Department of Crop and Soil Sciences

Commemorating Our Centennial, 1907–2007

TOUR OF SOIL CHEMISTRY LABS (09/22/07)
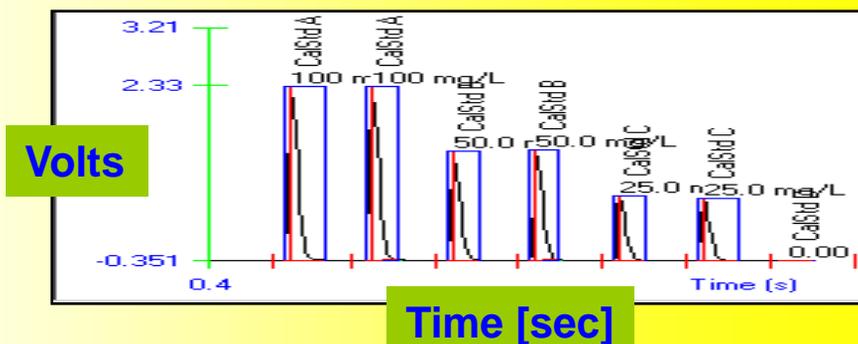
a Century of
SOLUTIONS

WELCOME TO THE TOUR OF SOIL CHEMISTRY LABS

- **Instrument:** Lachat QuikChem® FIA + 8000 Analyzer

- **Principle:** Analysis is based on reacting sample with reagent to form color complex which absorbs light at a specific wavelength. The absorbance of the reaction product is directly proportional to the concentration of the analyte in the sample.

- **Capabilities:** Two sample processing modules (channels) configured to analyze silica, iron, aluminum, nitrate, nitrite, ammonia, total Kjehldahl nitrogen (TKN), total dissolved nitrogen, ortho-phosphate, total dissolved phosphorus, molybdenum.

- **Operator:** Justine Cook, MS Candidate

- **Instrument:** **Shimadzu SSM-5000A and TOC-5000A Analyzer**

- **Principle:** The sample is combusted or decomposed to CO_2. and detected in a **non-dispersive infrared gas analyzer (NDIR).** The peak area counts are proportional to concentration of carbon in sample

```
#   AREA  ppm
1   9017  11.500
2   8728  11.131
3   8931  11.390
- - - - - - - - -
MN  8892  11.340
SD   148   0.1893
CU  1.66 %
```

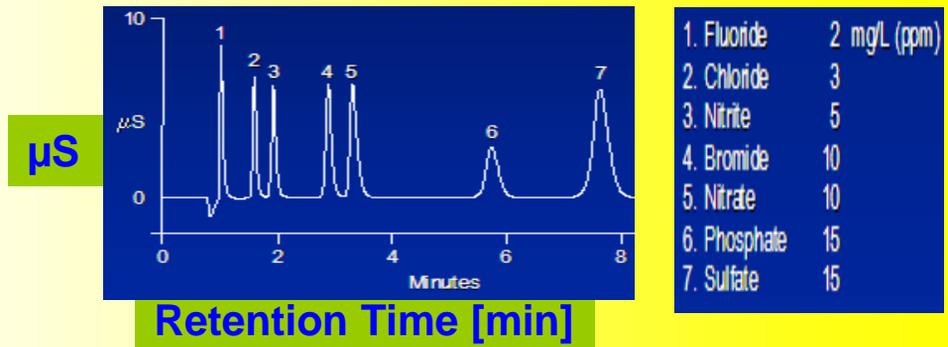**0%**   **Input Signal**   **25%**

0

10

Time [min]
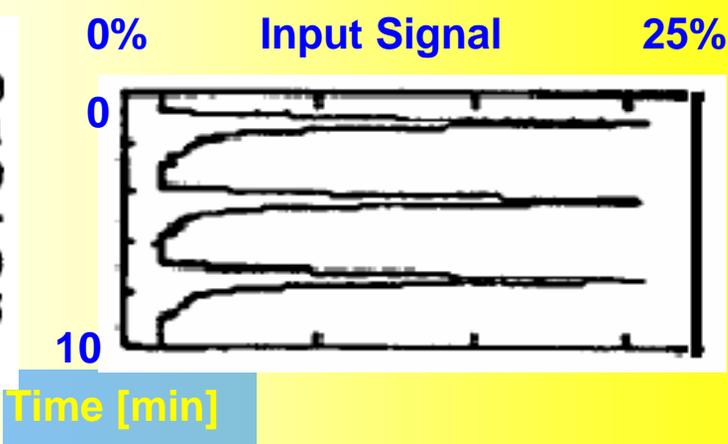
- **Capabilities:** Analysis of total carbon (**TC**), total organic carbon (**TOC**), inorganic carbon (**IC**), dissolved organic carbon (**DOC**), purgeable organic carbon (**POC**), and non-purgeable organic carbon (**NPOC**).

- **Operator:** **Kulbhushan Grover, PhD Candidate**

- **Instrument:** Dionex DX 500 Ion chromatograph (IC)

- **Principle:** Dionex DX 500 is a liquid chromatograph where charged species are separated by selective distributions in an electrolytic mobile phase and a stationary phase with weak ionic sites. Detection is performed by a conductivity detector – the greater the concentration of ions the higher the conductivity of the solution.


1. Fluoride	2	mg/L (ppm)
2. Chloride	3	
3. Nitrite	5	
4. Bromide	10	
5. Nitrate	10	
6. Phosphate	15	
7. Sulfate	15	

Retention Time [min]

- **Capabilities:** Rapid, sequential measurements of halides (Br$^-$, Cl$^-$ and F$^-$), oxides (NO$_2^-$, NO$_3^-$, PO$_4^{3-}$, SO$_3^{2-}$ and SO$_4^{2-}$) and alkali metal and alkaline earth cations.

- **Operator:** Dr. Ephraim Govere (Manager)

- **Instrument:** **Varian CP-3800 Gas Chromatograph**

- **Principle:** A portion of the sample is injected into a gas chromatograph (GC) and compounds in the sample are moved through the column by the carrier gas. They travel through the column at different rates depending on **differences in partition coefficients** between the mobile and stationary phases and are determined by detector and integrator.

μV

Time [min]
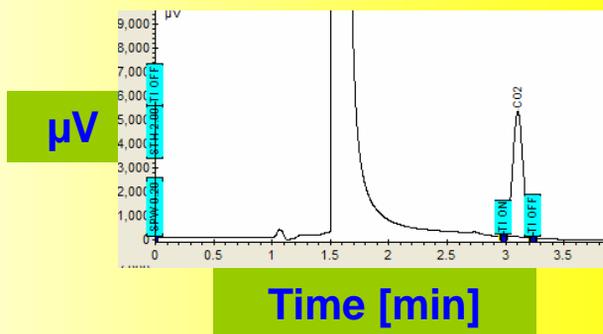
- **Capabilities:** Varian CP 3800 is equipped with *flame ionization detector* (**FID**), a selective and mass flow dependent detector for most organic compounds, specifically hydrocarbons, an *electron capture detector* (**ECD**) for a selective and concentration dependent detector for halides, nitrates, nitriles, peroxides, anhydrides, organometallics, and a *thermal conductivity detector* (**TCD**) a non-selective detector and concentration dependent detector for organic and inorganic compounds.

- **Operator: Marshall McDaniel PhD Candidate**

- **Instrument:** INNOVA 1412A Gas Analyzer

- **Principle:** Optical radiation, from infrared-source, is used to excite a gas molecule. The sample absorbs some of this radiation resulting in an increase in the internal energy. The **pressure changes** that occur upon periodic or pulsed sample heating can be detected by using a **microphone to monitor the acoustic wave**.

| Time	A: AMMONIA [ppm]	B: CO2 [ppm]	C: NITROUSOXIDE [ppm]
05-07-23 02:31:29	0.315	535.385	0.270
05-07-23 02:32:32	0.179	546.048	0.244
05-07-23 02:33:32	0.239	541.960	0.247

- **Capabilities:** Highly accurate, reliable and stable quantitative carbon dioxide (CO_2), nitrous oxide (N_2O) ammonia (NH_3), methane (CH_4), volatile organic carbons (VOC) and water (H_2O) vapour monitoring system. Capable of measuring almost any gas which absorbs infrared light.

- **Operator:** Marshall McDaniel, PhD Candidate

- **Instrument:** LICOR LI-7000™ CO_2/H_2O Analyzer

- **Principle:** The LI-7000 is a **differential, non-dispersive, infrared (NDIR) gas analyzer.** Measurements are based on the difference in absorption of infrared (IR) radiation passing through the reference cell of known CO_2 or H_2O concentration and the sample cell of unknown concentration. The radiation at the detectors is measured in both cells and used to compute absorption.


Peak Area Units vs **Time [sec]**
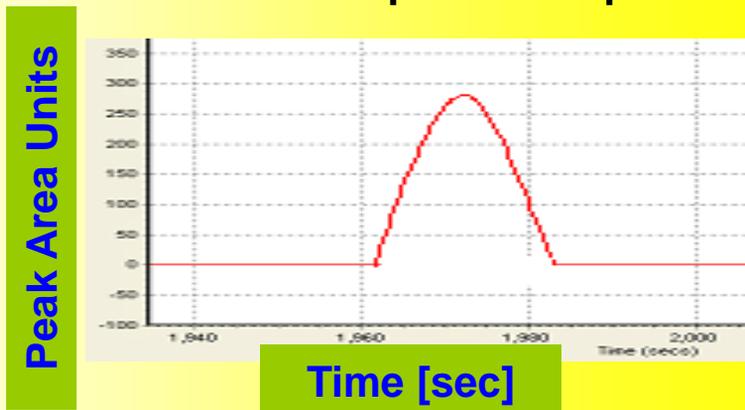
- **Capabilities:** High performance, dual cell analyzer for CO_2 and H_2O in the same gas stream.

- **Operator:** Emad Aboukila, PhD Candidate

- **Instrument:** Voltammeter - Metrohm 797 VA Computrace

- **Principle:** Current-Potential measurements from redox reactions are made at a working electrode for determination of organic compounds or trace metals.

Mercury Electrode

Cu peaks

Current (A)

Potential (V)
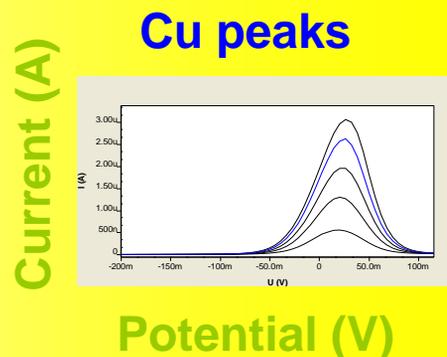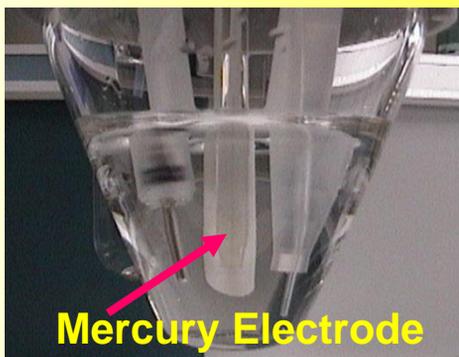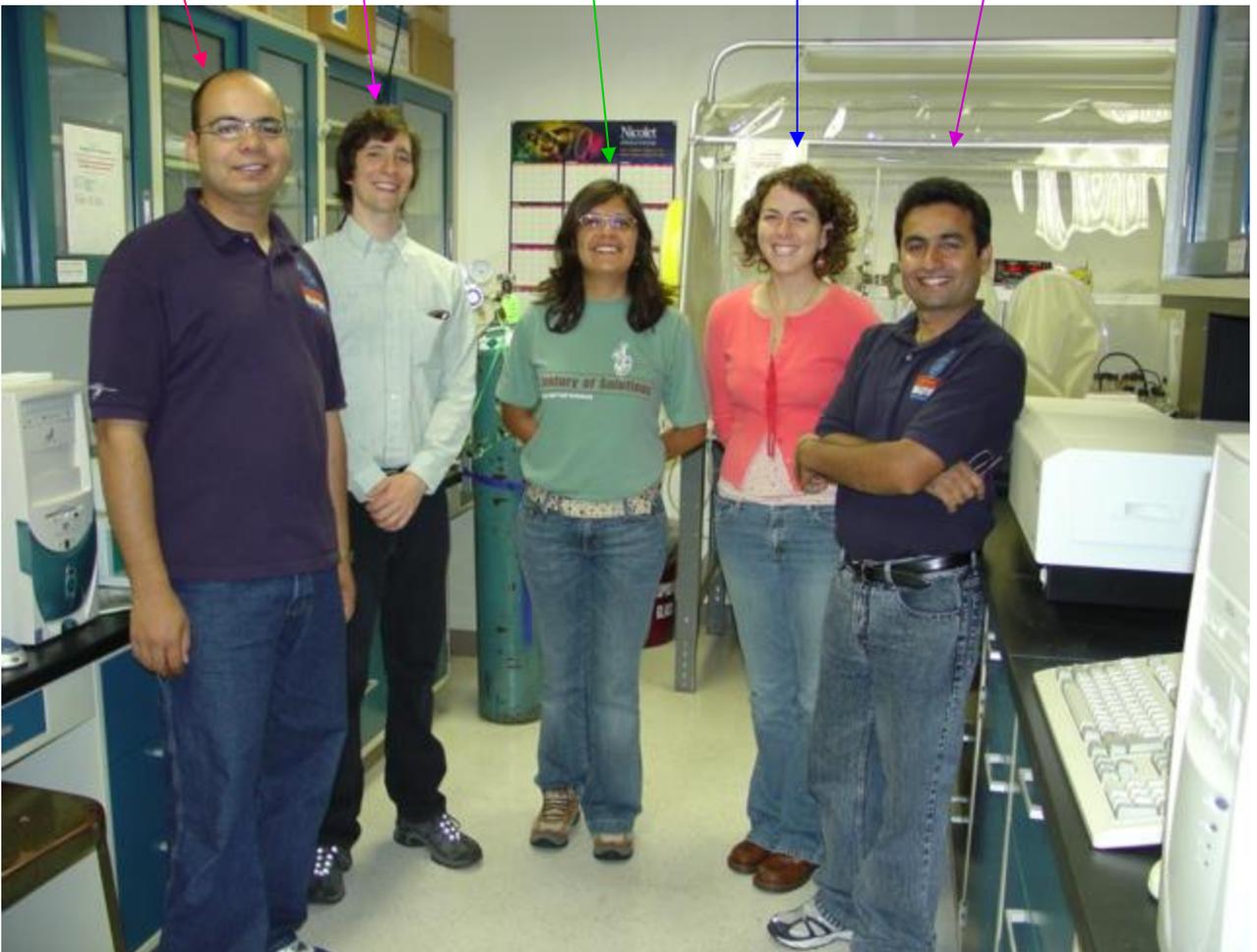
- **Capabilities:** Analysis of organic compounds and trace metal with a high degree of sensitivity (i.e. 50 ppt Cu) and with the additional capability to differentiate between various oxidation states and free and non-free ions.

- **Operator:** Nadia Martínez-Villegas, PhD Candidate

WELL DONE!!!

Emad, Marshall, Nadia, Justine, Kulbhushan

Thank you Alumni, graduate students, & Dept Head for making the tour a success!!