12. GRANITES OF THE COLES BAY AREA

by D. I. Groves

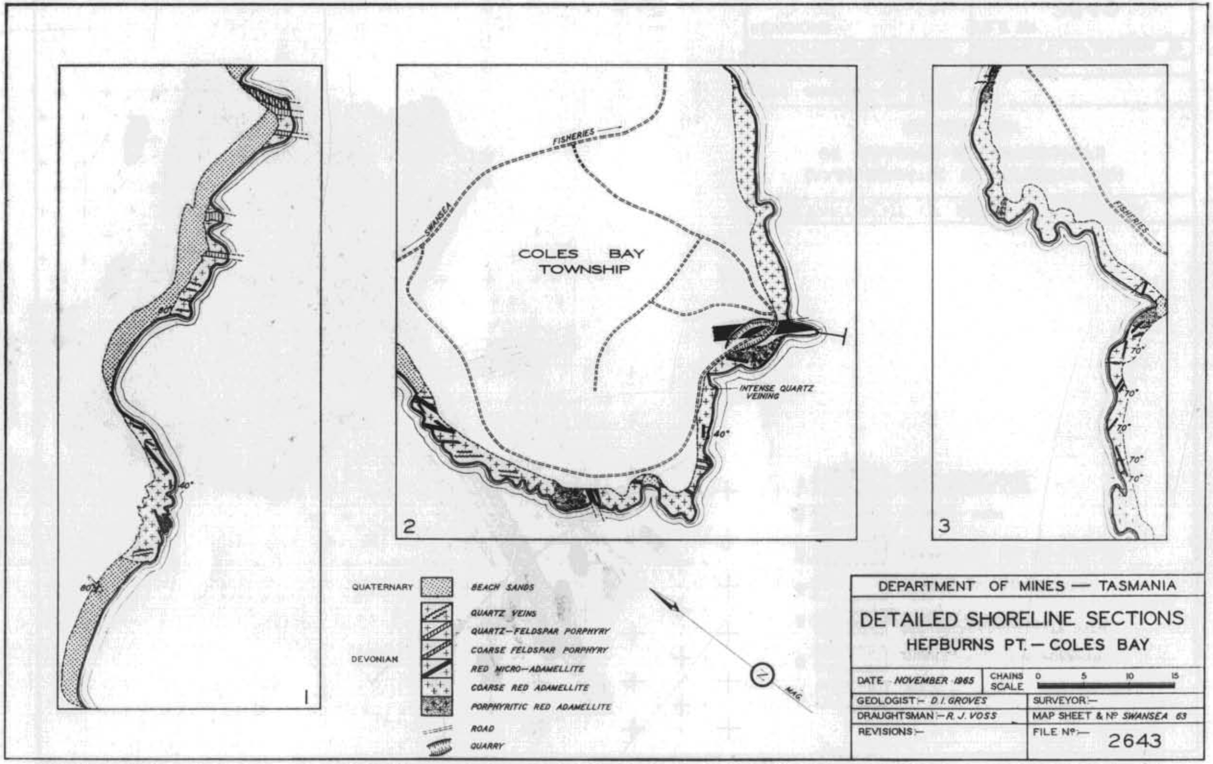
INTRODUCTION

A geological survey of the Coles Bay area of Freycinet Peninsula was undertaken during September 1965 to establish structural and age relationships between the varied granitic rocks which form the bulk of the area. Detailed examination was limited to accessible portions of the coastline, although a general survey was conducted over the whole area. (See Figure 28).

The granites form a rugged topography of low mountains, the Hazards, Mt Freycinet etc., which in places plunge in a series of cliffs directly into the sea. Small bays and coastal flats provide limited access to cliff sections, and access to the mountain areas is provided by a series of well marked tracks.

GEOLOGY

The predominant granitic rock of the Coles Bay area is a coarse subporphyritic red adamellite which encloses smaller areas of strongly porphyritic red adamellite. Limited areas of grey adamellite



FISHERIES
SWANSEA
COLES BAY TOWNSHIP
INTENSE QUARTZ VEINING
40°
60°
70°
2
3
1
QUATERNARY
BEACH SANDS
DEVONIAN
QUARTZ VEINS
QUARTZ-FELDSPAR PORPHYRY
COARSE FELDSPAR PORPHYRY
RED MICRO-ADAMELLITE
COARSE RED ADAMELLITE
PORPHYRITIC RED ADAMELLITE
ROAD
QUARRY
MAG.
DEPARTMENT OF MINES — TASMANIA
DETAILED SHORELINE SECTIONS
HEPBURNS PT. — COLES BAY
DATE NOVEMBER 1965
CHAINS SCALE 0 5 10 15
GEOLOGIST:- D. I. GROVES
SURVEYOR:-
DRAUGHTSMAN:- R. J. VOSS
MAP SHEET & Nº SWANSEA 63
REVISIONS:-
FILE Nº:- 2643

FIGURE 15.

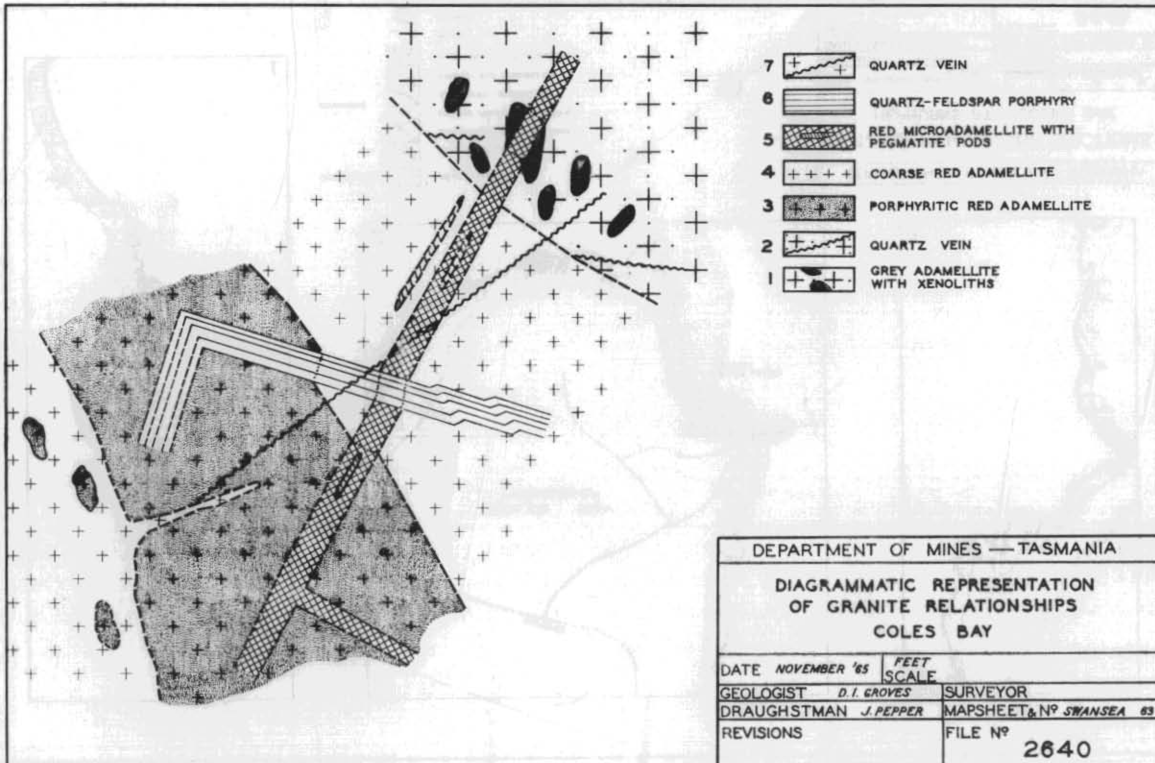

7 QUARTZ VEIN
6 QUARTZ-FELDSPAR PORPHYRY
5 RED MICROADAMELLITE WITH PEGMATITE PODS
4 COARSE RED ADAMELLITE
3 PORPHYRITIC RED ADAMELLITE
2 QUARTZ VEIN
1 GREY ADAMELLITE WITH XENOLITHS
DEPARTMENT OF MINES — TASMANIA
DIAGRAMMATIC REPRESENTATION OF GRANITE RELATIONSHIPS COLES BAY
DATE NOVEMBER '65
FEET SCALE
GEOLOGIST D. I. GROVES
SURVEYOR
DRAUGHSTMAN J. PEPPER
MAPSHEET & Nº SWANSEA 83
REVISIONS
FILE Nº 2640

FIGURE 16.

occur along the coastline at Bluestone Bay and Wineglass Bay. Numerous small bodies of porphyry and micro-adamellite intersect all three granitic types. The granites are bounded on the western side by Jurassic dolerite and overlain in limited coastal areas by Quaternary and possibly Tertiary sand and gravel which in places contain cassiterite.

MAIN GRANITE UNITS

The granitic rocks of the Coles Bay area can be divided into two major groups: the red and grey adamellites, the red adamellite being more potassic and approaching a true granite in composition. The red adamellite may be further divided into a predominant coarse even grained to subporphyritic type and a less common porphyritic variety. The predominant adamellite comprises large crystals of red microcline with small inclusions of albite in a coarse granular intergrowth of quartz, oligoclase-andesine, biotite and minor muscovite. The porphyritic adamellite has a similar composition but comprises large phenocrysts of red microcline in a finer grained groundmass.

The porphyritic adamellite occurs as irregular patches up to several hundred feet in length which are enclosed by the more even grained adamellite. Small pods of porphyritic adamellite, from a few inches to several feet in length, occur within the main mass of adamellite and in one exposure a narrow dyke of adamellite cuts the porphyritic variety for a distance of several feet (Figure 16). From these observations it would appear that the porphyritic adamellite is older than the even grained adamellite, although evidence for intrusion or replacement by the second adamellite is inconclusive. From the similarity in composition of the adamellites it is probable that they are phases of the same intrusion.

The grey adamellite is limited in occurrence to coastal sections at Bluestone and Wineglass Bays. It is an even coarse grained rock comprising almost equal proportions of potassic feldspar and andesine as elongate crystals up to 3 mm in length with granular quartz, small graphic intergrowths of quartz and feldspar and large biotite crystals. It contains numerous xenoliths of dark grey sedimentary rocks, which commonly have incipient developments of feldspar crystals in the core. The xenoliths are so numerous that Twelvetrees (1902) mapped the area at Bluestone Bay as Silurian slate.

Available evidence suggests that the red potassic adamellite is younger than the grey adamellite. The high proportion of xenoliths in the grey adamellite in contact with red adamellite which lacks xenoliths of sedimentary material suggests original intrusion of the grey adamellite into sedimentary country rocks which were not present during intrusions of the red adamellite. Further evidence is provided by dykes of red micro-adamellite which intersect both red and grey adamellite whereas dykes of grey micro-adamellite were only observed to intersect the grey adamellite. The red adamellite also cuts quartz veins which are restricted to the grey adamellite, isolated blocks of the latter rock also occurring within the more potassic rock.

Spry and Ford (1957) and Spry (1962) suggested that the red potassic adamellite had been formed by potash metasomatism of the more calcic adamellites. This was based on the occurrence of disconnected patches of plagioclase which were in optical continuity within crystals of orthoclase. Available evidence indicates that this is unlikely as the contact between the adamellites is sharp with a discontinuation of xenoliths of sedimentary material across the boundary.

McDougall and Leggo (1965) carried out isotopic age determinations on red potassic granite from Coles Bay. The grey granites and adamellites to the north of Coles Bay give calculated ages from 370 to 389 m.y. Measurements of Rb^{87}/Sr^{86} and Sr^{87}/Sr^{86} ratios for total rock, potash feldspar and plagioclase by McDougall and Leggo give an apparent date of 353 m.y. for emplacement of the red potassic granite. This is in agreement with their K/Ar date of 350 m.y. but varies from a reproducible date of 375 m.y. obtained from Rb-Sr biotite data. McDougall and Leggo considered that the discordance is due to loss of radiogenic strontium from potash feldspar and gain by plagioclase, with biotite as a closed chemical system, and conclude that the Rb-Sr biotite date of 375 m.y. is a reliable minimum age for the granite. Therefore the date of emplacement of the red potassic granite at Coles Bay is considered within the range of the grey granites and adamellites to the north.

It is evident that further isotopic age determinations should be carried out on the granites at Coles Bay, particularly as the field evidence strongly indicates a younger age for the red potassic granite, and the present results are slightly anomalous.

ACID DYKES

Numerous acid dykes, up to 100 feet in thickness, intersect the adamellites throughout the area and can be divided into two main groups, the micro-adamellites and quartz-feldspar porphyries. The micro-adamellites occur throughout the whole area, although they are more common in places, whereas the porphyries occur as small groups in limited areas. Limited exposures of intersection of the two types indicate that the porphyries are the younger (Figure 16).

The micro-adamellites have a granular texture and are composed largely of quartz, potash feldspar and oligoclase-andesine with minor biotite and muscovite. The potash feldspar has a dusky appearance due to partial replacement by sericite and has poorly developed multiple twinning in places, indicating probable microcline. Small inclusions of plagioclase crystals are common. Plagioclase occurs in almost equal proportions with the potash feldspar and is generally oligoclase or andesine. The quartz-feldspar porphyries contain large phenocrysts of quartz and potash feldspar (microcline?) up to 20 mm in length with smaller crystals of oligoclase-andesine and biotite in a fine groundmass of quartz and potash feldspar with minor plagioclase and muscovite. The phenocrysts contain inclusions of biotite and plagioclase, and in places have rims of graphic intergrowth of feldspar and quartz.

Pegmatites comprising large crystals of quartz, feldspar and biotite are common as small elongate patches within or subparallel to micro-adamellite dykes. Irregular patches of pegmatite containing zoned green mica (phlogopite?) with rims of fibrous muscovite occur sporadically throughout the adamellite and are rimmed by zones of fine grained aplite or micro-adamellite.

STRUCTURAL CONTROL OF DYKES

There is strong evidence for dilation being the dominant process controlling emplacement of the micro-adamellite porphyry and pegmatite dykes. The detailed nature of the dilations will be the subject for a further report.

Offset of micro-adamellite bodies by porphyry dykes and xenoliths by pegmatite and micro-adamellite dykes were found to be proportional to the width of the dyke and the angle of intersection as shown by Goodspeed (1940). The presence of sharp, chilled contacts confirmed an intrusive origin. Irregularities in the margin of the dykes were also found to correspond perpendicularly across the dyke in most instances. In several exposures, however, distant embayments of the dyke on one margin were matched by equivalent embayments in the other margin but with some offset from the perpendicular. The offset probably represents the thickness of a second oblique dilation dyke which merges with the exposed dyke (Figure 16). This is confirmed by rare examples of mutually intersecting dykes present on the foreshore.

A rose diagram (Figure 17) depicting trends of steeply inclined micro-adamellite and porphyry dykes in the Coles Bay area indicates a strong preferential NNW trend and a less perceptible easterly trend at about 100° to the former. A strong NW-NNW trend is also reflected in a rose diagram of quartz-vein trends from the same area. It is possible that the dykes were intruded into lines of weakness within the granitic mass, forming anastomosing NNW and E trending sets, enclosing large fracture blocks of granitic material. This is further supported by the presence of sub-horizontal bodies of micro-adamellite and porphyry which would limit the vertical extension of the granitic blocks.

The distribution of dykes throughout the granitic mass is non-uniform. The dykes tend to occur in groups or swarms with similar composition over a limited area, in which the isolation of blocks of granitic material by micro-adamellite dykes is evident on a small scale. The dyke swarms themselves may occur in structural weaknesses within the granitic mass on a larger scale.

BASIC DYKES

A basic dyke was recorded from near Wineglass Bay by Twelvetrees (1902) and is shown on the State Tectonic Map. A small basic dyke intrudes grey adamellite at Bluestone Bay, but it was not examined in any detail.

TIN DEPOSITS

There are fairly extensive cassiterite-bearing gravels in the Saltwater Creek area of Coles Bay which have been described by Twelvetrees (1902) and Keid (1944, 1954). Twelvetrees (1902) recorded small quartz veins enclosing coarse cassiterite and bands of greisen containing small quantities of ore in the Saltwater Creek area. The host rock for the cassiterite has been reported to be a grey granite, but from the distribution of exposures of unweathered adamellite it appears to be bleached or weathered red adamellite.

CONCLUSIONS

The Coles Bay granite mass represents a multiple intrusion of red potassic adamellite and associated acid dykes into an earlier, more calcic grey adamellite. Emplacement of a porphyritic red adamellite was followed by intrusion of a coarse red adamellite, red micro-adamellite, porphyry, pegmatite and quartz. Dilation was the predominant process of emplacement of the acid dykes, with limited marginal replacement. Alluvial cassiterite has been derived from small tin-bearing veins associated with the later emplacement.

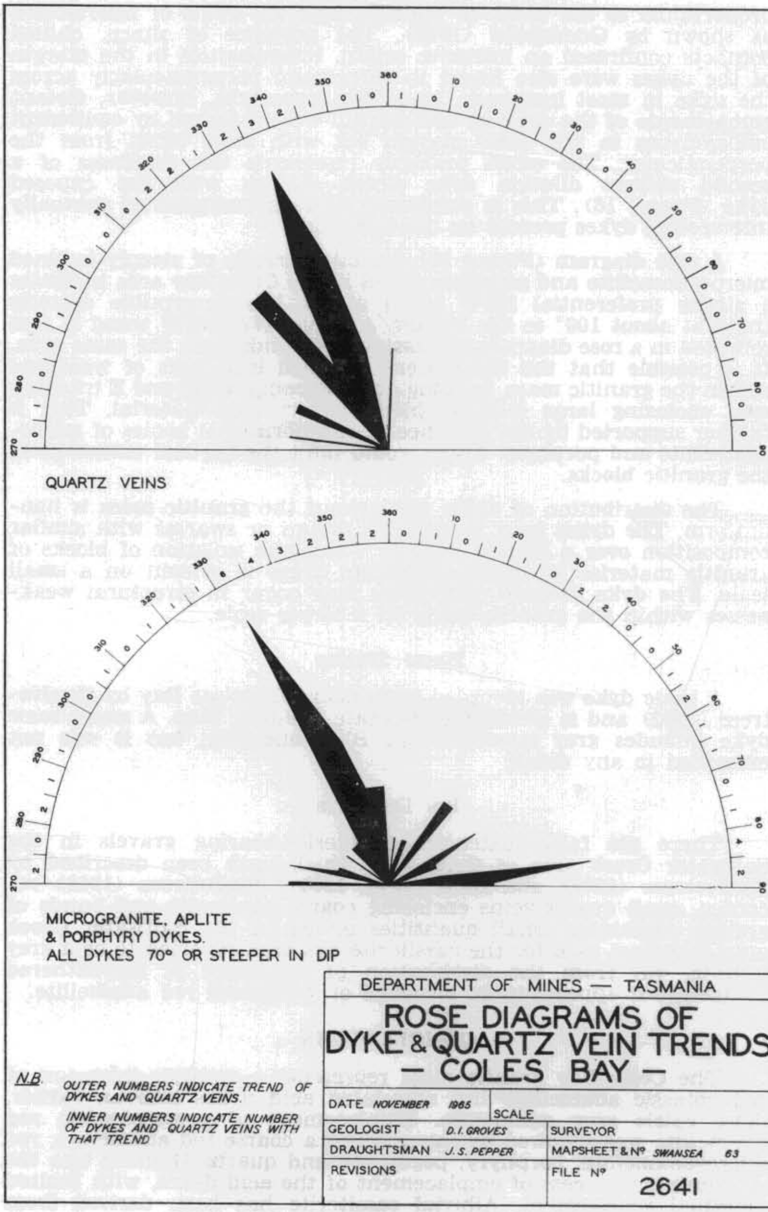


FIGURE 17.

5 cm

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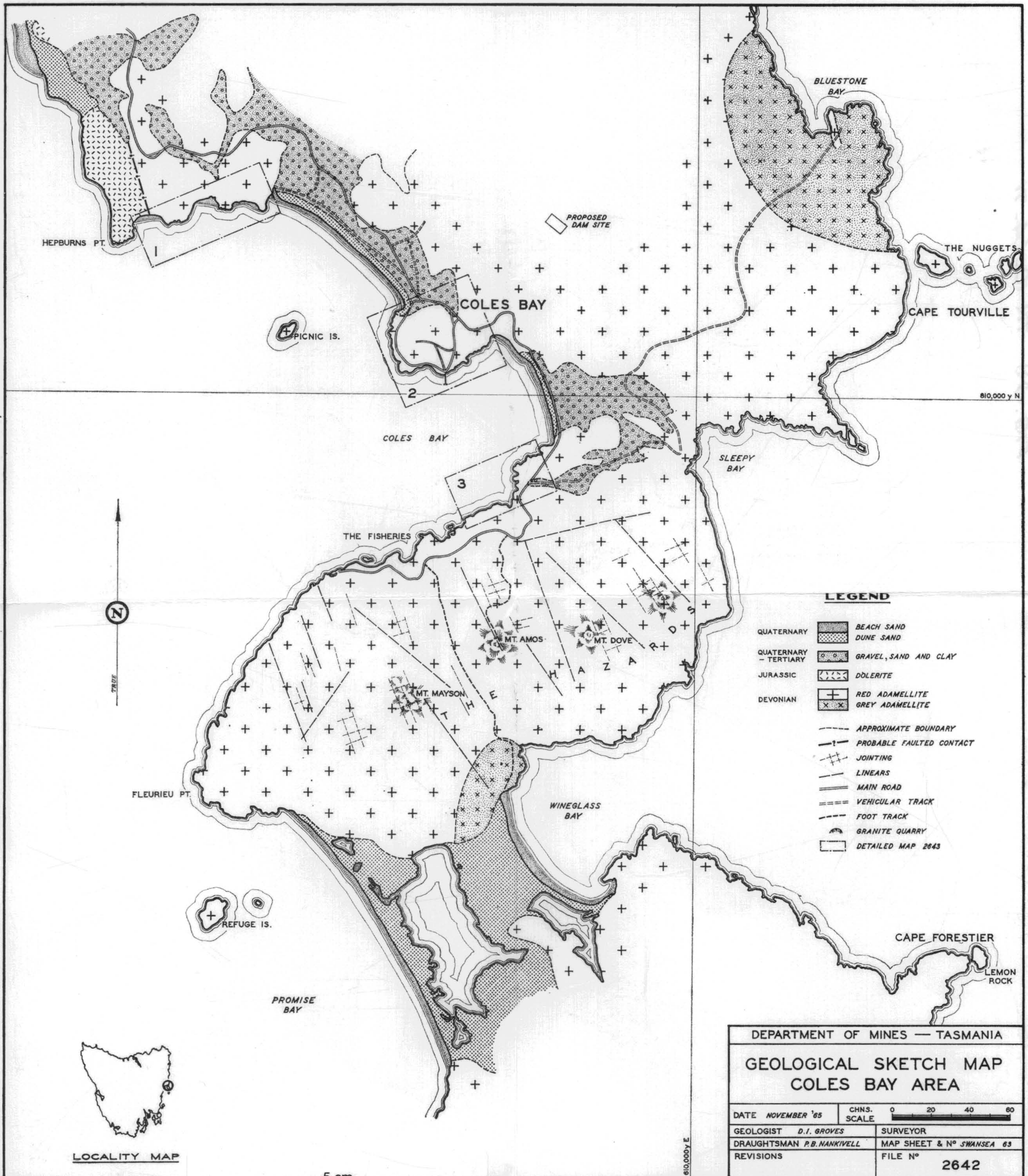

5 cm

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FIG. 28.