



Reconstruction of Mayan induced soil erosion during the Pre-Classic and Classic period from world's largest beach ridge plain.

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Hypothesis: Deforestation and periods of intensive land use in the watershed accelerated soil erosion and increased sediment supply to inland lakes and depressions. In the hinterland eroded soil forms marked beds of so called 'Maya Clay' in many lake records. We hypothesise that human induced soil erosion also resulted in large supply of sandy sediment to the rivers and contributed to the development of the extensive beach ridge plain at the Gulf of Mexico coast.

Millennial - Centennial time-scale

We use the beach ridge progradation rate as a proxy-measure of received sediment fluxes. Progradation rates are transformed to accumulation rates using the 3D geometry of the beach ridges to account for the effects of changes in accommodation space.

A large promontory was formed between ~2500 BC and AD 1050 when the San Pedro y San Pablo was the main river outlet of the Usumacinta drainage basin.

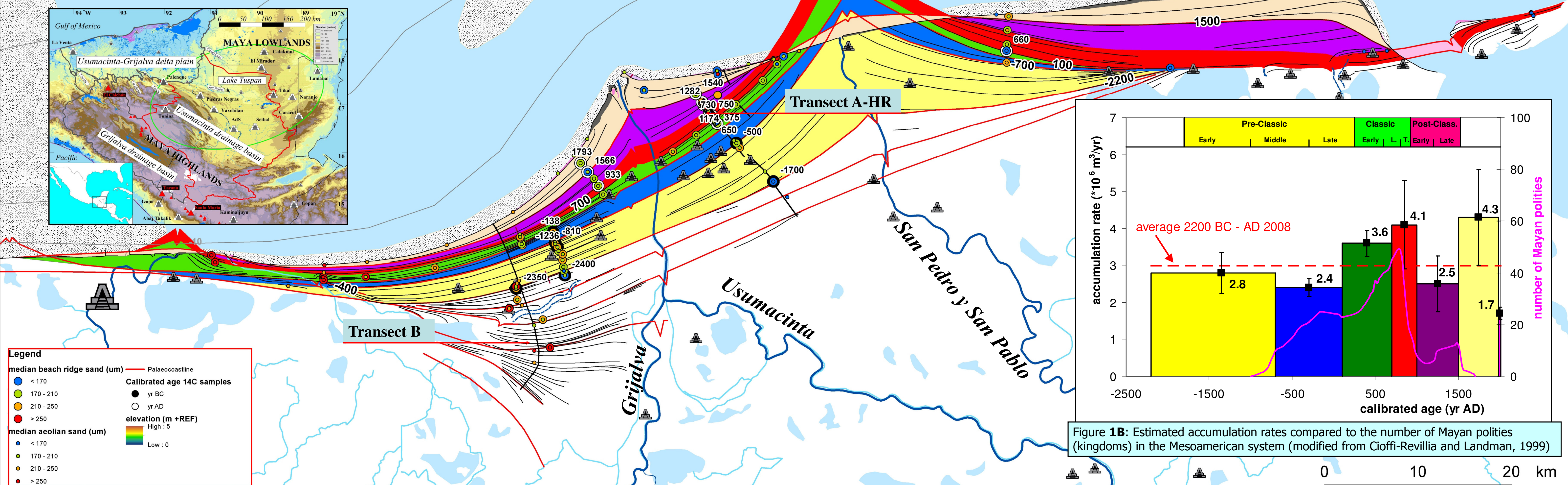


Figure 1A: Location map of the study site. The last 4200 years of beach ridge formation is divided into seven periods. For each period the accumulation rate has been estimated (see figure 1B).

Centennial - Decennial time-scale

We are currently investigating a 3 km long section of transect A, covering the Classic period. The section has been sampled at very high resolution and a detailed age-distance model is under construction based on AMS dated leaf fragments found in organic debris layers and supported by Ground Penetrating Radar measurements that reveal the internal architecture of the beach ridges. To determine the provenance of the sand, grain size and heavy mineral analyses are carried out on selected samples. End member modeling is used to 'unmix' the samples and to define the composition and relative abundance of the individual sediment populations.

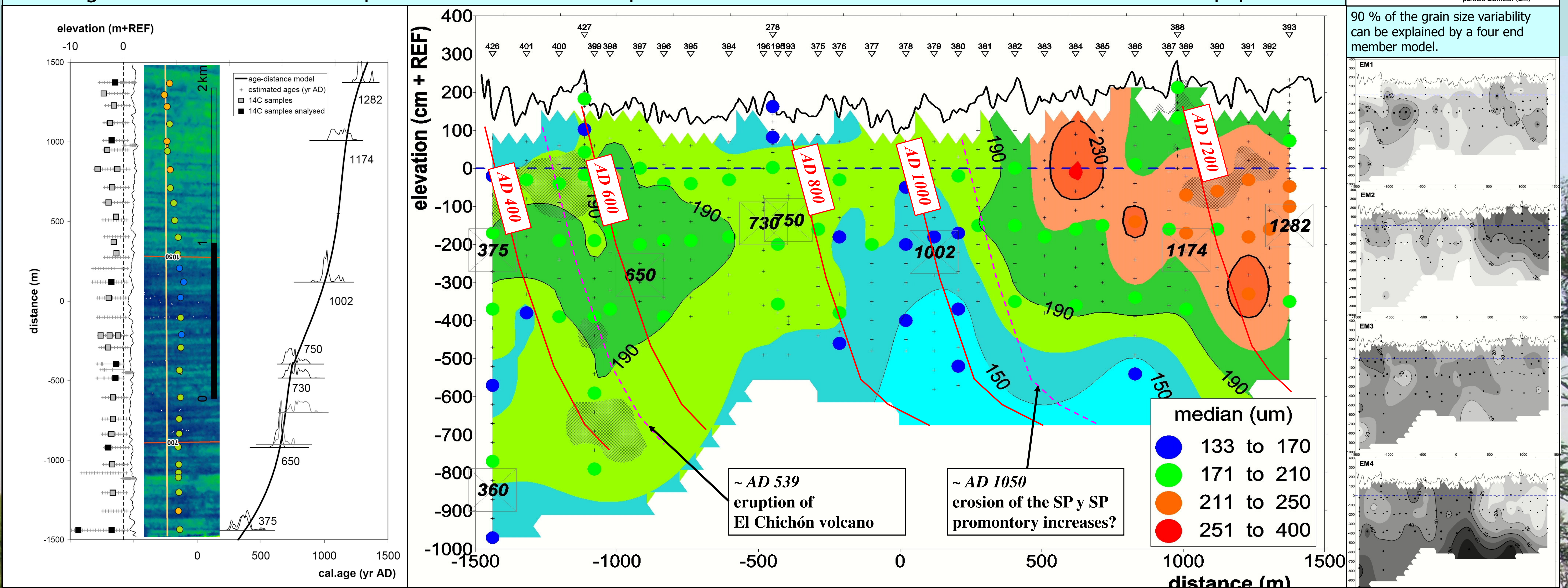


Figure 2: Age distance model for Transect A-HR.

Figure 3: Cross section of transect A-HR. Notice clear trends in grain sizes, like the coarsening upward trend. The hatched areas indicate samples with elevated concentrations of magnetite.

Results

- Very high accumulation rates (average 3 million m³/yr) compared to other large beach ridge systems (0.1 - 1.7 million m³/yr);
- no significant differences in rates between the Pre-Classic, Classic and Post-Classic period;
- no clear indications for human induced sediment supply to the beach ridge system during the Pre-Classic and Classic period;
- beach ridge sands are dominated by volcanoclastic sediments;
- high progradation rates occurred after volcanic eruptions of El Chichón volcano and during erosion of the SP y SP promontory.

Conclusion

The data so far is not supporting our hypothesis.