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6. Geology of a coastal section between Tomahawk and Boobyalla.

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During 1970 the Tomahawk-Mt Cameron area was mapped by the authors as part of a compilation of a 1:250,000 scale geological map of the Blue Tier Batholith. Bedrock exposure in the northern part of this area is sporadic, because of extensive cover by Quaternary sands (fig. 3). However, about 4 km ESE of Tomahawk township a coastal exposure extends almost continuously east for about 3 km. It was decided to map this exposure in more detail in an attempt to relate it to the regional setting, and to determine whether it provides answers to problems encountered inland in areas of poor exposure.

It was apparent from a preliminary examination that faults are common and important features of the coastal exposure. It was therefore decided to document the main features of these faults and their effect on surrounding rocks, so that their presence can be suspected, if not proved, in areas of poor exposure away from the coast.

REGIONAL SETTING

The coastal section is transverse to three rock units which can be followed to the south for about 7 km (fig. 3). South of this point the central unit is absent and contacts are complicated by the biotite-muscovite granite and biotite granite intrusions in the vicinity of Mt Cameron. The relationship between the three rock units in the northern part of the area is uncertain on a regional scale because of poor exposure.

The most westerly unit is a porphyritic biotite granite/adamellite, of moderately uniform composition, consisting of K-feldspar phenocrysts in a fine- to medium-grained groundmass of quartz, oligoclase, microcline and biotite. This unit is well exposed south of the main Bridport-Gladstone road, but is very poorly exposed north of this road towards the coast. It forms the northerly extension of the Poimena Pluton of Gee and Groves (1971).

The central unit is a foliated, fine- to medium-grained, biotite-muscovite granite/adamellite. It contains approximately equal proportions of biotite and muscovite. The western contact of this granite with the porphyritic biotite granite/adamellite trends generally NNW, and the weak foliation defined by alignment of micas trends NNW to N and is almost vertical. This intrusion has been tentatively called the Sheoak Hill Pluton, the main outcrop area being in the vicinity of Sheoak Hill (fig. 3).

The most easterly unit is a belt of slightly metamorphosed sandstone, siltstone and shale of the Mathinna Beds. The contact between the Sheoak Hill Pluton and these rocks is subparallel to the western contact of the Sheoak Hill Pluton (*i.e.* it trends generally NNW). Exposure of the Mathinna Beds is usually poor, but where outcrops are present the bedding trends NNW to NNE and dips both steeply E and W, *i.e.* it is consistent with the normal structural trend of the Mathinna Beds in this part of north-east Tasmania.

Where the main Bridport-Gladstone road crosses the Boobyalla River valley there are discontinuous exposures of foliated to massive biotite granodiorite which intrude the Mathinna Beds, and occupy areas of low relief. A complex zone of discontinuous bulbous-shaped intrusions of the biotite granodiorite into the Mathinna Beds lies about 500 m north-west of the confluence of the Boobyalla and the Little Boobyalla Rivers. Field relationships suggest that in this area erosion has partly uncovered the roof zone of a granodiorite intrusion into Mathinna Beds, with small upward protrusions of biotite granodiorite extending into the roof zone of contact metamorphosed sedimentary rocks. The dips of the Mathinna Beds are more gentle here than in the area to the north of the road where granodiorite is not exposed, and suggests re-orientation of pre-existing structures (generally regional folds with axes plunging shallowly NNW or SSE) during forcible intrusion of granodiorite near the contact (cf. Gee and Groves, 1971).

GEOLOGY OF THE COASTAL SECTION

Introduction

The coastal section has been subdivided into eleven units (labelled A-K, fig. 4). These are briefly described in sequence from east to west, the relationships between them summarised, and the relationship of the coastal section to the regional geology discussed. The original description of the section was made by Groves and Jennings (1970), and selected rock specimens were described by Everard (1970), and have also been examined by D.I. Groves.

Unit A

Unit A consists of slightly contact metamorphosed sandstones and siltstones of the Mathinna Beds that are exposed between high and low water levels. The sedimentary rocks (*e.g.* 70-128B) consist predominantly of partly recrystallized angular quartz grains with subordinate severely sericitized feldspar grains and minor clastic? muscovite in a matrix of recrystallized biotite, sericite and quartz. Some incipient quartz veins appear to have formed during recrystallization.

Bedding is well defined and generally trends NNW with steep dips to the west. An axial surface foliation (cleavage) is developed in places. It strikes just west of the bedding and dips steeper to the west than bedding in the same exposure. Some folds are present at the eastern end of the exposure. They have steep axial surfaces and small dihedral angles. Adjacent limbs converge sharply along a surface which appears to be a fracture or a small fault. The rocks are strongly jointed with shallowly east-dipping joints varying in trend from NNW to NE. Small ENE- to ESE-trending sinistral faults with limited movement are common and often occur in groups.

Small leucocratic granite bodies occur particularly towards the western contact. They are poorly exposed but vary in shape from elongate pod-like bodies to small dyke-like bodies trending N-S. These intrusions cut across the bedding of the Mathinna Beds at an acute angle, and appear to have had a negligible effect on the structure of these rocks in the contact area. Small dykes commonly occur in well-spaced joints, and quartz veins are also associated with the granite intrusions. The granites (*e.g.* 70-128A) are medium-grained, granular rocks consisting of altered microcline, oligoclase, quartz, muscovite and biotite. Some fine-grained quartz and biotite occur interstitially. The occurrence of bent and kinked cleavages in muscovite and strongly undulose extinction in quartz indicate that the rock has been deformed, and the occurrence of polygonal quartz aggregates suggests partial annealing. A feature of the rocks is the occurrence of coarse grains of yellow-green tourmaline.

Unit B

Unit B represents a zone of intense recrystallization of sandstone and siltstone of the Mathinna Beds. Bedding in the rocks is diffuse, and difficult to distinguish from the tectonic foliation. In places original bedding

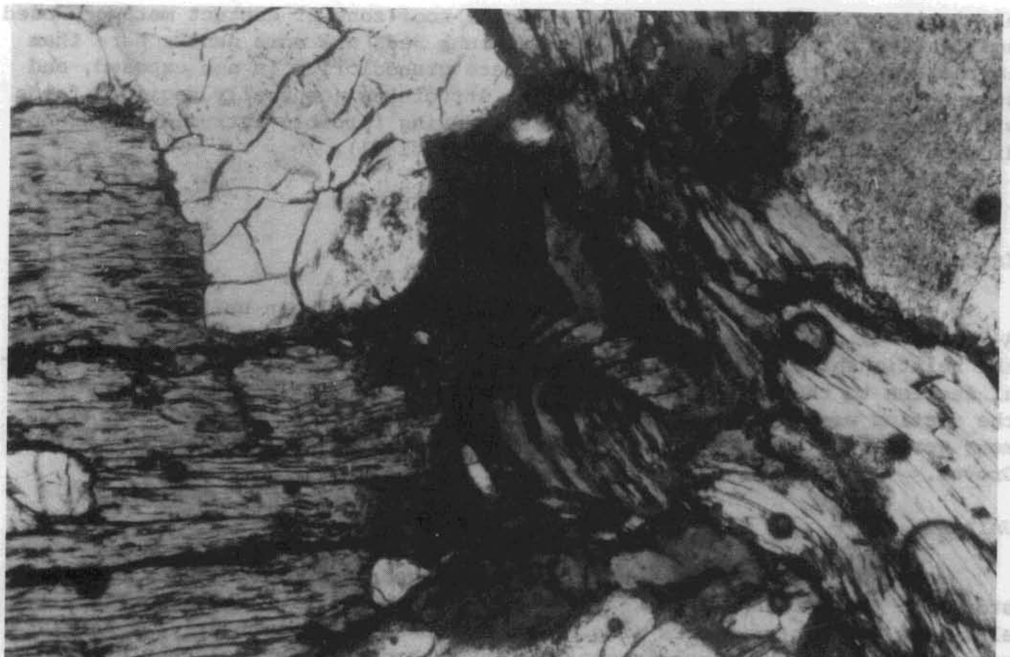

Plate 1. *Kinked and bent biotite crystals; foliated biotite granodiorite from Unit C. Specimen 70-129A, plane polarised light, field of view 0.9 x 1.4 mm.*

Plate 2. *'Shred' zones almost perpendicular to cataclastic foliation in biotite granodiorite from Unit I; inset shows details of structure.*

is recognisable and is subparallel to bedding in Unit A.

Towards the western boundary of Unit B the hornfelses contain irregular pods and anastomosing veinlets of granodiorite and minute quartz stringers. The contact with the granodiorite of Unit C is relatively sharp on a macroscopic scale and is sub-parallel to the bedding in the hornfelsed Mathinna Beds. On a microscopic scale (*e.g.* 70-128D) the boundary is transitional over about 10 mm with large ragged, sericitized plagioclase and K-feldspar crystals in a groundmass of polygonal quartz grains intergrown with muscovite and biotite, which typifies the hornfels a few millimetres from the contact. The plagioclase of the granodiorite and contact zone is strongly deformed with bent and kinked twin planes. Tourmaline is present in the contact zone.

Unit C

Unit C consists predominantly of foliated biotite granodiorite (*e.g.* 70-129A) which is a medium- to coarse-grained rock consisting of large grains of andesine, quartz and biotite with subordinate K-feldspar and interstitial quartz, biotite and chlorite. Severe deformation of the rock is demonstrated by bent, kinked and microfractured twins in plagioclase, and cleavage in biotite (Plate 1), and undulose extinction in quartz and K-feldspar. Annealing is indicated by polygonal quartz aggregates in interstitial material, and subgrains in larger quartz grains. Elongation of biotite and feldspar and streaking out of quartz aggregates define a generally N foliation.

Inclusions in granodiorite are abundant near both margins, especially at the eastern contact. The inclusions are of two types, far-travelled rounded inclusions of basic composition and angular fragments of hornfelsed country rocks (*e.g.* 70-129B). The adjacent granodiorite commonly contains scattered K-feldspar phenocrysts. The rounded, basic inclusions commonly are aggregated to form 'pudding-stone' accumulations (Plate 10), and both types of inclusion define a weak foliation striking about N and almost vertical. This is parallel to the foliation of the granodiorite. The granodiorite. The granodiorite also enclosed large rafts of hornfelsed Mathinna Beds, which are essentially disorientated bedding slabs.

Within the granodiorite there are wispy, discontinuous to anastomosing, biotite-rich zones that have been termed 'cob-web' or 'shred' structures dependent on their degree of parallelism. They have an irregular orientation, generally trending NNW and cutting across the foliation of the granodiorite and apparently post-dating its formation (Plate 2). In thin section (*e.g.* 70-129C, D) the 'cob-web' structures are defined by discontinuous, fine-grained, felted aggregates of biotite forming irregular veinlets between deformed plagioclase, quartz and biotite crystals (Plate 3). These felted biotite veinlets have replaced the granodiorite on all scales, even occurring along hairline fractures in deformed plagioclase crystals. They appear to be the result of hydrothermal alteration along numerous microfractures that were formed subsequently to the foliation of the granodiorite. Quartz veins, up to one metre wide, fill fractures approximately perpendicular to the foliation of the granodiorite. These may have been tension fractures related to the same deformational episode.

Unit D

Unit D consists essentially of plastically deformed hornfelsed Mathinna Beds, enclosed between biotite granodiorite to the east and west. The hornfelsed sedimentary rocks have flowed during deformation, and in places consist of lensoid-shaped bodies of different composition and grain size in juxtaposition.

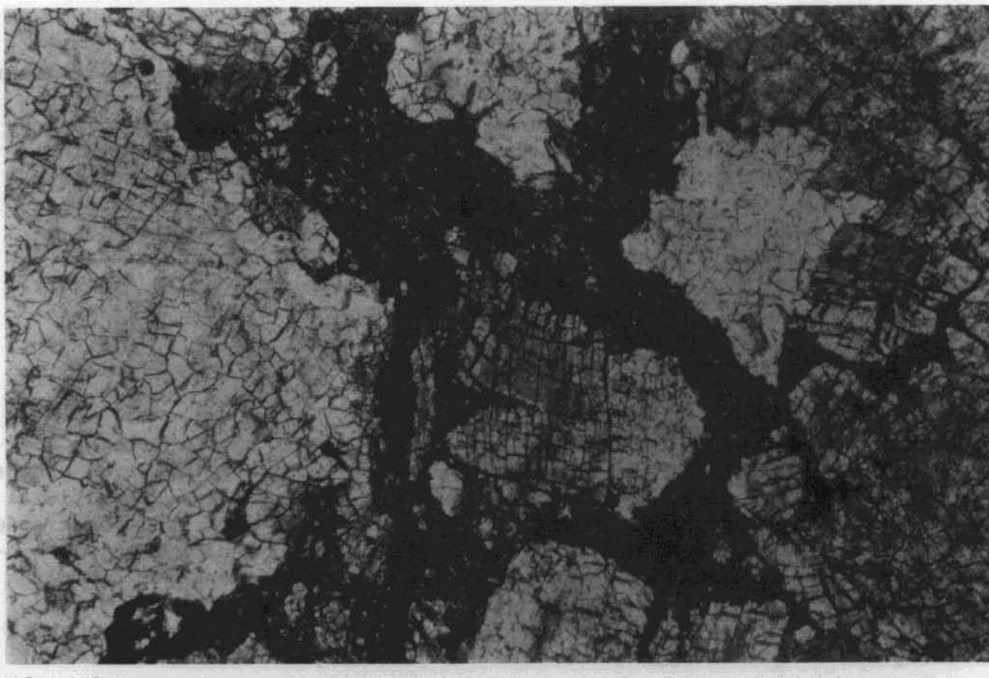

Plate 3. *Partly recrystallised 'shred' zones in foliated biotite granodiorite from Unit C. Specimen 70-129C, plane polarised light, field of view 2.25 x 3.5 mm.*

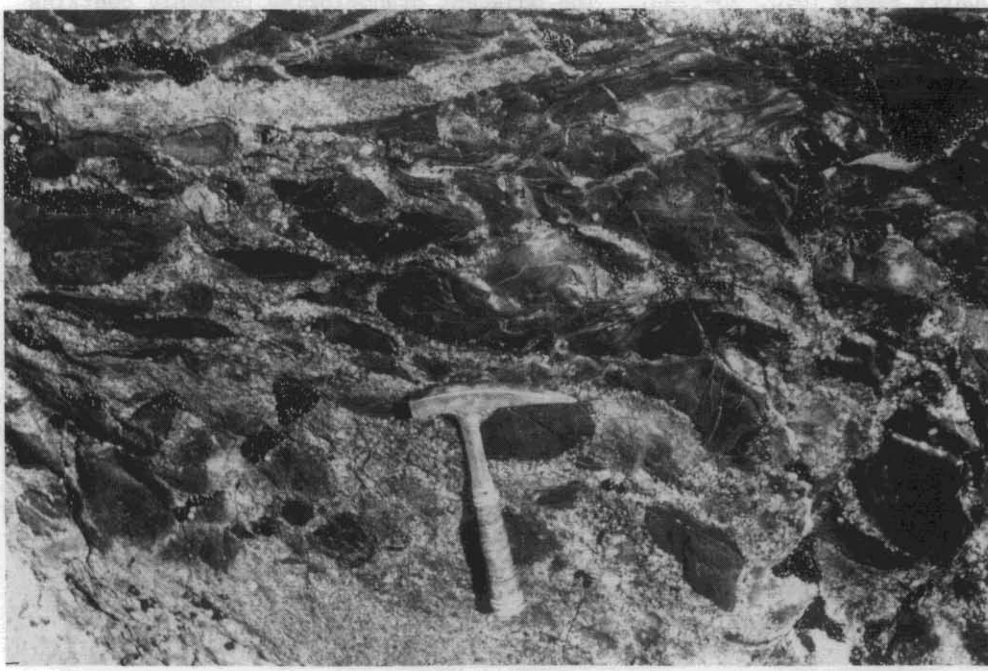

Plate 4. *Flattened, aligned inclusions in foliated biotite granodiorite near contact with Mathinna Beds of Unit E.*

Irregular shaped lobes of foliated granodiorite have been forcibly emplaced into the country rocks, and have resulted in plastic deformation adjacent to their margins. Deformed and partly recrystallized leucocratic granite (*e.g.* 70-129E), and foliated biotite granodiorite dykes cut the country rocks and trend approximately N-S and dip steeply east. The leucocratic granite consists of large bent crystals of microperthite, and deformed albite-oligoclase with recrystallized quartz occurring as polygonal aggregates. The rock contains no biotite. The largest granodiorite dyke, almost 3 m wide, contains numerous inclusions of variable lithology, including marginal 'pudding-stone' types.

Groups of small vertical, subparallel sinistral faults are present, trending NW-SE.

Unit E

The eastern part of Unit E consists of strongly foliated biotite granodiorite, the foliation being vertical and trending N. The granodiorite has structures similar to those of Unit C, *i.e.* 'cob-web' structures, elongate inclusions, and 'pudding-stones' (Plate 4).

The western part of Unit E is similar to the structure of Unit D with lobate foliated biotite granodiorite intrusions into deformed, hornfelsed Mathinna Beds. Some contacts are fracture surfaces, possibly related to faulting subsequent or contemporaneous with intrusion. Subparallel 'cob-web' structures (shred zones) are particularly abundant, adjacent to faulted contacts. They trend generally N-S, the direction of elongation of inclusions, and alignment of their component minerals.

Unit F

Unit F is an extensive exposure of biotite-hornblende granodiorite containing small, but abundant, inclusions. The rock (*e.g.* 70-129F) is a deformed, and partly recrystallized granodiorite similar to that of Units C and E but contains large tabular, slightly bent, green-brown hornblende crystals.

The foliation at the eastern margin trends 120°, and is vertical and subparallel to a foliation defined by alignment of inclusions. The foliation at the western margin trends 82°, and the inclusions define a foliation trending 97°. 'Shred zones' are abundant and cut the foliation at a high angle. They are most commonly disposed vertically in a general N-S direction and their trend ranges between 300° and 30°. They are particularly abundant adjacent to the western fault contact (*e.g.* 70-130A) where they cut an almost completely disaggregated granodiorite (Plate 6). A small N-S trending, vertical, leucocratic dyke (*e.g.* 70-129G) cuts the granodiorite. It consists of normally zoned oligoclase-albite, microperthite, quartz and minor biotite. The rock is deformed, and quartz grains are partly recrystallized although there is no obvious foliation.

Small, vertical N-S trending, sinistral faults are also present.

Unit G

Unit G comprises a foliated, fine-grained, biotite-muscovite granite, part of the Sheoak Hill Pluton. In the coastal exposure it is faulted against foliated biotite-hornblende granodiorite along its eastern margin, and against a transition zone into biotite-hornblende granodiorite along its western margin.

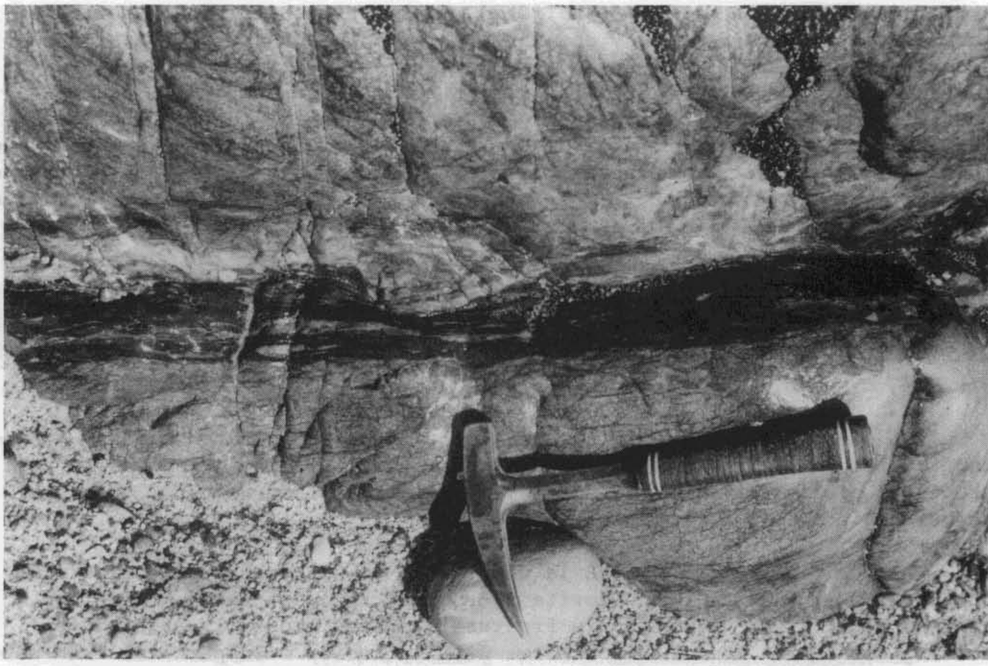

Plate 5. *Mylonite in fault zone on contact between Units F and G.*

Plate 6. *Well defined 'shred' zones cutting deformed plagioclase and recrystallised quartz aggregates in biotite-hornblende granodiorite from Unit F at the contact with Unit G. Specimen 70-130A, crossed nicols, field of view 2.7 x 4.3 mm.*

The eastern fault zone varies from 1 to 2 m in width, and trends 336° and dips 80°E. Inclusions are extremely common in the granodiorite adjacent to the contact, but are relatively rare in the biotite-muscovite granite where they are equidimensional and randomly disposed. The fault zone consists from east to west of over 700 mm of strongly sheared granodiorite merging into a 150 mm wide mylonite zone (Plate 5). The sheared granodiorite (*e.g.* 70-130A) has a strong foliation defined by subparallel zones of fine-grained biotite and fragmented amphibole between fractured, disorientated and bent crystals of feldspar, hornblende and biotite. Quartz again occurs as elongate aggregates of recrystallized grains. The mylonite (*e.g.* 70-130B) is a strongly laminated rock consisting of bands of fine-grained polygonal quartz and feldspar grains with irregular masses of felted sericite. Minor fold hinges are present, but no coherent folds are preserved. 'Cob-web' structures extend into the granitic rocks for about one metre on either side of the fault contact. The faulting and formation of the 'cob-web' structures may be penecontemporaneous as some of the latter structures appear to merge with the fault zone, and at least one 'shred zone', trending 27° appears to cut the fault zone.

About 6 m west of the fault zone is a similar zone about 700 mm wide that trends 12° and dips 80°E. Strongly developed fractures traverse the biotite-muscovite granite adjacent to the fault zones. They trend 357° and are vertical.

The granite in the vicinity of the fault zones is severely deformed and brecciated. In thin section (*e.g.* 70-130C) the rock comprises deformed oligoclase crystals, deformed and sericitized microcline, and irregular patches of recrystallized quartz which are cut by numerous, thin anastomosing veinlets of fine-grained chlorite and microcrystalline quartz. Some larger veinlets consist of fine-grained recrystallized quartz with the margins defined by the accumulation of chlorite. The rock has been completely disaggregated by small anastomosing fractures along which quartz grains were fretted or crushed. Hydrothermal activity appears to have been concentrated along these fractures, resulting in the formation of chlorite. The rocks have subsequently partly recrystallized.

The main mass of biotite-muscovite granite has a persistent poorly defined, E-W trending, foliation (92°-112°, vertical), although a NE-trending foliation is evident in some exposures towards the centre of the body. The granite (*e.g.* 70-130D) is a slightly deformed, strongly recrystallized rock consisting of microcline, oligoclase, irregular patches of polygonal quartz grains and scattered clusters of ragged muscovite and biotite. Numerous N-S trending fracture zones are present, and appear along the coastline as large gulches. The granite adjacent to these fracture zones (*e.g.* 70-130F) is slightly more deformed than normal and contains irregular areas of fine-grained quartz or microquartz between patches of granite of more normal texture. This may represent silicification of the granite, crushing of quartz, followed by partial recrystallization, or a combination of both processes.

'Cob-web' structures are common in the granite throughout the section, and increase in abundance towards the western fault contact, where the rock is increasingly fractured. The fractures are extremely variable in orientation towards the contact and the granite is increasingly silicified, the igneous texture is less recognizable and no foliation is apparent. Close to the fault zone strong fractures occur parallel to the fault and weaker fractures occur perpendicular to it. The granite contains zones up to one metre wide of a spotted rock (*e.g.* 70-131A) that are elongate parallel to the fault zone. These rocks are completely recrystallized granites consisting of sericitized feldspar, recrystallized quartz, muscovite and chlorite.

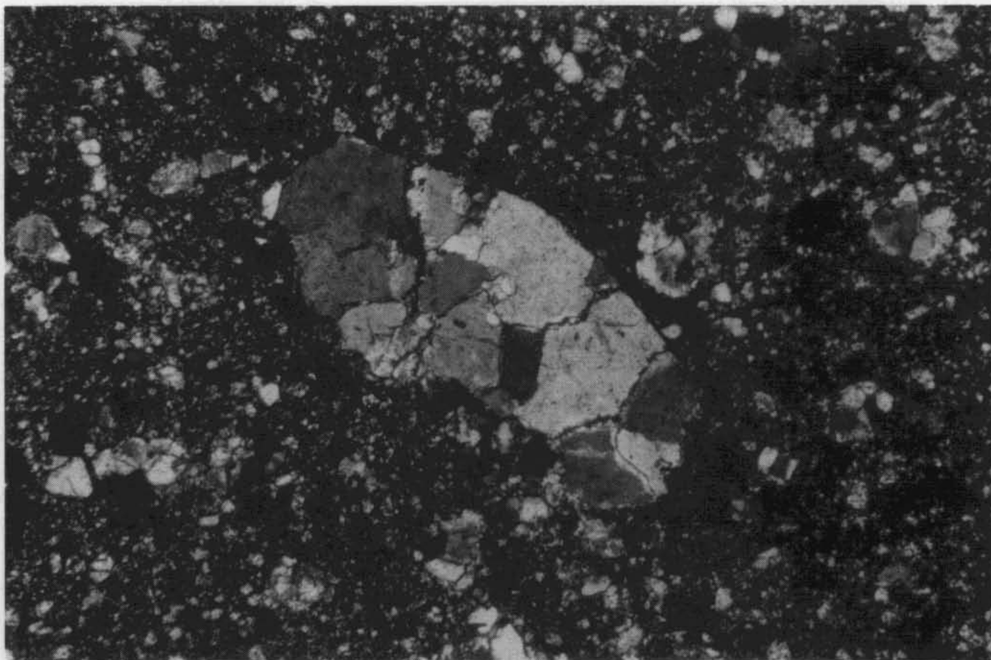

Plate 7. *Crushed and silicified granodiorite? from contact of Units G and H. Polygonal quartz aggregates are possibly pseudomorphs after feldspar. Specimen 70-131B, crossed nicols, field of view 2.35 x 3.75 mm.*

Plate 8. *Flattened inclusions aligned subparallel to cataclastic foliation in biotite-hornblende granodiorite from Unit I.*

Macroscopically the rocks are characterized by dark spots recognised in thin section as accumulations of chlorite, (apparently replacing biotite) in patches of quartz and sericite. The rock appears to have suffered hydrothermal alteration and recrystallization.

Unit H

Unit H represents the transition zone between the faulted boundary of the biotite-muscovite granite to the east and strongly foliated biotite-hornblende granodiorite to the west. The major fault direction is about 32°, and rocks within the fault zone are cut by closely-spaced fractures on this trend. Spotted rocks similar to 70-131A are common, and within the fault zone the main rock type is a fine-grained, dark grey rock containing white rounded inclusions up to 10 mm in diameter. In thin section (*e.g.* 70-131B) the rock consists of a fine-grained mosaic of quartz and biotite containing scattered larger grains of quartz or polygonal quartz aggregates which, from their external shape, appear to pseudomorph feldspar (Plate 7). The rock may represent a crushed and silicified granitic rock, by analogy with material in other fault zones in the section.

The fault zone is traversed by irregular acid dykes ranging from aplitic to pegmatitic in texture. In places the dykes are cut by the closely spaced fractures in the fault zone, and also by small, vertical, dextral faults trending 27°, but commonly in the same exposure they have also intruded along these fractures. These relationships indicate concomitant fracturing and intrusion. Some 2 m west of the main fault zone massive to irregular anastomosing quartz veins, up to one metre wide, occur throughout the siliceous rocks of the fault zone producing a coarse breccia-like structure in this area.

About 10 m west of the fault zone the transition rock has a recognisable vertical foliation trending 26°. This rock (*e.g.* 70-131C) is clearly a strongly deformed and partially recrystallized granitic rock. It consists of broken and bent crystals of altered microcline and oligoclase-andesine and irregular patches of recrystallized quartz, which are all cut by anastomosing veinlets of felted biotite and muscovite. Radiating masses of fine-grained, almost colourless amphibole occur throughout the rock and are superimposed on the deformational fabric. These, together with polygonal quartz aggregates and felted masses of mica within fracture zones suggest recrystallization subsequent to deformation. The deformed granitic rocks are intruded by small dilational acid granite and pegmatite dykes which are flat-lying in places.

In the centre of Unit H the foliation in the strongly deformed granitic rock trends 12° and is vertical. Individual 'shred zones' are locally discernible, but in general they are so closely spaced that they form a penetrative structure in the rock. The rock type in this area is a strongly deformed and partly recrystallized granitic rock (*e.g.* 70-131D). The main fabric of the rock is a strong foliation defined by segregation and elongation of quartz, feldspar and biotite. Quartz occurs as polygonal aggregates, whereas microcline and oligoclase-andesine crystals are bent, fractured and sericitized. Biotite occurs as felted masses associated with fine-grained olive-green amphibole in elongate lens-like zones parallel to the foliation. Some quartz and feldspar aggregates have an augen-like appearance and the rock in places has a gneissic structure.

About 8 m east of the western boundary of Unit H the rock is distinctly coarser grained and its original igneous texture is discernible macroscopically (*e.g.* 70-131E). The rock is a strongly foliated hornblende-rich granodiorite containing inclusions, flattened in the foliation, which is kinked

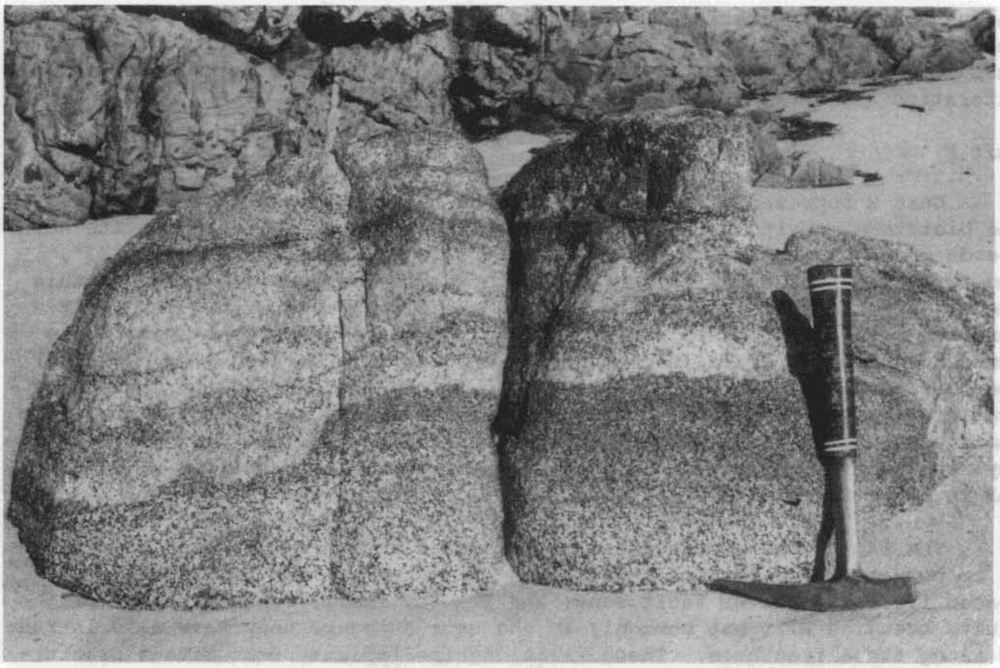

Plate 9. *Layering defined by biotite-rich and biotite-poor bands in porphyritic biotite granite/adamellite intrusion into Mathinna Beds, Unit J.*

Plate 10. *'Pudding-stone' accumulations of inclusions in unfoliated porphyritic biotite granite/adamellite (cf Plate 4).*

in places. 'Cob-web' or 'shred' zones are present, but generally cut across the foliation defined by mineralogical banding and crystal alignment. The foliation trends 0° and is vertical close to the contact with Unit I.

Unit I

The boundary between Unit H and Unit I is gradational. It was considered in the field as the approximate division between gneissic granodiorite (Unit H), and foliated granodiorite (Unit I). The latter (*e.g.* 70-132A) is typically a coarse-grained foliated rock consisting of slightly bent and fractured, zoned oligoclase-andesine and microcline, irregular areas of polygonal quartz aggregates and approximately equal proportions of hornblende and biotite, partly altered to chlorite.

The foliation throughout the unit trends between 335° and 345° and dips 80°-85°W. Elongate inclusions define a sub-parallel foliation, with individual inclusions commonly having a length:width ratio of 10:1 on the horizontal surface of the exposure (Plate 8). In places these xenoliths form distinct accumulations, which themselves are subparallel to the foliation of the granodiorite. 'Shred zones' are common throughout the unit, trending 30° and cutting the granodiorite foliation at a high angle.

Towards the western margin of Unit I 'shred zones' display a small component of sinistral movement which is demonstrated near the contact where they cut a flat-lying leucocratic granite dyke.

Unit J

The contact between biotite-hornblende granodiorite and hornfelsed Mathinna Beds of Unit J is not exposed in the beach section. Unit J itself consists predominantly of hornfelsed Mathinna Beds which have been intruded by irregular discordant bodies of porphyritic biotite granite/adamellite.

The indurated Mathinna Beds are predominantly khaki to grey, medium-grained hornfelses. They appear originally to have been siltstone and sandstone with subordinate shale. A thin section of a typical mottled hornfels (70-132B) shows fine-grained polygonal quartz aggregates and elongate grains of pale green to colourless amphibole and brown biotite. The rock has a diffuse banding defined by alternate irregular zones rich in biotite and amphibole. This also produces the mottled texture. Diffuse bedding in this zone trends 345° and dips 80°E, and small quartz stringers are subparallel to the bedding in finer grained bands.

Several irregular masses of porphyritic biotite granite/adamellite have intruded the hornfels near the contact with Unit I. The largest of these bodies occurs towards the back of the beach about 30 m west of the contact with Unit I. The granite/adamellite body has a small cupola-like form with a partly eroded roof of hornfelsed sedimentary rock. The bedding in the surrounding hornfels appears undisturbed by the granite intrusion and trends 345° and dips 80°E.

The granite intrusion shows unusual structures which have not been examined in detail. An obvious feature of the intrusion is the mineralogical layering defined by biotite-rich and biotite-poor bands (Plate 9). The orientation of the layering is variable but it is generally flat-lying and subparallel to the roof where this is exposed. Xenoliths of the hornfelses are abundant and locally form 'pudding-stone' accumulations in the roof zone (Plate 10). Tracts rich in xenoliths are subparallel to the mineralogical banding in places, but are also commonly randomly distributed. Some phenocrysts define a flow foliation parallel to the banding, particularly where they are close-packed.

The remainder of Unit J to the west of this intrusion consists of hornfelsed Mathinna Beds which strike NNW and dip 50°-60°E. Small irregular lobes and dykes of porphyritic biotite granite/adamellite occur but outcrops are so limited that their exact nature and trend is not clear.

Unit K

Unit K comprises an easterly mass of light grey, porphyritic microgranite, and a westerly mass of porphyritic biotite granite/adamellite typical of the Poimena Pluton. The contact of the hornfelsed Mathinna Beds and the porphyritic microgranite is covered with sand, but the lack of deformation in either rock suggests a normal igneous contact.

The porphyritic microgranite (*e.g.* 70-132C) consists of scattered cloudy orthoclase, zoned oligoclase, quartz, biotite and muscovite. It contains only rare xenoliths of hornfels. It appears to be intruded by small (*c.* 10 m x 20 m) bodies of porphyritic biotite granite/adamellite which locally contain 'pudding-stone' accumulations, and K-feldspar-rich zones.

The western part of Unit K comprises porphyritic biotite granite/adamellite which contains abundant dioritic inclusions which may reach one metre in diameter. There is no evidence of deformational fabrics or fault zones in these exposures. At the extreme western end of the exposure there are several leucocratic granite dykes which trend 115°-120° and dip 50°-60°S.

SUMMARY AND CONCLUSIONS

Units A to F

The coastal exposure of Units A to F confirms the nature of the most easterly regional rock unit in the area of interest deduced from regional studies. It is a belt of slightly to completely recrystallized sedimentary rocks of the Mathinna Beds, forming, at least in part, the roof zone of a granodiorite intrusion.

The emplacement of granodiorite has not caused disruption of the pre-intrusion structure of the Mathinna Beds on a regional scale, although locally there is evidence for forcible intrusion and some plastic deformation of hornfelses adjacent to the intrusive contact. These features, together with the foliated fabric of the granodiorite and foliation defined by flattening of inclusions, are similar to features of granodiorite contacts elsewhere in the Blue Tier Batholith. Gee and Groves (1971) have interpreted such marginal cataclastic structures as due to lateral pressure exerted by the magma during upwelling in the centre of the pluton and lateral spreading against the walls. Due to the limited exposure of the coastal section the origin of the cataclastic foliation is not certain, although the subsequent recrystallization of deformed quartz aggregates, suggests that it was formed during the general intrusive event when relatively high temperatures were maintained, and not subsequent to it.

Superimposed on the granodiorite foliation in the coastal section is a micro-brecciation, and hydrothermal alteration along resulting fractures, which is defined by 'cob-web' or 'shred' zones. These appear to be related to faulting, which resulted in shearing of the granodiorite and adjacent biotite-muscovite granite and the formation of a thin mylonite zone. Rocks in the fault zone are partly recrystallized, and biotite in micro-fractures in the rocks ('cob-web' zones) also appears to be recrystallized.

Unit G

Unit G is the northernmost exposed section of biotite-muscovite granite forming the Sheoak Hill Pluton. It is fault-bounded to the east and west. A weakly defined cataclastic foliation is overprinted by a micro-brecciation and alteration resulting in 'cob-web' structures. The micro-brecciation appears to be related to several fault zones, along which silicification and recrystallization of crushed granite has occurred.

An unusual feature of the coastal section of biotite-muscovite granite is the approximately E-W trend of the foliation in contrast to the approximately NNW-SSE trend inland from the coast. It is possible that the foliation has been reorientated during subsequent faulting, particularly if strike-slip movements have been involved.

Units H and I

Units H and I can only be traced about 300 m inland from the coast, and appear to occur in a south-tapering wedge. The eastern contact is clearly a fault zone, but the nature of the western contact with the Mathinna Beds is unknown. Units I and H are tentatively interpreted as a fault wedge, although it is possible that Unit J may also be part of the wedge, and that the contact between Units I and J may represent the original intrusive content of the biotite-hornblende granodiorite. The intrusion of the Mathinna Beds, but not the granodiorite, by porphyritic biotite granite/adamellite is evidence against the latter.

The most interesting aspect of Units H and I is the progressive deformation and recrystallization of the granodiorite towards the fault contact with the biotite-muscovite granite to the east. This deformation has been imposed on the normal cataclastic foliation of the granodiorite away from the fault zone. The deformational fabric of the granodiorite adjacent to the fault zone, has been partly overprinted by recrystallization, particularly of deformed quartz aggregates and biotite in 'shred' zones. The persistence of recrystallization textures suggests that relatively high temperatures were maintained during and subsequent to faulting.

The most plausible explanation for these features is that faulting occurred penecontemporaneously with intrusion of the foliated granodiorites and biotite-muscovite granites. The fact that no faults of this type have been observed in the coastal exposures of the porphyritic biotite granite/adamellite, which elsewhere in the batholith were intruded subsequently to the granodiorites (Gee and Groves, 1971), is added support for this hypothesis. There is no evidence to indicate whether or not the biotite-hornblende granodiorites of Units H-I and F were connected prior to faulting.

Units J and K

The nature of Unit J is not clear. This section of Mathinna Beds may be part of an original contact zone of the biotite-hornblende granodiorite which has been subsequently intruded by the porphyritic biotite granite/adamellite of Unit K, or may be a remnant of the roof or a roof pendant in Unit K. No hornfelsed sedimentary rocks have been found inland from this coastal exposure.

The greater proportion of Unit K is a porphyritic biotite granite/adamellite similar to that exposed inland and forming the northern extension of the Poimena Pluton. The porphyritic microgranite does not appear to extend for any significant distance inland, and must represent a relatively small intrusion. Such rocks are normally present as intrusions into the Poimena Pluton, but on the coast they appear to be intruded by the porphyritic granite/adamellite although the evidence is not unequivocal.

General

The coastal exposure does not provide any clear indication of the regional relationship between the porphyritic granite/adamellite of the Poimena Pluton, and the foliated biotite-muscovite granite of the Sheoak Hill Pluton. In fact, the coastal exposure provides little definite evidence on the relative age or mode of emplacement of the Sheoak Hill Pluton. If observed faulting is penecontemporaneous with intrusion this pluton may represent a concomitant intrusion with the foliated granodiorites, prior to intrusion of the rocks of the Poimena Pluton.

The coastal section confirms observations by Gee and Groves (1971) that emplacement of granitic rocks in the batholith is generally a passive process, but with marginal deformation and auto-deformation during emplacement of granodiorites. The features attributed to faulting in the coastal exposure do not appear elsewhere in the batholith, although only a regional survey has been made to the present time. The 'cob-web' or 'shred' zones may be the best indicators of possible fault zones such as those of the coastal section, as they are more extensively developed than the fault zones themselves.

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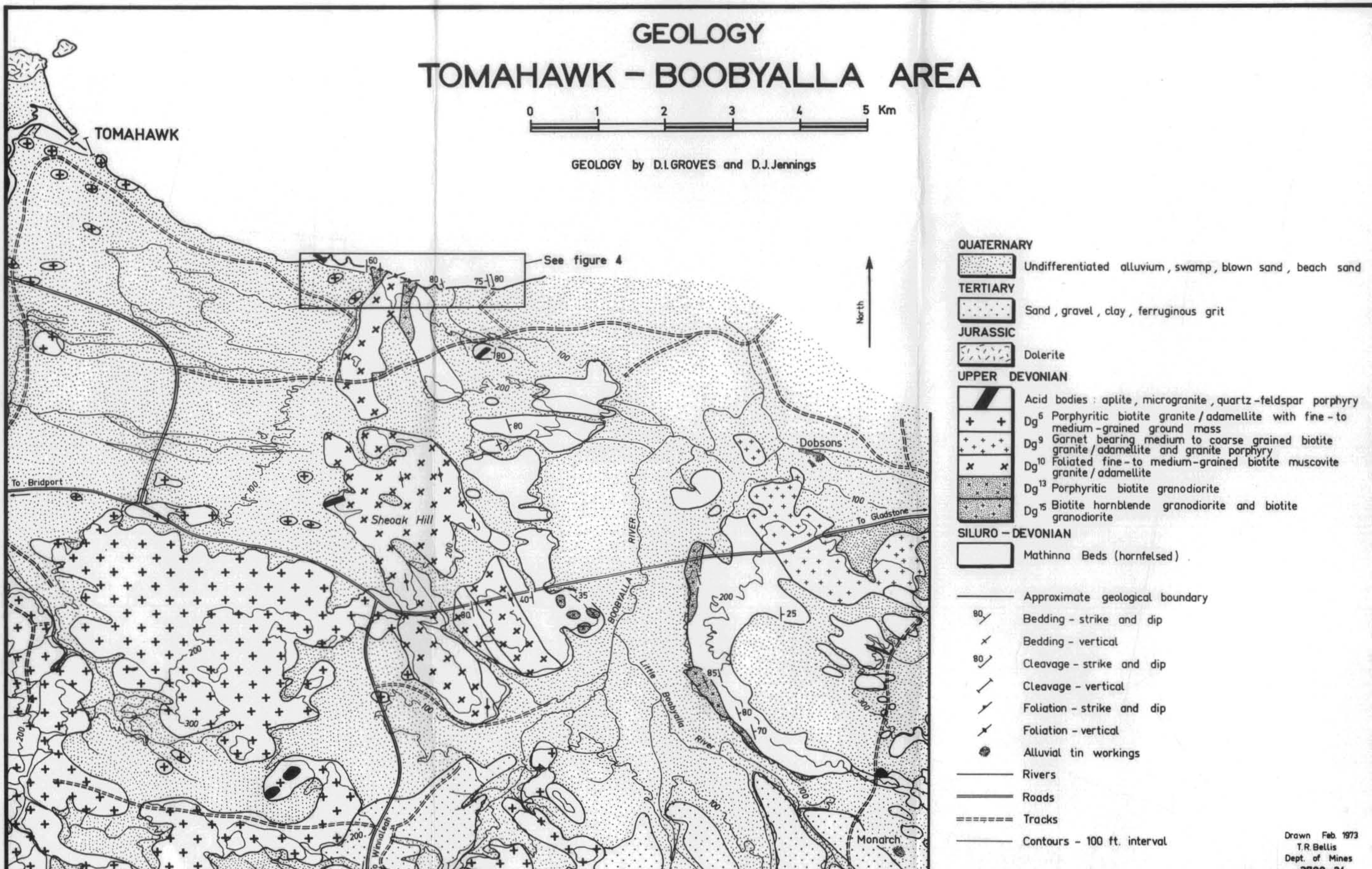

Figure 3.

TR16_22_36

5 cm

FIG 3 TR16_22_36

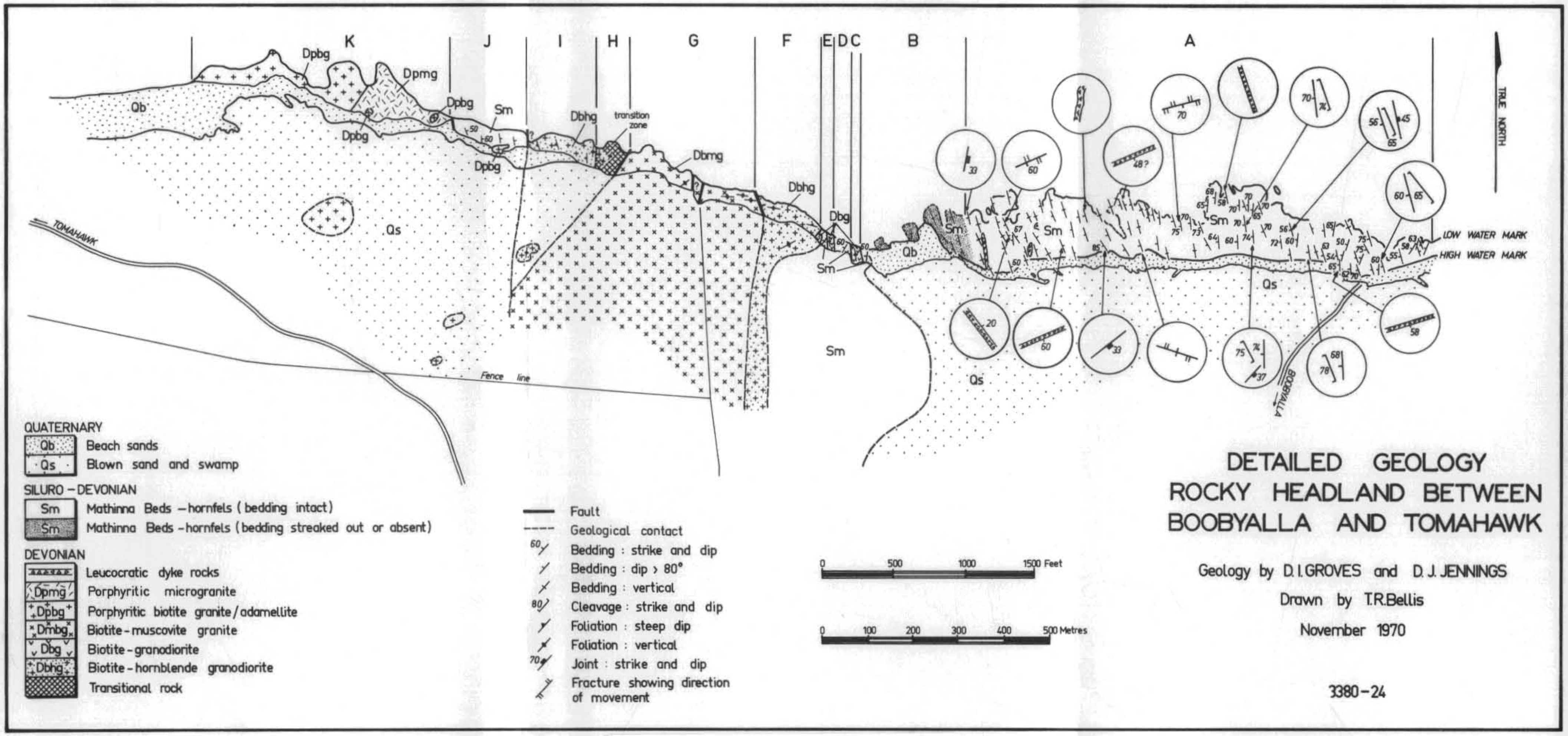

Figure 4.

5 cm

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FIG 4 TR16-22-36