Landmesser *et al* (in press), however, have tentatively identified magnetic anomalies symmetrically disposed about the crest of the rise with a proposed age of 42 my at the crest. With definitive data lacking they therefore suggest that the rise may be either thickened oceanic crust, or continental crust.

Basement structure over the Queensland, Eastern and Papuan Plateaux reveal three major trends; a separate one dominant on each plateau. On the Queensland Plateau NNW trends prevail particularly in and adjacent to the edge of the trough. These NNW trends are abruptly terminated by the NW trending slope of the plateau and many of the horst structures paralleling the Queensland Trough appear to have been offset in a NW direction. This NNW trend in basement structure may reflect an original Palaeozoic grain along which tensional forces associated with the Coral Sea opening have operated. This trend, however, closely parallels that of the Tasman Sea opening (Hayes & Ringis, 1973) and the Queensland Trough may reflect a rift associated with this event and predating the Coral Sea opening.

On the Papuan Plateau, basement highs trend in a NW direction subparallel to the Coral Sea Basin and basement rapidly deepens towards the Papuan landmass, where an extensive area of middle Eocene submarine tholeiitic basalts outcrops (Southeast Papuan Volcanic Province). This suggests a rifting phase to the north of the Papuan Plateau following the opening of the Coral Sea and may be the result of a jump in the Coral Sea spreading centre to the north of the plateau during the last stages of Coral Sea opening.

Major NE structures prevail on the Eastern Plateau and intersect the trend of the Coral Sea Basin terminating the extent of oceanic crust. This NE trend is considered to be a result of transform motion in continental crust at the time of the basin formation. A consequence of such motion may be the displacement and change in trend of the Owen Stanley Metamorphic Belt at its junction with the Southeast Papuan Volcanic Province. The Papuan Ultramafic Belt, however, shows no such displacement indicating that the overthrusting of the ultramafic mass was a post Coral Sea formation event.

The Aure – Moresby Trough appears to have resulted from early Eocene rifting and possibly crustal extension, the conclusion of which may have been the formation of the Southeast Papuan Volcanic Province. Whether this can be related to the same thermal anomaly associated with the Coral Sea opening or reflects a slightly later event cannot at present be ascertained. Figure 1 is a schematic tectonic map of the region.

It is probable that two or possibly three closely spaced rifting events have occurred during the Cretaceous – early Tertiary history of the western Coral Sea. The first of these was associated with the Tasman Sea opening and resulted in the formation of the Cato and Queensland Troughs and associated NE trending basement features on the Queensland Plateau. No sea-floor generation, however, occurred in the Queensland Trough. Following this, rifting and eventually continental break-up in the early Eocene occurred along the trend of the Coral Sea Basin. This may have been associated with rifting in the Aure – Moresby Troughs and generation of sea-floor basalts in southeast Papua. These later events, however, may be a consequence of a thermal event independent of that responsible for the opening of the Coral Sea.

At present it is not possible to ascertain whether the Coral Sea Basin resulted from a process of normal oceanic crustal generation, or of back-arc spreading as proposed by Karig (1971) and Packham and Falvey (1971). The absence of an obvious Eocene island arc in Papua, however, tends to negate the concept that development took place by a marginal basin process associated with arc migration.

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BASIN EVOLUTION AND MARGINAL PLATEAU SUBSIDENCE IN THE CORAL SEA

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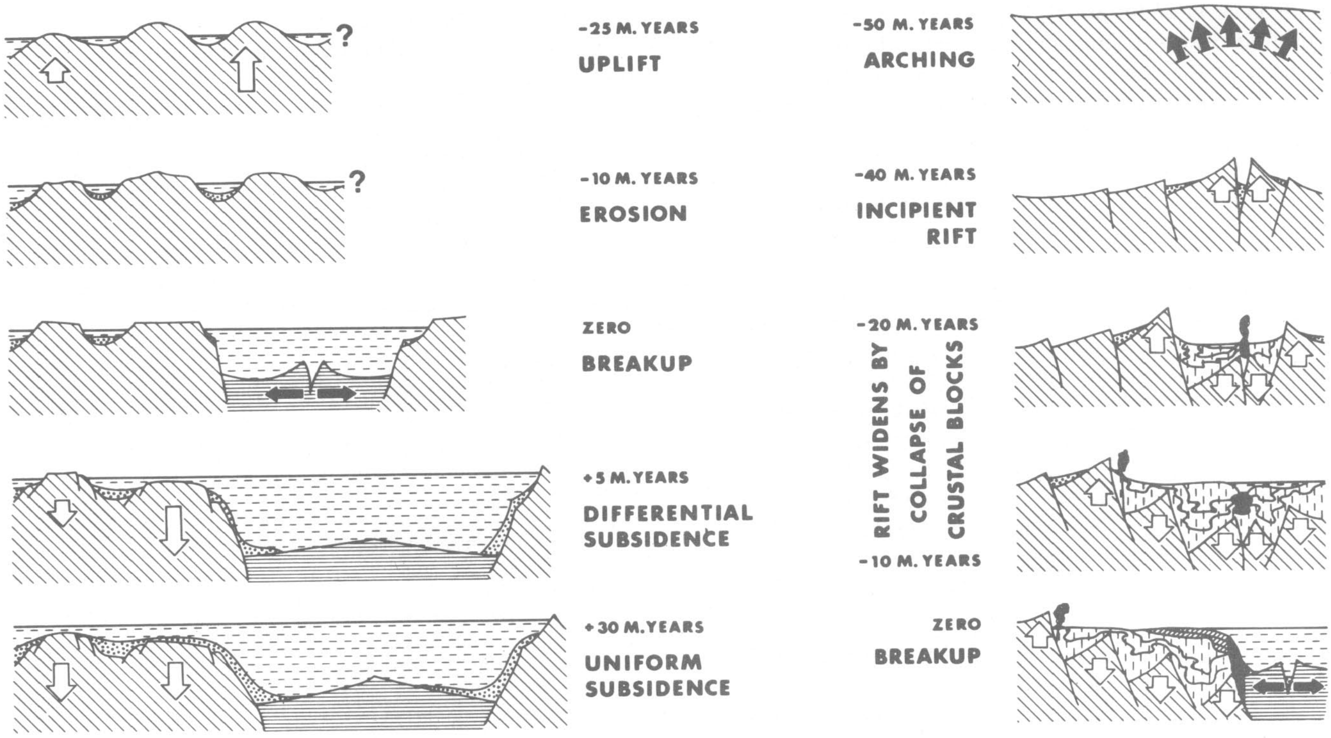
Marginal plateaus, such as the Coral Sea Plateau*, are special structures related to, and occurring within the transition zone between continental and ocean crust. They are continental structures which have been modified by the effects of tectonism associated with the formation of an ocean basin. The structure of a plateau owes as much to an original relationship with the continent adjoining it on one side, as it does to a tectonic relationship with the ocean basin adjoining it on the opposite side. The history of development of a marginal plateau reflects varying condition at a continent/ocean lithosphere boundary during development of a new continental margin.

***Also called the Queensland Plateau (ed.)**



(a) CORAL SEA BASIN AND PLATEAU EVOLUTIONARY MODEL

(b) ATLANTIC TYPE CONTINENTAL MARGIN. AFTER : FALVEY, 1974

Fig. 1

The Coral Sea Plateau lies between northern Queensland on its western side, and the Coral Sea Basin on its eastern side. It was covered by an extensive and systematic multi-sensor geophysical survey in 1971 (Mutter, 1974) and was tested by DSDP drilling (hole 209) in the same year (Burns, Andrews *et al*, 1973). Drilling revealed three basic lithologic units:

1) A basal unit consisting of shallow-water, largely terrigenous sediments deposited during middle Eocene and an unknown time interval before this (drilling did not penetrate to basement).
2) A hemipelagic rock deposited during upper Eocene. This is separated by a depositional hiatus from
3) pelagic sediment deposited from upper Oligocene onward.

This lithologic zonation has been matched with the acoustic zonation found on seismic reflection profiles. The Eocene/Oligocene hiatus in DSDP 209 corresponds well with a marked unconformity on the reflection profiles. The unconformity is often angular and is widespread on the Plateau. The lowest acoustic unit is a well stratified, structurally disturbed sequence which pinches out against basement highs, whose tops have been levelled by erosion. The lower unit represents the products of erosion of the basement highs and correlates with the basal rock unit in DSDP 209.

The geological history of the Coral Sea Plateau can be deduced from the distribution through time of the different litho-acoustic units. The history may be divided into three major episodes:

1) Uplift of the basement, erosion of basement highs, and deposition of the erosion products in shallow water. Uplift probably occurred in Upper Cretaceous and erosion continued through to and including middle Eocene.

2) Differential, orogenic subsidence, in which the outer edge of the Plateau subsided with respect to the inner. The shallow-water sequence was faulted, and, as terrigenous source areas diminished, a hemipelagic sequence developed. This occurred during upper Eocene and Oligocene.

3) Uniform, epeirogenic subsidence; source areas were lost and wholly pelagic sediment blanketed the Plateau. This occurred from Miocene onwards. The graben-troughs which form the western and southern margins of the Plateau probably formed between episodes 2 and 3.

With the stages in the evolution of the Coral Sea Plateau defined it is now possible to relate these to the evolution of the Coral Sea Basin. DSDP 210 drilled in the Basin gave the age of formation of oceanic crust as early Eocene. Thus a temporal relation between basin and plateau evolution can be defined and is shown schematically in Figure 1(a). The time scale is drawn zero at continental breakup. The inter-relation of tectonic events consists of plateau uplift and stabilization, followed by breakup and ocean basin genesis, followed by the two stages of plateau subsidence defined above. In Figure 1(b) this scheme is compared with the evolution of an Atlantic type continental margin as envisaged by Falvey (1974). The same time scale is employed so that a direct comparison can be made.

Major differences exist between the two models. The general Atlantic model is characterized by a protracted rift valley stage which develops from about 40 m.y. before breakup, and the sequence of tectonic events progresses from uplift (arching), to subsidence (collapse), and then breakup. In the Coral Sea model the rift valley stage is absent and the sequence from subsidence to breakup is reversed compared with the general Atlantic model. Although Falvey's model was not intended to define precisely the evolution of all Atlantic type margins, the significant differences observed may imply that the Coral Sea Basin is not of the general Atlantic type.

Karig (1971) classified the Coral Sea Basin as a Western Pacific 'marginal' basin. Such basins evolve by accretion of oceanic crust behind an island-arc trench system. If his model applied to the Coral Sea Basin, a south-dipping subduction zone should have been present in the position now occupied by eastern Papua and the Louisiade Archipelago at the time of basin formation in upper Paleocene and early Eocene. There is no geological evidence for such a subduction zone, and hence Karig's model may be discounted. The Coral Sea Basin must therefore be of a modified Atlantic type.

The absence of a rift valley stage may be explained by invoking rapid basin evolution; so rapid that the characteristic rift valley sediments would not have time to develop. Before this, a protracted uplift stage would occur. To explain this it is necessary to postulate a warm thermal anomaly, or more likely a hotter anomaly located some distance from the Coral Sea Basin. This thermal anomaly must have been capable of causing uplift of the crust without inducing metamorphism at its base. If the influence of this anomaly was later replaced by an intense but short-lived anomaly located in the Coral Sea Basin and associated with its opening, then the observed evolutionary scheme presents no difficulties. Subsidence of the Plateau will follow basin evolution as the intense anomaly would promote thermal metamorphism and crustal subsidence (Falvey, 1974). Lithospheric cooling and contraction in the basin after spreading ceases would heighten this effect.

Thus the continental margin of northern Queensland appears to have formed by a modified type of Atlantic margin development, the key to which is rapid evolution following some time after the action of a remote thermal anomaly located outside the Coral Sea Basin.

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DEPOSITIONAL AND TECTONIC PATTERNS IN THE NORTHERN LORD HOWE RISE – MELLISH RISE AREA

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Seismic profiling carried out by the Australian Bureau of Mineral Resources, the Deep Sea Drilling Project and Scripps Institution of Oceanography has provided data for the interpretation of the sedimentary and tectonic history of the area bounded by the Australian continent and the Tasman and Coral Seas, and extending eastwards towards New Caledonia.

The regional bathymetry reveals two dominant physiographic trends. The Australian margin, Tasman Basin, Cato Trough, Dampier Ridge, Middleton Basin, Lord Howe Rise and New Caledonia Basin all trend in a northerly or west of north direction. The western New Hebrides Basin, the broken ridge named the Rennel or Mellish Fracture Zone, and the faulted depression named the Louisiade Fracture Zone (Landmesser *et al,* 1975), in the northern part of the region, all trend in a northeast-southwest direction.

Nature of the Crust

The crustal structure of a number of these features has been established by previous workers (Ewing *et al* 1970, Shor *et al* 1971, Woodward and Hunt 1971). The Coral Sea, Tasman Sea and New Caledonia Basins are accepted as having crust of oceanic origin. The Queensland Plateau and Lord Howe Rise are considered to be continental.

The Cato Trough is rift bounded and has a basement deeper than 4.5 km, and is thus interpreted as being oceanic in origin. Interpretation of the structure of the Middleton Basin is complicated by the presence of volcanic highs in its eastern half)including Capel and Kelso Banks), but deep basement (4.5 km) has led to its interpretation as also being oceanic crust.

The Dampier Ridge has previously been considered as being volcanic, but more recently Ringis (1972) has suggested a continental origin. Profiles across the northern Dampier Ridge and its northern extension, herein named the Kenn Plateau, show a sedimentary sequence above basement which is identified as corresponding to a rift valley stage of sedimentation (as described by Falvey, 1974). This sequence is terminated by a pronounced angular unconformity identified as a break-up unconformity. Overlying this are more horizontal sediments. It is thus considered that the Dampier Ridge developed as a marginal plateau with rifting occurring initially to the east with the formation of the Middleton Basin, and later to the west with crustal generation in the north Tasman Basin and Cato Trough. Ringis (1972) in his analysis of Tasman Sea opening suggests a jump of the spreading axis from the Middleton Basin to the north Tasman Basin at around Anomaly 29 time.

This interpretation is complicated by the presence of many intrustions and possibly a large volume of extruded material. The original continental mass of the Dampier Ridge has been enlarged to the present size and shape by these

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