# Seasonal and tidal variations in porewater distributions of nutrients, oxygen, and sulfide in an urban tidal creek.


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# Cores were collected from mid-channel in the tidal creek in February, April and July, 2013.

**Voltammetric microelectrodes were used to profile changes in redox conditions with depth in the sediment.**

**Dissolved ammonium ion and phosphate were determined by classic colorimetric analysis of porewaters collected using a "whole-core squeezer".**

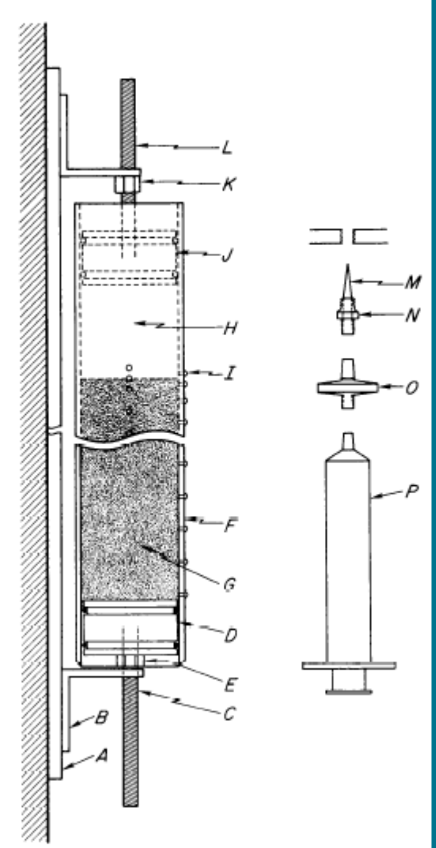
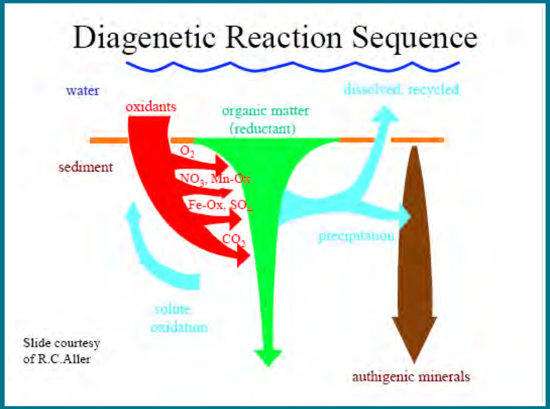



Fig. 1. Schematic of pressurized core pore-water sampler. Lettered components are described in the text.

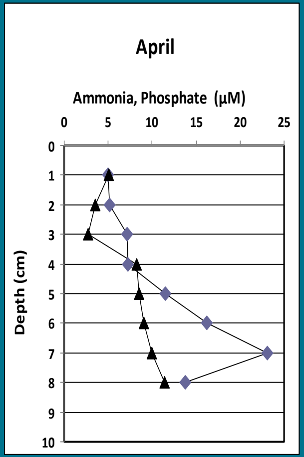
**Jahnke, 1988**

# This talk will present preliminary results for porewater distributions in sandy sediments in Wither's Swash.



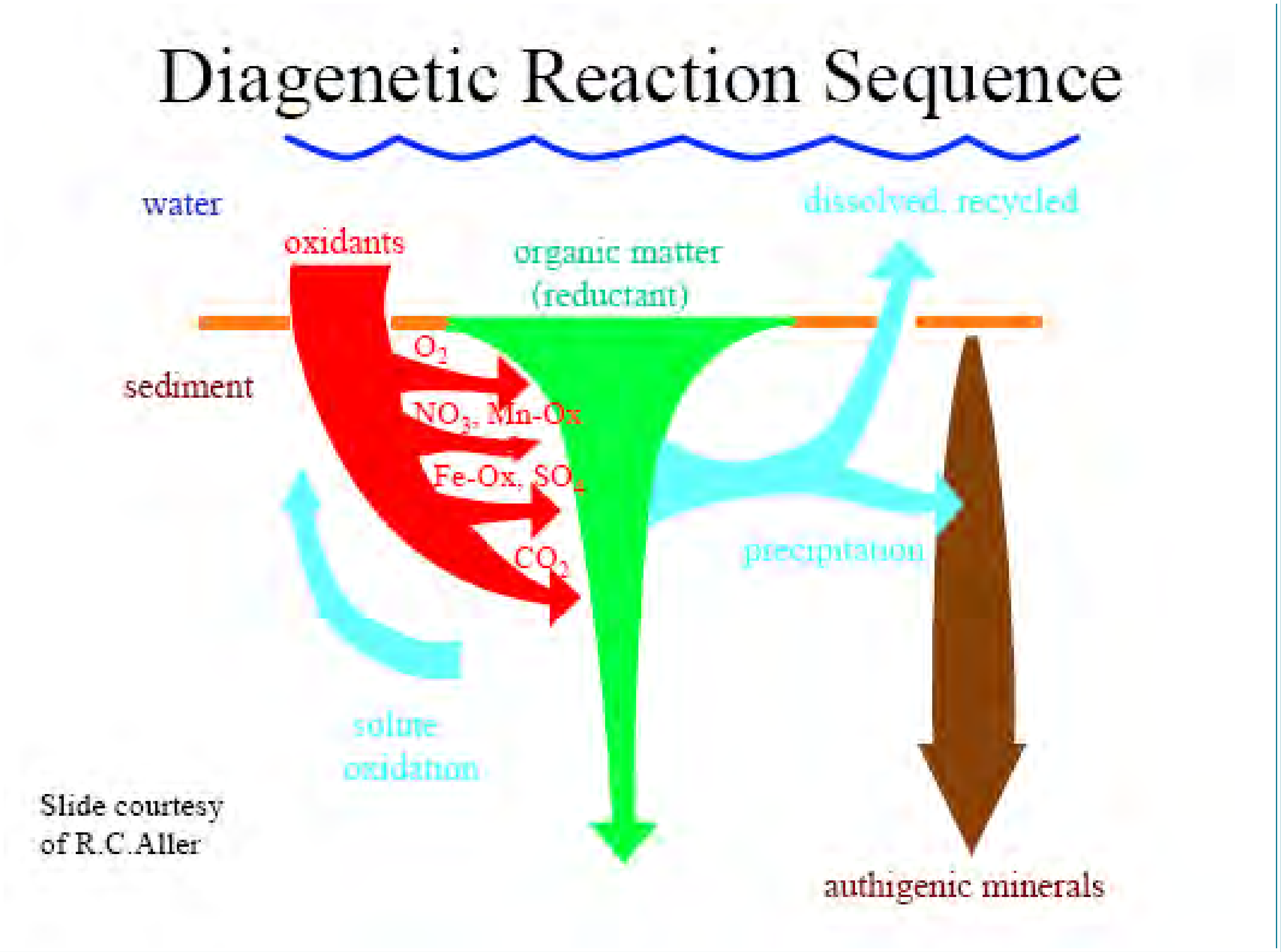

Early diagenesis in sediments

Microelectrode measurements of oxygen and sulfide

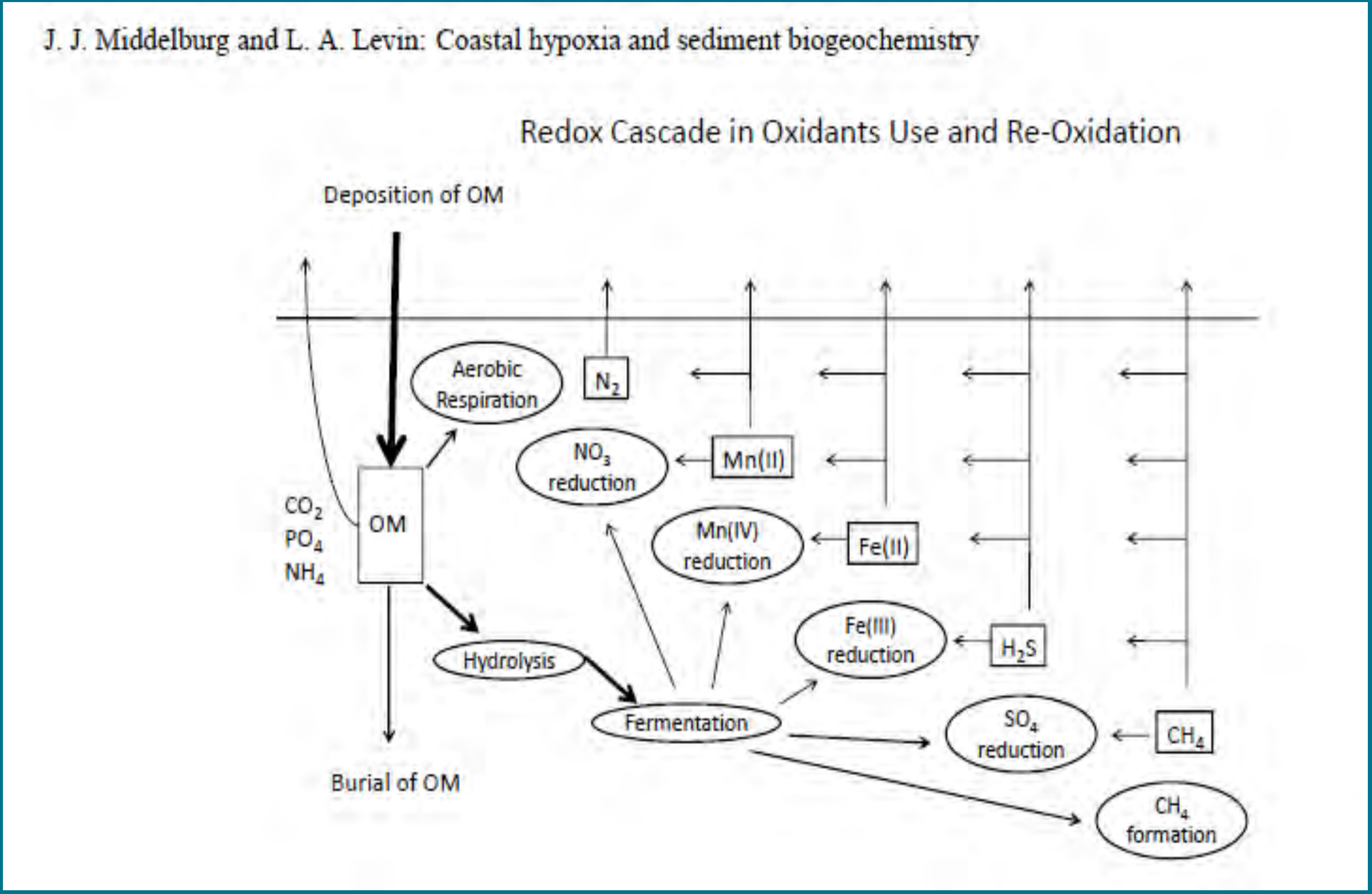



Ammonia and Phosphate Profiles

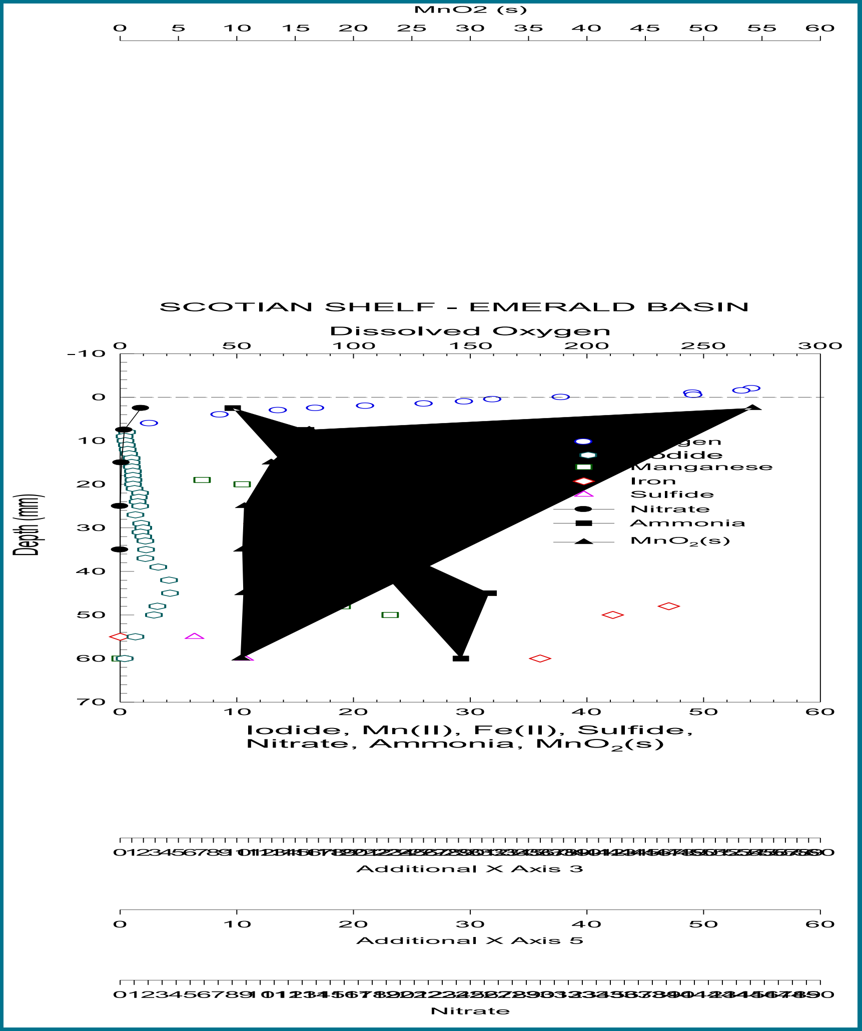
# Organic matter in sediments is oxidized by a series of microbially-mediated aerobic and anaerobic redox reactions.



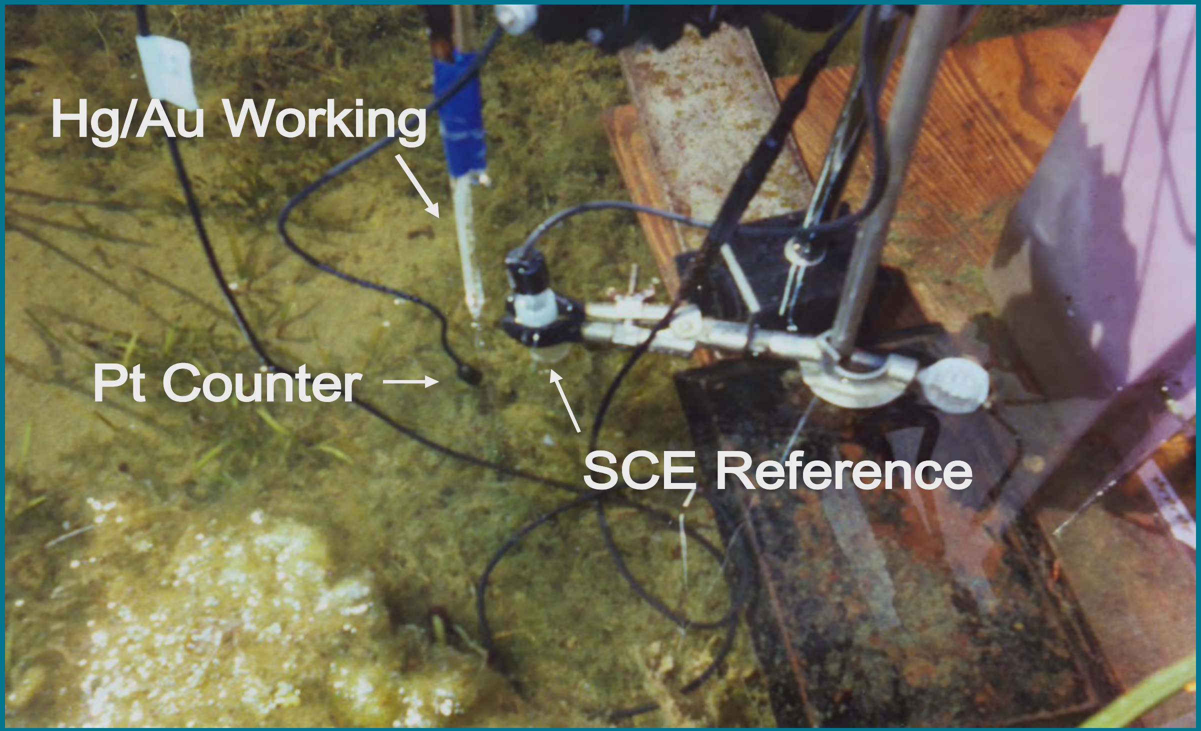
# A series of substrates are sequentially used as terminal electron acceptors during organic matter decomposition.

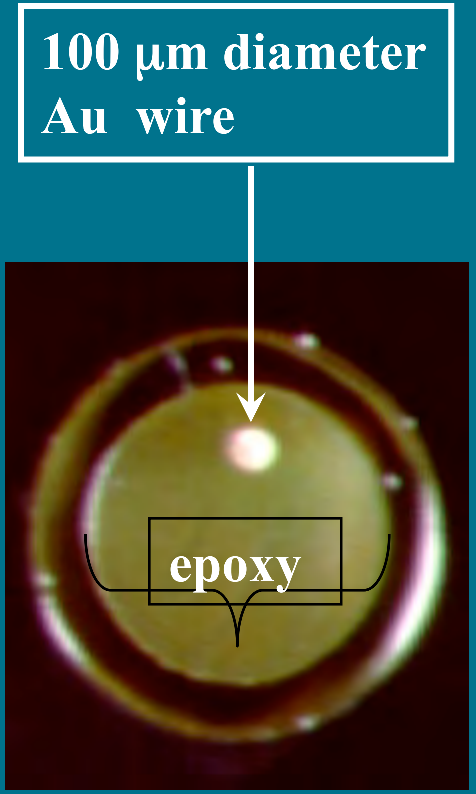


# As shown here for a coastal sediment, the dissolved species released to porewaters often vary over millimeters to a few centimeters.



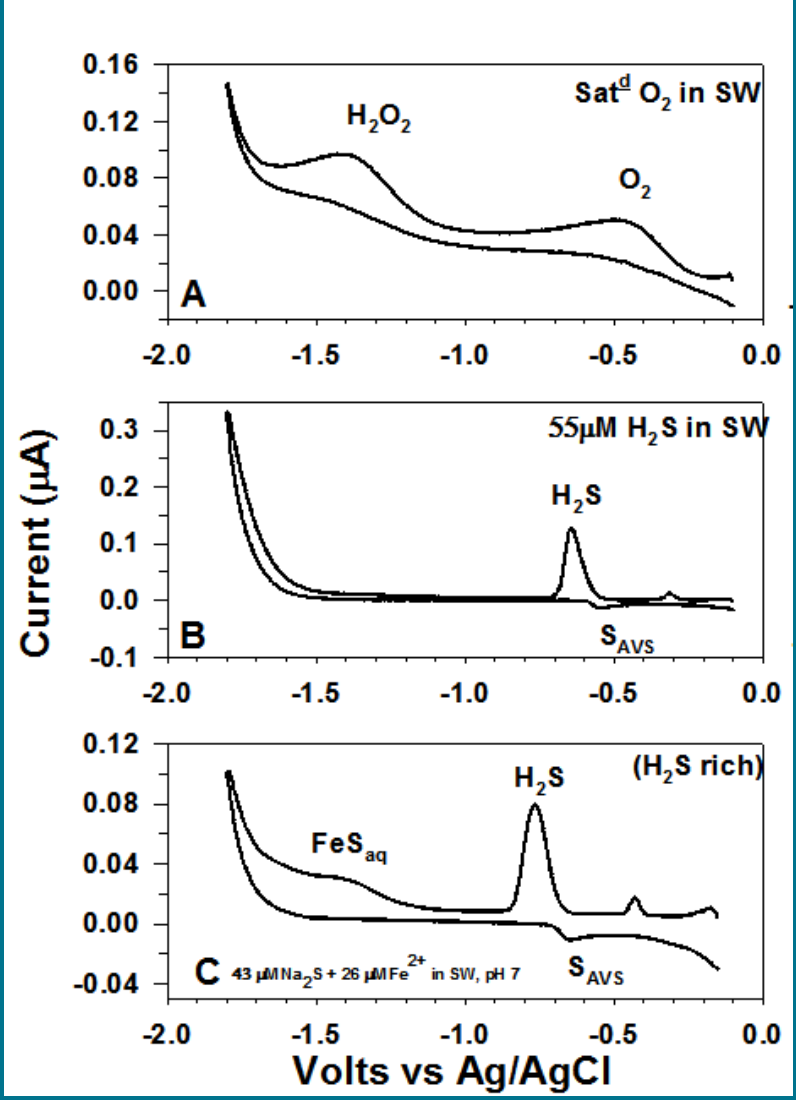
To achieve submillimeter resolution, we use a Hg-plated Au microelectrode and voltammetry to measure oxygen, sulfide and other dissolved species in porewaters.



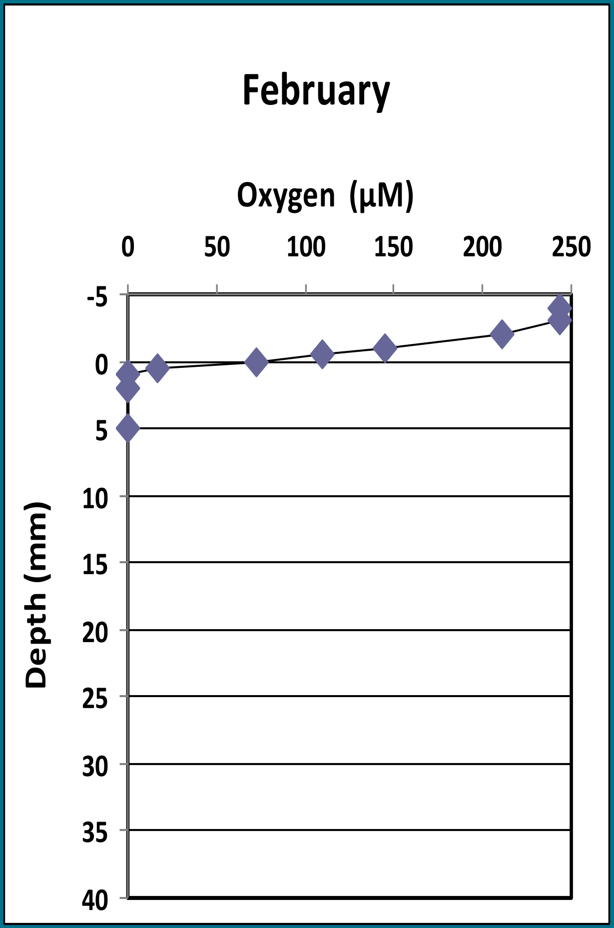

$O_2$, $H_2O_2$, $I^-$, $Mn^{2+}$, $Fe^{2+}$, Fe(III)-colloids, $FeS_{aq}$, $H_2S$, $S_x^{2-}$, $S_2O_3^{2-}$, All measurable in one scan, if present.

In voltammetric analysis, we vary the voltage and measure the resulting current as each analyte is reduced at it's characteristic redox potential.

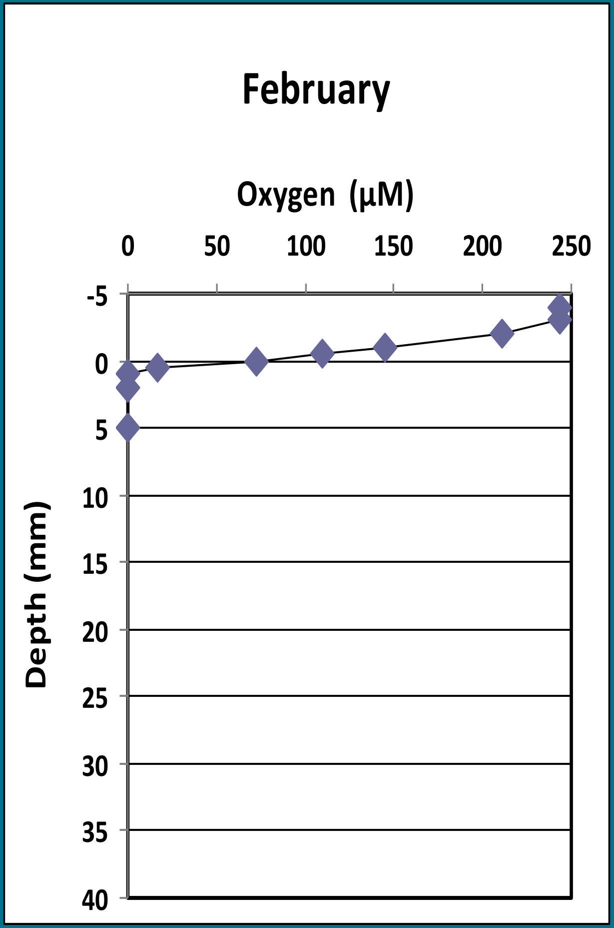


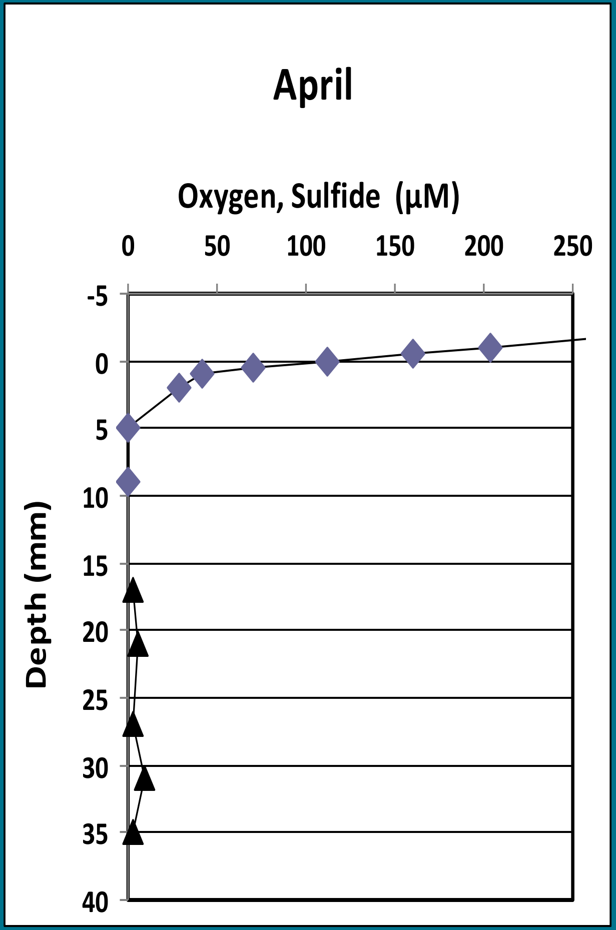

The wave or peak height is proportional to concentration.

In February, porewaters were suboxic through the upper 4 cm. Trace amounts of dissolved Mn were seen, but no iron or sulfide.



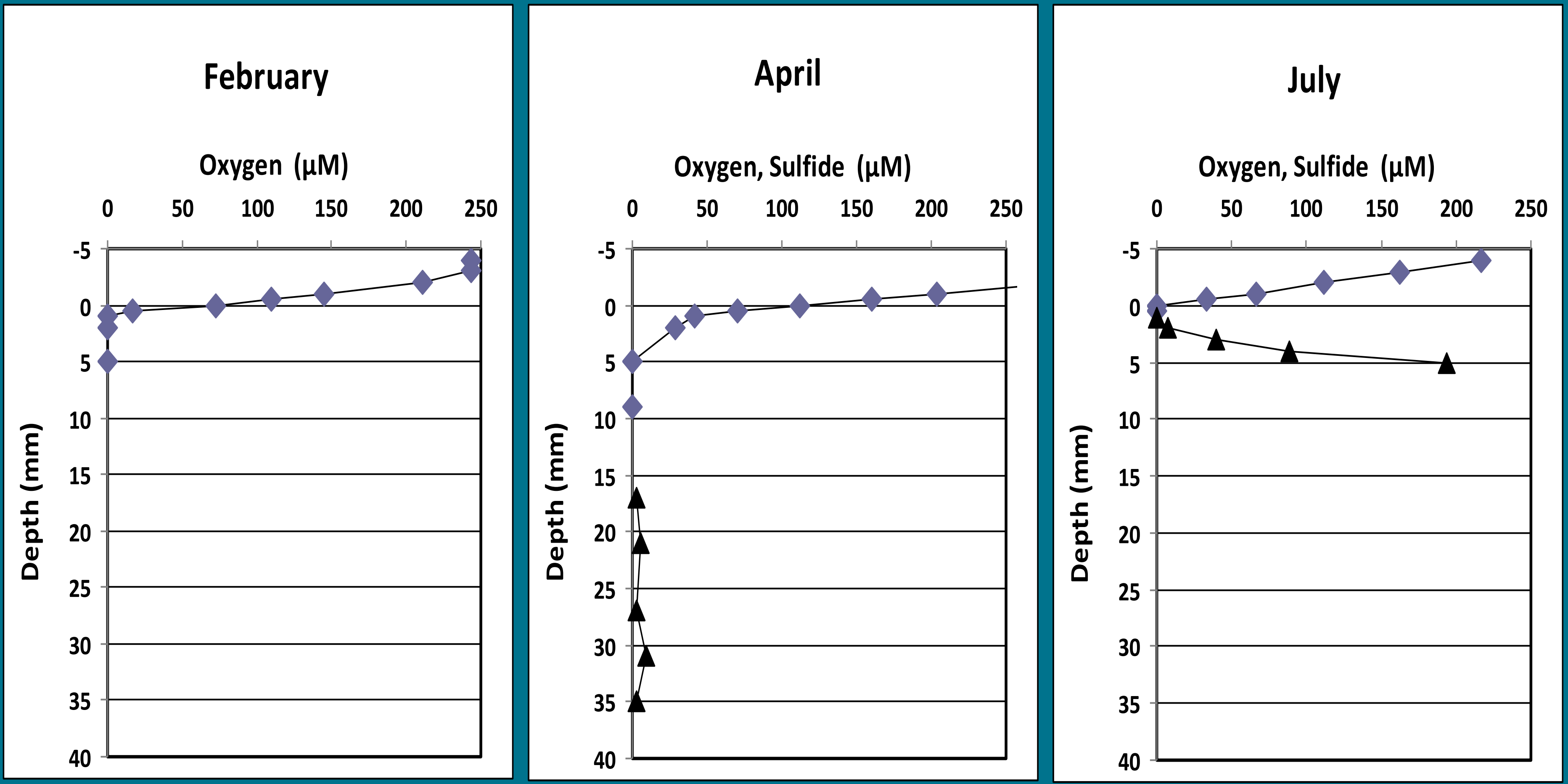
# In April, porewaters were oxic/suboxic to about 1.5 cm.
# A small amount of sulfide was detected, indicating some sulfate reduction.



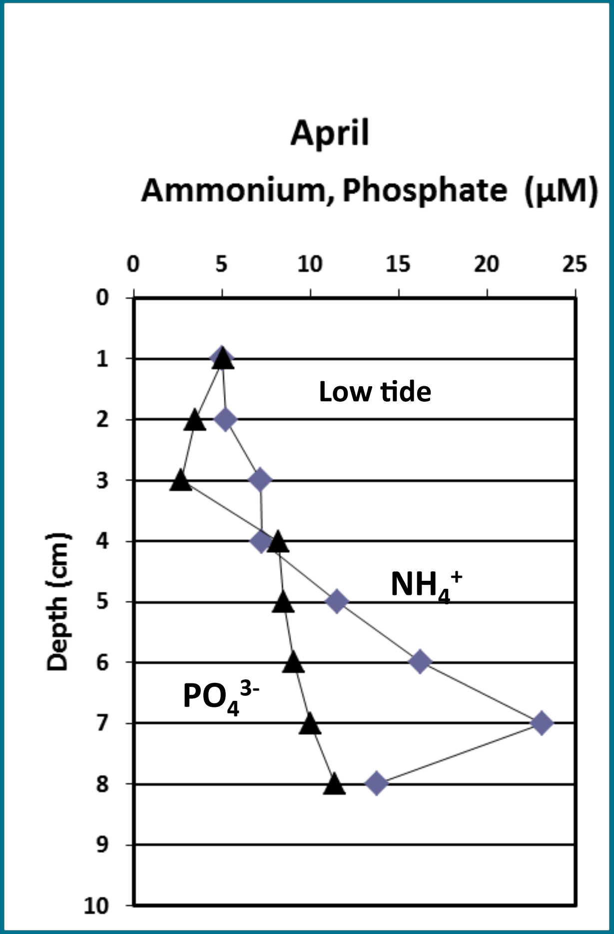

**Trace amounts of dissolved Mn were also detected.**

## In July, porewaters were anoxic and rich in dissolved sulfide below 1-2 mm.

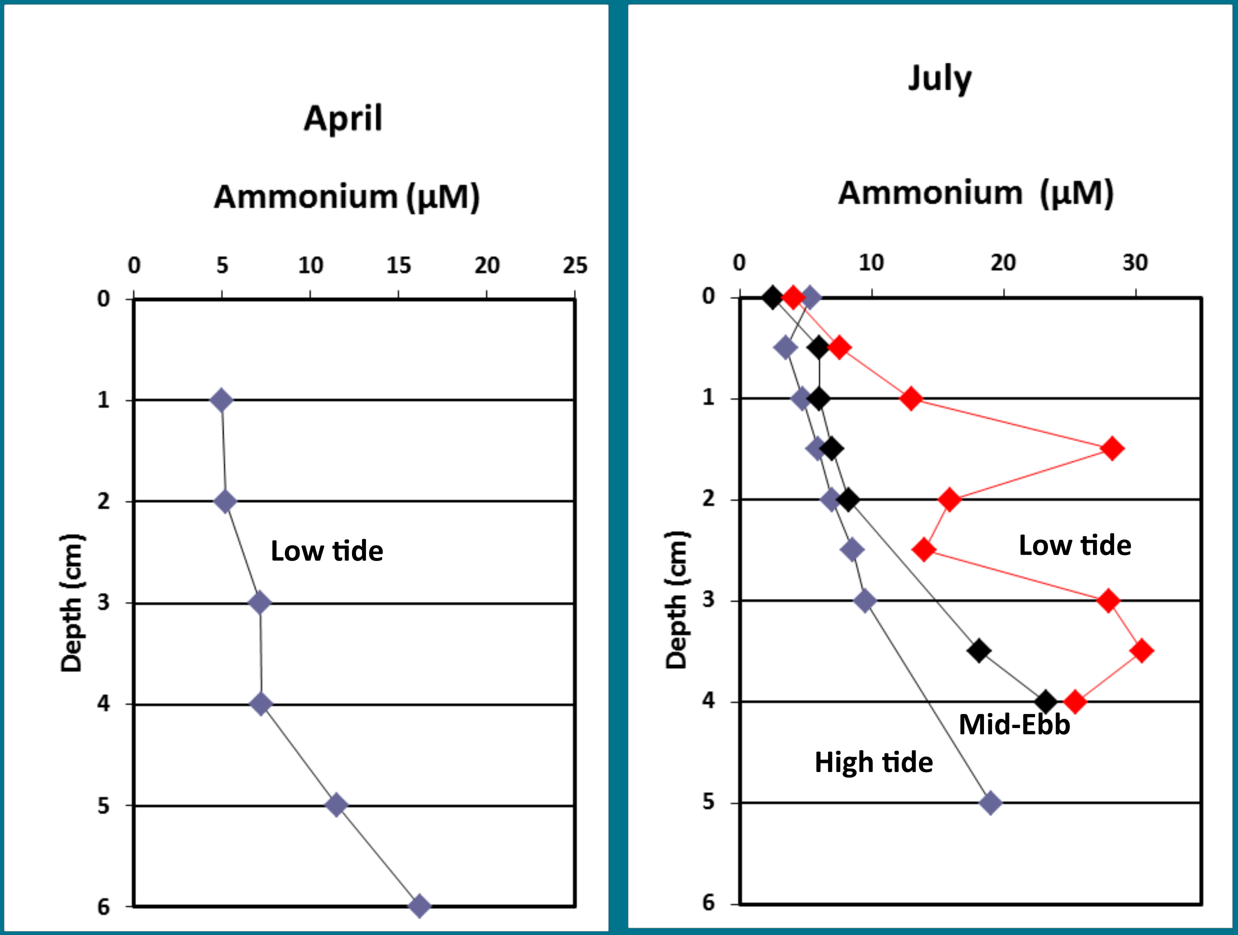



These seasonal changes have implications for the sequestration and remobilization of heavy metals from tidal creek sediments.

**Dissolved $NH_4^+$ and $PO_4^{3-}$ are added to porewaters by respiration of organic matter, increasing with depth in the sediment.**

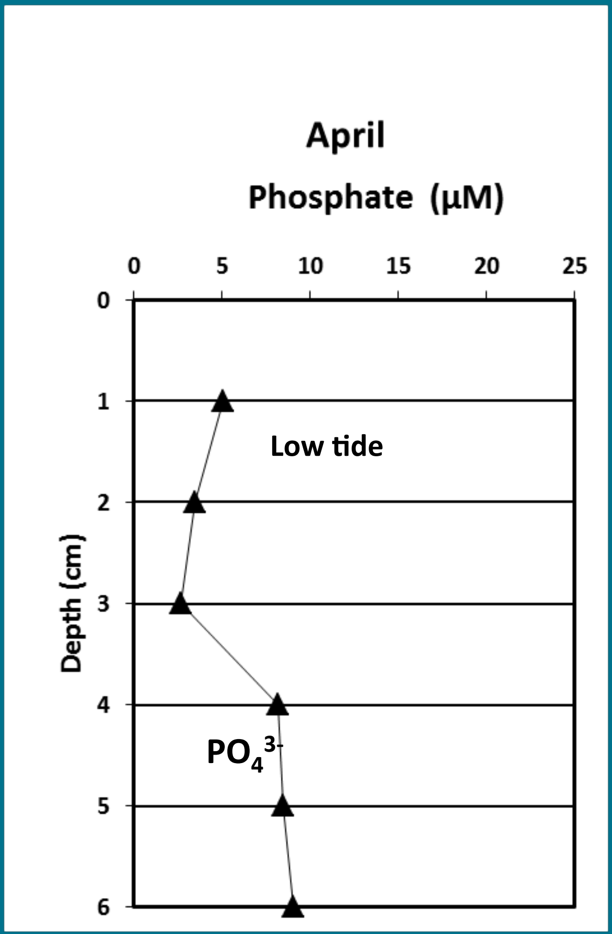


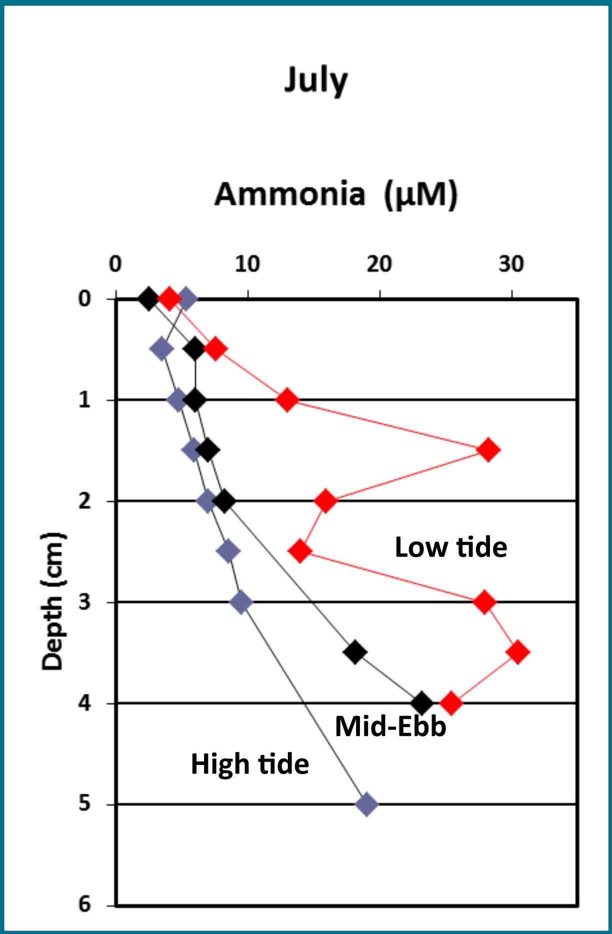
In July, porewater $NH_4^+$ concentrations at low tide were > double those in April.

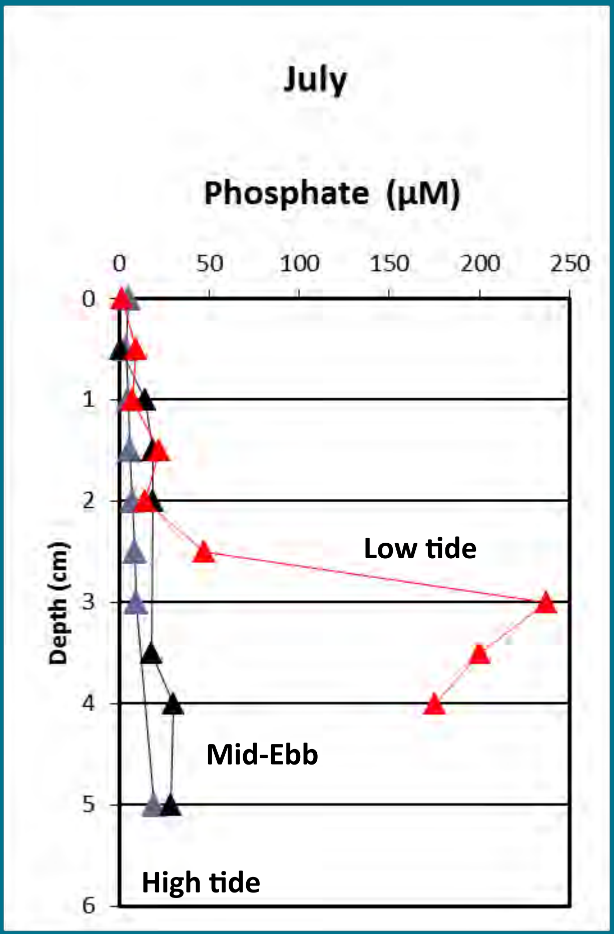



On the ebbing tide, $NH_4^+$ profiles increased and shifted upward.

$PO_4^{3-}$ showed similar behavior, with much higher concentrations at low tide in July than in April and profiles that increase and shift upward on the ebbing tide.



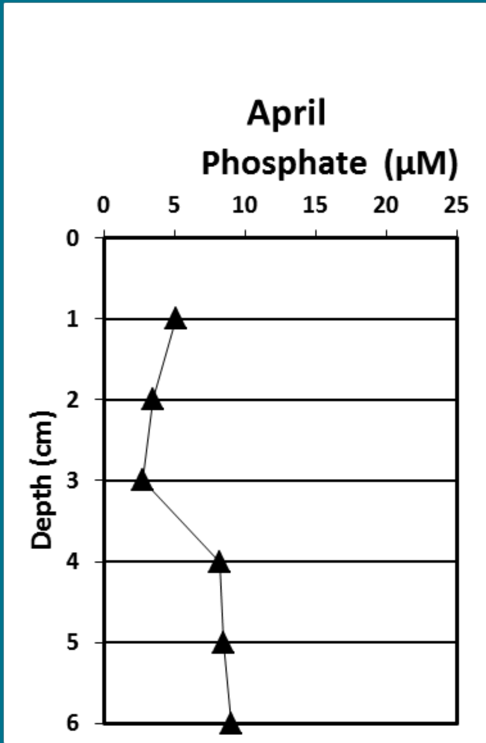



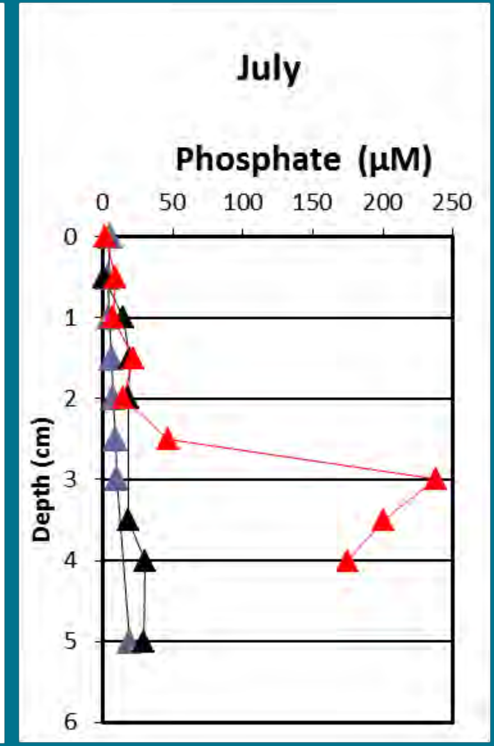



**In summary, these data indicate that nutrient fluxes from sandy tidal creek sediments vary in response to changing redox conditions and tidal pumping.**

**Nutrient fluxes are highest in the warm summer months.**

**Nutrient fluxes are greatest at low tide, indicating that the efflux from the sediment is dominated by advective groundwater flow.**




**Questions?**