

1981/43. Proposal for further radiometric dating of the St Marys porphyrite and other granitoids in the St Marys district, eastern Tasmania

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GEOLOGY

The St Marys porphyrite (Walker, 1957; McNeil, 1965) contains 50-80% phenocrysts comprising mainly quartz and plagioclase with subordinate biotite and hypersthene in a fine to fine-medium grained groundmass of quartz, potash feldspar, and biotite. In composition the rock is adamellite or rhyodacite. Many outcrops are inhomogeneous due to the presence of relatively coarse and even grained, elongate schlieren consisting of quartz, feldspar, biotite, and at least one other ferromagnesian. Xenoliths of country rock are also common and show relatively little recrystallisation.

*Northern contact*

At its northern end the porphyrite overlies Mathinna Beds and dips shallowly south (25°-30°). The porphyrite near the contact is strongly chilled (microcrystalline to cryptocrystalline groundmass) and there is negligible thermal metamorphism of the adjacent Mathinna Beds.

In a thin zone (maximum thickness 70 m) below the contact, the Mathinna Beds contain irregularly shaped patches of breccia within otherwise coherent and uniformly dipping beds. These patches are thought to result from the break up of water saturated beds due to slump movements (probably small scale) near, and to the top of the sedimentary pile.

Elsewhere in the zone is breccia conglomerate comprising cobble-sized clasts of Mathinna sandstone in a sandy to silty matrix. In one locality is a well exposed, angular unconformity about six metres below the igneous contact. The unconformity is overlain by thin, bedded breccia-conglomerate, thence turbiditic sandstone and mudstone. Although the sandstone both above and below the unconformity is turbiditic, that above is markedly coarser grained and far more feldspathic than the sandstone below. No volcanic clasts were recognised.

*Western contact*

At its western boundary, the St Marys porphyrite has an associated thermal metamorphic aureole that varies in width from about 200 m to greater than 1500 m. In an area where the aureole is wide, a contact dip of 45° below Mathinna Beds is inferred.

The porphyrite at the contact, although chilled, is coarser grained than in the north (fine grained groundmass).

*Southern contact*

Along its southern margin the porphyrite is bounded by a biotite hornblende adamellite known as the Piccaninny Creek adamellite. Much of the actual contact zone is occupied by a body of richly xenolithic granitoid of uncertain relation and variable thickness. McNeil (1965) documented thermal metamorphic effects in the adjacent porphyrite.

*Structure and the northern dykes*

Planar fabric components can be discerned in many outcrops of porphyrite, particularly where the outcrops are clean and lightly etched by

weathering. A variety of elements contribute to the fabric, namely elongation of schlieren, preferred orientation of xenoliths, and preferred orientation of mineral grains and clusters (notably biotite), both within schlieren and within the porphyrite. These various elements are commonly coplanar or close to coplanar, but in some localities they are oblique. There is more than one fabric component defined by preferred orientation of biotite in the porphyrite in some places.

In an approximately two kilometre wide zone along the western edge of the porphyrite the dominant foliation is defined by aligned biotite and by sparse schlieren. The foliation trends parallel to the zone and is steeply dipping. This zone is a linear extrapolation of a dyke that trends SSE from the Mt Pierson adamellite in the Blue Tier Batholith (Groves et al., 1977). At its southern end the dyke is petrographically similar to the adjacent St Marys porphyrite, but to the north it becomes coarse grained and potash feldspar is a prominent phenocryst phase.

Outside the western zone the dominant foliation is defined mostly by coplanar schlieren, xenolith, and biotite alignment. It is gently dipping and undulating. In the northern area it is sub-parallel or parallel to the contact.

A 'syncline' in the foliation forms a persistent N-S lineament near the coast. This lineament is coincident with an extrapolation of a lineament due to a dyke that forms the southern part of the Scamander Tier granodiorite (Groves et al., 1977). The three kilometres of country between the southernmost outcrop of the dyke and the porphyrite is obscured by superficial deposits.

On the basis of similar composition and appearance, McNeil (1965) inferred that the dyke and the Piccaninny Creek adamellite are part of the same mass. The lineament within the porphyrite provides a structural link of sorts between the two bodies.

### *Conclusions*

The St Marys porphyrite is similar to the thick rhyodacite bodies that occur in the Late Devonian caldera complexes of Victoria. For example, the Lake Mountain Rhyodacite of the Marysville Complex (McLaughlin, 1976, p. 88; Birch, 1978) is very similar. Like the Victorian rocks, there is no direct internal evidence of an extrusive origin nor, unlike the Victorian examples, is there an underlying volcano-sedimentary sequence.

Characteristics shown by the northern and western contacts of the St Marys porphyrite are seemingly contradictory. Whereas the western contact is clearly intrusive, the northern contact can be interpreted as a superposition relationship. The characteristics of the two contacts can be reconciled and the close similarity to the Victorian rhyodacites accommodated if the St Marys porphyrite is regarded as a composite extrusive/intrusive body.

The two kilometre wide western zone in the porphyrite is interpreted as the feeder for the northern and eastern parts, which are regarded as probably extrusive. The zone is continuous with the dyke that trends north to join the Mt Pierson adamellite; the forbear of that granitoid was probably the plutonic source of the porphyrite.

The fact that folds in Mathinna Beds at Scamander River (Williams, 1959) and near the northern contact have shallow southerly plunges may

support the idea that progressively deeper crustal levels are encountered northwards. This view is tentative, because the relationship between the structural history of the Mathinna Beds in this area and granitoid emplacement is still under consideration. In view of structures around the northern margin of the porphyrite it seems possible that a substantial amount of the shortening observed in the Mathinna Beds may have occurred after emplacement of the porphyrite, and this phase could have included southerly tilting.

It seems clear that there is a genetic link between the 'syncline' lineament in the eastern part of the porphyrite and the lineament of the Scamander Tier granodiorite. The possibility of a genetic link between the granodiorite and the porphyrite is yet to be tested, but if McNeil (1965) is correct, there is no link and the genetic link is between the granodiorite and the Piccaninny Creek adamellite.

PREVIOUS RADIOMETRIC WORK

(1) McDougall and Leggo (1965) obtained two K-Ar biotite ages from samples of St Marys porphyrite collected about four kilometres north-east of St Marys on the Tasman Highway. This locality is within the postulated extrusive part of the porphyrite well away from chilled margins and close to the postulated feeder.

Both samples gave ages of 375 m.y. with an experimental uncertainty of 12.5% (375±9.4 m.y.). Employing the decay constant of Steiger and Jäger (1977), this value becomes older by 6.5 m.y. (D.C. Green, pers. comm.); that is 381±9.5 m.y.

(2) J.D. Cocker has amassed Rb-Sr data (biotite and whole rocks) for most granitoids in the Blue Tier Batholith north of the porphyrite. This data is prepared but not yet published. Cocker did not sample the St Marys porphyrite.

(3) Cocker obtained an average Rb-Sr biotite age of 382.6 m.y. (uncertainty not specified) for the Mt Pierson adamellite (four samples) and similarly an age of 386.6 m.y. for the northern part of the Scamander Tier granodiorite (three samples).

(4) McDougall and Leggo (1965) obtained a K-Ar biotite age from a sample of Piccaninny Creek adamellite collected 16 km south-east of St Marys on the Tasman Highway near Piccaninny Creek. They cite an age of 371(±9.3) m.y. which adjusts to 377.5±9.4 m.y.

Cocker's value of 386.6 m.y. for the northern part of the Scamander Tier granodiorite falls only just within the experimental uncertainty of the K-Ar value for the Piccaninny Creek adamellite, and suggests that the Scamander Tier granodiorite is older than both the Piccaninny Creek adamellite and the St Marys porphyrite.

FURTHER RADIOMETRIC WORK

It is considered that the following would be useful in understanding the relationship between the St Marys area granitoids and their relationship relative to the rocks of the Blue Tier Batholith.

- (1) Rb-Sr biotite ages for:
  - (a) The Mt Pierson adamellite-St Marys porphyrite dyke at a point

sufficiently far north for the texture and mineralogy to be significantly different from the porphyrite.

- (b) The southern, dyke portion of the Scamander Tier granodiorite.
- (c) Within the main mass of the St Marys porphyrite.
- (d) The Piccaninny Creek adamellite.

(2) Rb-Sr whole rock age for the strongly chilled northern margin of the St Marys porphyrite. This zone appears to be little affected by post-crystallisation alteration and it cooled very quickly. Therefore the radiometric age should be very close to the age of emplacement.

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[26 May 1981]

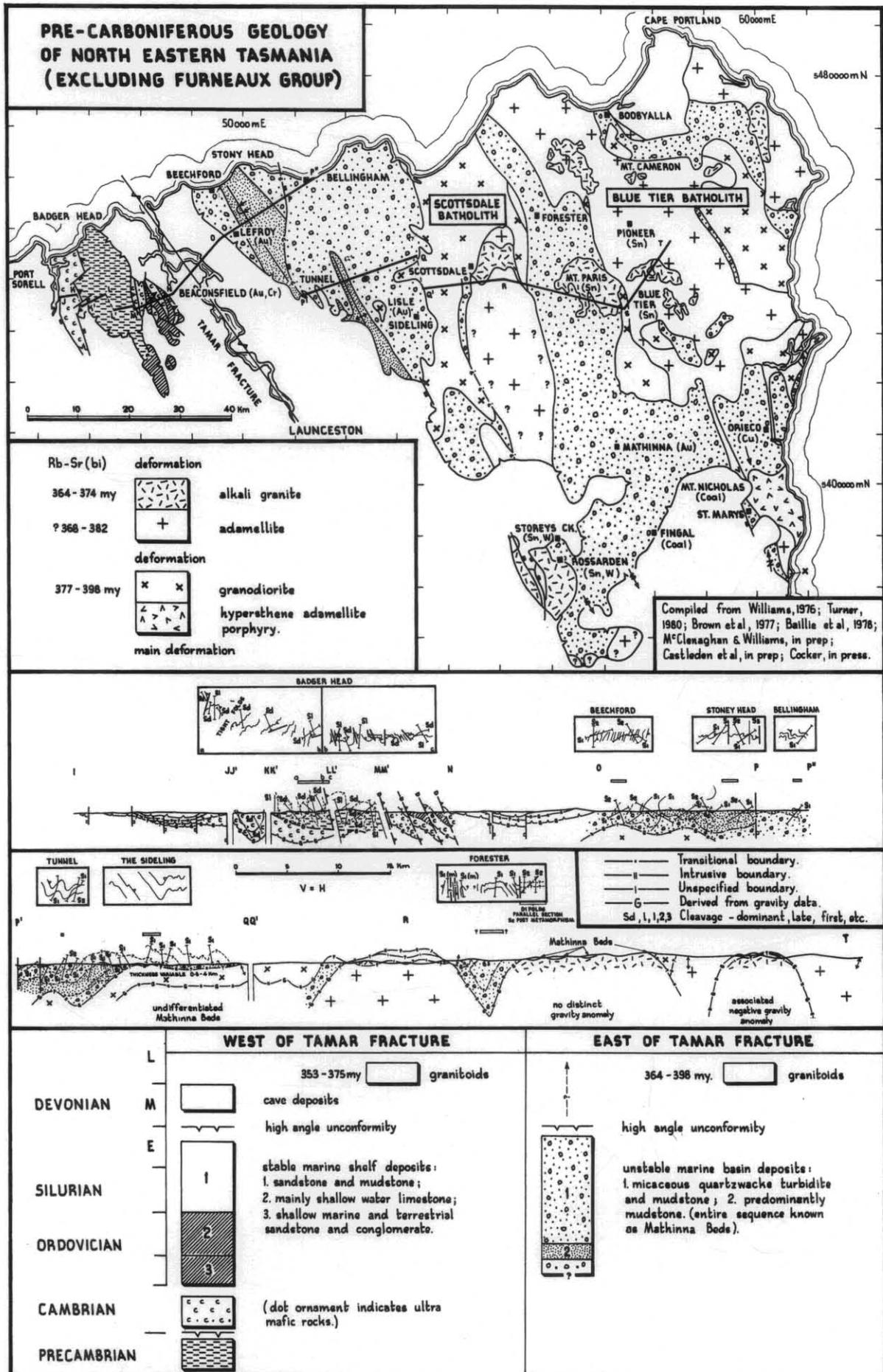


Figure 1. Pre-Carboniferous geology of north-east Tasmania

