

P cycling variations—geologic to agronomic

- Can we get traction on the glacial-interglacial timescale?
- Need terrestrial records
- Need a dynamic model of P weathering including erosion, glacial weathering, soil development, much more
- Need “downstream” record

One approach I have used for terrestrial variations

- Standard method--Soil chronosequences and terrestrial P cycle
 - substitution of space for time
 - assumes constant climate, lithology for comparing sites in a chronosequence
 - Hawaiian Island lava flows
- Lake sediment records and terrestrial P cycle
 - climate and lithology held constant
 - assumes P geochemistry of lake sediments representative of conditions in watershed

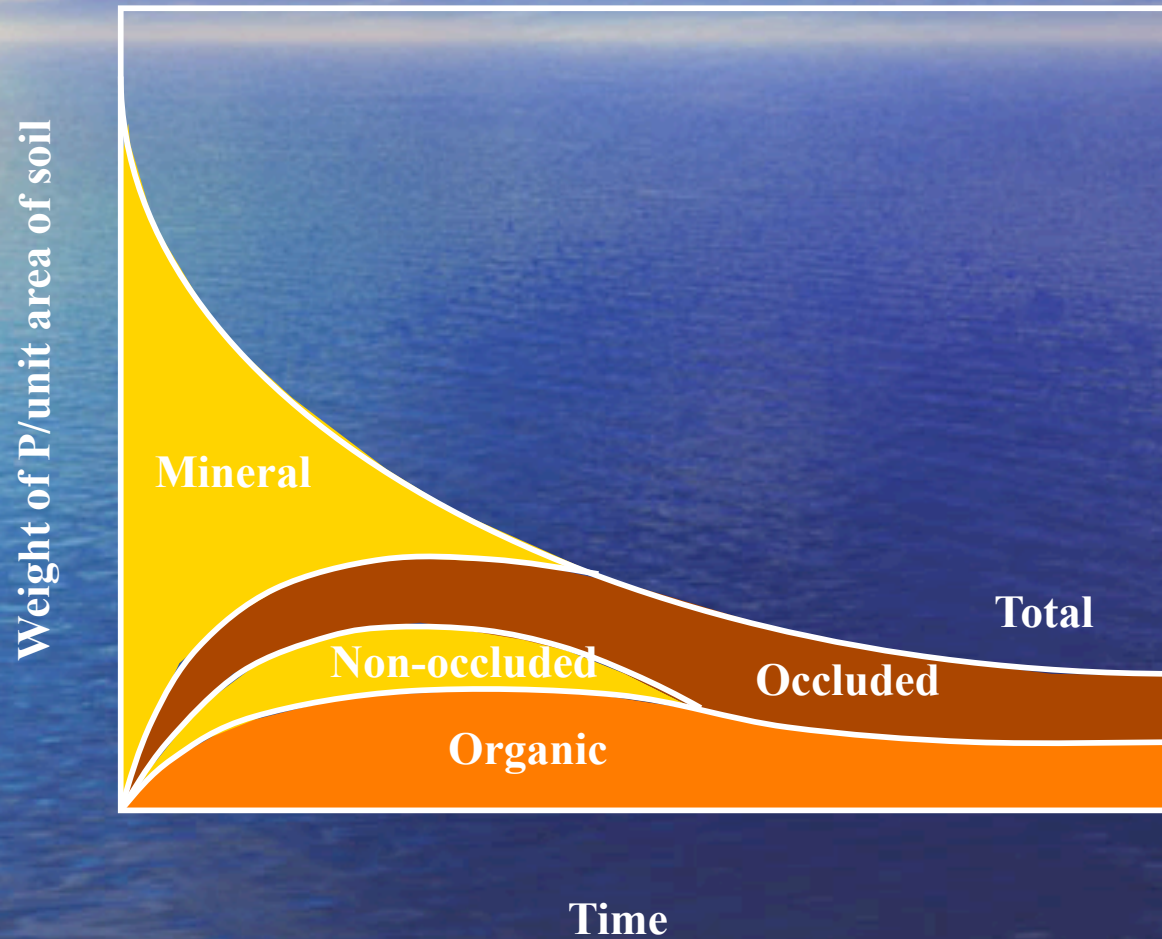
Approach to determining paleocycling of terrestrial P

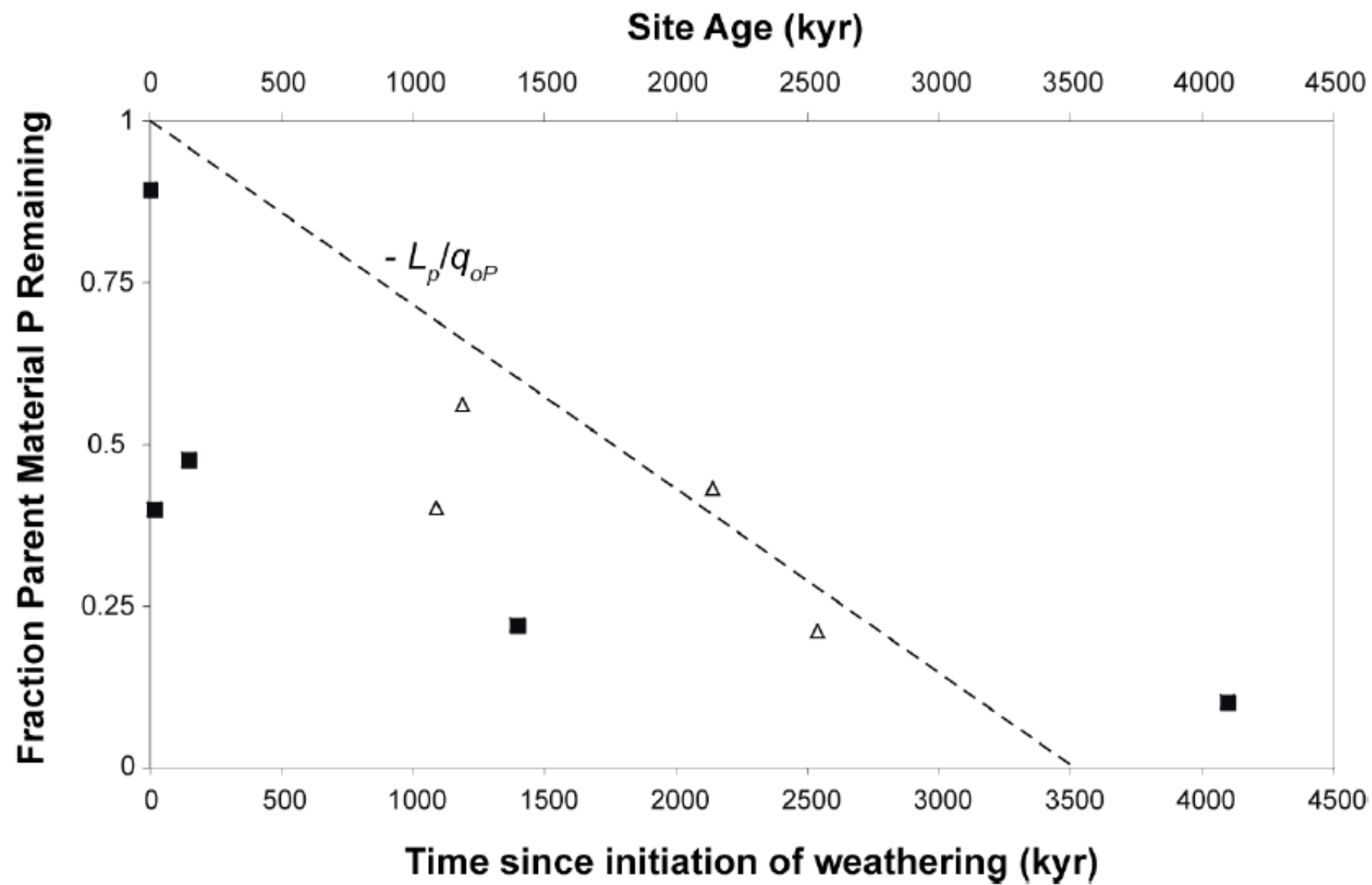
- Soil development and P transformations linked to bio-availability
- Changes in soil development with glaciation
- Terrestrial P cycle poorly understood in the past
- Lake sediment records and P geochemistry may provide framework



Role of landscapes and the dynamic nature of P cycling

Phosphorus transformations during soil development





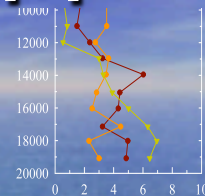
Anderson and Jackson Ponds, Western Appalachian Plateau

Late Holocene:
Grasses increase.
Mixed deciduous
forest and Prairie

Early-Mid Holocene:
Spruce declines, mixed
deciduous forest and
woodland dominates

Late Glacial: Spruce
dominated, Jack Pine
declined, Sedge
increased. Open boreal
forest

Full glacial: Closed
Spruce Forest; Deep
Open ponds, Low
organic productivity

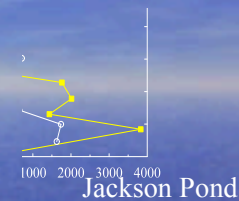


Age (yr B.P.)

Organic P

Occluded P

Mineral P



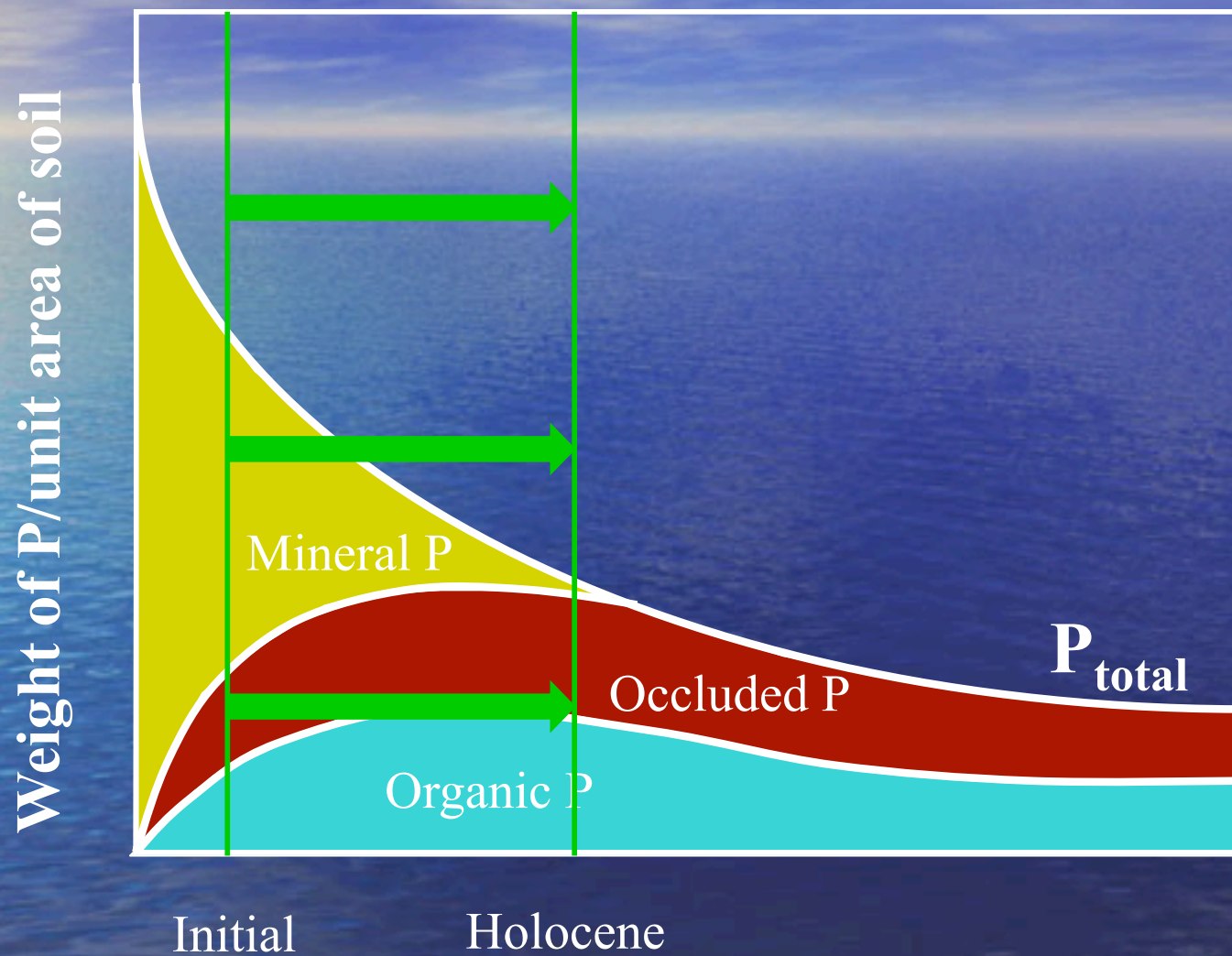
Jackson Pond

Anderson Pond

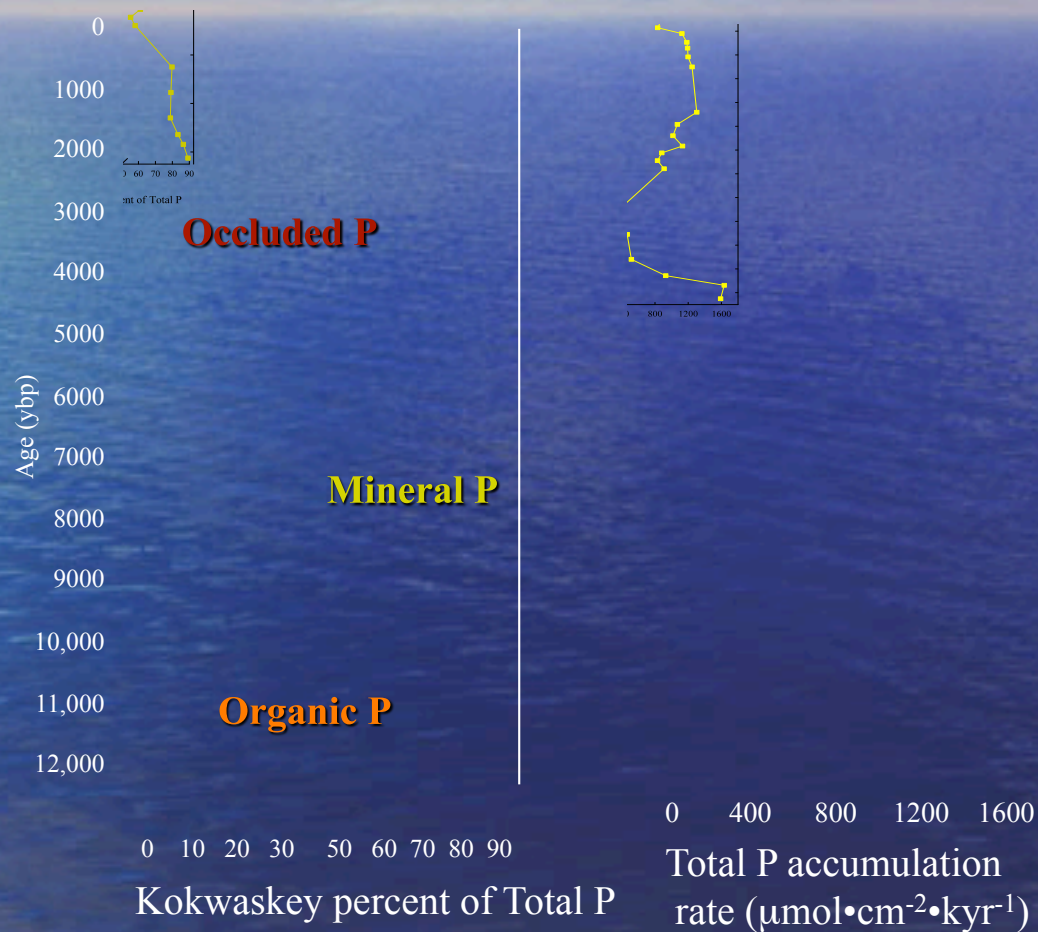
P concentration
($\mu\text{mol}\cdot\text{g}^{-1}$)

P accumulation rate
($\mu\text{mol}\cdot\text{cm}^{-2}\cdot\text{kyr}^{-1}$)

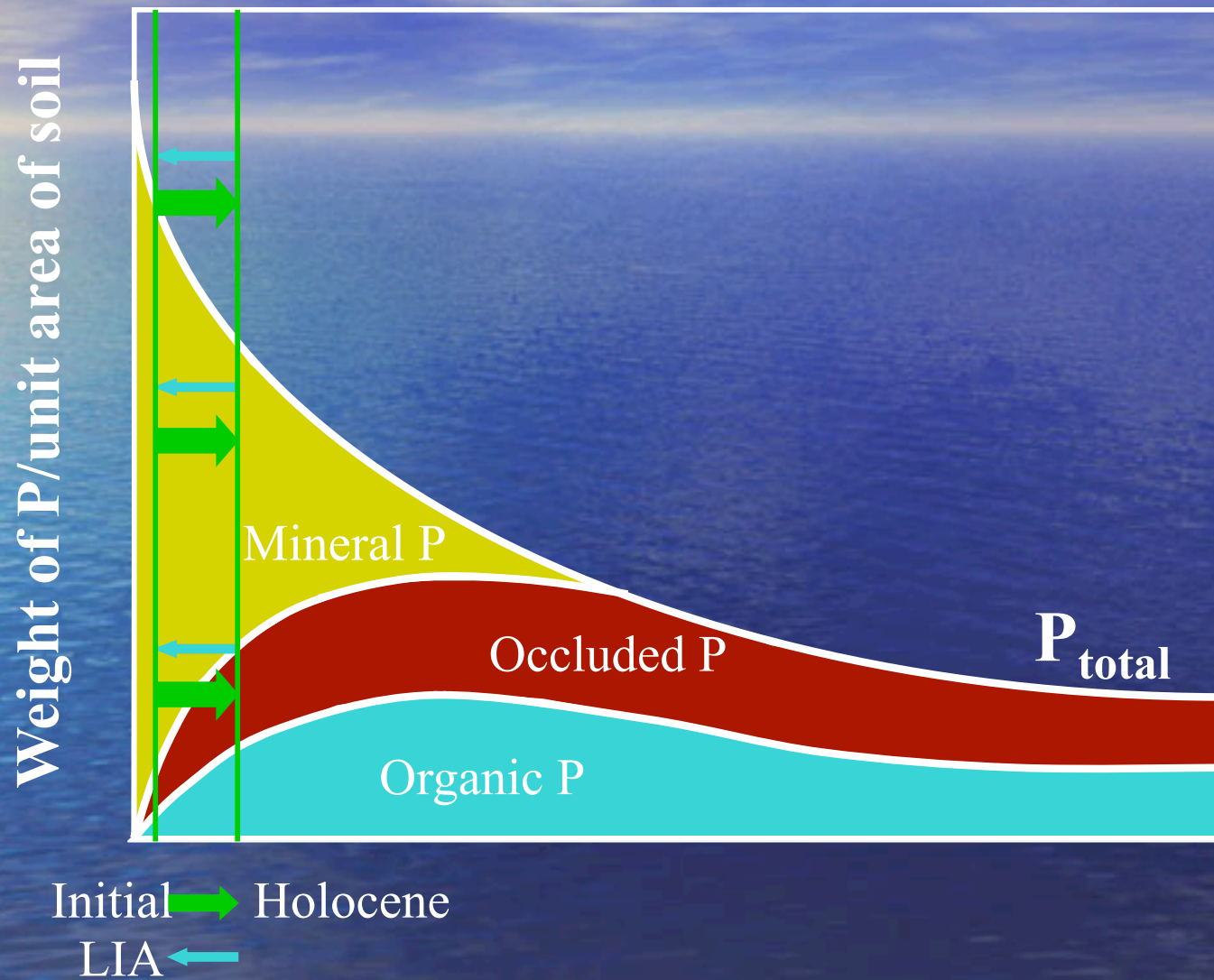
Phosphorus geochemistry - western Appalachian Plateau



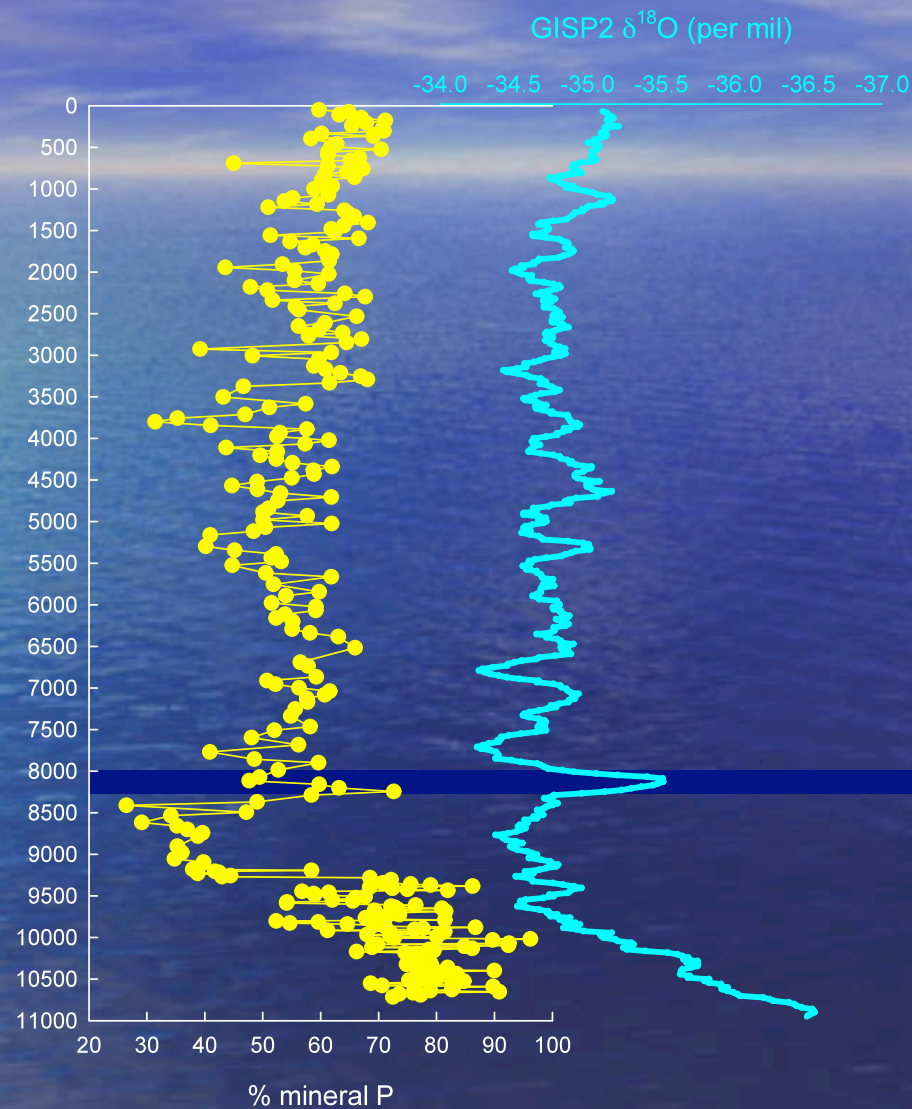
Kokwaskey Lake, Coast Mountains, British Columbia



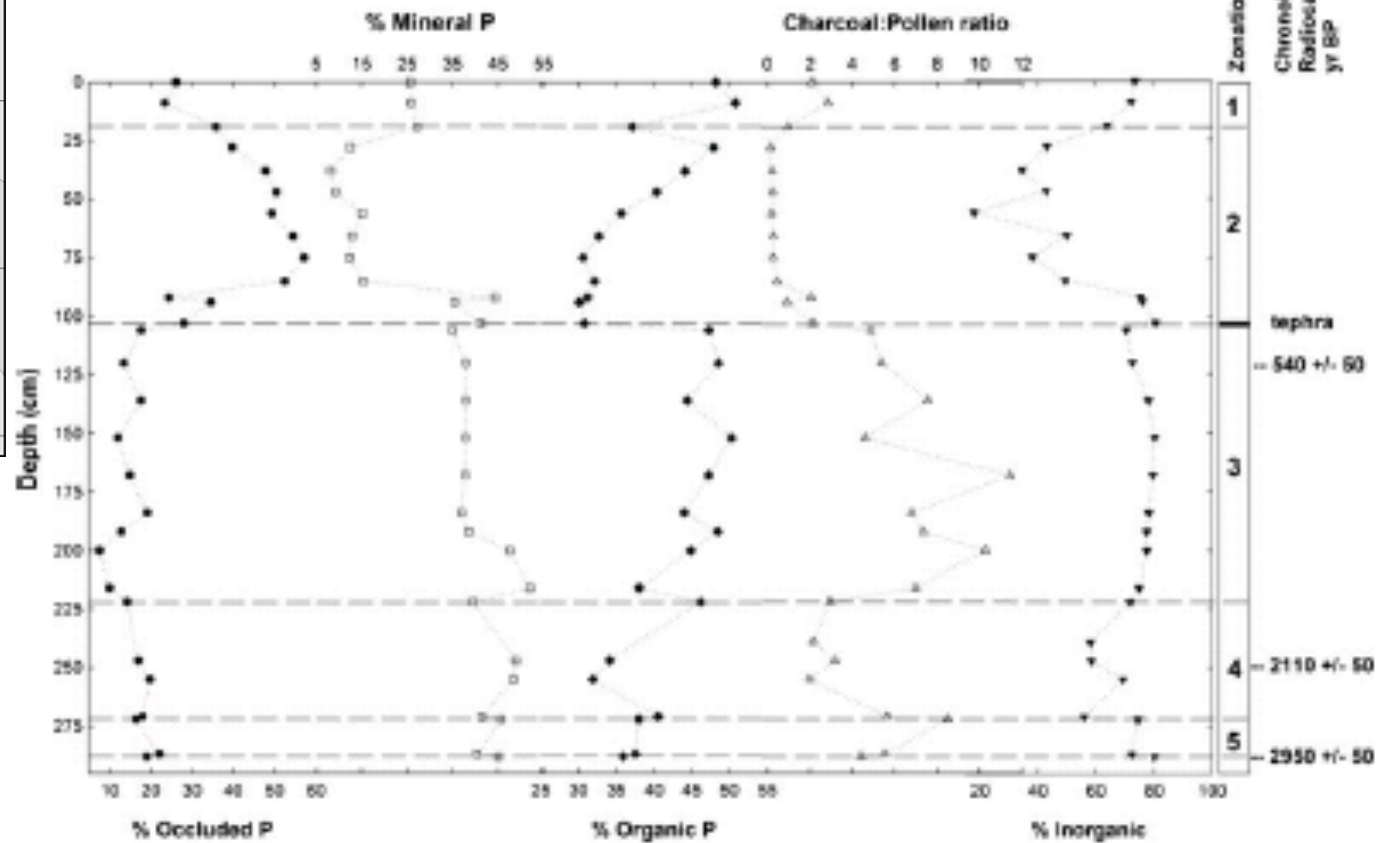
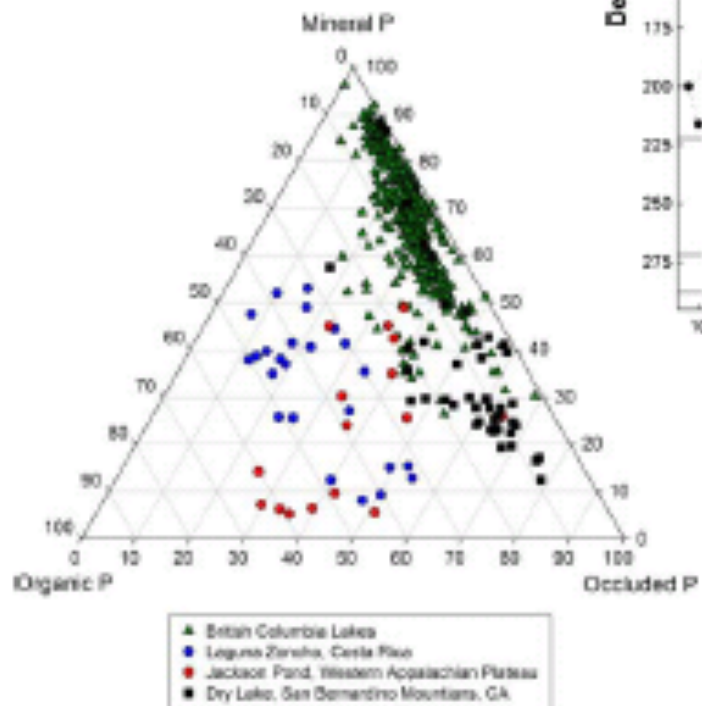
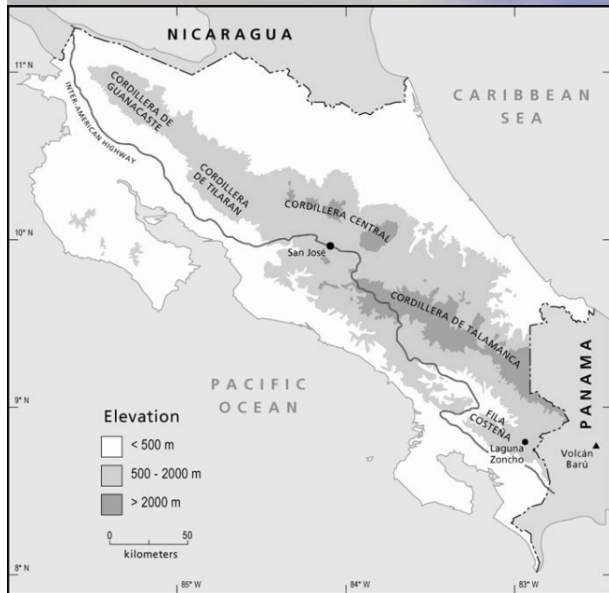
Phosphorus geochemistry - Kokwaskey Lake



Lower Joffre versus GISP2



Pre-Columbian influence on soil P chemistry



Future of the Phosphorus Cycle

