

(Cas *et al.*, 1976) show that the regional metamorphic cooling was approximately 350 million years ago. Thus, the regional north-south deformation occurred in the Early Carboniferous, probably between 365 and 350 million years ago. Multiple deformation on the Copperhanna and Wiagdon Fault Zones (Powell *et al.*, this volume) occurred during this deformation.

If the 359 ± 6 m.y. date on the Yeoval Granite represents the time of its intrusion, then its close correspondence with the independently determined timing of regional deformation and the slightly younger regional metamorphic cooling, leads to speculation that emplacement of the Yeoval Granite, and perhaps others obscured beneath the Permian and younger cover rocks to the north and east, may be genetically related to the regional deformation. It is possible that lateral diapiric spread of the Yeoval Granite and coeval batholiths has caused this deformation, in the manner postulated by Scholten (1973) for the Idaho Batholith.

Conclusion

The Hill End Trough is thus seen to be a depositional basin which had a life of at least 50 million years from mid-Silurian to mid-Devonian, and perhaps 65 m.y. until the Early Carboniferous. The Hill End Trough was deformed into the present Hill End Synclinorium in the Early Carboniferous 70 to 80 m.y. after its initiation. The Molong High has a longer history extending back at least as far as the Early Ordovician. Four episodes of andesitic to dacitic volcanism occurred on the Molong High in the 120 million years preceding the Late Devonian. Important mineralization is associated with plutons related to the andesitic island-arc volcanism (porphyry copper deposits), and to acid volcanics associated with the initial dilatation of the Hill End Trough (base-metal deposits). The Hill End and Sofala gold deposits have microstructures indicating that they were present during the regional deformation (Hordern, 1973). The gold was probably deposited from solutions mobilized during the formation of the regional slaty cleavage.

THE HILL END TROUGH — AN EMPIRICAL APPROACH

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The Southernmost parts of the Havre Trough and the region of confluence of the Kermadec arc system with the North Island of New Zealand are a modern analogue for the Late Silurian — Early Devonian palaeogeography of the Hill End Trough and its southern environs, including the Canberra region.

The dimensions of the Hill End Trough and its bounding highs are very much less than those of the multiple-arc systems of the southwest Pacific, except in their embryonic parts, so that direct comparison of the Hill End Trough system with entire, fully developed multiple-arc systems is inappropriate on the basis of scale alone.

Similarities between the Hill End Trough region and the Kermadec/New Zealand confluence are:

- (i) remarkable scale similarities;
- (ii) similar facies-distribution patterns;
- (iii) terrigenous sediment influences in the Hill End Trough and southernmost Havre Trough;
- (iv) the diffuse distribution of contemporaneous volcanics around the closure of both troughs, encompassing the frontal arc, trough, and remnant arc;
- (v) the parallelism of major regional structural elements to the trend of the troughs and their bounding highs;
- (vi) the existence of broad magmatic provinces of largely silica-intermediate to silica-rich calc-alkaline affinities on line with the troughs (the Quaternary Central Volcanic Region in New Zealand; the Siluro-Devonian Canberra Magmatic Province in New South Wales);
- (vii) the setting of these magmatic provinces in gross extensional environments that parallel, and are continuous with, the troughs to the north;
- (viii) effective basements of older flysch-like rocks in both provinces.

The Merrions Tuff, a regionally extensive volcanic unit within the Hill End Trough, has an initial $^{87}\text{Sr}/^{86}\text{Sr}$ ratio of 0.7062, which is similar to that which led Ewart and Stipp (1968) to infer a crustal anatexis origin for the rhyolites and ignimbrites of the Central Volcanic Region of New Zealand.

This supports the conclusion that the Hill End Trough is, at most, an embryonic inter-arc basin. During the Late Silurian-Early Devonian it had an effective basement of probable sialic or intermediate character. There is no evidence of an oceanic basement.

SILURIAN ENVIRONMENTS OF THE NORTHERN MOLONG RISE

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NSW Department of Mines

For the northern Molong Rise, three Silurian longitudinal palaeogeographic units are postulated: essentially a shallow basin flanked by two acid igneous complexes (Figs. 1, 2). At the time of maximal carbonate development, a central Narragal Lagoon passed westwards onto a shelf edge characterised by non-magnesian carbonate sand and oncoliths, the Molong Shelf Edge. This developed atop earlier acid igneous rocks along the western flank of the Molong Rise. The shallow water areas, either of mud or carbonate sand, may be grouped under the term Narragal Shelf. Late in Silurian time, the entire Molong Rise began to drown, influx of pelagic mud almost everywhere replacing carbonate deposition. Local maintenance of carbonate environments