There's a Sand Layer in my Peat!

Back Barrier Salt Marshes as a Geological Archive of Storm Activity

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Farmers in the Marsh

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- Study Area – Ogunquit River Estuary in Wells, ME
- Do remnant agricultural embankments have a sedimentary signature?

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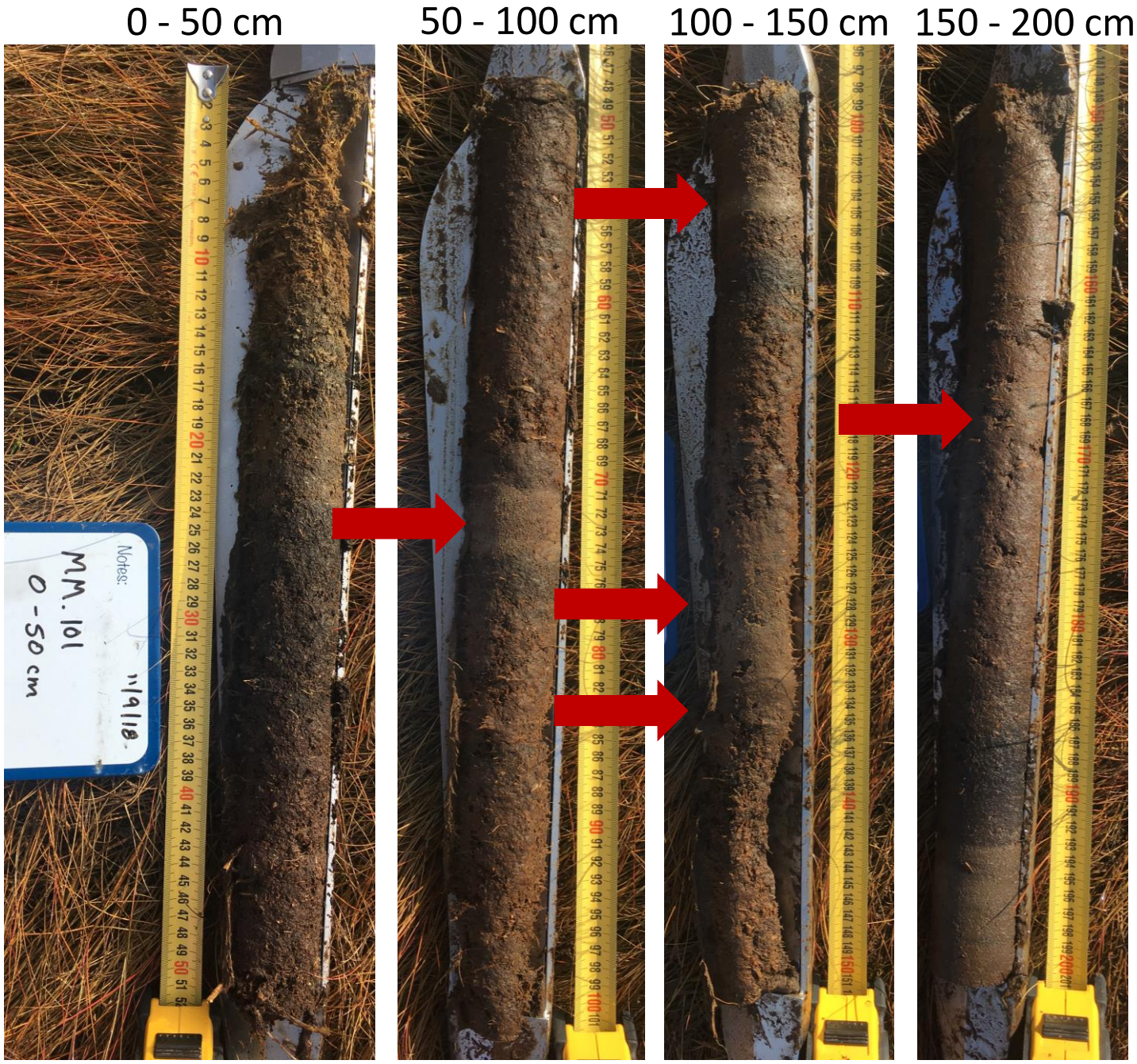
- Do remnant agricultural embankments have a sedimentary signature?
- Possibly!

Storm Deposits

- Core 101 – North of Moody Embankment
- 5 sand layers

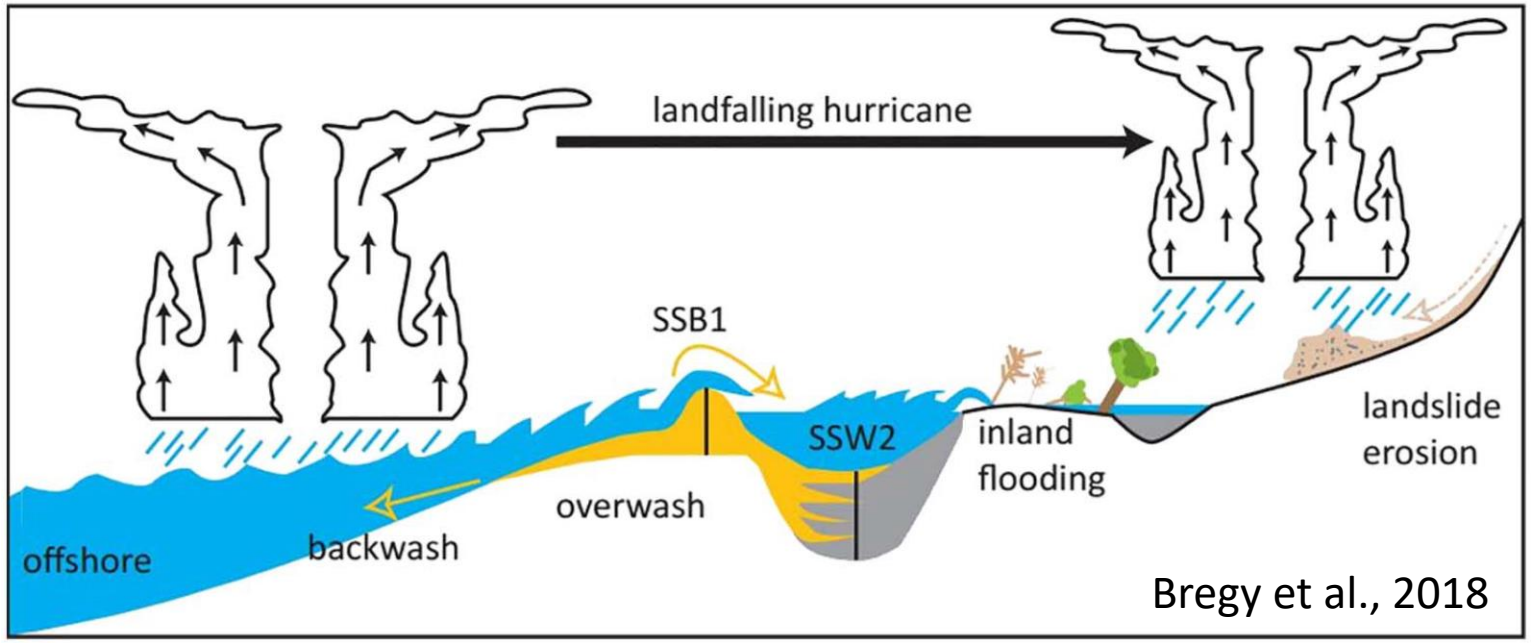


Storm Deposits

- Core 102 – South of Moody embankment
- 16 sand layers

Paleotempestology

- The study of past storm activity through geological proxies
- Why is this important?
  - Increased intensity/frequency of extreme storm events and relative sea-level rise trends



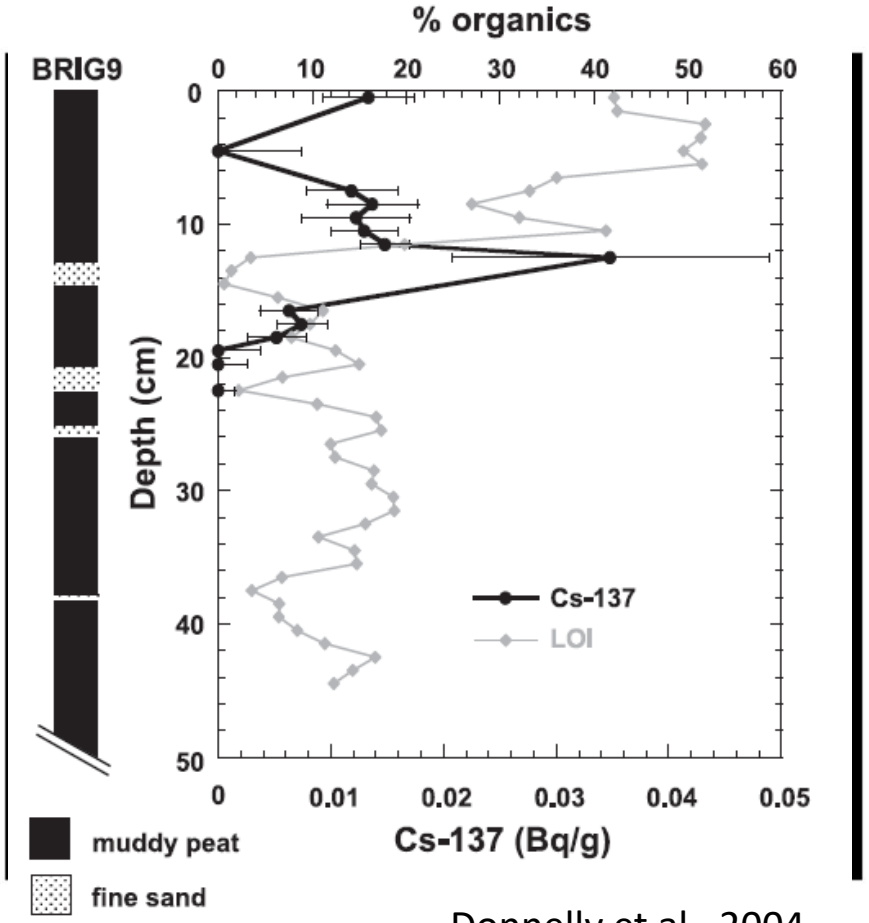
Bregy et al., 2018

Paleotempestology

- The study of past storm activity through geological proxies
- Why is this important?
  - Increased intensity/frequency of extreme storm events and relative sea-level rise trends
- What do we gain?
  - An extended record of intense storms
  - Assessment of hurricane/nor’easter risks and recurrence intervals
  - A better understanding of drivers of intense storm variability

Modern Analogues

- Sediment grain size – sediment transport and deposition
- Sediment organic content
- Microfossil species and condition (Kosciuch et al., 2018)
  - Sediment origin and distance of transport



Donnelly et al., 2004

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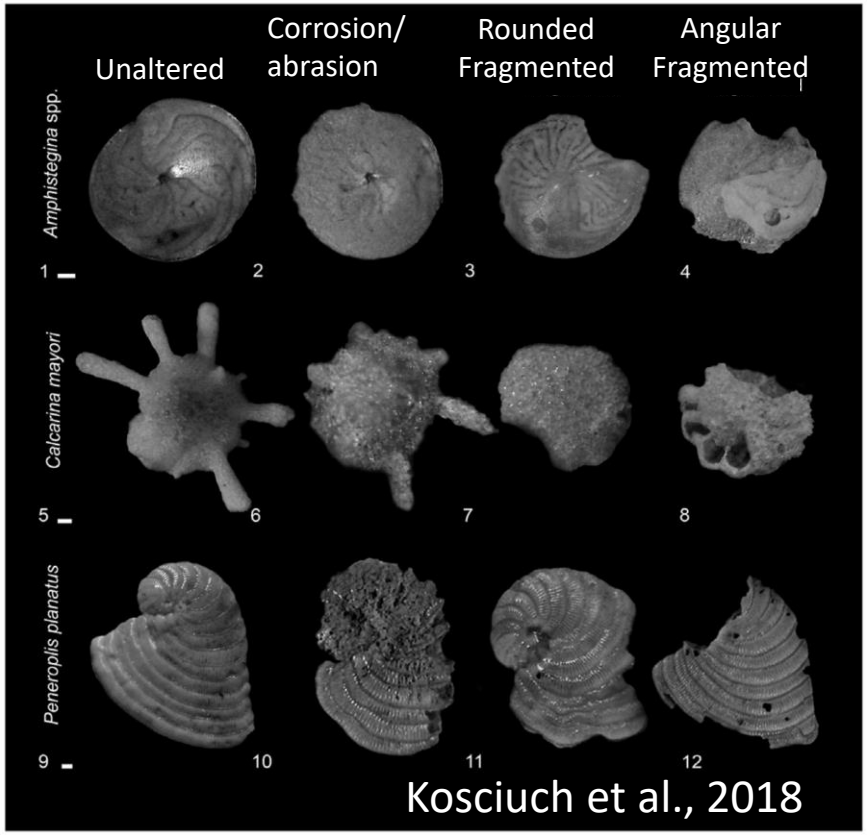
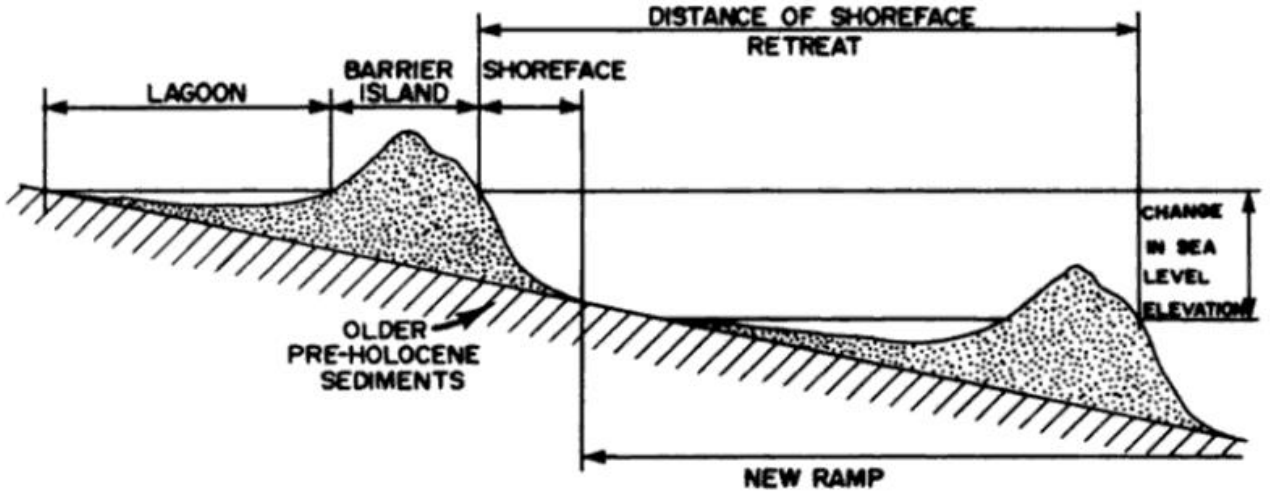


Kosciuch et al., 2018

Complications and Limitations

- Barrier height changes
- Changes in sensitivity to inundation
  - RSL rise
  - Changing coastline position
  - Coastline development



Wells, 1995

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- Barrier height changes
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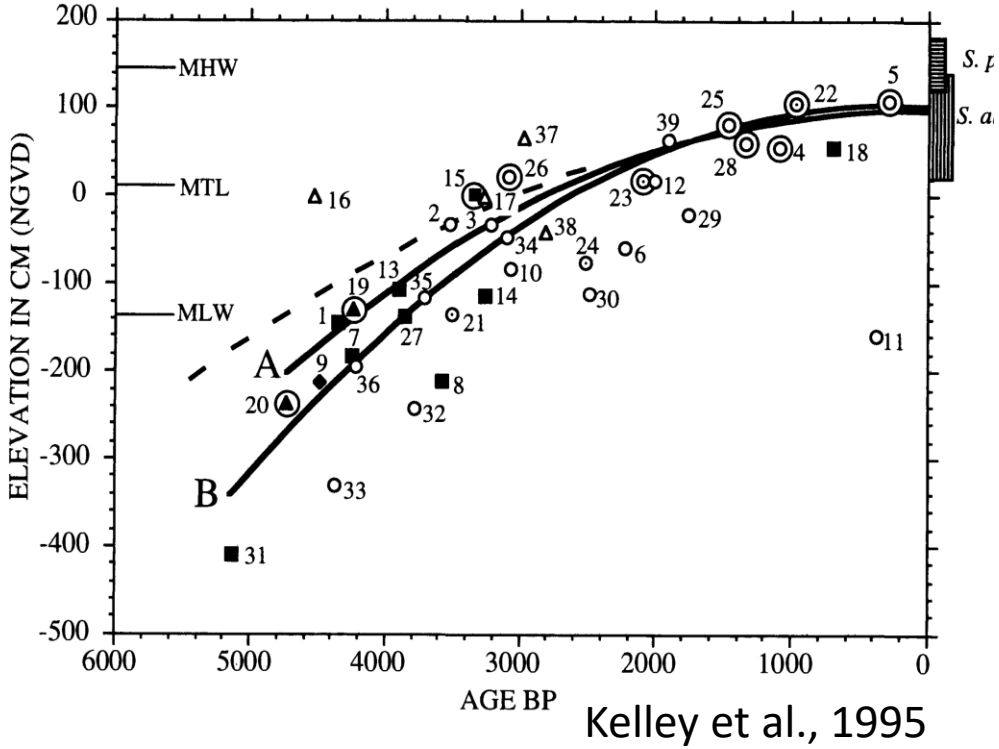
- Preservation potential of deposits
  - Post-event and repeat surveys
- Records are limited to depth of salt marsh peat sequences



Kelley et al., 1995

Concluding Remarks

- A wealth of unused geological evidence is preserved in New England marshes with salt marsh peat sequences that span the last ~4,000 years in southern Maine (Kelley et al., 1995).
- These deposits can help New England coastal communities better prepare for future changes in storm activity
- Current research site in Falmouth, MA (Castagno et al., 2017)
- Past research sites in southern Rhode Island (Donnelly et al., 2001; Ford, 2003) and Saco, Maine (Buynevich et al., 2004).

Thank You!

References

- Bregy, J. C., Wallace, D. J., Minzoni, R. T., Cruz, V. J. (2018). 2500-year paleotempestological record of intense storms for the northern Gulf of Mexico, United States. *Marine Geology*, 396: 26-42.
- Buynevich, I. V., FitzGerald, D. M., and van Heteren, S. (2004). Sedimentary records of intense storms in Holocene barrier sequences, Maine, USA. *Marine Geology*, 2010: 135-148.
- Castagno, K. A., Ruehr, S. A., Donnelly, J. P., and Woodruff, J. D. (2017). Grain-size analysis and sediment dynamics of hurricane-induced event beds in a coastal New England pond [abstract #EP12B-08]. American Geophysical Union Conference, New Orleans, LA, Fall 2017.
- Donnelly, J. P., Bryant, S. S., Butler, J., Dowling, J., Fan, L., Hausmann, N., Newby, P., Shuman, B., Stern, J., Westover, K., and Webb III, T. (2001). 700 yr sedimentary record of intence hurricane landfalls in southern New England. *GSA Bulletin*, 113(6).
- Ford, K. H. (2003). Assessment of the Rhode Island Coastal Lagoon Ecosystem (Unpublished doctoral dissertation). University of Rhode Island, Kingston, RI.
- Kelley, J. T., Gehrels, W. R., and Belknap, D. F. (1995). Late Holocene Relative Sea-Level Rise and the Geoloical Development of Tidal Marshes at Wells, Maine, U.S.A. *Journal of Coastal Research*, 11: 136-153.
- Kosciuch, T. J., Pilarczyk, J. E., Hong, I., Fritz, H. M., Horton, B. P., Rarai, A., Harrison, M. J. and Jockley, F. R. (2018). Foraminifera reveal a shallow nearshore origin for overwash sediments deposited by Tropical Cyclone Pam in Vanuatu (South Pacific). *Marine Geology*, 396: 171-185.
- Randall, PE. *Hampton: a Century of Town and Beach, 1888-1988*. [photos] Chapter 5, pg 266, 271, 272. http://www.hampton.lib.nh.us/hampton/history/randall/photos/photos5.htm
- Wells, J. T. (1995). Effects of Sea Level Rise on Coastal Sedimentation and Erosion. In Eisma, D (ed.), Climate Change: Impact on Coastal Habitation (pp. 111-136). Florida, USA: Lewis Publishers.