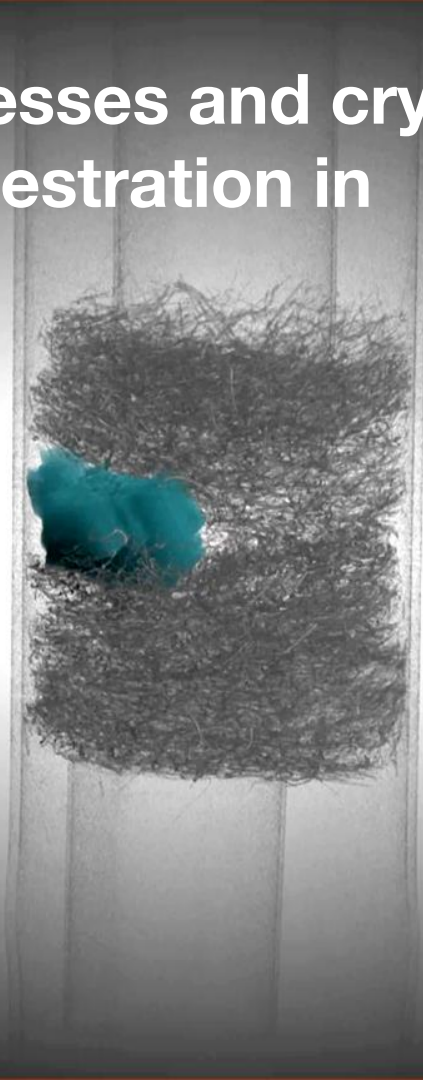


Ion exchange processes and crystal imaging of Pb sequestration in clinoptilolite



Lead (*Plumbum*, Pb)



You Can't Judge Very Well
how a color will look on your house by the way it looks on the color card. The better way is to have your painter try the color on a few boards of the surface to be covered. Change it till it suits you. You can do this if your paint is mixed on the job, of

**COLLIER
White Lead**
(Dutch Boy Painter Trade-Mark)

and pure linseed oil. White lead paint may be tinted any conceivable color. It is the standard long-wear paint that has proven its worth through generations of use. It is blitch-proof, scale proof, crack-proof.

Come to us for your paint supplies and

Ask for our Painting Points
containing color schemes and many helpful painting suggestions.

T. N. COLEMAN,
Druggist
C. W. BIGERT

A black and white illustration of a painter sitting on a barrel. The painter is wearing a cap and a long-sleeved shirt, and is holding a paintbrush in his right hand and a color card in his left hand. The color card is a small rectangular board with a circular logo on it. The painter is looking towards the viewer.

FACT: LEAD IS TOXIC

It is harmful to everyone and

DAMAGES:



BRAIN



KIDNEYS



LIVER



BLOOD



REPRODUCTIVE SYSTEM

Young children

are most vulnerable. Their nervous systems are still developing and they absorb **4-5 times more than adults**, which can cause:

- intellectual disability
- underperforming at school
- behavioural issues



In adults

lead exposure increases the risk of:

- ischaemic heart disease
- stroke



In pregnant women

lead exposure damages many organs but also affects:

- the developing foetus

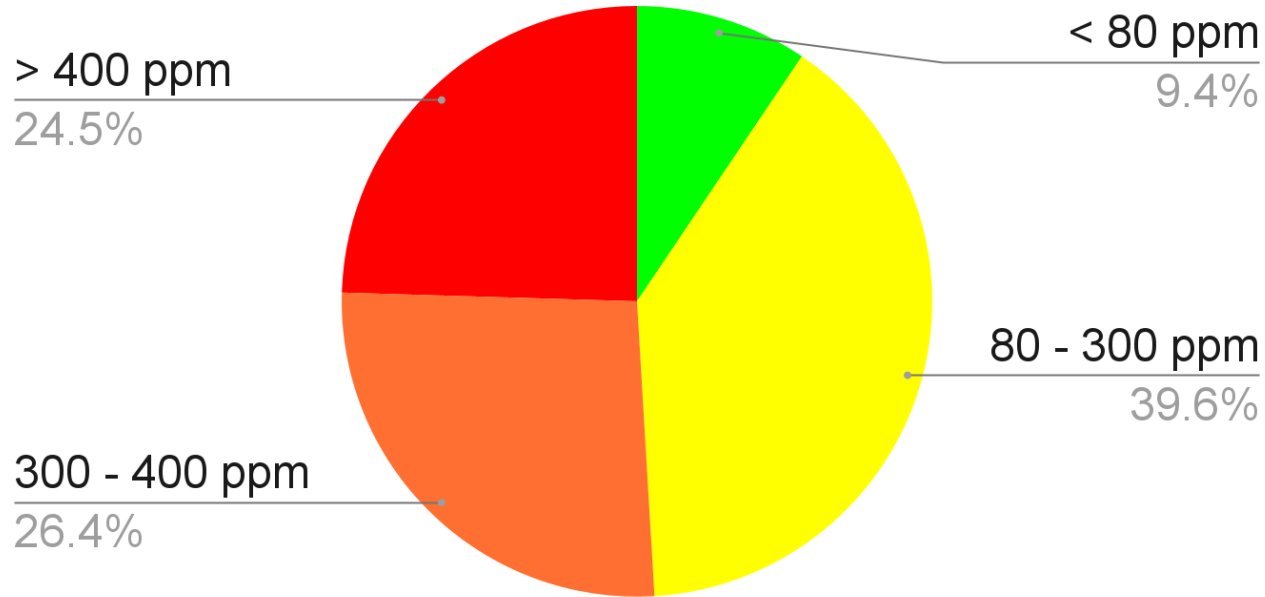


There is no safe level of lead exposure



World Health Organization

Out of 53 samples we collected in L.A.



Average was 270 ppm



Sinks: Places We Call Home

“Sinks are places where pollution can be deposited. Sinks typically are land, air, or water, but racially devalued bodies can also function as *sinks*.”

Laura Pulido, *Geographies of race and ethnicity II: Environmental racism, racial capitalism, and state-sanctioned violence*, 2016.

ART & SCIENCE COLLIDE

09 14 2024

Wounded soil/ wounded communities

- Danger on children
- Cancer, respiratory illnesses
- Disconnection from soil
- Fear of soil
- Pain, distrust, anger
- Non human communities also disturbed

Healthy soil/ healthy communities

- Soil as a source of life
- Connection with soil
- Being able to play in our backyards, grow our own food
- Empowerment of communities
- Building relationships with



Maru García
LA based Artist +
Researcher
Pb project coordinator



Aaron Celestian Ph.D.
Curator, Mineral Sciences
Natural History Museum
Los Angeles
Pb lead scientist

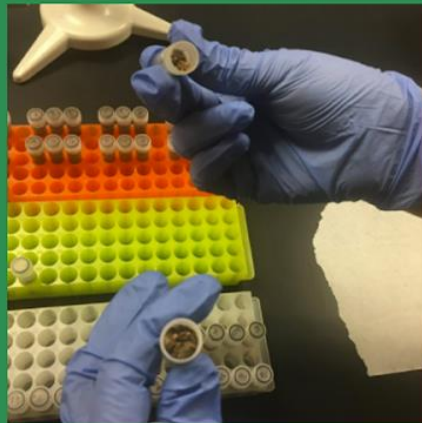


Maura Palacios Ph.D.
Assistant Professor of
Biology
Mount San Antonio
College
Pb researcher

How are we doing this?



Soil collection



eDNA testing and
Lab scale Pb
experiments



Community
education

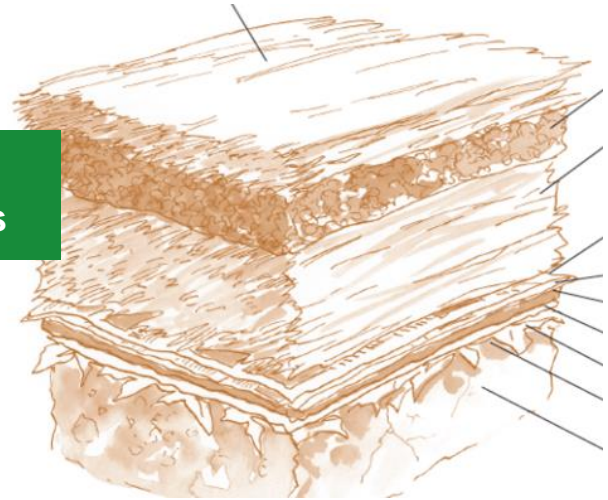


Field testing and
characterization

Apply at the soil surface:

- Zeolite + mulch
- Zeolite + cardboard + compost + mulch

Add water
between layers



Least soil disruption
Keep moisture
Physical barrier

pH
Lead
Microbial diversity



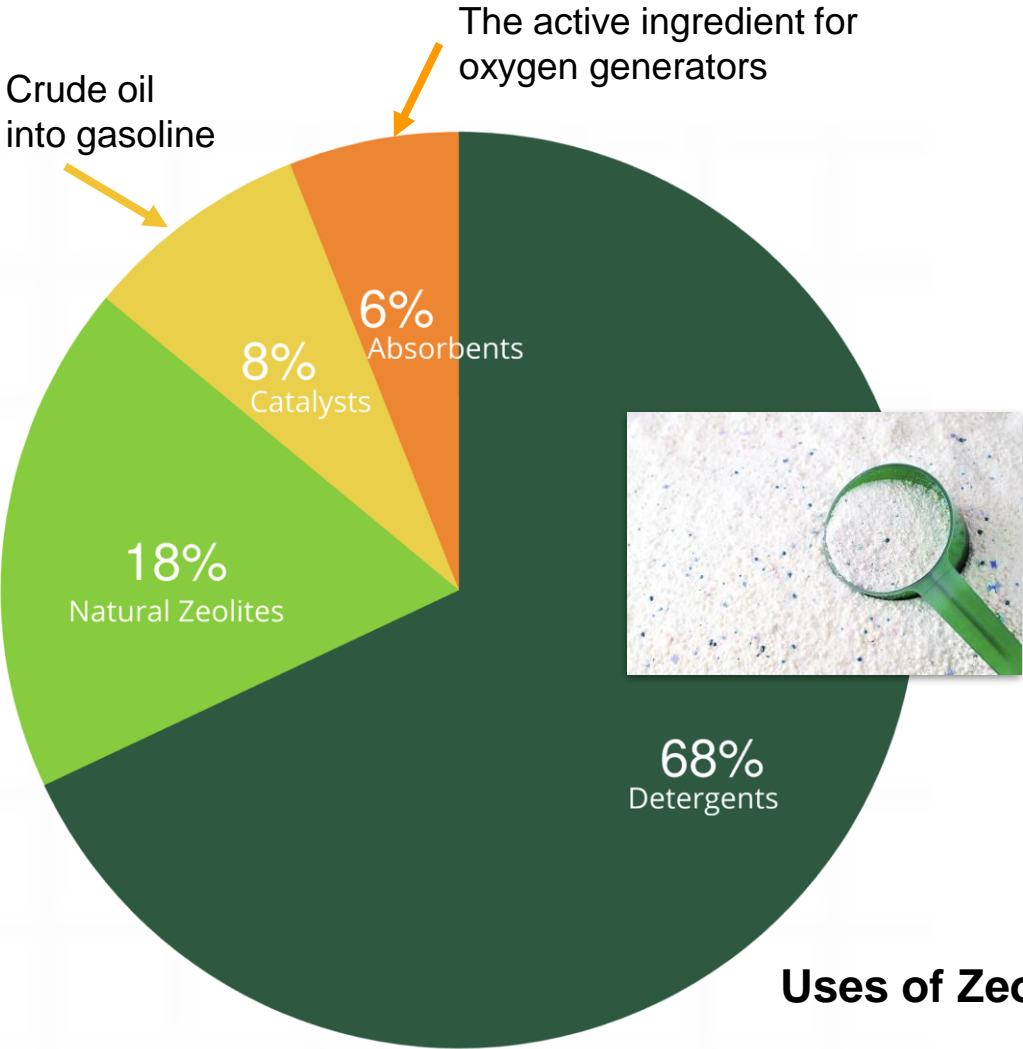
The Application



Zeolites



Zeolites means 'boiling rock'

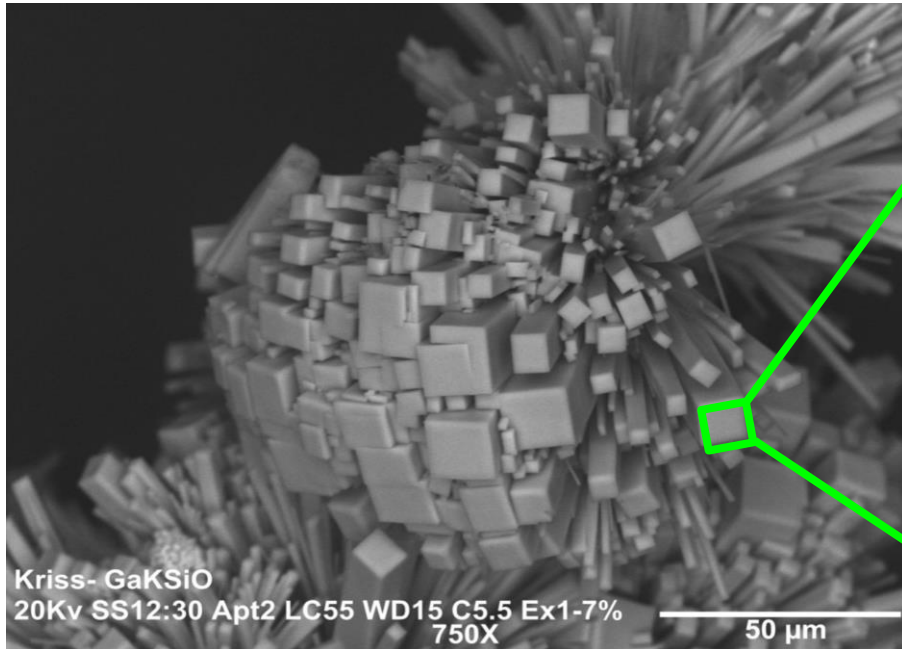


Uses of Zeolites

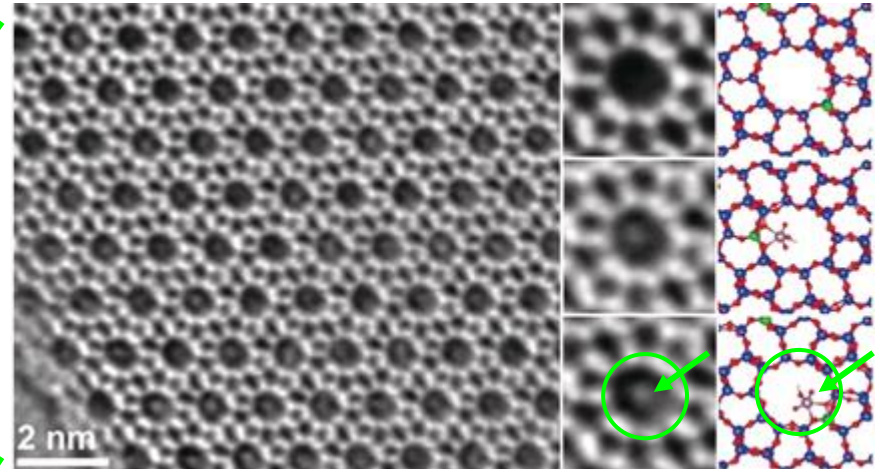
What makes the zeolite so useful?

They have nano sized pores where water and metals can move in and out.

Zeolites are very good at separating things at the molecular level.



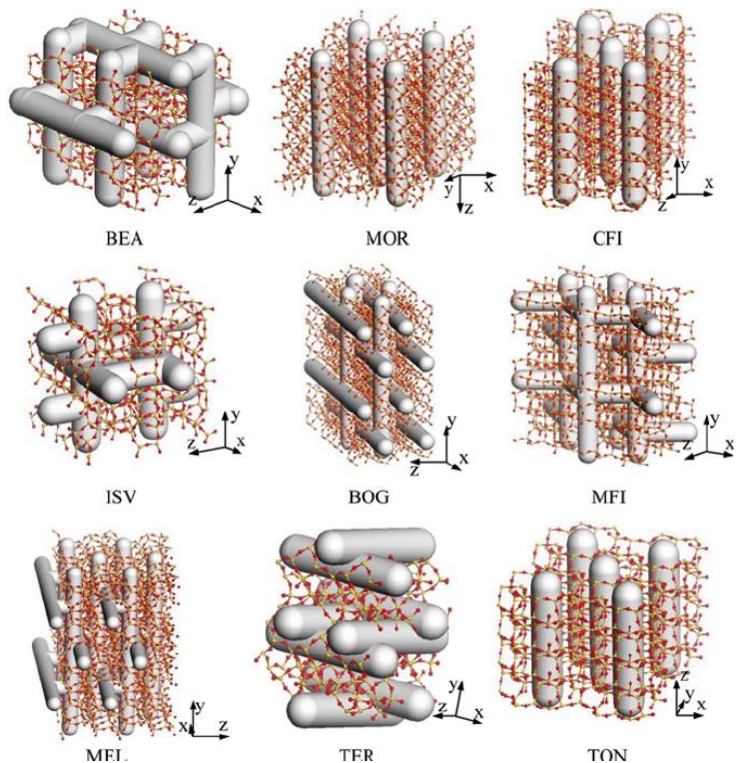
Scanning electron microscope image



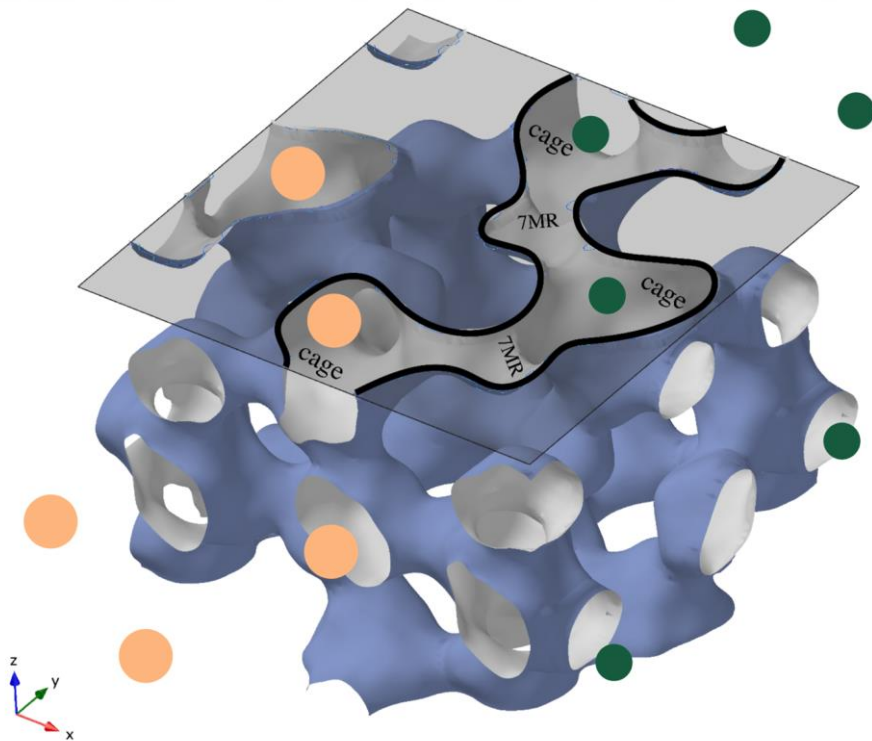
Transmission electron microscope and atomic models

How do zeolites work?

It's all in the structure



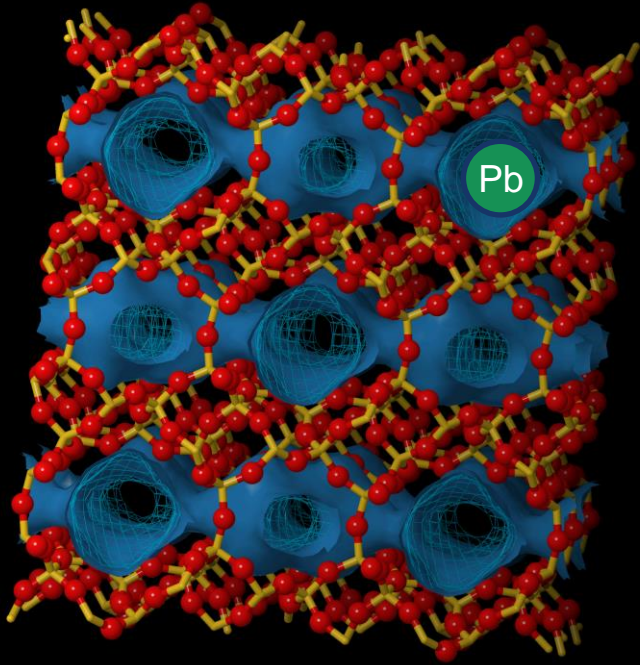
Ion Exchange



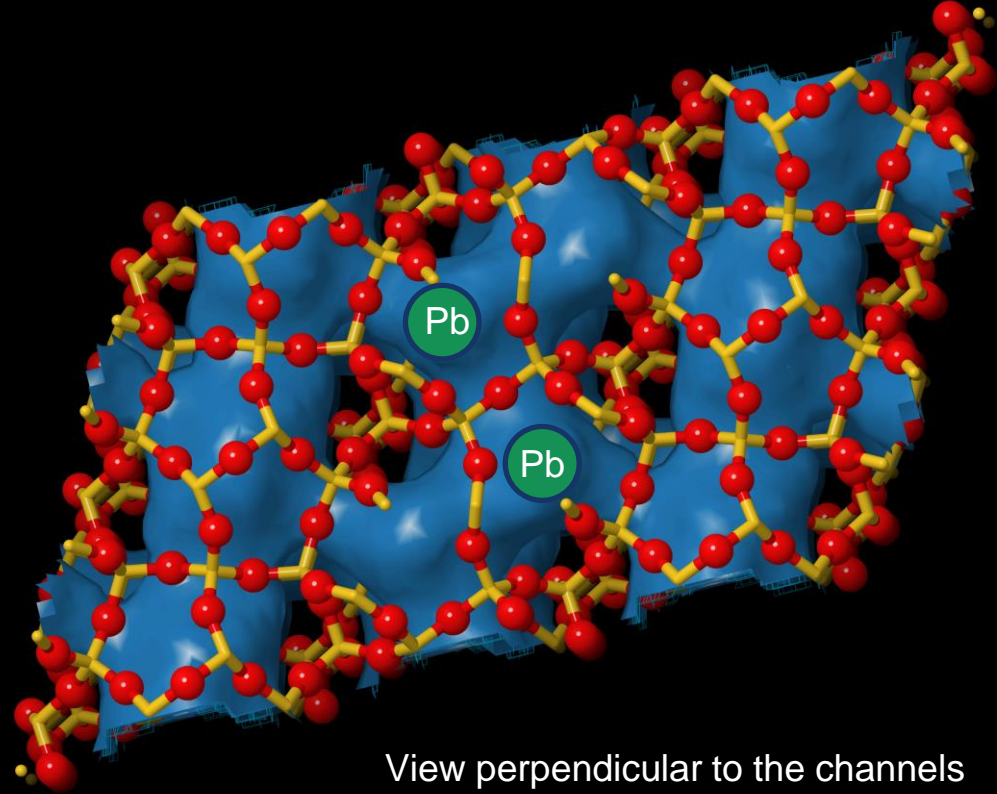
The crystal is always **ready to absorb** atoms and molecules in such a way to **lower the energy** of the system.

A list of some zeolite structures. Sometimes it is easier to just view the **void space (tubes)**, and ignore the atoms.

Clinoptilolite Tunnel Network



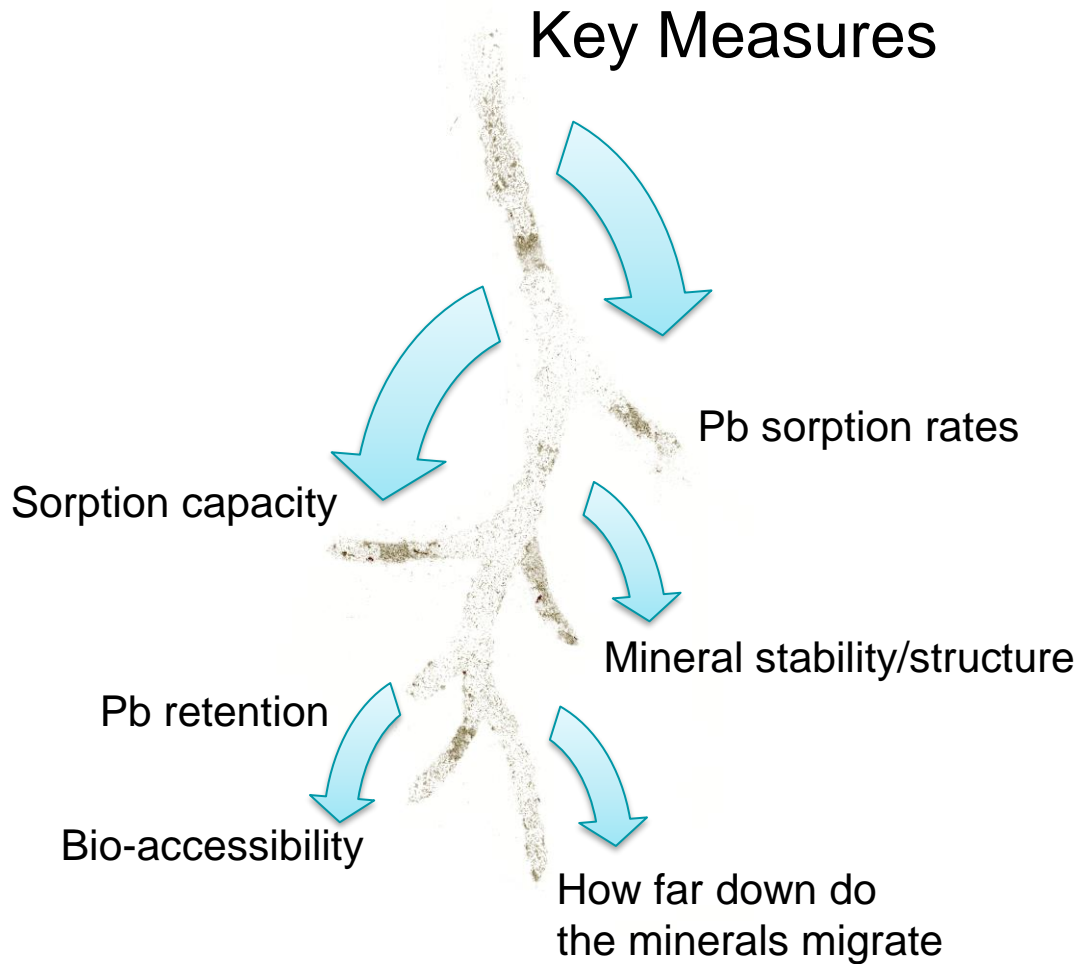
View down the channels



View perpendicular to the channels

Our Scientific Goals

FIND THE LEAD



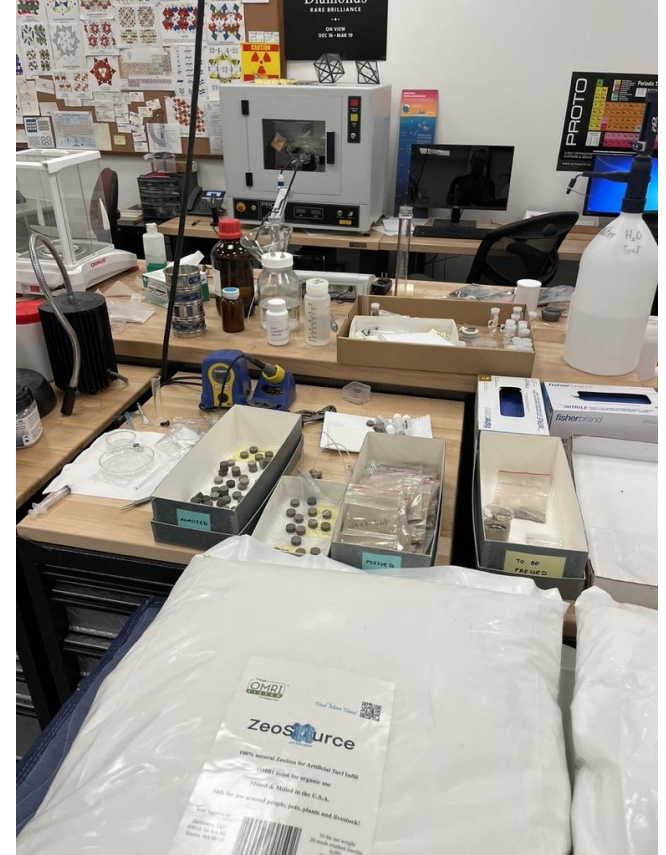
Getting Large Amounts of Zeolite

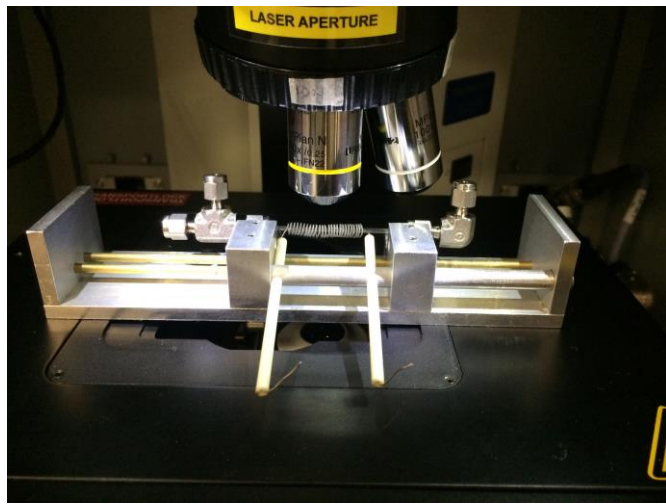


ZeoSource Facility in Victorville, CA



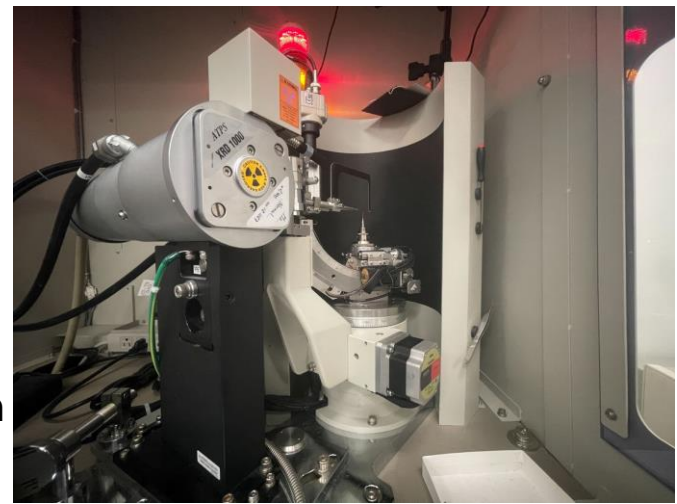
Maru next to 2,000 lb bag of clinoptilolite





Raman

Instruments for Comparison



Diffraction



X-ray
Fluorescence



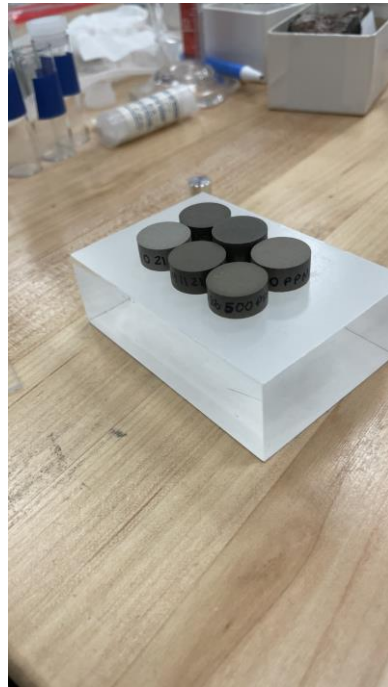
Micro-CT

Testing Soils For Lead Concentration

Pressing Pellets



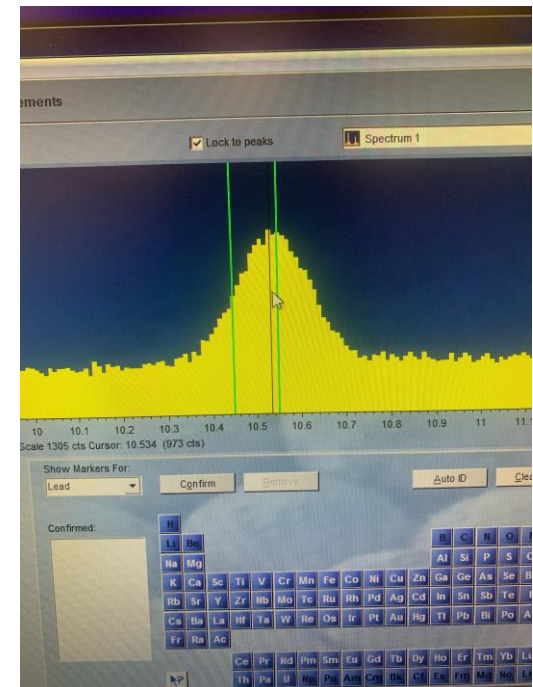
Pellets



Element Analysis



X-ray Fluorescence Spectrum



Testing How Well the Zeolite Works

Community soils



Zeolite + soil



Extraction



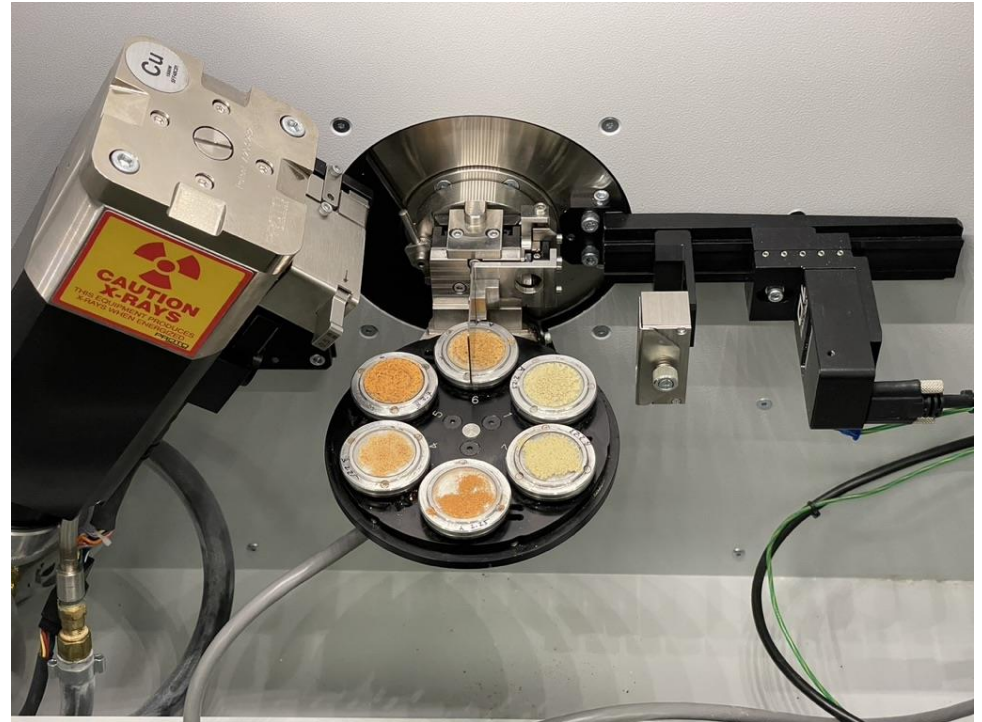
Diffraction

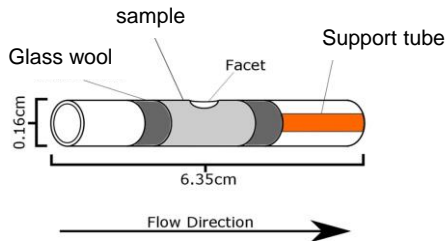
Unit cell measurement to see if Pb exchanged

Single crystal XRD for structure determination

Determine mineralogy of competing Pb phase for mineral sorption

X-ray Diffraction
to determine soil mineral content

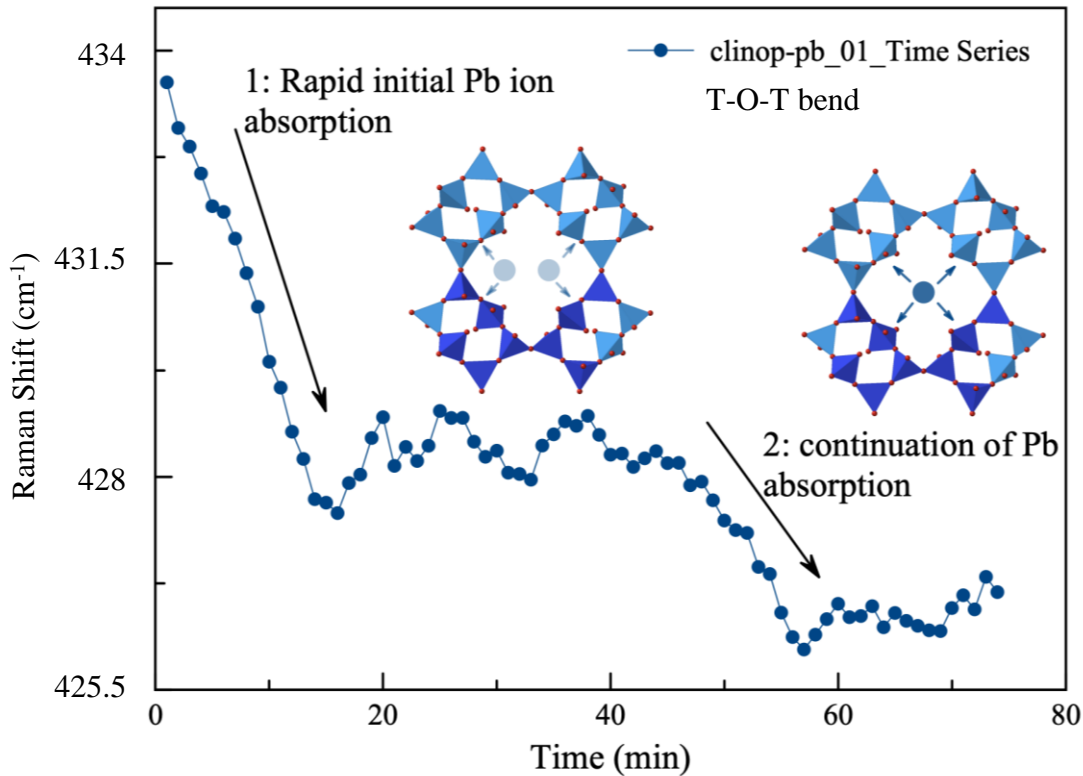




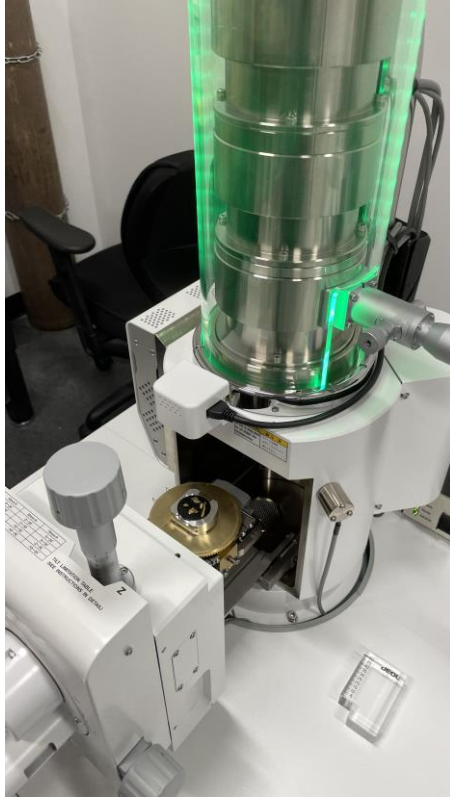
Raman Spectroscopy
to determine Pb uptake properties in crystal

Crystal Structure Characterization

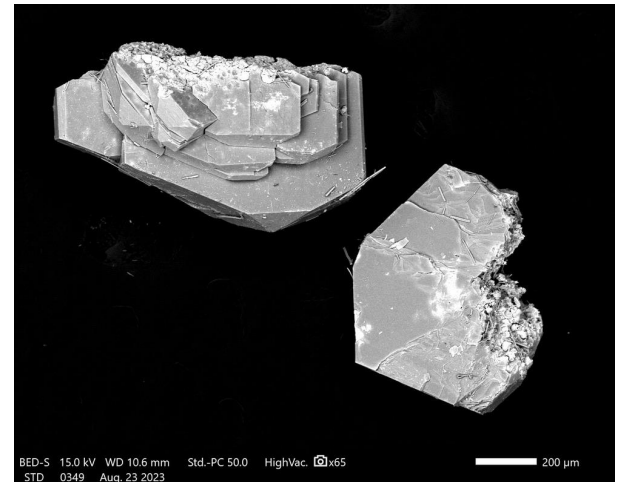
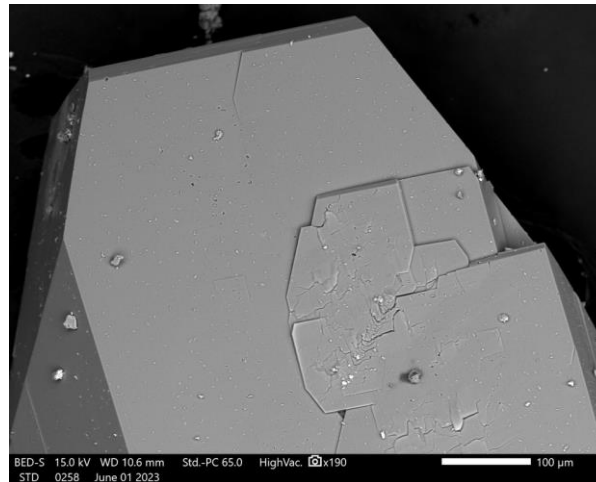
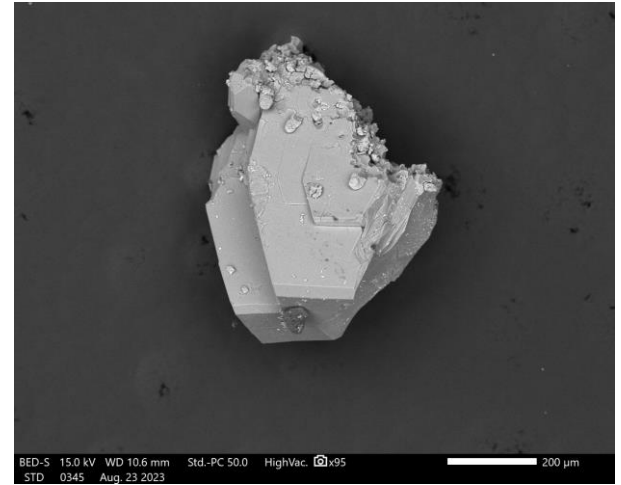
molecular dynamics for Pb sites



Scanning Electron Imaging

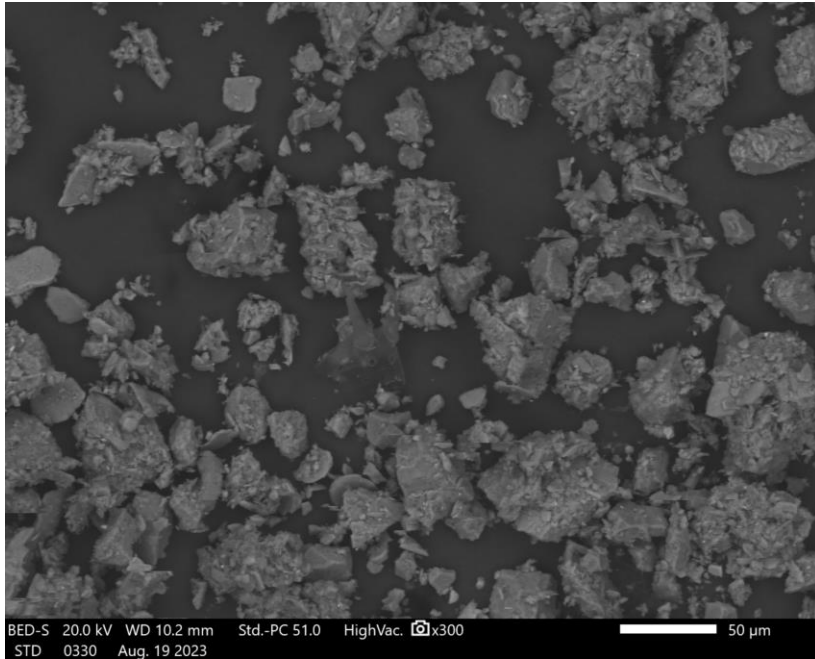


SEM images of Pb exchange in clinoptilolite. The brighter the colors, the more Pb.

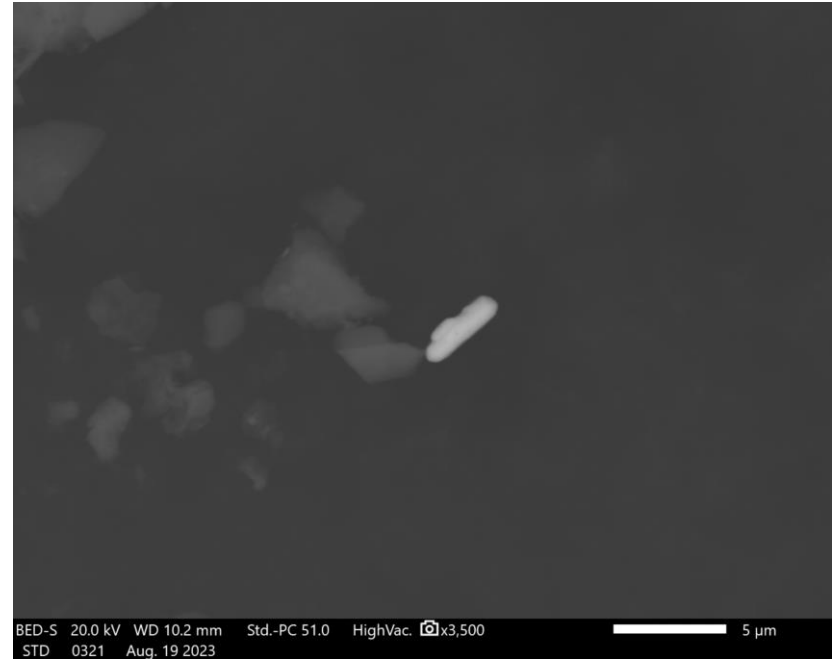


Whole Soil SEM Analysis

Soil, mostly clay/quartz

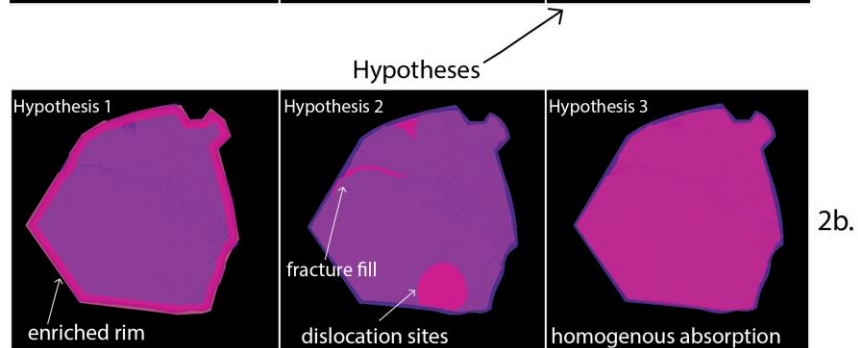
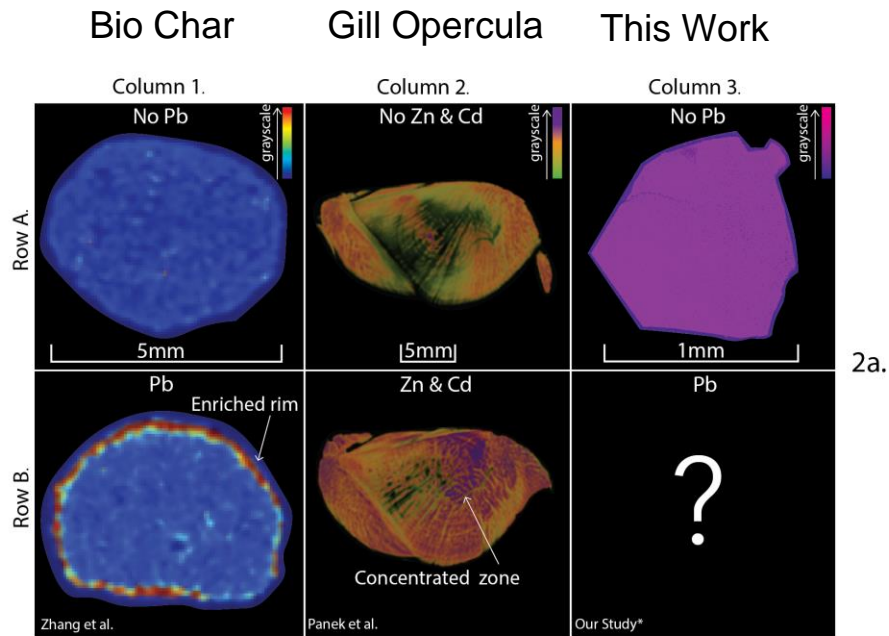


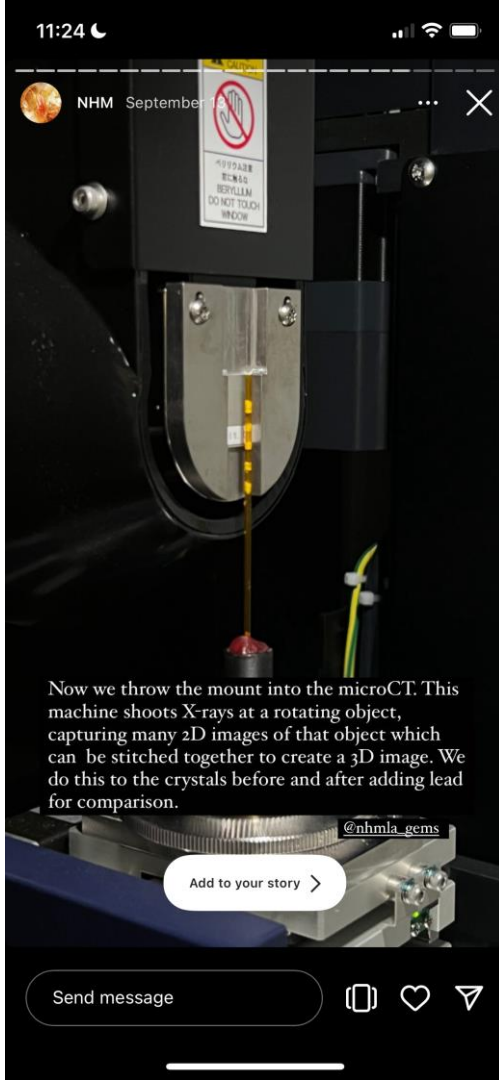
Zeolite grain found with Pb



Where is the Pb
Going?

And how does CT
help?





1. Load crystals into the flow cell
2. Find a CT scanner
3. Scan single crystals in column

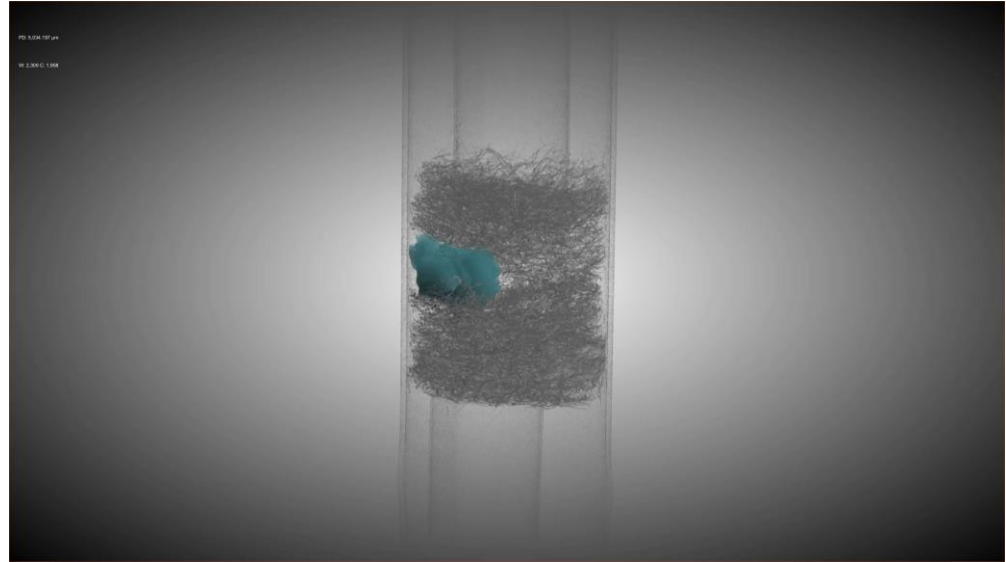
Micro CT Experiments

Advantages

- In situ analysis
- Bulk analysis

Challenges

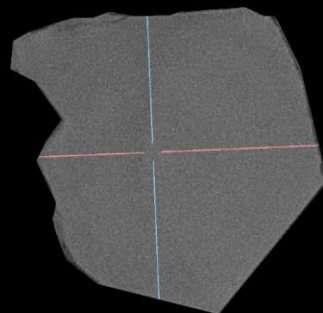
- Element contrast
- Concentration measurements



Looking for a Working Zeolite

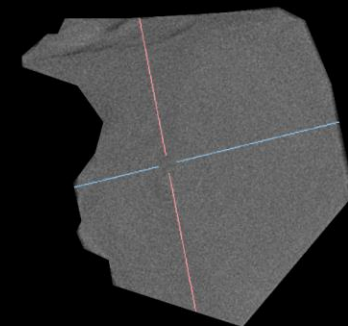
Ca Clinoptilolite Scans

No Lead



500 microns

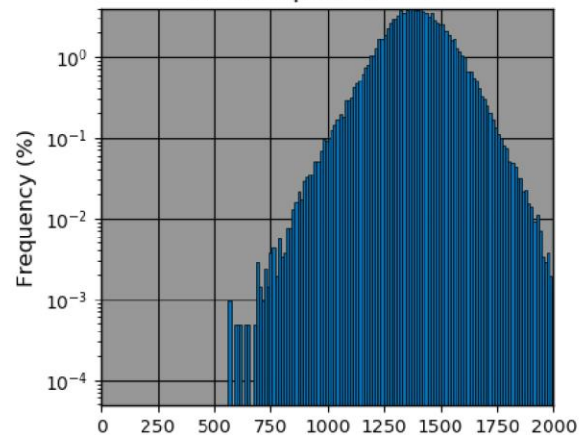
Lead



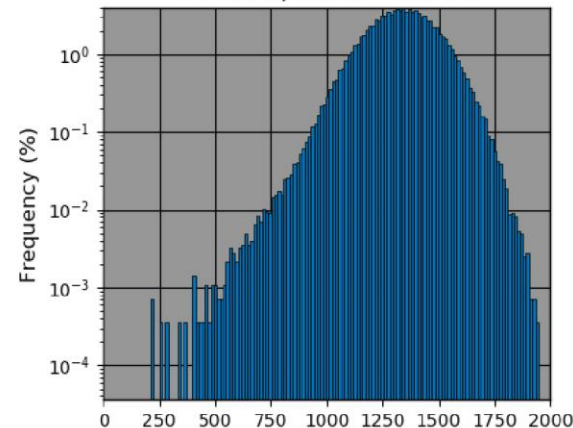
500 microns

Histograms

Ca Clinoptilolite no Pb



Ca Clinoptilolite with Pb



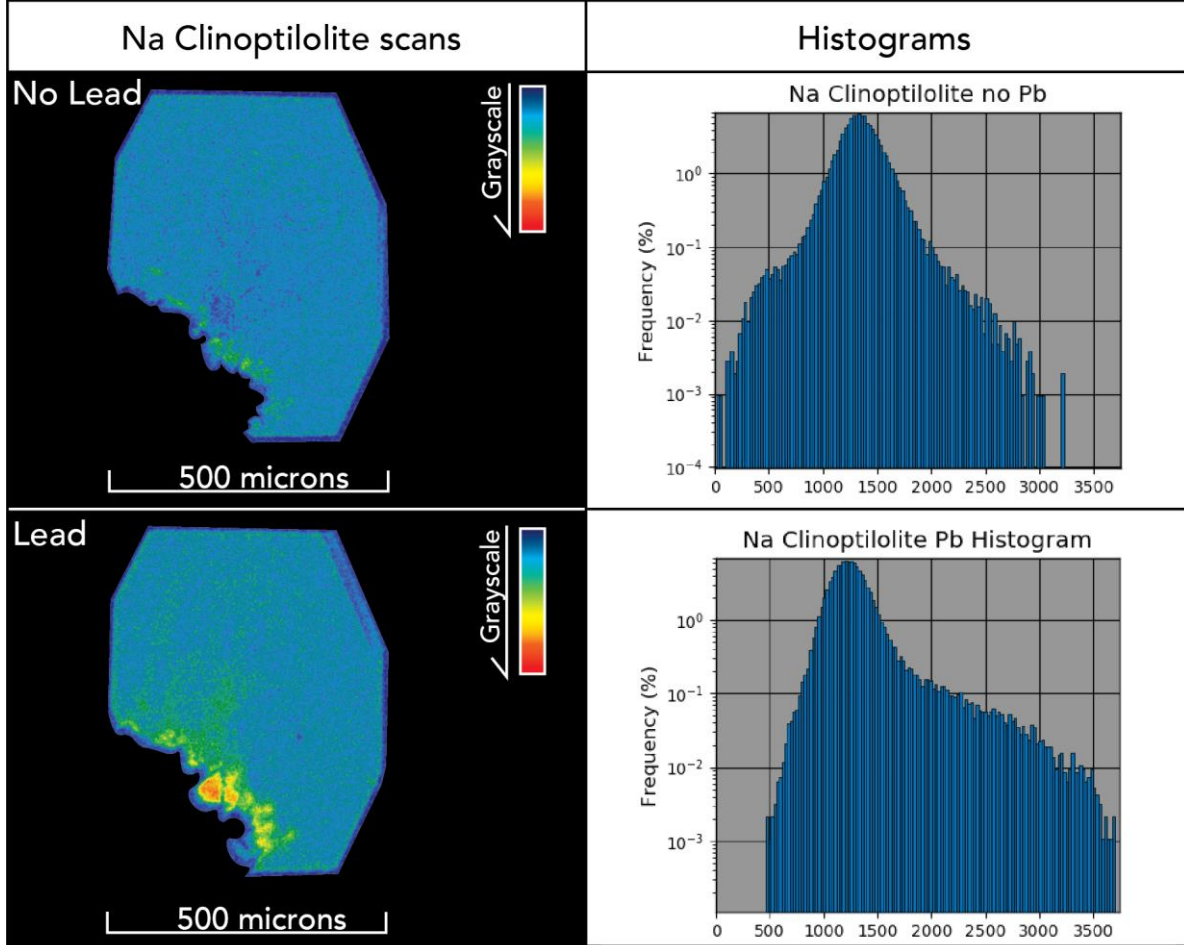
*Notice no apparent change in Ca Clinoptilolite after Pb exchange

Large Single Crystal Analysis

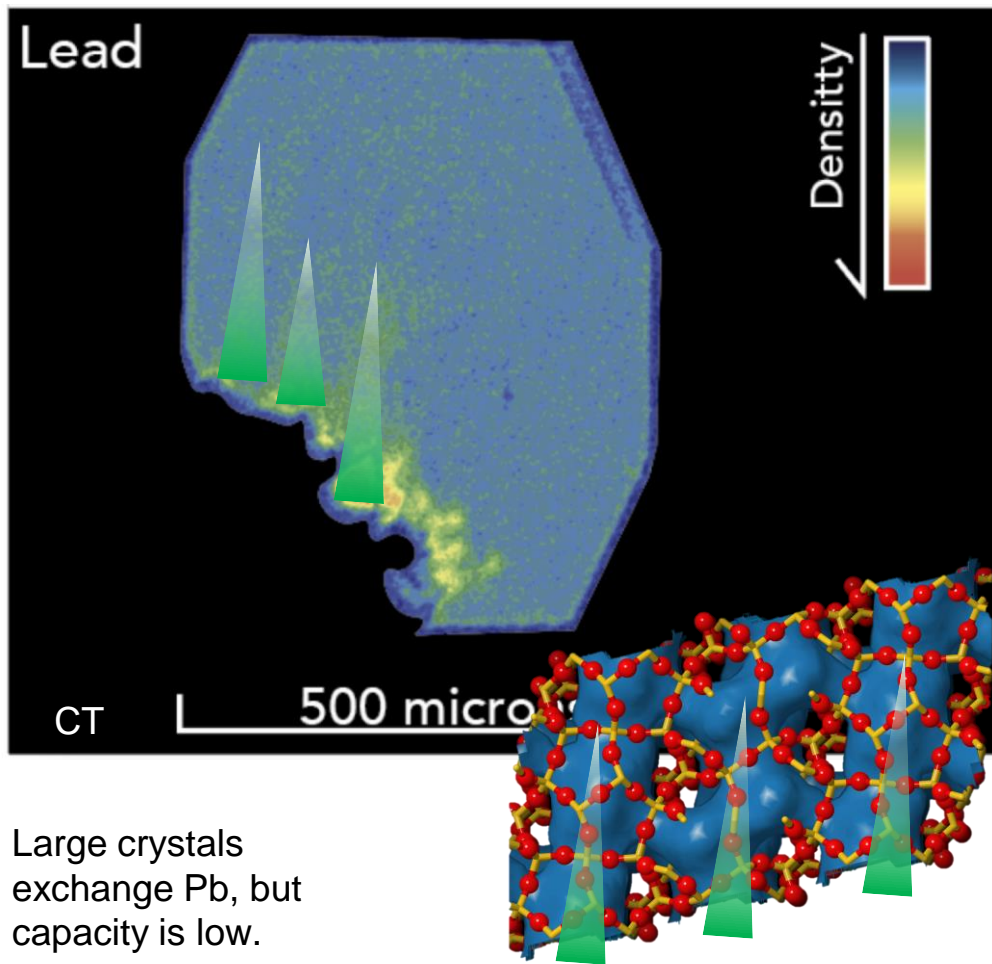
Determine density contrast

Correlate to Pb concentration

Examine Pb throughout crystal



*Notice change in Na Clinoptilolite scan and histogram after Pb exchange. Lead absorption occurring along broken edge of grain. Histogram shifts right with greater frequency of high grayscale values

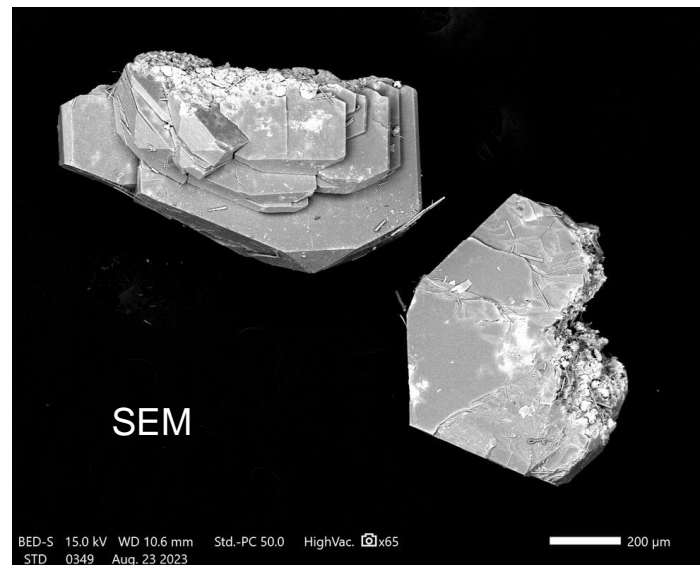


Large crystals exchange Pb, but capacity is low.

Details of Single Crystal CT

Same results as we saw from SEM

Single crystal XRD was not helpful



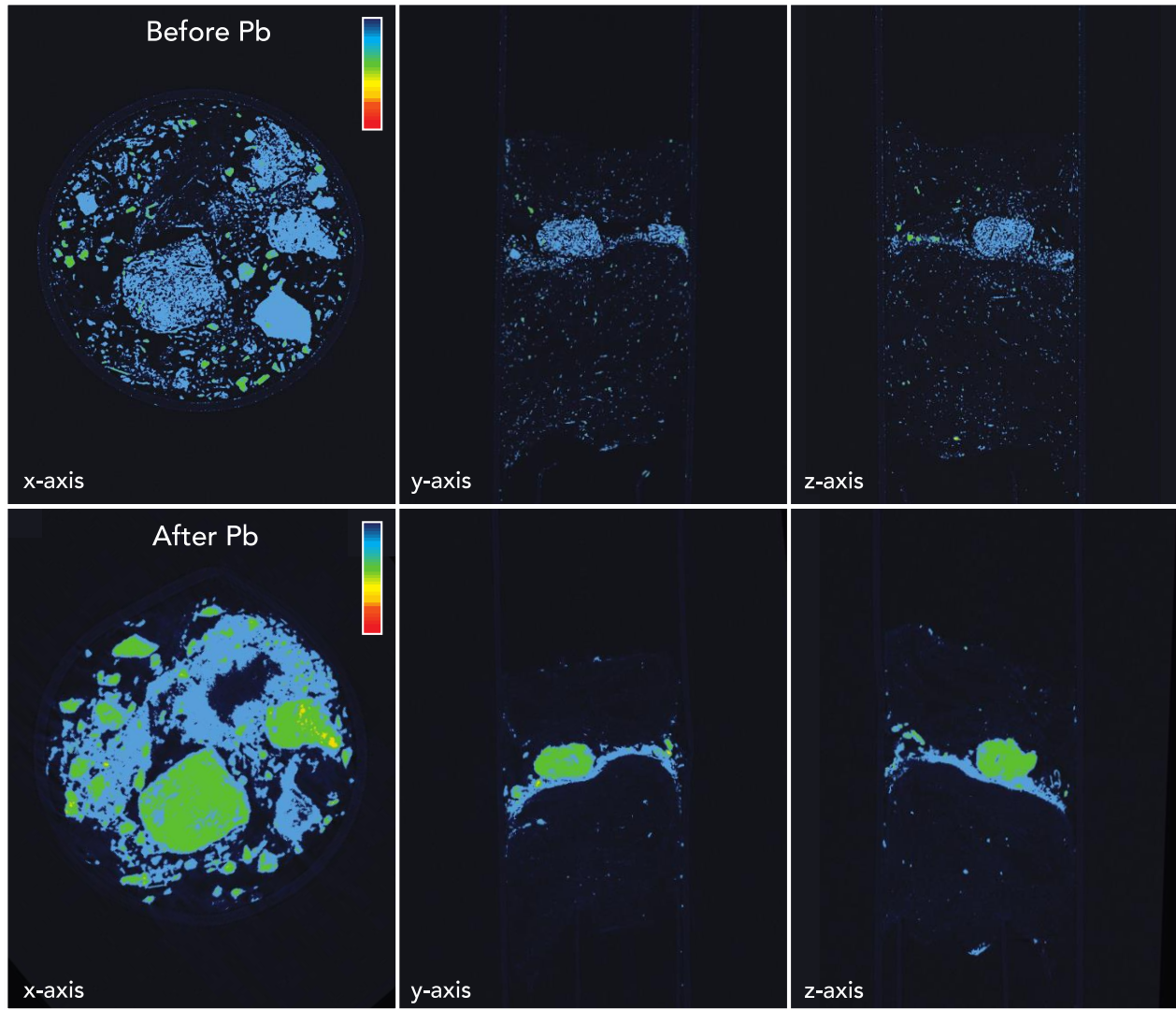
Whole soil analysis

using < 10 micron clinoptilolite

Big difference

Significant Pb sorption

Small crystals exchange better



Do all zeolites work?



Clinoptilolite-Na

- Crystal size dependence
- Channel geometry important
- Starting chemistry critical

After CT was calibrated, we were able to rapidly screen crystals

Why is knowing which zeolites are good for which elements?

Sponsored

A quick google search



Zeolite Detox Pack | Liquid...
\$112.00
Touchstone ...
★★★★★ (799)



Pure Body Extra - Nano...
\$79.95
Touchstone ...
★★★★★ (2k+)



Zeolite Liquid Tonic - Heav...
\$49.95
Zuma Nutrition
★★★★★ (30)



Pure Body | Gut Digestiv...
\$38.95
Touchstone ...
★★★★★ (473)



Pure Body Extra - Nano...
\$365.00
Touchstone ...
★★★★★ (2k+)



Pure Synergy Organic...
\$60.00
Pure Synergy
★★★★★ (1k+)



Zeolite Fulvic Pack | Liquid...
\$169.00
Touchstone ...
Free by 1...



Zeolite Pure | Full Body...
\$52.99
Amazon.com
\$50.34 at...

Sponsored



Zuma Nutrition
<https://www.zumanutrition.com> › zeolite › detox

100% Organic & Non-GMO - Zeolite Detox Liquid Tonic

Helps to remove free radicals & heavy metals with nature's most powerful detoxifier. Made with a unique blend of volcanic minerals & designed for maximum bioavailability.

Why Zuma · Shop Athletic Performance · Shop Beauty Collection · Shop Immunity

Sponsored



thegoodinside.com
<https://www.thegoodinside.com>

Zeolite Detox Pack - 100% Natural Zeolite

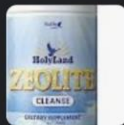
Special Offer: Save 20% Off Your Zeolite Detox Pack. Everyday Exposure to a Variety of...



Amazon.com
<https://www.amazon.com> › organic-zeolite › k=organi...

Organic Zeolite

Zeolite Pure | Full Body Detox Cleanse | Safe, Gentle, & Effective Energy Booster That Supports Gut Health, Mental Clarity, & Healthy Inflammation Response ...



Things to know

Uses

What is zeolite good for

Contraindications

Who should not take zeolite

Benefits for humans

Zeolite benefits for humans

Benefits and side effects

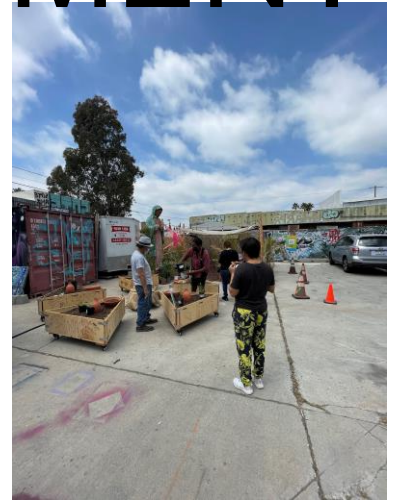
Zeolite benefits and side effects

More

Feedback



EDUCATION - ENGAGEMENT



Questions?