

ABSTRACT

The Esk “Trough” in southeast Queensland lies within the northern part of the New England Fold Belt, a Palaeozoic to early Mesozoic accretionary/orogenic complex that parallels part of the eastern margin of the Australian plate. Prior to this study, the “Trough” was defined by an elongate belt of Early–Middle Triassic continental sedimentary and intermediate volcanic rocks of the Toogoolawah Group, superimposed upon Devonian–Carboniferous basement accretionary units and faulted against adjacent Permian units. The “Trough” is unconformably overlain by Late Triassic intermediate and silicic volcanic rocks. The geological history of the Esk “Trough” was largely unknown and it had been presumed that it was a discrete basin, initiated and filled as a graben/rift valley during the Early Triassic. Sediment accumulation in the Esk “Trough” ceased with a deformational event in the Middle Triassic that represented the culmination of the contractional event, the Hunter-Bowen Orogeny (ca 265–230 Ma). The purpose of this study was to determine the origin of the basin, describe its geological evolution and component units and account for its present position within the Northern New England Fold Belt.

The component units of the Triassic Toogoolawah Group had been sequenced as the Bryden/Gayndah Formation, Neara/Mount Marcella Volcanics and Esk Formation in ascending stratigraphic order. Structural cross-sections compiled from field data in this study have resulted in a redefinition of this stratigraphic order with the Neara/Mount Marcella Volcanics being reassigned as the youngest unit, and the Bryden/Gayndah and Esk Formations being correlated, both with each other, and as lateral facies equivalents with parts of the Neara Volcanics in an interfingering relationship. The majority of exposed Bryden/Esk/Gayndah Formation is interpreted as a fluvially dominated depositional environment that formed meandering and braided channel, floodplain and lacustrine deposits. Alluvial fan deposits are recorded in the basal rocks. The deposits of the Neara/Mount Marcella Volcanics record a period of intermittent volcanism with the majority of exposure indicating a depositional environment with an abundant supply of pyroclastic and autoclastic material that was rapidly reworked by processes in the continuum fluvial → hyperconcentrated flood flow → debris flow → debris avalanche. Deposits that characterise debris aprons are abundant within the volcanics.

Adjacent to the Esk “Trough” on its eastern, southeastern and southwestern boundaries are the Permian sedimentary and volcanic sequences - the Marumba beds, the Northbrook beds and the Cressbrook Creek Group respectively. Of these Permian units the Northbrook beds and Cressbrook Creek Group are confirmed as late Early–early Late Permian age based on macrofossil assemblages examined within this study. An unstable shelf, or perhaps slope environment, is indicated for their deposition. They are regarded as correlative units based on similarities in fossil fauna, lithology, depositional environment and degree and style of deformation. They are thus concluded to be basal to, and genetically part of, the same basin as the Triassic Toogoolawah Group. The Marumba beds are considered to be older than the mid-Permian Northbrook beds and Cressbrook Creek Group based on differences in lithology, fossil prevalence, metamorphic grade and structural fabric and an Early Permian age is suggested for this unit.

Traditionally the Esk “Trough” as a graben/rift has been equated with the present-day outcrop distribution of the Triassic Toogoolawah Group but the Toogoolawah Group is not fault-bounded. Unconformable contacts between Toogoolawah Group units and older rock units on both sides of the Esk “Trough” have been described: on the east with the Early Permian Marumba beds and Devonian–Carboniferous basement Amamoor beds and a nonconformity with the Late Carboniferous Claddagh Granodiorite, and on the west with an altered pillowed basalt unit of possible Permian age and with Devonian–Carboniferous basement Maronghi Creek beds.

In the area of the angular unconformity with the Early Permian Marumba beds, the basal unit of the Toogoolawah Group consists of continental redbed sediments with material sourced from oxidised Marumba beds, which were steeply dipping prior to deposition of the Toogoolawah Group. Thus, by the Early Triassic, the thrusting during the Hunter-Bowen Orogeny had produced an exposed fold-thrust highland that was the provenance for the sediments of the Toogoolawah Group.

This study has redefined the component units and evolutionary history of what is herein referred to as the Esk Basin. It is concluded that the Esk Basin evolved through three phases:

1. An Early Permian phase of extension during which the marine rocks of the Marumba beds were deposited.
2. A mid-Permian phase of passive thermal subsidence resulting in the Northbrook beds and Cressbrook Creek Group marine shelfal to slope deposits.
3. A latest Permian–Early Triassic phase of foreland loading during which the continental Toogoolawah Group was deposited in depositional environments ranging from fluvial plains to debris aprons.

This history parallels the tectonic evolution of the Bowen Basin in central Queensland and the rock units assigned to the three phases of the Esk Basin correlate chronologically, lithologically, stratigraphically and palaeo-environmentally with a range of units within the eastern Bowen Basin. The Esk Basin developed in a depocentre on the southeastern margin of the larger Bowen Basin and was likely contiguous with it. Thus the Esk Basin records some of the most easterly preserved onshore exposure of the Bowen Basin. Dismemberment by Hunter-Bowen thrusting involving movement along pre-existing major fault zones resulted in the structural isolation of the Esk Basin from the larger Bowen Basin.

Evidence is presented for the existence of a continental volcanic-arc, active during the Early–Middle Triassic (ca 242–235 Ma) along the eastern margin of the Australian plate in southeast Queensland, the arc having been active during an hiatus in deformation in this region.

The development of the Esk Basin records an important component of the deformation and magmatism related to plate motion at the eastern Australian margin. It confirms that within southeast Queensland thrusting along the Hunter-Bowen Orogeny had, by the Early Triassic, produced an exposed fold-thrust highland, and that the terminal thrusting of the Hunter-Bowen Orogeny in this region occurred prior to the end of the Middle Triassic. Permo–Triassic contraction during the Hunter-Bowen Orogeny was also associated with the westward migration of arc magmatism onto the continent, resulting in the emplacement of the Neara Volcanics and voluminous Late Permian–mid-Triassic I-type intrusions within southeast Queensland.