CSDCO

Continental Scientific Drilling Coordination Office

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Minneapolis, USA

ANF-SONDAGES
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LacCore

- Roots: Lacustrine core repository / lab / facility
- Utilization increased 20x since 2000
- Staff involvement with large CSD projects
- Community need led to expansion of scope

CSDCO

- Formalizes, enhances, expands roles
- Unites fundamental CSD (drilling/coring) resources

CSDCO

CSDCO

Continental Scientific Drilling Coordination Office

- 5-year NSF Cooperative Agreement
- Start Date: July 1, 2014
- Builds on LacCore Facility infrastructure and experience
- Merge facilities: 2019

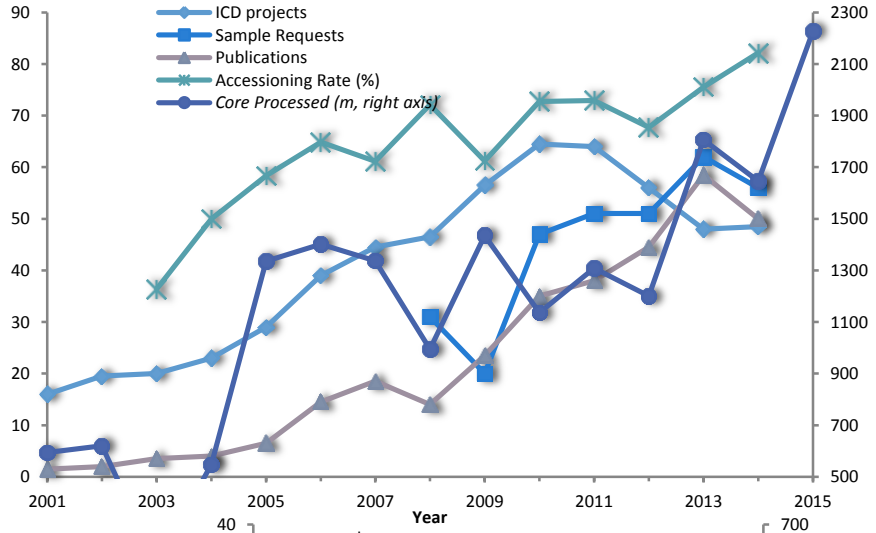
DOSECC—Drilling, Observation, Sampling of Earth's Continental Crust

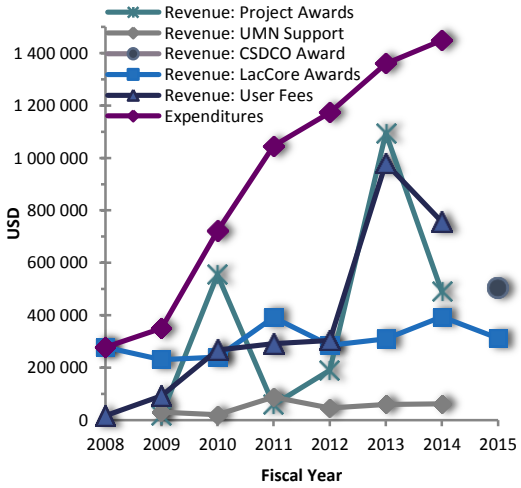
- Nonprofit in Salt Lake City
- Primary CSD coordinating entity until 2012
- Owned, operated rigs and platforms
- Continues as for-profit entity DES
  - Small equipment pool
  - ICDP purchased lake drilling system
  - General contractor role
  - Tool development

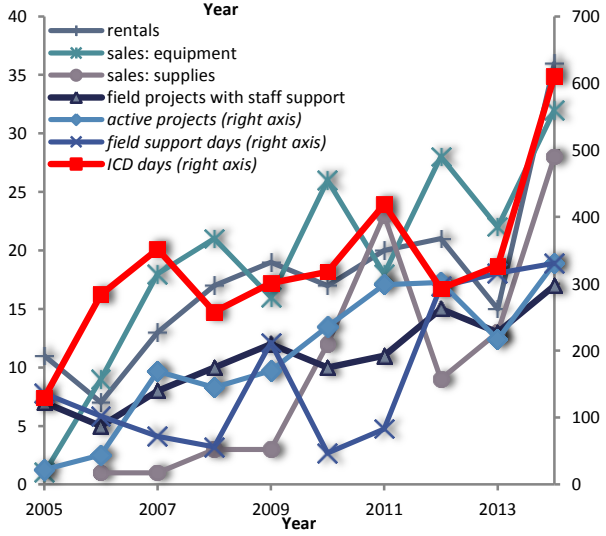
Statistics June 2010-2014

- Supported a minimum of **3,015 people** from **775 institutions** in total, for more than **44,000 contact-days** through all means including visits, field activities, meetings, phone, and email collaborations
- Of these, a minimum of 1,227 individuals from 268 institutions visited the facility for a total of 5,067 visits
- 57 projects received staff support in field operations, for a total of **1,026 staff-days in the field**
- 92 projects rented field equipment
- 5,960m of core were processed at the facility
- 589 projects were supported in total, representing 15 NSF divisions
- 220 sample requests were filled from materials in the core repository collection (each request ranges from a few samples to ~10,000 samples)
- 100 sets of lacustrine sediment coring equipment were sold (various models)
- 311 sales of specialized field and laboratory supplies, including ~148 phone and/or email orders
- Supported the execution of 11 major continental scientific drilling projects, with development support for 14 similar projects in preparation, and ongoing downstream support (data management, curation, sampling, visualization) for 14 past large CSD projects. **50 times as many shallow coring projects** (550 total) received support from LacCore services during this time.
- Permanent, senior facility staff increased in number from 3 to 8 (with an average of 10 technicians now employed full-time or part-time) to meet the increased use of the facility
- More than 223 papers were published on results from projects that utilized LacCore services
- 75% of visiting projects accessioned cores
- 25,000m of cores from 6,253 sites now archived. Expanded to include diverse continental core material (rock, soil, peat, permafrost), reflecting overall facility expansion to support additional science domains.

Statistics


ICD projects
Sample Requests
Publications
Accessioning Rate (%)
Core Processed (m, right axis)
Year


Revenue: Project Awards
Revenue: UMN Support
Revenue: CSDCO Award
Revenue: LacCore Awards
Revenue: User Fees
Expenditures
USD
Fiscal Year


rentals
sales: equipment
sales: supplies
field projects with staff support
active projects (right axis)
field support days (right axis)
ICD days (right axis)
Year

CSD Projects

23 completed or active large CSD projects

6 projects pending

≥ 20 projects in preparation

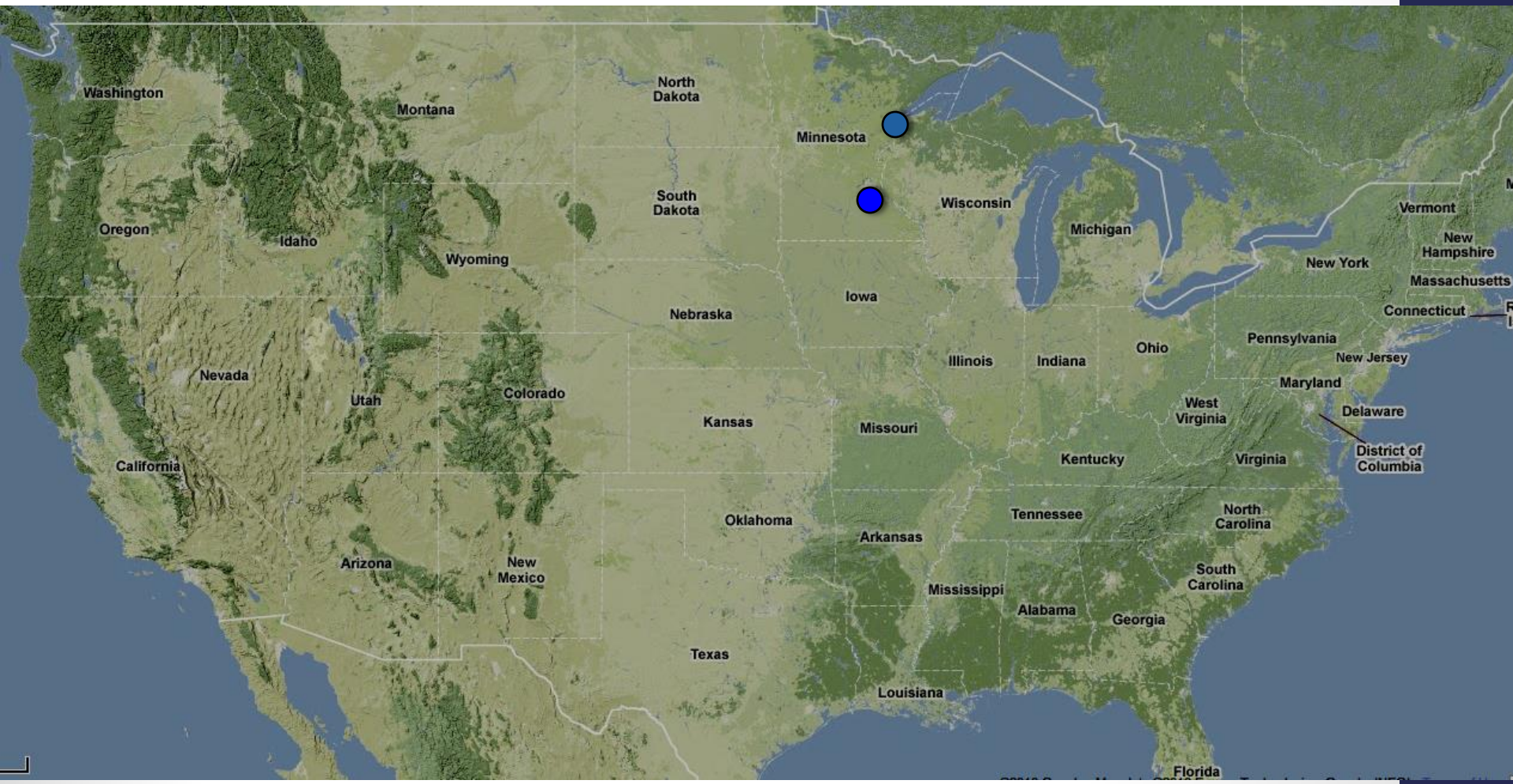
+ 50 times as many smaller-scale projects

All core-based research + Boreholes

- Paleo
- Critical Zone
- Hydrology
- Geothermal
- Seismology
- Magmatism
- Biogeochemistry
- Fault Zones
- Impact structures
- Tectonics

CSDCO LacCore

- *Main Facility*
  University of Minnesota, Minneapolis
- *XRF Lab — Large Lakes Observatory*
  University of Minnesota, Duluth



Project Development

- Scientific objectives
- Borehole/Cuttings/Core
- Depths
- Site surveys: pre-proposal development
- Analyses to be performed; protocol requirements; drilling fluids; tracers
- Downhole logging
- Site access
- Local resources: transportation, fuel, water, food, lodging, human capital
- Personnel travel, visas
- Permitting
- Season/weather considerations
- Site-specific safety considerations
- Risk management
- Bureaucratic, political, cultural considerations
- Outreach activities
- Bidding process
- Budget + contingency
- Proposals: ICDP, NSF, foundations, others
- Update bids
- Sign contracts

Logistics

- Local customs and resources
- Carnet
- Local partners
- US Export License requirements
- Travel: immigration, visas, transportation, housing, food
- Local financial transactions
- Local export permit requirements
- US importation requirements
- Freight

Operations

Company rep

- Ensures contractor follows client priorities, executes drilling plan safely and efficiently, meets goals and timelines
- Provides continual communication between drillers and scientists
- Provides institutional memory between projects
- Drilling engineering support

Curator

- Sample handling, subsampling, data capture

Field Support

Equipment design, rental, sales

- **Surface cores:** push, gravity, freeze, Eckman dredge
- **Long cores:** Kullenberg, Livingstone, Mackereth, Nesje, vibracorer
- **Vessels:** small inflatables to large platforms

Site survey coordination

- GPR, CHIRP, multibeam, airgun seismic reflection, passive seismic

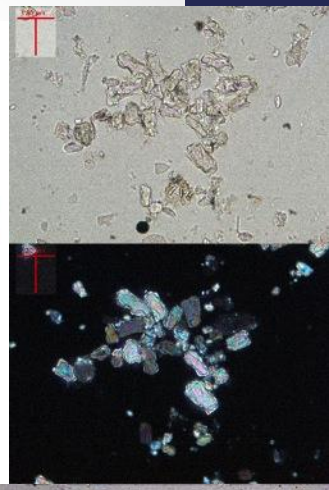
Water sampling and analysis

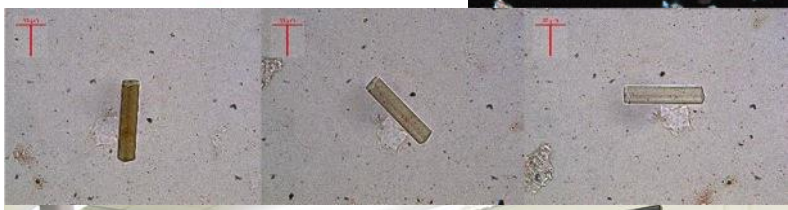
Equipment Operation Training

Lab

Core processing

- Multisensor logging, scanning
- Core splitting
- Imaging
- Lithologic Description
- Subsampling
- Analysis





Lab

Geotek MSCL

- gamma density
- p-wave velocity
- electrical resistivity
- magnetic susceptibility (loop)
- natural gamma radiation

Geotek XYZ

- magnetic susceptibility (point)
- color reflectance (UV/vis/near-IR)

Geotek CIS (linescan)

DMT CoreScan (linescan)

Cox ITRAX

- XRF
- X-radiography

NSI X5000 X-ray CT scanner

Core processing

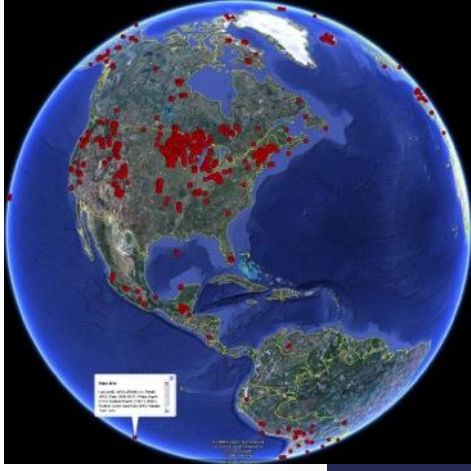
- Cast saw splitter
- Band saw (diamond grit blade)
- Rock saws
- Table saw (metal tubes)
- Wood planer (freeze cores)
- Microtome (freeze cores)
- Scroll saw
- Drill press

- CoreWall workstations
- Freeze Dryer
- Drying ovens
- Desiccators
- Fume hoods
- Centrifuges
- Microscopes: petrographic, binocular, pollen, diatom

Services

- Smear slides
- Sampling
- LOI
- Carbon coulometry
- Sulfur coulometry
- Biogenic silica
- Grain size: laser diffraction
- Grain size: wet sieve
- XRD
- Thin section prep
- SEM / EDS
- Isotopes
- Diatoms
- Pollen
- Pollen concentrate AMS 14C
- Charcoal
- Multisensor logging
- Core splitting
- Linescan imaging
- XRF / X-radiography
- CT scans
- Lithologic description
- Epoxy embedding

Curation



Physical Samples

- Storage
  - Refrigerated
  - Ambient
  - Frozen
- Sample distribution

Data

- Registration
- Distribution
- Visualization
- Archiving

Project Reports, Publications

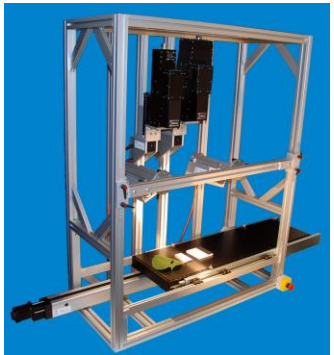
- Goals
- Operations
- Major outcomes
- Lessons learned
- Scientific findings

Infrastructure Development

Drilling technology
- Winkie drill
- Percussion coring system
- Tool developments/mods
- Deep drilling engineering

Lab
- CT scanner
- Hyperspectral imager
- Containerized labs
- Refrigerated containers

Repository diversification
- Refrigerated
- Ambient
- Frozen



Integrated Informatics

Data Management

- LacCore Drilling DB—drill site metadata capture
- ICDP DIS—all drilling data/metadata
- *DESC—Digital Environment for Sample Curation (collections mgmt)*
- *SCODDEX—drilling/coring data repository*

Registration: IGSN—globally unique identifiers

Visualization

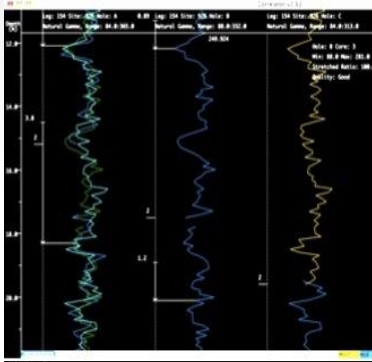
- CoreWall / Corelyzer—core/data visualization
- Correlator—stratigraphic correlation
- PSICAT—lithologic description
- CoreRef—web application for rapid display of fundamental datasets
- GeoMapApp—integrates IMLGS data (see below)

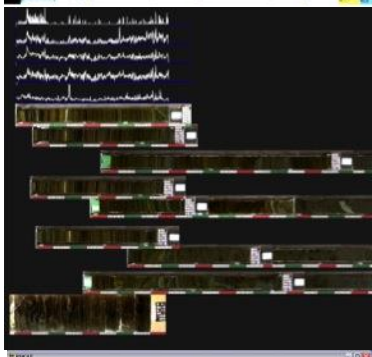
Reference/Interpretation

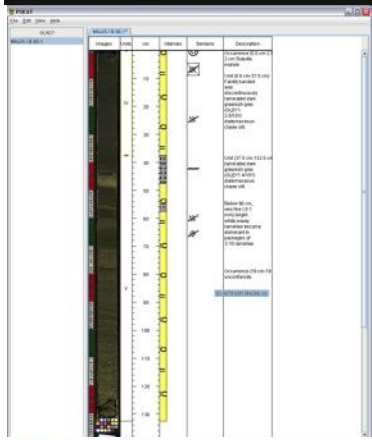
- TMI—Tool for Microscopic Identification (sediment component ID)

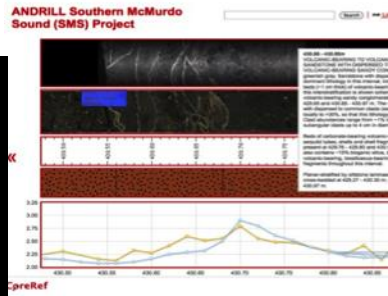
Archives

- IMLGS—Index to Marine and Lacustrine Geological Samples
- IEDA—Integrated Earth Data Applications







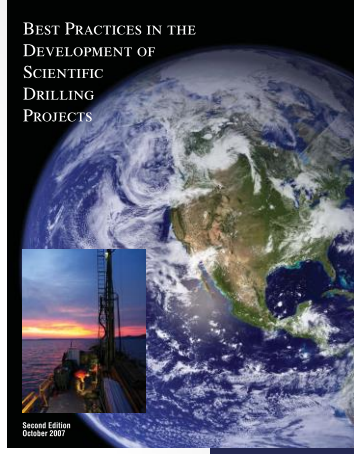


EARTHCUBE

icdp

TMI
TOOL FOR MICROSCOPIC IDENTIFICATION

Clearinghouse



- Leverage existing infrastructure
- Formalize PI responsibilities
- Initial project publications: Scientific Drilling, EOS, GSA Today
- Initial project reports
- Full publication archive
- Datasets
  - core/sample metadata
  - lithologic descriptions + other initial core datasets
  - all downstream data generated
- Core sampling histories
- Community best practices, project planning resources
  - Existing CSD docs
- Standard operating procedures
- Institutional memory
- Project-specific outreach activities

Community Engagement

- Meetings / Professional Societies
  - AGU, GSA, AAPG, Goldschmidt, etc
  - CSD Annual Meeting
  - Domain workshops
- Build / strengthen connections to disciplines via governance committee memberships
- Listservs, email distribution lists, social media, short courses

Community Coordination

ICDP

NSF-funded entities

- IODP, CZOs, CUAHSI, EarthScope

Federal agencies

- USGS, EPA, DOE, NPS, BLM, BIA, NASA, DOD

State agencies

- Natural Resources/Env Protection
- State Geological Surveys (USGIN/OneGeology)

Smithsonian, natural history museums

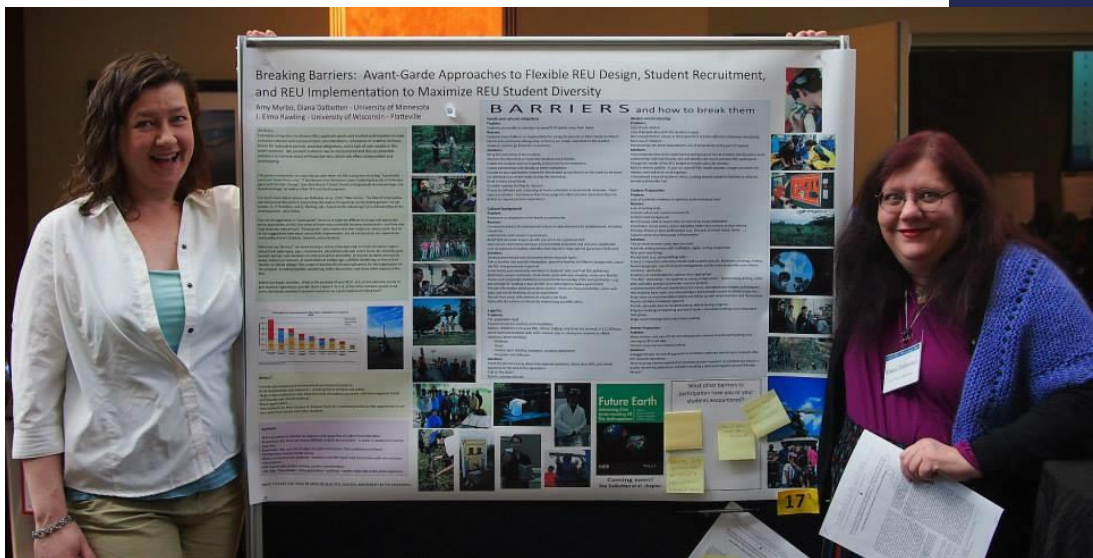
Native American Tribal governments

Industry

Municipalities

Outreach, Diversity, Education

- Broaden participation
- Increase public engagement
- Enhance workforce development
- Expand access to training and infrastructure



ODE activities

Outreach
- Community-driven research
- Tribal lands and resources
- CSD advocacy and promotion

Diversity
- Breaking barriers to participation (IAGD)

Education
- Informal
- Undergraduate Research: REUs, Kecks, class projects
- Lab and field experience for local teachers
- Clearinghouse (SOPs, best practices, etc.)

Training
- Direct training—field work, lab visitors, remote support: ~1200 annually
- Workshops
- Short courses
- Summer internship program

Outreach: community-driven research

- Work with PIs, beginning in the earliest stages of project development
- Visit site with PIs (more than once) to work with stakeholders
- Develop research questions to be addressed as part of drilling project
- Collect local data (quantitative, historical, traditional)
- Work with PIs and their students to help them communicate
- Help develop communications materials

Personnel

Anders Noren, CSDCO Director

Amy Myrbo, Director of Outreach, Diversity, & Education/ Research Associate

Jessica Heck, Manager

Ryan O'Grady, Operations and Infrastructure

Kristina Brady, Curator

Brian Grivna, Informatics

Doug Schnurrenberger, Consultant

Tony Gambeski, Financial Administrator

Jessica Rodysill, Scientific Support

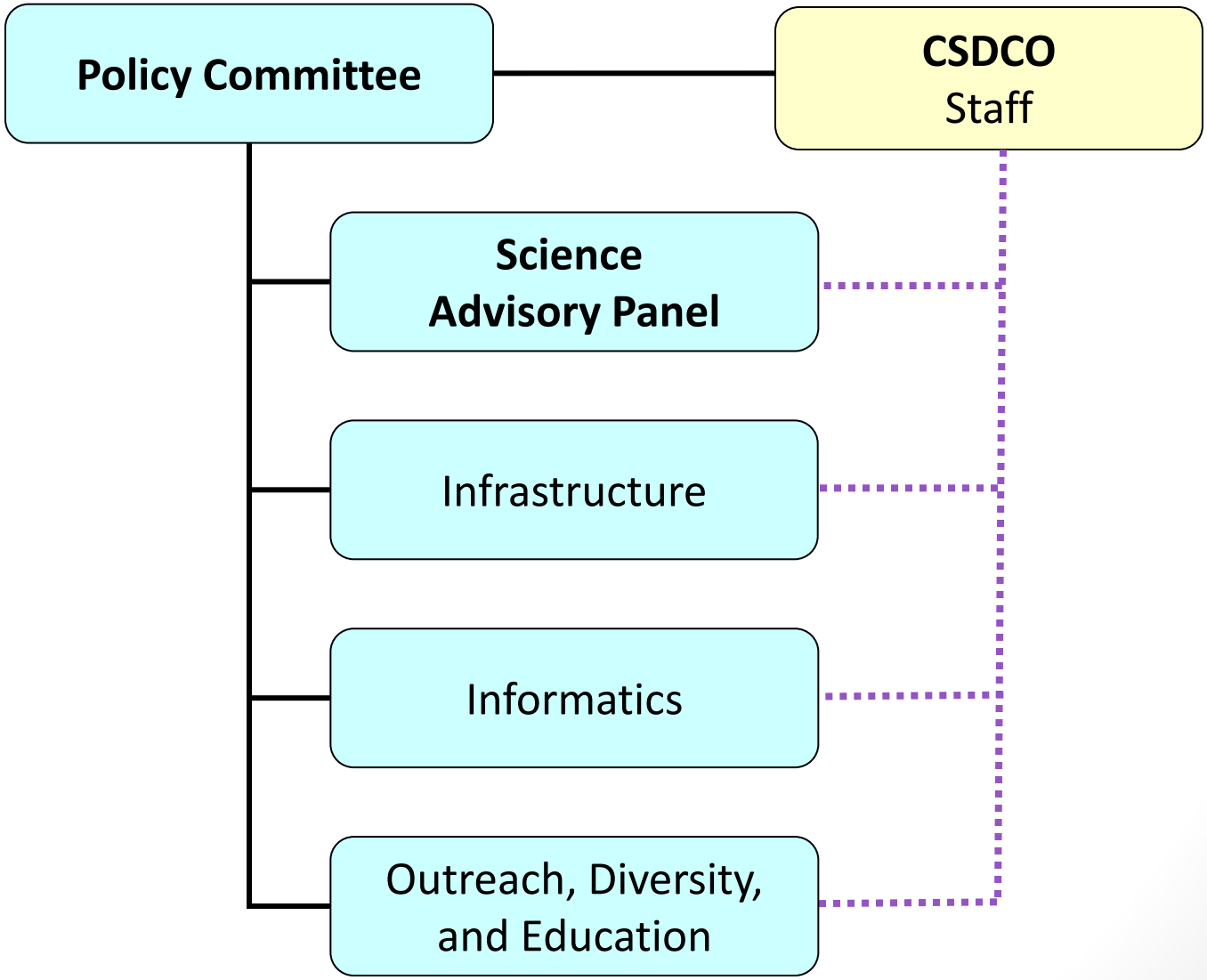
Aaron Lingwall, XRF Lab Manager

Erik Brown, XRF Lab Director

Emi Ito, LacCore Director

+ 12 Technical Staff

Governance Structure



Some Current Projects

HSPDP

CPCP

IDRAs

+ hundreds of smaller projects

+ undergraduate summer research programs

+ graduate training courses

HSPDP

Hominin Sites and Paleolakes Drilling Project
Andy Cohen et al.

- Paleolake sequences in East Africa, 0-5 Ma
- Proximal to hominin fossil localities
- Establish environmental context for hominin evolution
- Drilling sites 2012-2014
  - Kenya: Olorgesailie, Baringo, Turkana, Magadi
  - Ethiopia: Afar, Chew Bahir
  - Tanzania: Olduvai
- 30 collaborating institutions, ~100 participants
- 3000 meters of core total

HOMININ SITES AND PALEOLAKES DRILLING PROJECT

CPCP

Colorado Plateau Coring Project

Paul Olsen, John Geissman, Randy Irmis, Dennis Kent, Roland Mundil

- Complete Triassic section
- Outcrops equivocal
- Unweathered samples

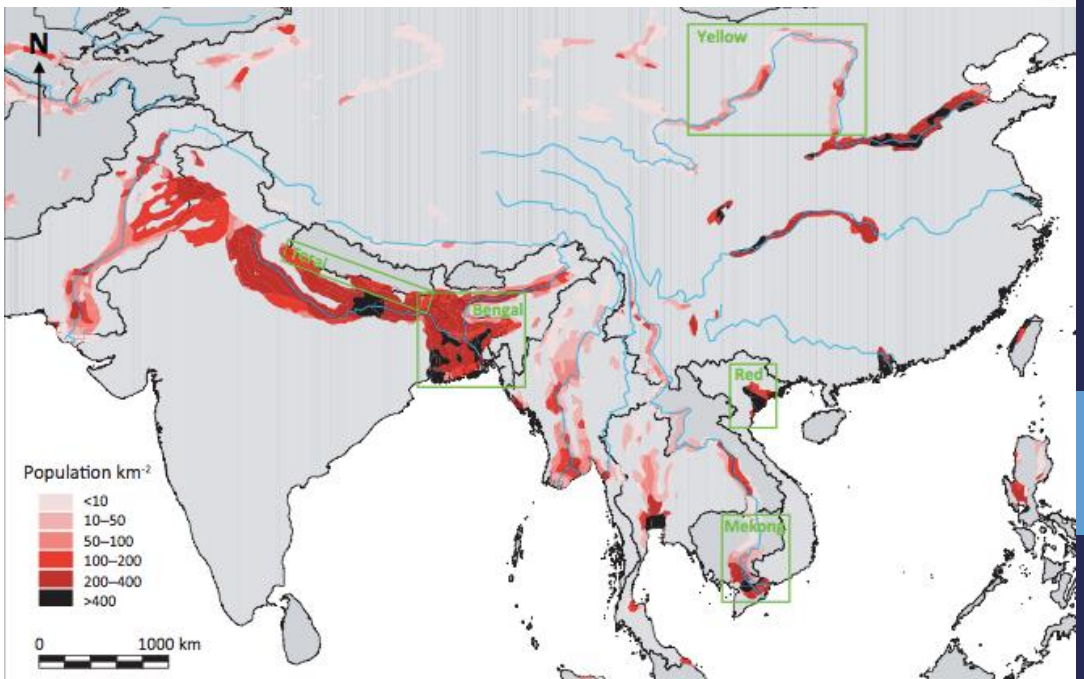
IDRAs

International Drilling to Recover Aquifer Sands and and Arsenic Contaminated Groundwater in Asia

Lex van Geen

- Microbially-mediated reductive dissolution of iron oxyhydroxides leads to high arsenic in shallow groundwater (~1000x WHO limits)

- Freeze sampling
- Testing in Illinois



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