ENVIRONMENTAL CHANGES IN THE SOUTHERN CARIBBEAN ASSOCIATED WITH CLOSURE OF THE PANAMANIAN ISTHMUS: A COMPARISON OF STABLE ISOTOPE DATA FROM BIVALVES AND FORAMINIFERA

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Closure of the Panamanian Isthmus approximately 3.5 Ma must have resulted in major oceanographic changes in Caribbean shallow water environments. We are investigating these changes by analyzing the stable isotopic composition of foraminifera and bivalves. The two types of data should be complimentary, in that foraminifera can be analyzed from many successive horizons in a stratigraphic section and both benthic and planktic environments can be sampled, whereas a bivalve shell records a sequence of seasonal changes over one to several years.

We have analyzed samples from three Caribbean Tertiary basins: the Limon Basin (eastern Costa Rica), the Bocas del Toro Basin (northwestern Panama) and the Panama Canal Basin (north central Panama). Geologic sections range in age from approximately 8 Ma to approximately 1.5 Ma; paleodepth of the samples ranges from 20m-300m.

Bivalve stable isotope profiles from the Late Miocene exhibit somewhat greater within-shell $\partial^{18}O$ ranges than are typical today for the southern Caribbean, indicating a difference in seasonal temperature and salinity patterns prior to closure. Bivalve samples from approximately 3.5 Ma and younger exhibit $\partial^{18}O$ ranges increasingly typical of modern specimens. Between approximately 3.5 Ma and 2.0 Ma, however, specimens from the Limon Basin exhibit consistently greater within-shell $\partial^{18}O$ ranges than do those of the Bocas del Toro Basin. This suggests differing environmental conditions, probably differing seasonality regimes, in these two basins.

The $\partial^{18}O$ values of planktic foraminifera record a general warming from approximately 8 Ma to 2.5 Ma. Preliminary paleotemperature estimates from benthic species within particular depth ranges seem to record a similar pattern. The pattern of $\partial^{13}C$ - $\partial^{18}O$ contrasts through the Mio-Pliocene suggests that upwelling increased in intensity around the time of closure, and then decreased by 2.5 Ma. Foraminiferal stable isotope data do not exhibit consistent differences between the Bocas del Toro and Limon Basins.

The environmental patterns detected with bivalves and foraminifera reflect the differing strengths of these two taxa in paleoenvironmental analysis. Foraminifera are well-suited to recording overall trends, but bivalve seasonality data provide important and otherwise unrecorded information.