1980/14. A basaltic intrusion near St Marys

P.W. Baillie

Abstract

A concordant body of alkali-olivine basalt intrudes Triassic coal measure sedimentary rocks of the Upper Parmeener Supergroup in a creek 3 km NNW of St Marys. The basalt is about 30 m thick and intrudes sedimentary rocks that include tuffaceous sandstone. The age of the basalt is unknown but it is identical to, and occurs at the same stratigraphic level as nearby extrusive basalt that is Triassic in age.

INTRODUCTION

Igneous activity of Triassic age has long been suspected in Tasmania (Lewis and Voisey, 1938). In a stratigraphic section, Hale (1962) shows basalt in the Mt Nicholas area but concludes 'despite the abundant evidence afforded by the volcanic arenites that igneous activity was increasing during the Triassic, no supporting evidence has been found'. Recent unpublished work (Bacon, 1979; Calver and Castleden, in prep.) has shown that both acid and basic volcanic rocks occur in the Triassic of north-east Tasmania.

This report is based on a creek traverse carried out by the author as part of the mapping of the St Marys Quadrangle in 1980. The creek is unnamed and rises in Derek Marsh [EQ964006], a low area between the Nicholas Range [EQ953002] and South Sister [EQ976011]. The rocks in the upper parts of the creek consist of coal measures of Triassic age, while the lower parts consist of basalt. It is the contact area (upstream for approximately 500 m from EP969986) that is the subject of this report.

A summary of the regional geology of the area is presented by Baillie and Calver (1980).

Acknowledgements. Dr E. Williams provided valuable help in the field and critically read the manuscript. Dr D.C. Green assisted with the petrology.

STRATIGRAPHY

The country rock consists of Triassic coal measure sedimentary rocks of the Upper Parmeener Supergroup. Lithologies present include massive cross-bedded lithic sandstone, plant bearing mudstone, carbonaceous siltstone, reworked tuffaceous sandstone, minor quartz sandstone and coal.

Approximately 300 m of sediments are present below a sill of Jurassic dolerite in the creek above the contact area. To the west, the coal measure sedimentary rocks overlie a thin basal unit of quartz sandstone which in turn conformably overlies Permian glacio-marine sedimentary rocks of the Lower Parmeener Supergroup (Baillie and Calver, 1980).

Reworked tuffaceous sandstone is a minor part of the sequence above the contact, exposed 20 m downstream of Station 0 and in the section exposed above the contact at Station K (fig. 1). The rocks are thinly-bedded, and very dark grey in colour due to a high carbonaceous content.

Sample PM18 is from the first mentioned locality and is a medium-grained (range 0.05 - 0.8 mm, average 0.4 mm), poorly-sorted sandstone containing angular to well-rounded clasts of variable sphericity in a carbonaceous/clay matrix.

The clasts are variable in composition and consist of usually angular quartz, abundant biotite, usually well-rounded lithic fragments and volcanics. The volcanics appear to be dominantly intermediate in composition (? syenite or ?trachyandesite). One clast, containing quartz and biotite, is probably rhyolite.

The lack of rounded quartz clasts and the presence of biotite, together with the presence of intermediate volcanic clasts, suggests an episode of acid to intermediate volcanism at the time of deposition of these rocks at a source not far away, as indicated by the presence of biotite which is readily broken down under normal weathering conditions.

IGNEOUS GEOLOGY

Figure 1 is a detailed map of the contact area and shows the areal distribution of basalt and sedimentary rocks in the creek.

The basalt is uniform in composition and when fresh (PM12) consists of phenocrysts (usually less than 2.5 mm in diameter) of iddingsitised olivine, 1 mm laths of labradorite, abundant often acicular apatite, titaniferous augite, abundant opaques and glass. Crystals of titaniferous augite which envelope and occasionally cut the feldspar crystals show that the rock has a sub-ophitic texture. Apatite needles occasionally reach 3 mm in length. The overall composition of the rock, in particular the abundant apatite, indicate that the rock is an alkali-olivine basalt.

The key to understanding the nature of the basalt body is the contacts that are exposed in the creek section. Until these are understood no inference on the age of the body can be drawn. Three upper and one lower contact are exposed in the creek section (fig. 1).

UPPER CONTACTS

The three upper contacts are exposed near Stations E, K and O, as indicated on Figure 1, and will be described in descending order.

Contact 20 m downstream from Station O

This is a concordant contact that dips to the south-west at about 15°. The top surface of the basalt has 2 - 10 mm wide sub-vertical sedimentary dykes that often show triple-point junctions and appear to be infilled cooling cracks. Samples from the sedimentary dykes show that the rocks very close to the basalt have been pyrometamorphosed.

Sample PM20 is a brown, flinty hornfels that in thin-section is a glassy, extremely fine-grained rock consisting almost entirely of cryptocrystalline silica. Dark patches, probably originally sedimentary features, have been stretched perpendicular to the dyke margin and there has been later recrystallisation of silica in an *en echelon* fashion oblique to this direction.

PM16 is a similar rock and shows the development of involuted folds, indicating that the sediment was squeezed into a crack in the basalt. This thin section shows the contact between sediment and basalt. On a microscale, a sedimentary dyke 0.3 mm in width has passively filled a micro-crack within the basalt. Close to the basalt the sediment is spotted; the ovoid porphyroblasts are retrograde after ?cordierite.

Original quartz clasts are relatively unaltered, but the clay fraction has been partially melted, as is also seen in PM20. These rocks are hornfels that grade into porcellanites very close to the actual basalt contact and have formed at high temperature and low pressure.

A similar sedimentary dyke from the actual exposed contact shows a gradation from hornfels in the dyke to relatively unmetamorphosed carbonaceous sandstone in the source bed which immediately overlies the basalt. The dyke and bed however have been strongly hydrothermally altered by carbonate; anastomosing fractures in the rock have controlled carbonate deposition.

Dips of up to 20° in the coal measure sedimentary rocks downstream of the contact are probably the result of the intrusion, although drag-folding as a result of a concealed fault in the near vicinity cannot be excluded as a cause.

The evidence of the pyrometamorphosed sedimentary dykes and the continuity seen from one such dyke to overlying sedimentary rock clearly indicates that the basalt has intruded the country rock at this locality.

Contact at Station K

The contact is exposed in the left-hand bank of the creek where tuffaceous carbonaceous sandstone and plant-bearing mudstone overlie basalt. The sediments are not markedly metamorphosed but some hydrothermal alteration is present.

Contact at Station E

This is the most complex contact in the creek section and consists of two large blocks of hornfelsed mudstone overlying basalt. Some brecciation is present.

The top of the basalt contains sedimentary dykes similar to those previously described. The blocks of sedimentary rock each have an area of about 3 m^2 and unlike any sedimentary rock (with the exception of the sedimentary dykes) are strongly hornfelsed, so that it is often difficult to distinguish sedimentary rock from basalt. As indicated on Figure 1, the upstream contact dips in a southerly direction at about 30°, whereas the downstream contact is sub-horizontal.

The zone of brecciation has an area of only about 2 m^2 and consists of angular blocks of sedimentary rock up to 300 mm in length in a matrix of broken basalt.

Strong hornfelsing of both overlying country rock and sedimentary dykes once again indicate that the basalt is intrusive, but the brecciation indicates low pressure and hence a shallow intrusion. The brecciation may indicate the presence of a feeder, perhaps along a fault.

LOWER CONTACT

At only one locality (16 m upstream from Station I) is the lower contact exposed. Here, massive basalt concordantly overlies cross-bedded, carbonaceous mudstone that is apparently unmetamorphosed.

FORM OF THE BODY

Figure 2 is obtained using the data of Figure 1 and shows that one body of basalt about 30 m in thickness is present. The overall concordance and intrusive nature suggest that the body is a sill intruded at shallow depth. A possible site for a feeder is present near Station E.

DISCUSSION

It has been shown that a thin sill of alkali-olivine basalt intruded sediments that contain re-worked tuffs. What then is the age of the basalt? Three reasonable possibilities exist:

(1) Tertiary

(2) Jurassic associated with the dolerite

(3) Triassic

It is considered that the second choice can be discarded because of the difference in composition between the basalt and the Jurassic tholeiites.

A Tertiary age for the intrusion cannot be excluded. Compositionally, the basalt appears to be very similar to other Tertiary alkali-olivine basalts. However in view of the deformation seen in some of the sedimentary dykes (*e.g.* PM16), a Tertiary age is not favoured. The involutions, developed as the rock passively filled cracks, formed on the top surface of the basalt and would probably not have developed if the sediment had been well lithified. Had the rock been partially melted and mobilised, it could well have flowed in, but it has already been noted that porcellanites only formed very close to the actual basalt contact.

The basalt body has the same stratigraphic position as extrusive basalt which crops out north of the Nicholas Range and South Sister (*i.e.* near the base of the coal measure sequences of the Upper Parmeener Supergroup) and this basalt is Triassic in age (Calver and Castleden, in prep.). The Triassic basalt is identical petrologically to the basalt described herein, which by inference is also Triassic in age, although this cannot be proved.

Even if the basalt intrusion does not eventually prove to be Triassic in age, the evidence provided by the reworked tuffs in the coal measures provides good evidence for an episode of acid to intermediate Triassic volcanism in north-east Tasmania.

REFERENCES

BACON, C.A. 1979. *Sedimentology of the Late Triassic coal measures in north-eastern Tasmania*. B.Sc. Hons. thesis (Part B), University of Tasmania: Hobart.

BAILLIE, P.W.; CALVER, C. 1980. Geology of the Mt Nicholas, Fingal Valley and Mt St John areas. *Unpubl.Rep.Dep.Mines Tasm.* 1980/13.

HALE, G.E.A. 1962. Triassic system, *in* SPRY, A.H.; BANKS, M.R. (ed.). The geology of Tasmania. *J.geol.Soc.Aust.* 9(2):217-231.

LEWIS, A.N.; VOISEY, A.H. 1938. A record of volcanic activity in Tasmania during Triassic times. *Pap.Proc.R.Soc.Tasm.* 1937:31-39.

[2 June 1980]

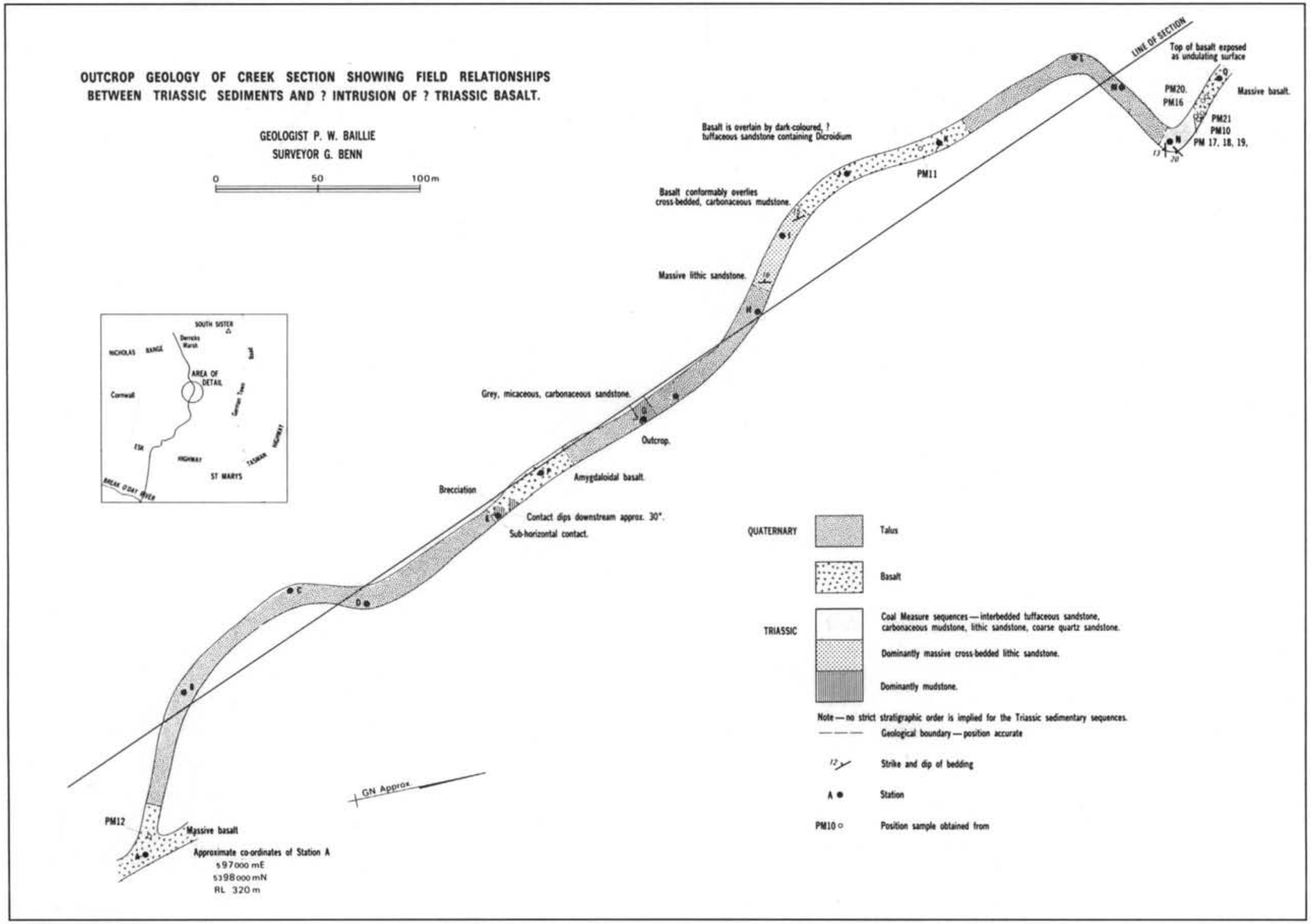
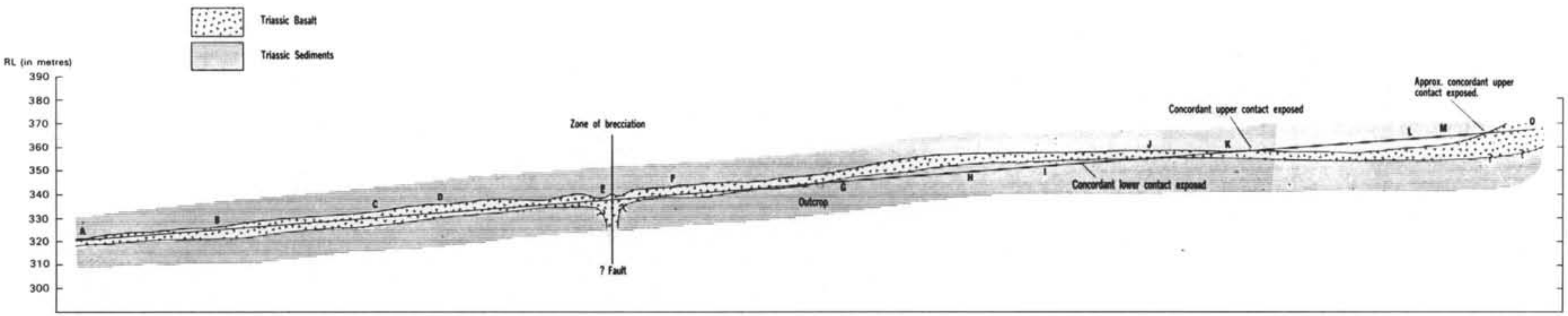


Figure 1.

5 cm

5/6



POSTULATED FORM OF SHALLOW BASALTIC INTRUSION INTO TRIASSIC SEDIMENTS (SECTION A-O)

Figure 2.

5 cm