed at Three Slice Nunatak. If this is so there are several possibilities as to the geology in the area :- a) the dark rock is indeed metasediment in which case the lighter coloured rock could be intrusive (the contacts resemble the adamellite/metasediment contact at the extreme eastern end of the Joerg peninsula)

b) the dark rock is a basic plutonic rock intruded into homogeneous gneisses or intruded by acid plutonic rock.

The above two account for the exposures surrounding the ice-covered massif. The two extensive wall exposures (L and N-O on aerial photographs) on the south side of the Solberg Inlet and to the east of the pass across the peninsula consist of a black rock in contact with a

heterogeneous rock of disrupted dark fragments in a paler coloured host. This mixed rock, which resembles the heterogeneously banded gneisses found elsewhere, lies on top of the black rock with apparent conformity. The simple explanation for this could be a plutonic intrusion within banded gneisses, the metasediments of site K being on an isolated cliff face separated from the eastern exposures by a small snow gap. However if the dark rock is all metasediment then the overlying, banded rock could either be a sil of a mixed intrusive nature or overthrust gneiss, the latter seemingly improbable due to the uniform contact. The dark rock of the previous exposures has apparently sharp contacts with, and forms irregular bodies within, the lighter component and this distribution would tend to favour possibility b) overleaf, although the exact relation might be complicated by the snow cover.

It therefore seems probable that the dark 'bodies' are of two differing lithologies : metasediments surrounding the northern and northeastern margins of the Rock Pile Peaks massif and at site K; and basic plutonic east of the pass across the peninsula (L and N-O) and on the western side of the Rock Pile Peaks massif, with a possible tectonic junction occurring in the snow gap west of site K. This interpretation is shown in Fig.3 although it must be stressed the conclusions are highly speculative.

3. STRUCTURAL GEOLOGY

1. Folding

Only a few structural measurements were

recorded and they are insufficient to give a detailed structural analysis of the area. However, from observations made of the inaccessible rock walls bordering the Hemingway Pass and the pass through the Rock Pile Peaks peninsula, the structure, as evidenced in the sequences of ?banded and rafted gneisses would appear to be one of gentle folding on an approximate E-W axis. The ?banded gneisses of the Bowditch Crests and the face exposure in the southeast of the pass across the Rock Pile Peaks peninsula display a gentle southerly dip. Steeper dips were observed on the faces bordering the south-western side of the Hemingway Pass as evidenced by the xenolithic basic rafts in the gneisses, and seen to pass into sub-horizontal beds further north towards the top of the Pass. Little evidence can be seen for dipping of the gneisses in the southeastern exposures of the Hemingway Pass, but further around to the south the rafts in the gneisses dip fairly steeply to the west indicating the possible presence of a subsidiary, fairly tight, N-S fold axis.

Similar E-W folding has been described by Stubbs from the northern side of the Joerg peninsula, who also found folding on a general N-S axis in the sediments of western Joerg peninsula and the volcanics of Francis Island. South of Mobiloil Inlet Fraser and Grimley have recognised two periods of folding : the first, which only affects the Metamorphic Complex rocks, having axes trending NNW-SSE; and the second with axes WNW-ESE.which has involved virtually all the rocks and is suggested to be co-genetic with the thrusting in the area.

2. Faulting

No inconclusive evidence of faulting was seen but two types, major fault zones and local minor faulting, can be postulated.

The pass running approximately NW-SE across the Rock Pile Peaks peninsula appears to be the line of a definite morphological discontinuity separating the high and steeply dissected western area from the lower and relatively flat eastern massif of Rock Pile Peaks itself. Dubious evidence for the existence of a major break through this peninsula is given by the occurrence of the dark 'bodies' (mentioned in the geology section) in the Rock Pile Peaks massif which were not observed to the west of the pass. In the area to the southeast of Mobiloil Inlet Fraser and Grimley have described fault zones running approximately WNW-ESE separating Kenyon Peninsula from the mountainous area to the southwest, with large downthrows to the northeast and it is postulated that the downthrow was similarly to the northeast in the Rock Pile Peaks peninsula.

Minor faulting with displacements of only a few metres is suggested by the apparent discontinuity of basic rafts on the southwestern side of the Hemingway Pass. The fault planes have been accentuated by gullying in the steep cliff faces.

ACKNOWLEDGEMENTS

Thanks must again go to my sledging companion Fergy Anckorn, and also to geophysicist Barry Dikstra, who supplied some of the specimens, photographs and discussion on which this report is based.

APPENDIX

Two further rock exposures are described from locations outside the main work area : Ptolemy Nunatak where advantage of a long bad-weather lie-up was taken to examine the outcrop near the depot (unfortunately the specimens collected had to be left at the depot because of weight restrictions and were unable to be picked up later in the season) ; and an exposure on the south side of Mobiloil Inlet visited by a geophysics party and, although in Fraser and Grimley's area, apparently not described before. The two locations are shown in Fig.4 together with the work areas along the Bowman and Wilkins Coasts.

Ptolemy Nunatak (E.4657)

Scattered rock exposures occur along a 15ft. ridge running due west down from the survey cairn (Photo. P4). The main rock type is a very coarse grained augen gneiss (Photo. P5) with quartz and feldspar (yellow-white) augens surrounded by mica and feldspar (specimen E.4657/1). The augens have rounded cross sections with average diameters of 8mm., although exceptionally large augens up to 16cm. x 8cm. were observed (specimen E.4657/2). Rounded mica-rich pods had a scattered occurrence but were never greater than 11cm. across. Gneissosity was recorded as dipping 50° in directions varying from 298°-312° magnetic. The few joint planes exhibited a rust-red staining and had vertical or near-vertical dips with strikes around 044° magnetic.

A thin band of garnet-bearing gneiss was seen to have sharp contacts with the augen gneiss. This rock was fine grained, with a silver-grey colour, consisting of

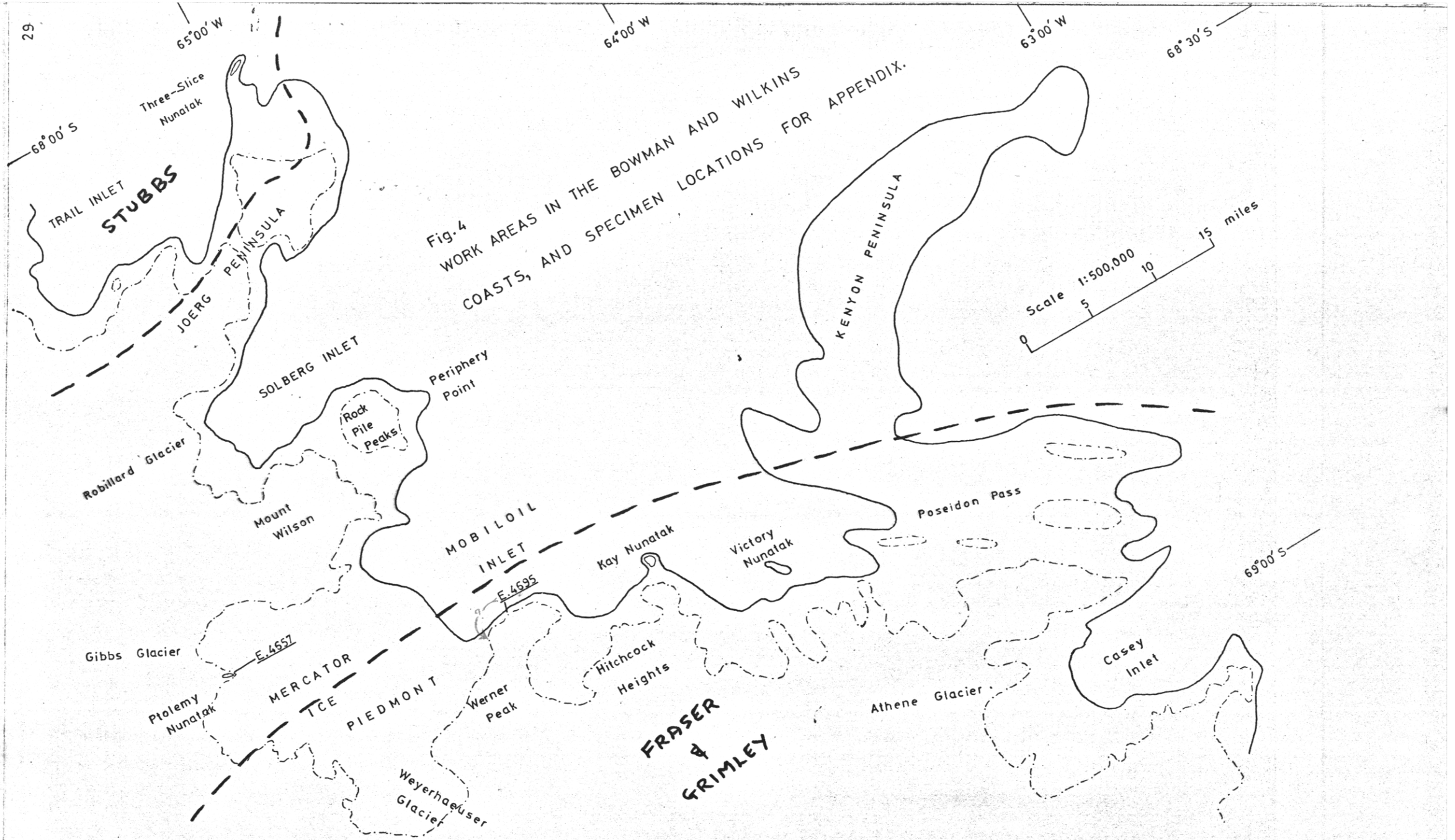


Fig. 4
WORK AREAS IN THE BOWMAN AND WILKINS COASTS, AND SPECIMEN LOCATIONS FOR APPENDIX.

mica, quartz and feldspar and conspicuous pink euhedral garnets up to 2mm. across, many exhibiting fracturing (specimen E.4657/4). Both the augen gneiss and the garnet-bearing gneiss are intruded by a dark green-black schistose rock which is also evident as pods within the augen gneiss and contains phenocrysts of feldspar and quartz. In one exposure where the black schist cuts the garnet-bearing gneiss there is a concentration of mafic minerals, elongated in the gneissosity direction of the country rock, and a yellowing of the quartz at the contact. The black schist in some exposures displays thin contorted veining from 4cm. to 9cm. in width of a yellowish-white material with distinctive dark micas (specimen E.4657/3).

Comparison

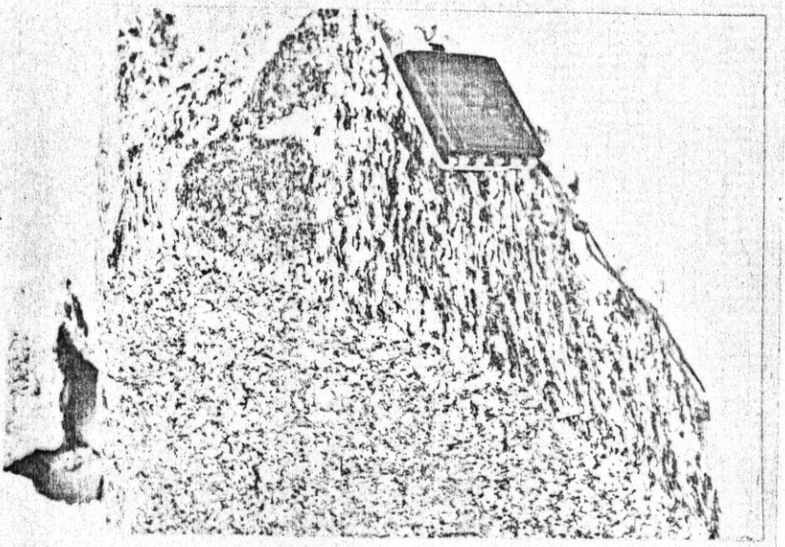
The augen gneiss is very similar to the gneiss obtained from station E.4658 in the Rock Pile Peaks peninsula and the comparison of the latter with those from adjacent areas has already been described. The garnet-bearing gneiss however was not seen in the main work area and a similar lithology has not been described by Stubbs. Fraser and Grimley however describe garnet-bearing quartzo-feldspathic gneisses from the west side of the Weyerhaeuser Glacier which are "interbanded with and subordinate to biotite gneisses".

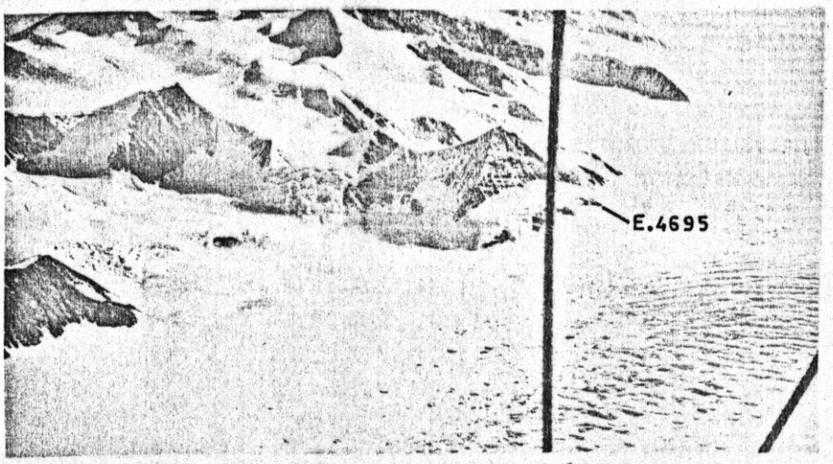
South side Mobiloil Inlet E.4695 (68° 39′ S, 65° 11′ W)

The specimen was collected from the foot of a ridge running northwards from an extensive cliff face on the southern side of Mobiloil Inlet and to the north of Werner Peak (Photo. P6). The rock, a banded white and grey

P4
Outcrop at Ptolemy Nunatak.
(station E.4657)

P5
Typical gneiss of station E.4657 showing well-defined fabric.





P6 Aerial view of station E.4695 on the southern side of Mobiloil Inlet.

quartzite, was taken from the "sub-vertical limb of a fold with a hidden unconformity above dividing the folded strata from fairly gently dipping schists similar to those (as seen from a distance) widespread in the area and forming the whole of the adjacent rock wall.....the overlying schists appear very incompetent with much boudinaging".

In hand specimen the rock is a fine grained banded quartzite with flecks of mica evident in the white component and also imparting a faint schistosity to the grey part by concentrations into thin layers. The white quartzite has a faint greenish tinge to it and is traversed by thin grey veins emanating from, and presumably infilled by the same minerals as in, the grey quartzite. Both coloured lithologies are cut by thin veins of quartz with individual crystals up to 2mm. evident.

Petrography.

The white quartzite consists of a hemi-granoblastic mosaic of interlocking quartz and albite (An_{3-8}) grains. The average size of the grains is 0.1mm. to 0.2mm. but several larger composite quartz and corroded plagioclase grains attain sizes of about 0.7mm. (although the former occurrence might be part of a former vein through the rock). All the quartz grains display undulose extinction and the albites occur in two types : an untwinned variety showing patchy extinction and possible faint zoning ; and a fresher variety, often larger in size, displaying Carlsbad and irregular lamellar twinning, and also a chequer-board type of twinning with widely spaced albite and pericline twins. None of the lamellae showed any signs of bending or distortion, The

untwinned albite and the larger of the twinned plagioclase feldspars are poikilitic to small quartz blebs. Minute sericite is evident as a dusting to all grains.

Small (0.1mm.), randomly orientated biotite flakes occur throughout, displaying straight cleavages and having a pleochroic scheme α=very pale straw, $\beta=\gamma$=light orange brown. Marginal alteration to pale green chlorite was evident in a few of the larger biotite flakes. Small detrital minerals include ragged sphene, an olive-green tourmaline, apatite and a turbid, often euhedrally rhomboid, epidote. Subhedral pseudo-hexagonal grains of colourless ?garnet are also present, mostly isotropic though some possess a very low birefringence. The apatites are the optically positive variety found in the gneisses north of Mobiloil Inlet. Several small flakes of muscovite are present in the thin section and small zircons are seen including the biotites. The concentrations of mica, ?garnets and detrital minerals in the white quartzite give rise to the thin faint banding observed in the hand specimen.

The grey quartzite band has a similar plagioclase and quartz composition though the texture is more granoblastic, and occasional rare microcline grains are evident. In addition to the small unorientated biotites there are abundant larger biotites (average length 0.3mm.) which show a faint orientation and again a marginal alteration to pale green chlorite, the latter also being found as small individual crystals. The darker bands in the rock are the result of concentrations of the large biotites and lighter tonal variations are caused by the presence of sphene,

?garnet, epidote and apatite which appear to be concentrated independently of the biotite-rich layers.

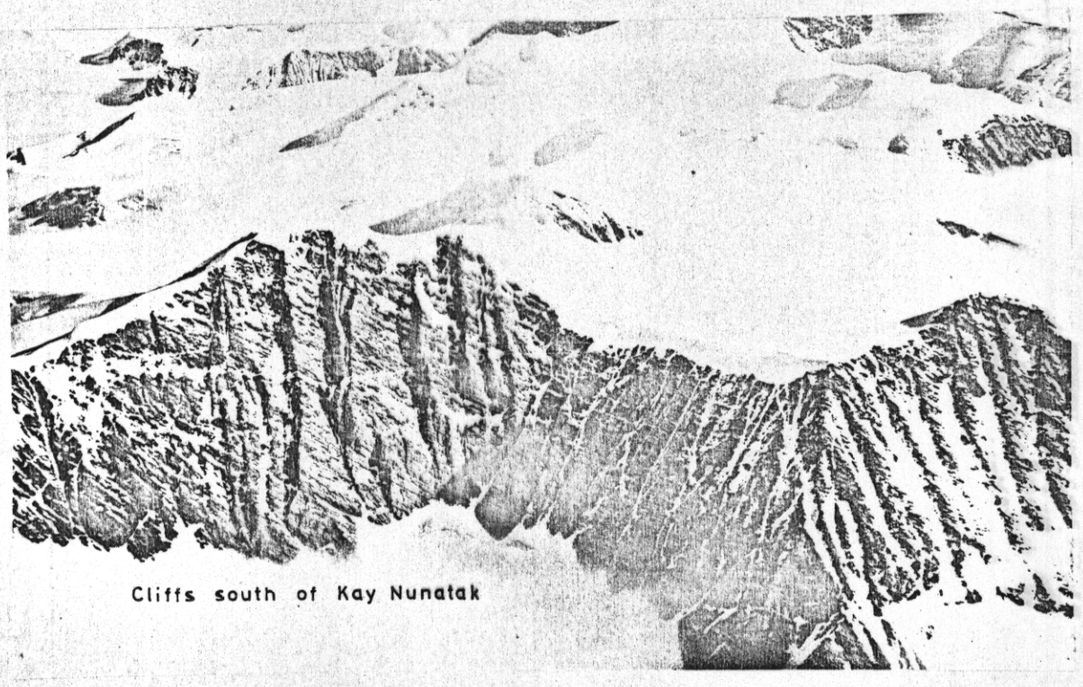
Comparison.

Compositionally the banded quartzites resemble the quartzites of the Kay Nunatak sediments in having predominant quartz, highly sodic plagioclase feldspar and a similar heavy mineral suite but no lithic fragments. Furthermore these quartzites crop out at the northeast of Kay Nunatak as "steeply dipping and strongly folded beds" overlain by thrusted conglomerates. In the cliffs to the south of Kay Nunatak gently dipping sequences of "prominently banded and intensely deformed rocks" from mylonites up the succession to foliated augen gneisses, quartzo-feldspathic gneisses and interlaminated schists have been recorded above a major thrust zone. These belong to the 'cataclastic rock' group of Fraser and Grimley and strongly resemble the 'schists' observed in the cliff face behind station E.4695.

These latter schists, however, have been described by Dikstra (personal communication) as being very similar to outcrops observed to the south of Kay and Victory Nunataks (presumably belonging to the metamorphic Basements rocks of Fraser and Grimley), and it is therefore possible that the thrust zone might dip westwards bringing the Basement rocks of the hinterland directly over the sediments (and hence causing the absence of the cataclastic and volcanic rocks occurring above the sediments at Kay Nunatak). A definite identification of the rocks above the ?thrust zone and the true nature of the ?thrust zone however will have to await further work in the area.

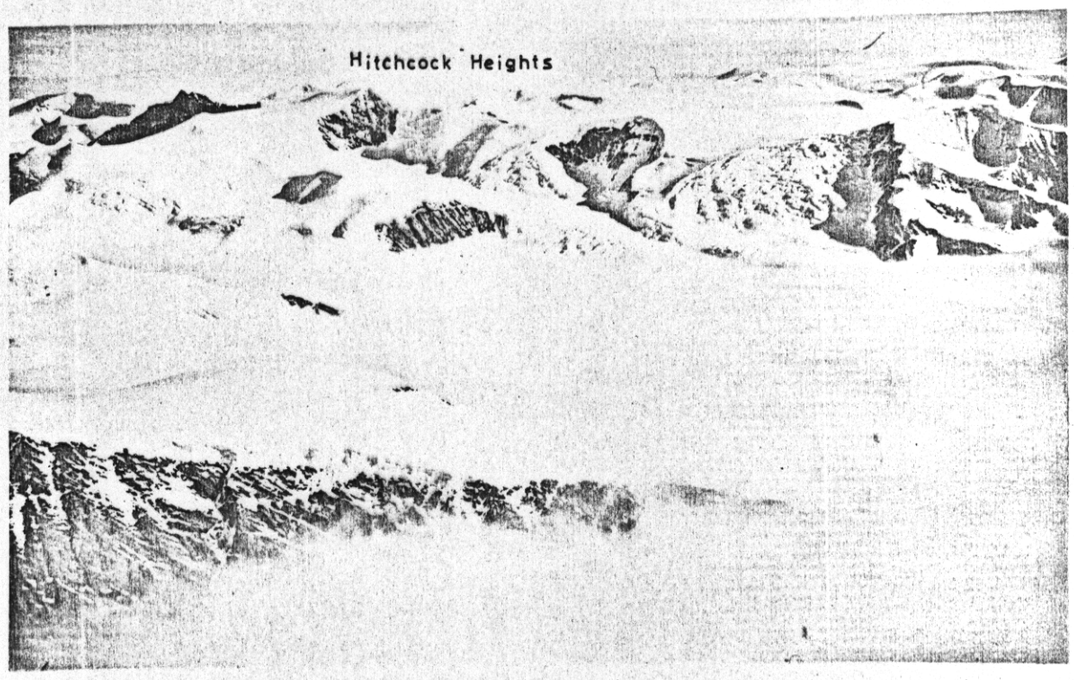
List of photographs and sketches on following pages.

1.



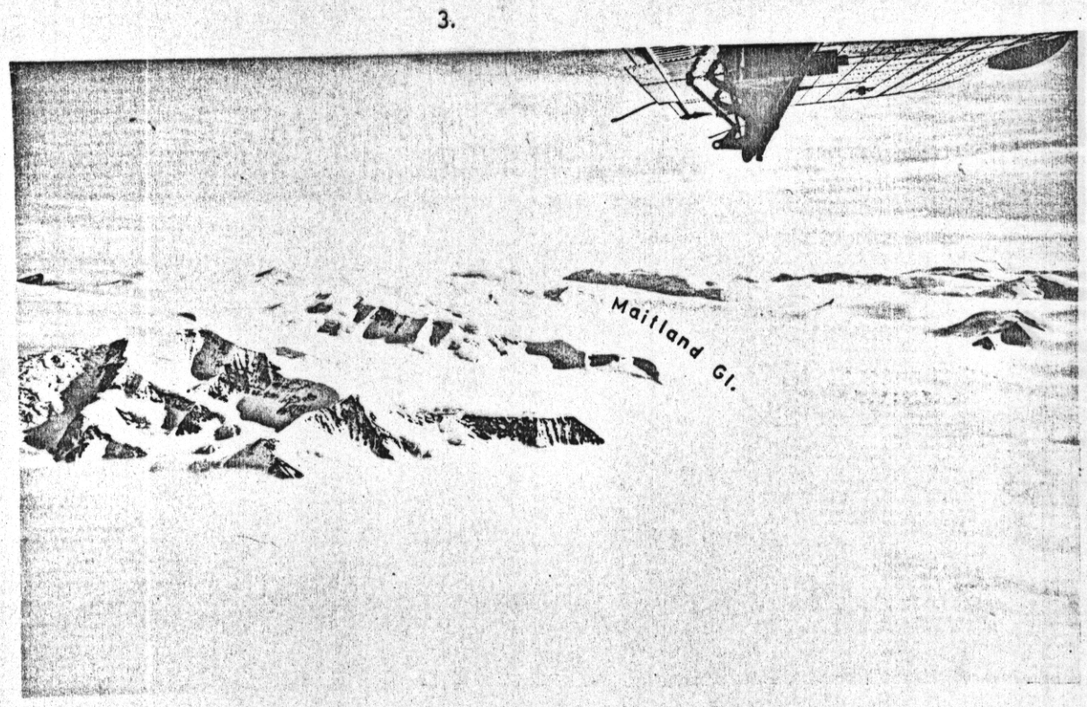
Cliffs south of Kay Nunatak

2.



East to west panoramic views of the area south of Mobiloil Inlet.

3.



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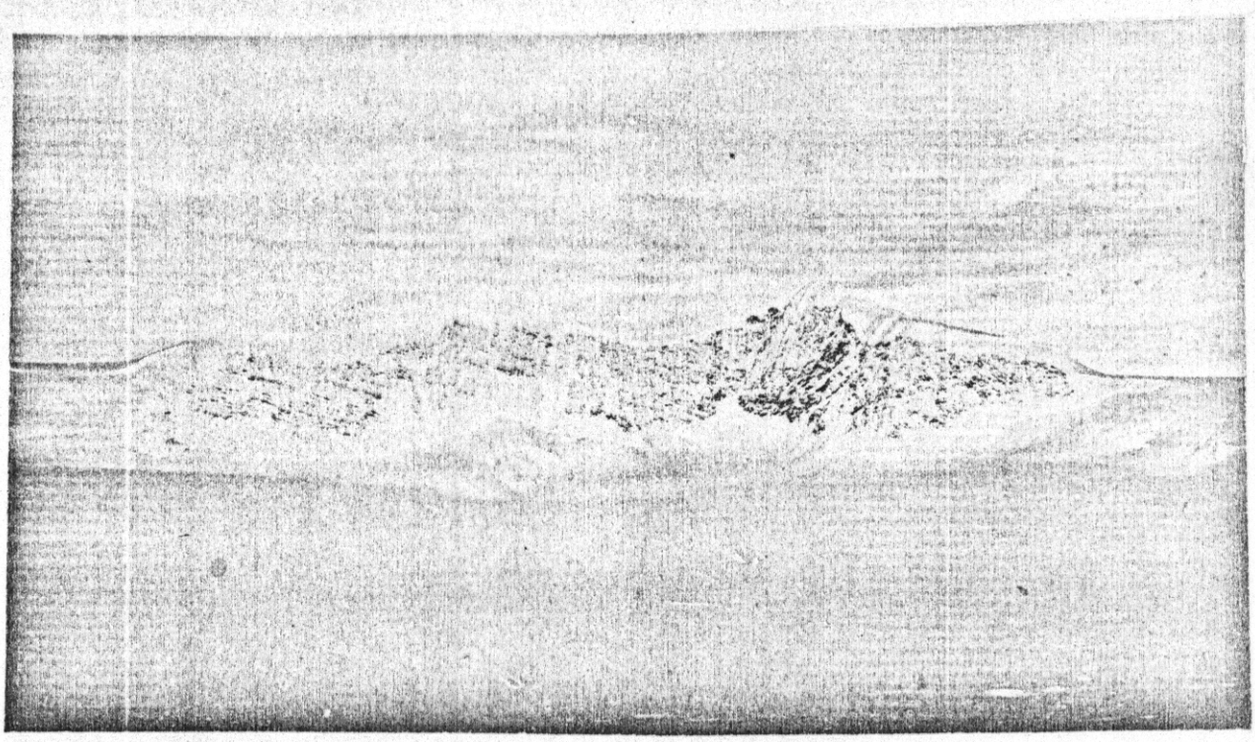
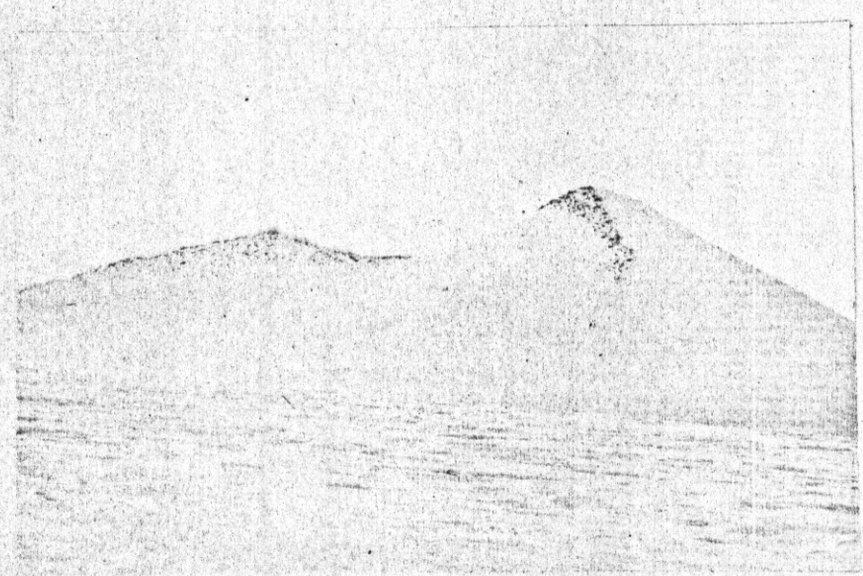
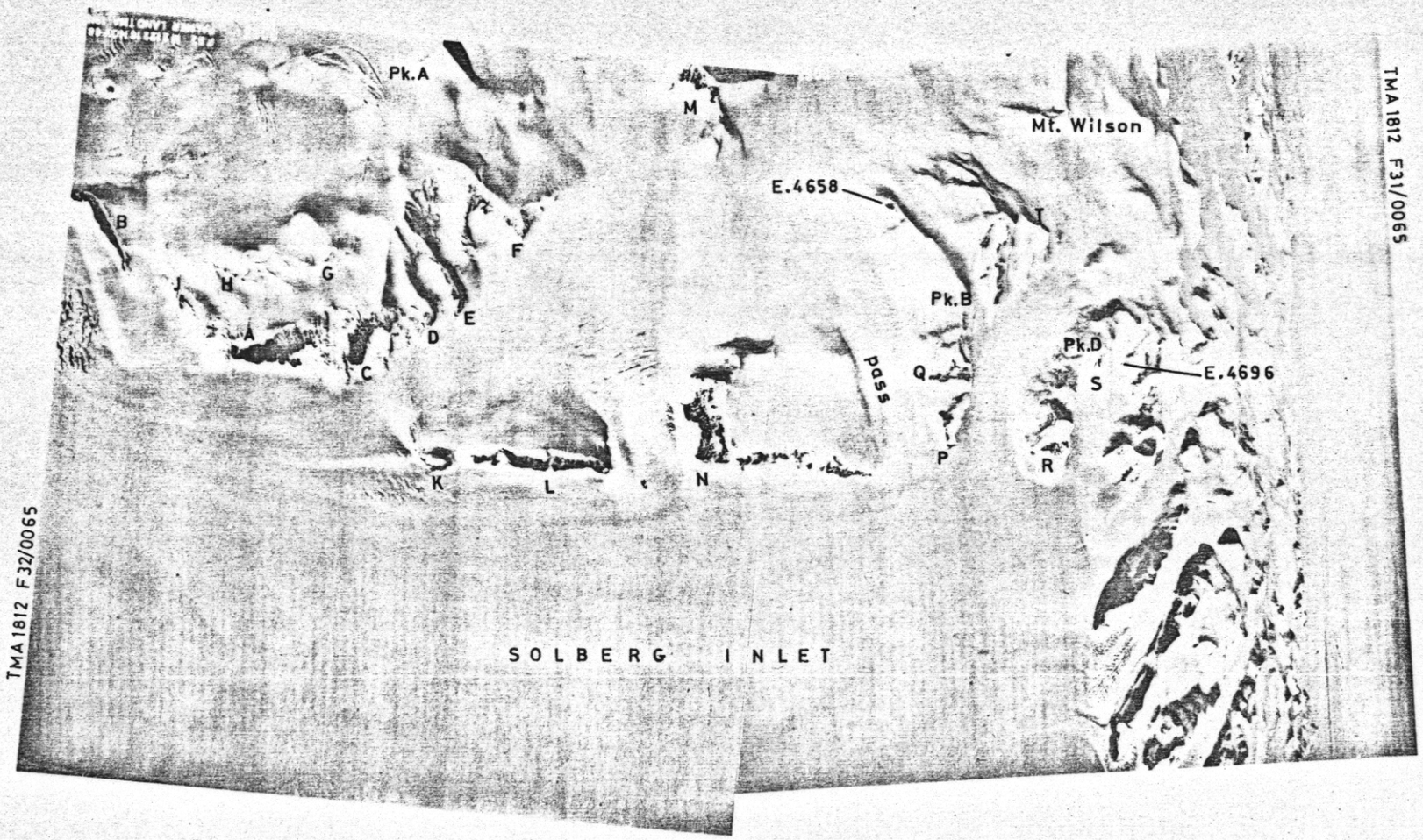


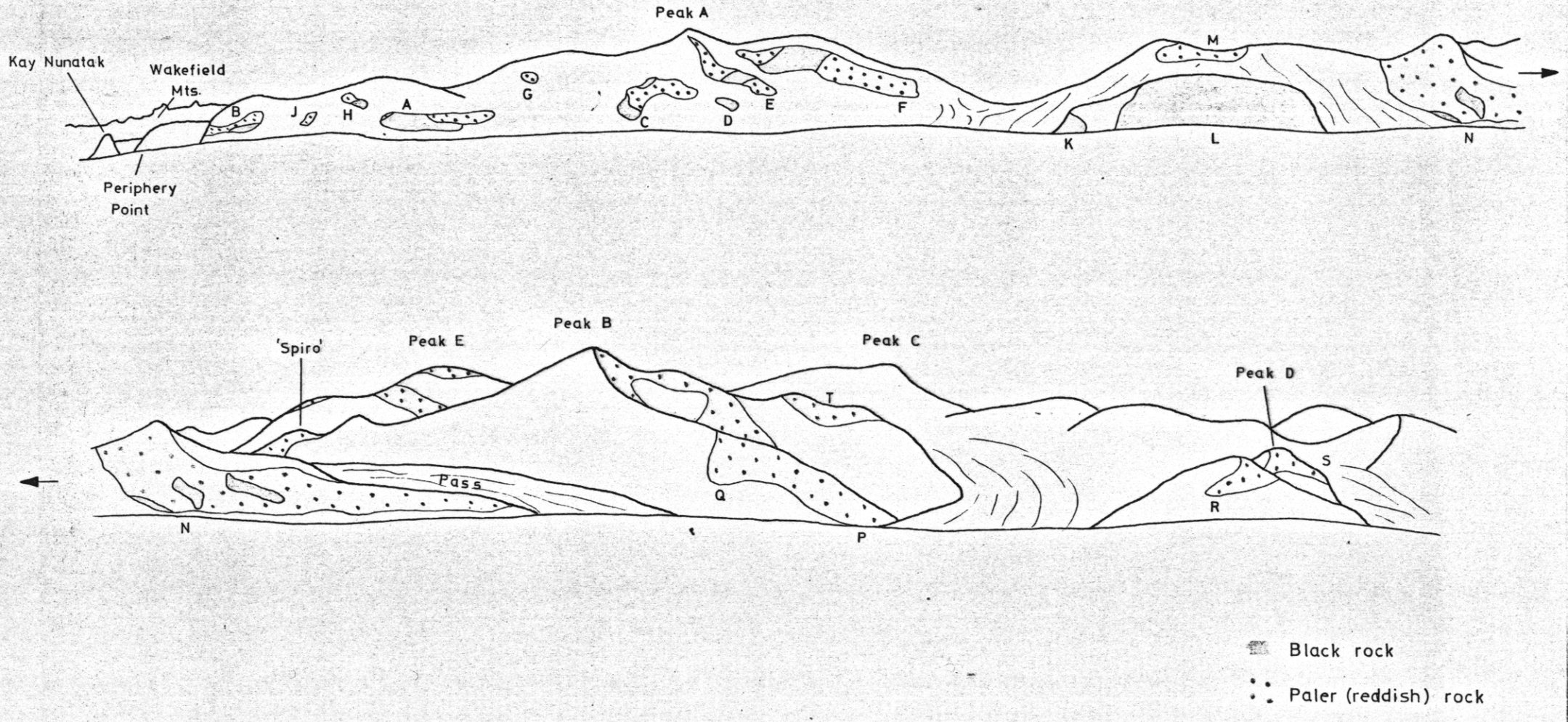
The black intrusive body in banded gneisses in the cliff face on the eastern side of the pass across the Rock Pile Peaks peninsula.



The outcrop at Spiro survey station with the lower, western ridge on the left.

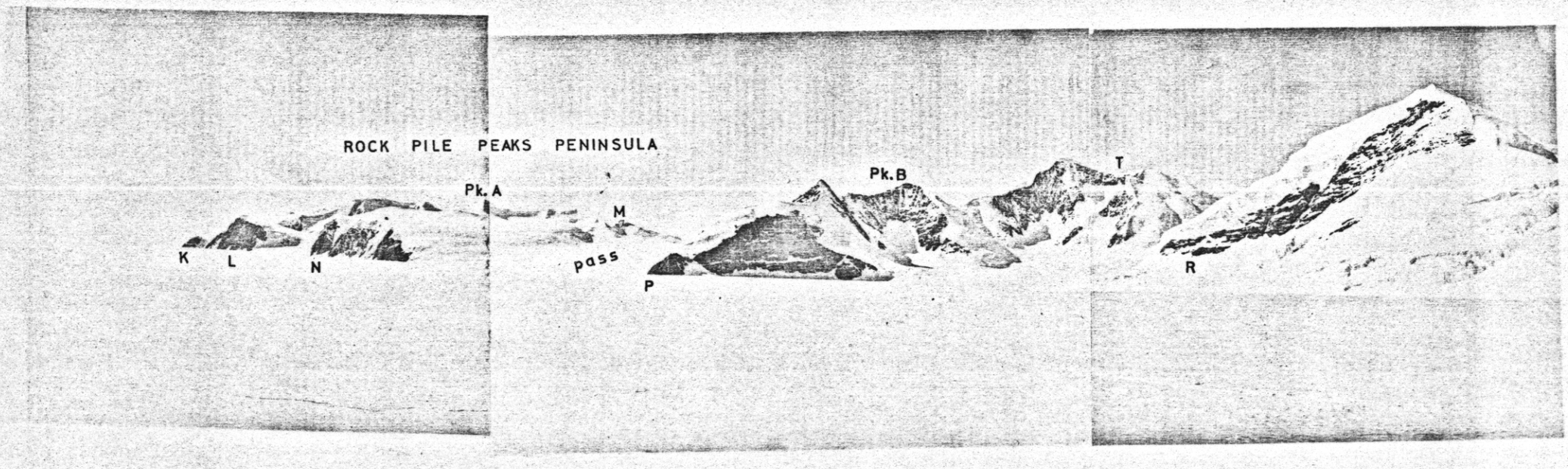
Aerial photographs of northern side of Rock Pile Peaks peninsula, and key to features on pages iv, v and vi.



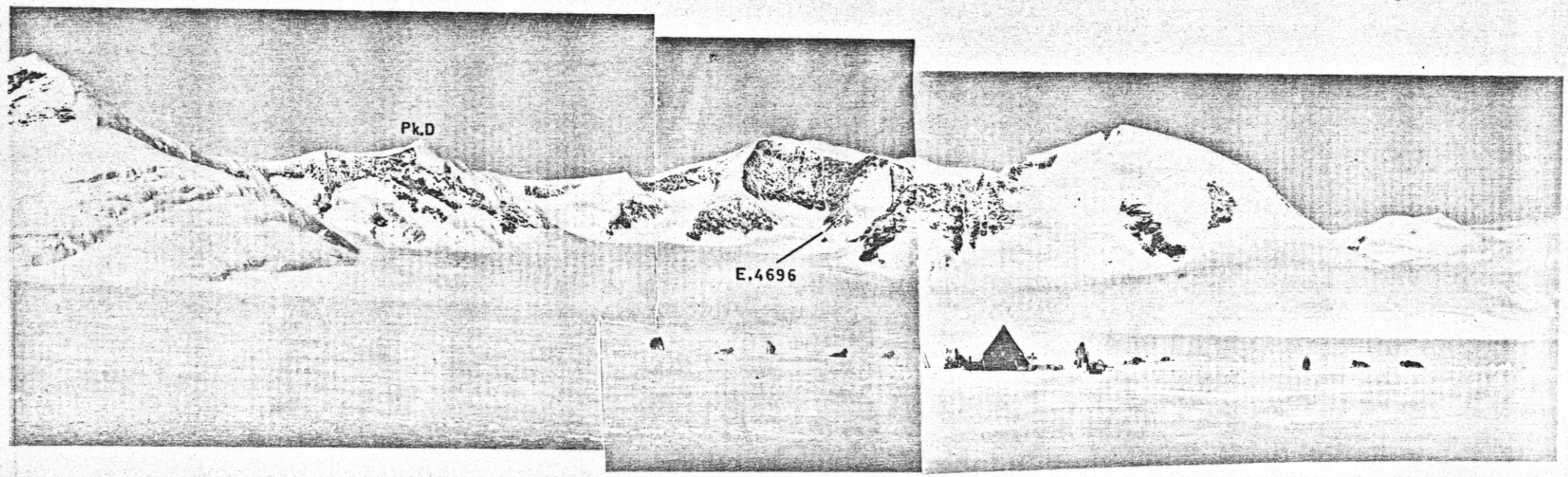


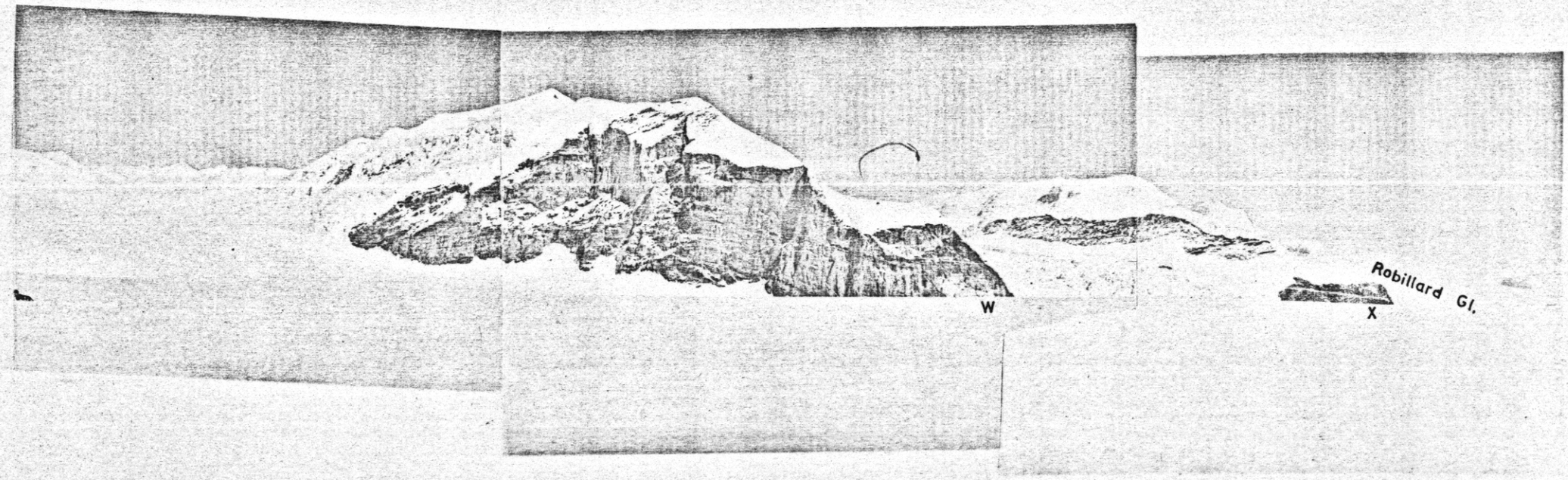
Sketch of northern side of Rock Pile Peaks peninsula

(letters refer to features on accompanying aerial photographs)

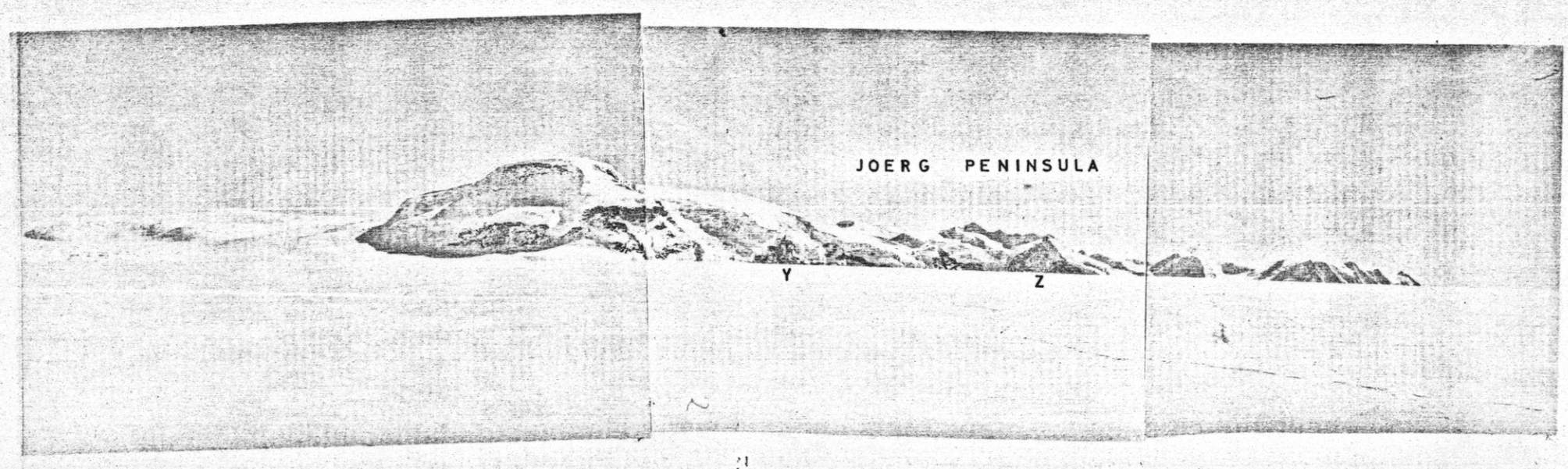


Panorama of the southern side of Solberg Inlet. (See page iii for reference).

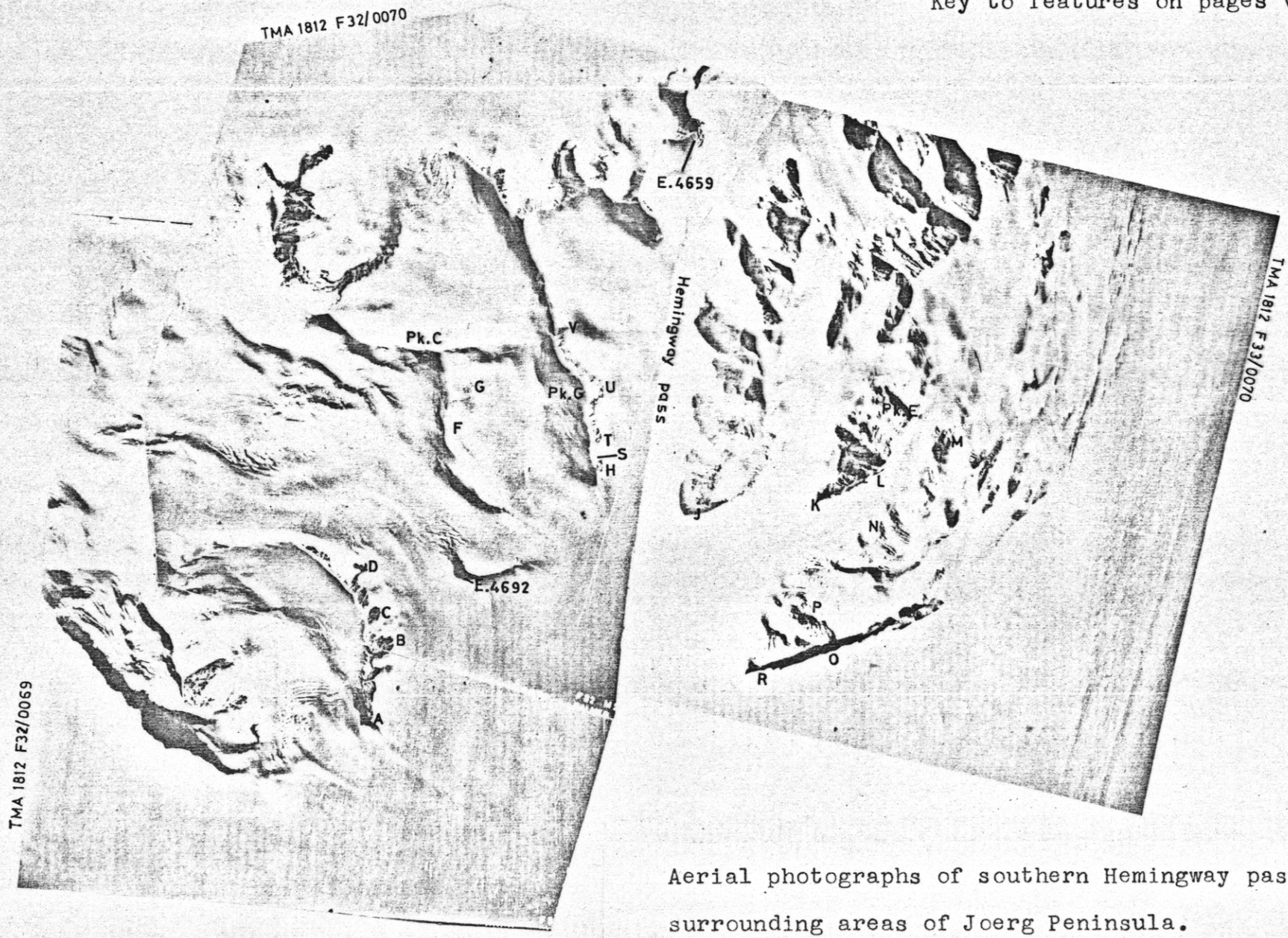




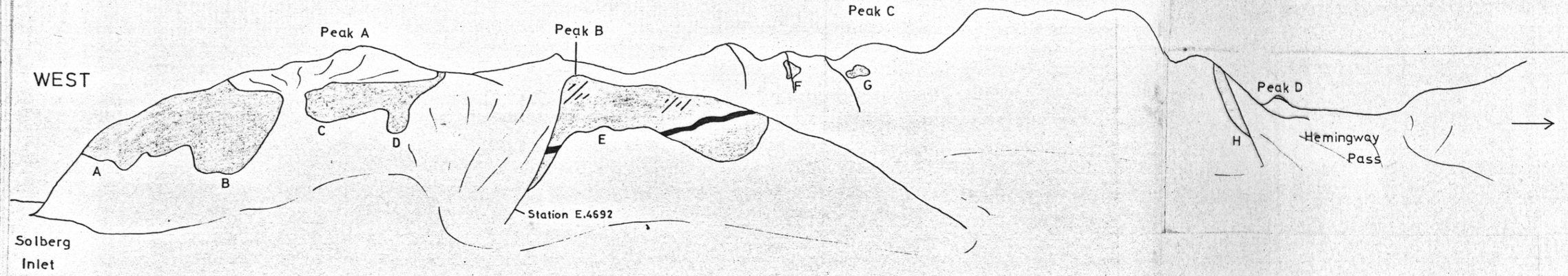
Panorama of the west and northern sides of Solberg Inlet. (See page x for reference).



Key to features on pages viii and ix.



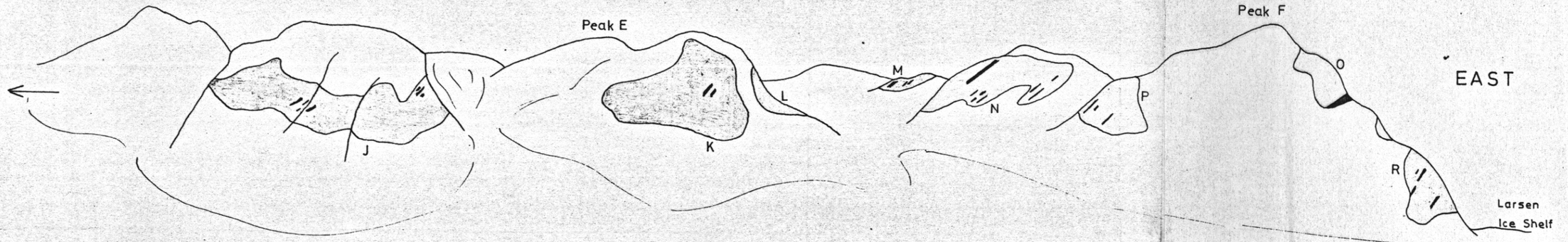
Aerial photographs of southern Hemingway pass and surrounding areas of Joerg Peninsula.

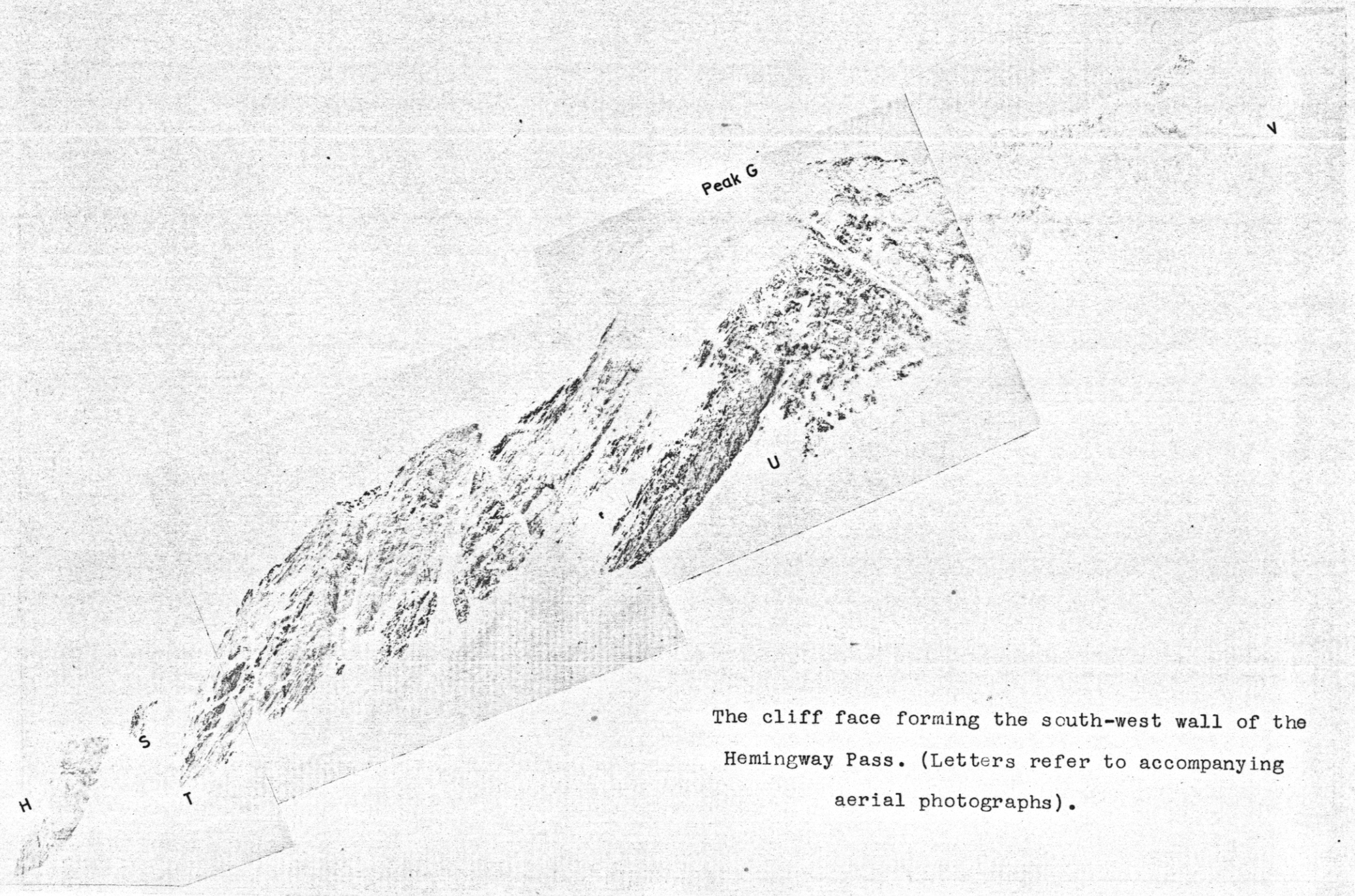


Brown to red rock with numerous black rafts.

Sketch of the area surrounding the southern entrance to Hemingway Pass.
(Letters refer to accompanying aerial photographs).

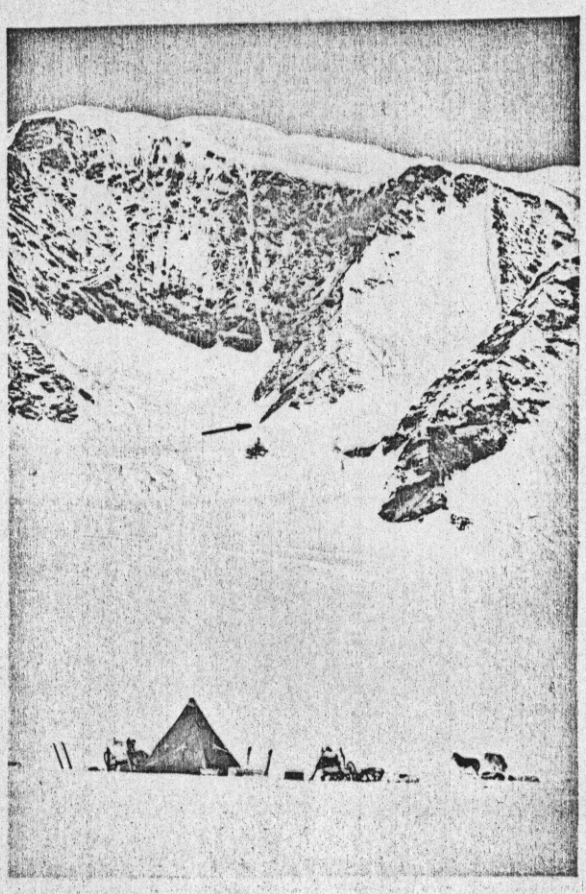
The most conspicuous of the black rafts and 'sills'.





The cliff face forming the south-west wall of the Hemingway Pass. (Letters refer to accompanying aerial photographs).

Aerial photograph of west and north-west Solberg Inlet, and key to features on page vi.



Station E.4696, south-west Solberg Inlet.