Sediment-Water Exchange Processes in Lake Erie

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LEMN

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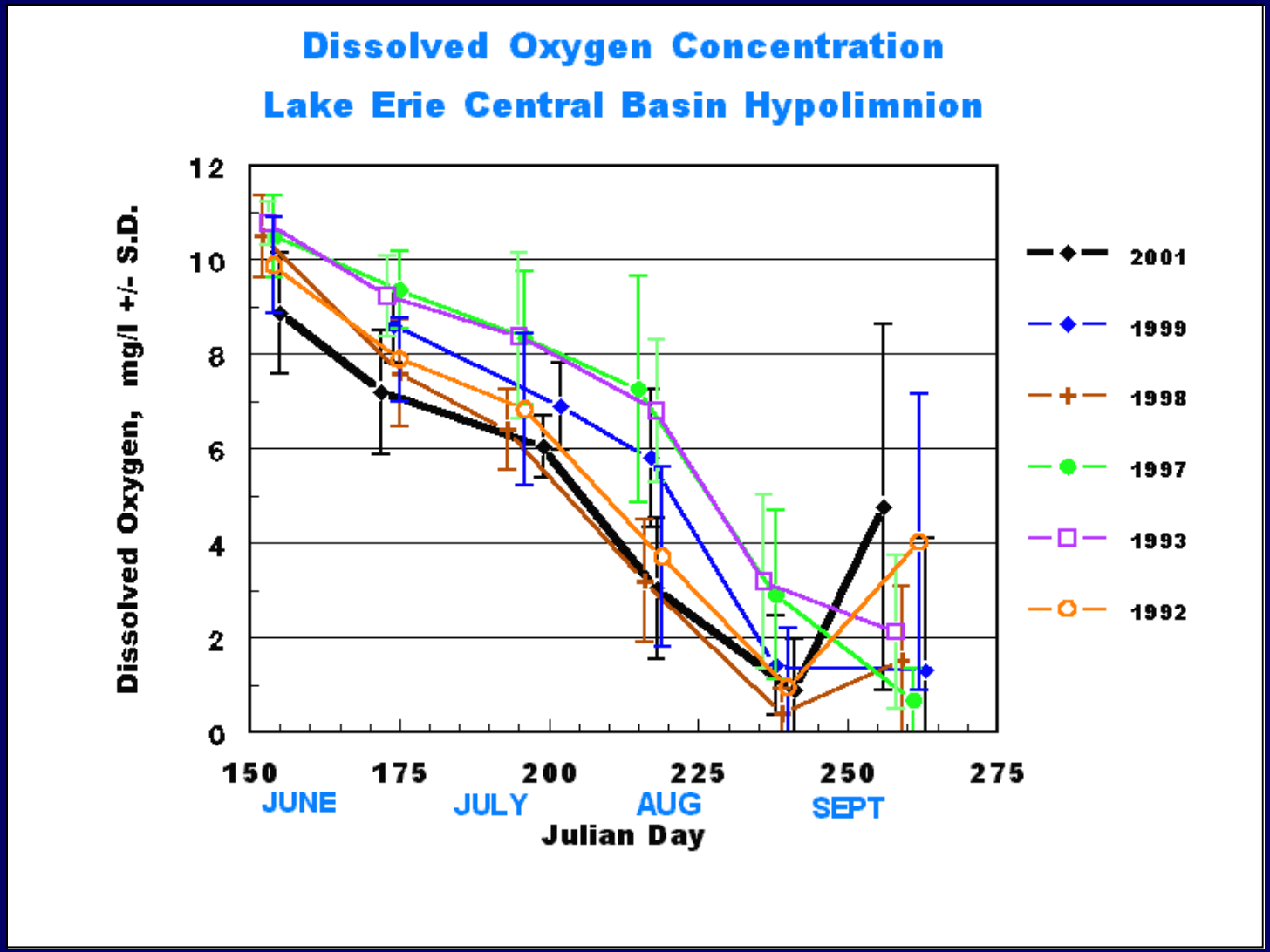
Ohio Lake Erie Commission | Sea Grant | The Ohio Sea Grant College Program | Great Lakes Restoration

Overview

- SOD
- Biogeochemical processes and modeling
- Resuspension and internal loading
- Historical depositional fluxes

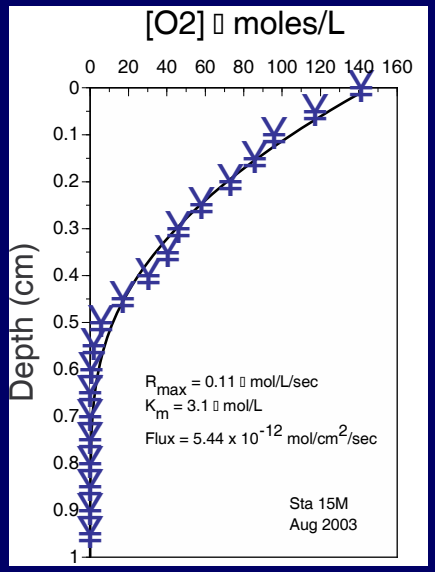
Role of Sediments in Hypoxia

SOD: EPA monitoring cruises



Role of Sediments in Hypoxia

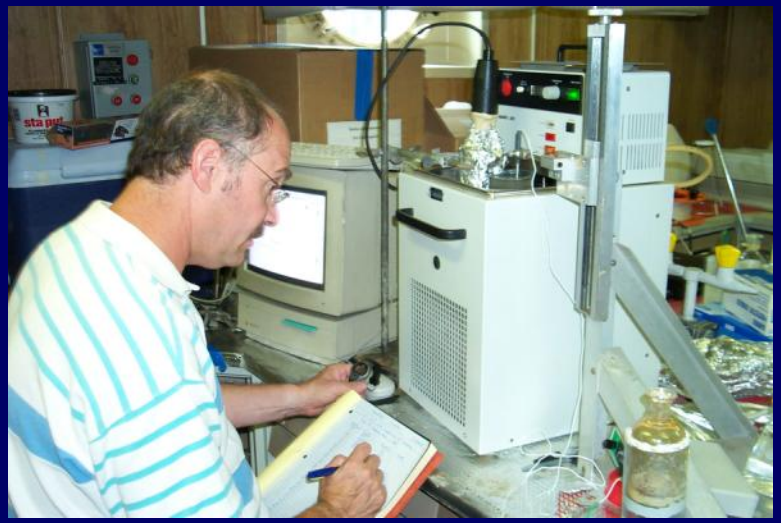
SOD: Oxygen microelectrodes

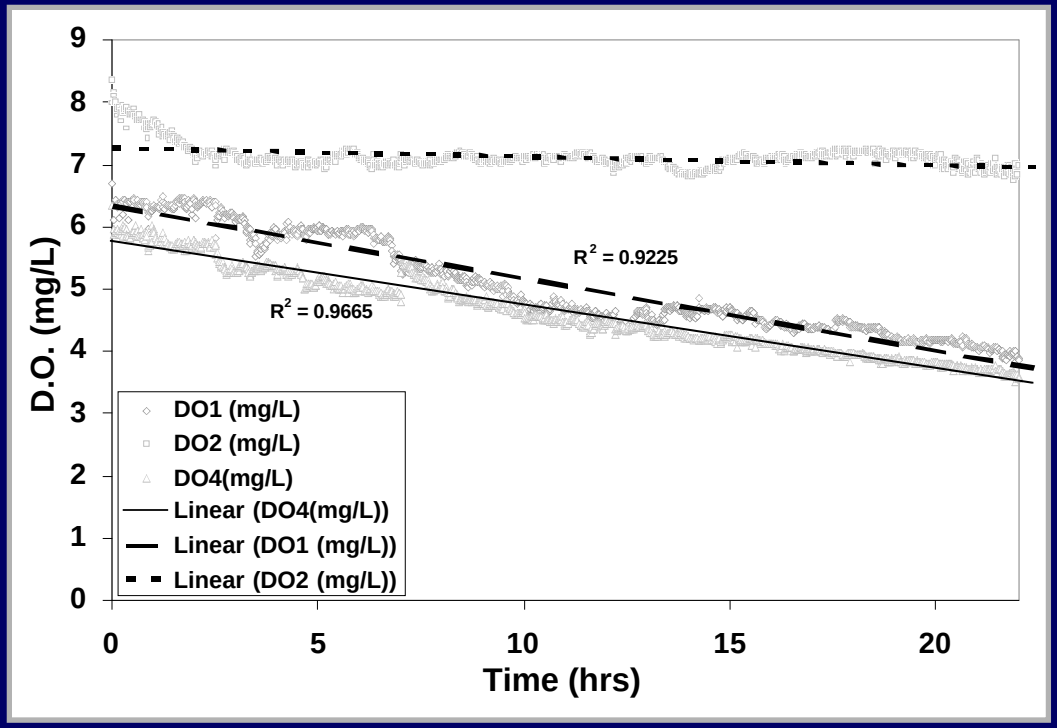


Matisoff and Neeson 2005

Role of Sediments in Hypoxia

SOD: Whole core incubations

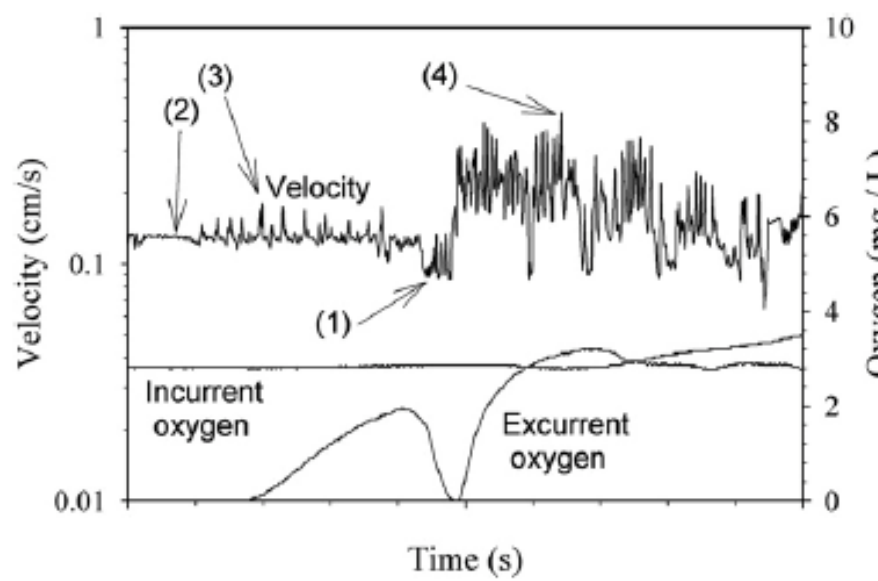


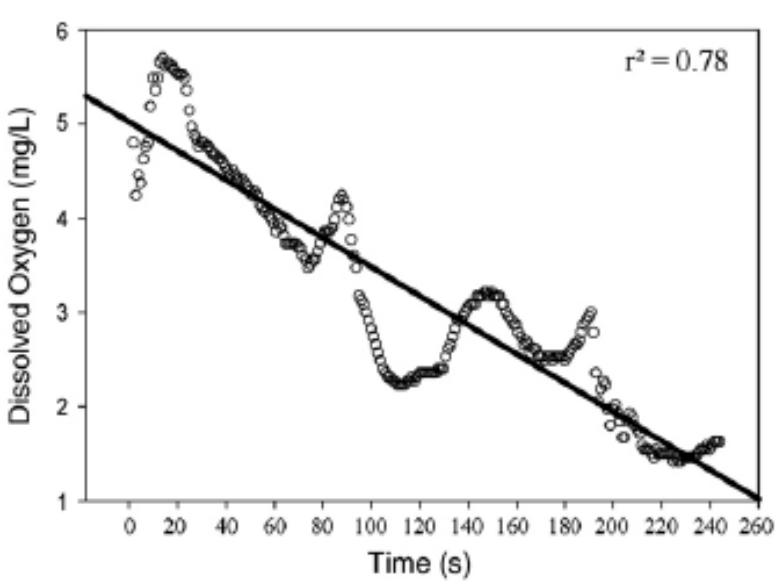


Smith and Matisoff 2008

Role of Sediments in Hypoxia

Bioturbation: Mayflies



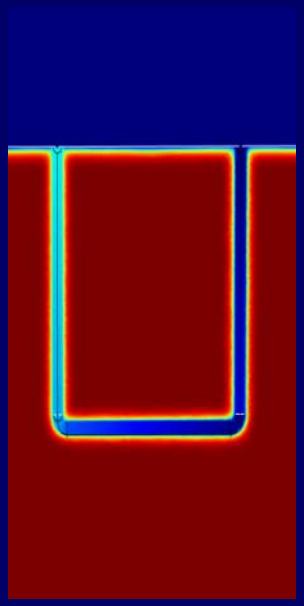


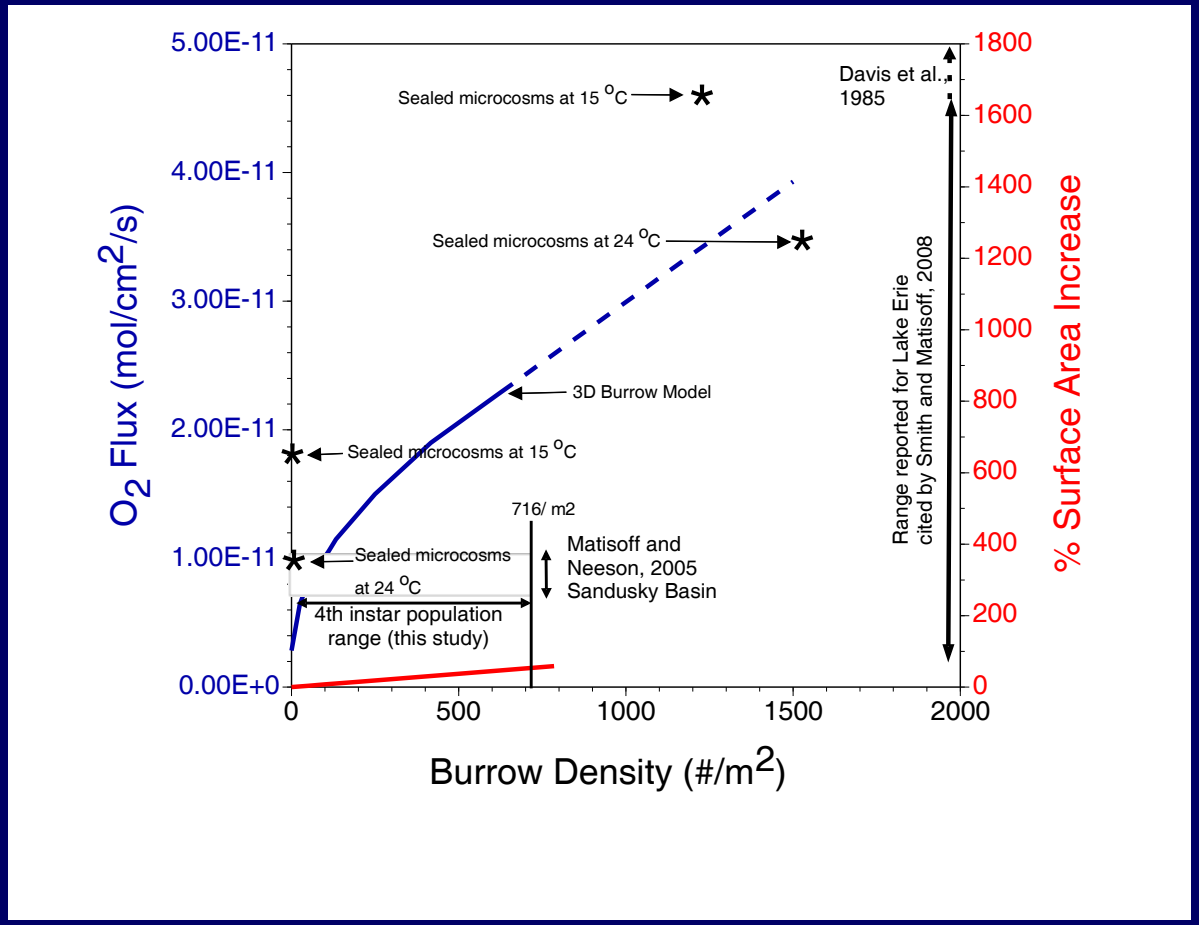
Edwards, Soster, Matisoff, Schloesser 2009

Mayflies increase SOD 2-5 X that of the controls
increase SOD 22-71% at natural bottom densities

Role of Sediments in Hypoxia

Bioturbation: Chironomids





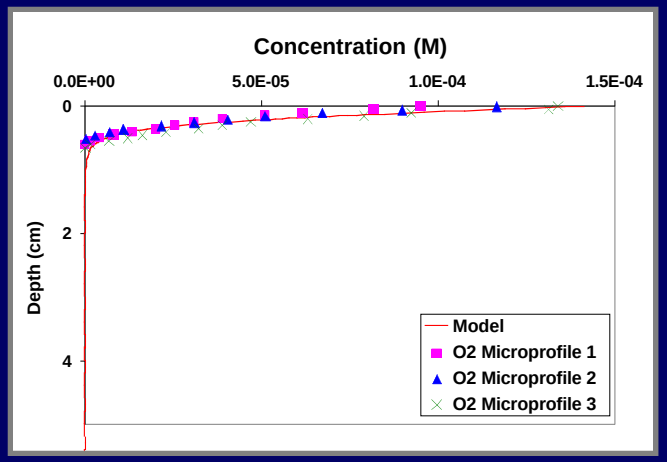
Soster, Matisoff, Schloesser, and Edwards in preparation

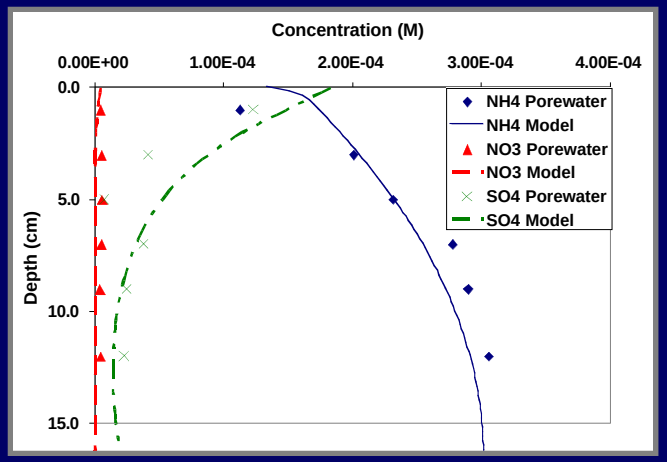
Role of Sediments in Hypoxia, Internal Loading

Biogeochemical processes and modeling:

Sequential Organic Matter Degradation Reactions

- Aerobic Respiration
- Denitrification
- Manganese Oxyhydroxide Reduction
- Iron Oxyhydroxide Reduction
- Sulfate Reduction
- Methanogenesis

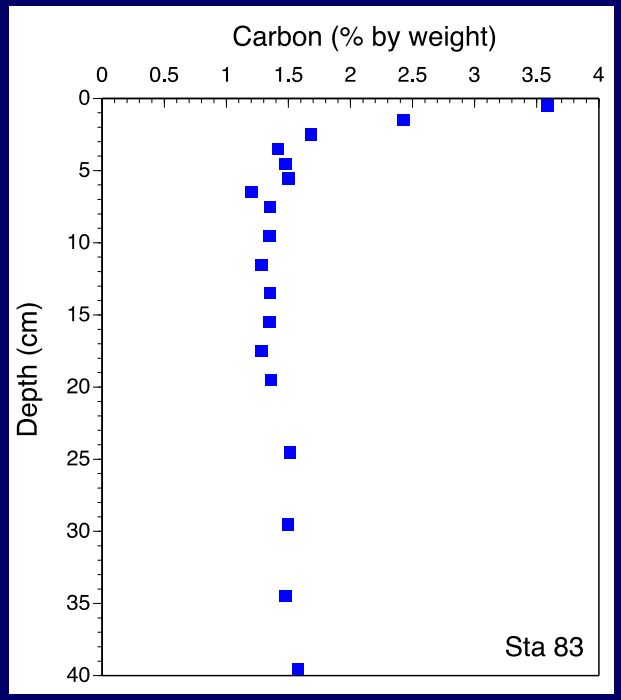


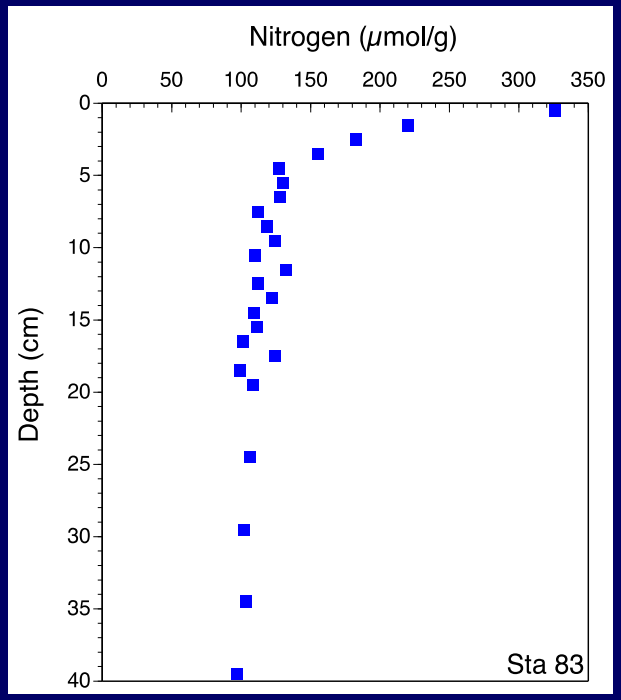


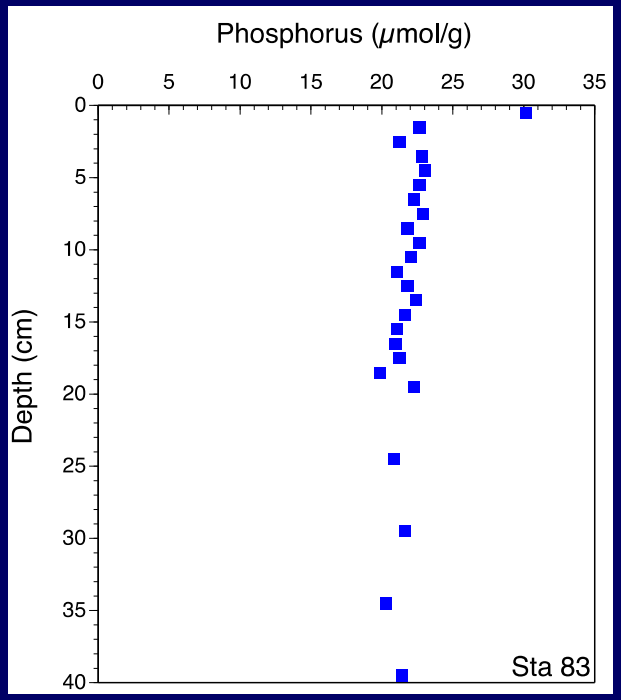
Smith and Matisoff 2008

Role of Sediments in Internal Loading

Biogeochemical processes and modeling: Nutrient diagenesis or change in loadings?

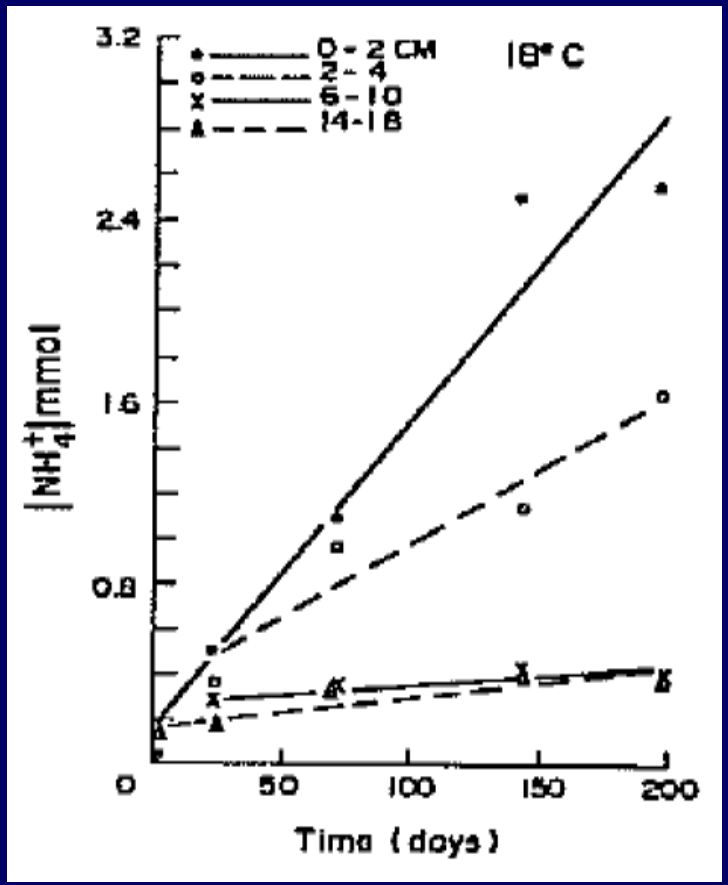


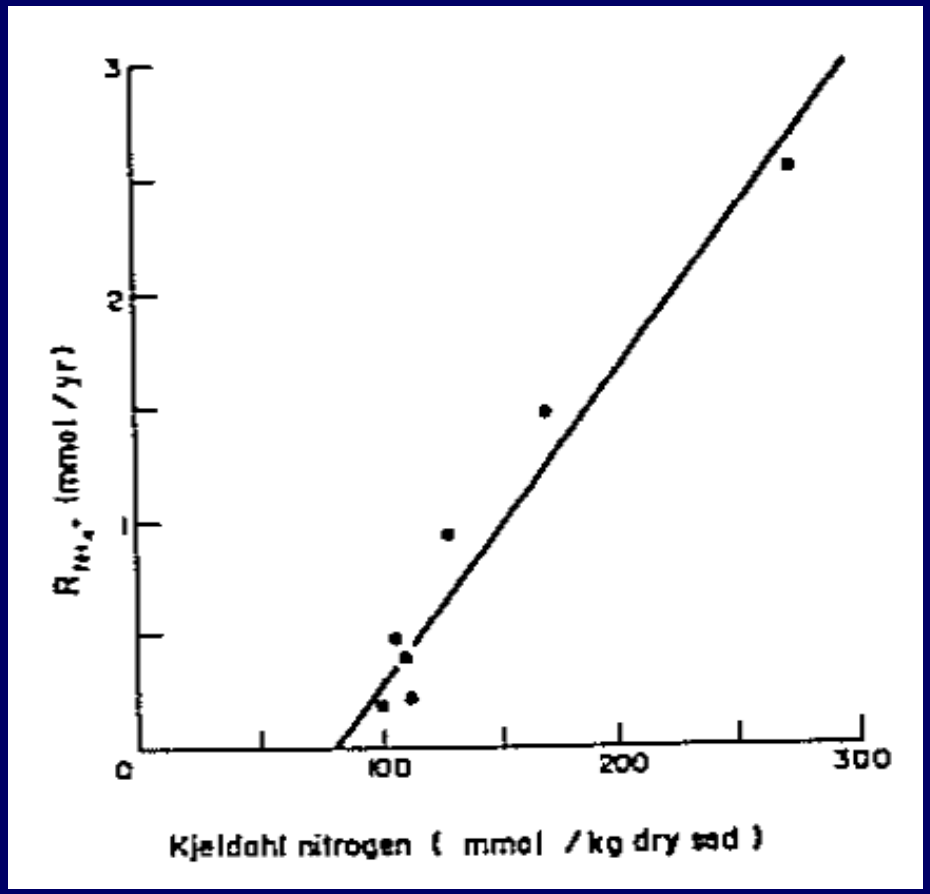




Role of Sediments in Internal Loading

Biogeochemical processes and modeling:
Nutrient diagenesis or change in loadings?





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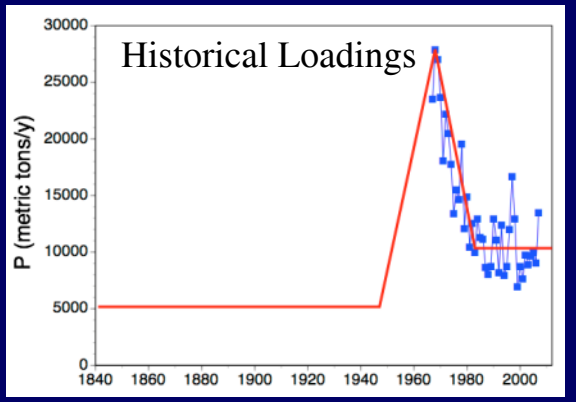
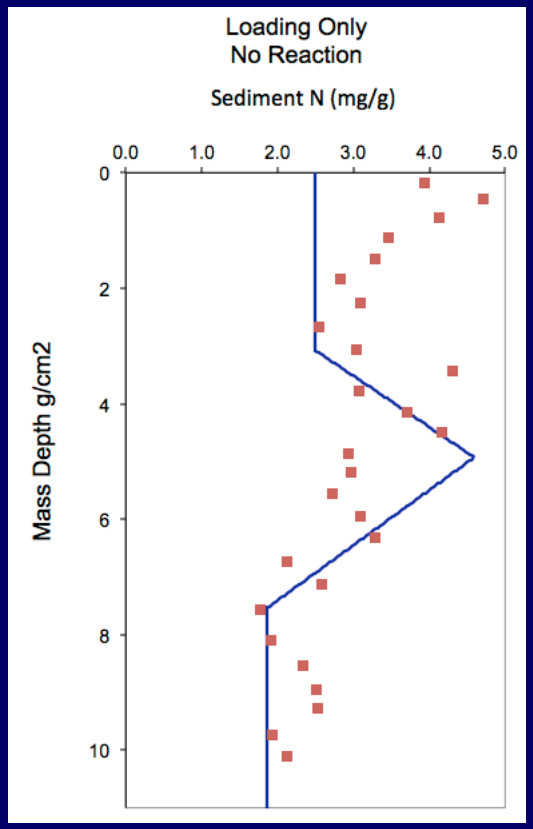
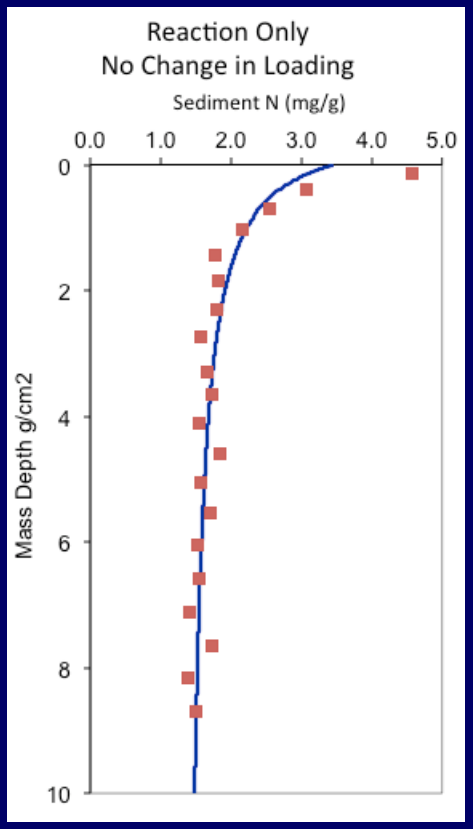
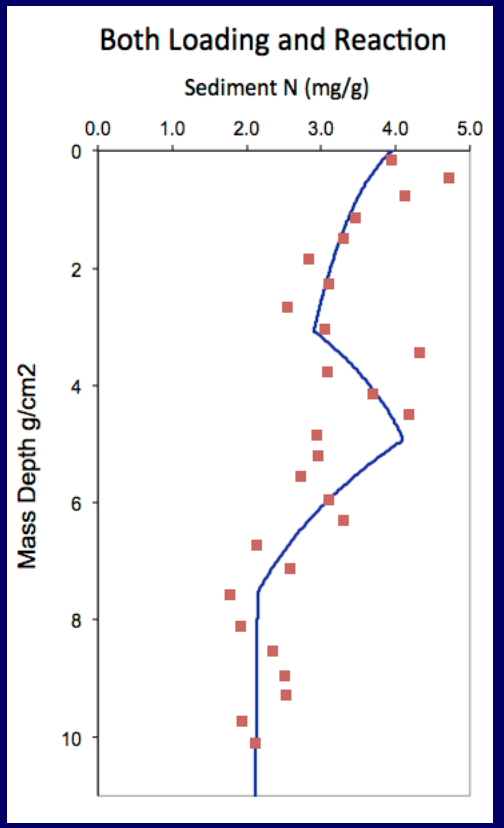




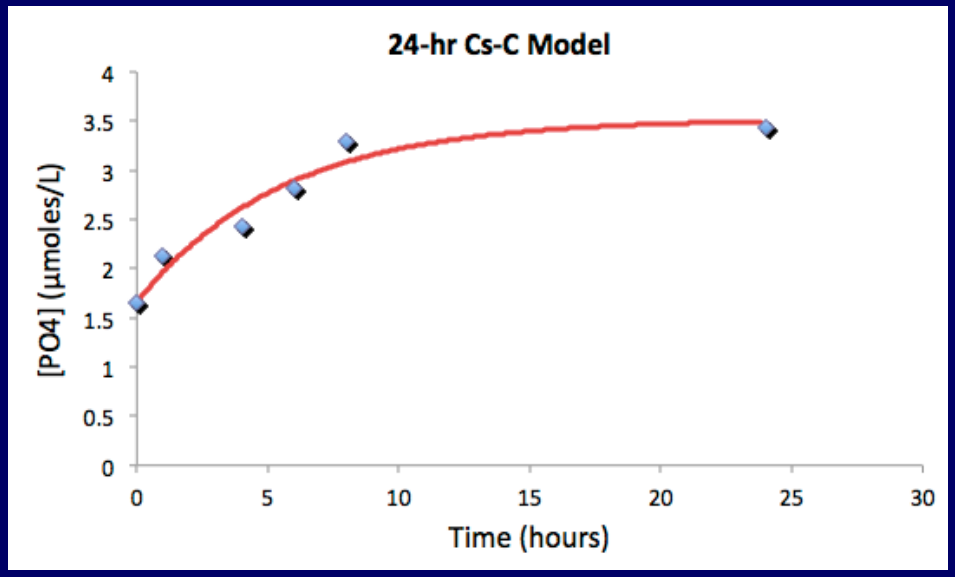


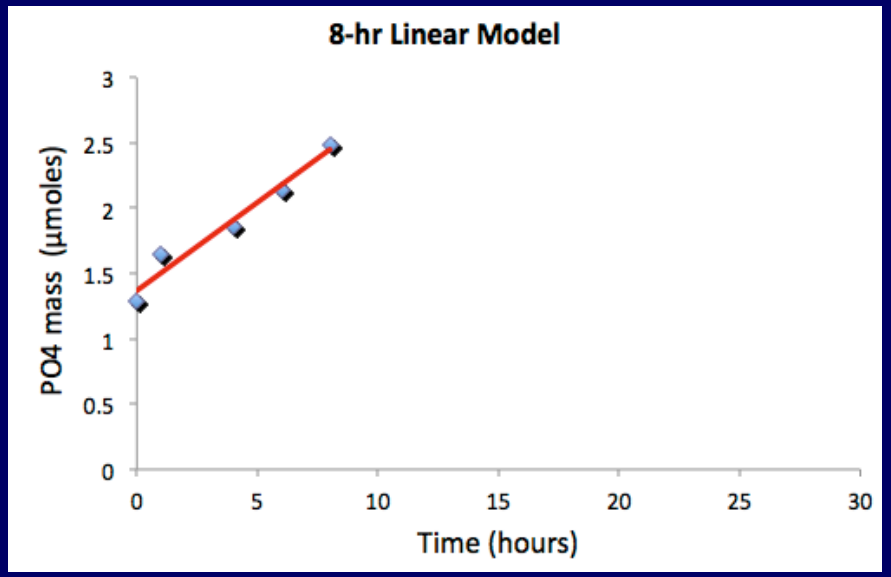


Matisoff in preparation

Role of Sediments in Internal Loading

Internal loading from resuspension:





Matisoff , Hummel and Steely in preparation

Role of Sediments in Internal Loading

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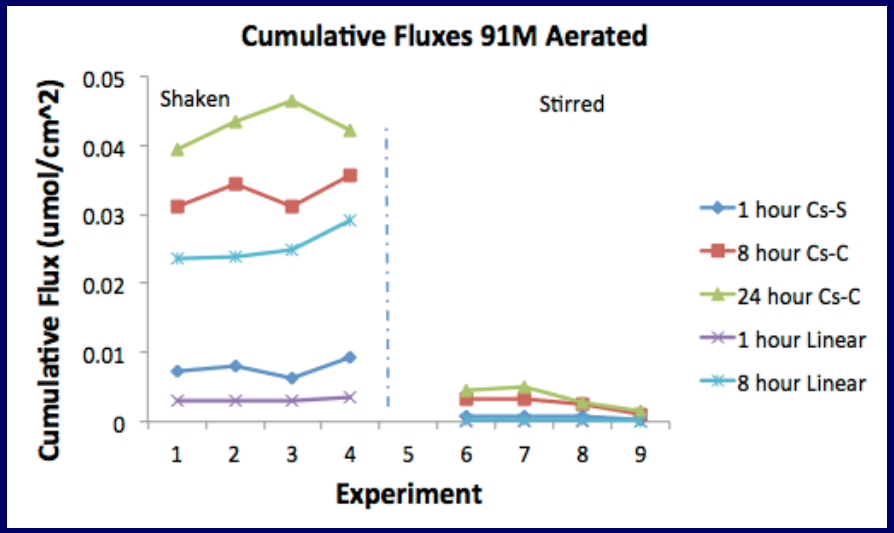

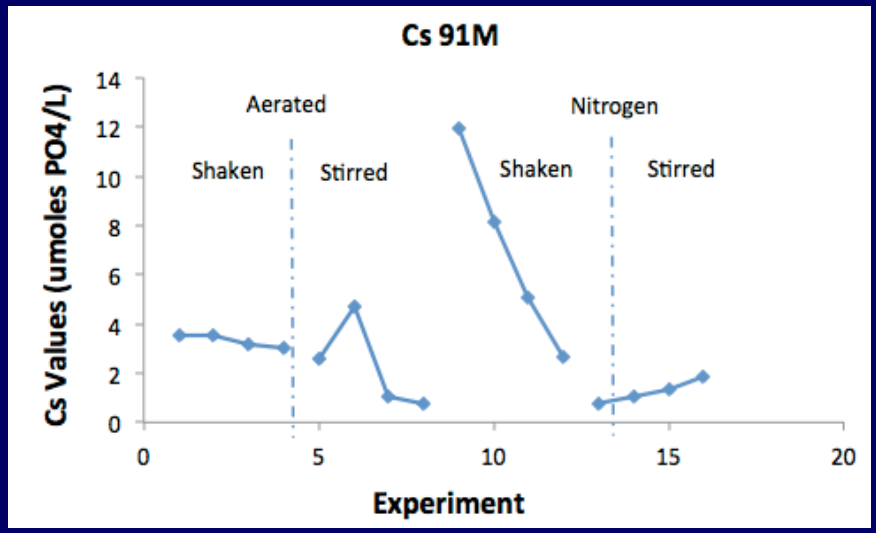

Matisoff , Hummel and Steely in preparation

Conclusions

- SOD is spatially and temporally variable and is influenced by organic matter degradation and bioturbation
- Nutrient profiles in sediments reflect both the historical changes in loadings and post-depositional diagenetic reactions
- Vigorous resuspension results in increased P release from sediment compared with incubation or even slightly stirred sediment.
- Water with resuspended sediment reaches a ‘saturation concentration’ of SRP within about 24 hours (=1-4 µM aerated = ~100 µg P / L; 1-12 µM anaerobic)