

THE GRAVITY FIELD OF TOPOGRAPHY BURIED BY SEDIMENTS

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The gravity field of the continents is constantly changing because of mass redistribution associated with erosion and sedimentation. To understand just the effect of sedimentation on the continental gravity field, we investigated the gravity field over topography in the Northern Indian Ocean that was completely buried by sediments of the Bengal Fan.

An isopach map made from the seismic reflection and refraction in the Bay of Bengal shows two prominent N-S trending features in the basement topography. One is the northernmost portion of the Ninetyeast Ridge which is totally buried by sediments north of 10°N . The other buried ridge trends roughly N-S for 1400 km at 85°E to the latitude of Sri Lanka and then curves toward the west. It has basement relief up to 6 km. Two free-air gravity anomaly profiles across the region show a strong gravity low (~ -60 mGal) over the 85°E Ridge, while the Ninetyeast Ridge shows a gravity high.

To interpret the negative free-air gravity anomaly over the 85° ridge, we model the lithosphere as a thin elastic plate and calculate its flexural and gravitational response to an uneven sediment load. A plausible formation history for a buried ridge consists of at least two major episodes. The first is the formation of the ridge on a lithosphere with a flexural rigidity of D_1 . At some later time the ridge is buried by an influx of sediments, the lithosphere is cooler, and the flexural rigidity has increased to D_2 . The character of the gravity field depends primarily upon the initial and final values of flexural rigidity. These D_1 and D_2 values are varied to obtain good agreement between the model and observed gravity anomalies. Best fitting models have a 180 times increase in flexural rigidity between ridge formation and sediment burial. An approximate relationship between flexural rigidity and crustal age shows that the 85°E Ridge was formed on relatively young lithosphere, 5-15 m.y. old and that it was buried when the lithosphere was 40-80 m.y. old.