Sea Level reconstructions from thick mangrove peat deposits in Florida, Belize and Panama – age and paleo elevations of basal peats vs. continuous sampling, and relationship to geophysical sea level models

OR,

How can we develop better Paleo SL Reconstructions and past rates of Sea Level Rise to predict mangrove survival into the future?

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Geological sea level reconstruction

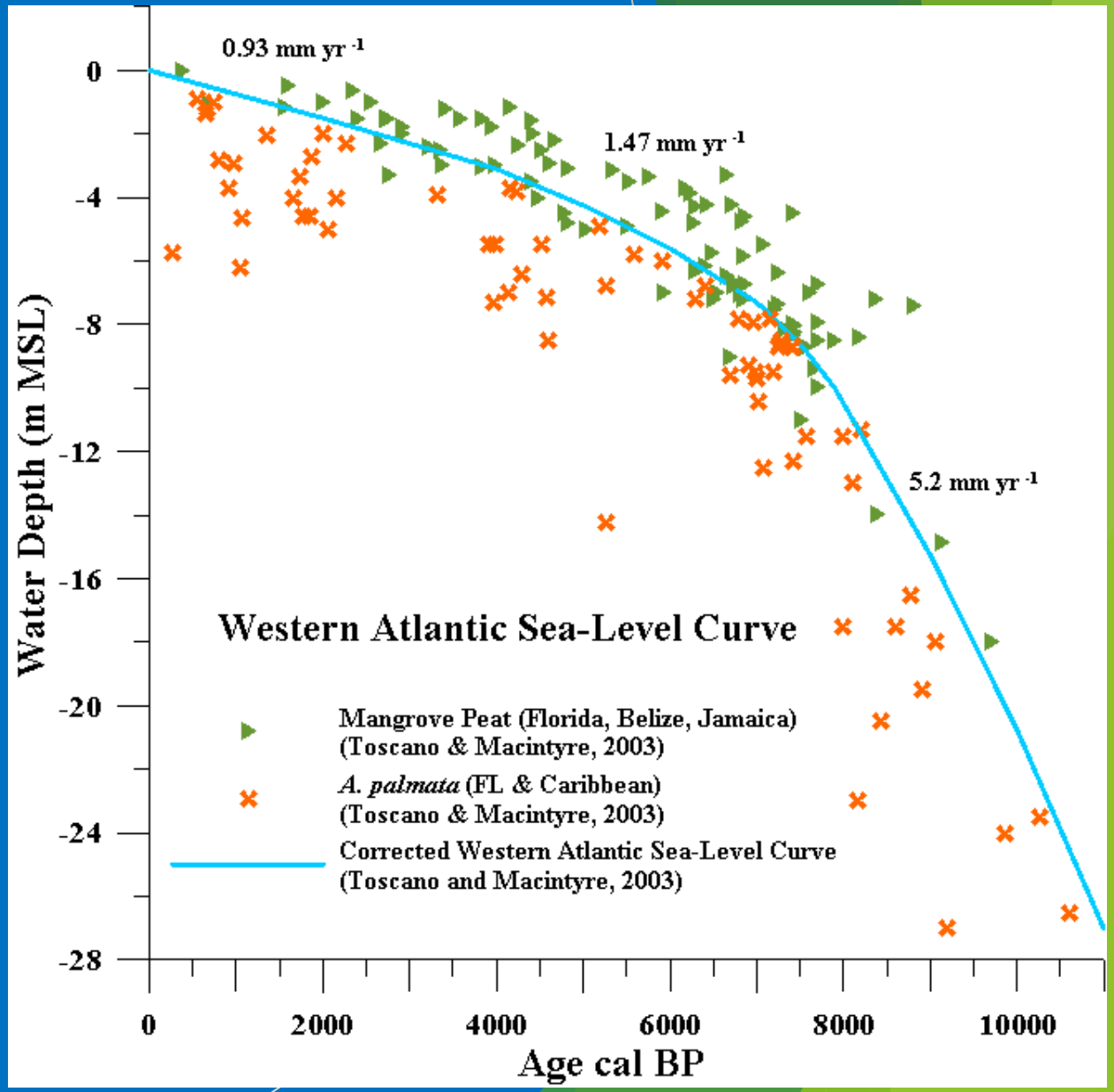
Datable Proxies with reliable relationships to sea level/tide range, forming long geologic records with SLR:

- Coral (reef crest *Acropora palmata*, *-1 to -5 m)*
- Intertidal peat (*R. mangle*, < 0.5 m range)

- Challenges and Assumptions:
  - Radiometric dating accuracy
  - Samples retrieved *in situ*, not transported or vertically displaced
  - Proxies' elevation ranges/errors can be tightly constrained
  - Lack of active/observed tectonics = vertical stability over time
  - If all of the above, the proxies' age/depths dictate the placement of the SL curve, *right?*

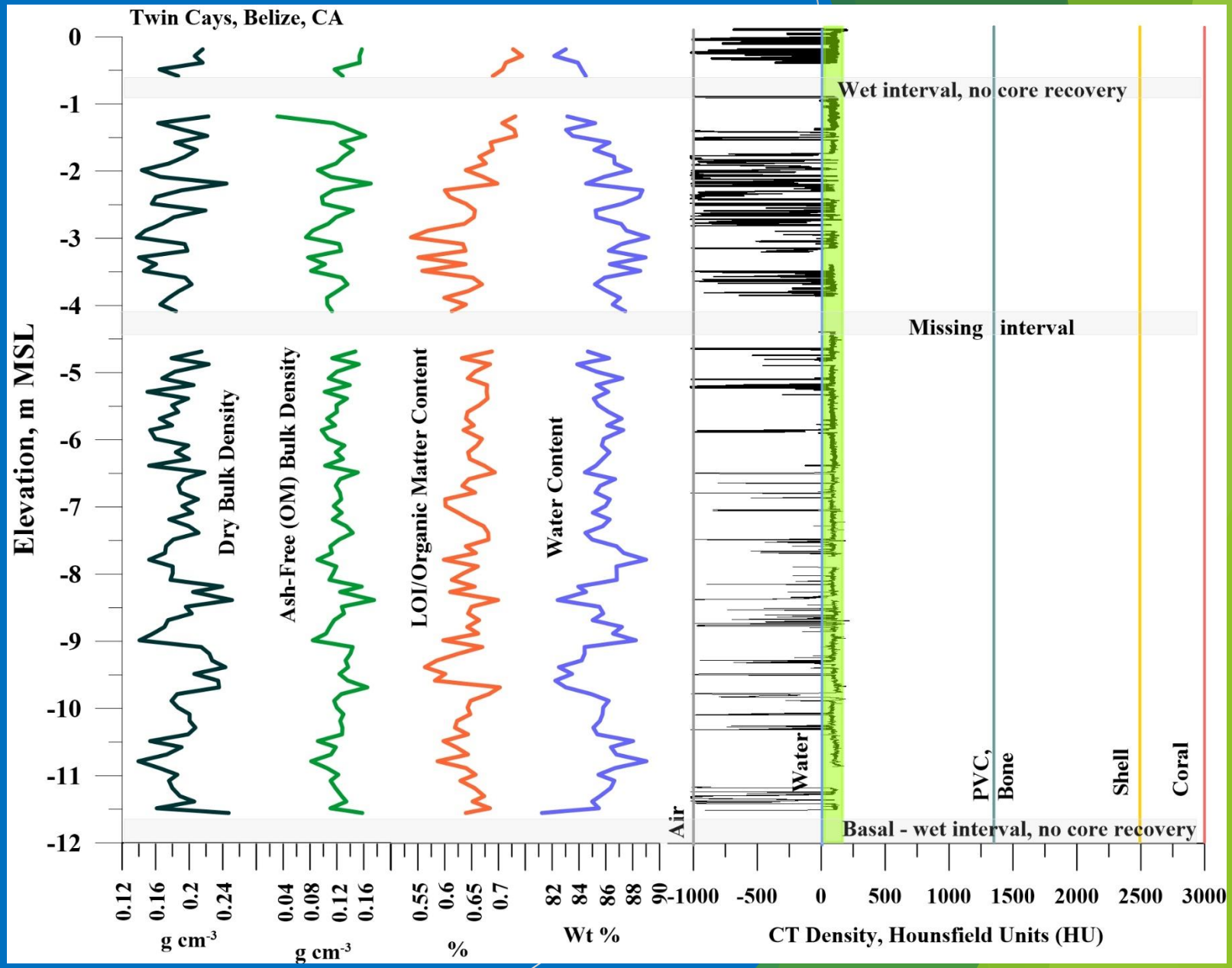
Geological sea level reconstruction

- Mangrove work in Belize, Florida and Jamaica proved that peat keeps pace with SLR over millennia.
- BUT: Intertidal (microtidal) peats showed up to 4 m of elevation range at any time. Coral data seemed more reliable, so mangrove record was not utilized in placing this curve.
- How do we narrow the spread of peat data? What are the problems?
- Is SL Curve placement based on geologic data accurate, objective or informative?



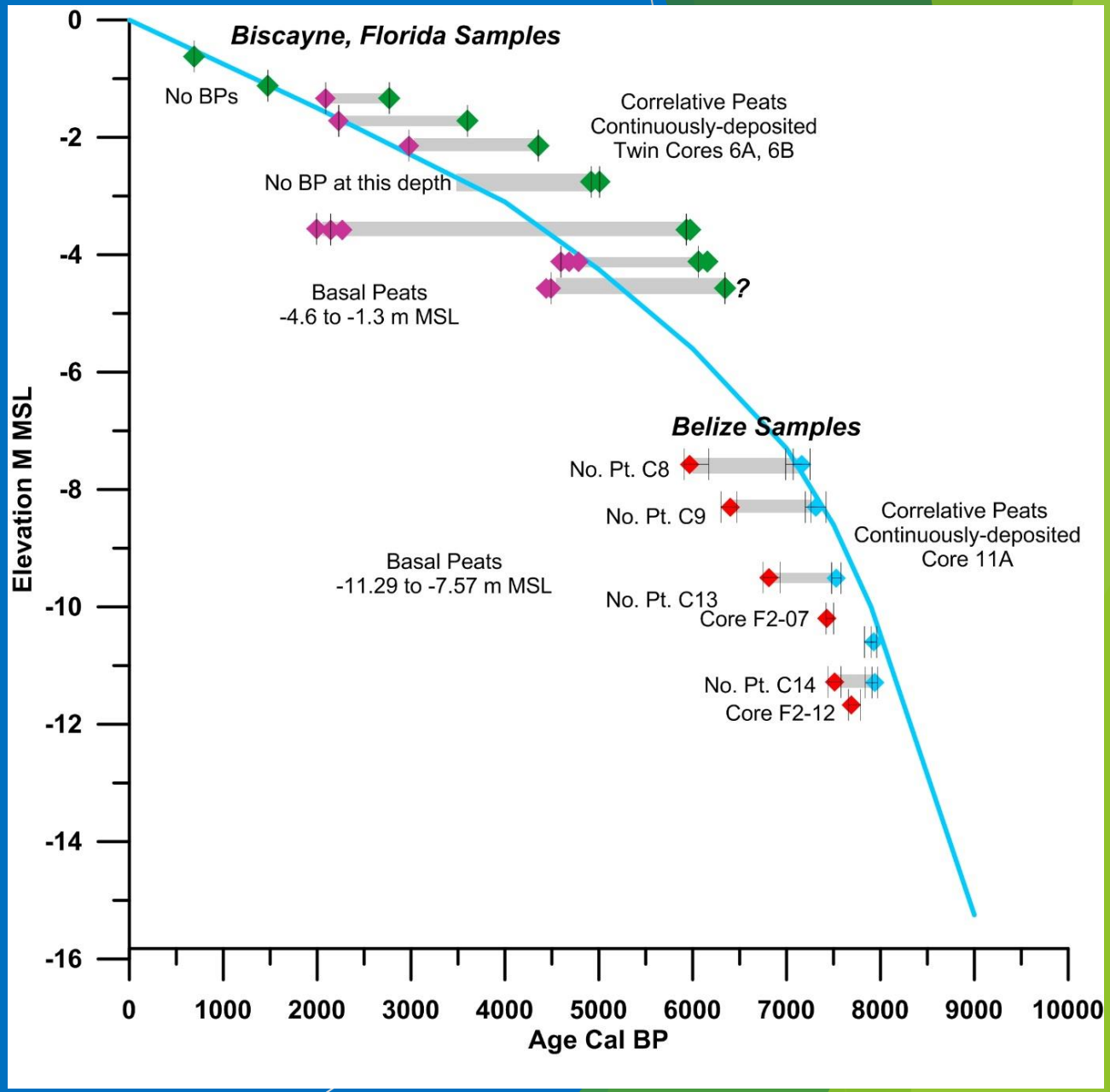
DISCOVERIES- GEOLOGICAL SEA LEVEL RECONSTRUCTION

- Sea level researchers assume basal peats are un-compacted so give more accurate paleo SL elevations than peat higher in the section.
- BUT, thick peats keep pace with SLR so must contain virtually the full record of SLR at any site - a waste not to use it!
- Quantitative Computed Tomography (CT) densities through *R. mangle* peat cores (Poster 74) documents no increase in density down core and the presence of voids throughout, thus *no compaction* of peat sections, even up to 12 m. Bulk peat analysis confirms no increasing trend in bulk densities and no decreasing trend in water content with depth in core, with identical values/ranges regardless of peat depth or location.



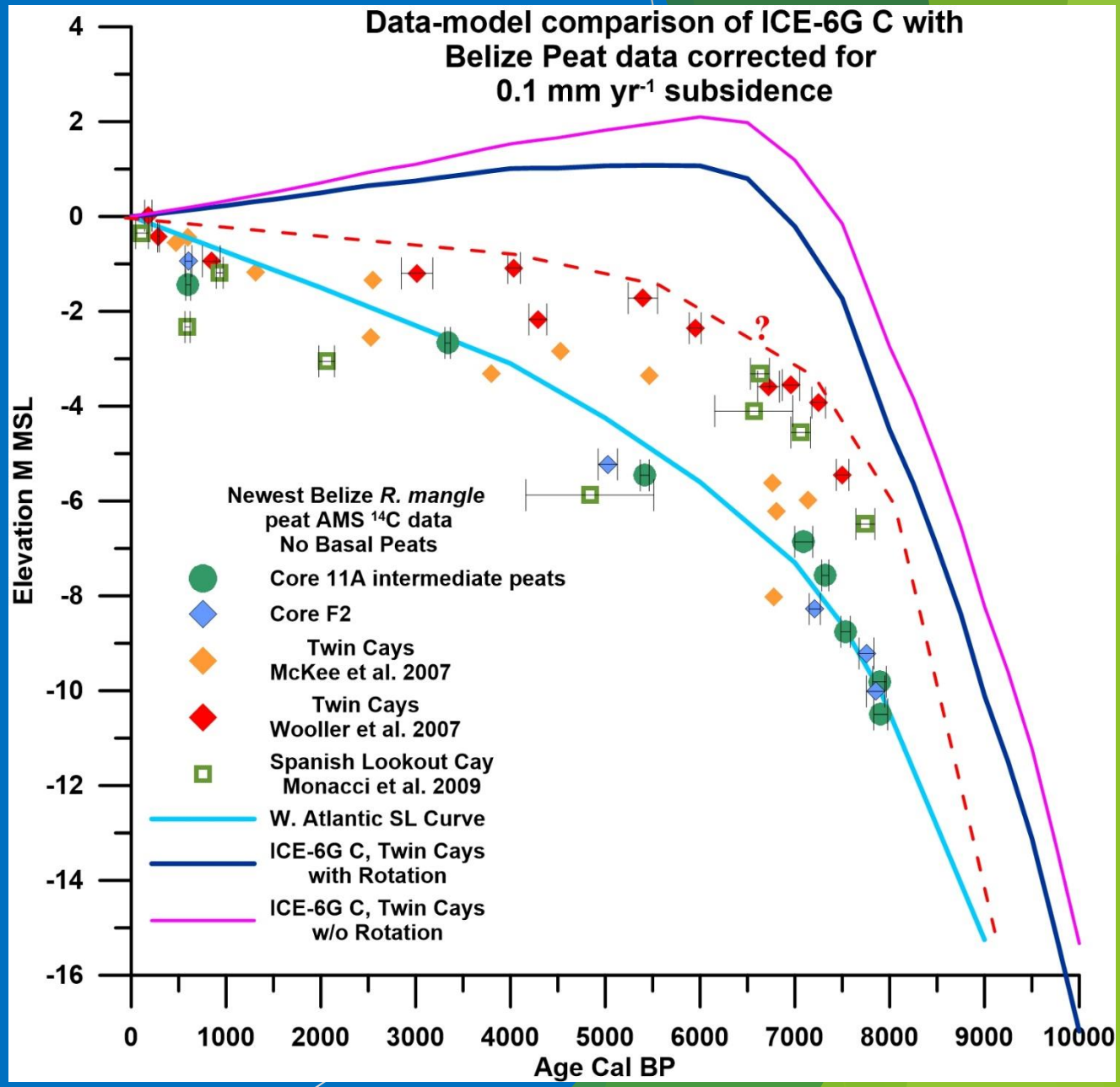
DISCOVERIES- GEOLOGICAL SEA LEVEL RECONSTRUCTION

- Comparison of ages of basal vs. intermediate peat samples at the same elevations shows *significant basal lag* at 2 sites!
- Peat-forming environments require centuries to become established on carbonate bedrock (see photo below of modern *R. mangle* on limestone).
- *Basal Peats do not record sea level accurately! Curve will be too low, too late.*



WORK IN PROGRESS- GEOLOGICAL SEA LEVEL RECONSTRUCTION

- Geophysical models might provide objective criteria for evaluating high quality geologic data.
- Misfits between model levels and intertidal peat still need to be reconciled and corrected (e.g. subsidence).
- Negative rates of SLR over past 6 kyrs are suggested by these models. Have mangroves been accumulating only in response to local subsidence?
- Predicting sustainability of mangroves under accelerating SLR will depend on model adjustments and better constraining paleo ages and sample elevations to reproduce actual rates of peat accumulation.



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