Occurrence of Phosphorus in Groundwater and Surface Water of Northwestern Mississippi

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Outline of Today’s Talk

- Study area
- Occurrence of phosphorus in groundwater of the MRVA aquifer
- Possible contributors to phosphorus in the MRVA aquifer
- Why is it important?
- Further questions that need to be answered
- Largest river basin in Mississippi
- Agricultural land use
- Avg rainfall is 114 cm/yr
  - Only 28% occurs during the growing season
  - Small percentage infiltrates
- Irrigation needed to optimize crop production
Irrigation Withdrawal from the Mississippi River Valley alluvial aquifer

~ 4 billion gallons per day during the growing season
Occurrence of phosphorus in the Mississippi River Valley alluvial aquifer
Three studies from 1998 - 2010

- **1998**
  - 14 wells were in Mississippi
  - Median phosphorus concentration was 0.35 mg/L

- **2009 and 2010**
  - 59 wells were sampled Delta wide
  - Median phosphorus concentration was 1.0 mg/L

- **2010**
  - 46 wells were sampled Delta wide
  - Median phosphorus concentration was 0.62 mg/L
Possible Sources
Natural source in the soils or aquifer sediments

- Dissolved iron, in micrograms per liter
- Dissolved phosphorus, in milligrams per liter

Graph showing:
- Depth below the water table (m)
- Total phosphorus, in mg/L
- Dissolved iron, in micrograms per liter
- Dissolved phosphorus, in milligrams per liter

Oxic and Anoxic zones.
Nonpoint source such as fertilizer and animal waste
Why study phosphorus in groundwater?
Why study phosphorus in groundwater?

Jacobson, 2010
Average annual county level P application, 1997-2006

Alexander et al., 2008
P from groundwater could influence concentrations in streams at times of baseflow

- Baseflow separation technique (BFI) estimates that from 1995-2007, MRVA contributed 8% of the baseflow dissolved P load.
What do we need to know?

- What is the source of the phosphorus in the MRVA aquifer?
  - No mineralogical analysis has ever been done

- Is water from the MRVA contributing to high P concentrations in the surface water?
  - Irrigation return flow
  - Shallow groundwater recharge to streams
  - Offsite movement of P attached to sediment during high flow events

- What is the influence of irrigation pumpage on P concentrations in the aquifer?

- What is the influence of surface water recharge from the Mississippi and other rivers on P concentrations in the groundwater?
Conclusions

- Phosphorus concentrations in the MRVA aquifer are well above the national background of 0.03 mg/L.
- Median concentrations of P are higher in the Holocene alluvium subunit of the MRVA aquifer.
- Phosphorus application data coupled with data identifying MS as contributing large P yields to the Gulf of Mexico seem to indicate that there is another source of phosphorus to Delta streams.
- Baseflow concentrations in the Bogue Phalia indicate that there is contribution to stream phosphorus loads from the MRVA aquifer.
Questions?