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Depths, paleodepths and the percentage of foraminiferal assemblages comprising planktonics in Trinidad

Brent Wilson

Petroleum Geoscience Programme, The University of the West Indies, St. Augustine, Trinidad and Tobago, West Indies - bwilson@eng.uwi.tt

The modern shelf sea around Trinidad is impacted by freshwater outflow from the Amazon, Essequibo and Orinoco rivers, which collectively deliver >20% of the global freshwater input to world's oceans. This outflow, which commenced during late Miocene times, lowers salinities around Trinidad relative to normal seawater, creating a surface layer 50 m deep with a salinity of <33.5 ppt, and induces high phytoplankton primary productivity. This has been found to impact on Recent benthonic foraminiferal diversities on the inner to middle shelf (1-100 m), which are low relative to assemblages at the same depths in oceans of normal marine salinities. However, there have not yet been any studies of the Recent around Trinidad examining relationships between depth (*D*) and the percentage of the total foraminiferal assemblage comprising planktonics (*P*), although this would aid greatly in determining paleodepths in and, by extension, the sequence stratigraphy of the Neogene on the island.

Linear regression applied to a data set of 27 Recent sediment samples from depths 1-102m around Trinidad indicates that:

$$D = 19.7 + 1.34P \ (r = 0.854, p < .0001) \qquad (1)$$

This expression, for which 95% confidence intervals are computed, is applied to 36 samples from a 266 m section of the late Miocene San José Calcareous Silt (Manzanilla Formation, *Globorotalia acostaensis* Zone) of NE Trinidad. Previous clustering of these samples using benthonic foraminifera has indicated that they were deposited in six different biofacies. Planktonic foraminifera were recovered from five of these; the single sample representing the sixth biofacies contained *Haplophragmoides wilberti* only and did not yield planktonics. Modern *Haplophragmoides wilberti* live among supratidal mangrove swamps. Of the remaining biofacies:

- Biofacies 1, dominated by *Amphistegina gibbosa*, comprises 1 sample only, for which $P = 0.9\%$, corresponding to $D = 2$ m (95% confidence limits, 0 – 37 m)

- Biofacies 2 comprises 1 sample only, dominated by *Ammonia beccarii*, for which $P = 3.4\%$, corresponding to $D = 24$ m (4 – 40 m)
- Biofacies 3, dominated by *Textularia* sp. A, comprises 3 samples for which the mean $P = 6.1\%$ (standard deviation = 3.7%) corresponds to a mean $D = 28$ m (95% confidence limits on the mean, 8 – 44m)
- Biofacies 4 is dominated by *Hanzawaia carstensi* and comprises 17 samples. These were deposited in two packages that, comprising the upper and lower parts of the sequence, enclose Biofacies 5. For Biofacies 4 the mean $P = 9.7\%$ (maximum = 28.6%, minimum = 1.5%, standard deviation = 8.6%), corresponding to a mean depth of $D = 32$ m (95% confidence limits on the mean, 10 – 50 m)
- Biofacies 5 comprises 10 samples in the middle part of the sequence in which the fauna is dominated by *Pseudononion atlanticum* with subdominant *Elphidium translucens.* For this biofacies the mean P is 17.5% (maximum 32.9%, minimum 7.4%, SD = 8.9%) corresponding to a mean depth of $D = 42$ m (95% confidence limits on the mean, 26 – 62 m)

Student's *t*-test indicates that there is no significant difference in the mean D for Biofacies 3 and 4, but that the mean D in Biofacies 5 exceeds that in Biofacies 3 and 4. From this it is concluded that the sequence was deposited in middle neritic and shallower water, but that water depths varied over time. Despite wide variations in the values of P within biofacies, it appears that samples from Biofacies 5, from the middle of the sequence, were deposited during a sea-level highstand. In contrast those from Biofacies 4, the two packages of which sandwich Biofacies 5, were deposited during relative lowstands. The remaining biofacies, including that with *Haplophragmoides wilberti*, are intimately allied with those parts of the sequence deposited in the shallower-water Biofacies 4, and indicate times of shallowest water and riverine influence.

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