Perspectives on the Sampling and Processing of Soils from Tidal Marsh and Subaqueous Environments

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ISSUES

- Tidal Marsh soils are saturated continuously.
- Subaqueous soils are permanently submerged beneath standing water.
- Both are commonly found in coastal systems.
- The collection, transport, and storage of soil samples from tidal marsh and subaqueous environments present many challenges not normally encountered when working in subaerial environments.

Know your system before you sample

What are the physical properties?

This will affect how you can sample.

Are the soils soft (high n-value) or hard/dense?

Will they “flow”?

very high n-value, fine textured

very sandy, little fines

What are the chemical properties?

This will affect how you store the samples

Are they likely to contain sulfides?

Salt/Brackish/Estuarine or Fresh

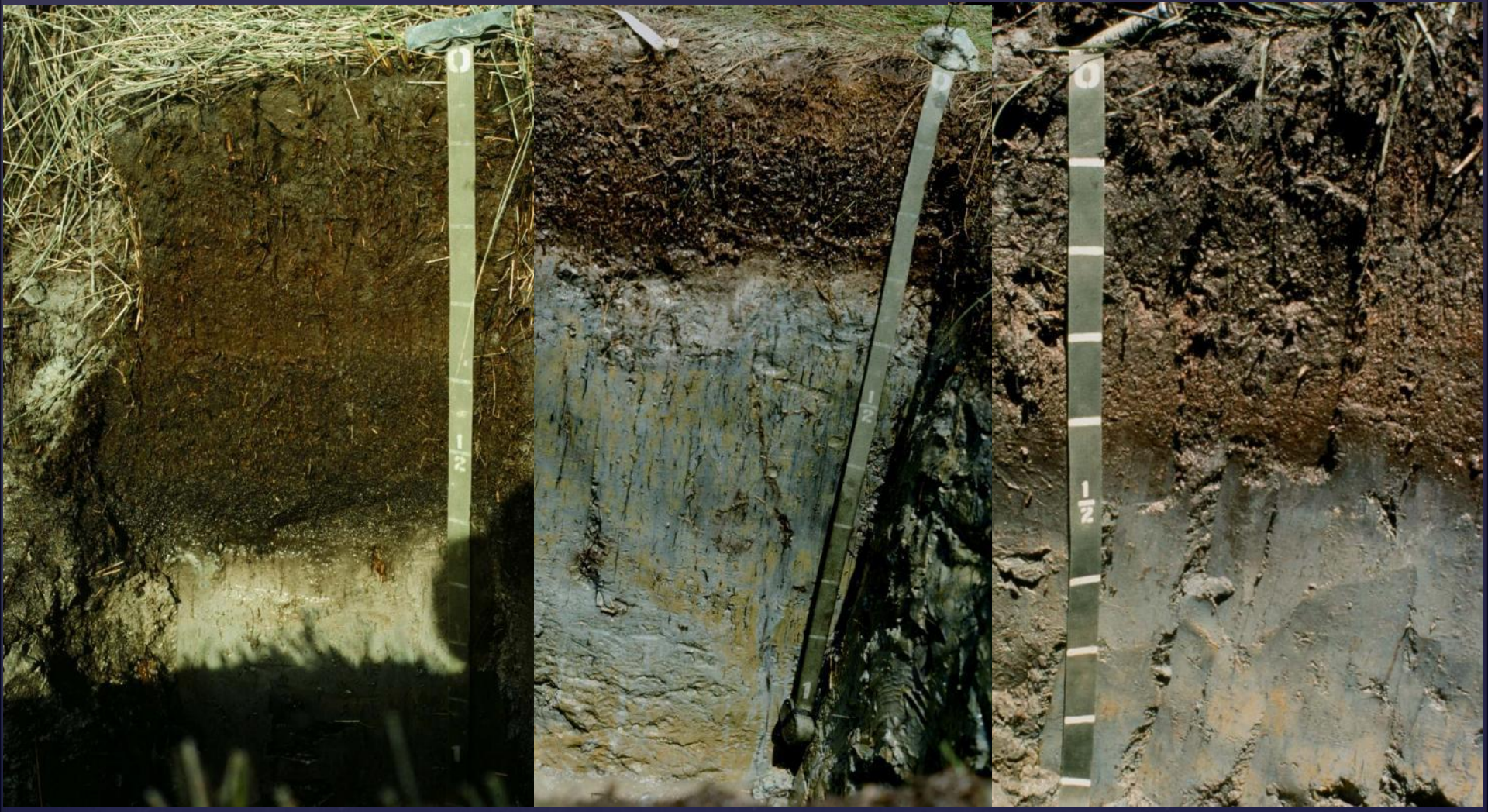
Sampling

Tidal Marsh Soils

- Excavating a pit
- Bucket Auger
- Macaulay Sampler
- Vibracorer

Subaqueous Soils

- No pit excavating!
- Bucket Auger
- Macaulay Sampler
- Vibracorer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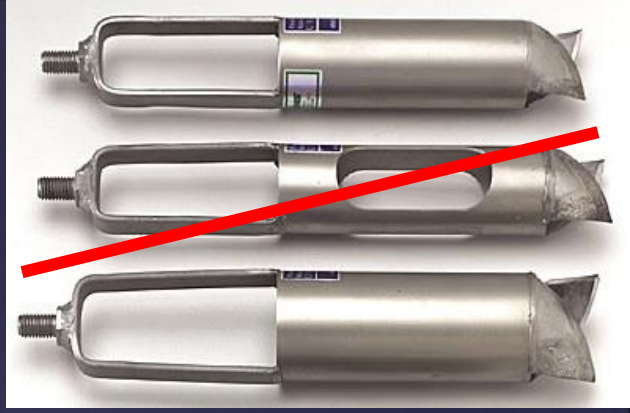
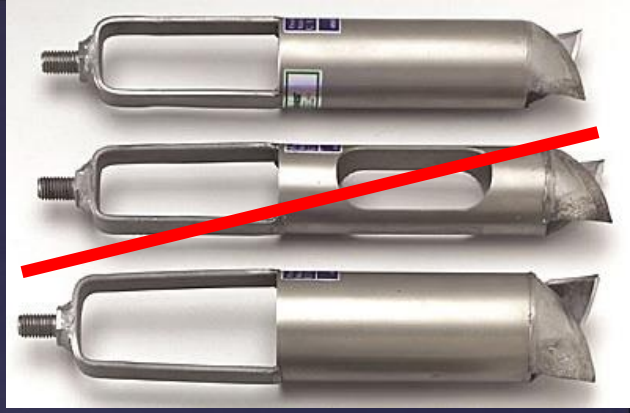
Bucket Auger



Can be used in the marsh
Can also be used in subaqueous environments
Fast and inexpensive

Bucket Auger



Limitations

- Limited to shallow water
- Difficult at soil depths below 75 cm
- Must be “in” the water to sample
- Poor horizon resolution
- May have difficulties with high n-value material
- No volume controls (for Bulk Density)
- Only during warm season (or dry suits needed)

Macaulay Sampler

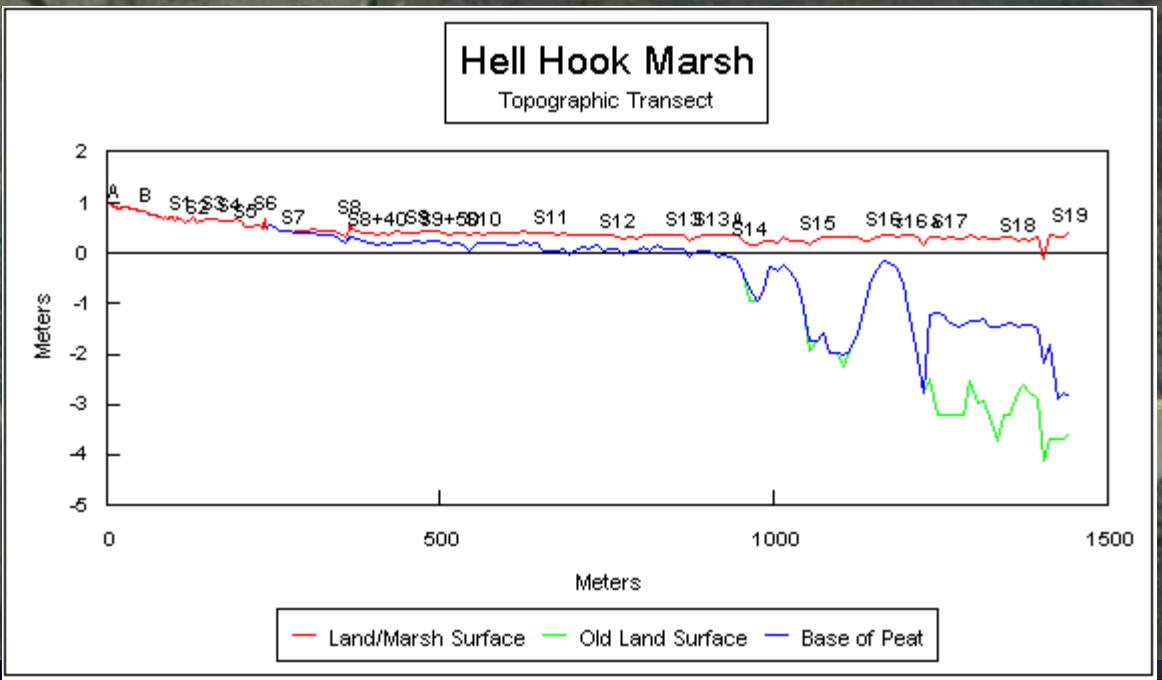
- Relatively fast
- Can be done from a boat
- Samples collected in 50 or 100 cm sections as “undisturbed” half cores (5 cm in diam)
- Good horizon resolution
- Good for bulk density

Macaulay Sampler

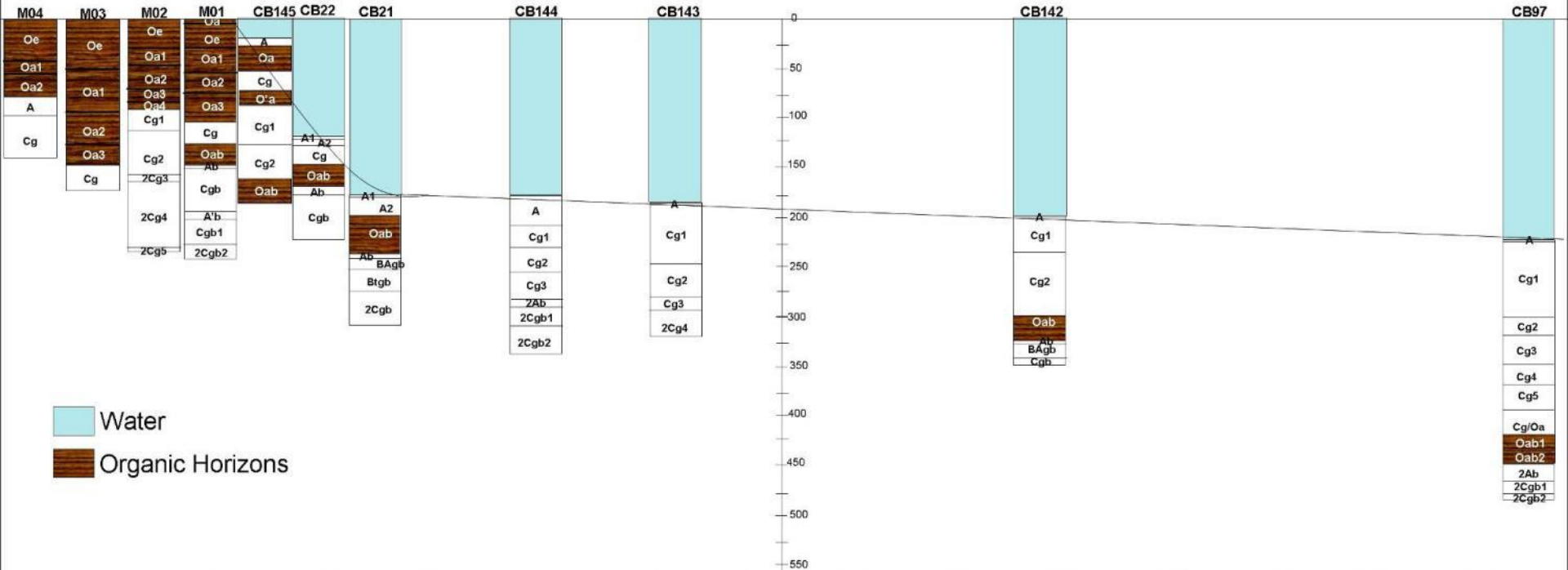
Adding extensions can permit deep sampling, and also, sampling in deep water.

Macaulay Sampler

S19 Marsh Sampling to 4 meters



Macaulay Sampler

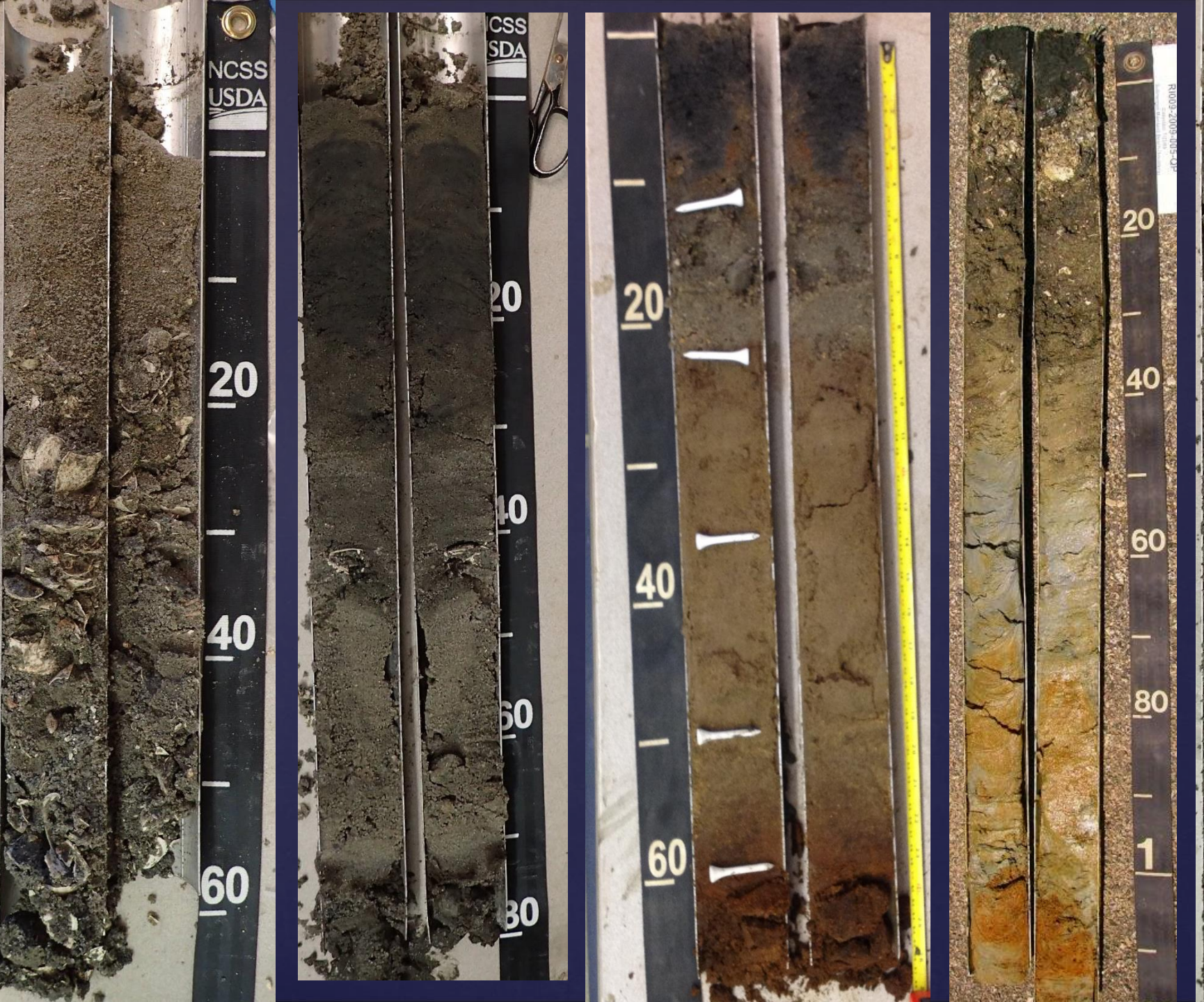


Macaulay Sampler Limitations

- Limited to fluid materials
  - (higher n-value, > 0.7)
  - At least slightly or moderately fluid
  - Too fluid may be lost during sampling
- Small sample size
  - Half core, 5 cm diam.
- Moderate cost – ($1000)

Vibracoring

- Tube is filled with water and plugged/sealed
- Tube is then removed from the soil - requires a winch or chainfall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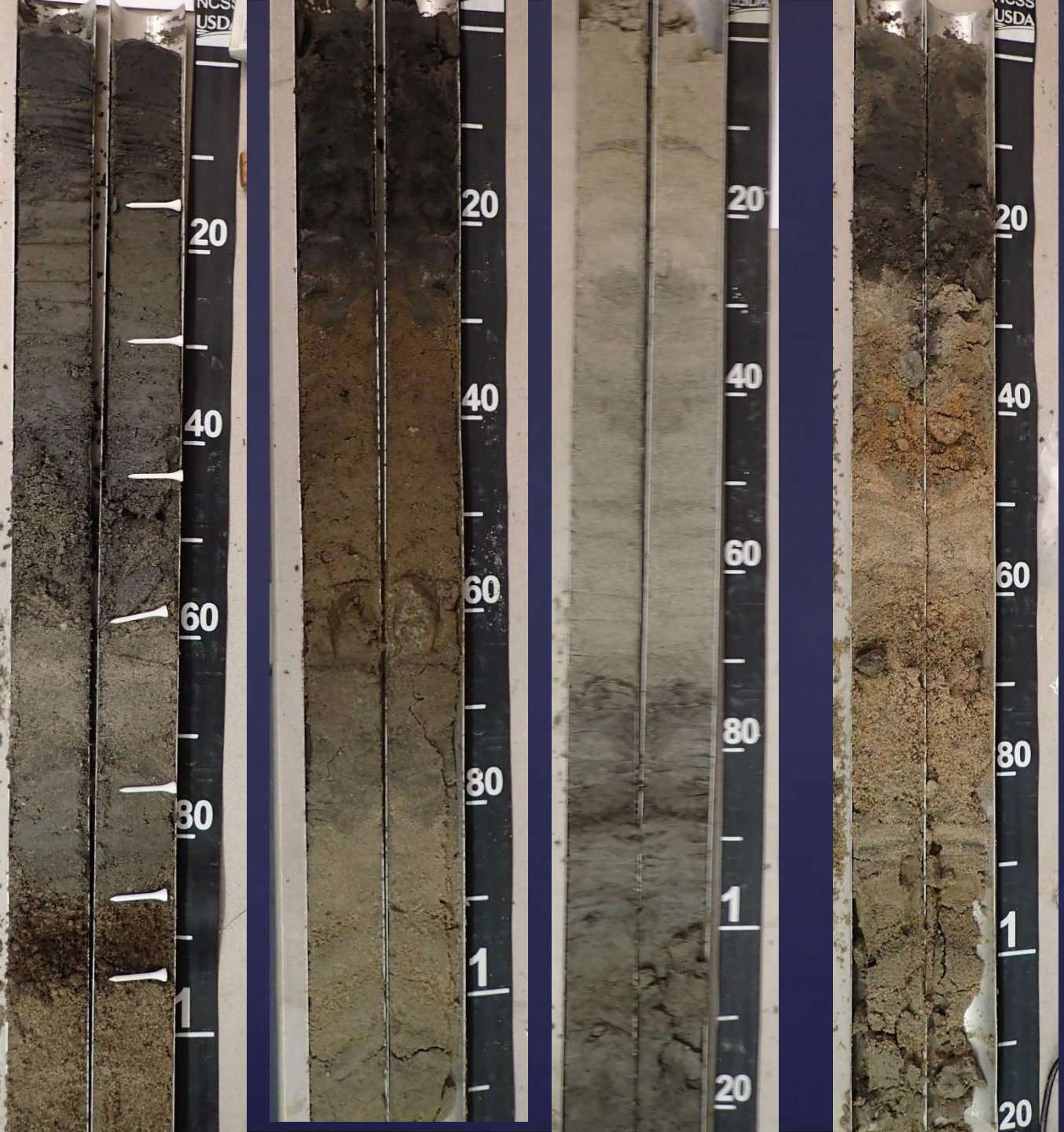
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Vibracoring Benefits

- Excellent undisturbed cores
- Up to several meters long
- Can be used in dense materials
- Can be stored for later examination

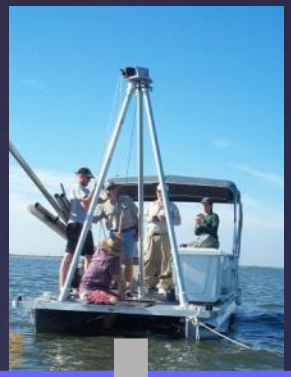
Vibracoring

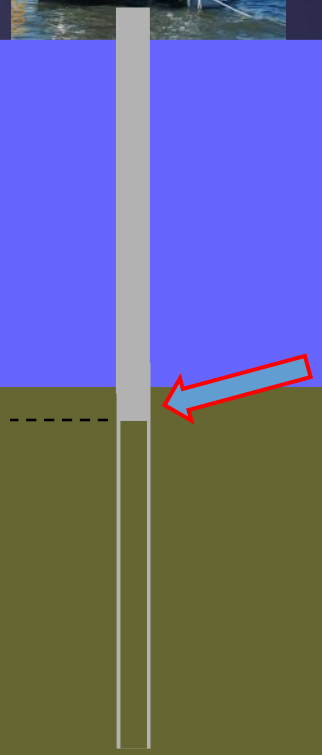
Limitations

- Slow and cumbersome (set up)
- Costly equipment
- Some “collapse” – change in volume (especially with organic rich horizons)

Problems with Collapse

- **Poor estimate of volume for bulk density measurement**
- **Only estimates of horizon depth**



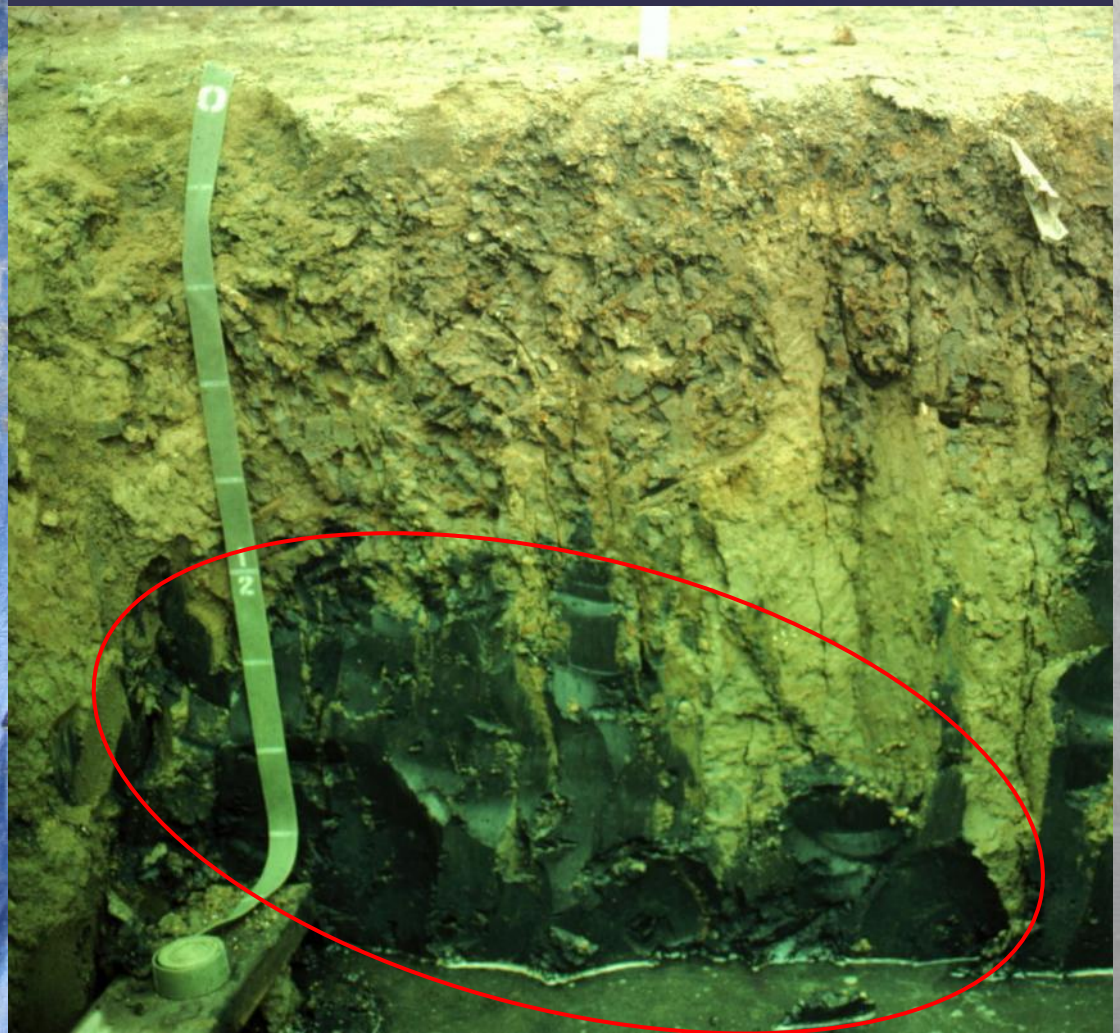


Sample Handling and Storage

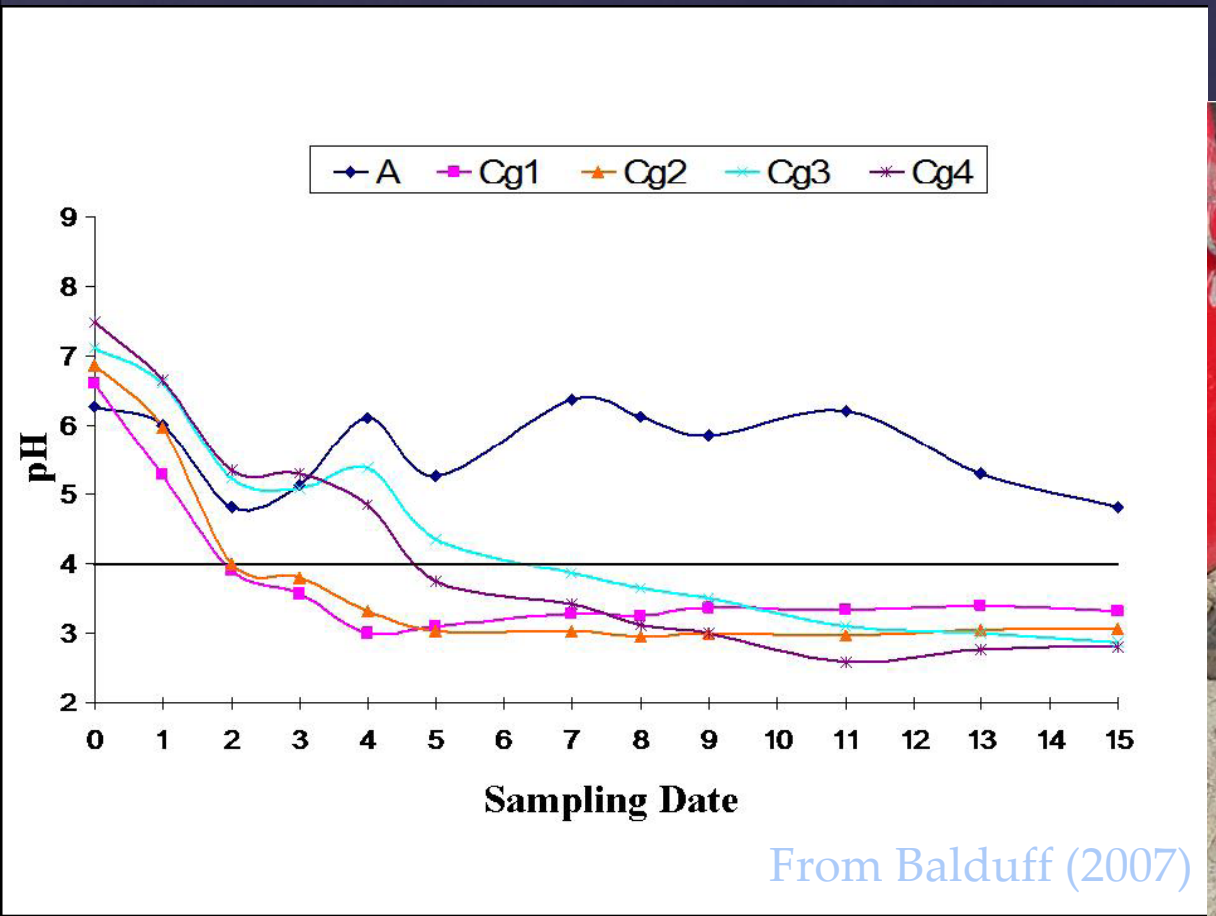
Physical properties pretty stable
Chemical properties highly labile – can change radically!

- FeS –minutes to hours
- Pyrite FeS2 – days to weeks
- pH – days to weeks
- Salinity – days to weeks
- Carbonate content – months?
- OM – pretty stable

FeS – Iron Monosulfides
AVS (acid volatile sulfides)
Black pigment
Highly labile

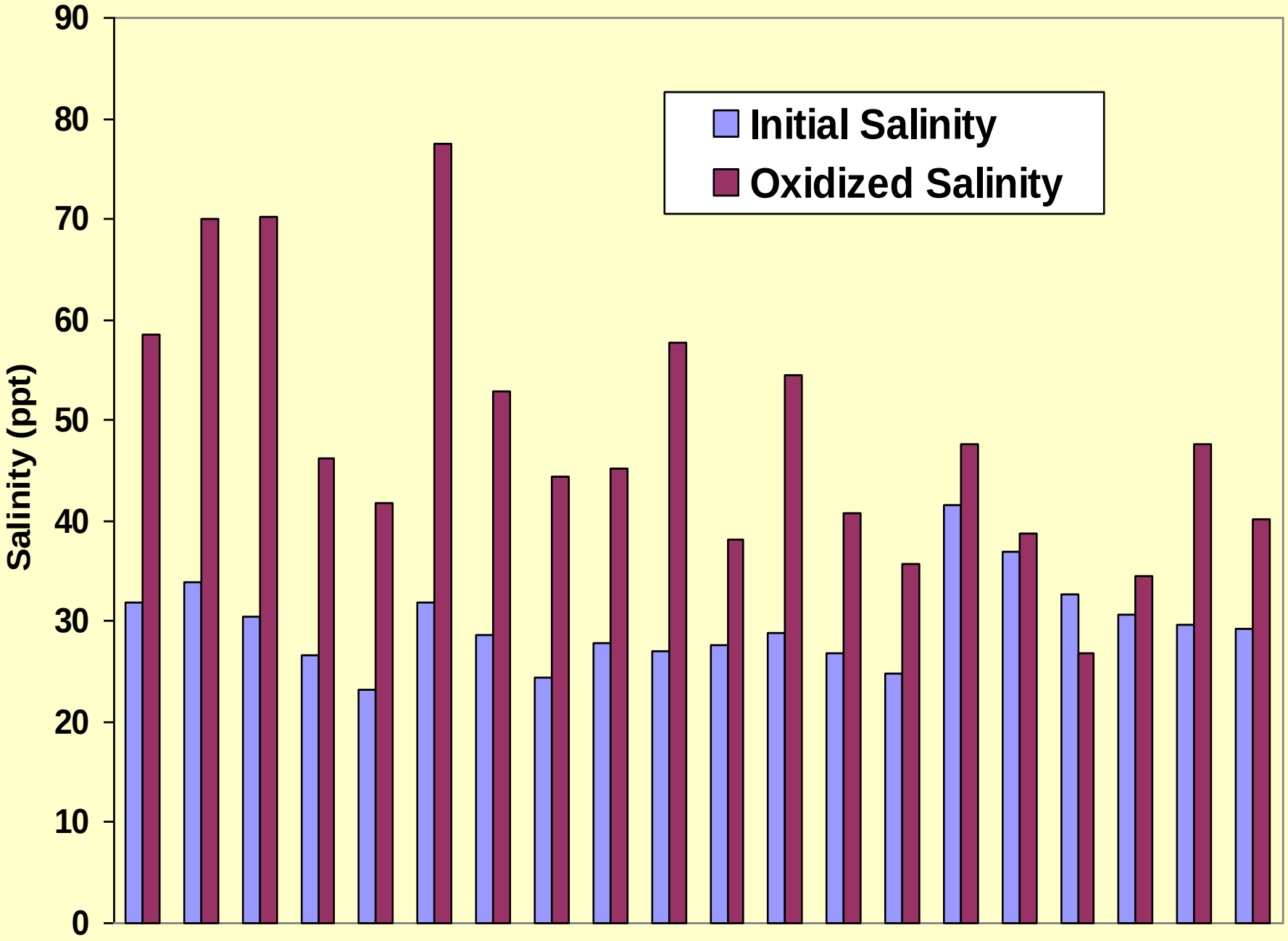


- Moist, oxidizing, pH Incubation over time
- Optimizes conditions for microbial oxidation of sulfide minerals and generation of acidity and salts



From Balduff (2007)

(From Payne, MS Thesis)



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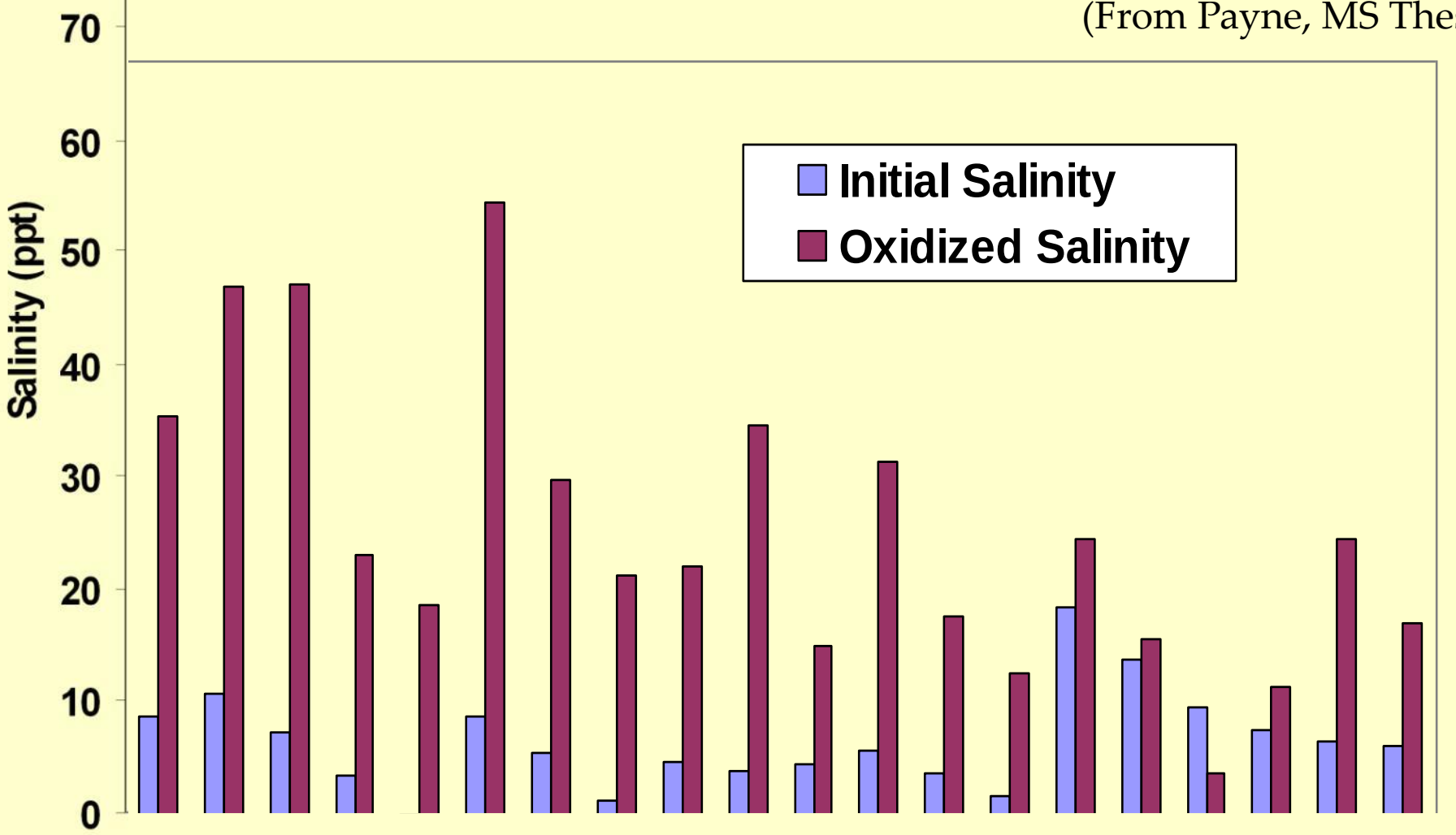

Could have sulfides in low salinity materials and see even more dramatic changes

Handling and Storage

Most of the problems are related to chemical or microbiologically driven changes related to exposure to oxygen.

Therefore, the general principles governing protection against these kinds of changes in soil properties will be to:

1. slow down the chemical reaction
2. protect against exposure to oxygen
3. or both

Handling and Storage

Slowing down the chemical and microbial reactions

Bare minimum

- Store on ice in a cooler
- Refrigerate and analyze immediately

Slowing down the chemical and microbial reactions

Prefered

- Sparge with N_2
- Then store on ice (or preferably) freeze in the field
  - Dry Ice
  - Liquid N_2
- Store frozen until analyzed

Working in these environments

Is challenging . . .


. . . but it can be done (fun)!