IDS 366 – Sophomore Seminar II
Mile High Chemistry
Yost Lake Status Update 3

Table of Contents

Section I ~ Methods

Section II ~ Results & Discussion

I. Methods

Section 1.1 ~ Deep Water Sample

We collected one deep water sample. Taking the raft out to the lake, we used the depth finder to determine the lake was 8 meters deep. We then used a Kemmerer Sampler, and took a water sample at 2 meters deep. Even at this depth, we collected large quantities of mud.

Section 1.2 ~ Soil Analysis (part 2)

Soil Organic Matter

We first took the weight of the three crucibles we used for drying the soil. Then we measured the crucibles with the soil in them. Having both pieces of information, once we burned away all the organic matter on a hot plate, we then weighed the crucible with the now dry (and burned) soil, and the difference in weight of wet soil and dry soil gave us the weight of the soil organic matter in g. Knowing the weight of the crucible gave us the exact weight (in grams) of the soil both wet and dry.

$CaCO_3$

To determine whether or not our soil samples had Calcium Carbonate ($CaCO_3$) we first dried soil in the oven in Soil Tin, and waiting for at least 30 minutes to ensure it was completely dry, we added acid to the soil, watching for a fizzing reaction between the acid and the soil.

Soil Nitrogen and Phosphorus

Using the soil samples we brought back to the classroom, we mixed DI Water in with the soil in a beaker, stirred for a few minutes, and let it sit for 5 minutes. We then dipped the respective strips (Nitrogen and Phosphorus) into the beakers, following the directions on the strip bottles.

Section 1.3 ~ CO_2 in the Atmosphere

This measurement took two parts: first we set up the field air sampler in the lab, and then we took it out to our lake to run it. To set up the field air sampler (GilAir5 Personal Air Sampler) we poured Barium Hydroxide acid ($BaOH_2$) into an Erlenmeyer Flask that had a rubber stopper with a hole for a tube to connect (via rubber tube) to the particulate air filter. We added enough to cover the filter resting in the flask. Once the flask was clamped in place, and the tube connected between the flask and the filter cartridge, we took the system out to the field.

Before setting up the filter cartridge, we weighed the filter, to get an initial weight. Once taken, making sure to wear gloves while working with the filter and cartridge, we connected it to the air sampler.

At the lake, we set the air sampler near the edge of the lake, away from the base of trees, and turned the air circulator (set to 5L/min) on. We let the circulator run for 60 minutes. Once we brought the sample back, we weighed the filter to determine the weight of the particulate matter collected in grams).

Section 1.4 ~ Total Atmospheric Deposition

We used a passive sampling technique – a bulk sampler – to gather our total (wet and dry) precipitation in the atmosphere. The materials we needed were a funnel and screen (which we were missing) that funneled into a smaller, acid washed jar. We let it sit outside for a period of 8 days. Bringing it back to the

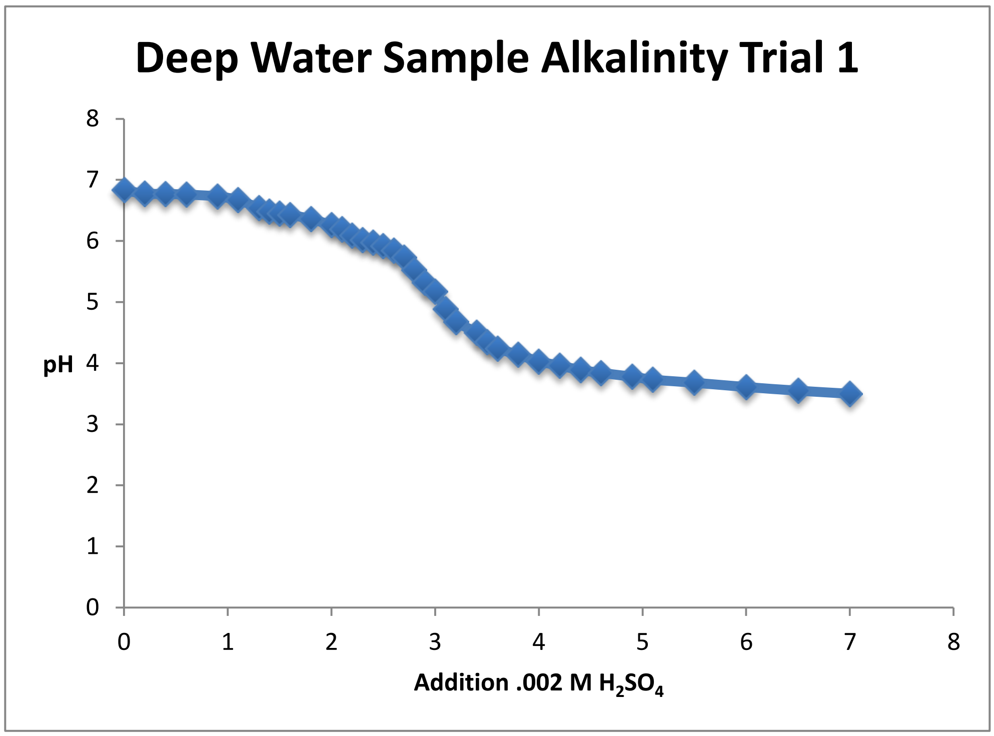
II. Results and Discussion

Section 2.1 ~ Deep Water Sample

Data:

Alkalinity

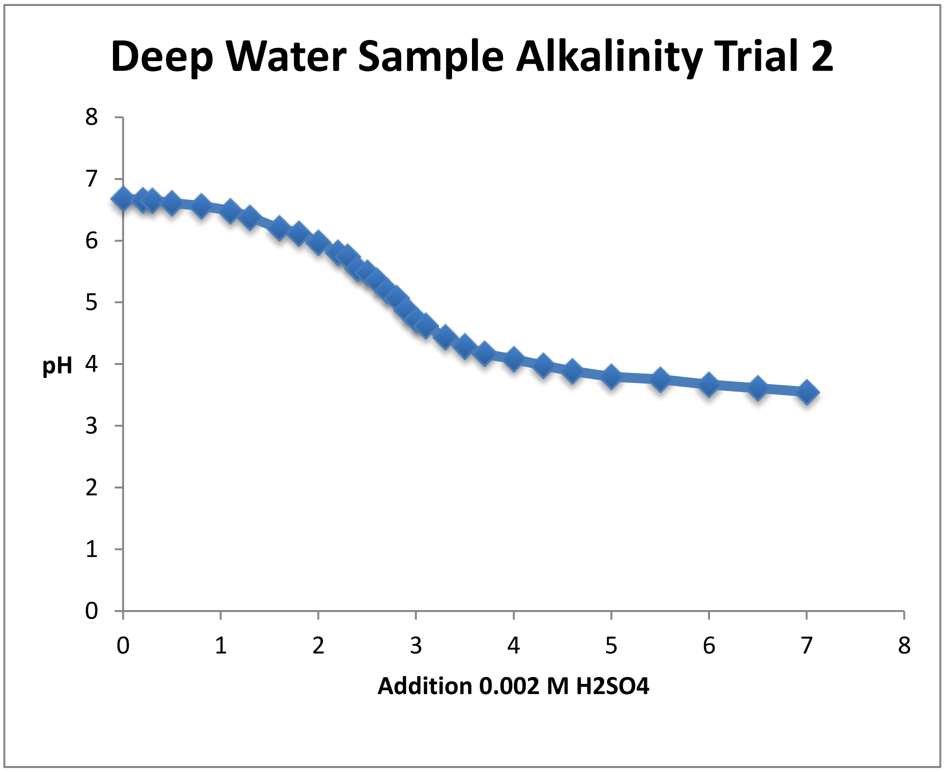
Addition	pH
0	6.83
0.2	6.775
0.4	6.77
0.6	6.76
0.9	6.73
1.1	6.67
1.3	6.54
1.4	6.48
1.5	6.45
1.6	6.43
1.8	6.36
2	6.26
2.1	6.19
2.2	6.09
2.3	6.02
2.4	5.98
2.5	5.92
2.6	5.84
2.7	5.73
2.8	5.52
2.9	5.32
3	5.17
3.1	4.89
3.2	4.68
3.4	4.5
3.5	4.34
3.6	4.24
3.8	4.14
4	4.03
4.2	3.96
4.4	3.89
4.6	3.84
4.9	3.78
5.1	3.73
5.5	3.68
6	3.61
6.5	3.55
7	3.5



Alkalinity: 20.67 mg/L

Addition	pH
0	6.68
0.2	6.66
0.3	6.65
0.5	6.61
0.8	6.56
1.1	6.48
1.3	6.38
1.6	6.2
1.8	6.12
2	5.97
2.2	5.81
2.3	5.74
2.4	5.55
2.5	5.48
2.6	5.35
2.7	5.19
2.8	5.07
2.9	4.88
3	4.72
3.1	4.62
3.3	4.44
3.5	4.29
3.7	4.17
4	4.08
4.3	3.98
4.6	3.89
5	3.8
5.5	3.75
6	3.67
6.5	3.61
7	3.55

Alkalinity: 20 mg/L



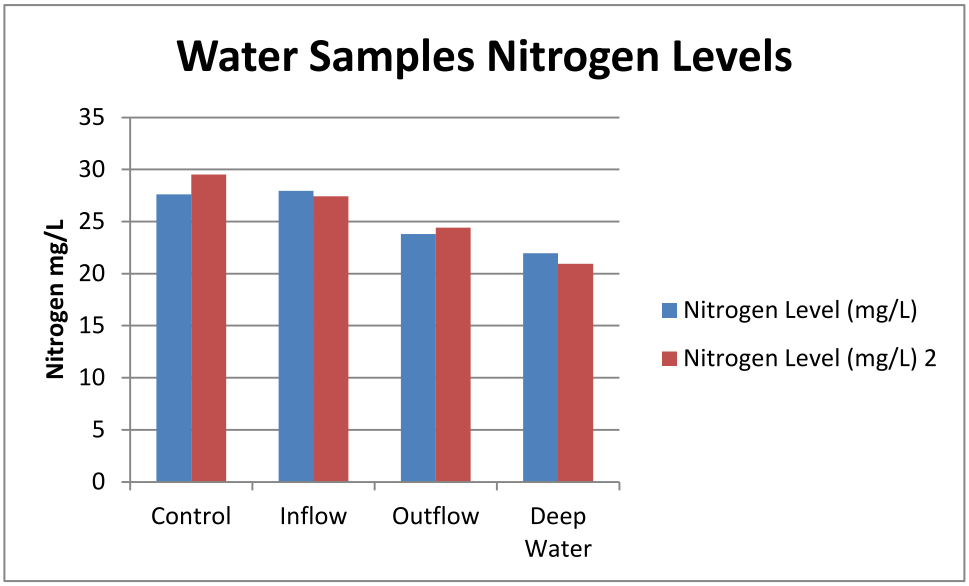
Standard Deviation & CI95:
This includes the earlier water samples: ±0.221
CI95 = 17.768 & 18.072

Discussion:

The deep water sample proves to have a marginally larger alkalinity to the rest of the lake (2-3 $mgCaCO_3/L$ more). The alkalinity is still very small, meaning that the lake as a whole is quite vulnerable towards acidification (if acid rain were to reach this ecosystem).

Nitrogen

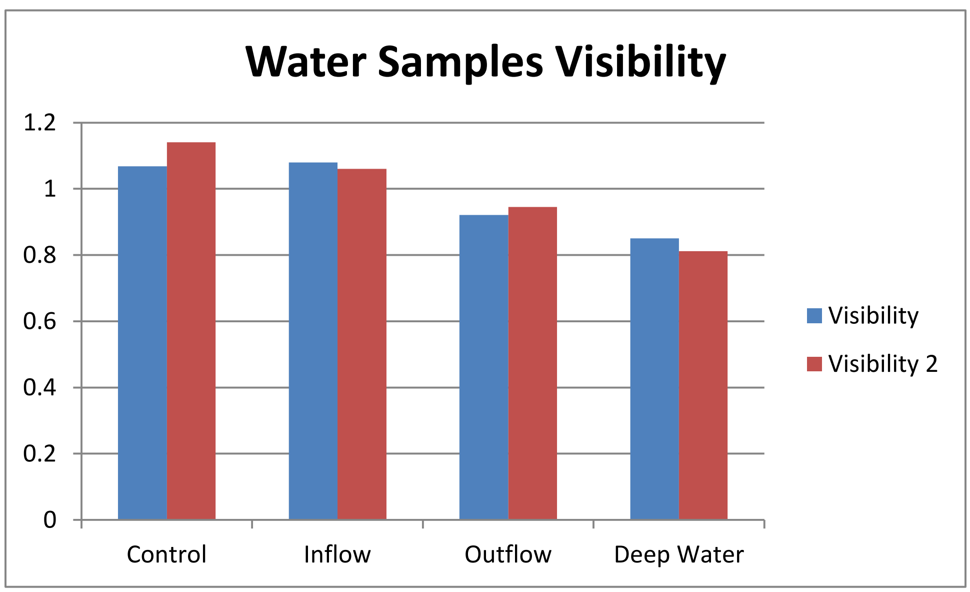
Sampling site	Visibility	Nitrogen Level (mg/L)	Visibility 2	Nitrogen Level (mg/L) 2
Control	1.068	27.625	1.141	29.52604167
Inflow	1.08	27.9375	1.06	27.41666667
Outflow	0.921	23.796875	0.945	24.421875
Deep Water	0.85	21.94791667	0.812	20.95833333



Standard Deviation & CI95:
±0.129mg/L
CI95 = 25.543 – 25.365

Discussion:

The Nitrogen level in the deep water sample was found to be lower than that in the littoral zone of the lake, which supports the Nitrogen pulse idea. With the Nitrogen coming in with the snowmelt, it makes sense that the shores will be more highly concentrated, as the runoff will take a while to reach the deeper portions of the lake, by which time, the aquatic plants will likely have taken in Nitrogen as nutrients.



Section 2.2 ~ Soil Analysis (part 2)

Data:

Soil Organic Matter

	Crucible weight	Total Weight	Post Burn Weight	Soil Weight	Organic Content	SOM %
Control	24.2315g	37.0465g	33.6293g	12.815g	3.4172g	26.6656262
East	17.6657g	27.7006g	26.1135g	10.0349g	1.5871g	15.8158028
Outflow	17.7555g	30.514g	22.5509g	12.7585g	7.9631g	62.4140769

Discussion:

What these data show us is that the soil taken near the outflow has a significantly higher percentage of soil organic matter than the other two samples do. What the outflow tells us is that there is a high water-holding capacity in that soil (organic material holds 90% of its weight in water) and it releases almost all that water back to plants for use, unlike a clay-like soil which holds much water, but retains almost all of it instead of it being available for plant use. Seeing more water and more organic matter in this part of the lake makes sense, because it was taken near the outflow, where the water seeps underground for its outflow rather than. These data also tell us that there should be a bigger reservoir of nutrients in the soil near the outflow sample.

$CaCO_3$

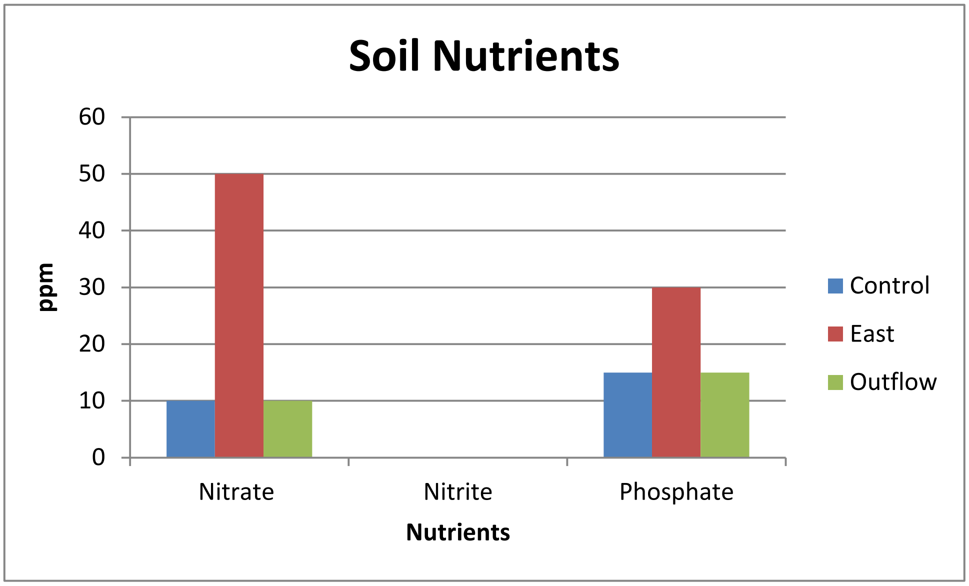
Reaction: Negative reaction of CO_2 gas bubbles when acid mixed in with dried soil.

Discussion:

Given the negative reaction (of an approximate experiment), we can tell there is none or trace amounts of Calcium Carbonate ($CaCO_3$). This means there is no chemical limestone in the water, which indicates that the soil has a very low buffer zone against Nitrogen.

Soil Nitrogen and Phosphorus

	Nitrate (ppm)	Nitrite (ppm)	Phosphate (ppm)
Control	10	0	15
East	50	0	30
Outflow	10	0	15



Discussion:

The Nitrogen level is rather low for soil nutrients, in regards to growing crops. An early season measurement (which is what we took) of 20 ppm is sufficient to produce a good corn harvest and 14 ppm is sufficient, if an additional Nitrogen/nutrient source such as animal manure is applied. The low Nitrogen reading in the soil also supports the theory that the high Nitrogen reading in the water comes from a Nitrogen pulse as a result of the snowmelt, rather than groundwater pollution seeping through the soil.

Section 2.3 ~ CO_2 in the Atmosphere

Data:

Filter 1 (g)	0.009
Particulates (g)	0.11721
moles air	0.1549819
µmol CO2	45.6852792
ppm CO2	294.778151

Discussion:

As a result of our active air sampler, we found that CO_2 in the atmosphere is about 294.78 ppm. This is below the current global average of 401ppm. A lesser concentration means a less powerful CO_2 greenhouse warming effect on the local environment. It likely means that this ecosystem is less effected by CO_2 emissions from industrial sources than areas with greater concentrations of CO_2.

Section 2.4 ~ Total Atmospheric Deposition

Data:

Area (cm^2)	457.071667
Nitrogen (ppm)	0
Phosphates (ppm)	5
Particulates(mg/L)	23.442
Volume	5
pH	7.2
Precipitation	720 ml
Precipitation per cm^2	1.57524531

Discussion:

Over the 8 day period of letting our bulk sampler sit out, we collected more precipitation than the sampler could hold. What we ultimately were able to collect was 720 ml of precipitate. We discovered it had a pH of 7.2 and that the precipitate had no Nitrogen in it, and small amounts of Phosphates.