An introduction and invitation

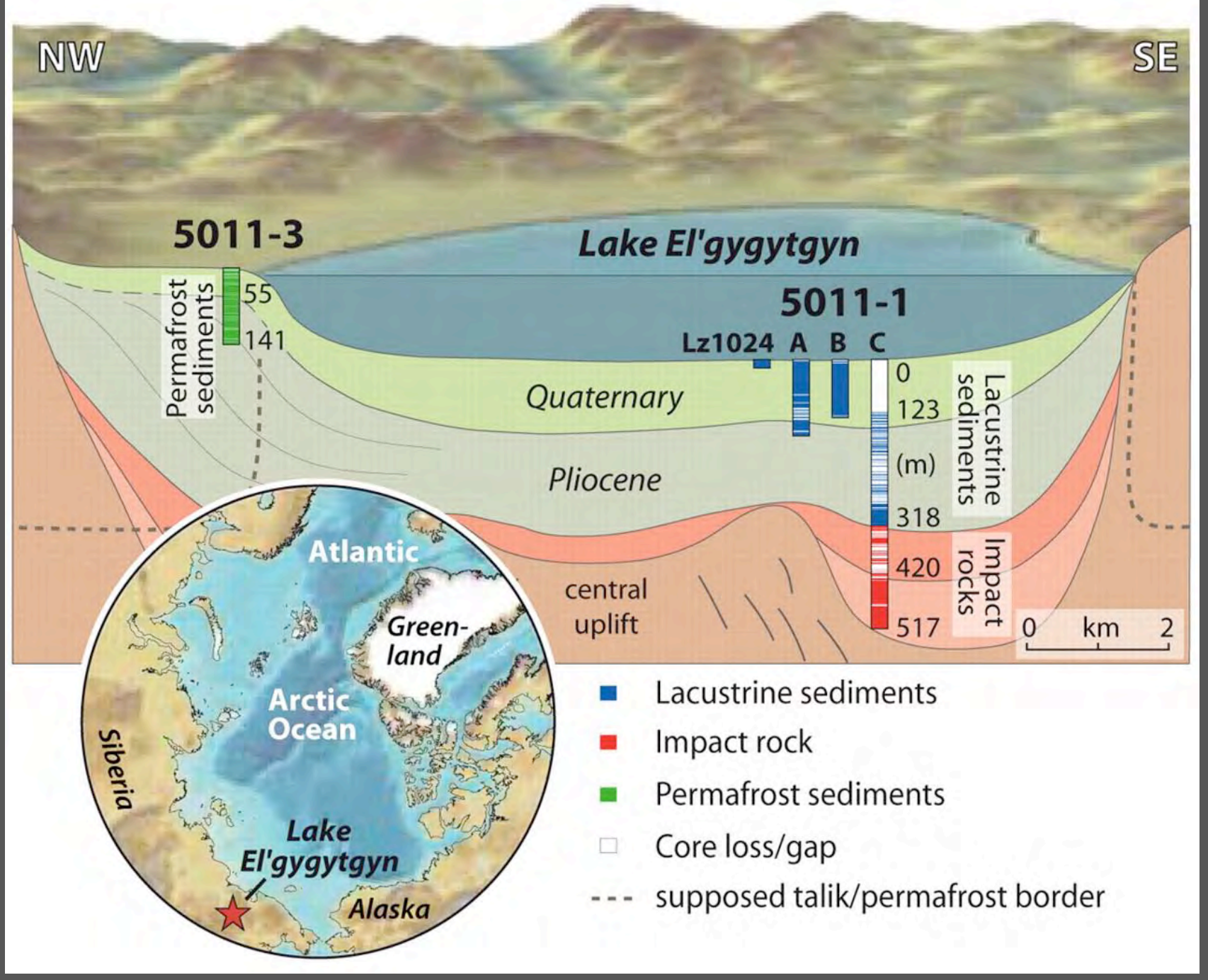
Uli Harms
GFZ German Research Centre for Geoscineces
Head of Operational Support Group
Executive Secretary ICDP

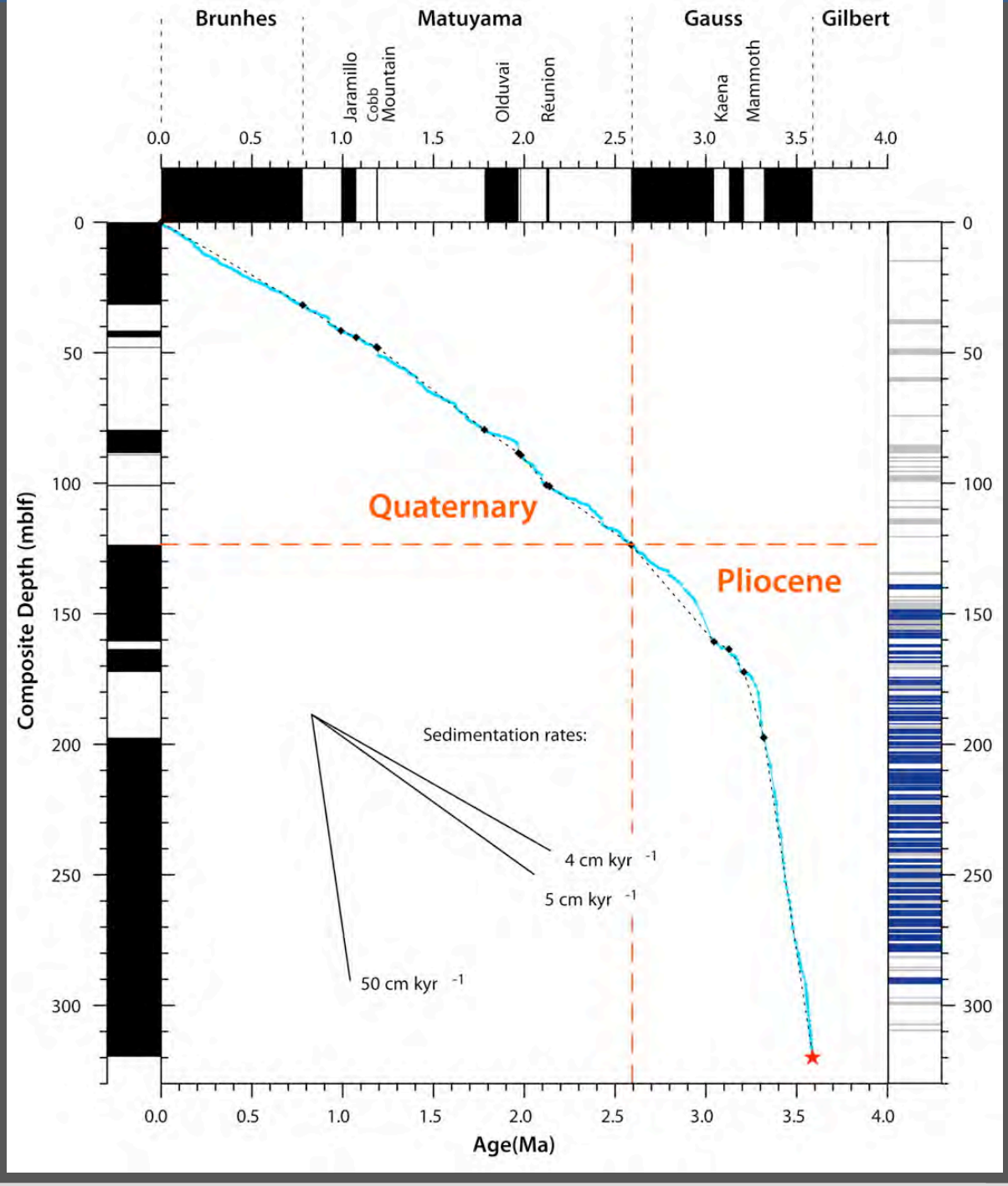
ICDP is an international program to support scientific continental drilling through financial and logistical support to international science teams with a need for drilling

- is an internationally managed and operated Earth science research program
- addresses fundamental problems of global significance
- serves the entire Earth Science Community
- is undertaken by international teams of scientists at carefully selected sites around the world
- is proposal-driven and peer-reviewed
- is providing funding and operational support
- is coordinating research projects with IODP and other national and international programs

ICDP Mission

"Through the unique capacities of scientific drilling to provide exact, fundamental and globally significant knowledge of the composition, structure and processes of the Earth's crust".


NW
SE
5011-3
Lake El'gygytgyn
5011-1
Permafrost sediments
55
141
Lz1024
A
B
C
0
123
(m)
318
420
517
Quaternary
Pliocene
Lacustrine sediments
Impact rocks
central uplift
0
km
2
Atlantic
Green-land
Arctic Ocean
Siberia
Lake El'gygytgyn
Alaska
Lacustrine sediments
Impact rock
Permafrost sediments
Core loss/gap
supposed talik/permafrost border


Brunhes
Matuyama
Gauss
Gilbert
Jaramillo
Cobb Mountain
Olduvai
Réunion
Kaena
Mammoth
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
Quaternary
Pliocene
Sedimentation rates:
4 cm kyr -1
5 cm kyr -1
50 cm kyr -1
Composite Depth (mblf)
0
50
100
150
200
250
300
Age(Ma)

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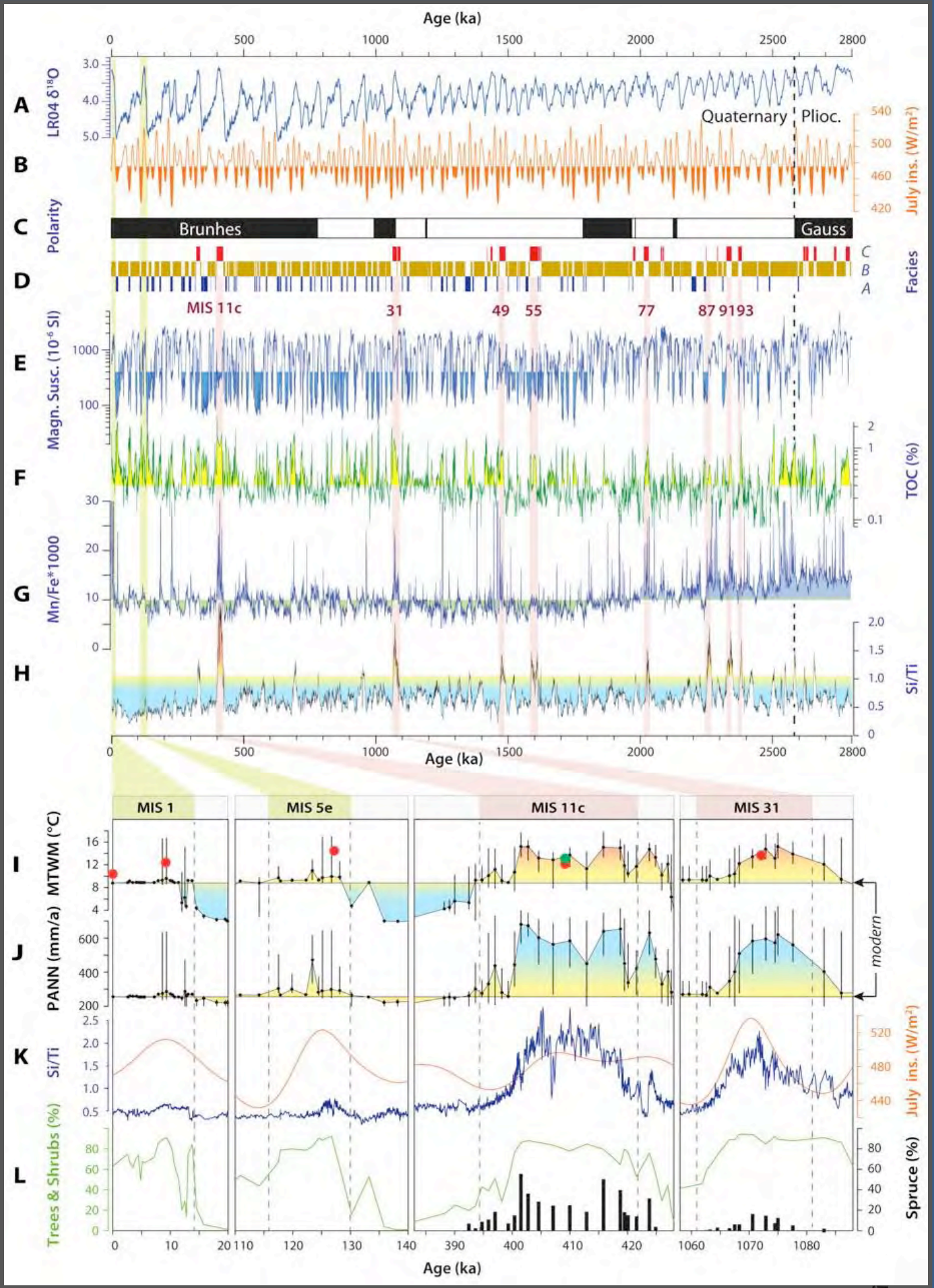
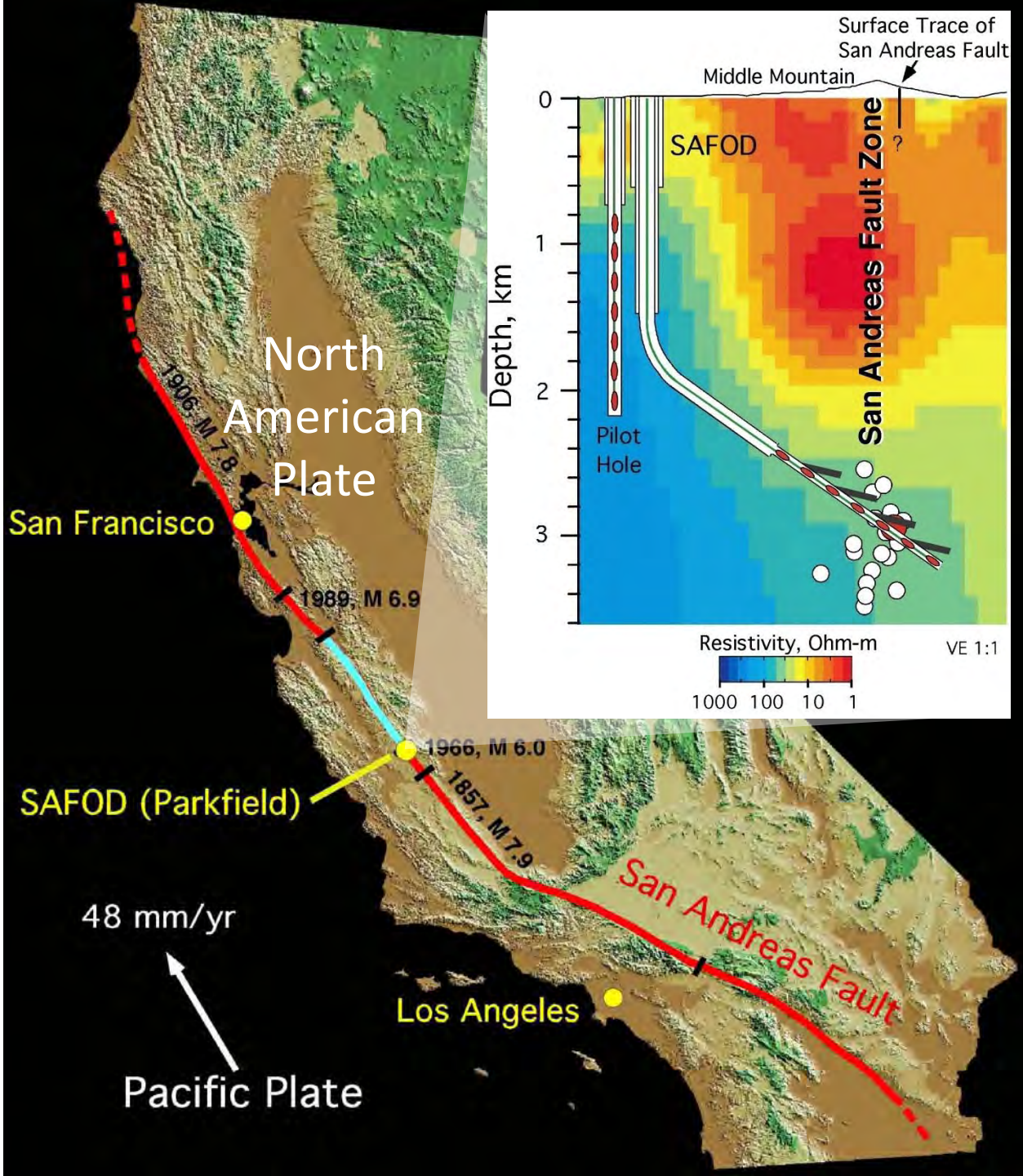

Age (ka)
A
LR04 δ18O
Quaternary
Plioc.
B
July ins. (W/m²)
C
Polarity
Brunhes
Gauss
D
Facies
MIS 11c
31
49
55
77
87
91
93
E
Magn. Susc. (10⁻⁶ SI)
F
TOC (%)
G
Mn/Fe*1000
H
Si/Ti
MIS 1
MIS 5e
MIS 11c
MIS 31
I
MTWM (°C)
J
PANN (mm/a)
modern
K
Si/Ti
July ins. (W/m²)
L
Trees & Shrubs (%)
Spruce (%)
Age (ka)

San Andreas Fault Observatory at Depth (SAFOD)

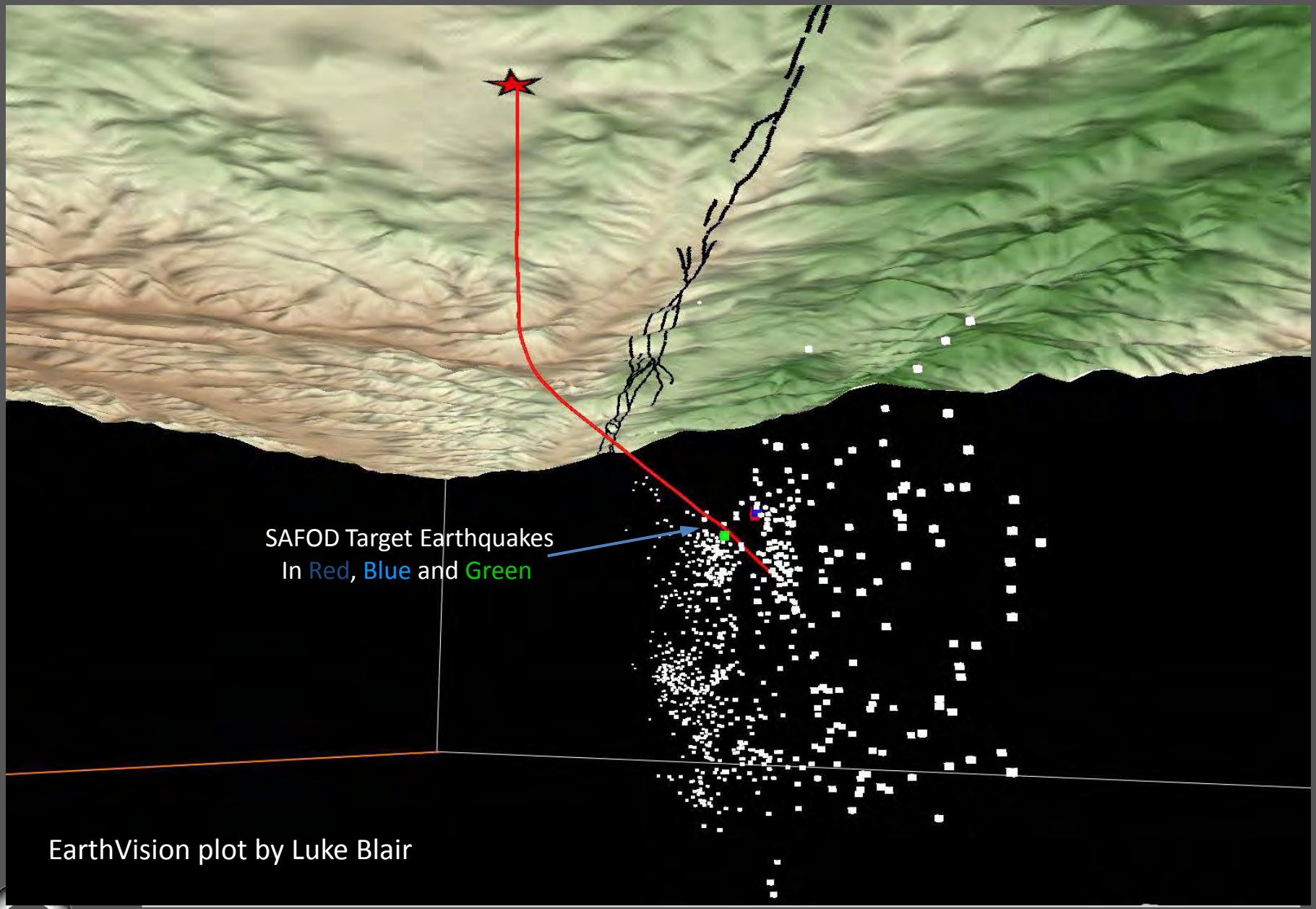
- Test fundamental theories of earthquake mechanics
- Establish a long-term observatory in the fault zone

Pilot Hole 2003
Main Hole 2004/05/07
2008+ Observatory

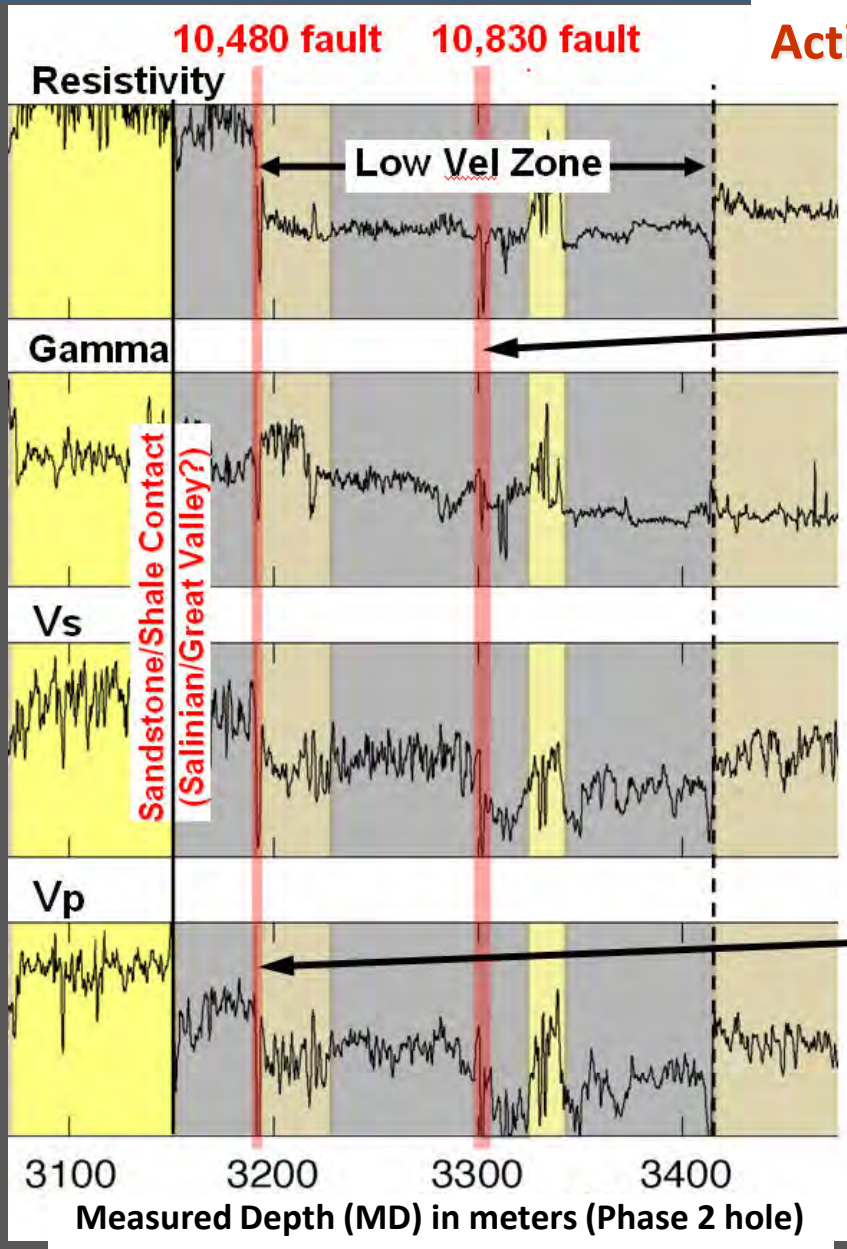


PASO Microearthquakes, 2002-2006

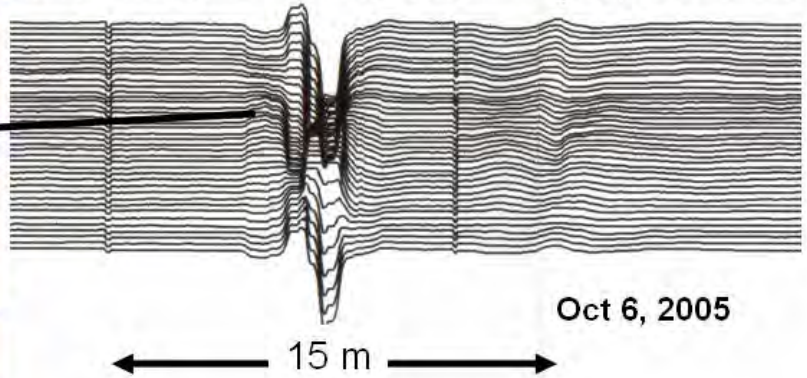
(*Cliff Thurber, Steve Roecker and Haijiang Zhang*)



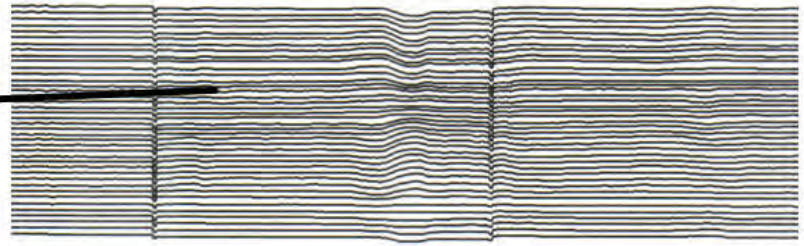
Active Faults Identified in Phase 2 Hole



Casing deformation logs identify main deformation zone at 3301 m (10,830 ft fault)



Log 5 (June 5, 2007) reveals new, secondary zone of casing deformation at 3194 m (10,480 ft fault)



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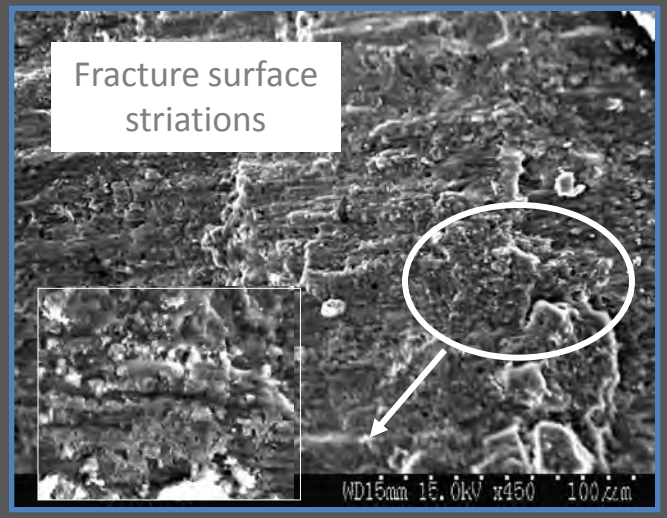
First penetration of active fault at seismogenic depth
First extraction of intact rock material (135 feet)



Ultra-thin (nm) film of secondary smectite phase on polished and striated. Smectites well oriented and occasionally fibrous in form, creating slickenfibers.

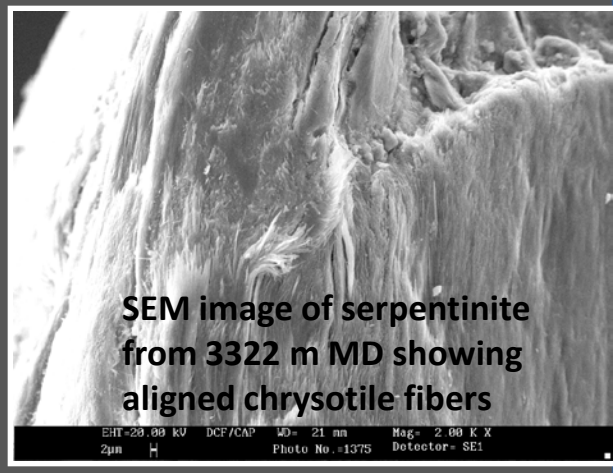
Fault Gouge Layer (1.5 m thick)

Highly sheared serpentinite layer with fragmented calcite veins

Foliated fault gouge with serpentinite and sandstone porphyroclasts

Foliated gouge with serpentinite and sandstone porphyroclasts

Serpentinite cut by white (calcite) veins



SEM image of serpentinite from 3322 m MD showing aligned chrysotile fibers

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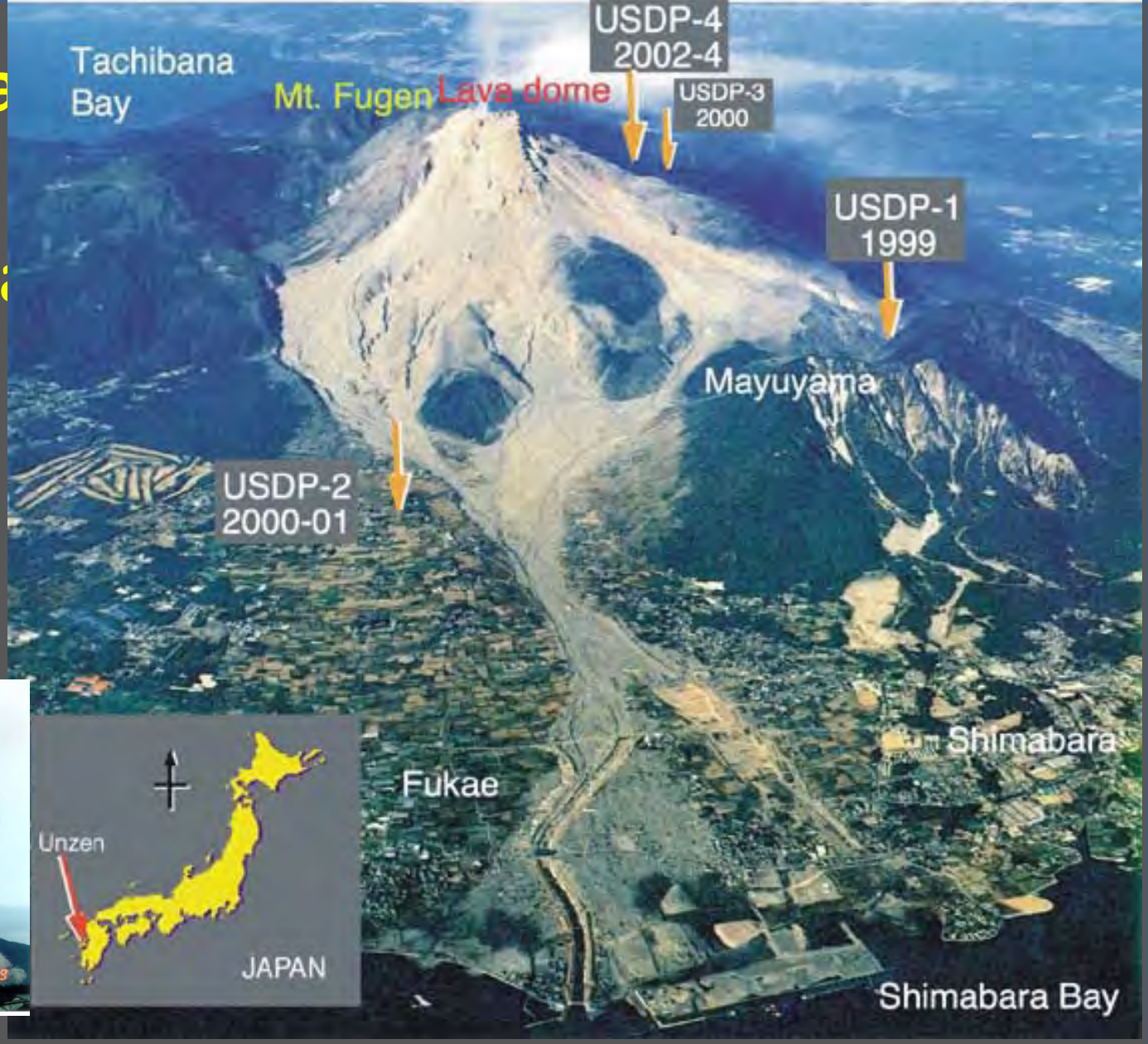
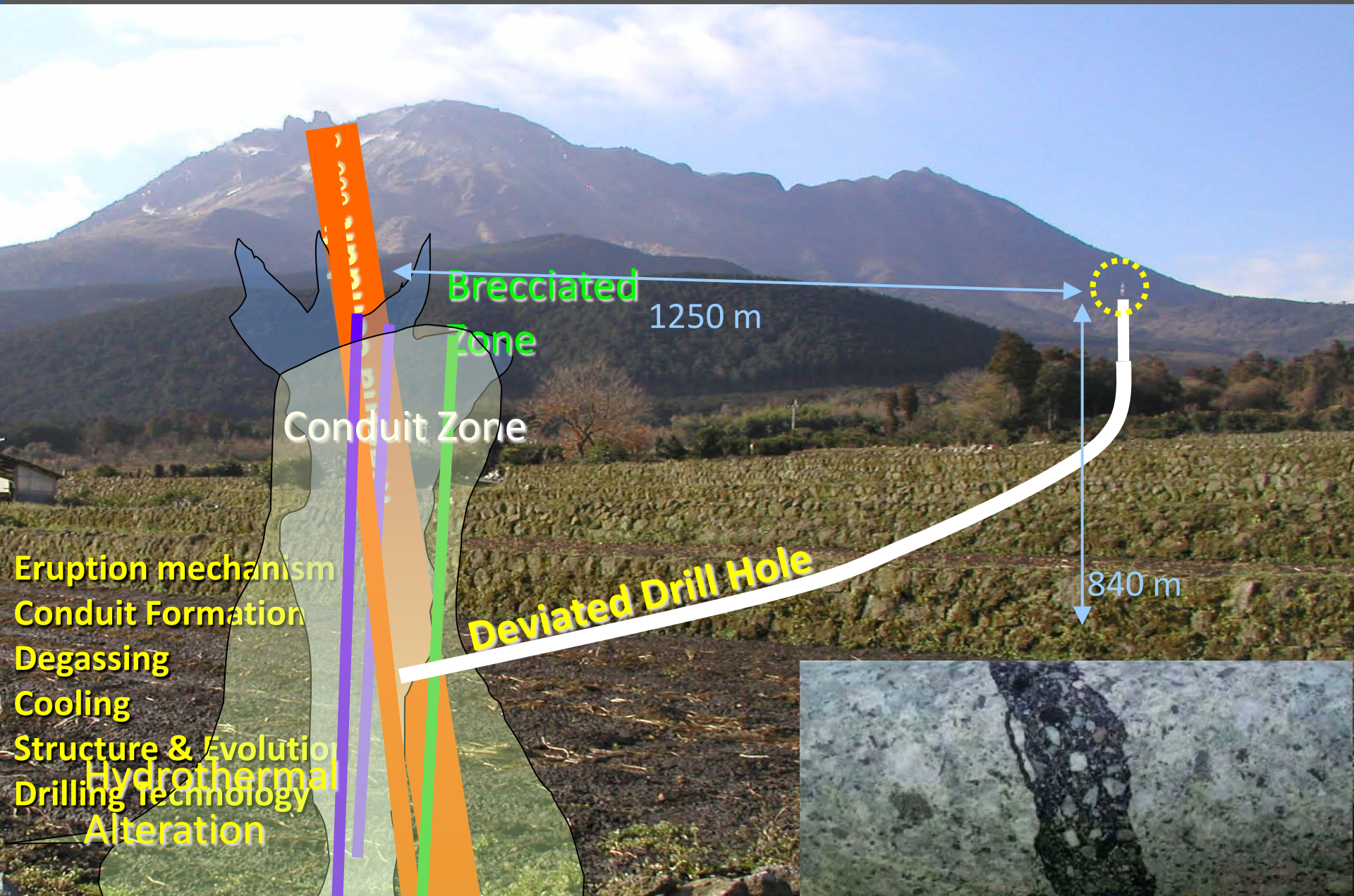
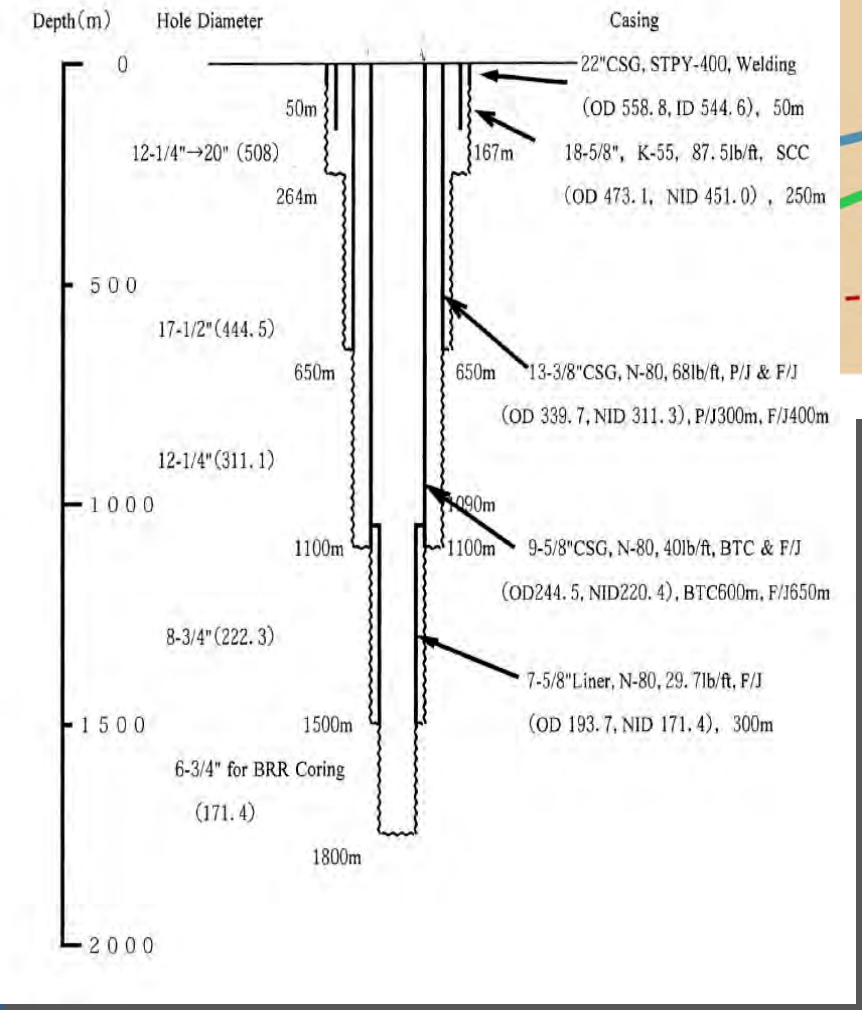
Unzen Volca
Drilling
Project, Japa

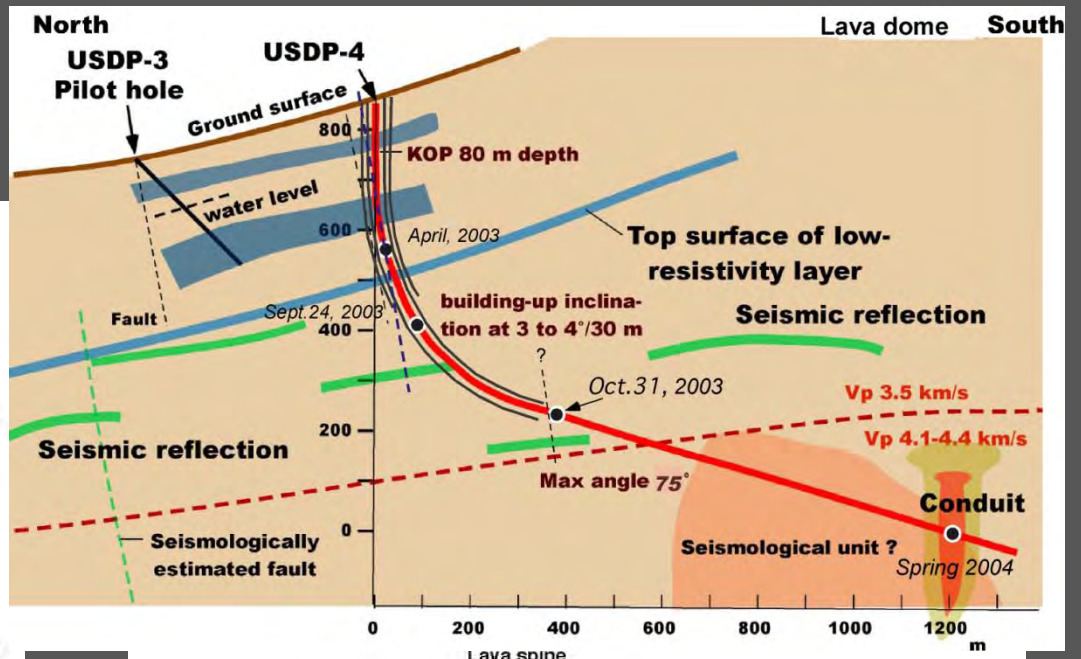


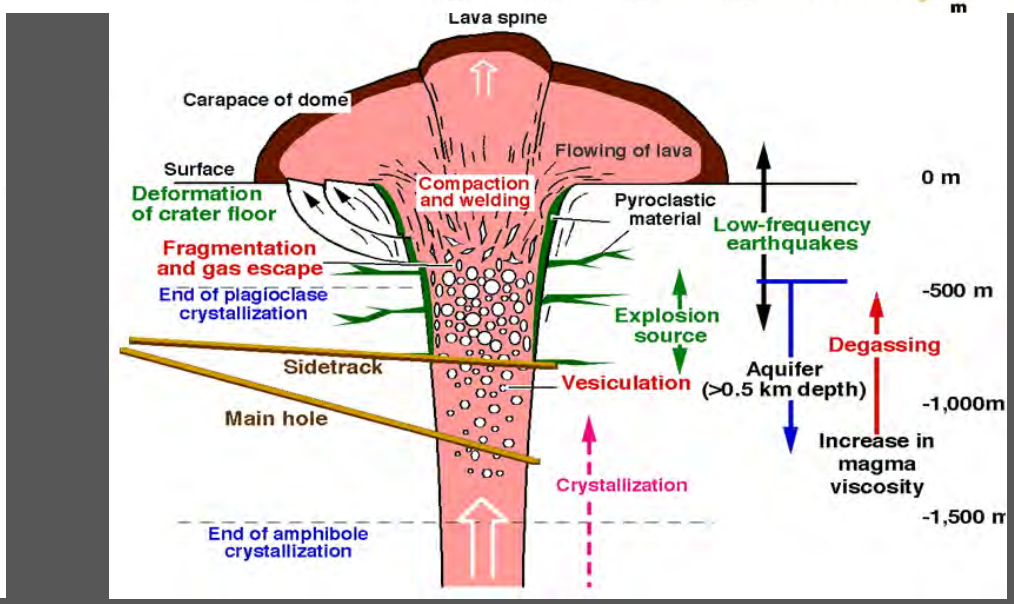
Unzen Volcano Drilling Project, Japan



Unzen Volcano Drilling Project

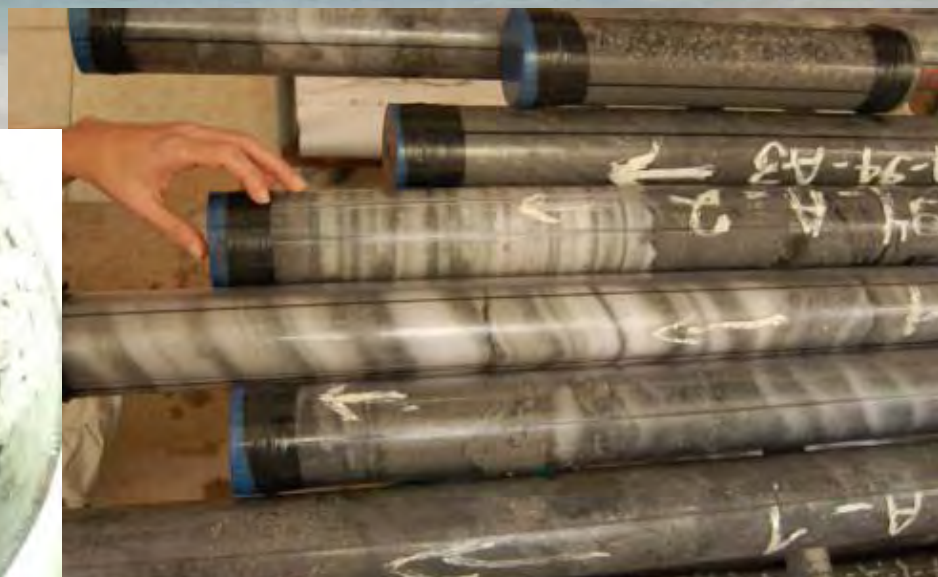


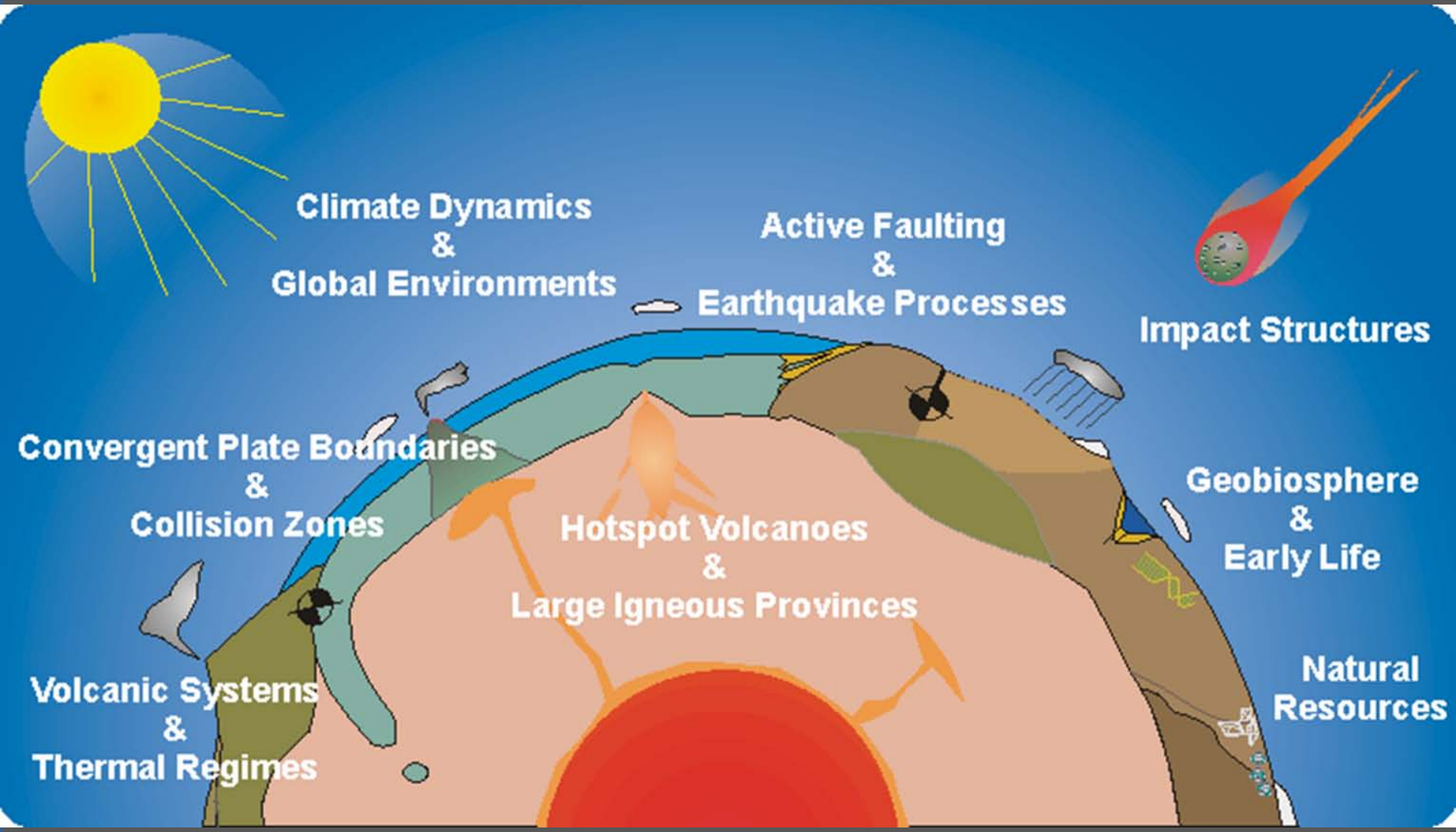





Lake Lisan ~ 25000 y; - 160 m
Dead Sea ~ 6000 y; - 370m
eeting 1997; - 413 m
eeting 2008; - 421m

Dead Sea Drilling




Climate Dynamics
&
Global Environments
Active Faulting
&
Earthquake Processes
Impact Structures
Convergent Plate Boundaries
&
Collision Zones
Geobiosphere
&
Early Life
Hotspot Volcanoes
&
Large Igneous Provinces
Natural
Resources
Volcanic Systems
&
Thermal Regimes

ICDP Membership

Member Countries

- Germany
- USA
- Japan
- China
- Canada
- Austria
- Norway
- Mexico
- Poland
- Czech Republic
- Iceland
- Finland
- South Africa

Member Countries ctd.

- Italy
- Spain
- Sweden
- Switzerland
- New Zealand
- France
- Israel

Member Organizations

- UNESCO
- Schlumberger

2011/12 Newcomers

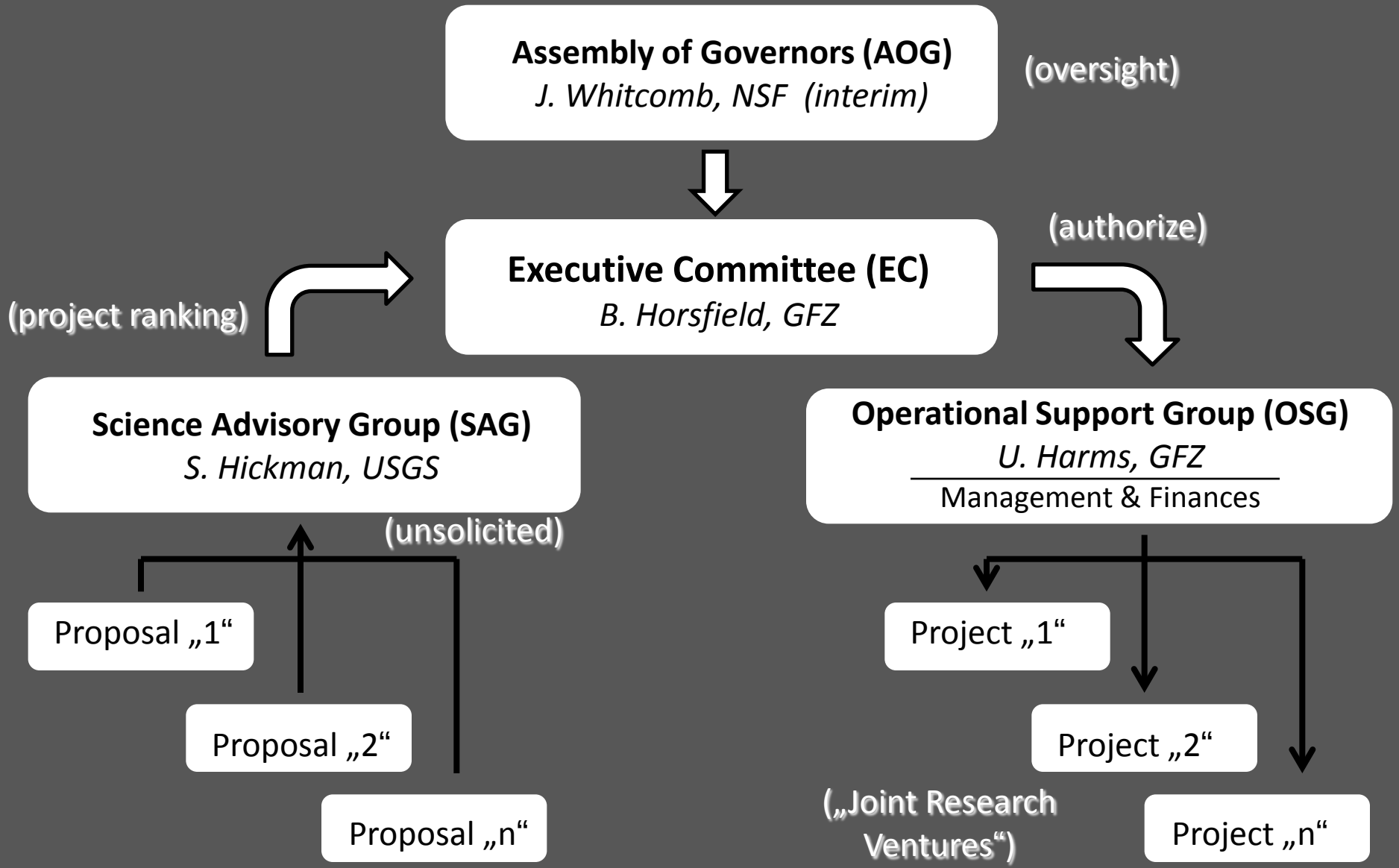
- India
- Netherlands
- United Kingdom
- South Korea

Interests & Negotiations

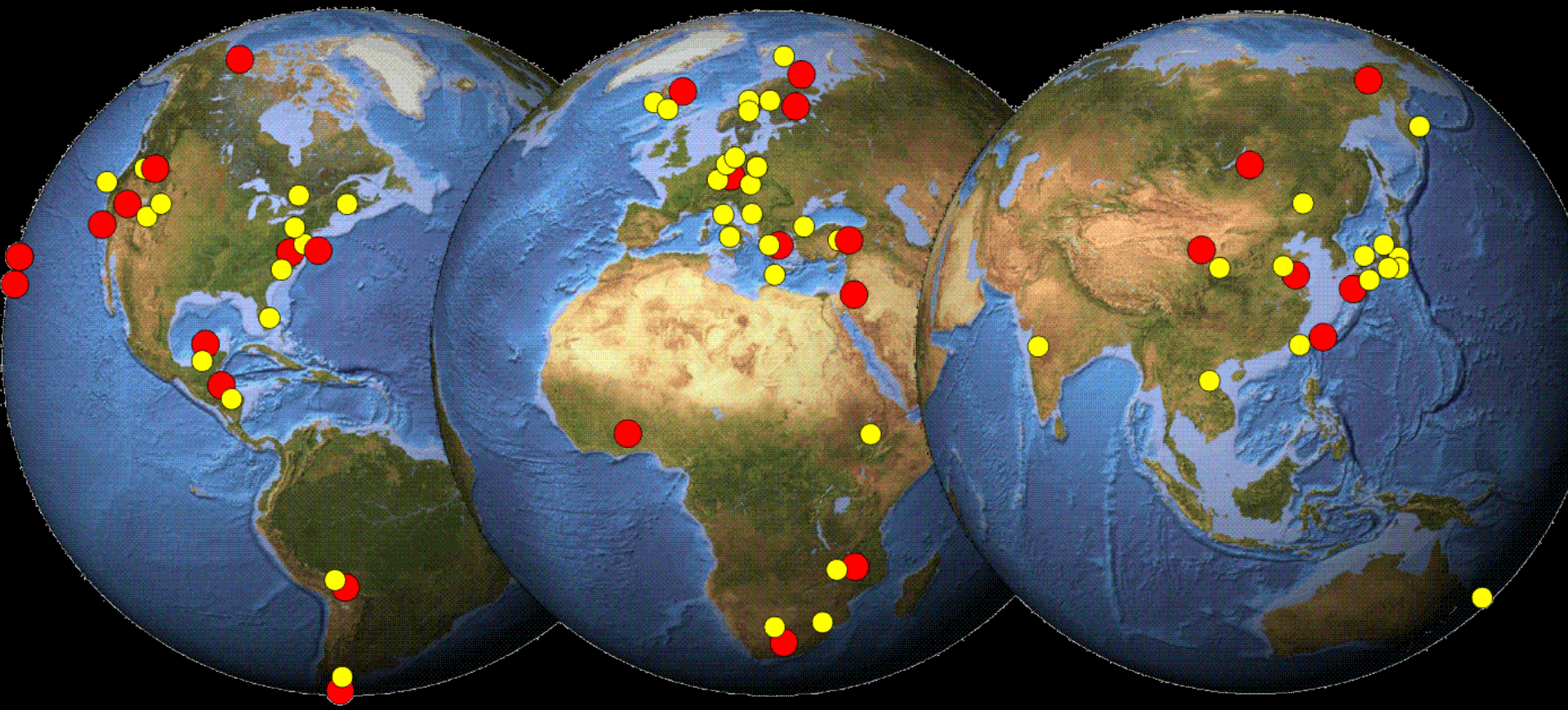
- Columbia
- Brazil
- Russia
- Turkey
- Denmark
- Belgium (Flanders)

+ more

Organizational Structure



ICDP Workshops and Projects



Criteria for Selection of ICDP Projects

• **Global Criterion**	Problem of Global Significance "World-Class" Geological Site
• **International Criterion**	Broad International Collaboration Best Possible Science Team Pooling of Resources and Technology
• **Societal-Needs Criterion**	Relevance of Problem to Society Collaboration with Industry
• **Need-for-Drilling Criterion**	Proof of Necessity for Drilling
• **Depth-to-Cost Criterion**	Balancing of Costs and Drilling Design

From Proposal to Project

Constitute an essential component in the preparation of a full proposal, as they allow PI s

- **to invite experts in the respective field from all over the world**
- **to strengthen and broaden the project**
- **to establish an international science team**
- **to prepare a detailed science, operations, and budget plan for a full proposal**

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Funding Strategy

ICDP funds are granted for project development and drilling-related expenses, but not for science support

- Foster International Co-operation and Project development through Workshops (seed money to lift projects)
- Form partnerships with other scientific, private, governmental or industry groups for project funding
- Direct money to drilling operations, scientific-technical on-site support, facilities and data management

Project Funding through ICDP

Two ways of funding:

1. Leg = Financial Support

2. Leg = Operational Support

Operational Support Group – OSG
of ICDP at GFZ in Potsdam

Both can be requested by ICDP projects

Project Co-Funding through ICDP, other Agencies, and Industry

Application to

1. **ICDP** by Group of PI´s and
2. **National Funding Agencies, Universities, Geological Surveys** by single PI´s or groups
3. **PI´s negotiate with industry**

ICDP co-financed Drilling Projects
(Total Costs vs. ICDP Contribution)

Projects (22)	Total Funds	ICDP funds	ICDP %
examples:			
Mallik	16,500,000 USD	1,300,000 USD	8%
SAFOD	14,951,000 USD	1,720,000 USD	12%
Unzen	12,200,000 USD	2,500,000 USD	13%
Chelungpu	2,370,597 USD	150,000 USD	6%
Bosumtwi	1,760,000 USD	1,235,000 USD	70%
FAR DEEP	970,000 USD	550, 000 USD	51%
Lake Potrok Aike (~)	2,300,000 USD	1,300,000 USD	57%
Lake El´gygytgyn(~)	9,900,000 USD	2,200,000 USD	22%
++other projects++			
Total	**100,800,000 USD**	**20,700,000 USD**	**21%**

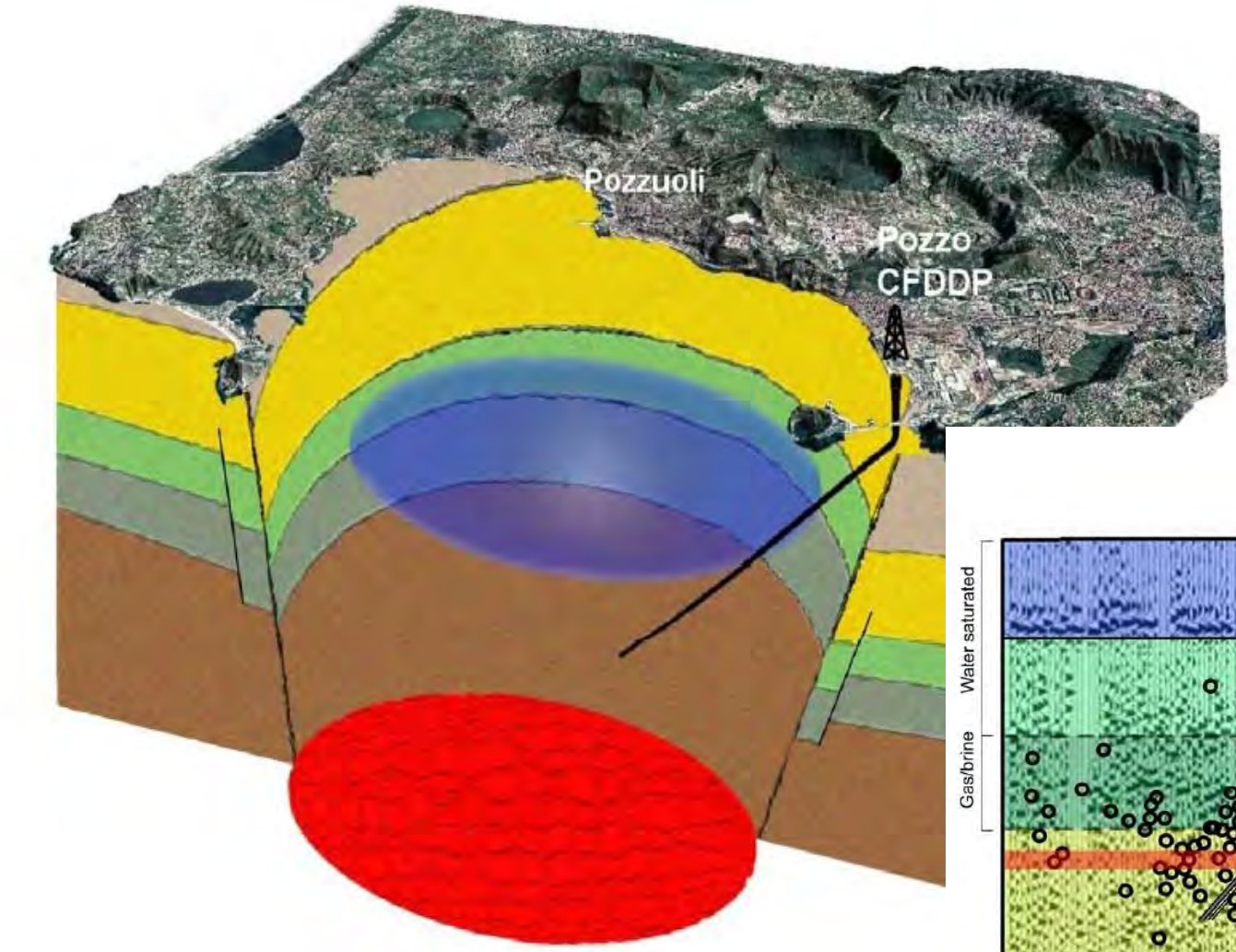
Operational Support Group (OSG)

- assists PIs in developing Full Proposals
- supports PIs in planning & design of Drilling Projects
- assists PIs in scientific and engineering drill site operations and management
- provides drilling equipment, downhole tools and field laboratory facilities
- offers a robust data management system
- conducts ICDP Training Courses
- helps organizing ICDP Workshops

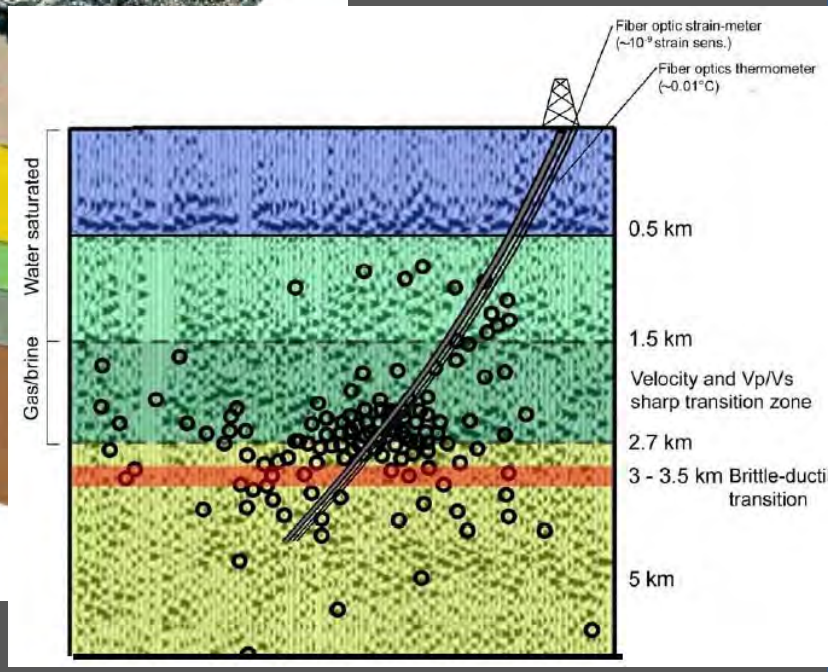
OSG is a service covered by the GFZ

Campi Flegrei Caldera Deep Drilling Project (CFDDP)

A natural laboratory to understand mechanisms of caldera dynamics and to develop techniques for eruption forecast and effective risk mitigation



Drilling from land 3.5 km deep into the center of the caldera



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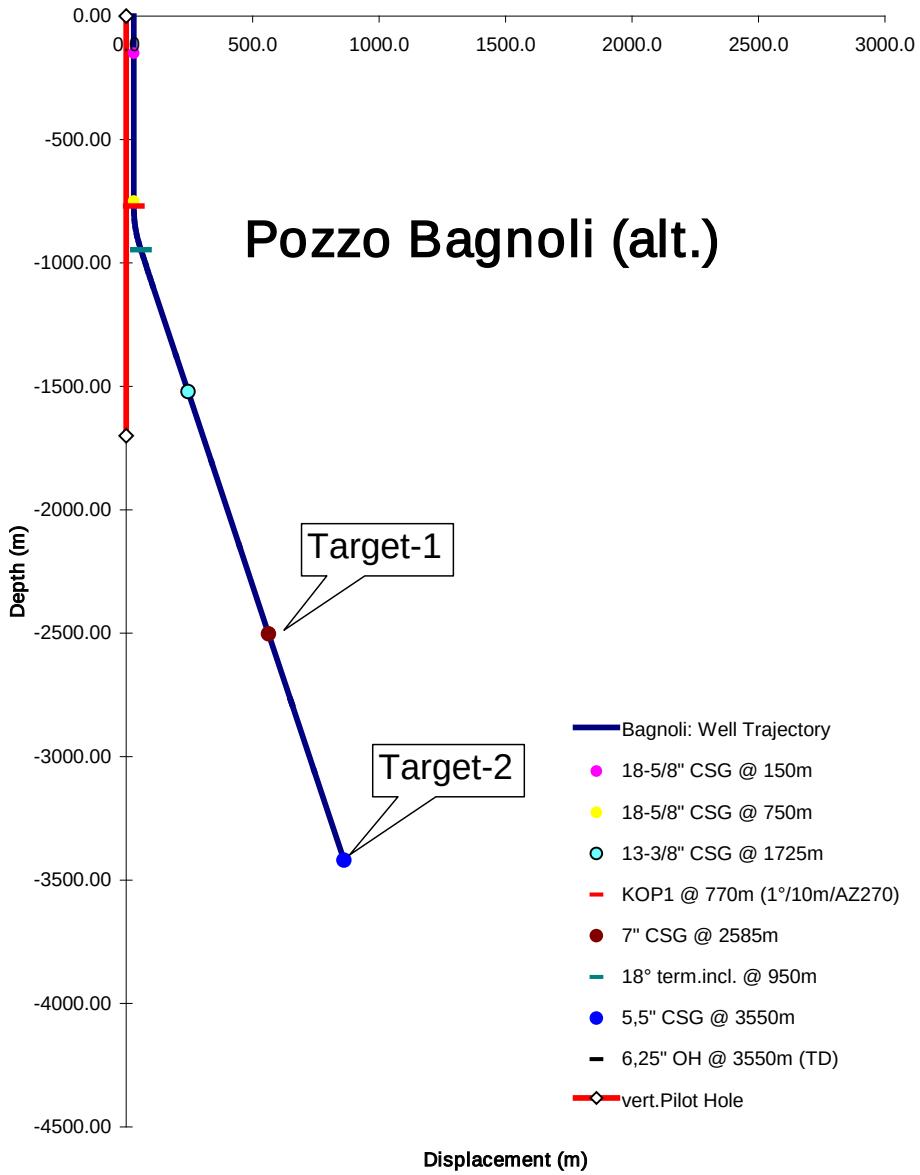
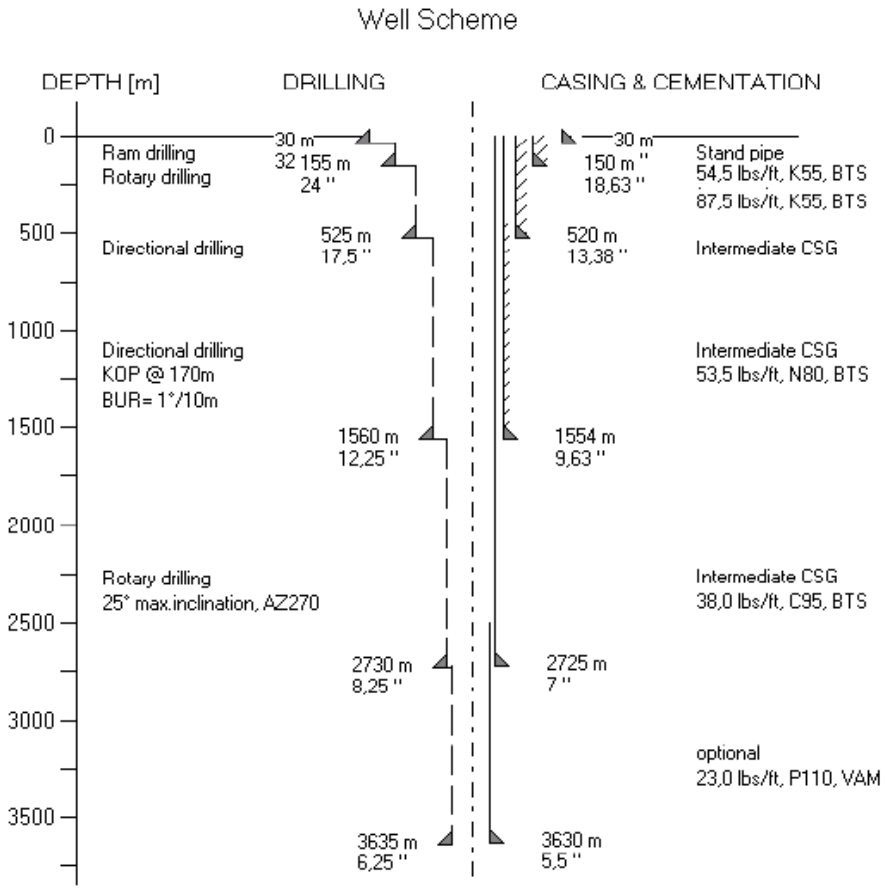
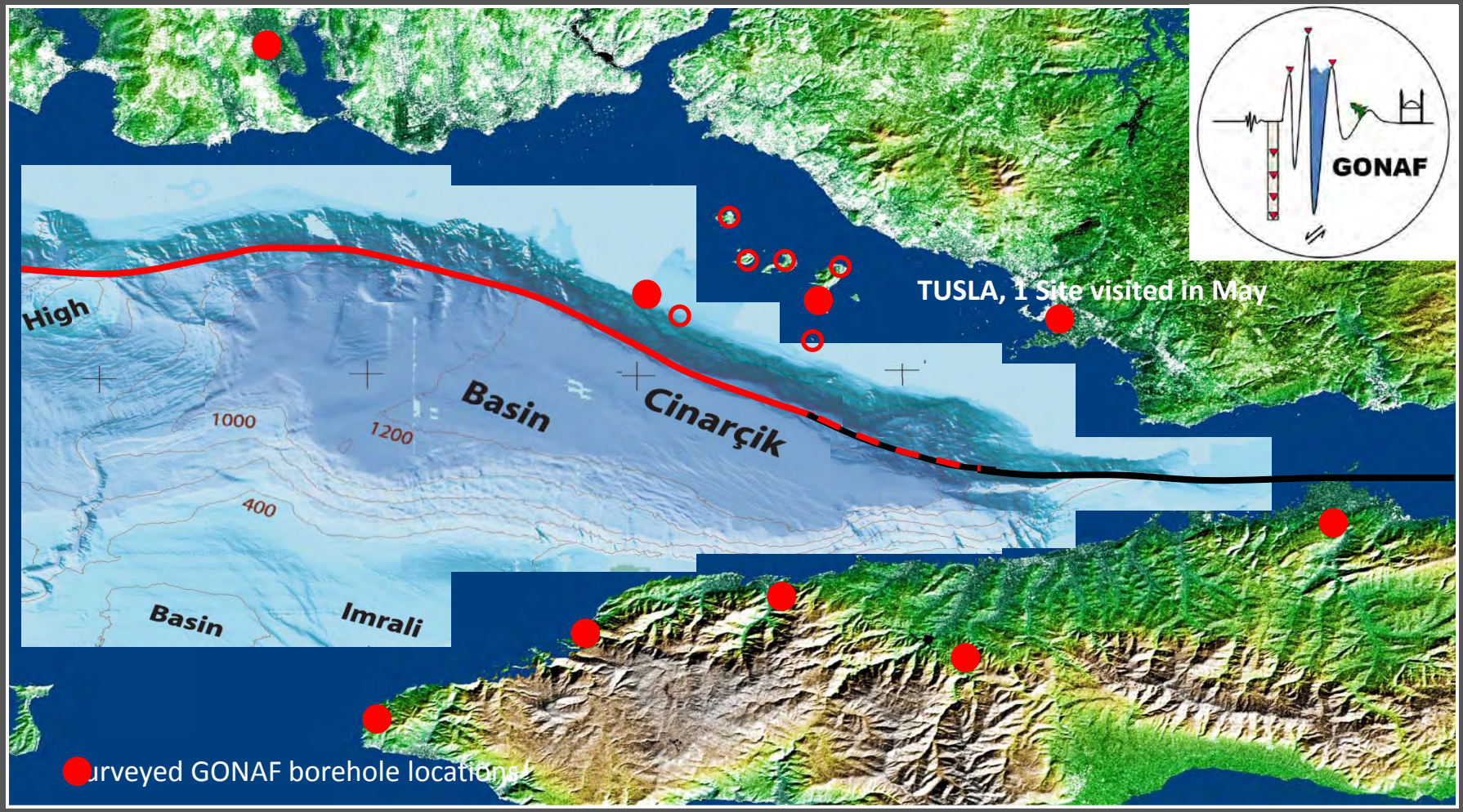
Campi Flegrei Caldera Deep Drilling Project (CFDDP)





GONAF: A Deep Geophysical Observatory at the North Anatolian Fault Zone (2012)

8 boreholes of 8 1/2” size will be drilled to 300 m depth each. A measurement string with 8 broadband-seismometers will be cemented per hole

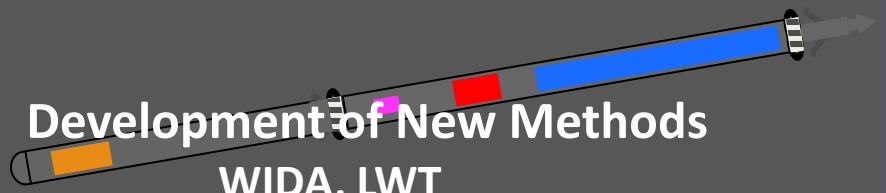


Geophysical Borehole Measurements

Logging Sondes

standard

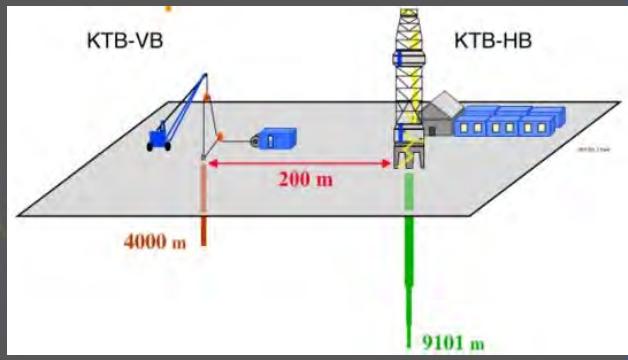
slimhole



Development of New Methods

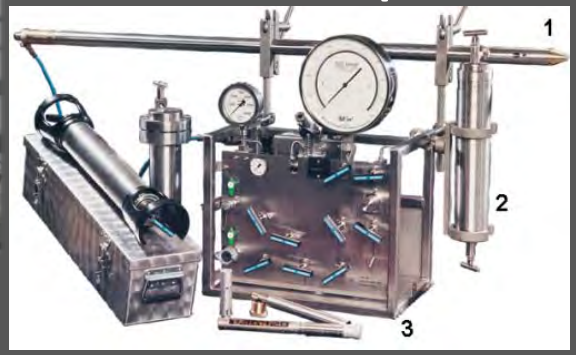
WIDA, LWT

KTB Underground Lab & Test Site



Geophone-Chain

Fluid Sampler



Logging Winches

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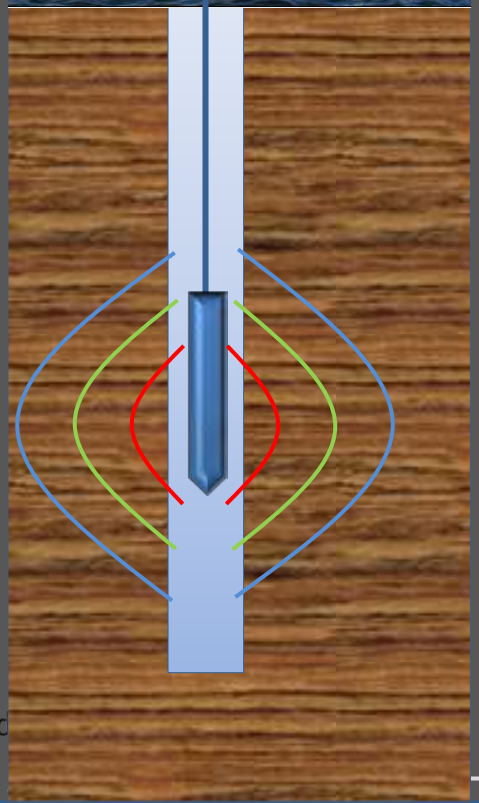
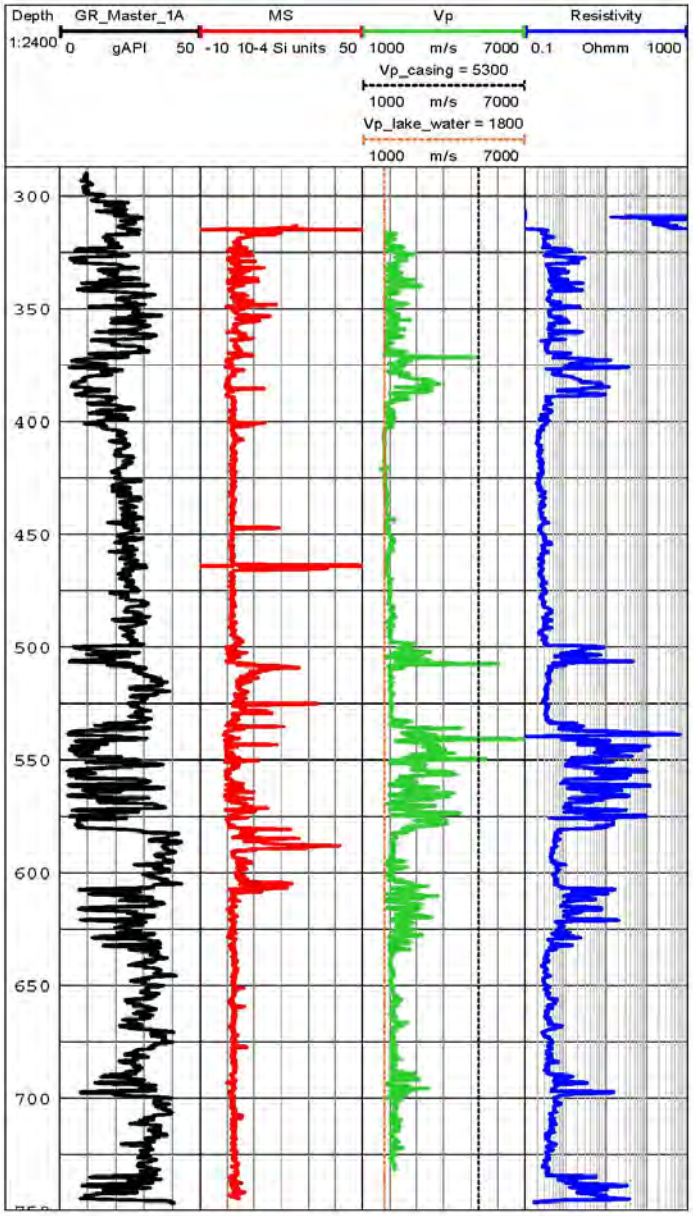
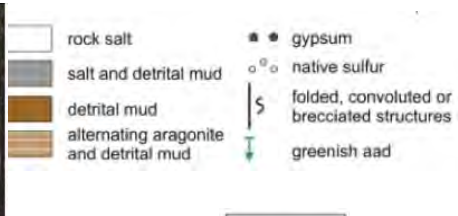
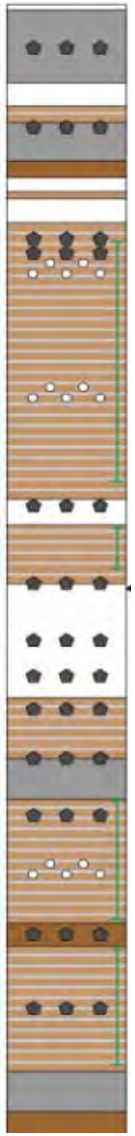



Depth
1:2400
GR_Master_1A
0 gAPI 50
MS
-10 10-4 Si units 50
Vp
1000 m/s 7000
Resistivity
0.1 Ohmm 1000
Vp_casing = 5300
1000 m/s 7000
Vp_lake_water = 1800
1000 m/s 7000
300
350
400
450
500
550
600
650
700


rock salt
salt and detrital mud
detrital mud
alternating aragonite and detrital mud
gypsum
native sulfur
folded, convoluted or brecciated structures
greenish aad

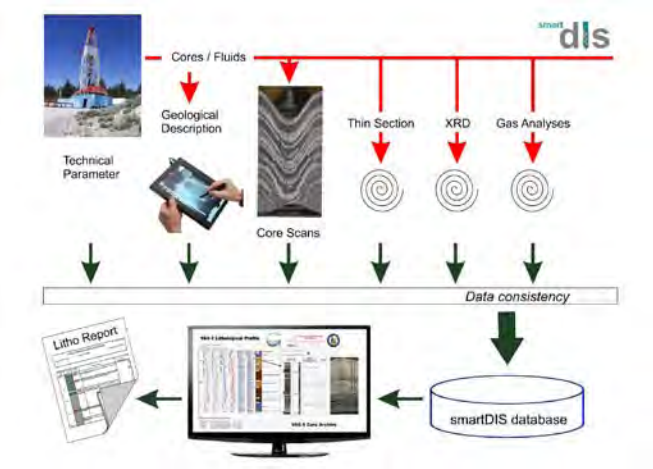


Page 1

Information System for ICDP Projects

Drilling Information System

= data acquisition

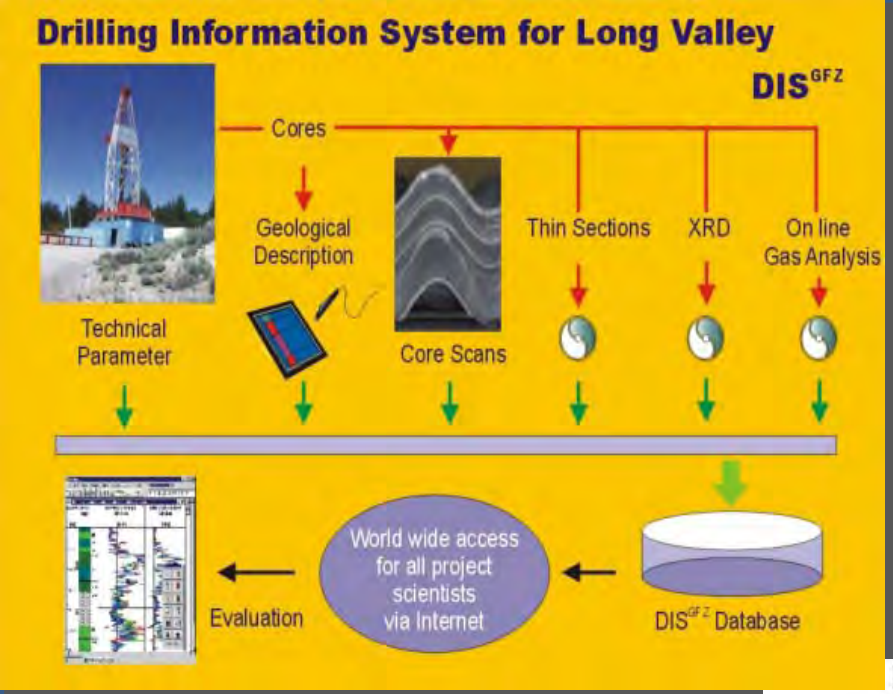


ICDP Web Information Network

= data dissemination

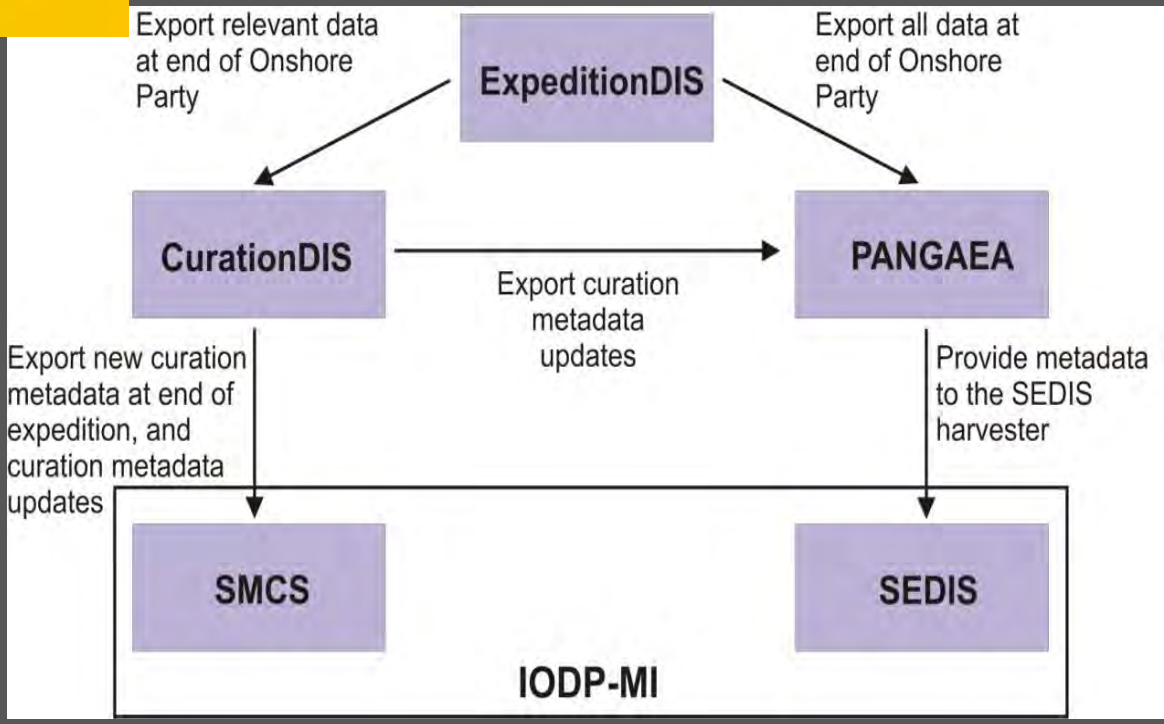
Datasets in Scientific Drilling Database (PANGAEA / SDDB)

= data publication



Drilling Information System

Data and Information:
Capture
Storage
Distribution



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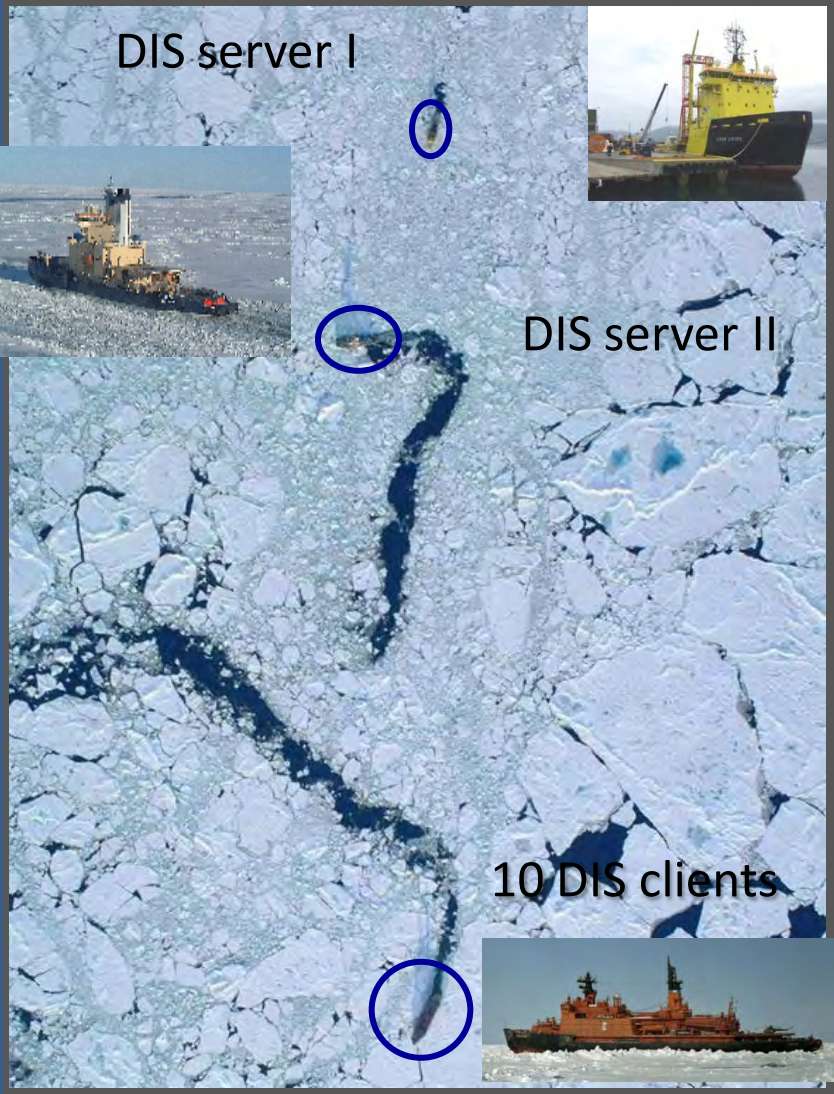
DIS Flexibility

Arctic Coring Expedition



Fennoscandia Arctic Russia – Drilling Early Earth Project

far-deep.icdp-online.org

© DSDDP – Dead Sea Deep Drilling Project

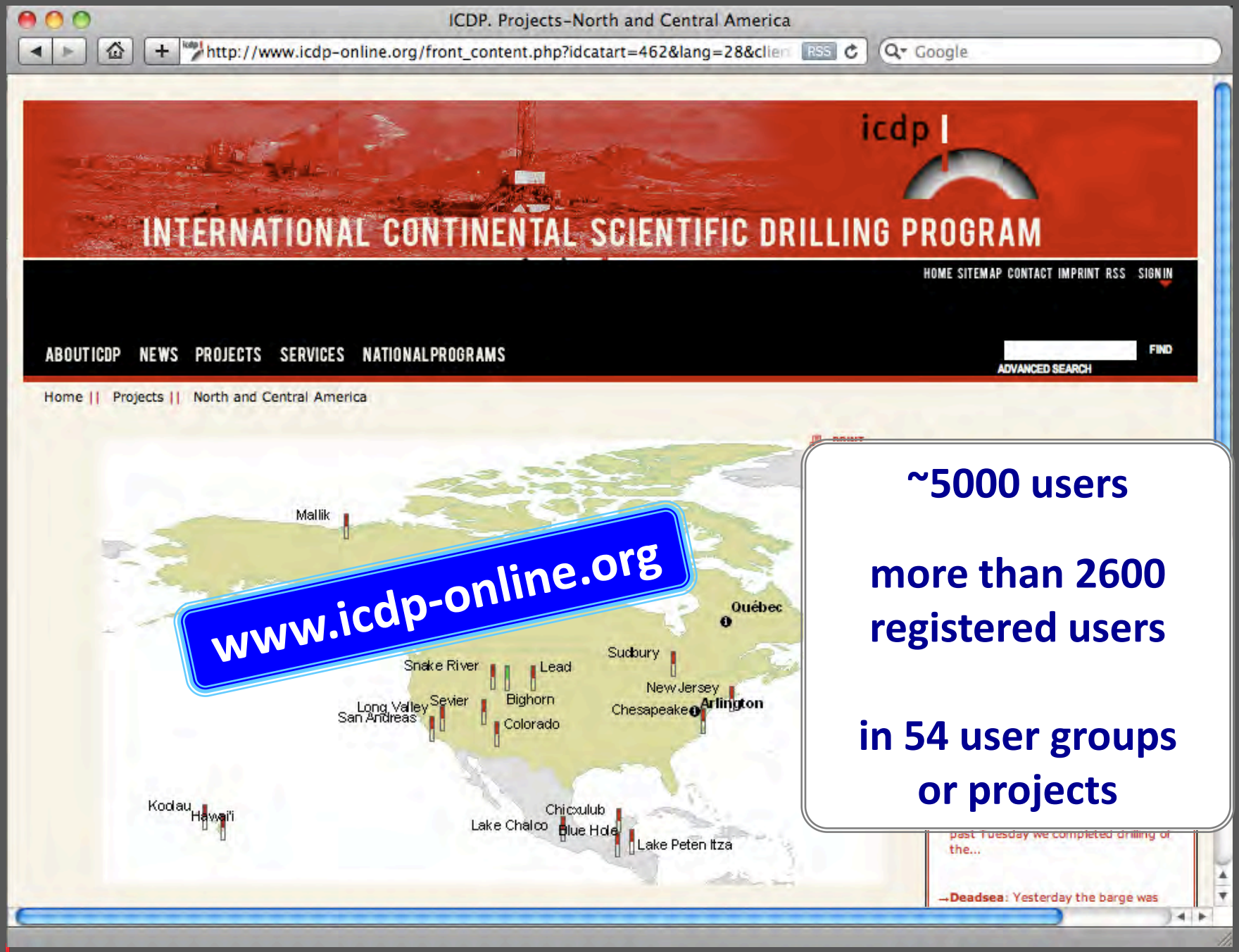
DSDDP – Dead Sea Deep Drilling Project

Field work completed

- Drilling reports
- Core Recovery
- Low-res. magn. susceptibility measurements

Initial core description completed

- Core scanning
- Core descriptions
- High-res. magn. susceptibility measurements
- XRF measurements
- Sampling (3rd party in July 2012)

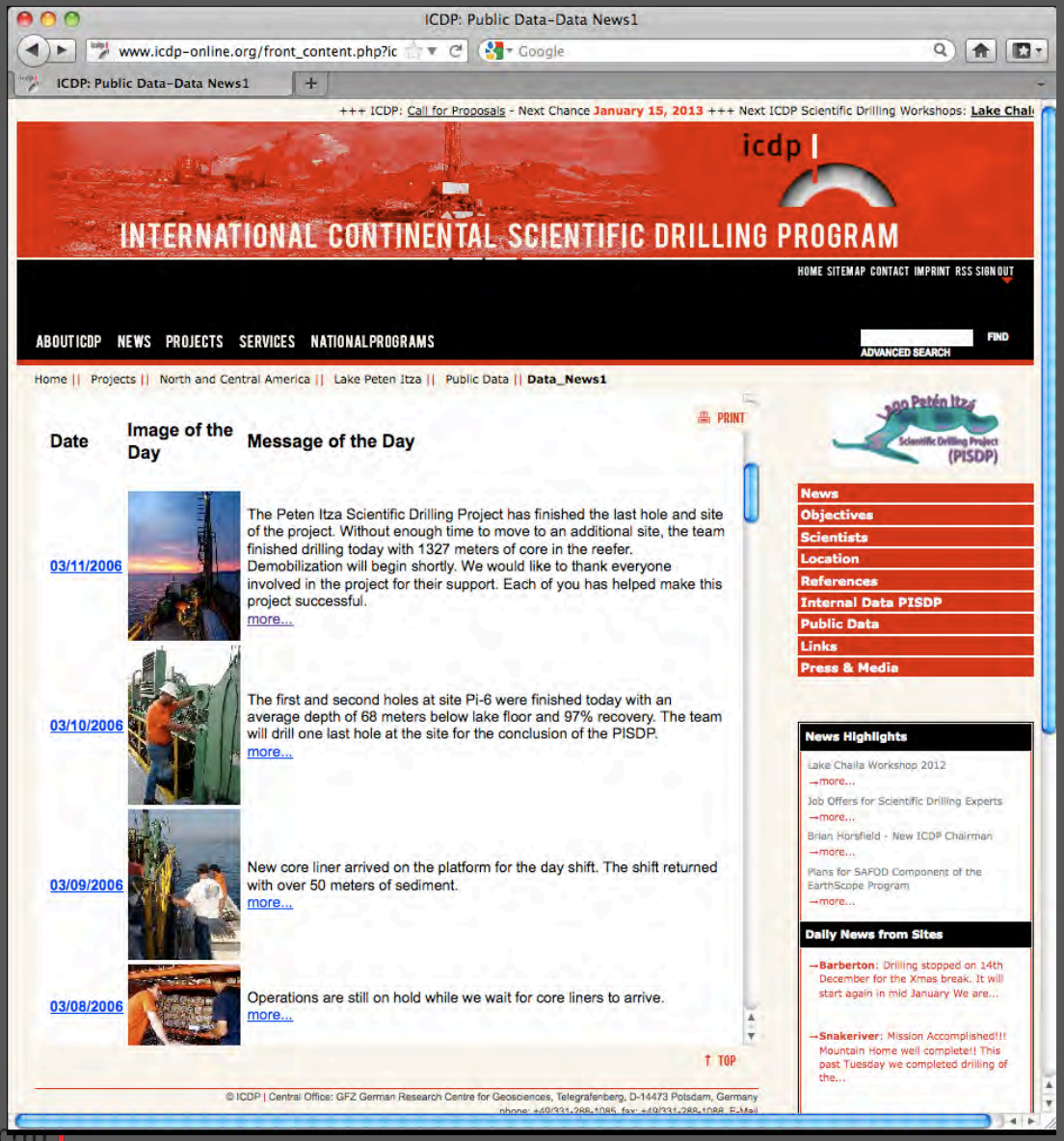


~5000 users

more than 2600 registered users

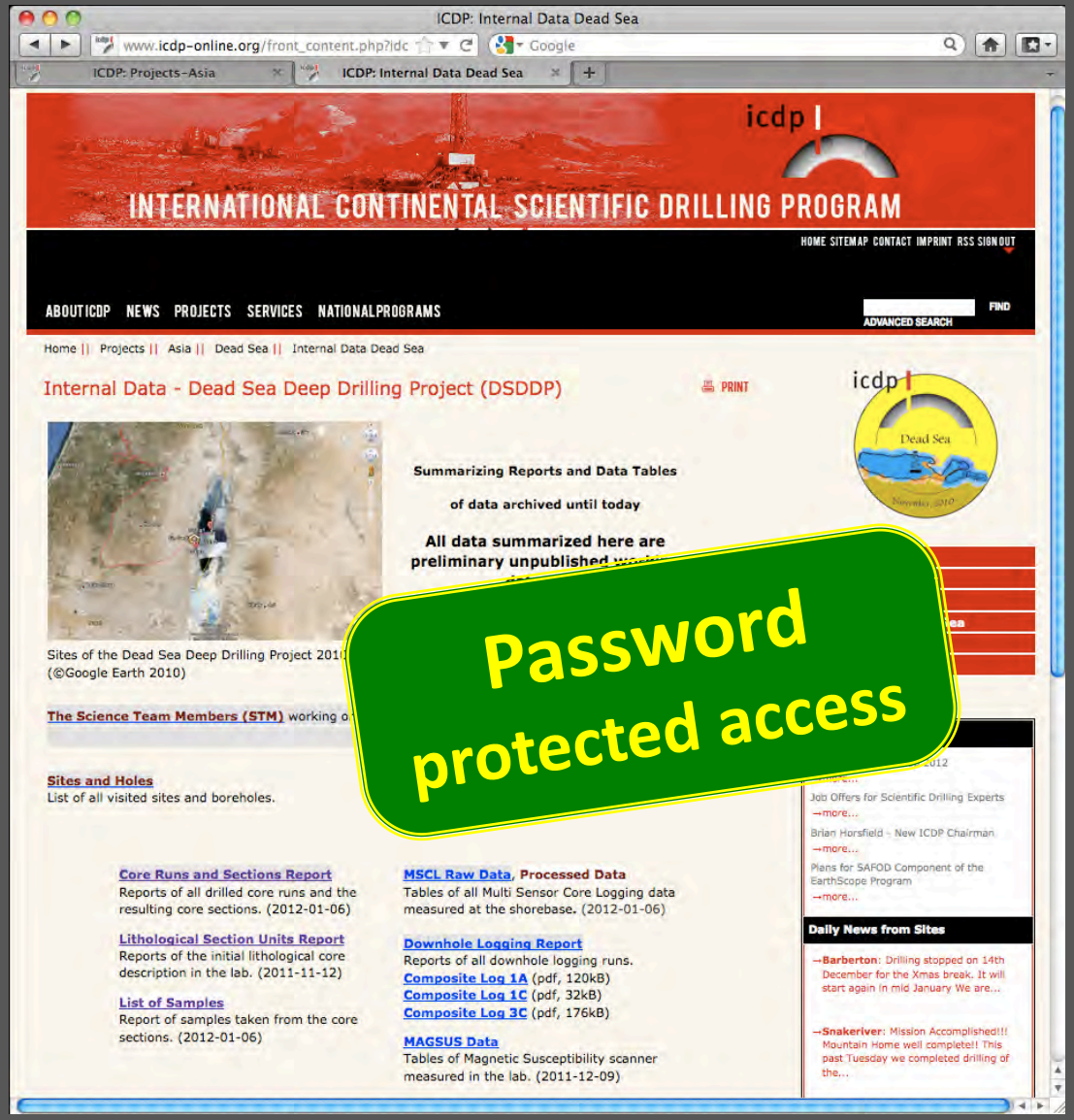
in 54 user groups or projects

ICDP Web Pages for ICDP Projects



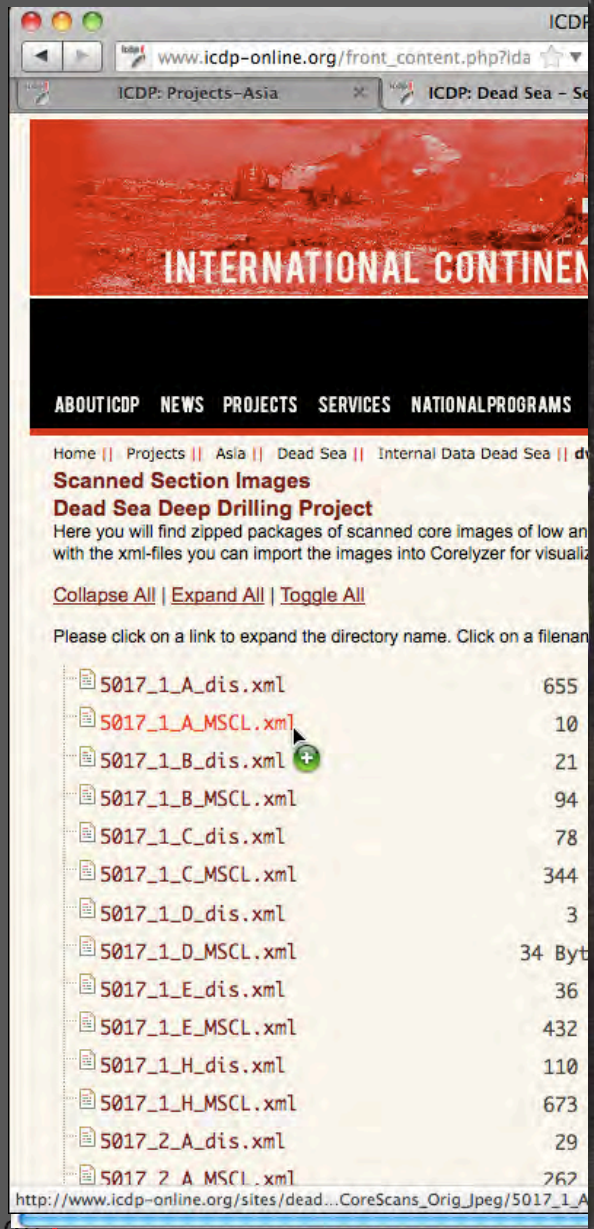
Public Data

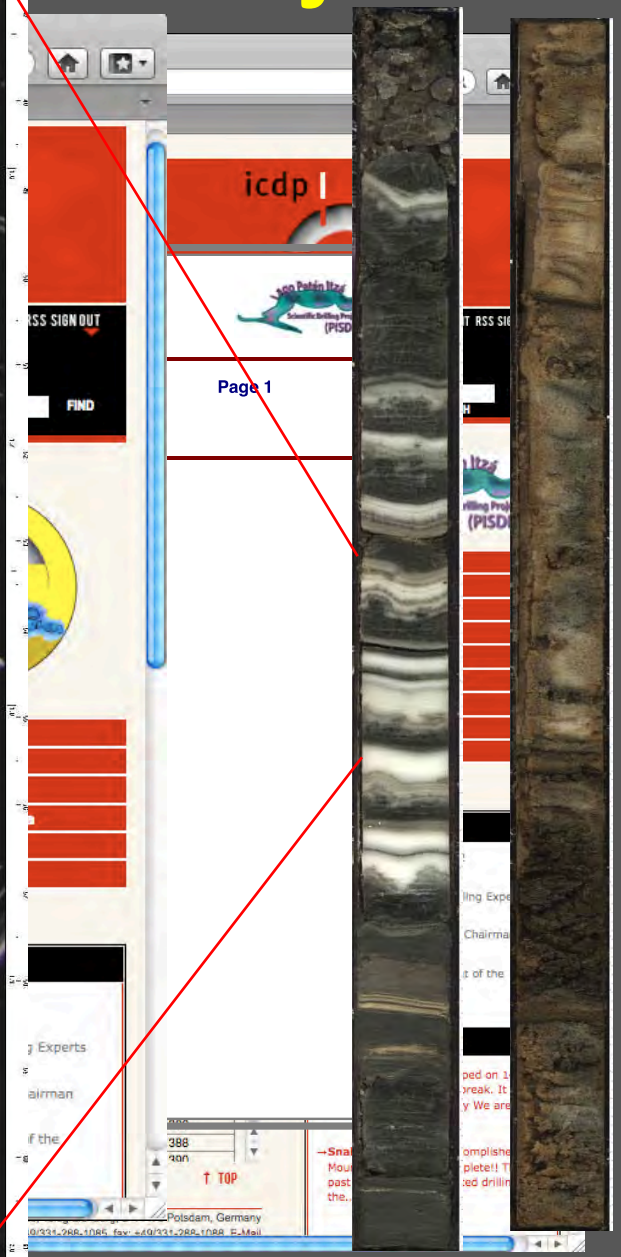
ICDP Web Pages for ICDP Projects



Internal Data

ICDP Web … DP Projects





ICDP Outreach and Education

Training Course 2011

October 10. - 14. 2011, Windischeschenbach, Germany

ICDP Training Course 2012

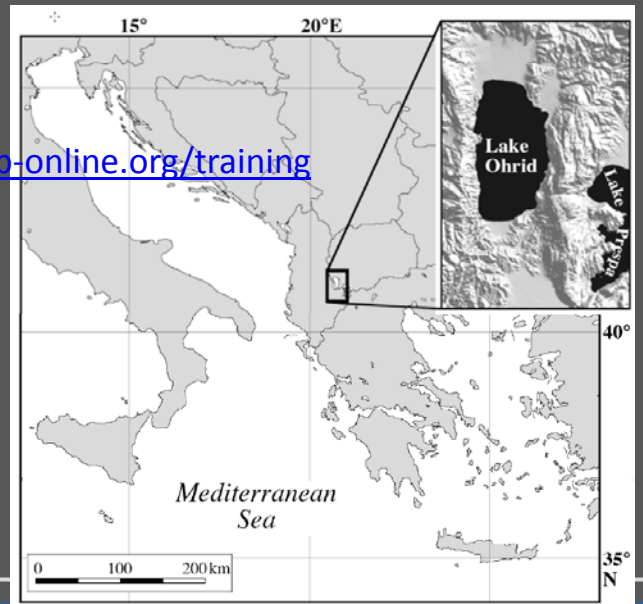
The International Continental Scientific Drilling Program, ICDP invites scientists from upcoming scientific drilling projects in soft sediments to apply for the

2012 ICDP Training Course on Lake Drilling

to be held from October 15-19, 2012 at Lake Ohrid (Macedonia). This training course will touch upon all relevant aspects of scientific drilling in lakes, including project planning and management, pre-site studies, drilling engineering, drill core handling and storage, on-site core analysis, downhole logging, data management, and post-drilling activities. The training course is recommended for master students, doctorate students and post-docs involved in scientific drilling.

Deadline for application is July 15, 2012; decisions will be communicated by end of July. Preference will be given to applicants involved in ICDP drilling projects, applicants from ICDP member countries, developing countries, and those from countries considering ICDP membership. For the successful candidates, costs including those for travelling, visa, and accommodation will be covered by the ICDP. Applications should include a letter of interest, CV, and at least two letters of support.

Please send your application to icdp-outreach@gfz-potsdam.de
Further information on ICDP training measures can be found at www.icdp-online.org/training



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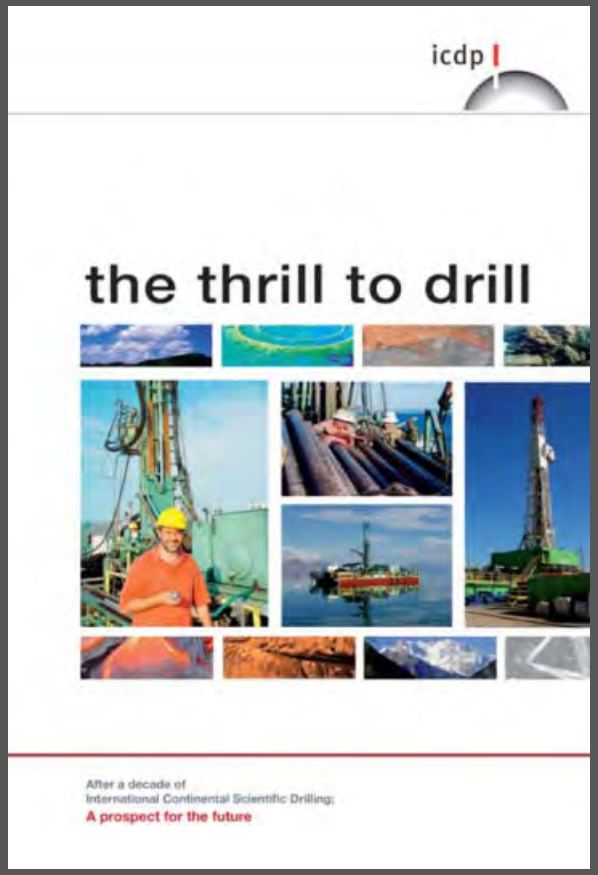
Outreach


icdp
the thrill to drill
After a decade of
International Continental Scientific Drilling:
A prospect for the future


ISSN: 1816-8957
No. 11, March 2011
Scientific Drilling
Reports on Deep Earth Sampling and Monitoring
Climate and Ocean Change in the Bering Sea 4
San Andreas Fault Zone Drilling 14
Climate History from Lake El'gygytgyn, Siberia 29
World's Deepest Ice Core 41
Climate and Tectonic Unrest: Dead Sea Drilling 46
Workshop Reports:
Sampling Earth's Mantle 51
Drilling into 3.5-Billion-Years-Old Rocks 66
Published by the Integrated Ocean Drilling Program with the International Continental Scientific Drilling Program

ICDP Equipment Pool

organized by

Operational Support Group

at GFZ

Data Management System

5.5 km Wireline Drillstring

Slimhole Sondes & Downhole Logging

Core Scanning & Logging

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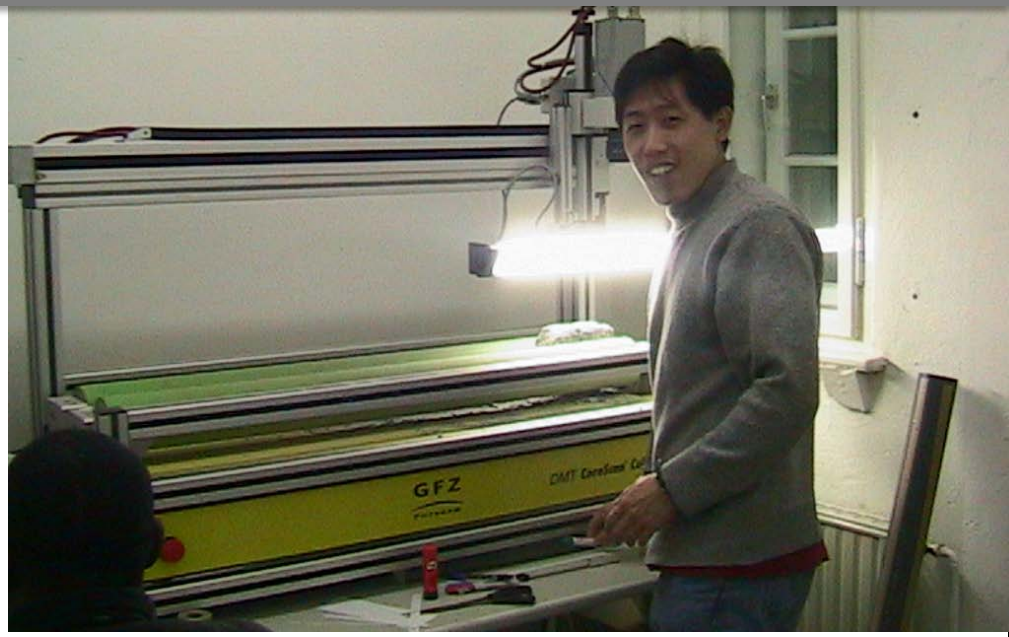
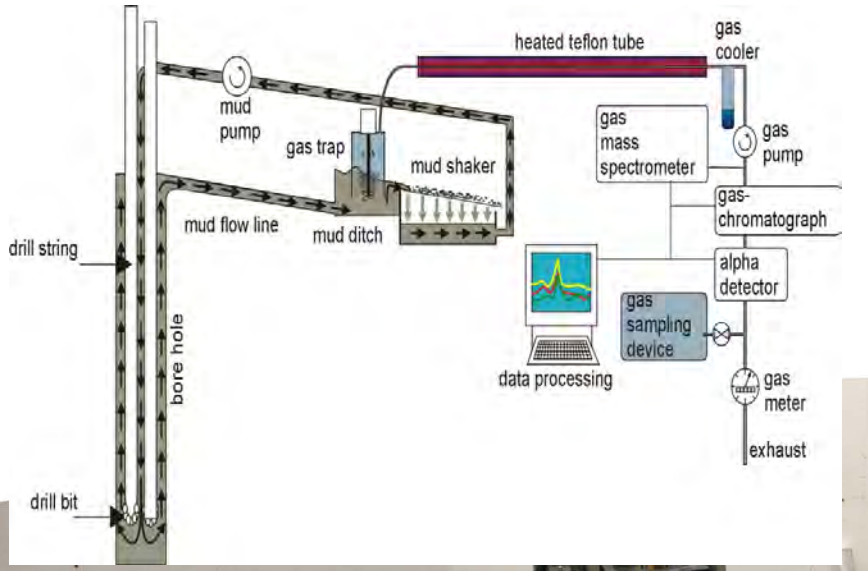
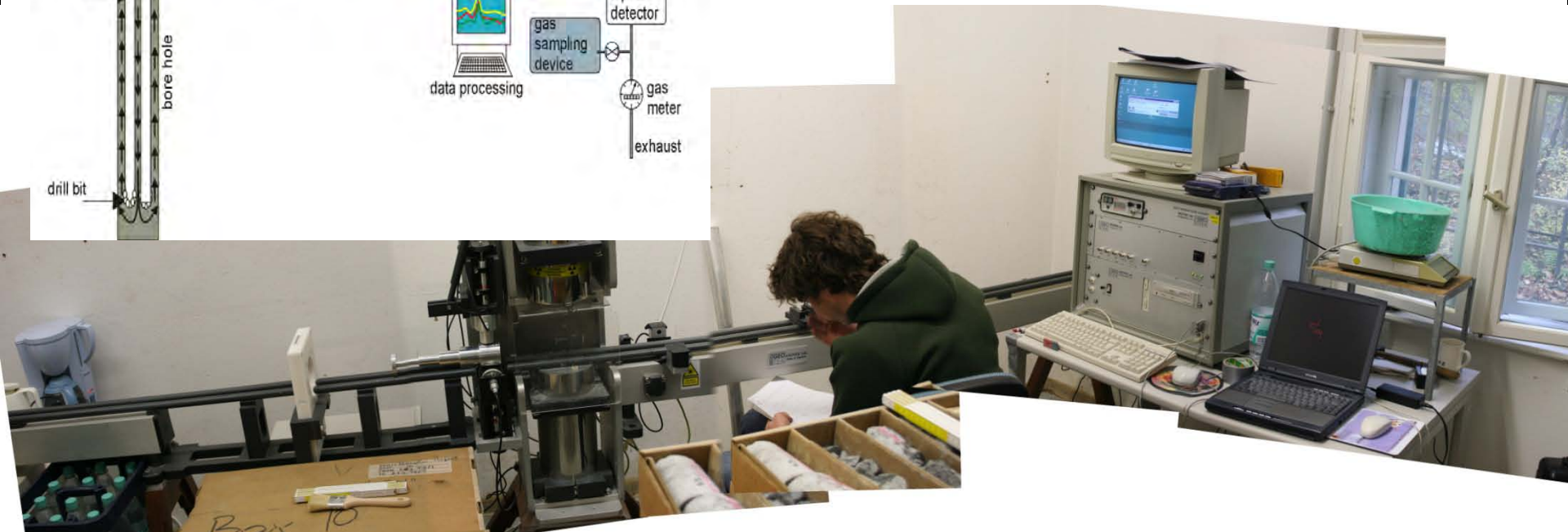
ICDP Drill Site Instruments

- **Optical Scanning**
- **Petrophysical Logging**
  Magn. Suscept, Gamma Density, Sonic Velocities
- **Online Gas Monitoring**







German Scientific Earth Probing Consortium
GESEP

Core Repository for Continental Cores

BGR Core Repository
Berlin Spandau

MARUM Core Repository

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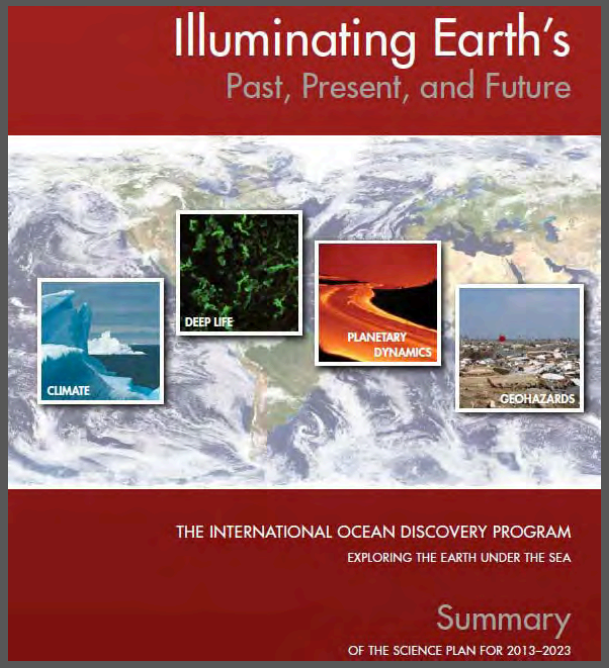
New Science Plan to be developed in 2013

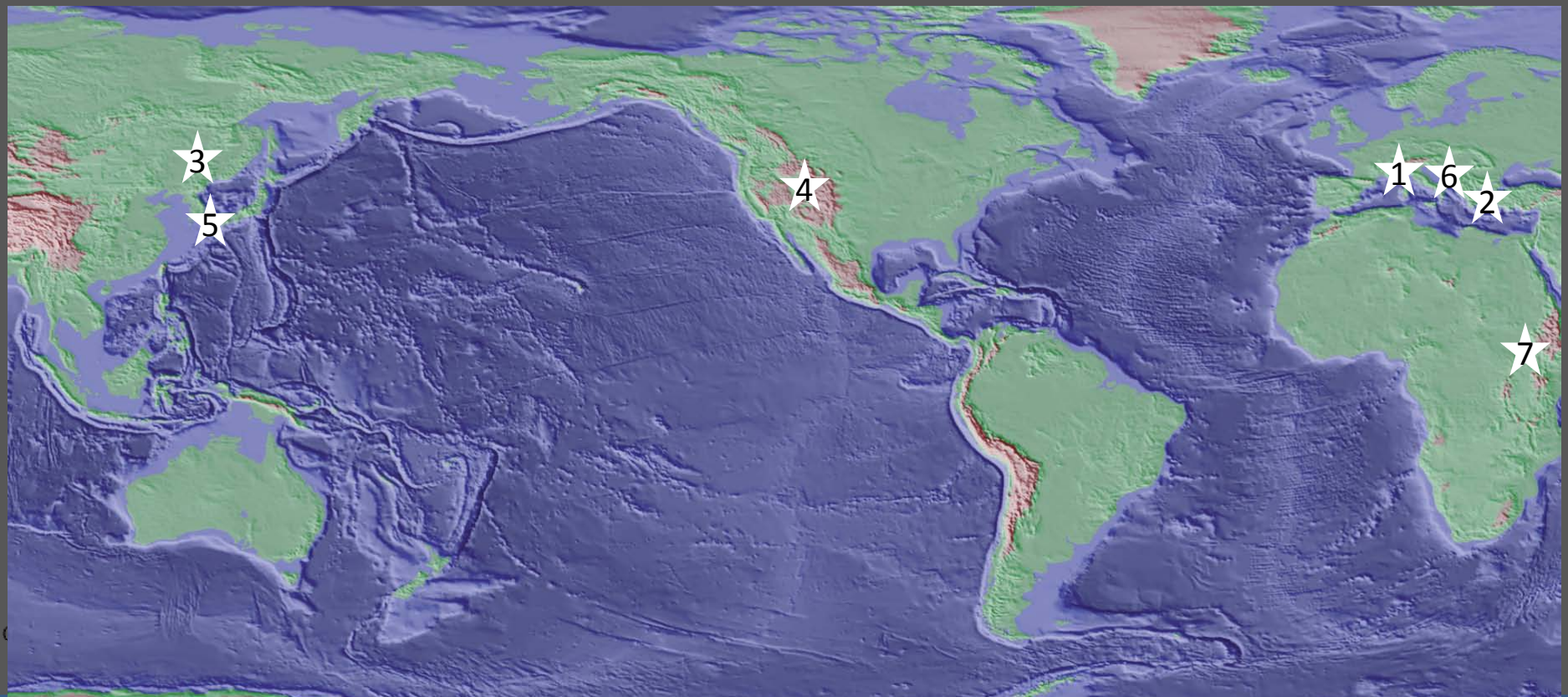
„The Past is the Key for the Future“



Coordinate with IODP

Drilling Projects Starting 2012/13

Campi Flegrei	starting Jun. 2012	Naples, Italy
GONAF	starting Sep 2012	Istanbul, Turkey
Songliao Basin	Jul. 2012? – Jun. 2013	Daqing, China
Colorado Plateau	Sep. 2012	Arizona, USA
COREF	Jul. 2012 – Sep. 2012?	Ryukyu Islands, Japan
Lake Ohrid	Sep. 2012 – Oct. 2012	Macedonia, Albania
Human Origins	Dec. 2012 – Jan. 2014	Kenya and Ethopia, Africa



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Campi Flegrei
Deep Drilling Project

The Campi Flegrei Deep Drilling Project

Science.

To investigate mechanisms of unrest at large volcanic calderas.

Technology.

To test new sub-crustal networks for the geophysical and geochemical monitoring of volcanoes.

Application.

To enhance models for forecasting eruptions and for assessing geothermal potential.

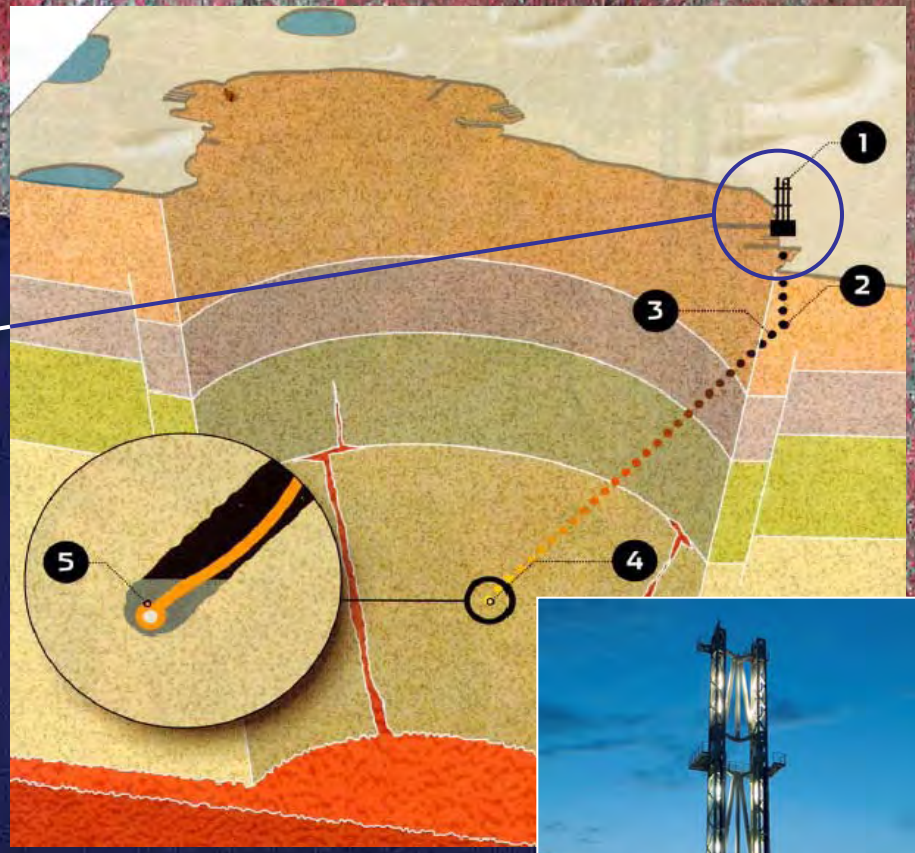
Italy: INGV – Vesuvius Observatory.
Germany: GFZ, German Research Centre for Geosciences.
UK: UCL & Royal Holloway, University of London.
Switzerland: ETH, Swiss Federal Institute for Technology.
US: US Geological Survey .

Campi Flegrei Deep Drilling Project

Campi Flegrei

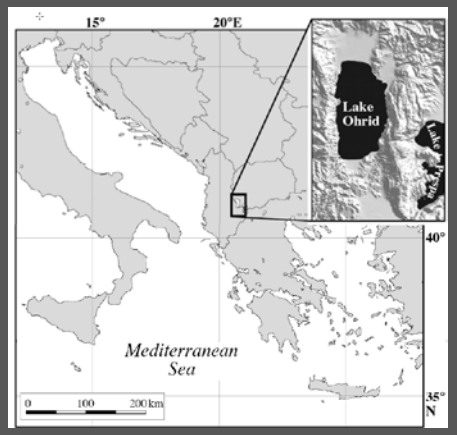
Naples

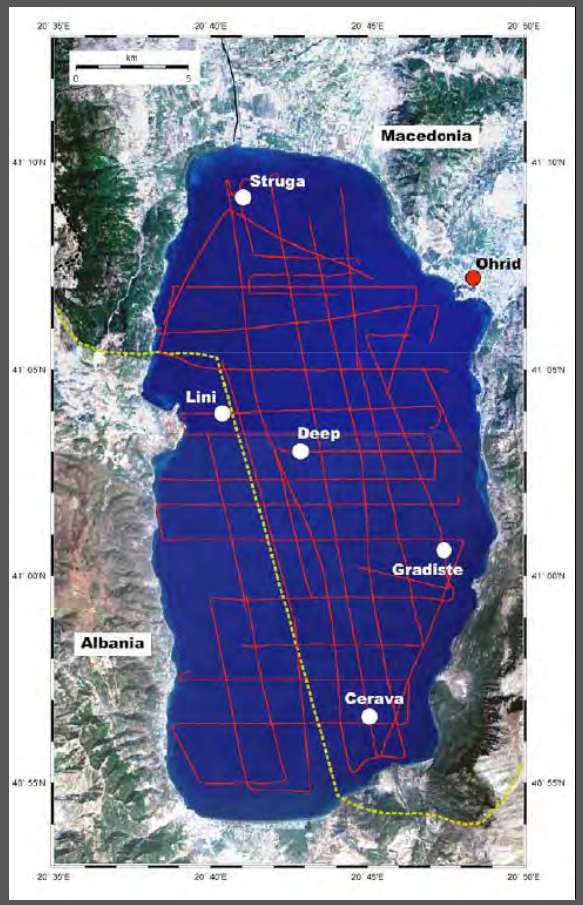
Vesuvius



Drill to 3.5-4 km, through caldera rim and towards zone of pressure increase during recent unrest.

Scientific Collaboration On Past Speciation Conditions in Lake Ohrid (SCOPSCO)





Lake Ohrid is a deep (286 m) and ancient lake (probably Miocene in age)

- Development of a lake chronology to understand evolution of biodiversity.
- volcanic history from tephras,
- seismotectonic history from turbidites.
- continuous terrestrial climate history.

Lake Ohrid	Sep. 2012 – Oct. 2012

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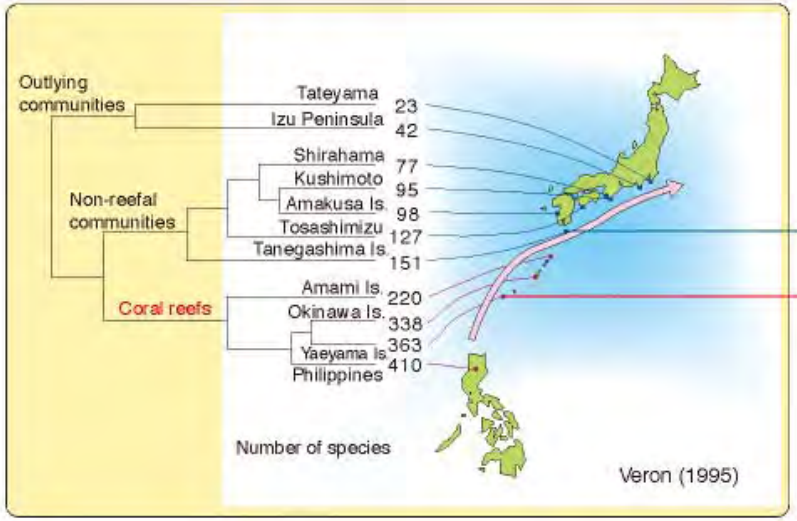
COREF Project

Toward understanding responses of coral reefs and coral reef ecosystem to Quaternary climatic changes



Coral community in the North Ryukyus

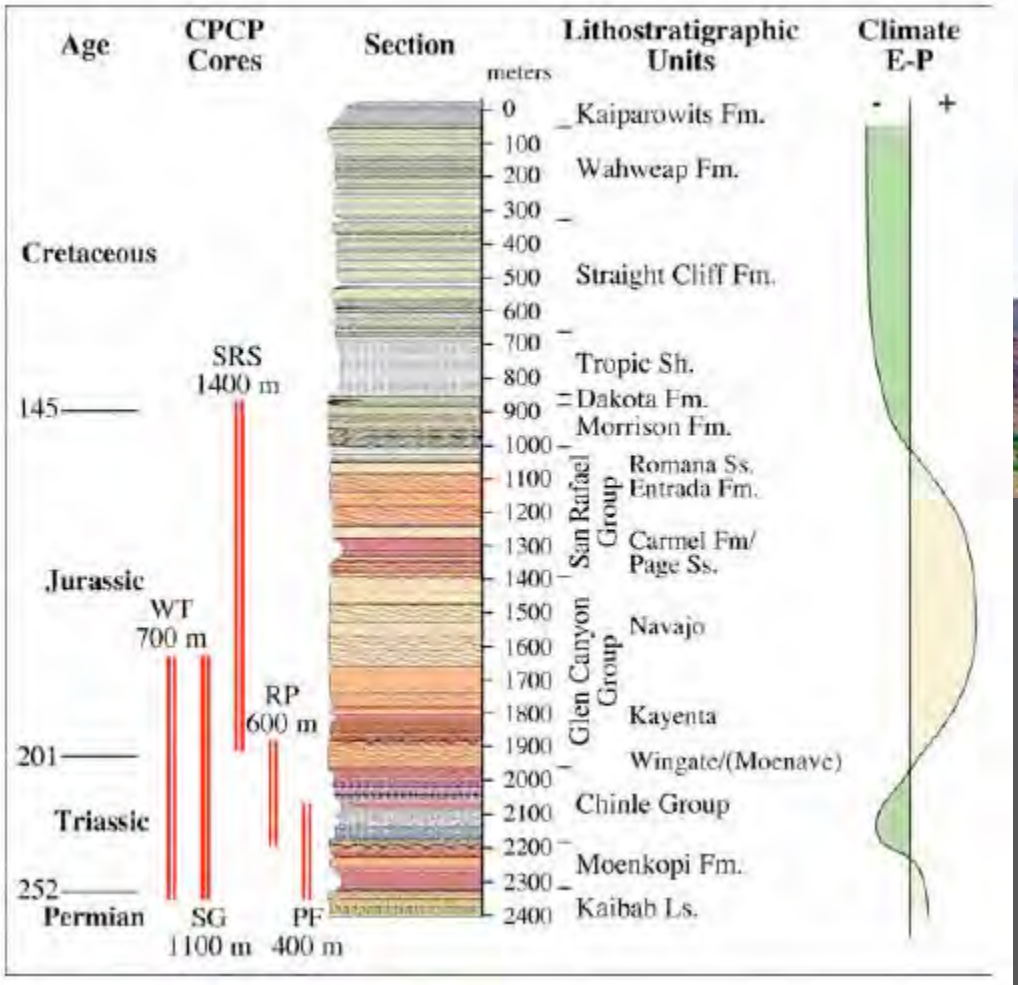
Southward migration at glacial stages

Changes in coral communities responding Quaternary climate changes

Northward migration at interglacial stages

Coral community in the South Ryukyus

Colorado Plateau Coring Project: 100 Million Years of Climatic, Tectonic, and Biotic Evolution in Continental Cores



Workshop: May 8-11, 2009
Albuquerque
New Mexico, USA
38 participants from 8 countries

Drilling begins: September 2012

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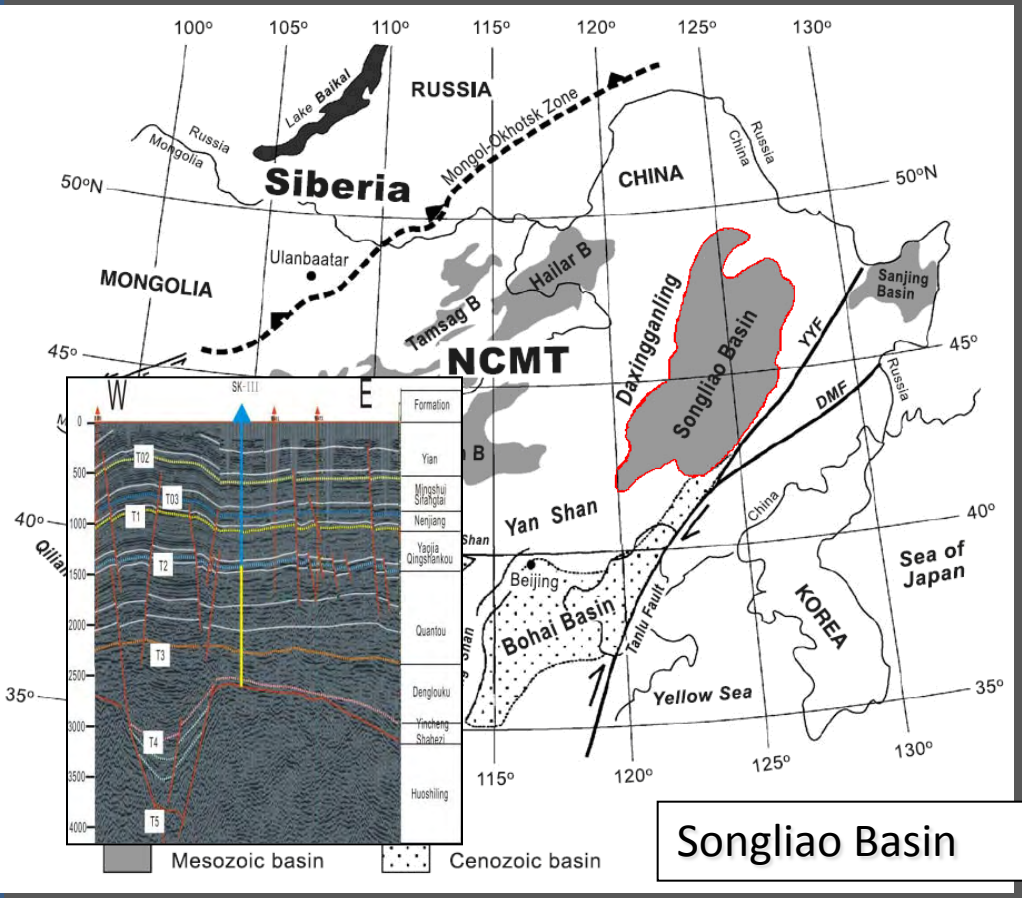
Continental Scientific Drilling Project of Cretaceous Songliao Basin

Continuous High-Resolution Terrestrial Archive
Greenhouse Climate Change



Recover a nearly complete Cretaceous terrestrial sedimentary record from a 5 km deep corehole.
Determine basin-filling history and understand the response of terrestrial environment to geological events related to the carbon cycle and greenhouse climate change.

Songliao Basin	Jul. 2012 – Jul. 2013

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Scientific Drilling for Human Origins

ICDP Workshop to investigate critical time intervals in hominin-paleoenvironmental history
Addis Ababa, Ethiopia, Nov 17 - 21, 2008
60 participants, 9 countries

Drilling begins: December, 2012

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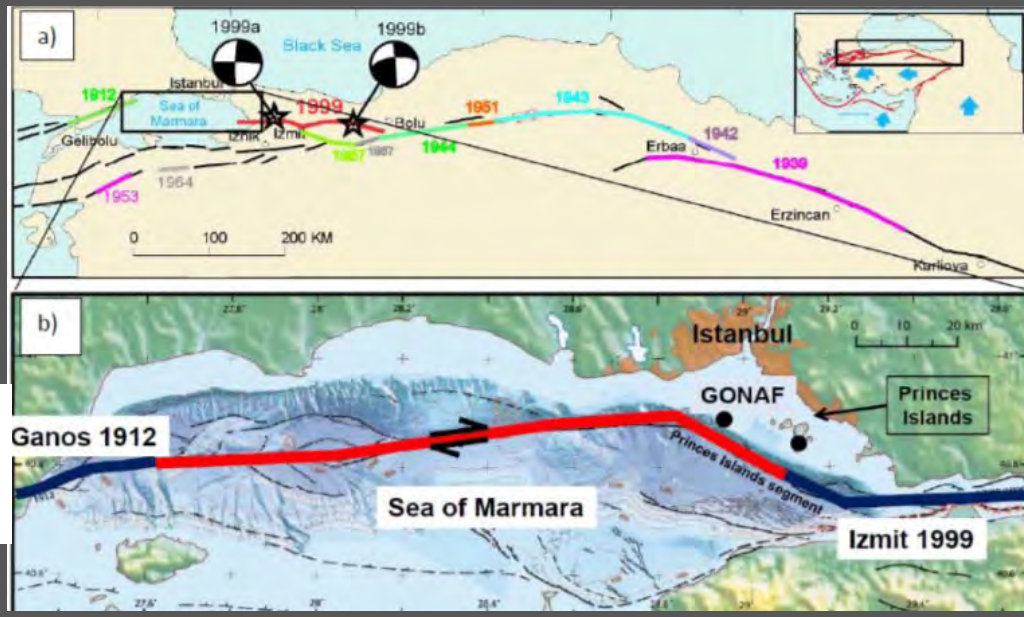
GONAF

A deep Geophysical Observatory at the North Anatolian Fault

- Two 500-m-deep boreholes located a few km from Marmara section of North Anatolian Fault Zone (NAFZ) will be used to:
- Install strings of 6 short-period and 1 broadband/strong motion seismometers to precisely locate and characterize small earthquakes within and close to the NAFZ, as well as possibly record an expected large earthquake.
- Make first measurements of stress orientations/magnitudes for Marmara Sea region.



Drilling begins September 2012

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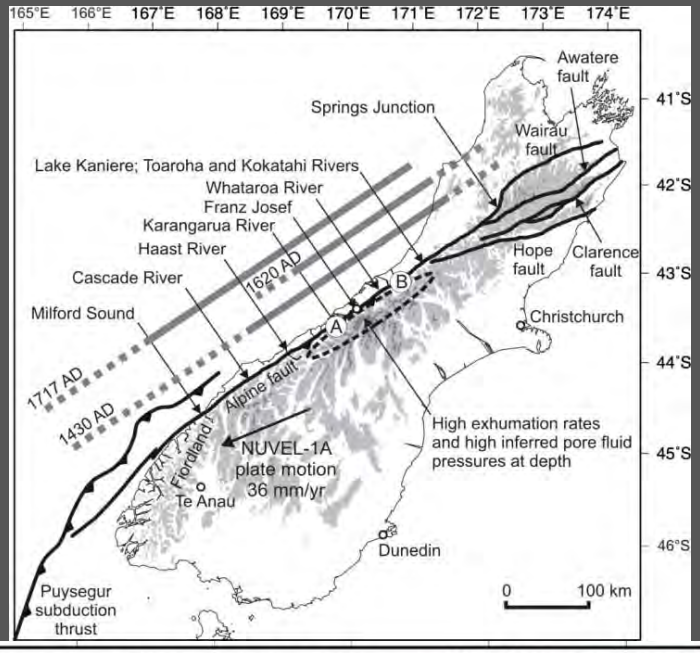
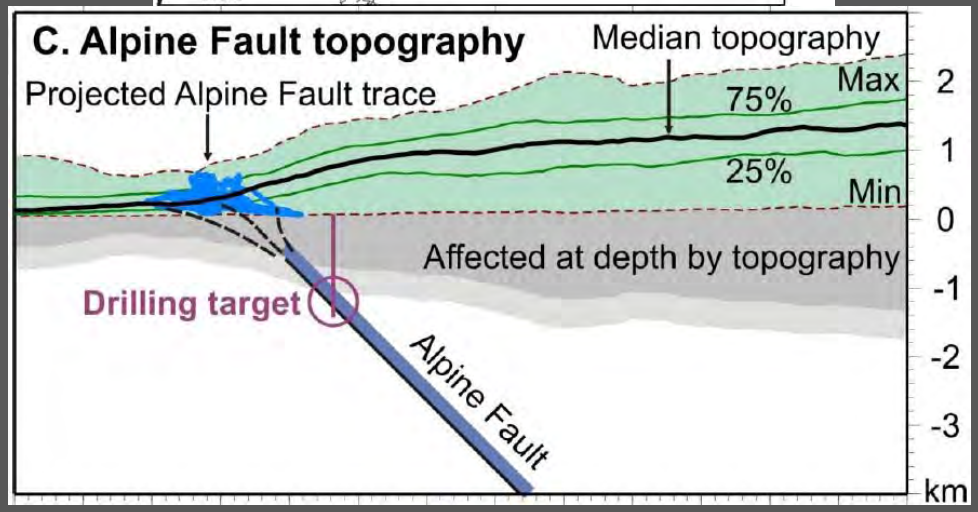
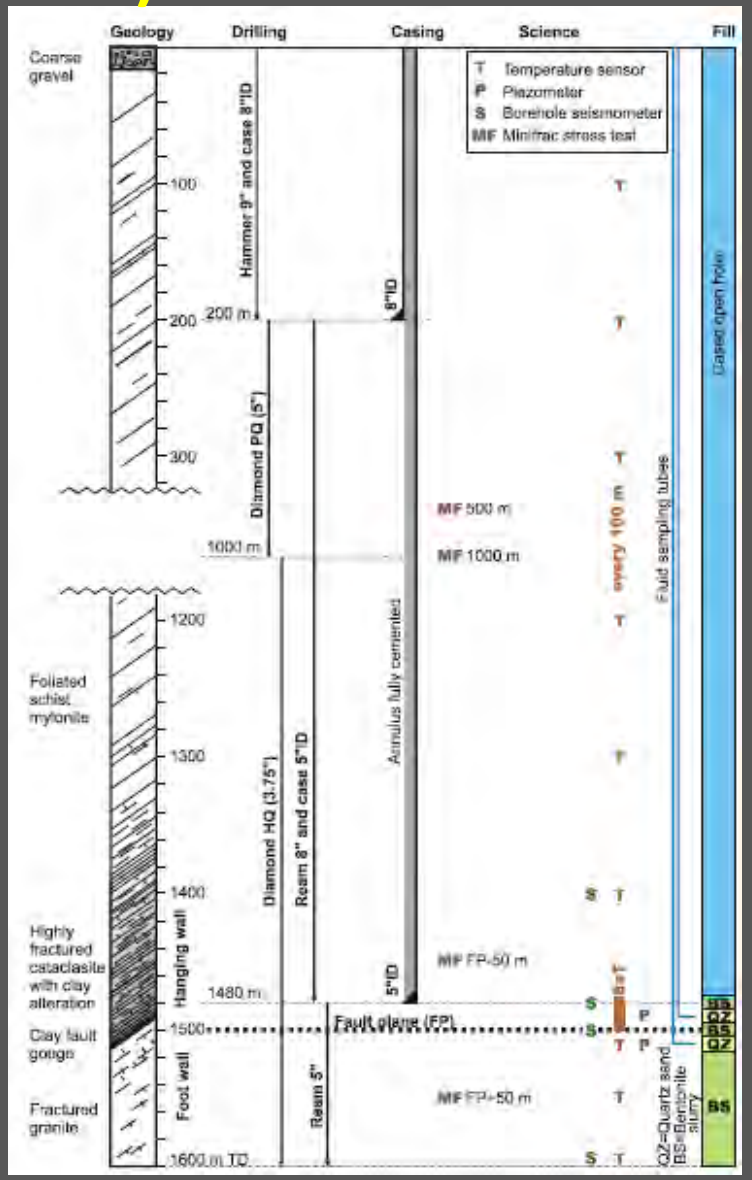
Active Deformation Processes in a Major Trans-pressional Fault (Alpine Fault)







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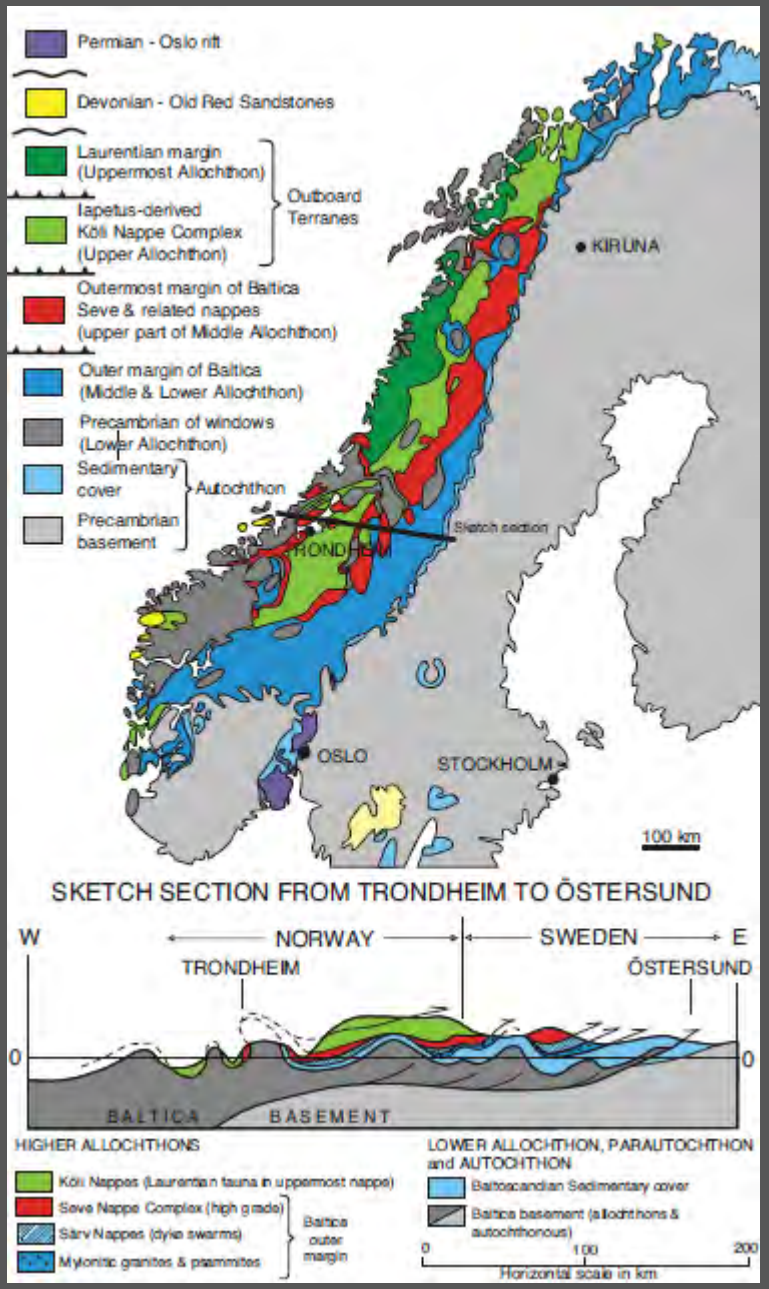
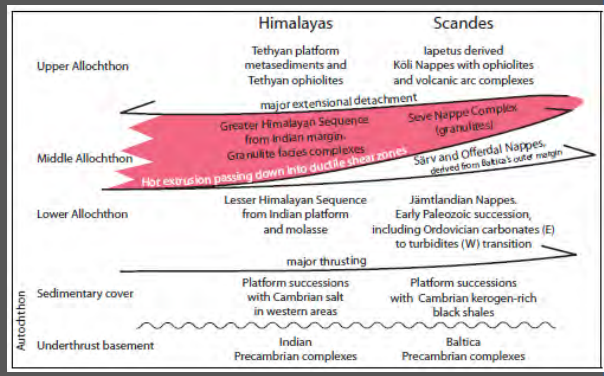
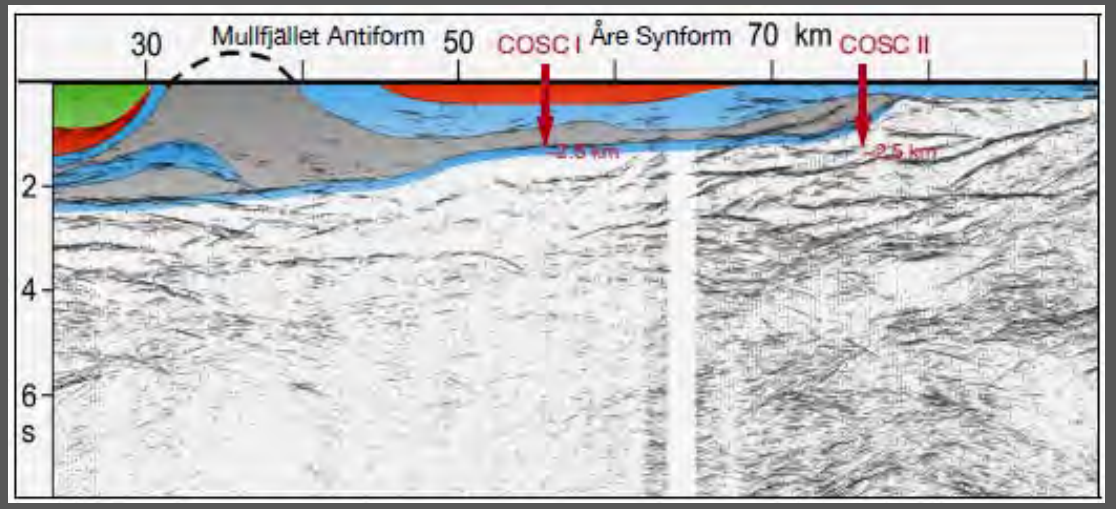
Collisional Orogeny in the Scandinavian Caledonides (COSC)



Two drill holes, each to c. 2.5 km depth, will reach from high-grade nappes through allochthons and penetrate 1 km into underlying basement





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Lake Chalco
March 5-8,
in Mexico City,
Mexico

Lake Towuti
March 26-29,
Bandung,
Indonesia

Lake Challa
September 10-14,Nairobi,
Kenya

Oman Ophiolite
September 13-17,
in Palisades,
USA

Workshops 2012

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C. Spitzweg: Geologist, ~1860

Costs of International Science Programs

- **ITER Fusion Reactor**, 33 Nations, 10 Bio €, Fusion as Energy Source

- **Human Genome Project**, 6 Nations, 2,7 Bio €, Deciffering the Human Genes

But:

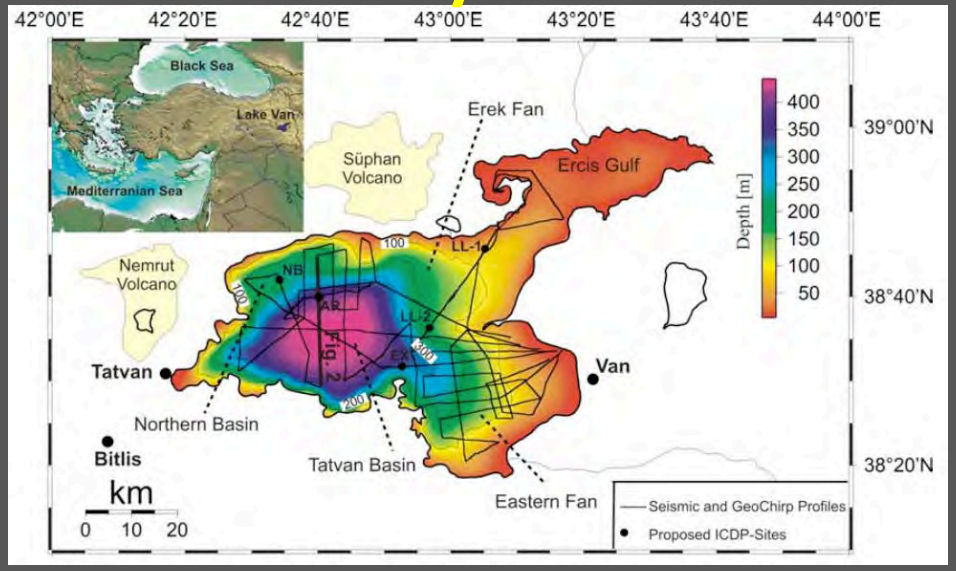
- **Geoscience 2009:** IODP, 200 Mio €; ICDP, 3 Mio €

Prerequisites for Success

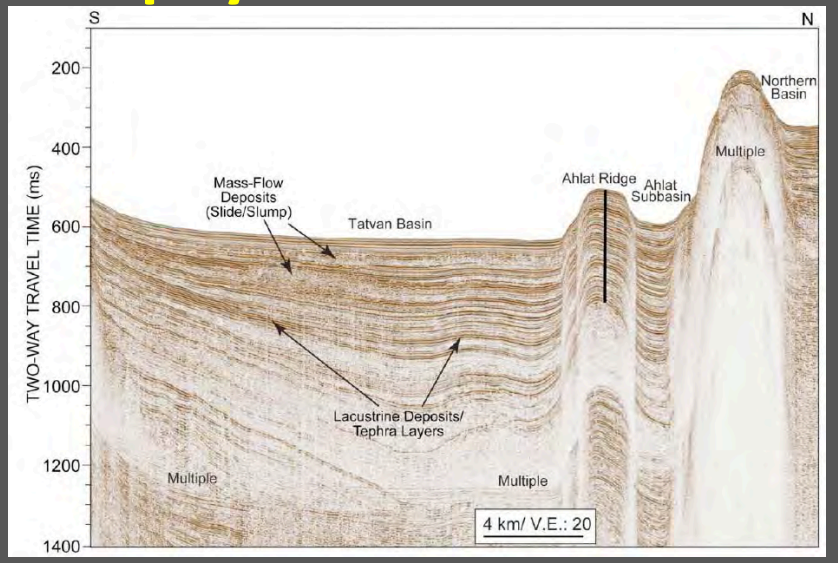
- A bright scientific idea to study processes or/and test important hypothesis that are only accessible through drilling
- Drilling at Sites of Global Scientific Importance and Societal Relevance as Example for Comparable Settings
- Excellent geophysical and geological Site Surveys to justify drilling target, drilling depth, and to reduce drilling risks
- Technical Feasibility and Budget Realities
- Environmental and Societal Compliance. Acceptance and Support through National Authorities early in the Project Planning Phase required.
- High Degree of International Cooperation (ICDP) in best possible Science Teams with Educational Potential

Scientific Prerequisites

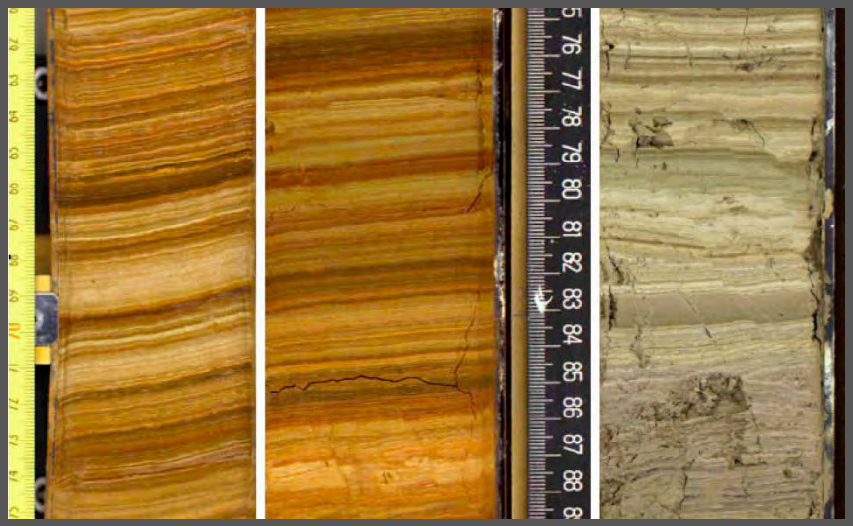
Pre-Site Survey



Geophysics



Short cores



Geochronology

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Organizational Prerequisites

- Successfull application to ICDP plus other agencies to collect Commingled Funding / Cooperation with Industry
- Scientific Leadership and Team Building through Lead PIs
- Support from home institutes and National Acknowledgement
- Formation of a real Scientific Team with spirit and engagement
- Communication, Motivation and Planning Skills in PI Group and in the Scientific Team - Constant information, reminders, (re)commendations
- Experience with Drilling Projects or Large / International Projects
- Engineering Support „company man“ and good relation to drilling contractors,
- Management Support – a full time project / budget manager
- Sufficient Contingency Funding / Risk Management
- PERSISTENCE!

Differences to IODP

- The ICDP support is based on the „comingled funding“ principle
- Each ICDP drilling project is independently organized in the form of a Joint Research Venture (JRV)
- Drilling on land involves a much greater diversity of targets and drilling depths, which in turn require application of a much broader spectrum of drilling techniques

TAKE HOME MESSAGE

Activities of ICDP

Develop the New Science Plan in 2013

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Thank you

International Scientific Collaboration on the Climatic Evolution of the Tropical Andes, ICDP Workshop, 15-17 June, 2011 in Tarma, Peru

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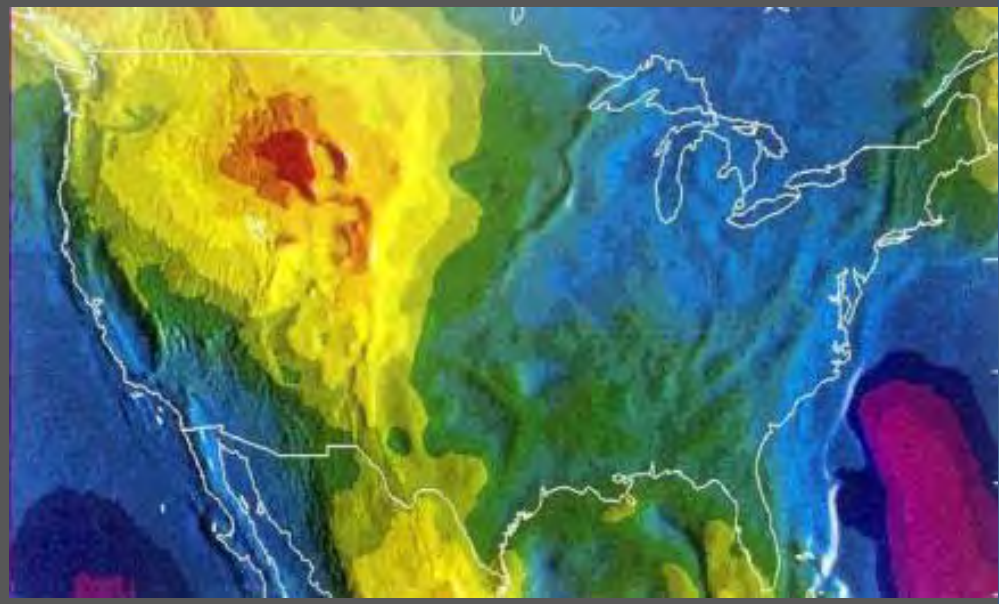
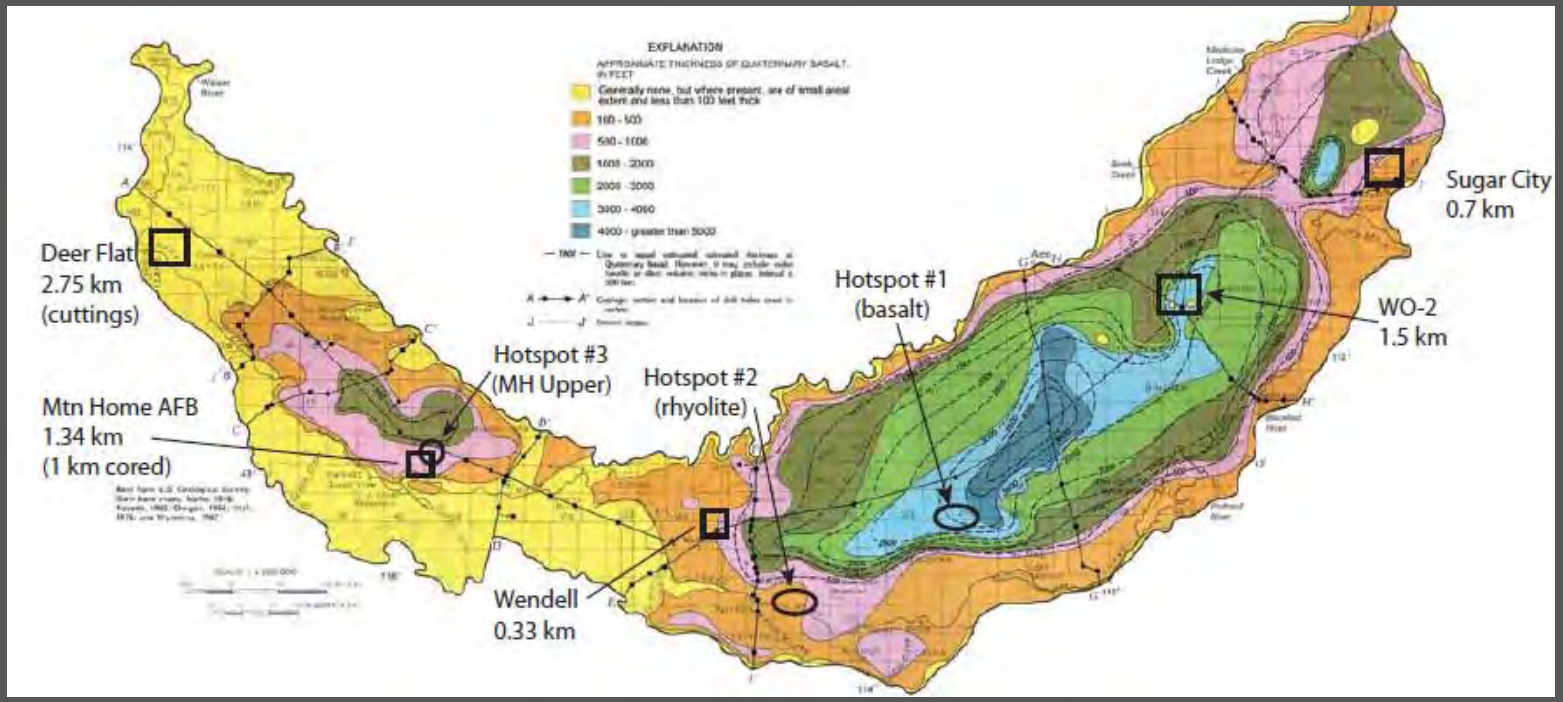
HOTSPOT:

Drilling the trace of the Yellowstone Hotspot in the Snake River Plain

ICDP 1.2 Mio $





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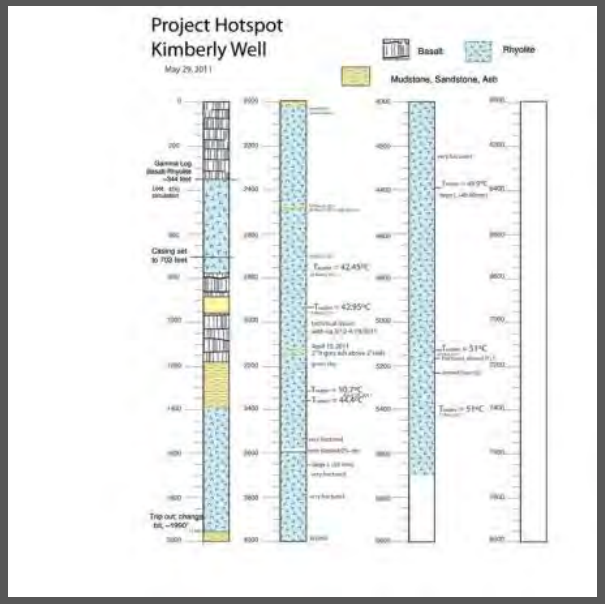
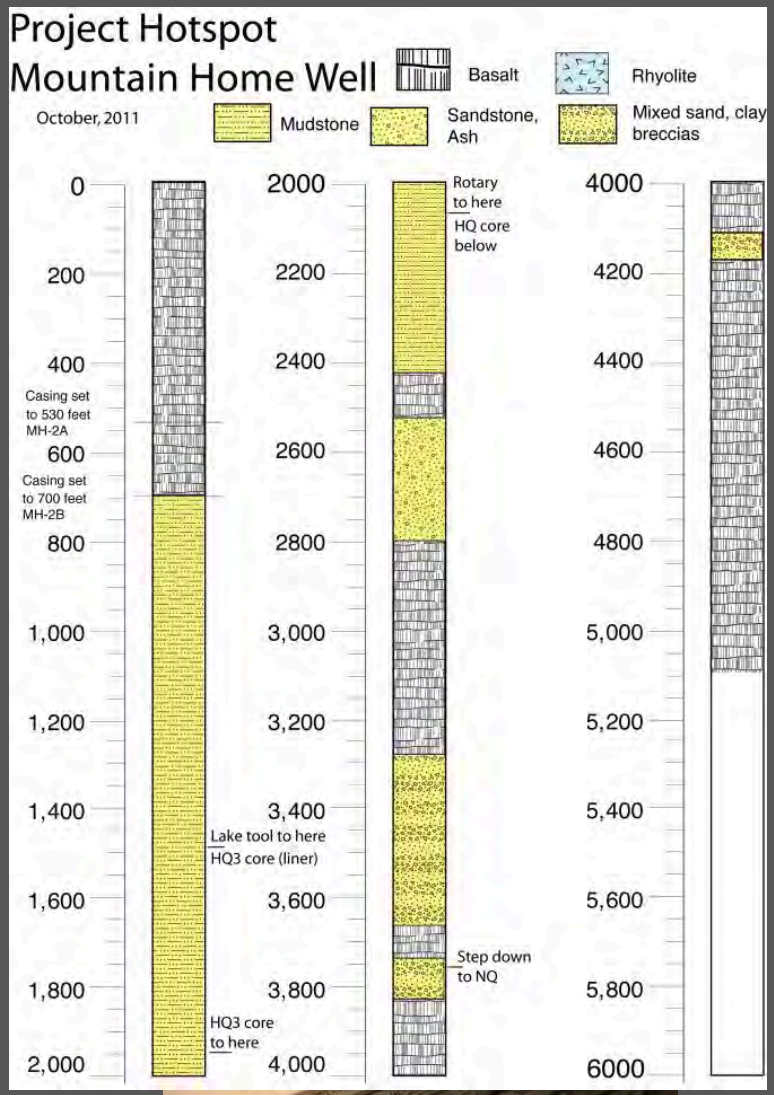
HOTSPOT:

Drilling the trace of the Yellowstone Hotspot in the Snake River Plain

1. Kimberley – 1958 m
2. Kimama – 1912 m
3. Mountain Home – 1821 m
   artesian fracture drilled at 1745 m





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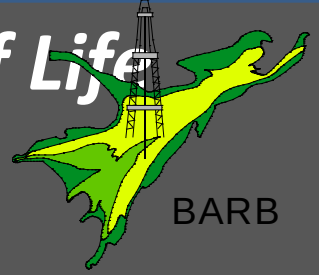
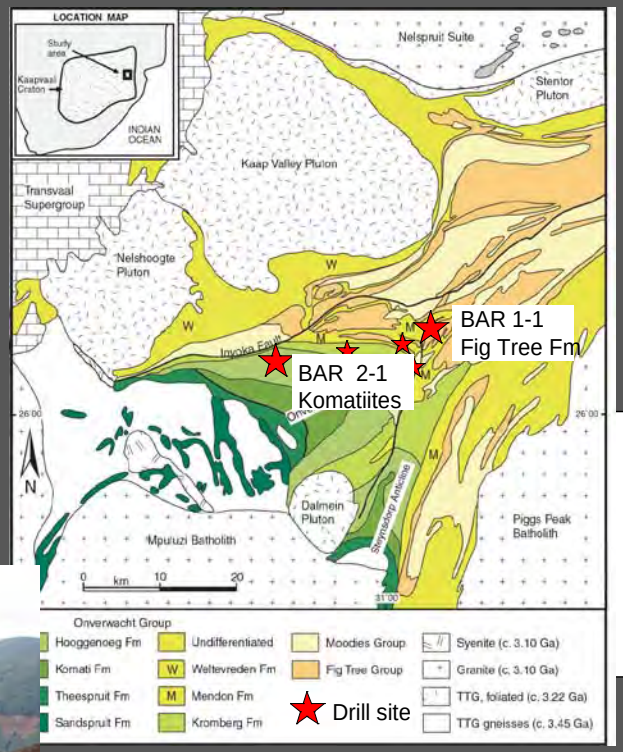
Peering into the Cradle of Life

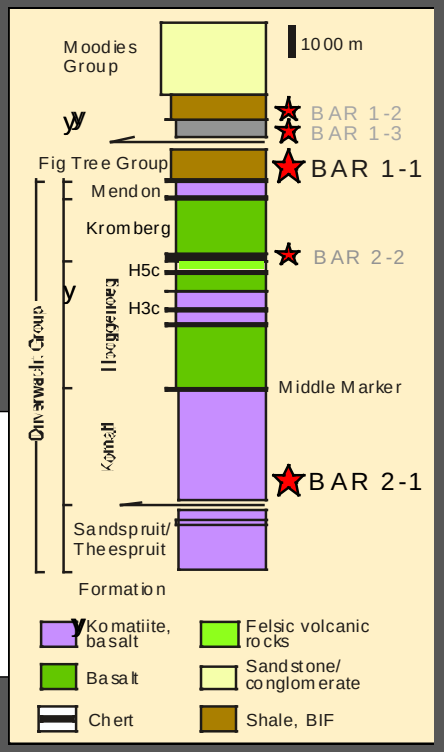
Scientific Drilling

in the

Barberton Greenstone Belt







In the komatiites: the complete differentiation of the tumulus unit and the presence of hyaloclastite (not exposed at the surface) allow rigorous interpretation of fractional crystallization and magma evolution.

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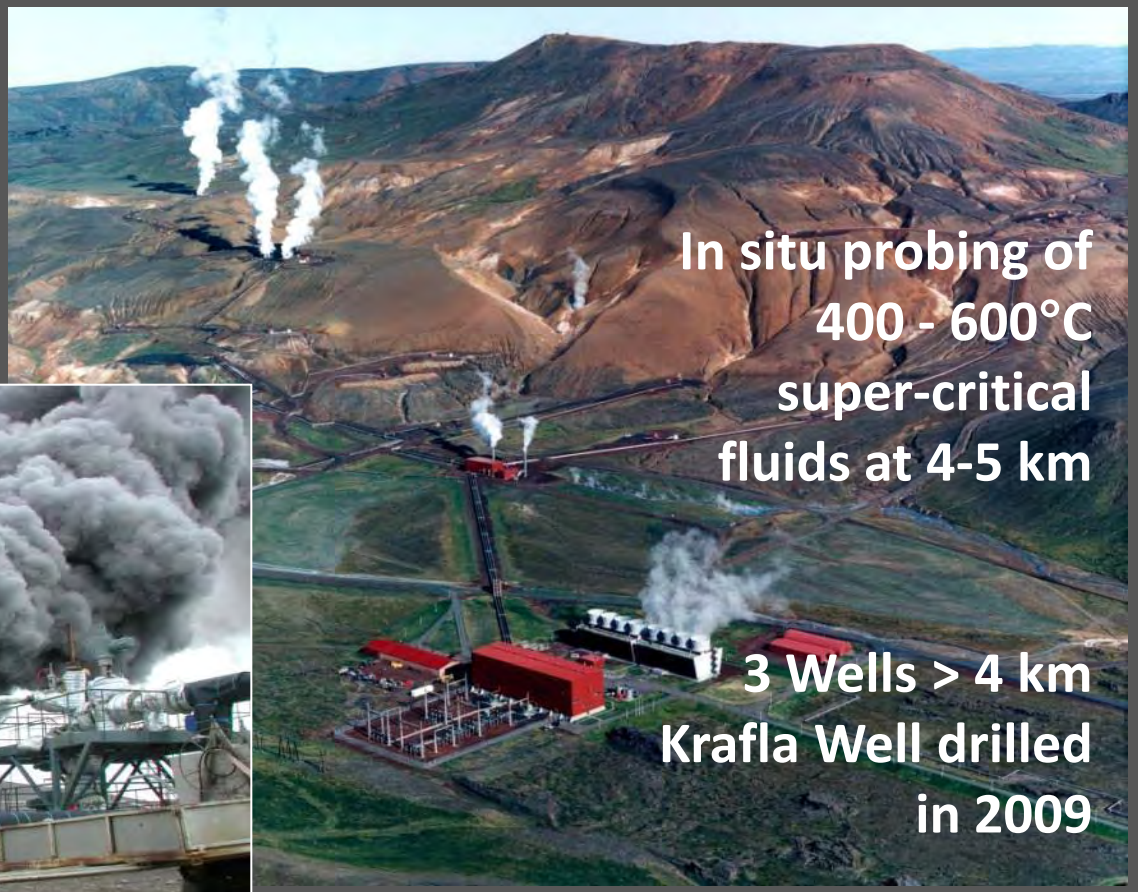
Deep Vision:

IDDP



IDDP-1 : superheated well capable of producing 30-40 Mwe, 410°C at 40 bar

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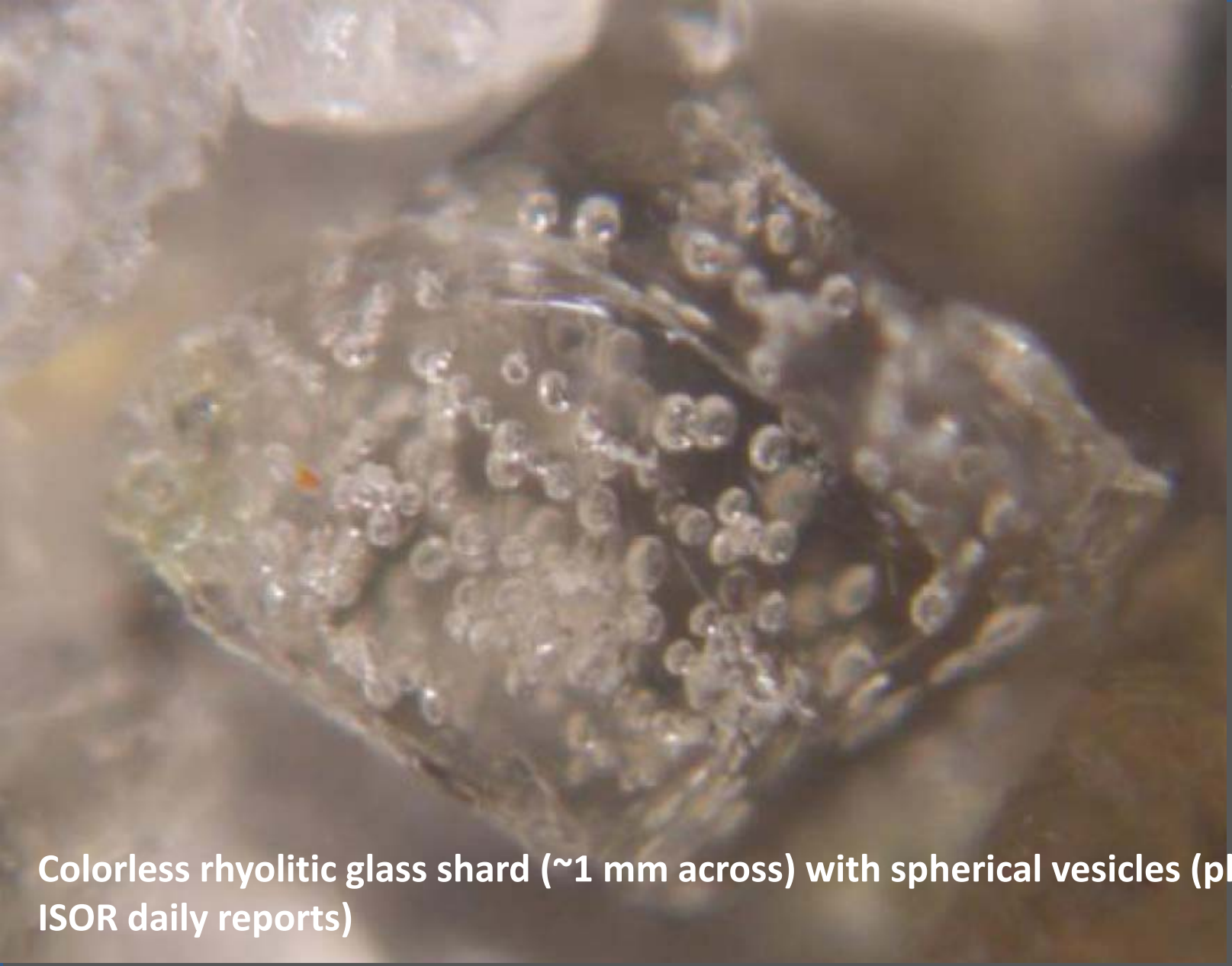
Spot coring test successful

full recovery of 9 m core at 2800 m depth



Colorless rhyolitic glass shard (~1 mm across) with spherical vesicles (photo from ISOR daily reports)

ICDP Drilling Projects (2005-2012)

	Climate	Faulting	Volcanoes	Impacts	Geobiosph.	Plate Bound.	Mantle Pl.	Natural Res.	
Alpine Fault		X							1
Barberton Greenstones	X		X		X	X	X		6
Barberton Cradle of Life	X				X			X	3
Campi Flegrei			X					X	3
Chesapeak Bay	X			X	X				3
Colorado Plateau	X				X				2
COREF	X				X				2
COSC						X			1
Dead Sea	X	X							2
FAR DEEP	X				X			X	3
GONAF		X							1
Hominin Sites	X				X				2
Iceland Deep Dr.			X				X	X	3
Laguna Potrok Aike	X		X						2
Lake El'gygytgyn	X			X					2
Lake Malawi	X				X				2
Lake Ohrid	X				X				2
Lake Petén Itza	X				X				2
Lake Qinghai	X								1
Lake Van	X		X		X				3
SAFOD		X							1
Snake River Plain	X		X				X	X	4
Songliao Basin	X		X	X	X			X	5
	17	4	7	3	12	2	3	7	