THE MERRIONS TUFF – ITS GENESIS

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The Early Devonian Merrions Tuff is a volcanogenic pulse up to 990 m thick, interrupting the more normal deposition of greywacke-slate sequences of the Hill End Trough. It is a distinctive, competent *structural and stratigraphic datum* for the Trough sequence (Fig. 1). Unfolding suggests that it may have had 1½ times to twice its present areal extent of approximately 1,850 km^2 with the major shortening being in an east-west direction.

The Merrions Tuff consists of *juvenile volcaniclastic aggregates* deposited as *subaqueous mass flows* and similarly regionally extensive porphyries here interpreted to be *subaqueously erupted and emplaced lava.*

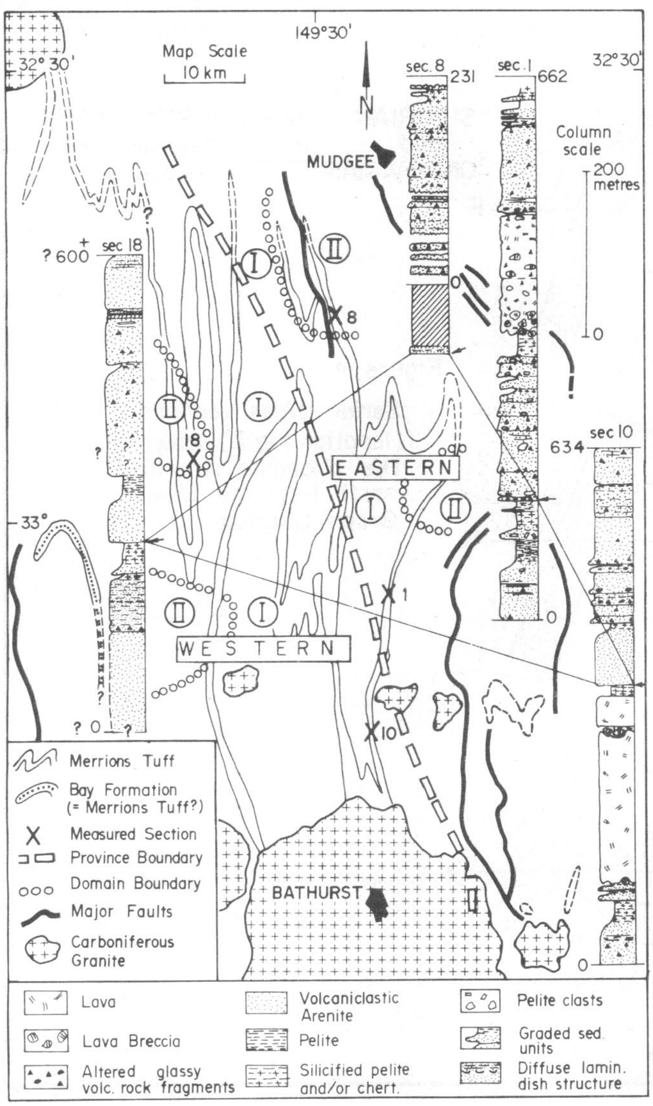

FIGURE 1
Outcrop pattern for the Merrions Tuff. Two main depositional Provinces (the Eastern and Central) are recognized, each of which is subdivided into two Domains (I and II). Representative sections for each Domain are presented. The major time plane within the Formation is shown. Dashed outcrop areas are currently correlated as Merrions Tuff, but little direct evidence exists for these correlations.

Three *lava* units, which together are as volumetrically significant as the volcaniclastic component, are recognizable. They are grossly tabular, but in plan have lobate outlines. They are coherent, sparsely vesicular or amygdaloidal, conformable bodies. Fragmentation occurs only in their tops and bases. It is concluded that the lavas were erupted subaqueously, and that the depth of emplacement may have been about 2 km.

Phenocryst assemblages in the lavas include plagioclase-quartz and plagioclase-quartz-K-felspar. *Chemically* the lavas appear to have been silica intermediate with calc-alkaline affinities.

Sedimentation units, like the Formation as a whole, have a tabular geometry on a regional scale. They have a thick, massive aspect, and show structures indicative of mass emplacement by *highly concentrated sediment flows.* Thin units (up to 2 m) may be continuously graded, indicating that the major transport/grain support mechanism was *turbulent suspension.* The thicker units are either non-graded, graded only near the tops, or display a crude coarse-tail grading near the bases. Other structures include diffuse lamination, outsize clasts, bed amalgamation, minor channelling, and isolated dish structure. The transport/grain support mechanisms in the thicker units are considered to be dominated by *dispersive pressure* with minor contributions from turbulent suspension (more particularly in the upper levels of individual sedimentation units).

Clasts in the volcaniclastic aggregates are volcanic quartz, plagioclase, and variously K-felspar and altered glassy fragments. The similarity between the clast assemblages and phenocryst assemblages in the lavas suggests that the volcaniclastics were derived from a parent magma of similar affinities to those of the lavas.

Regionally the Merrions Tuff can be subdivided into *depositional provinces and domains* (Fig. 1), based on lateral variations in sequence. Lateral variations are controlled by factors including: the inferred presence of several source distribution points for the volcaniclastic component along both the eastern and, to a lesser extent, the western margins of the Trough; ponding generated by eruption of thick lava units on an essentially flat subaqueous palaeotopography; and palaeotopographic lows, particularly along the western margin of the Trough.

MULTIPLE DEFORMATION ASSOCIATED WITH THE WIAGDON FAULT ZONE ALONG THE TURON RIVER, NEAR SOFALA

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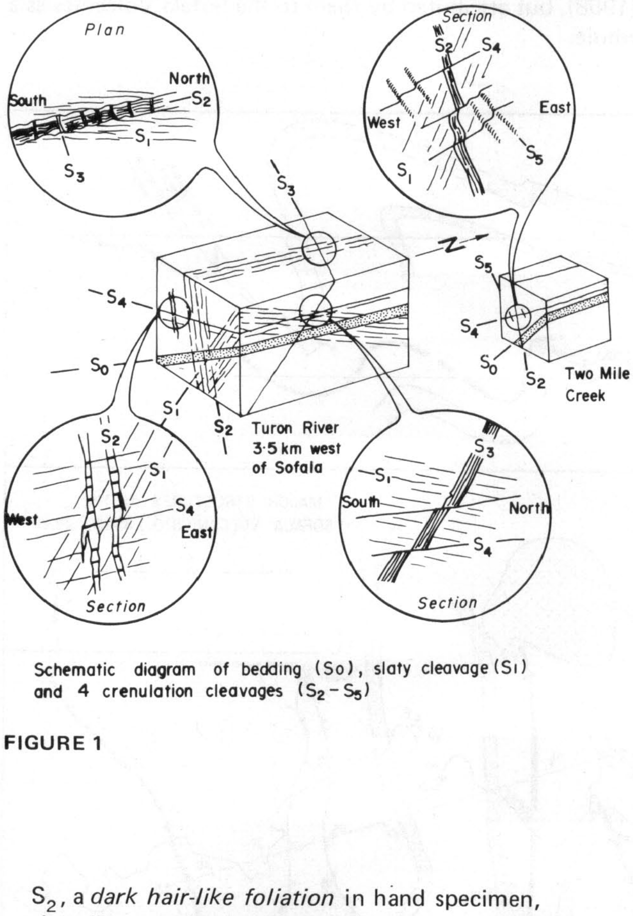
In an area (3 x 4 km) immediately west of the Wiagdon Fault Zone near Sofala, four crenulation cleavages with associated folds postdate the regional slaty cleavage (Hordern, 1973). Cross-cutting and refolding relationships indicate the relative ages of the cleavages. The structural surfaces are:

S_0 *bedding,* defined by sandy and slaty interbeds, the sandy beds ranging up to 3 m thick. Graded bedding and bottom structures indicate meso- and macroscopic first-generation folds overturned towards the east. These regional folds are close to very tight, and plunge gently northward, and have:

S_1, *axial-surface slaty cleavage* that dips west at variable angles from nearly vertical to horizontal as the axial surfaces of associated folds vary from overturned to recumbent, as, for example, at Wallaby rocks. S_1 has been overprinted by at least four crenulation cleavages (Fig. 1), *viz.,*



Schematic diagram of bedding (So), slaty cleavage (S1) and 4 crenulation cleavages ($S_2 - S_5$)

FIGURE 1

S_2, a *dark hair-like foliation* in hand specimen, that dips steeply east in slate (modal plane, 71/103) and west in psammite (68/288). In thin-section, S_2 appears as whisker-like bands of reoriented phyllosilicates. Bands vary in width and have ragged boundaries.

S_3, a *weak southerly dipping crenulation cleavage* (66/184), that is more restricted in occurrence than S_2 and appears as crenulations of S_1, or as crenulations within S_2.

S_4, an *extremely penetrative, shallowly westward-dipping foliation* (12/298) that seems to be parallel to, and associated with the Sunrise Fault (a thrust west of the Wiagdon Fault Zone). In places, S_4 is so strongly developed that it has the appearance of a very fissile slaty cleavage, yet it can be distinguished in outcrop because it buckles many small quartz veins parallel to S_1. In thin section, a strong mineral differentiation can be seen along the cleavage zones, and limbs of buckled quartz veins have been partially removed by pressure solution.

S_5, is a *weak, local crenulation cleavage* that deforms S_4 and occurs in only one locality in Two Mile Creek.

These crenulation cleavages are restricted to a zone within 2 km immediately west of the Wiagdon Fault Zone (Willis, 1972), and were evidently generated by movement along this zone. Packham (1968) and Hobbs and Hopwood (1969) interpret the Wiagdon Fault Zone as a major structural and stratigraphic boundary between highly deformed flyschoid sediments of the Hill End Trough and more open, concentrically folded sediments of the Capertee High — a boundary along which there may have been considerable displacement as the trough sequence was thrust eastward. Our mapping shows that the thrust probably marks a dislocation on the underside of a zone of overturned folds at the contact between the well-bedded flyschoid sequence to the west and a highly deformed, more structurally massive volcanic complex to the east (Gilfillan, 1975). Near Wattle Flat a similar thrust passes laterally into the overturned limb of a major anticline, and further south the Wiagdon appears to break up into a series of thrusts, each on the overturned limb of an east-facing anticline. Mapping between Sofala and Capertee (Gilfillan, 1975; Henry, 1975) shows that the intense first-generation deformation continues through all rock sequences, including the Upper Devonian Lambie Group. We dismiss the contention that the area east of the Wiagdon Fault Zone is less intensely deformed than the Hill End Trough sequence; instead we consider that the paucity of penetrative cleavage and the longer wavelength of the folds are due to the lower ductility contrast of rocks east of the thrust during the regional deformation. We suggest that the facies disjunction of Siluro-Devonian rocks across the Wiagdon Fault Zone is far less marked than implied by Packham (1968), and that consequently the amount of displacement on the thrust may be smaller than commonly assumed. Many of the thrusts associated with the Wiagdon Fault Zone system may simply be dislocations developed on the overturned limbs of folds that were no longer able to accommodate deformation by bedding-plane slip. We consider that the crenulation cleavages near Sofala are the product of continuing deformation in the contact zone between the well-bedded sequence of the Hill End Trough and the structurally massive volcanic complex of the Capertee High.

The area of multiple deformation includes the type section of the Chesleigh Formation along the Turon River (Packham, 1968), although the lower part of the formation is in fault contact with the adjacent Bell's Creek Volcanics. By taking into account the exposed overturned folds, we calculate that Packham's estimate of thickness should be reduced by 30% to 2500 ft (750 m).