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DRILLING PROGRAM

Data and Information Management in Drilling Projects

Capture of Primary Data in Scientific Drilling Projects

Scientific Drilling
Ronald Conze

German Research Centre for Geosciences GFZ

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Where does this core come from ?

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A Rule of Thumb

Without Ideas and Targets no Project

Without Project no Drilling

Without Drilling no Hole

Without Hole no Core

Without Core no Data

Without Data no Scientific Output

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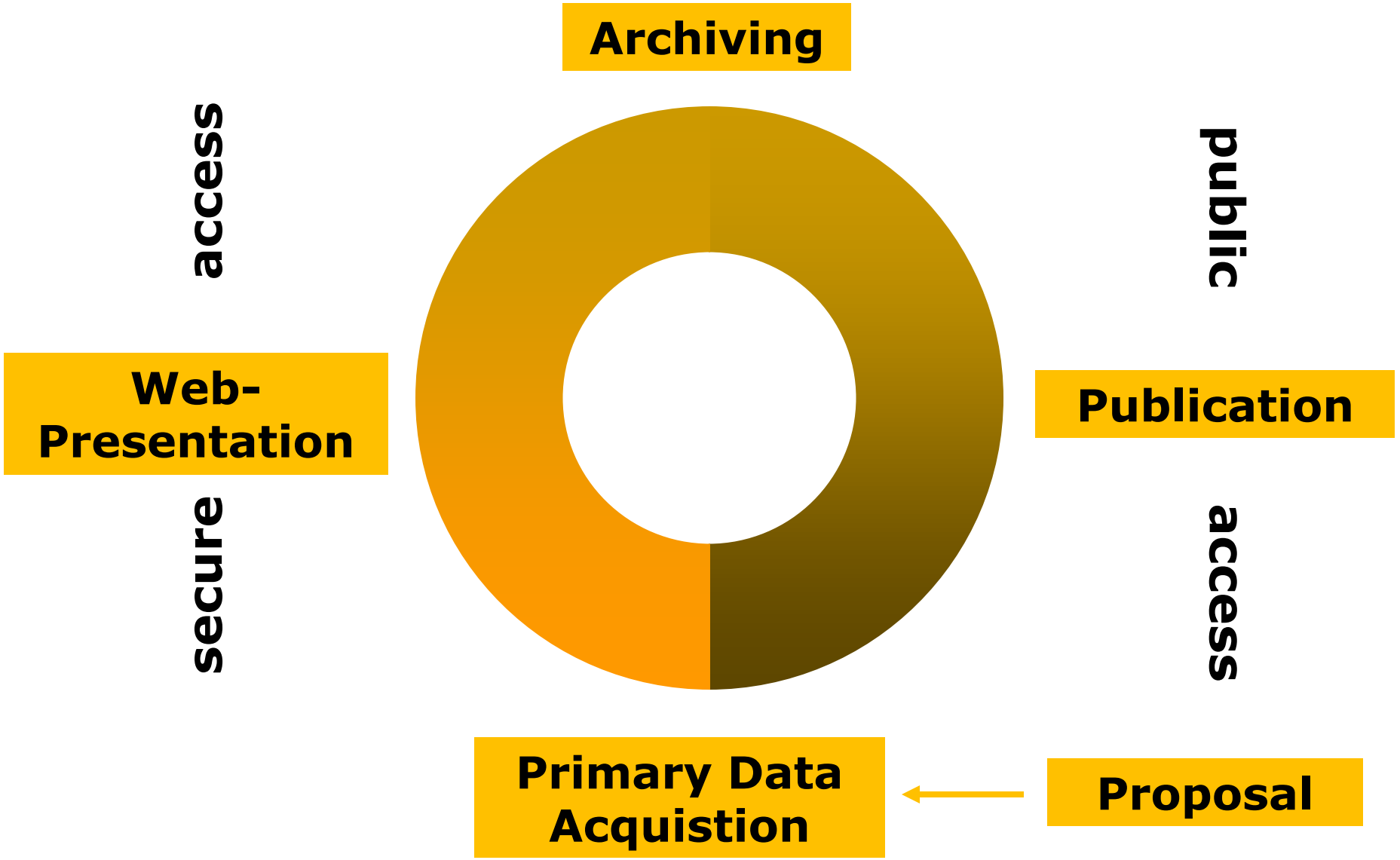
General Lifecycle of a Scientific Drilling Project



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Information System for ICDP Projects

Drilling Information System (DIS)

= data acquisition

↓

Web Site within the ICDP Information Network

= data dissemination

↓

Datasets in Scientific Drilling Data Centers

= data publication

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Drilling Information System

Targets:

- **operational support in on-site data management**
- **toolbox to build and maintain individually designed DIS for a distinct drilling project**
- **main focus on Data Acquisition**

Targets (cont.):

Data Acquisition

- documentation and administration of
  - **basic – initial - primary data**
  - **initial measurements and reports**
  - **sample requests and sample distribution**
- to provide
  - **common reference for all Science Team Members including depth matching**
- as early as possible
- to avoid non-synchronized and non-authorized data files

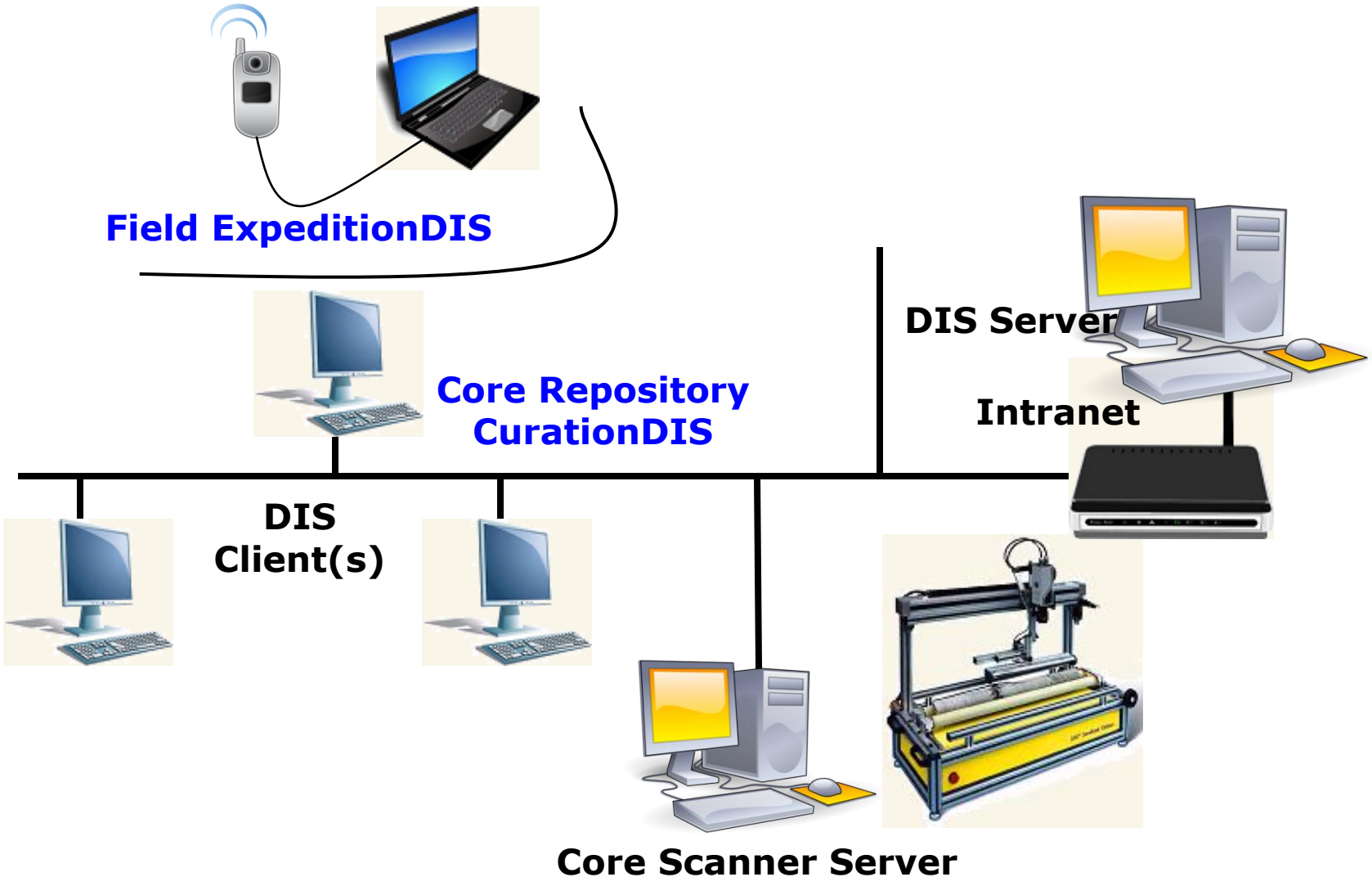
Realization

Requirements ?

Personnel and Responsibilities ?

Policies ?

DIS – Standard Local Infrastructure

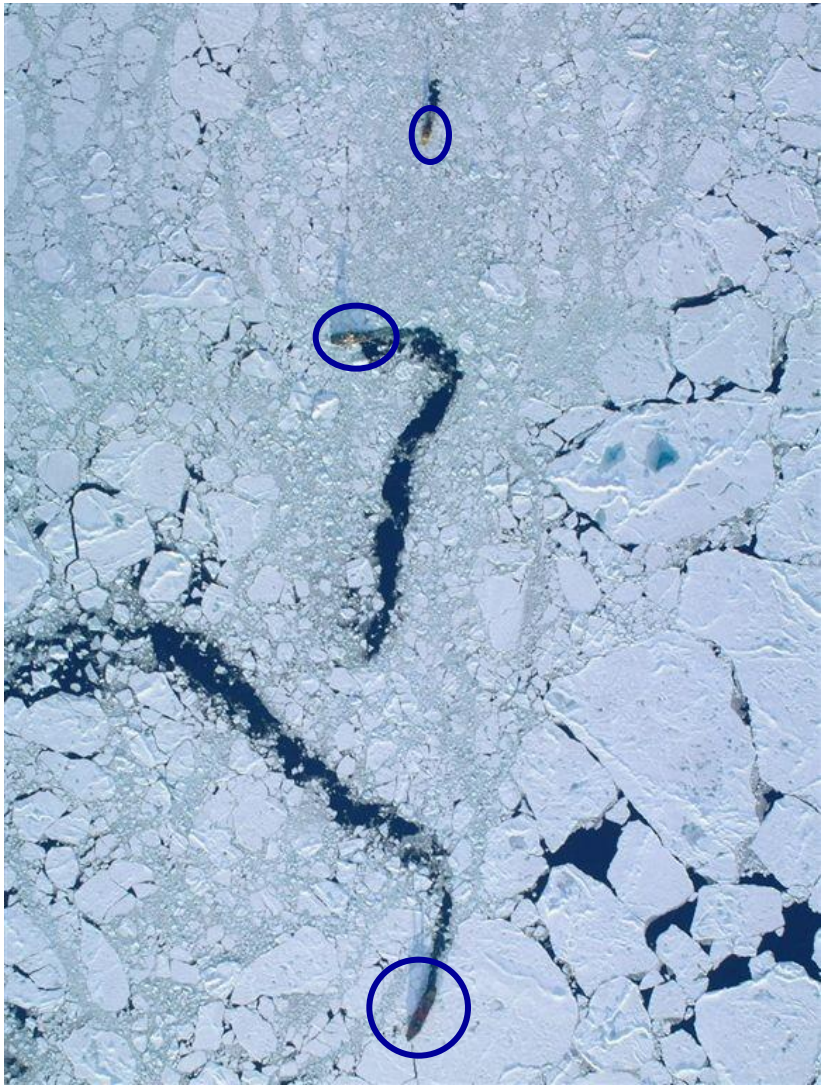


Scalability – Arctic Coring Expedition (ACEX)

drill ship

science & lab ship

icebreaker



DIS server I

wireless LAN
DB-
replication

DIS server II

WLAN 11Mb –
7.5 km 10 kb –
20 km

up to 10 DIS clients ship based Intranet

satellite uplink to the Internet

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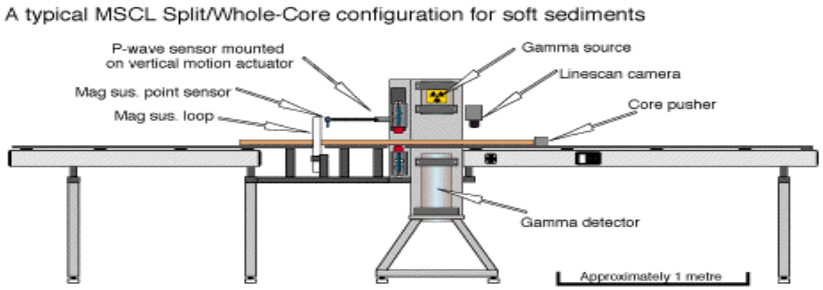
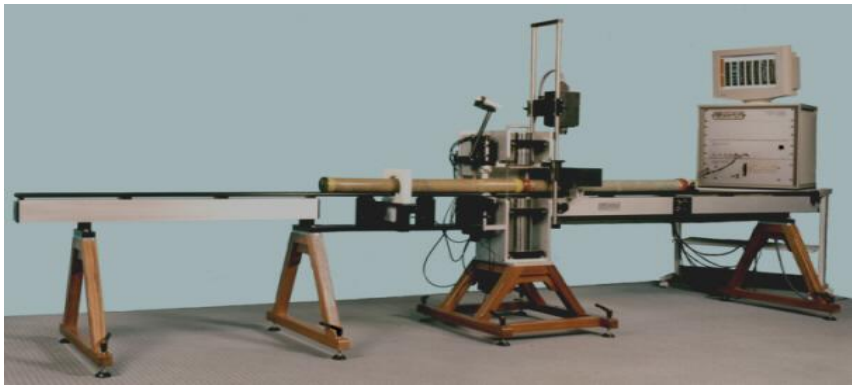
Scalability – Fennoscandia Arctic Russia – Drilling Early Earth Project (FAR-DEEP)

far-deep.icdp-online.org

Optional Measuring Devices with DIS-Interface

GeoTek Multi Sensor Core Logger (MSCL)

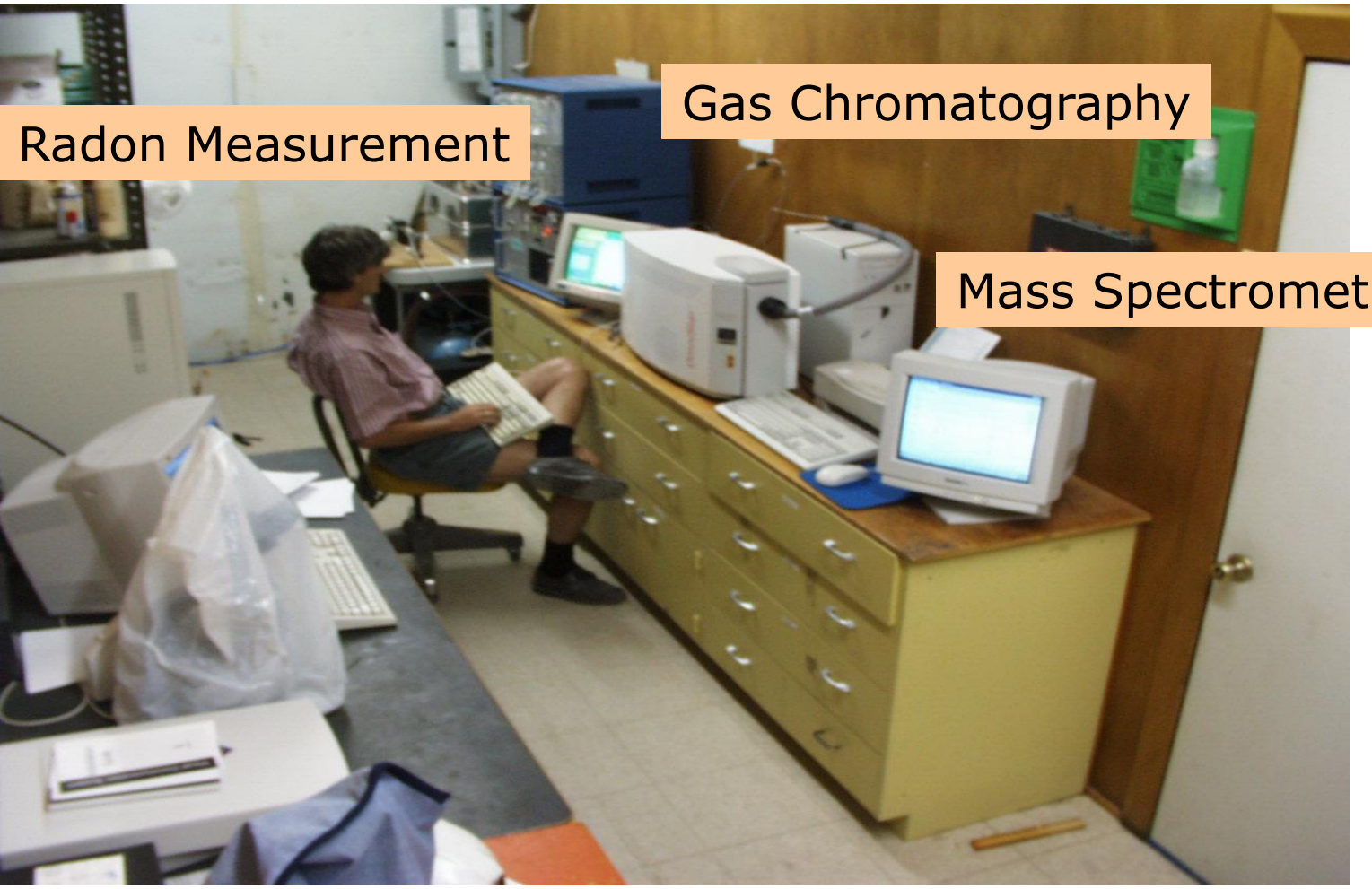




- Core diameter measurements
- P-wave measurements
- Gamma Ray Attenuation (bulk density)
- Magnetic susceptibility
- Core imaging
- Natural Gamma
- Electrical Resistivity

Optional Measuring Devices with DIS-Interface

Online Gas Monitoring

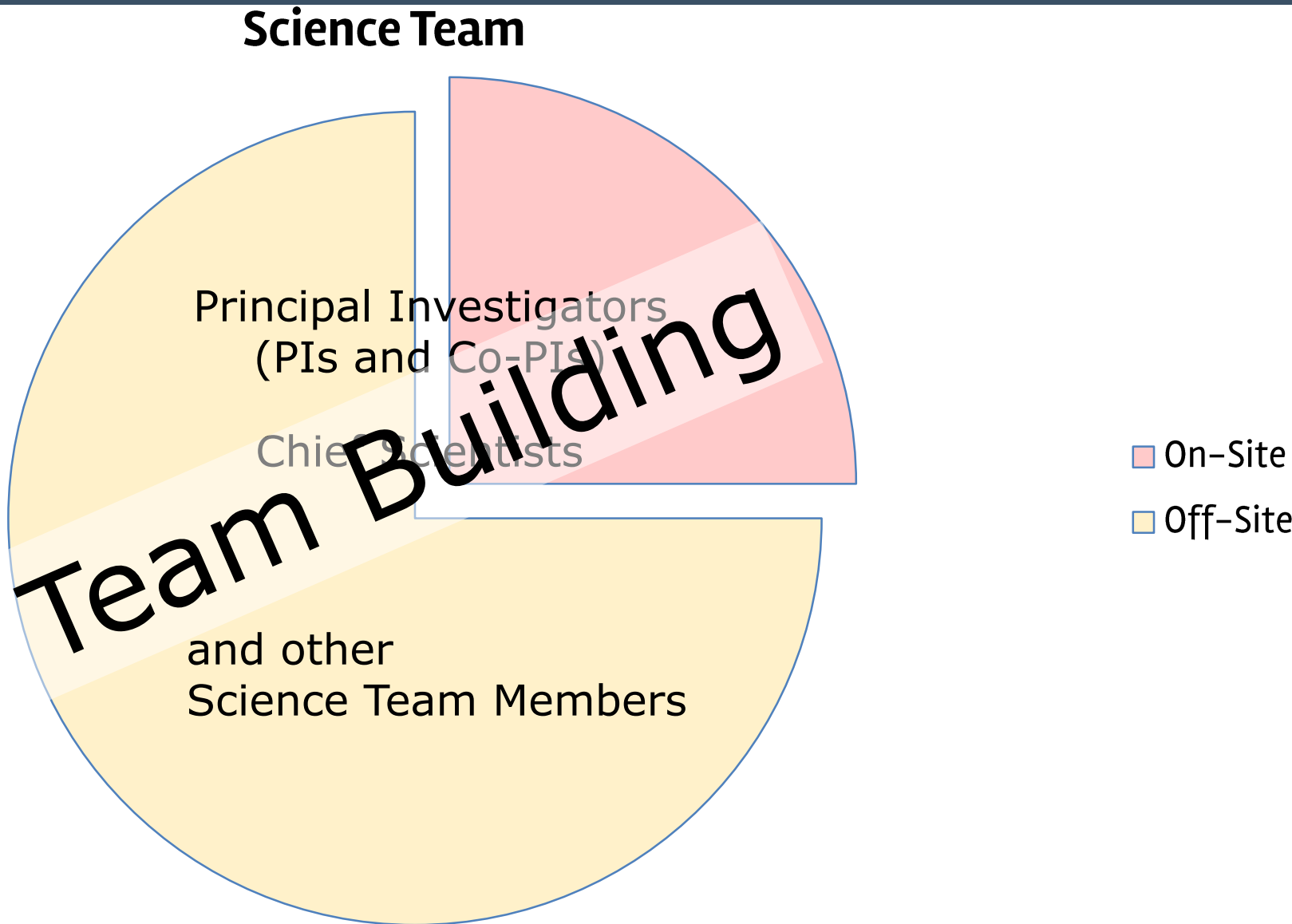


Optional Measuring Devices with DIS-Interface

Computer Tomography (CT) Scanning

- on whole round cores
- achieving 3D models
- and 2D slices in all directions

Science Team and Personnel



Policies – Rights

Data Management

- two different user groups: **Public** and the **Science Team.**
- the Science Team members are defined by the PIs.
- each Science Team member will get a personal login (username and password).
- each Science Team member is allowed to access the internal project pages of the Web-site.
- each Science Team member is allowed to use the internal project data for their own investigations within the context of the project.

Data Management

- each Science Team member is not allowed to use the internal project data for other projects.

- each Science Team member agrees to share own project data, results, and papers with the Science Team.

- each Science Team member is obliged to cite the information he/she uses.

- the composition of the Science Team and the time period of confidentiality have to be defined by the PIs.

Work Flow

What comes next ?

Which are the dependencies ?

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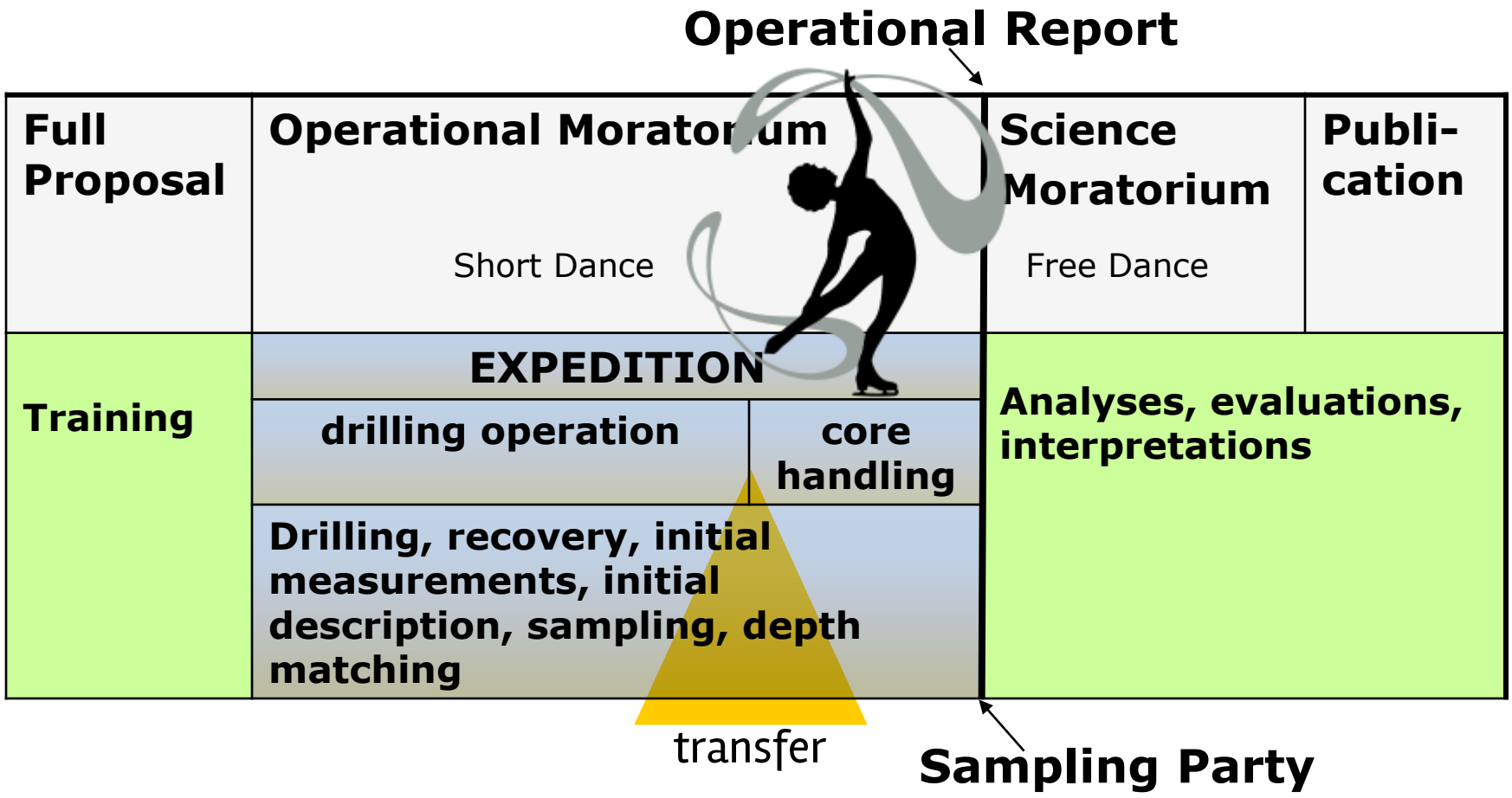
General Lifecycle of a Scientific Drilling Project



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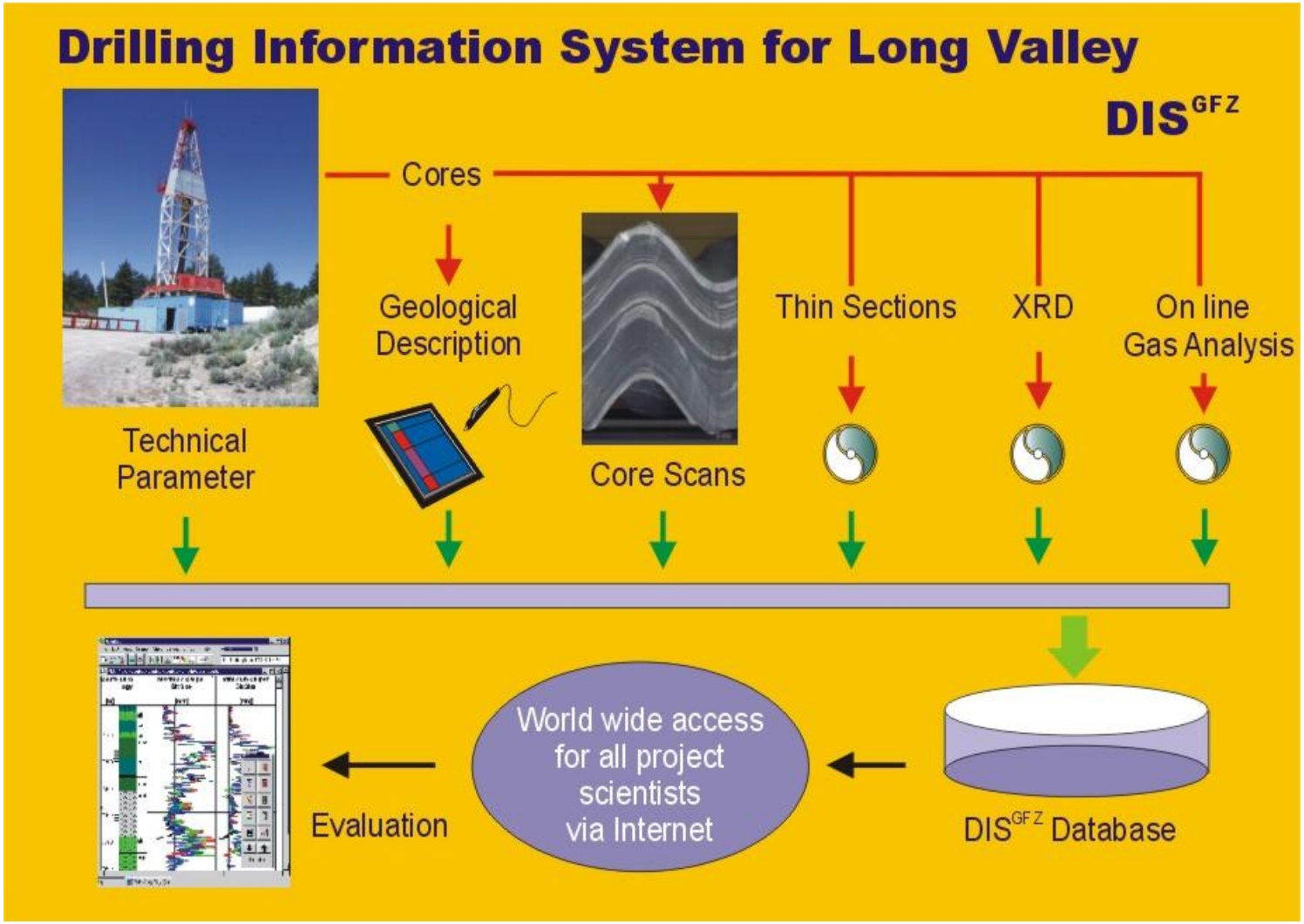
Common Architecture



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General On-Site Core Logging Workflow

Core Recovery

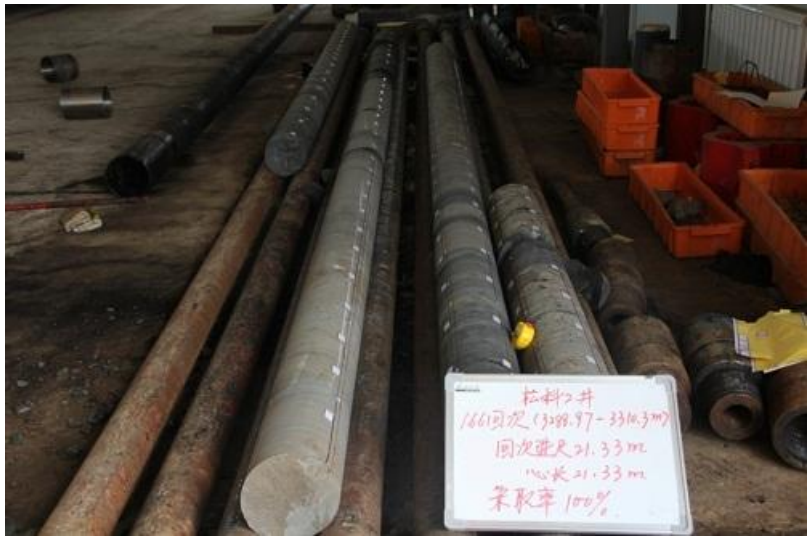
- **Core Run #**
- **Driller Depth**
- **Drilled Length**
- **Time of Core On Deck**

General On-Site Core Logging Workflow

- Core Run #
- Driller Depth
- Drilled Length
- Time of Core On Deck

Songliao Basin Drilling

Core Recovery



General On-Site Core Logging Workflow

Cleaning

Fitting

Marking

- Core Recovery
- Section #
- Section Length
- Location in Box

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General On-Site Core Logging Workflow

Unrolled Core Scans

Optional Measuring Devices with DIS-Interface

DMT CoreScan³

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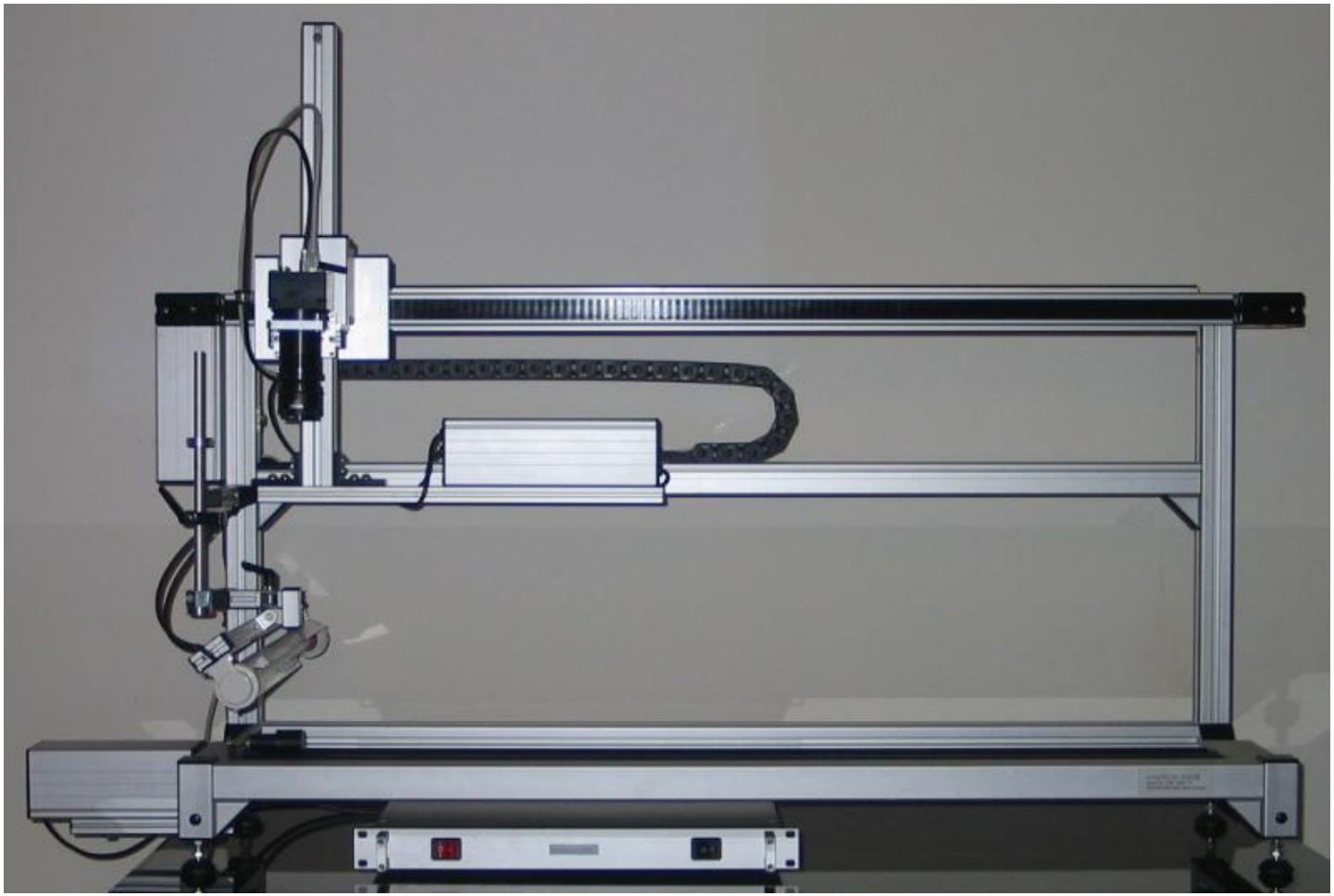
Optional Measuring Devices with DIS-Interface



smartcube® GmbH
Information Management Systems

Smart Camera Image Scanner smartCIS

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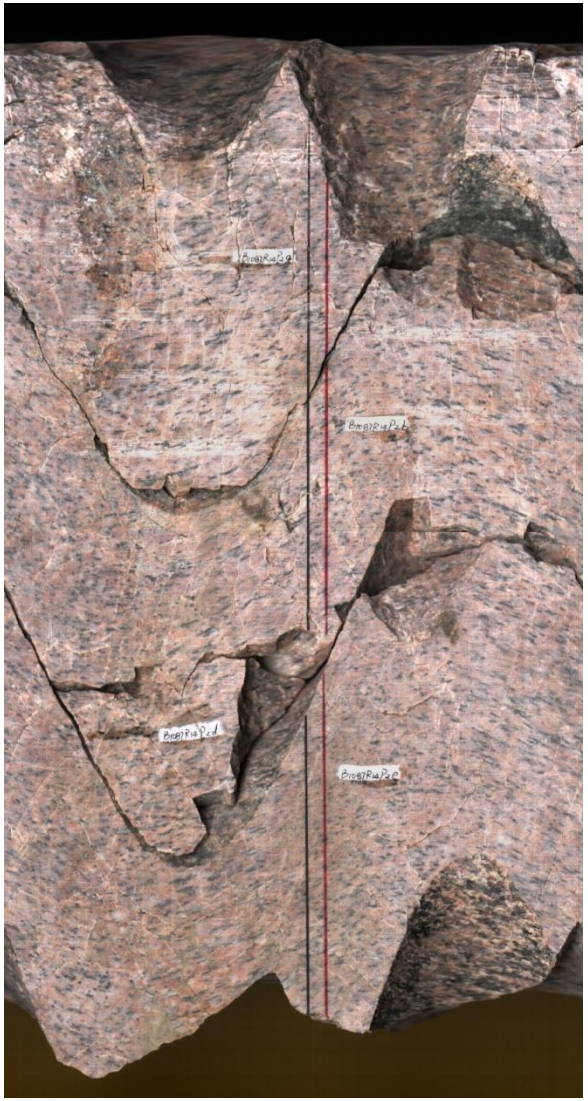
General On-Site Core Logging Workflow



Unrolled Core Scans

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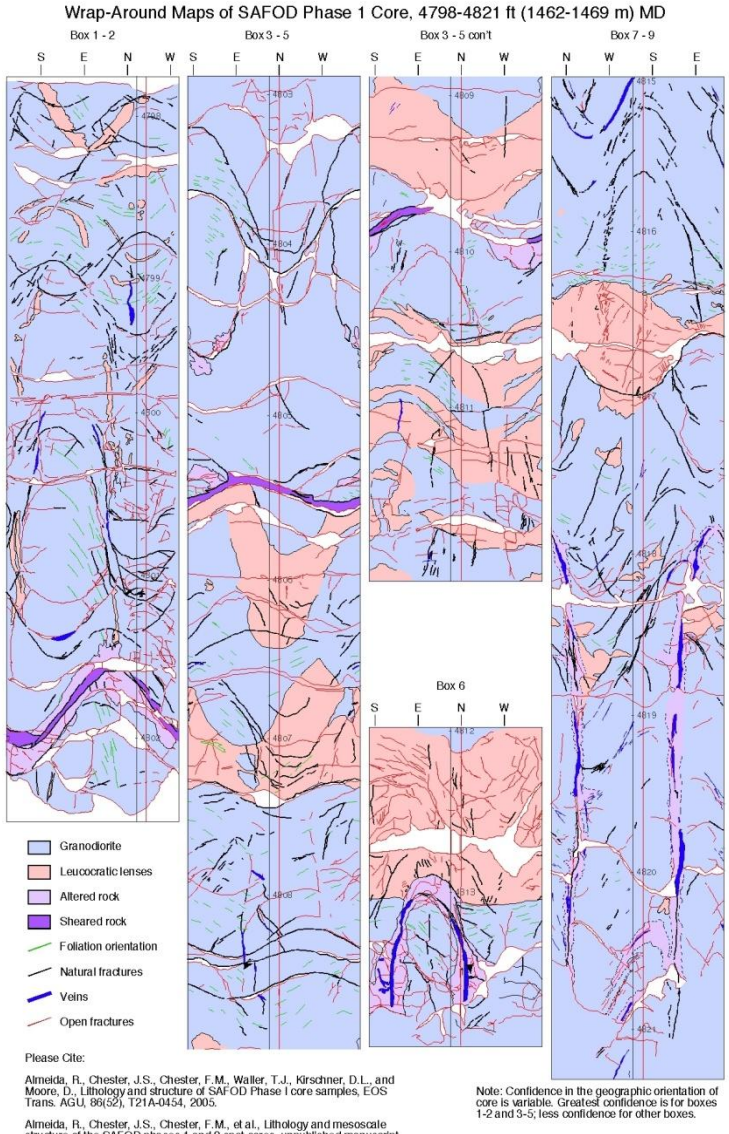
Wrap-Around Core Mapping

San Andreas Fault Zone, California, U.S.A.

Wrap-Around Core Mapping



San Andreas Fault Zone, California, U.S.A.

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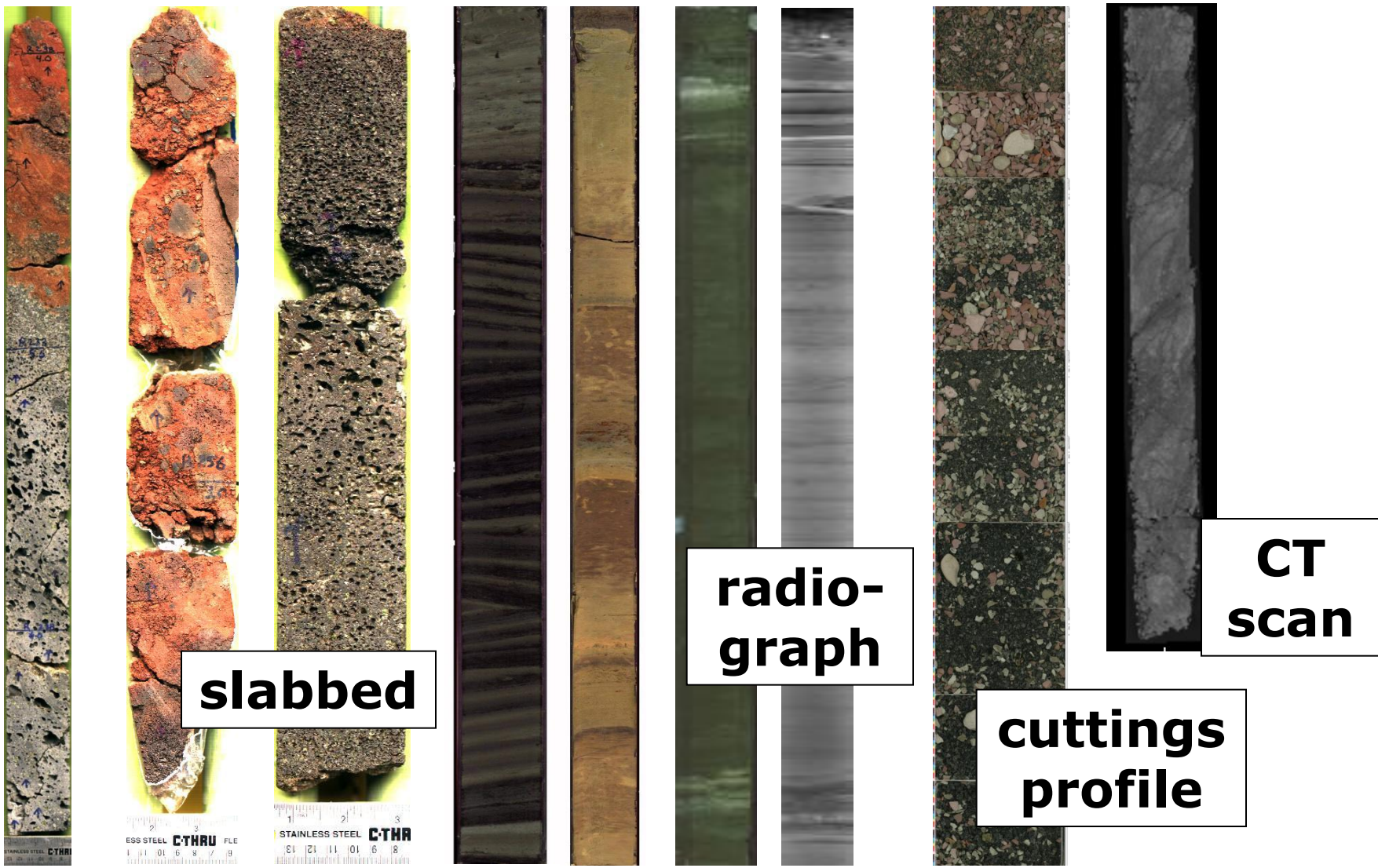
General On-Site Core Logging Workflow



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General On-Site Core Logging Workflow

Cuttings in Match Boxes

IDDP-1, Iceland Deep Drilling Project

General On-Site Core Logging Workflow

Splitting

- Working Half
- Archive Half

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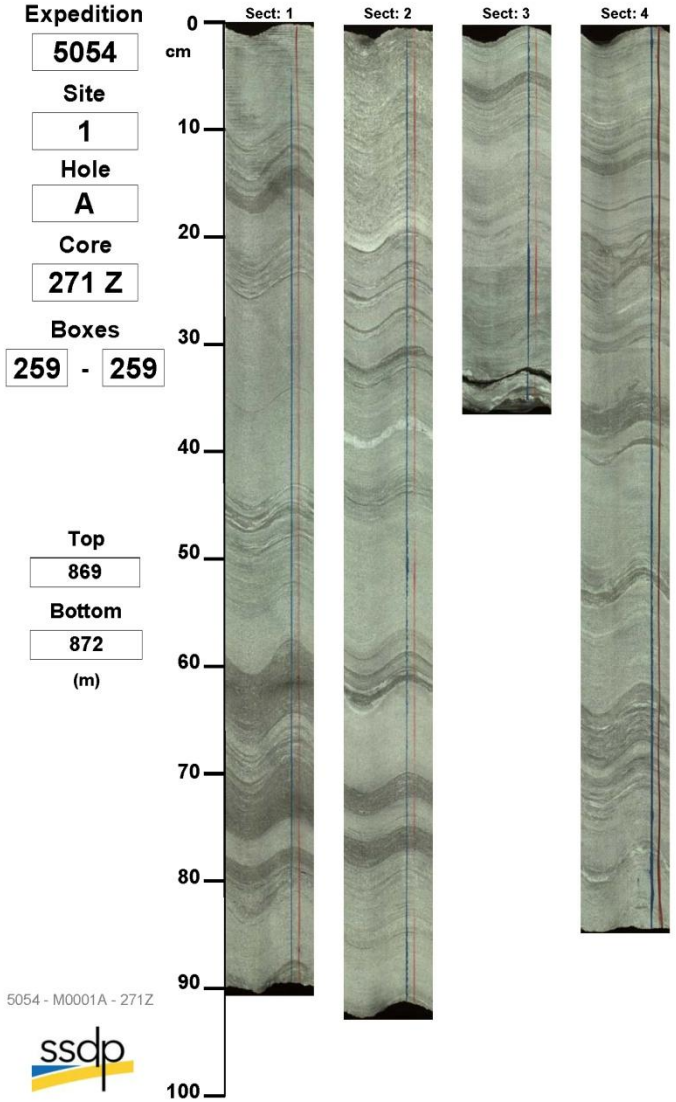
General On-Site Core Logging Workflow

Core Box Images

Slabbed Core Scans

General On-Site Core Logging Workflow



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General On-Site Core Logging Workflow

General On-Site Core Logging Workflow

Initial Lithological Description

optional

- Paperforms
- digital Input-forms
- Datapumps for spread sheets
- Image Annotationen
- graphical initial description using
  - PSICAT
  - Corelyzer

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ANDRILL

General On-Site Core Logging Workflow

PSICAT

File Edit View Help

5011_1_A

30_2 30_3 30_4 31_1 31_2 32_1 32_2 32_3 33_1 33_2 33_3 34_1 **35_1** 35_2 35_3 36_1 36_2 36_3 36_4 37_1 37_2 38_1 38_2 38_3 38_4 38_5 39_1 40_1 40_2 41_1 41_2 41_3 41_4 41_5 42_1 42_2 42_3 42_4

4_2 | 5_1 | 7_1 | 15_1 | 18_3 | 21_2 | 21_3 | 50_2 | 46_1 | 44_3 | 35_1

cm	Images	Type	Grain Size	Structures	Textures	Components	Color	Description
72				layered				left top at 71.3cm, right top at 74.8cm; left bottom at 75.3cm, right bottom at 78.0cm
74								
76			silt	homogen...			2.5Y-4/1	75.30 cm-77.10 cm left top at 75.3cm, right top at 78.0cm; left bottom at 77.1cm, right bottom at 79.3cm
78			fine sand	homogen...			2.5Y-5/2	77.10 cm-78.20 cm Tephra T5; left top at 77.1cm, right top at 79.3cm; left bottom at 78.2cm, right bottom at 80.6cm
80			silt	homogen...			5Y-5/1	78.20 cm-101.20 cm bended, left top at 48.2cm, right top at 80.6cm; Tephra T5 at 79.6 to 85.8cm (volcaniclastic, fine sand, homogeneous, 2.5Y-5/2)
82								
84								
86								

77.10 cm-78.20 cm

Depth: 77.1000000 cm - 78.2000000 cm

Unit Type: tephra

Lithology: siliciclastic % 100

Grain Size: fine sand | None | None

Structures: homogeneous | None | None

Textures: None | None | None

Components: None | None | None

Color: 2.5Y-5/2

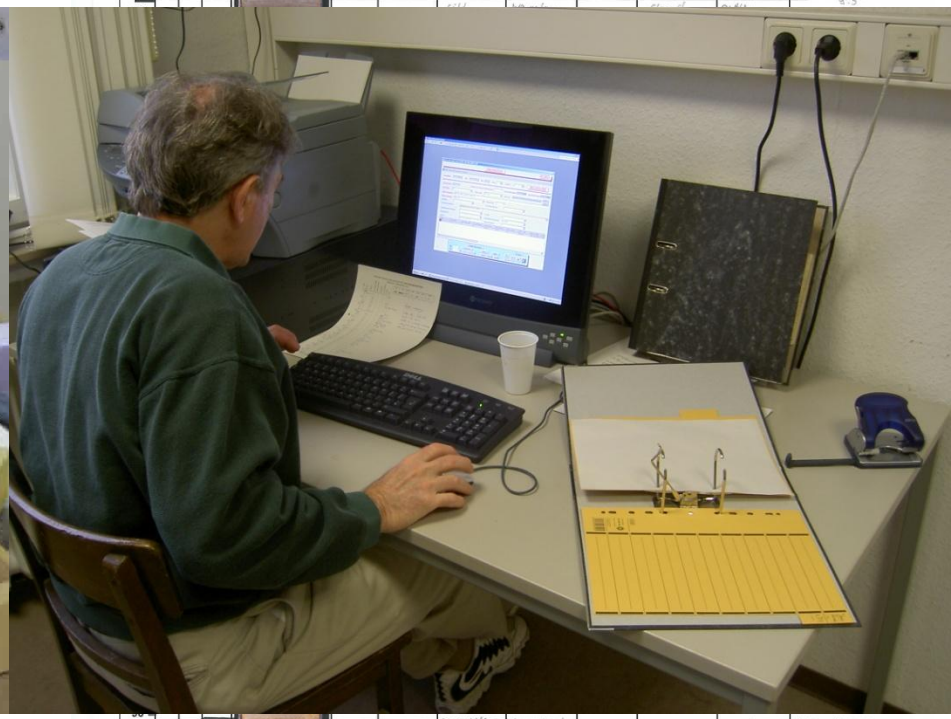
Description: Tephra T5; left top at 77.1cm, right top at 79.3cm; left bottom at 78.2cm, right bottom at 80.6cm

Opened section '35_1'

Google-Ergebn... | conze@gfz-pot... | dis_basics_1 - ... | TeamViewer

Visual Core Description

General On-Site Core Logging Workflow



Visual Core Description

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General On-Site Core Logging Workflow

Cross Checking

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General On-Site Core Logging Workflow

Sampling prohibited

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General On-Site Core Logging Workflow

Packing

Shipping

Archiving

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General On-Shore Core Logging Workflow

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General On-Shore Core Logging Workflow

marum Universität Bremen FB Geowissenschaften RIG

GeoB 16201 - 1

2000 - 3500

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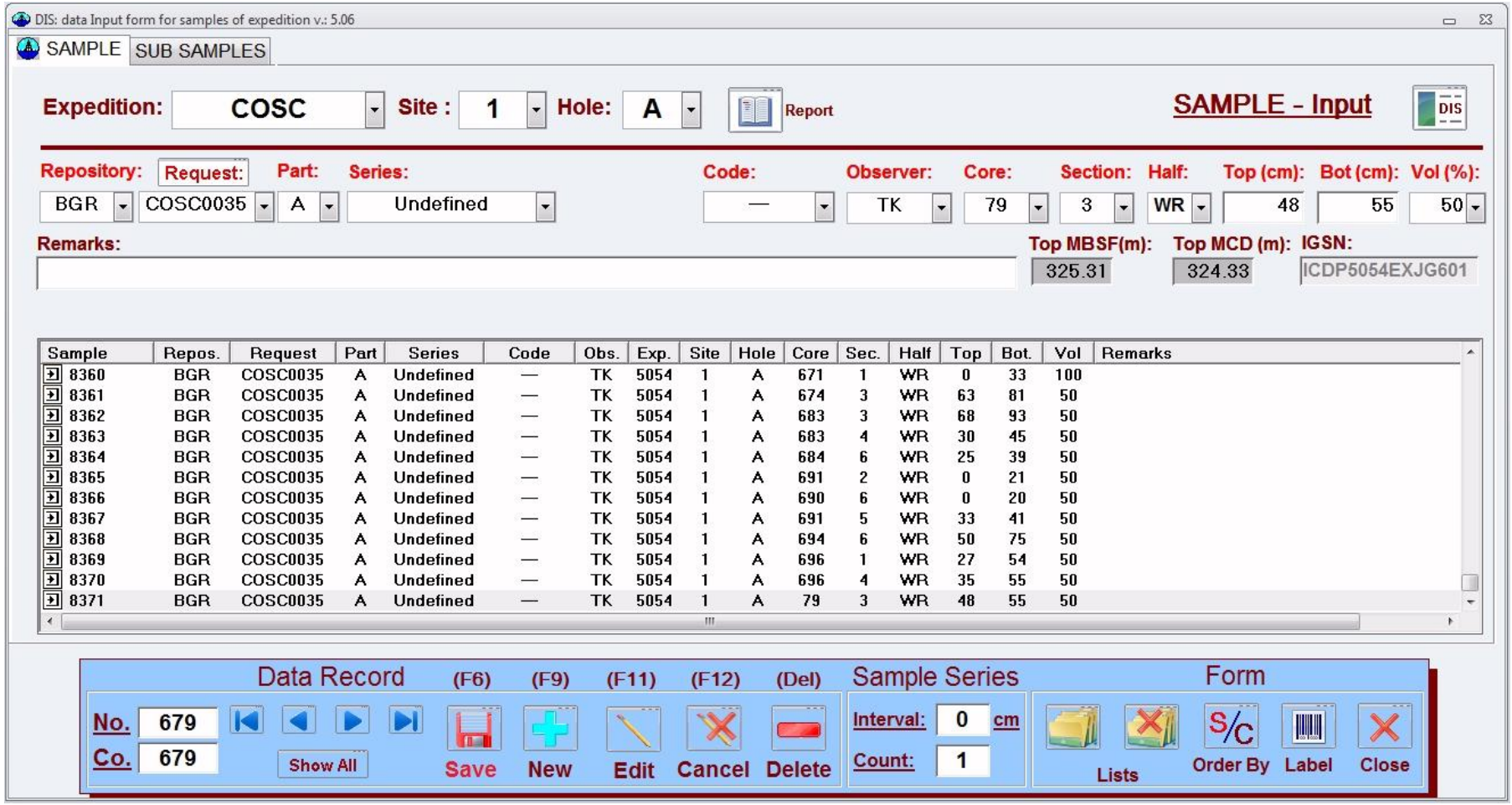
General On-Shore Core Logging Workflow

Sampling



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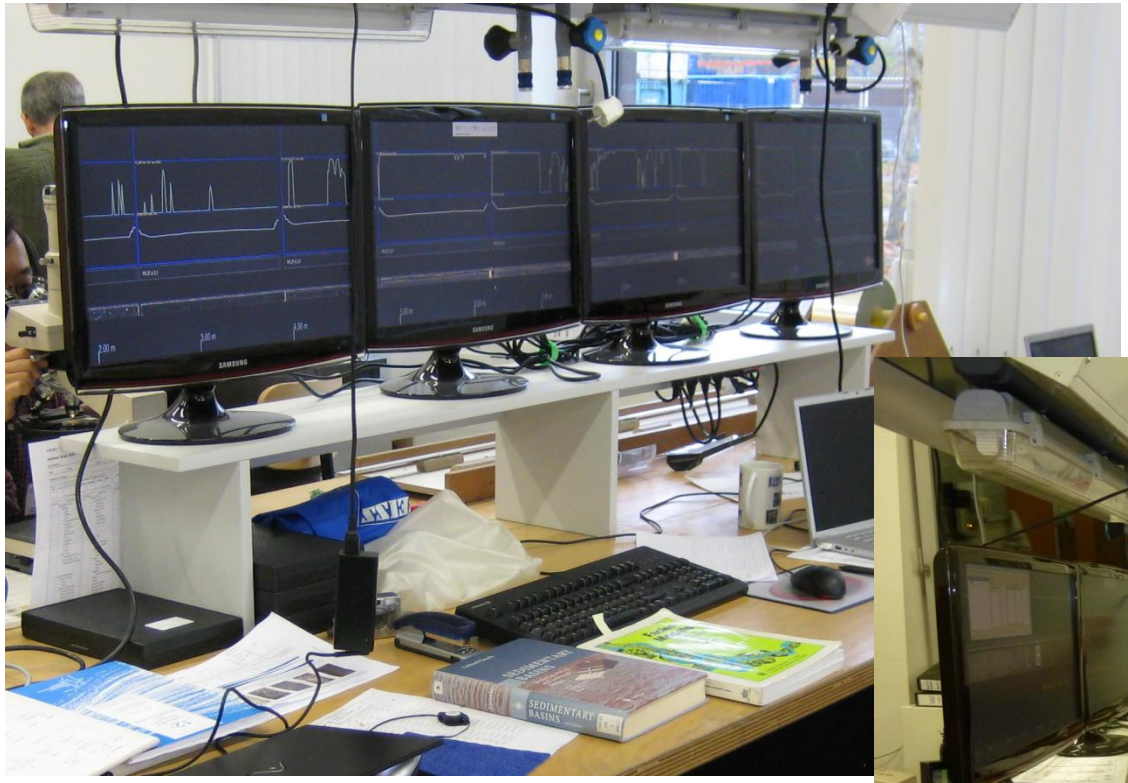
ECORD

General On-Shore Core Logging Workflow

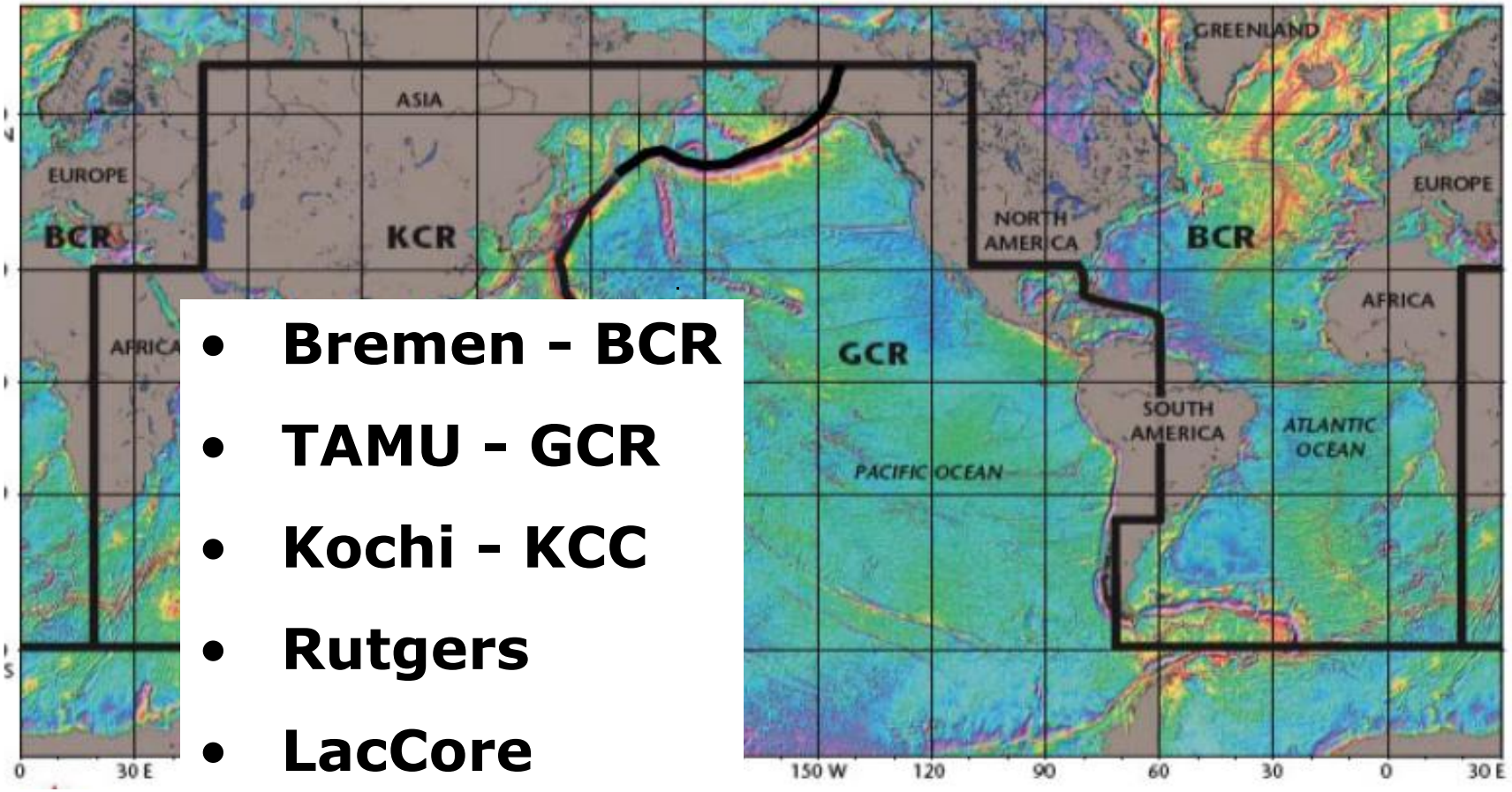


Corelyzer (CoreWall)

Stratigraphic Interpretation

General On-Shore Core Logging Workflow

Core Repositories



- **Bremen - BCR**
- **TAMU – GCR**
- **Kochi - KCC**
- **Rutgers**
- **LacCore**
- **Berlin**

Data Model

Which entities and relationships exist ?

Naming Conventions ?

Which additional information are useful ?

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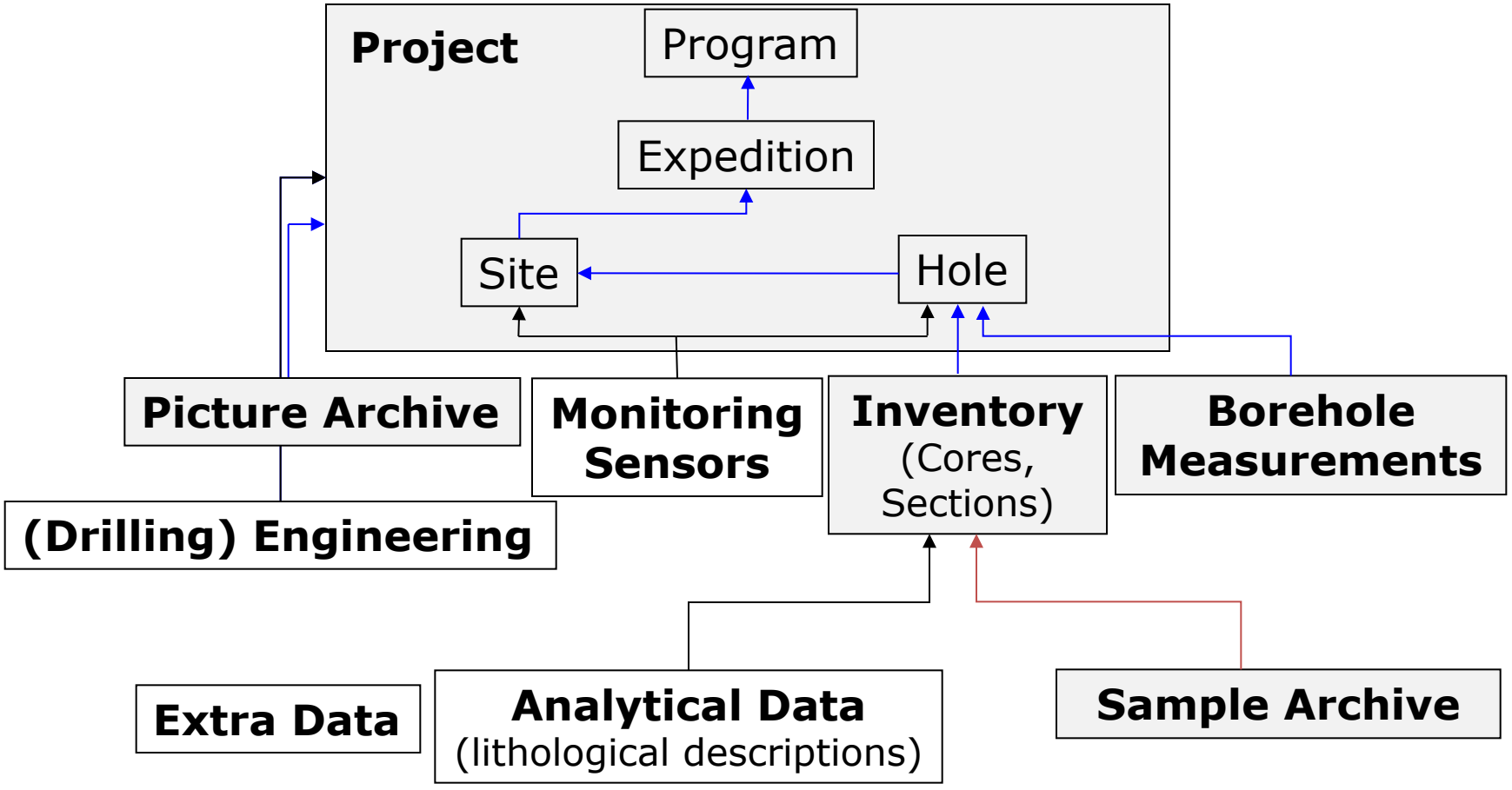
DIS Kernel

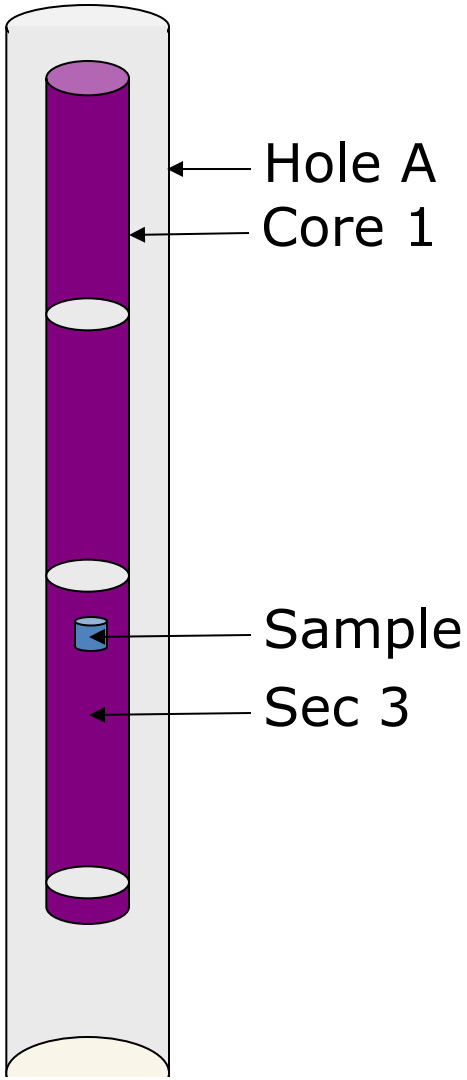


Naming Conventions

Expedition and Site followed by Hole, Core, Section, Interval ...

5052-2-A-1H-3A,10-12

- Hole A (A-Z)
- Core 1 (1-n)
- H-hydraulic, X-extended, R-rotary
- Section 3 (1-n) plus Core Catcher Section
- WR-whole round, A-archive half, W-working half
- interval (cm, relative to top of section)



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Naming Conventions

Expedition and Site followed by Hole, Core, Section, Interval

...

5052-2-B-45H-3

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ICDP Information Network

How to get access to ICDP Information and Data ?

What are the services ?

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Information System for ICDP Projects

Drilling Information System (DIS)

= data acquisition

↓

Web Site within the ICDP Information Network

= data dissemination

↓

Datasets in Scientific Drilling Database (PANGAEA / SDDB)

= data publication

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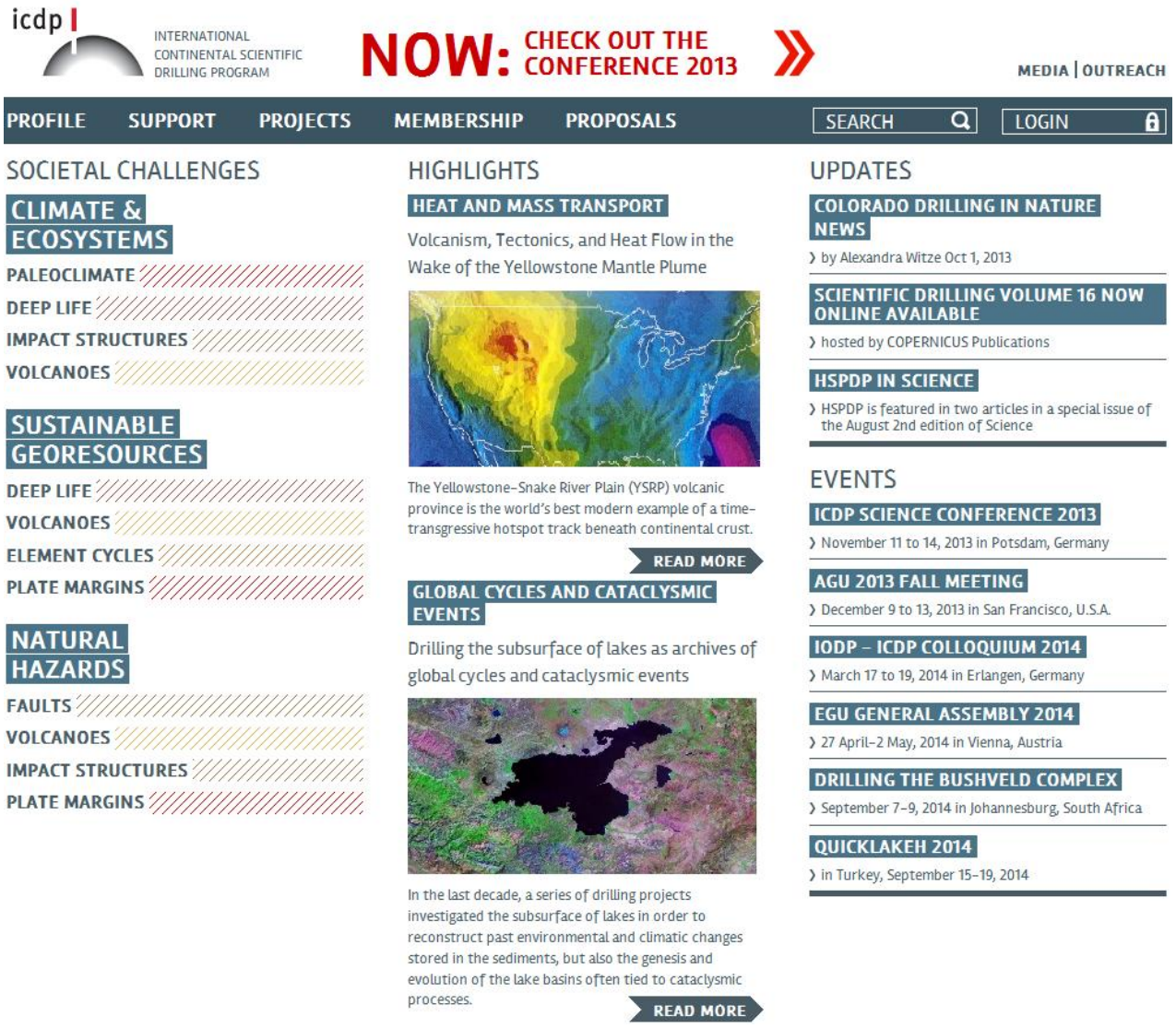
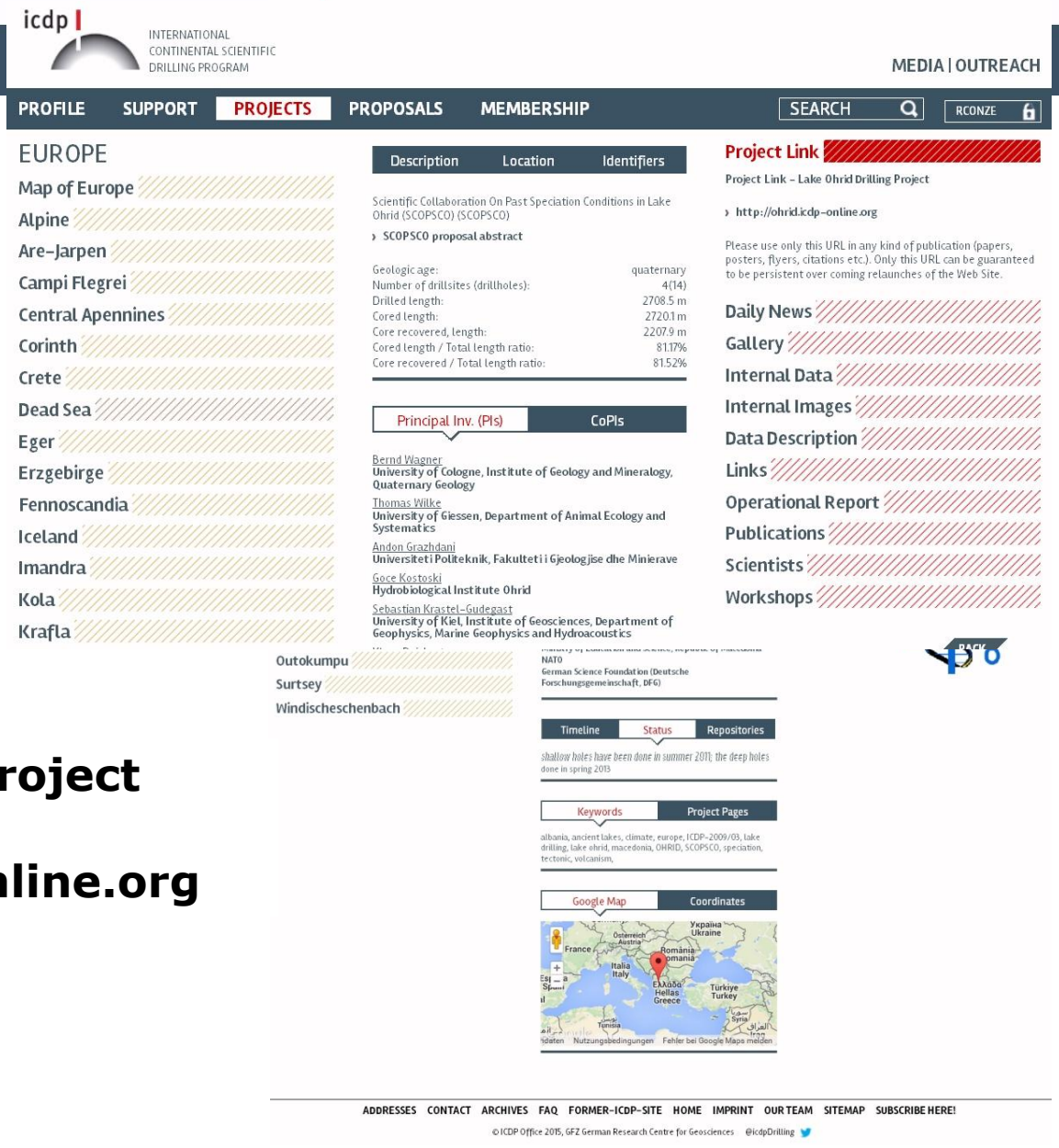
Web Site for Scientific Drilling Projects



- ~8000 users
- more than 4000 registered users
- in 60 user groups or projects

Web Site for Scientific Drilling Projects



Lake Ohrid Project Web Site at ohrid.icdp-online.org

Benefits

Ready for Data Publishing

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Information System for ICDP Projects

Drilling Information System (DIS)

= data acquisition

↓

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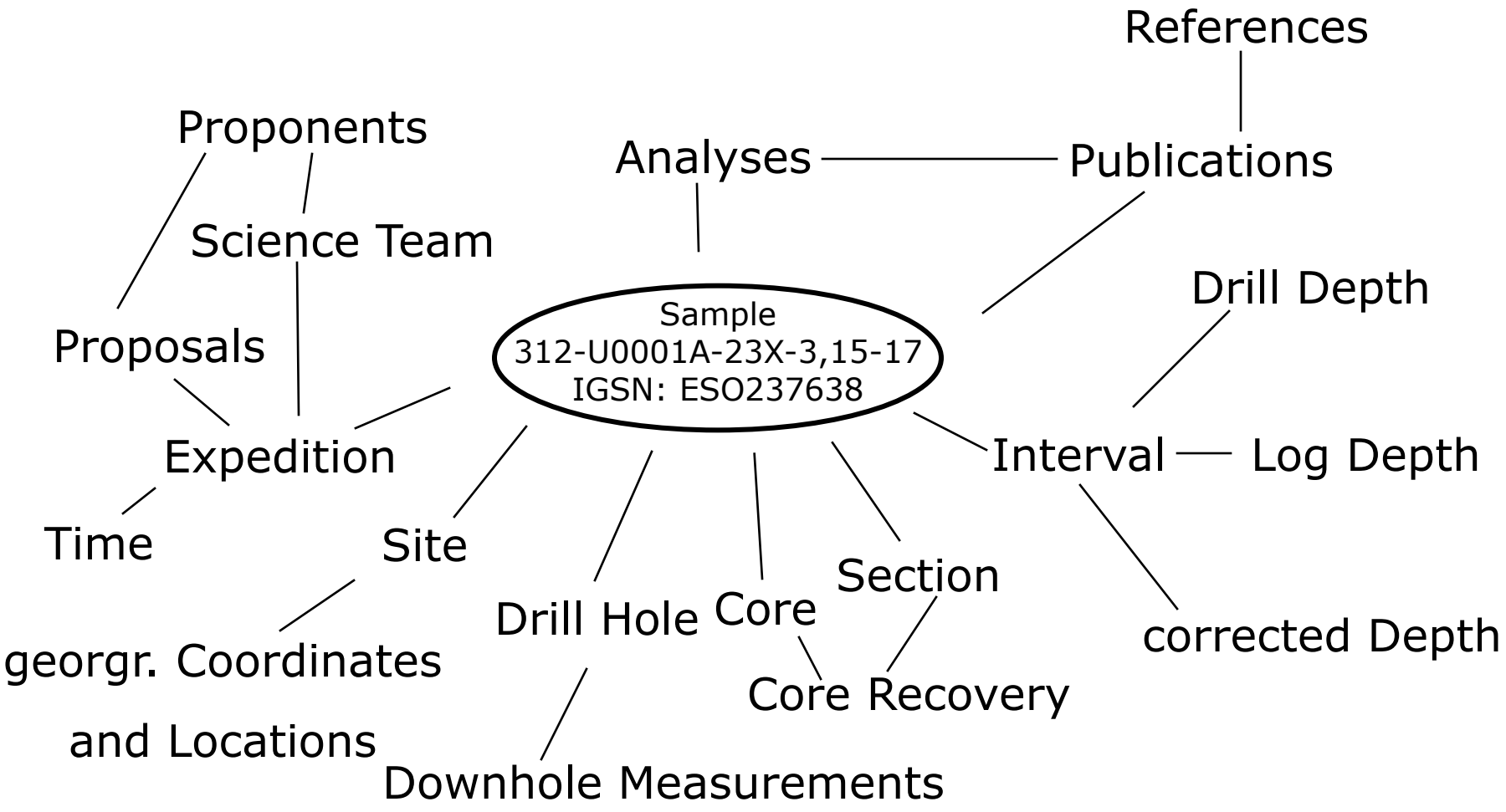
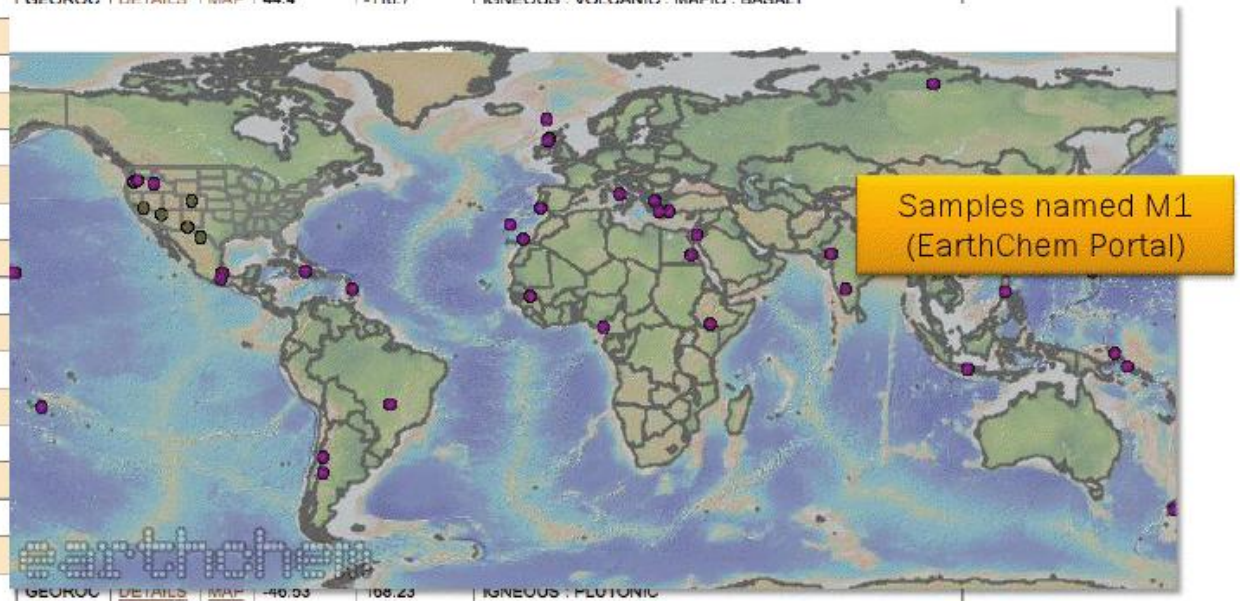
Benefits – Metadata Unlimited



Benefits – Metadata Unlimited

Ambiguous Naming

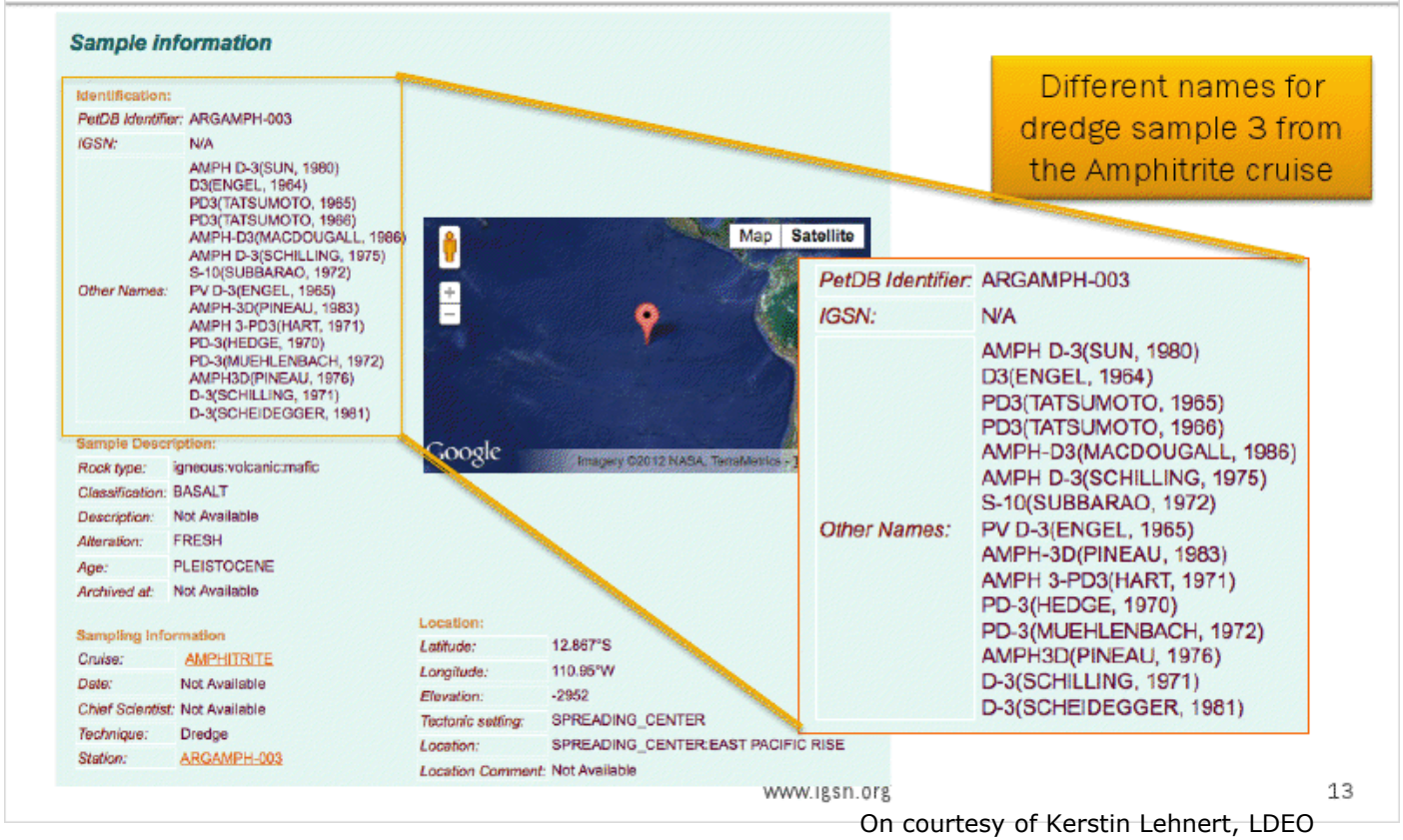
M1	GEOROC	DETAILS	MAP	43.7	141.55	IGNEOUS : VOLCANIC : INTERMEDIATE : ANDESITE
M-1	GEOROC	DETAILS	MAP	44.2	145.1	IGNEOUS : VOLCANIC : MAFIC : BASALT
M1	GEOROC	DETAILS	MAP	38.5	140.5	IGNEOUS : VOLCANIC : NOT-GIVEN
M-1	GEOROC	DETAILS	MAP	44.4	-116.7	IGNEOUS : VOLCANIC : MAFIC : BASALT
M1						
M1						
M.L						
M-1						
M-1						
M1						
M1						
M1						
M1						
M1						
M1						
M-1						
M-1						
M1						
M-1						
M1	GEOROC	DETAILS	MAP	-46.53	168.23	IGNEOUS : PLUTONIC
M-1	GEOROC	DETAILS	MAP	26.5	101.7	IGNEOUS : PLUTONIC : ULTRAMAFIC : PERIDOTITE
M1	GEOROC	DETAILS	MAP	36.73	24.42	IGNEOUS : VOLCANIC : FELSIC : RHYOLITE
M-1	GEOROC	DETAILS	MAP	32.0222	130.682	IGNEOUS : VOLCANIC : INTERMEDIATE : ANDESITE



On courtesy of Kerstin Lehnert, LDEO

Benefits – Metadata Unlimited

Changing Names



On courtesy of Kerstin Lehnert, LDEO

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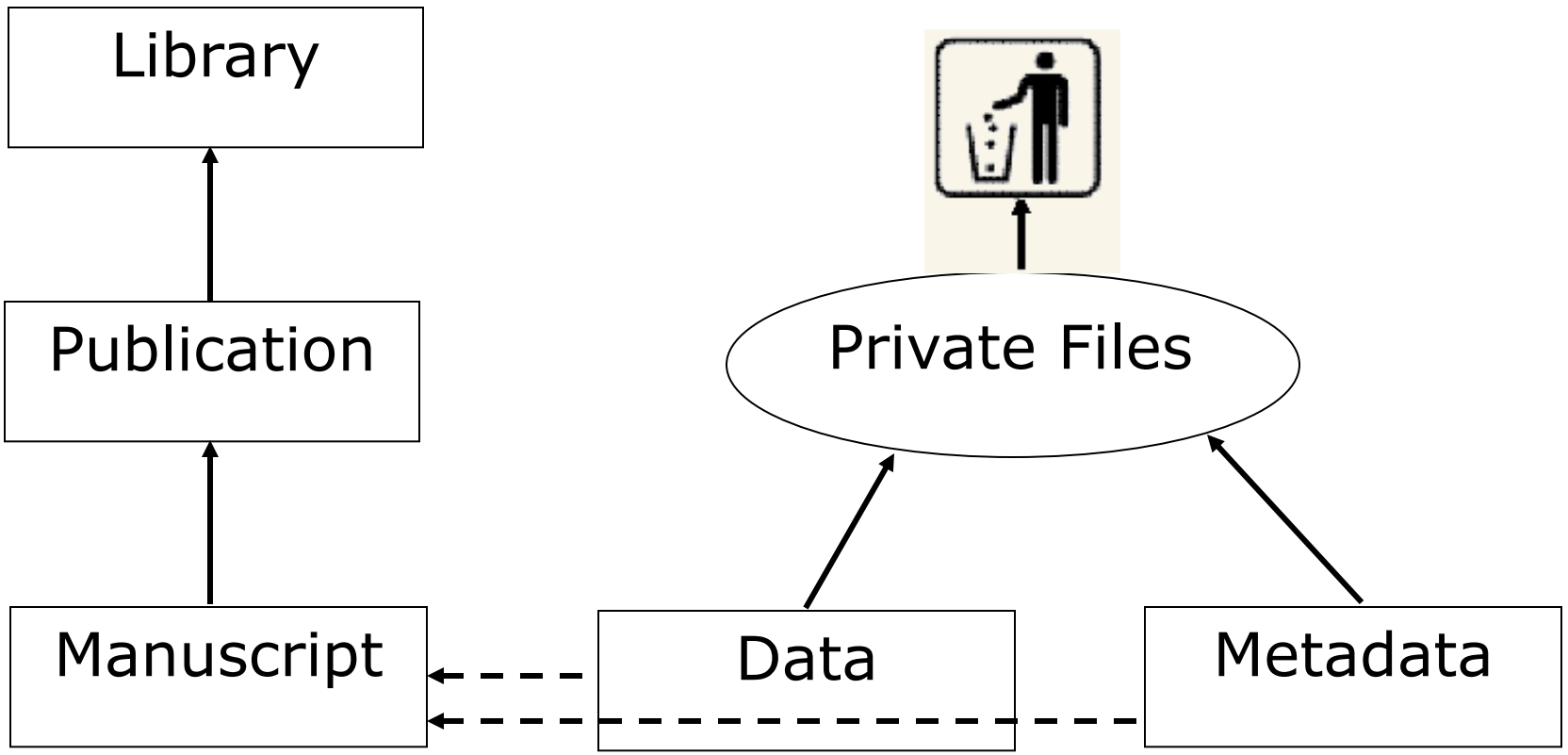
Benefits – Publication and Citation of Data



Data Science Journal, Volume 5, 15 June 2006

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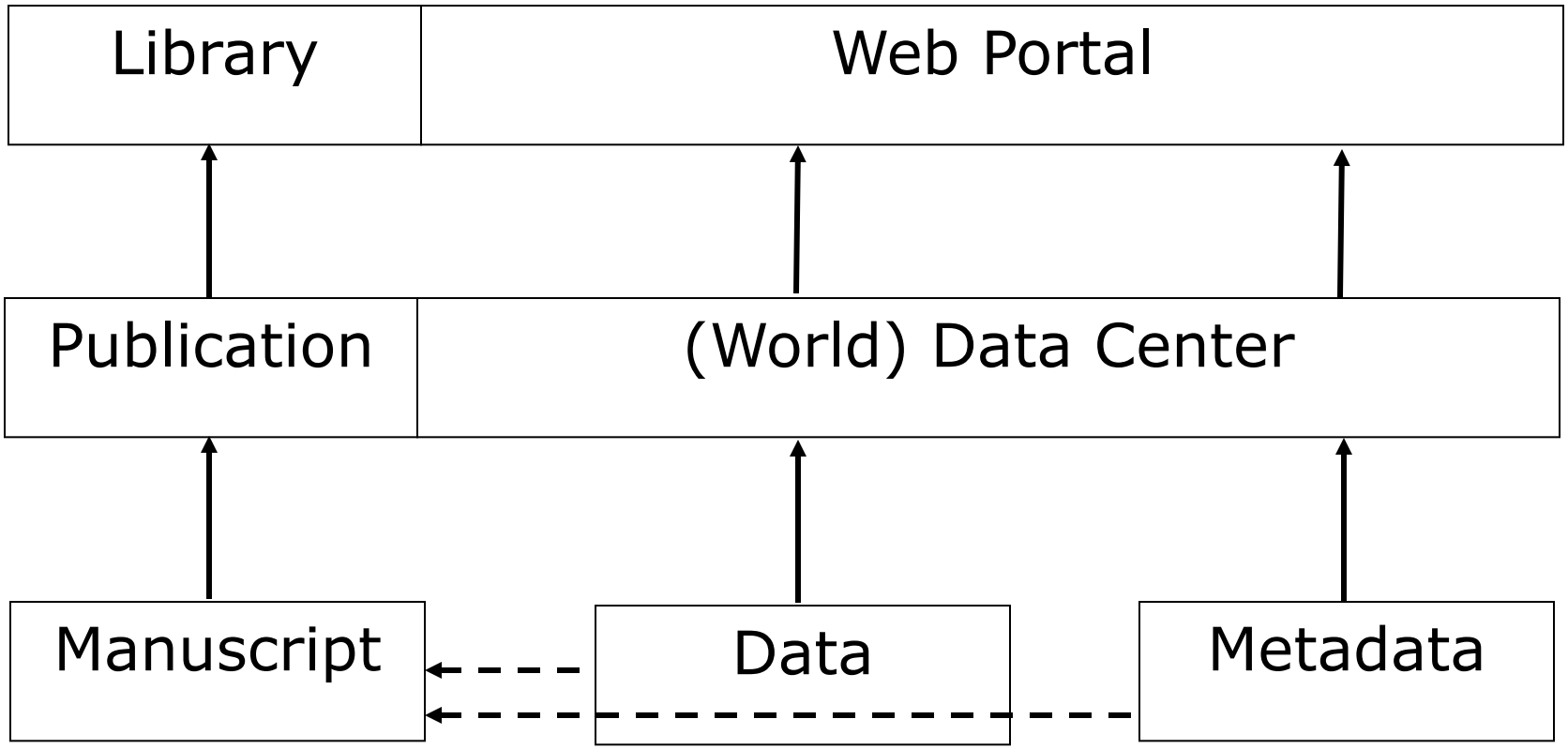
Benefits – Publication and Citation of Data



Data Science Journal, Volume 5, 15 June 2006

Benefits – Publication and Citation of Data and Samples

Unique Identifiers

- for published articles, journals, and monographs

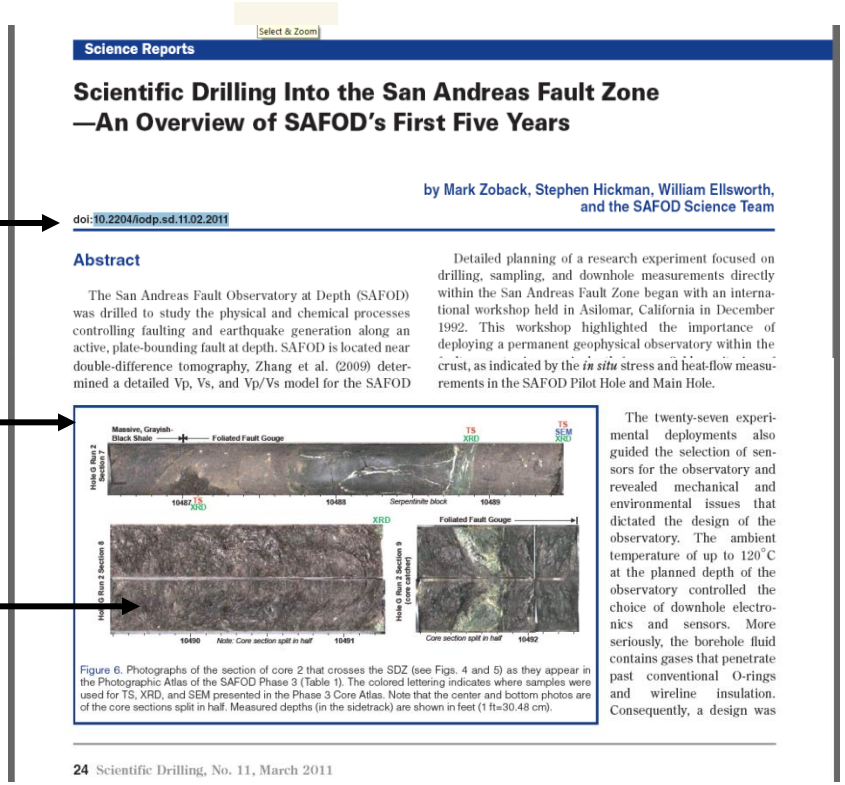
  DOI: **10.2204/iodp.sd.11.02.2011**

- for published data sets

  DOI: **10.1594/GFZ.SDDB.1071**

- for published samples

  IGSN: **ICD237AG8**



Science Reports

Scientific Drilling Into the San Andreas Fault Zone —An Overview of SAFOD's First Five Years

by Mark Zoback, Stephen Hickman, William Ellsworth, and the SAFOD Science Team

doi:10.2204/iodp.sd.11.02.2011

Abstract

The San Andreas Fault Observatory at Depth (SAFOD) was drilled to study the physical and chemical processes controlling faulting and earthquake generation along an active, plate-bounding fault at depth. SAFOD is located near double-difference tomography, Zhang et al. (2009) determined a detailed Vp, Vs, and Vp/Vs model for the SAFOD

Detailed planning of a research experiment focused on drilling, sampling, and downhole measurements directly within the San Andreas Fault Zone began with an international workshop held in Asilomar, California in December 1992. This workshop highlighted the importance of deploying a permanent geophysical observatory within the crust, as indicated by the *in situ* stress and heat-flow measurements in the SAFOD Pilot Hole and Main Hole.

Figure 6. Photographs of the section of core 2 that crosses the SDZ (see Figs. 4 and 5) as they appear in the Photographic Atlas of the SAFOD Phase 3 (Table 1). The colored lettering indicates where samples were used for TS, XRD, and SEM presented in the Phase 3 Core Atlas. Note that the center and bottom photos are of the core sections split in half. Measured depths (in the sidetrack) are shown in feet (1 ft=30.48 cm).

The twenty-seven experimental deployments also guided the selection of sensors for the observatory and revealed mechanical and environmental issues that dictated the design of the observatory. The ambient temperature of up to 120°C at the planned depth of the observatory controlled the choice of downhole electronics and sensors. More seriously, the borehole fluid contains gases that penetrate past conventional O-rings and wireline insulation. Consequently, a design was

24 Scientific Drilling, No. 11, March 2011

DOI: Digital Object Identifier

IGSN: International Geo Sample Number


End

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GFZ German Research Centre for Geosciences, doi:10.2312/ICDP.2015.002

Useful Links:

1. Lab Procedures - LacCore Standard Operating Procedures: http://lrc.geo.umn.edu/laccore/analyses.html
2. Core storage and sampling - BCR Practices and Procedures: http://www.marum.de/Page3478.html
3. Lake and Marine Drilling Planning and Operations Manual

http://www.dosecc.org/images/stories/DOSECC_pdfs/Lake__Marine_Manual-FINAL.pdf

4. International Ocean Discovery Program (IODP) – http://www.iodp.org
5. System for Earth Sample registration (SESAR) - http://www.geosamples.org/
6. Corelyzer, Correlator, CoreNavigator - http://www.corewall.org/
7. The Virtual Core Repsoitory - http://www.gesep.org/infrastruktur/kernlager/portal/
8. PANGAEA - http://www.pangaea.de/
9. Scientific Earth Drilling Information Service (SEDIS) - http://sedis.iodp.org/
10. Scientific Drilling Journal - http://www.scientific-drilling.net/
11. ICDP Primer - http://www.icdp-online.org/media/icdp-best-practice-brochure-primer/

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