THE ANNUAL-TIDE TIDAL FLAT NEAR BOCA CHICA, TEXAS

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POSTER SESSION ABSTRACT

The south end of Laguna Madre, near Boca Chica, east of Brownsville, Texas, is in good part a tidal flat. Many islands stand above it: (1) lomas (lunettes; hills), rising to 7 – 10 m, with an eolian non-dune origin, (2) beach ridge plains, with a maximum elevation of 1.5 m; the ridges were built by storm surge (wind set-up) from the lagoon, not by swash or Gulf of Mexico waves.

The tidal flat is covered by saline lagoon waters for much of the fall, winter, and spring. The rest of the year, much of it is dry. This cycle involves a change in water elevation up to 2 – 3 m, between summer (low) level and severe storm tides.

Sediment from the lagoon is raising the surface of the tidal flat: (1) areas formerly mapped as water now are dry; (2) grain size parameters from the beach ridge plains show clear evidence of significant shoaling; (3) eolian dust collects quickly and visibly on cars and other objects.

The main mechanism of sediment transport onto the tidal flat is Postma's "settling lag" hydrodynamic effect. This works best with a strong north wind, driving a wedge of lagoon water onto the tidal flat, raising the water level markedly, building local waves, and providing for sedimentation (fall-out from the wedge) in areas that are dry during the summer.

Trenches reveal distinctive bedding: horizontal, with poorly-defined discontinuous bedding "planes" extending laterally only tens of centimeters. The lack of lateral continuity is due to: (1) bioturbation by animals (e.g., crabs, worms), (2) bioturbation by roots under patches of salt-tolerant plants (e.g., Salicornia), (3) algal and halite crystal networks, (4) hydrodynamic effects, including wave work, baffling effect of plants, wind work, and Langmuir cell work (wind-driven spiral flow), (5) uneven settling.

Wave-type ripple marks on the sediment surface require some wave activity, and small waves have been observed. However, they are local, have fetch values of only a few kilometers, typically have wave heights of only a few centimeters, and do not produce swash. Hence this is a low-to-zero energy tidal flat, except during storms. Ripple marks were not seen in trench walls, and were rare on the modern surface.

This may be the modern analog for certain ancient examples, which until now have been difficult to interpret.

The significance of this work is as follows:

1) Annual-tide effects have been described.

2) Distinctive bedding (horizontal, discontinuous, poorly defined) has been described.

3) This may be the key to interpreting several ancient rock units which do not match other environments of deposition.

4) An example of Postma's settling lag effect, which creates small features and contributes to shoaling, has been described.

5) Evidence for the work of wind-driven Langmuir cells in water only tens of centimeters deep has been listed.

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