

SEDIMENT REDISTRIBUTION ON THE GREAT BARRIER REEF SHELF  
BY CYCLONE WINIFRED

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Severe tropical cyclone Winifred traversed the Great Barrier Reef shelf between Cairns and Tully on February 1, 1986. Pre-cyclone studies had outlined the shelf bedforms and terrigenous-carbonate facies patterns between the coast and the inner shelf of the reef tract. Re-surveys commencing four days after Winifred demonstrated the following data:

Large areas of the inner shelf were bathed in surficial muddy river plumes, some of which reached 30 km seaward to the inner edge of the Reef tract. Suspended material was present throughout the shelf water column. In mid-shelf areas (water depths greater than 20 m), the particulate content increased towards the seafloor, to a maximum concentration of 6 milligrams per litre.

A seaward-thinning mud drape, generally 10 to 100 mm thick, was present on the inner and middle shelf. Commonly, a normally graded, medium sand to silt layer occurred at the base of this mud drape. Elsewhere, particularly on the middle shelf, a medium to coarse shelly or quartzose lag was present, either at the surface or under a mud drape a few millimetres thick.

Off-reef and shoreward transport and deposition of skeletal debris and carbonate fines took place from the inner edge of the Reef tract during and after the cyclone.

The mud drape incorporates material from three sources, in varying proportions across the shelf. The sources are; new river influx, resuspended bottom sediment and, material derived from nearby reefs.

Longitudinal bedforms were widespread on the middle shelf at water depths of 28 to 35 m, and form a furrowed substrate of linear convex ridges, approximately 1 m high and 40 to 150 m wide, separated by narrow V-shaped depressions. The ridges consist of terrigenous and biogenic muddy sand and gravel, overlying a mottled pleistocene clay.

Northward facing 1.2 to 2 m wavelength megaripples occur in the furrows between the ridges; megaripples also occur in extensive fields outside zones of ridges.

Well-sorted quartzose/bioclastic sand less than 10 mm thick occurs on top of some convex ridges, probably representing sand ribbons developed in sympathy with the underlying ridge topography.

It is inferred that storm-waves associated with the passage of cyclone Winifred caused widespread unmixing of bottom sediments. On the middle shelf, long-shelf transport of bedload sand ribbons and megaripples was effected by powerful northward-flowing bottom currents. Wind-forced downwelling may have resulted in offshore water flow along the seafloor, depositing the graded bed. As the storm decayed, a widespread mud drape began to accumulate. Bioturbation had started within a few days, was well advanced after three months, and is expected to homogenise the thin sedimentary units produced by the cyclone.