

Fabien Arnaud¹, Cécile Pignol¹, Bruno Galabertier¹, Xavier Crosta², Isabelle Billy², Elodie Godinho³, Karim Bernardet³, Pierre Sabatier¹, Anne-Lise Develle¹, Rosalie Bruel^{1,4}, Julien Penguen⁵, Pascal Calvat⁵, Pierre Stéphan⁶, and Mathias Rouan⁶

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² Environnements et paléoenvironnements océaniques et continentaux (EPOC), Université de Bordeaux, CNRS, Bordeaux, France

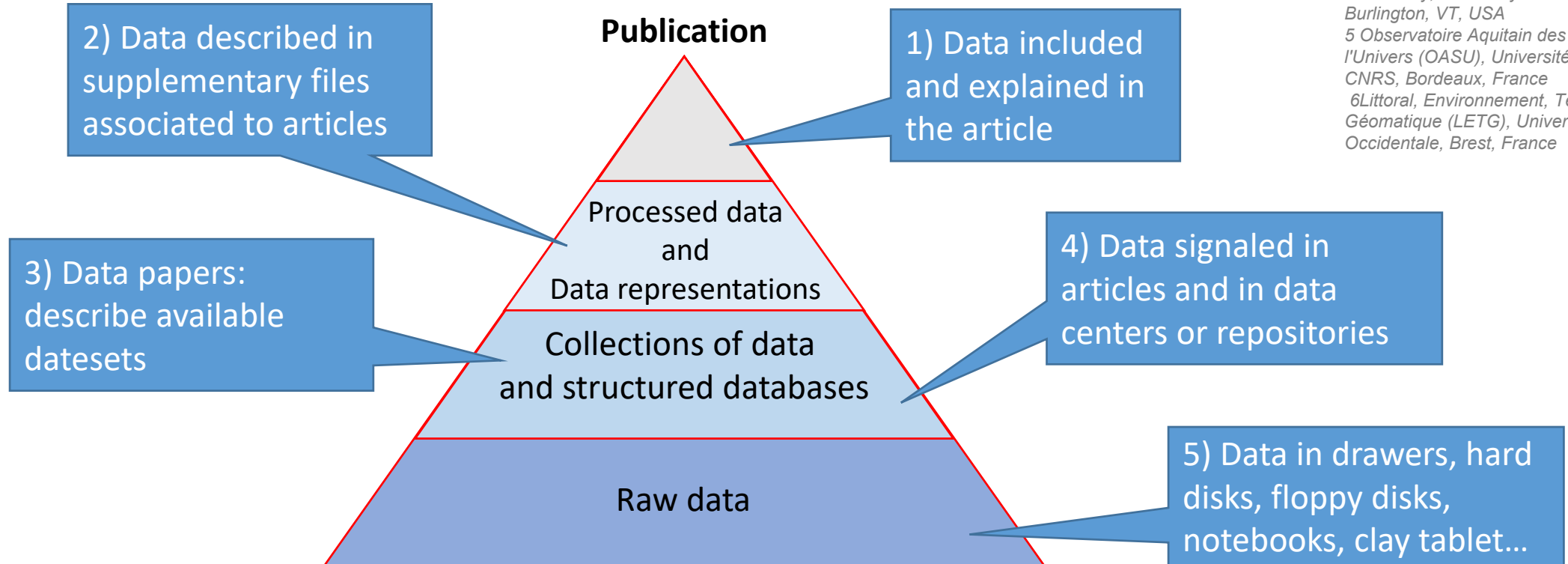
³ Division Technique de l'Institut des Sciences de l'Univers (DT-INSU), CNRS, La Seyne-sur-Mer, France

⁴ Rubenstein Ecosystem Science Laboratory, University of Vermont, Burlington, VT, USA

⁵ Observatoire Aquitain des Sciences de l'Univers (OASU), Université de Bordeaux, CNRS, Bordeaux, France

⁶ Littoral, Environnement, Télédétection, Géomatique (LETG), Université de Bretagne Occidentale, Brest, France

The pyramid of data: general case



Findable . Accessible . Interoperable . Reusable .

Adapted from Report on integration of data and publications. Opportunities for data exchange (Relly et al., 2011)

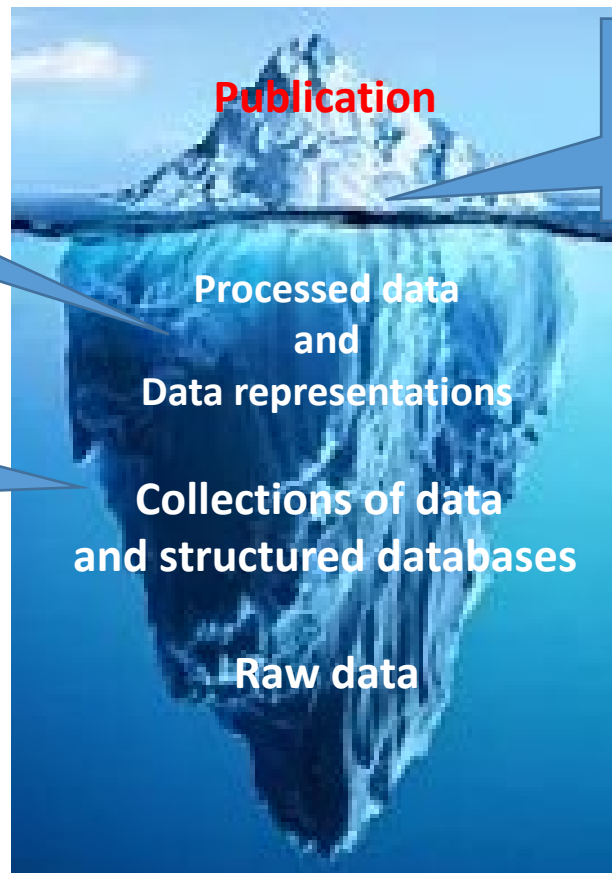
Publications are just the emerged tip of a huge iceberg of « frozen » data



**Findable . Accessible .
Interoperable . Reusable .**

2) Data described in supplementary files associated to articles

3) Data papers: describe available datasets

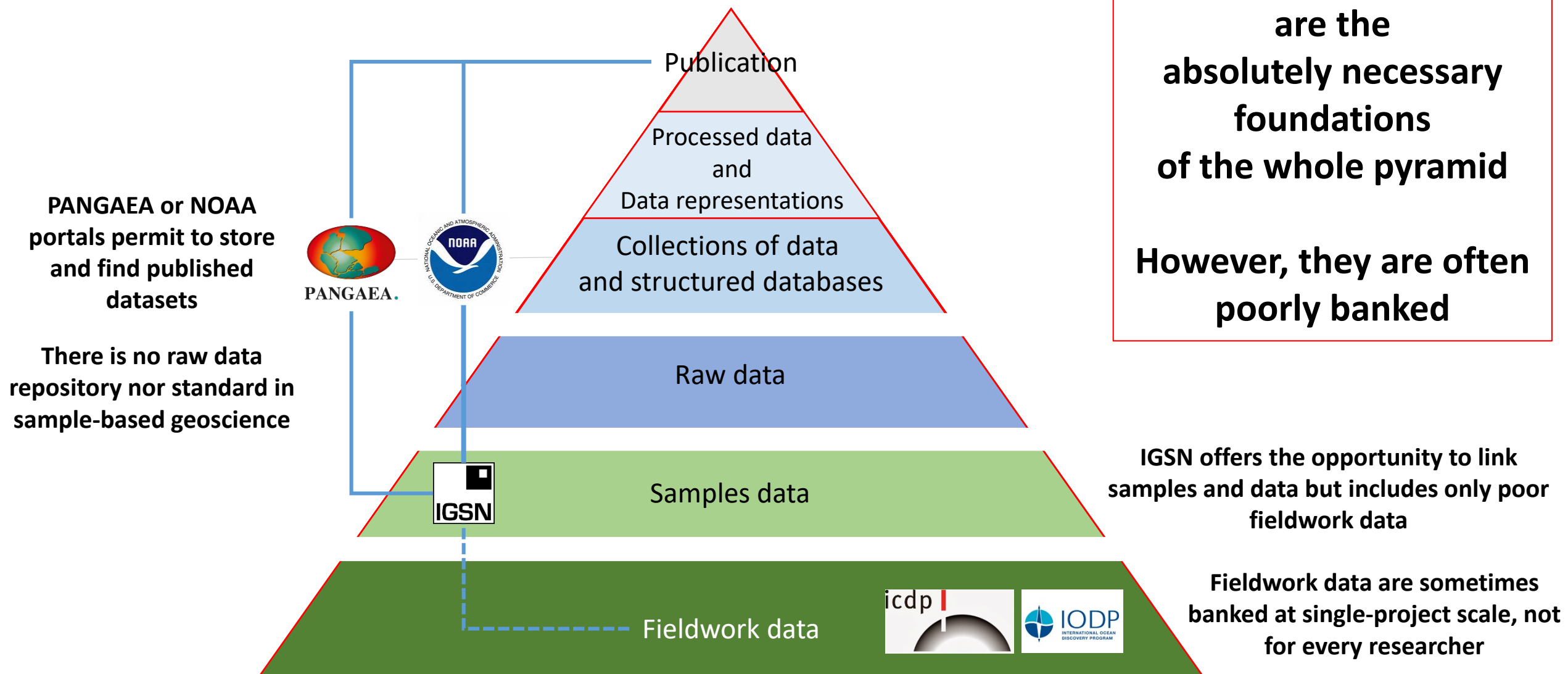


1) Data included and explained in the article

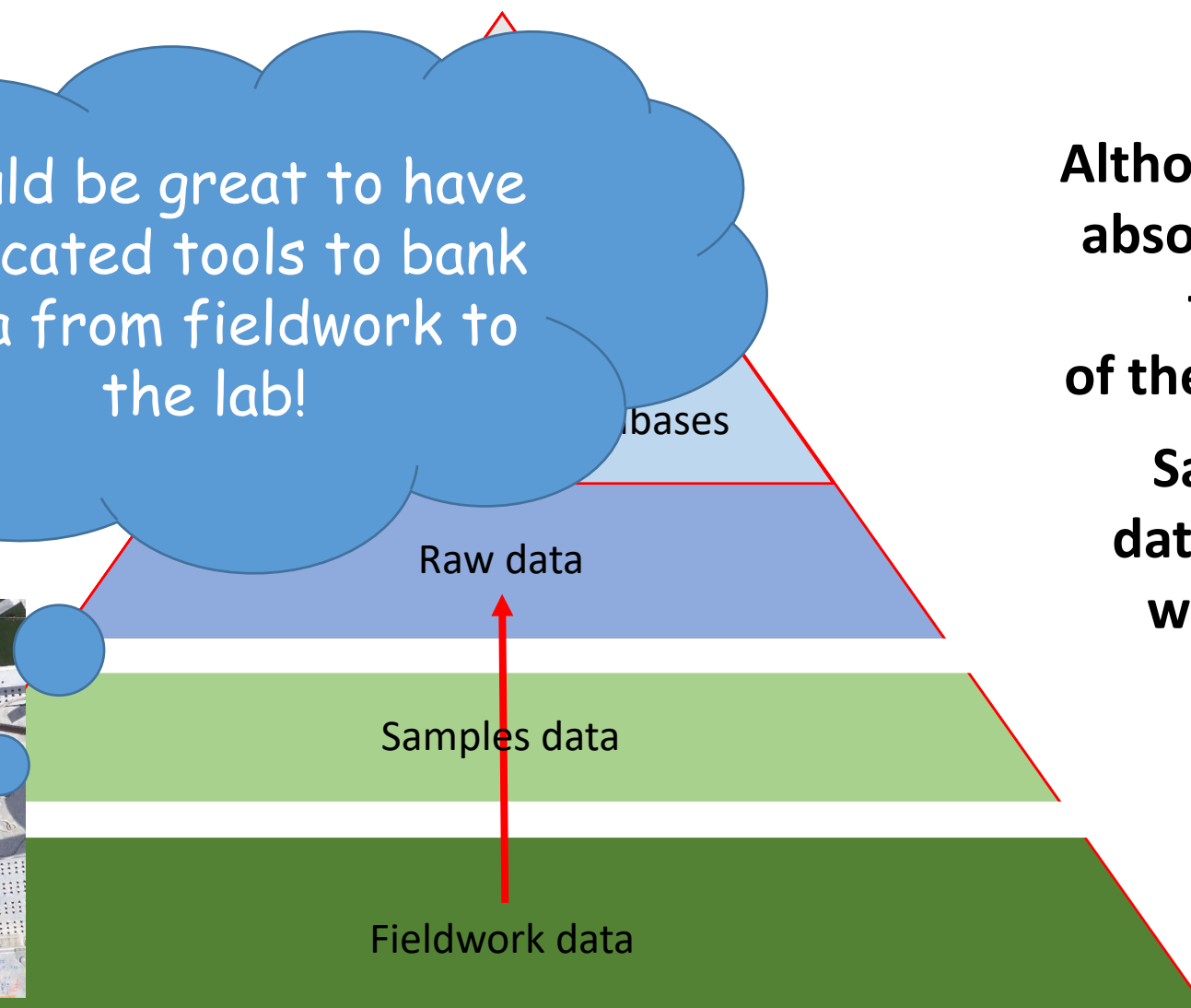
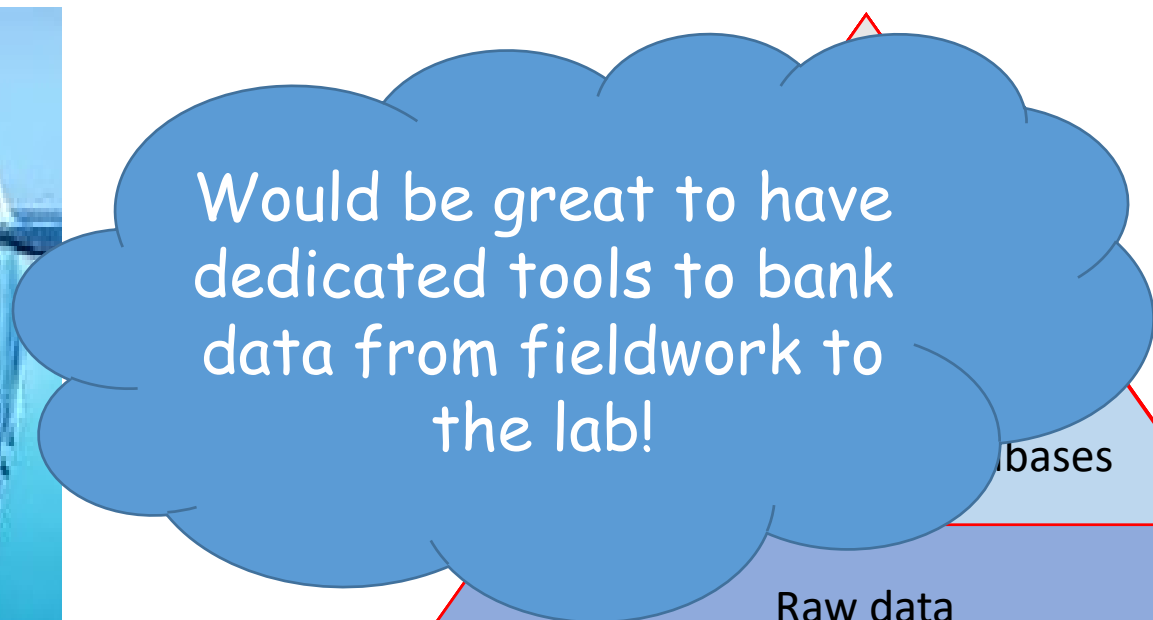
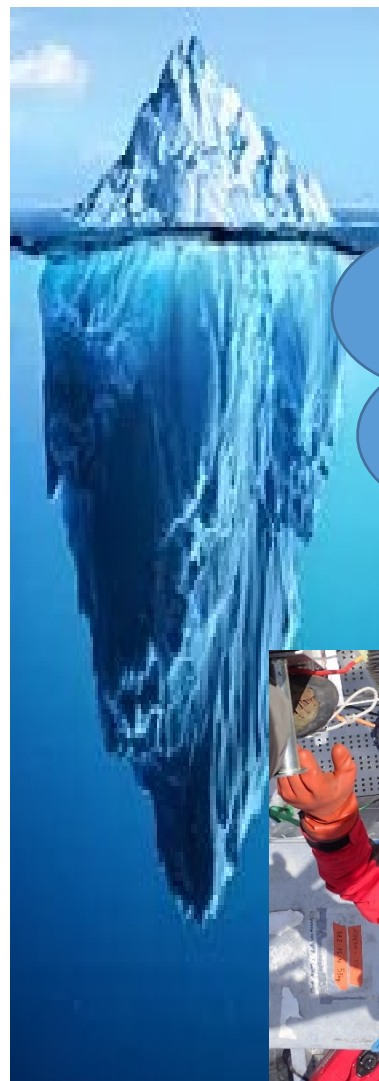
4) Data signaled in articles and in data centers or repositories

5) Data in drawers, hard disks, floppy disks, notebooks, clay tablet...

The pyramid of data: case of field-based (geo)sciences



The pyramid of data: case of field-based (geo)sciences



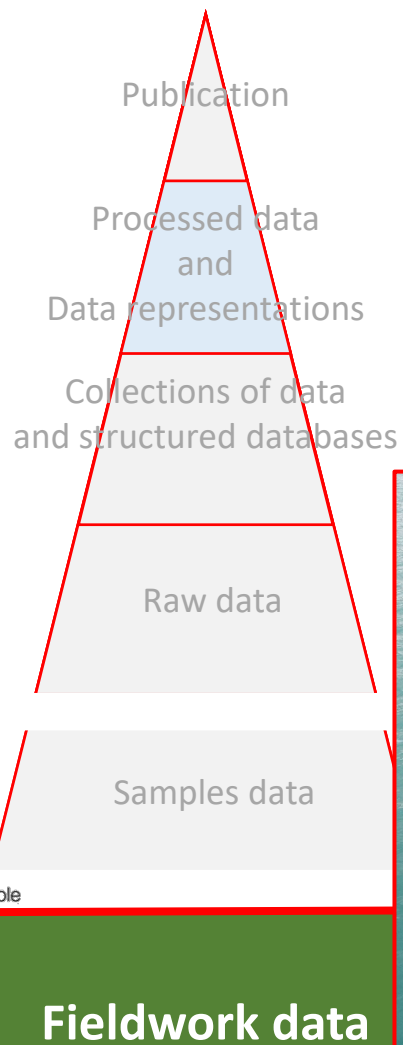
Although, they are the absolutely necessary foundations of the whole pyramid:

Samples and field data are often barely within the iceberg itself...

How to turn kilos of mud into megabytes of data?

10 years of efforts in curating lake sediment cores and their associated results

➔ Catching fieldwork data at the source: CoreBook Android App.

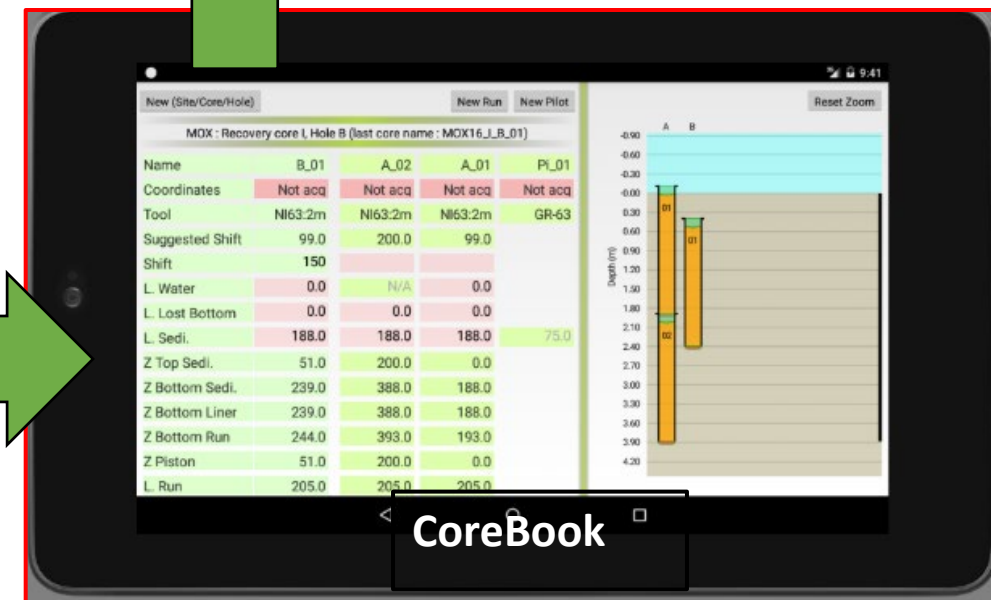
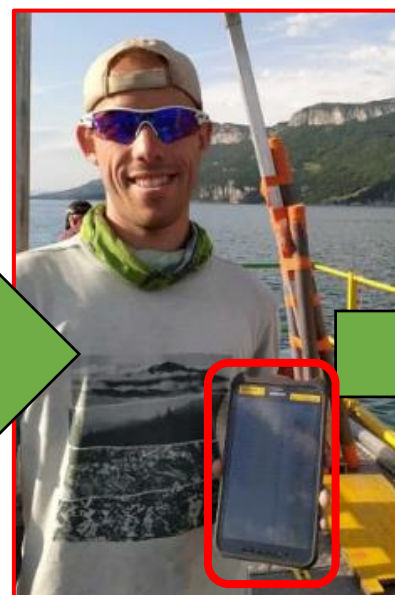
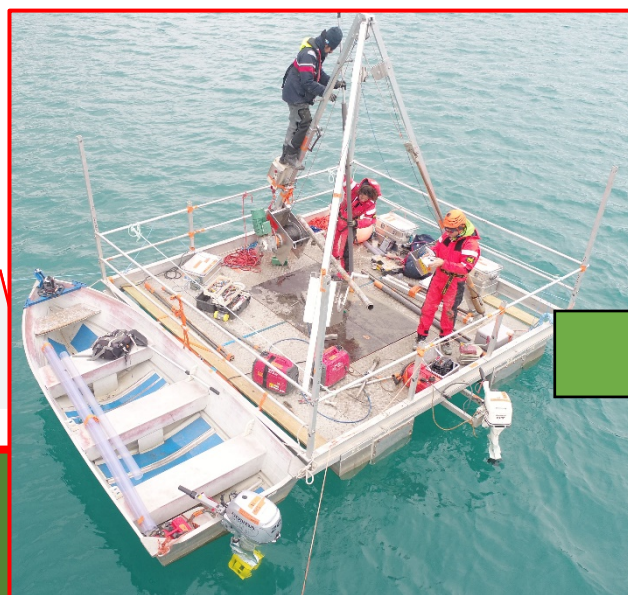


Functions to help field operations (navigate, find older coring locations, placement of anchors, display of parallel cores)

Operator-friendly Data filling



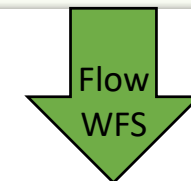
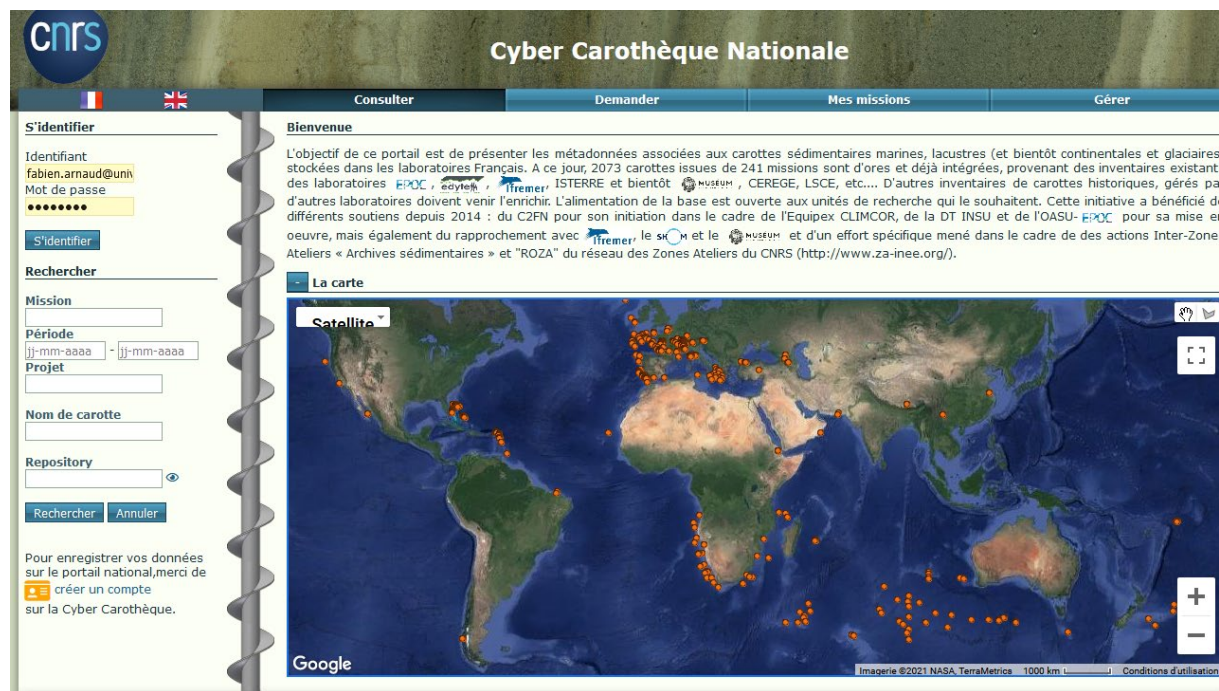
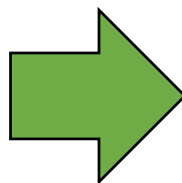
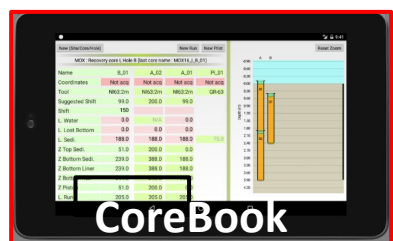
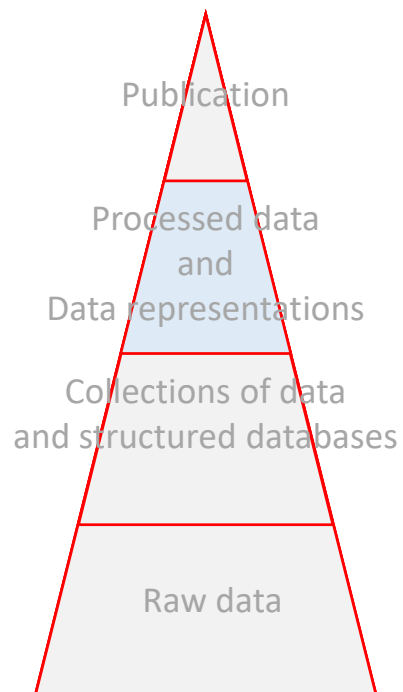
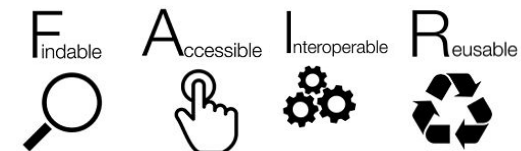
XML exchange file Ready for input into a database



How to turn kilos of mud into megabytes of data?

10 years of efforts in curating lake sediment cores and their associated results

➔ Banking and displaying fieldwork data: the National Cyber-core repository
([Cyber-carothèque nationale](#))



Export geographical point & fielddata for GIS SYSTEM

Samples data

Fieldwork data

How to turn kilos of mud into megabytes of data?

10 years of efforts in curating lake sediment cores and their associated results

Banking and displaying fieldwork data: the National Cyber-core repository ([Cyber-carothèque nationale](#))

Zoom

Search by zone

All referenced surveys

Mission	Année	Chef de mission	PI(s) des prélèvements (liste non exhaustive)	Par	Prélèvement
KERGUELEN200601/12/06	2006	Fabien Arnaud	Fabien Arnaud		2 Carotte(s)
PALAS 2006	2006	Fabien Arnaud	Fabien Arnaud		16 Carotte(s) 4 Échantillon(s) de terrain
PALAS19-GUYNEMER	2019	Fabien Arnaud	Fabien Arnaud		15 Carotte(s) 4 Échantillon(s) de terrain
PALAS19-MYTHOS	2019	Jostein Bakke	Jostein Bakke		32 Carotte(s) 15 Échantillon(s) de terrain
PALAS2014	2014	Fabien Arnaud	Pierre Sabatier, Jerome Poulencard, Jostein Bakke		21 Carotte(s)

All referenced cores and samples

How to turn kilos of mud into megabytes of data?

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Mission information

Mission PALAS19-GUYNEMER

Description

Fichier source Corebook

XML
source file

Code
Début de mission 27-11-2019 06:00
Fin de mission 27-11-2019 18:00

Description

Projet PALAS
Contexte scientifique

Connaissances préliminaires

Commentaire

Confidentialité Publique

Remerciements

DOI
URL
CSR

Link to project: permit
to display all
surveys/cores within
the same project

Automatic survey
report with DOI
(under development)

Participants

Chef foreur [Arnaud Fabien](#)^{ID}
Chef de mission [Arnaud Fabien](#)^{ID}

Acknowledgement of
crew members with
determined role and
ORCID identification

PI(s) des prélèvements (liste non exhaustive)
[Arnaud Fabien](#)^{ID}

Financier

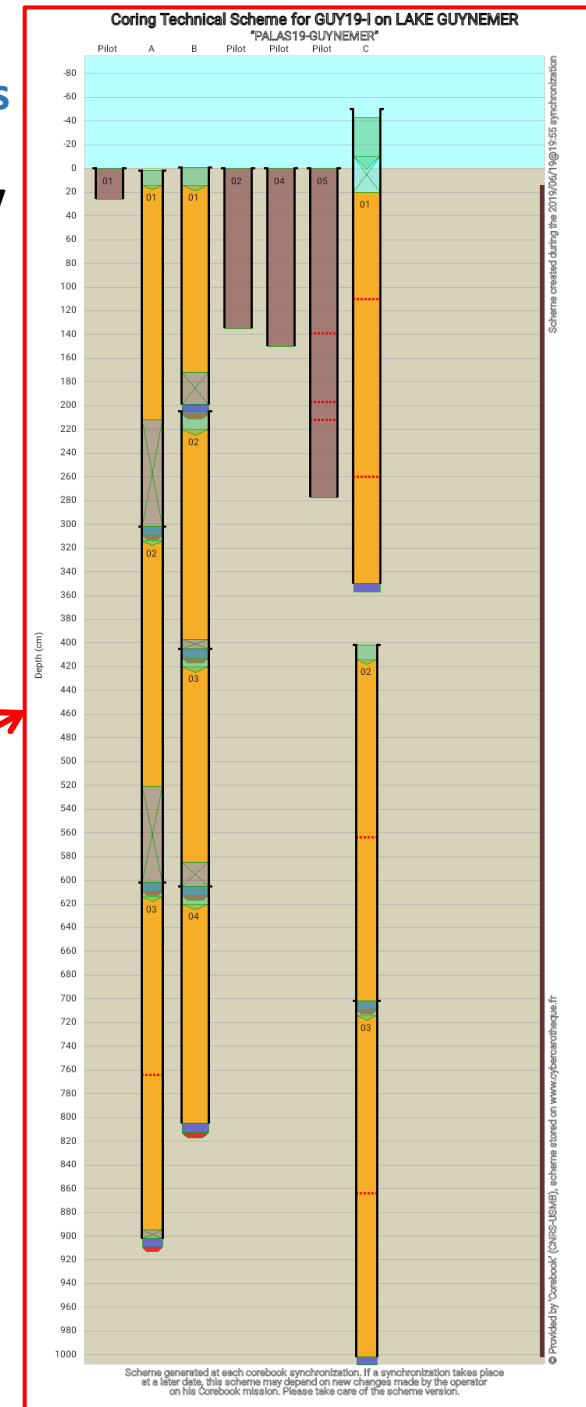
Aucun(e)

Documents liés

GUY19-I-Pil-05-20191223-141634.jpg
GUY19-I-Pil-05-20191223-141716.jpg
GUY19-I-Pil-05-20191223-141736.jpg
[GUY19-I.20190619-195534.Coring.Schema.png](#)
GUY19-I-B-01-20191201-064036.mp4
EPGUY19-01-20191204-113555.jpg
EPGUY19-01-20191204-113630.jpg

Any additional
document (pictures,
sounds, videos) taken
with CoreBook App.

When applicable: link
to the sketches of
parallel corings



How to turn kilos of mud into megabytes of data?

10 years of efforts in curating lake sediment cores and their associated results

➔ Banking and displaying fieldwork data: the National Cyber-core repository
([Cyber-carothèque nationale](#))

Sample (core) information

Description

N° IGSN **TOAE0000000078**

Site / Station **GUY19-I**

Nom **GUY19-I-A-03**

Matériau **Sédiment**

Type de prélèvement **Carotte (recouvrement)**

Environnement **Étendue d'eau (douce) naturelle - Lac**

Plateforme

Profondeur bathymétrique (m) **94**

Altitude (m) **131.0**

zone(s) **French Southern and Antarctic Lands, France**

Lieu **LAKE GUYNEMER**

Point GPS (WGS84, DD) **-49.11344500 69.02049300**

Date **28-11-2019 16:01**

Nom du carottier **U-NIEDERREITER 63-3m (EDY)**

Nom de la configuration **2-NIED63-3m PO/TC (EDY)**

Diamètre intérieur (mm) **63**

Longueur du prélèvement (m) **2.93**

Longueur matière récupérée (m) **2.81**

Époque géologique

PI **Fabien Arnaud**

Sondeur/Foreur en chef

Commentaire

IGSN unique
identifiant

Codified usual name :
Site-Year-Station-Hole-Section

Where is the core
stored?

Link to coring tool
information

Children
subsamples

Mission

Mission **PALAS19-GUYNEMER**

DOI / CSR

Début de mission **27-11-2019 06:00**

Fin de mission **27-11-2019 18:00**

Projet **PALAS**

Code projet (Reference)

Chef de mission **Fabien Arnaud**

Sondeur/Foreur en chef **Fabien Arnaud**

Repository

Repository **Environnements, DYnamiques et TERRitoires de la Montagne (EDYTEM)**

Documents liés

Aucun(e)

Sous-prélèvements associés

Export csv			
Nom	Parent	IGSN	Profondeur supé
GUY19-I-A-03-A Section	GUY19-I-A-03 Carotte (recouvrement)	TOAE00000000582	
GUY19-I-A-03-B Section	GUY19-I-A-03 Carotte (recouvrement)	TOAE00000000583	

How to turn kilos of mud into megabytes of data?

10 years of efforts in curating lake sediment cores and their associated results

Banking and displaying fieldwork data: the National Cyber-core repository (cyber-carothèque nationale)

Coring tools information

ID	1 Nom de la configuration	2 Mode	3 Lien mécanique	4 Type Carottier	5 Carottier	6 Extracteur (core catcher)	7 Couronne	8 Trousse coupante / ogive	9 Dernière MAJ	10 Unité
107	1-UwPILOT90 (EDY)	Gravitaire	Câble	Interface	U-PILOT 90 (EDY)	Aucun(e)	Aucun(e)	Aucun(e)	2019-04-03 15:45:52	EDYTEM
106	1-UwPILOT63 (EDY)	Gravitaire	Câble	Interface	U-PILOT 63 (EDY)	Aucun(e)	Aucun(e)	Aucun(e)	2019-04-03 15:45:44	EDYTEM
105	1-NES (EDY)								2019-04-03 15:45:22	EDYTEM
104	2-USI								2019-04-08 15:43:08	EDYTEM
103	2-USI (EDY)								2019-04-08 15:43:44	EDYTEM
102	2-NIE (AFRI EDY)	Fonçage	Câble	stationnaire	90-2m (EDY AFRI)	NIEDERREITER 90 (AFR) Sph	Aucun(e)	90 2m TC (AFR)	2019-04-08 15:44:31	EDYTEM
101	2-NIED90-2m PO/TC (AFRI EDY)	Battage-Fonçage	Câble	Piston stationnaire	U-NIEDERREITER 90-2m (EDY AFRI)	8 (cm) NIEDERREITER 90 (AFR) PO	Aucun(e)	4 (cm) NEIDERREITER 90 2m TC (AFR)	2019-04-08 15:45:01	EDYTEM
100	2-NIED63-3m PO/TC (EDY)	Battage-Fonçage	Câble	Piston stationnaire	U-NIEDERREITER 63-3m (EDY)	7 (cm) NIEDERREITER 63 PO	Aucun(e)	4 (cm) NEIDERREITER 63 2m/3m TC	2019-04-08 15:45:40	EDYTEM

Normalised description of any coring/drilling tool + its configuration

- 1- Name of the configuration
- 2- Mode (energy for penetration)
- 3- Link to the energy source
- 4- Type of corer
- 5- Usual name of the corer
- 6- Type of core catcher (if any)
- 7- Type coring bit (if any)
- 8- Type of cutting shoe (if any)
- 9- Latest update
- 10- Corer's owner

Configuration used to take GUY19-I-A-03

**What happens in the lab
(core subsampling and
analytical measurements)
remains mostly a black
box until final processed
data are published**



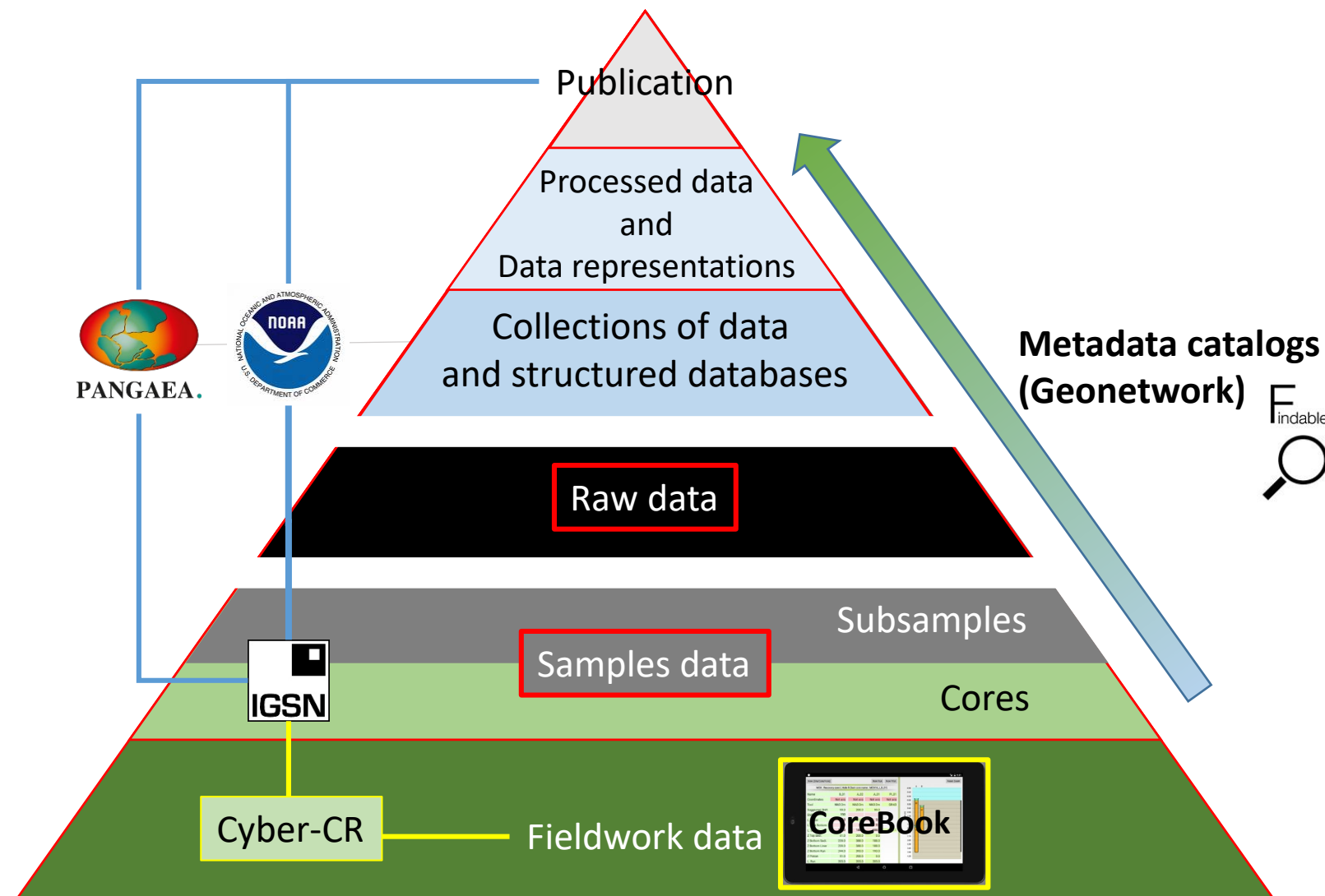
Remaining challenges are :

- 1) Curating core handling and subsampling data
- 2) Keeping track of previous operations (coring, subsampling, sample treatment) while analytical measurements are performed, together with analysis metadata

Ongoing attempts

- 1) Attempt to prolongate the cyber-core repository using [Collec-Science software](#) (not discussed here)
- 2) Prototype of an organised [Paleo-database for basic data](#) : **ROZA**

The pyramid of data: case of field-based (geo)sciences

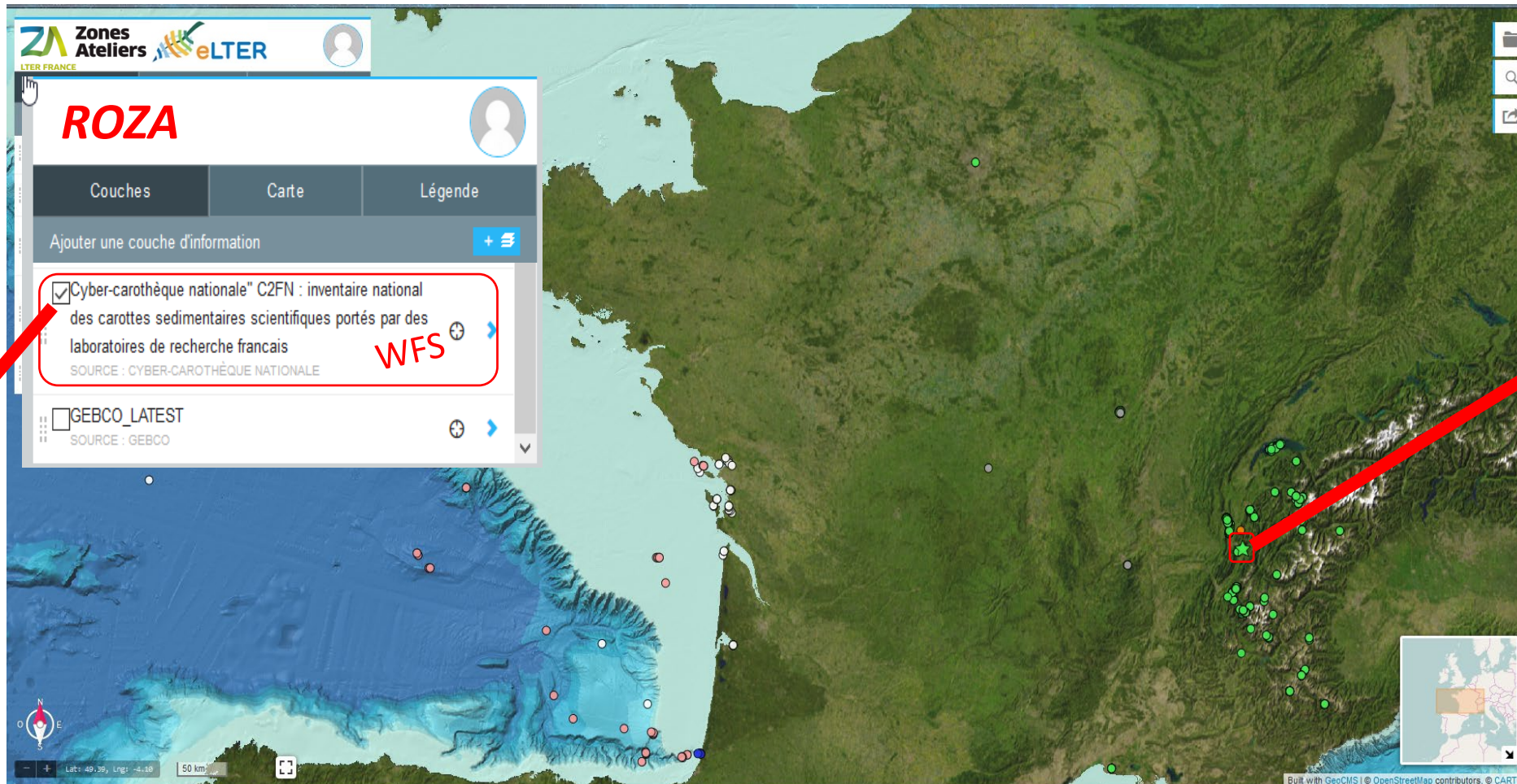
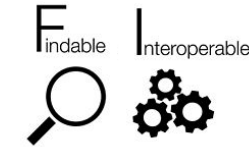


How to turn kilos of mud into megabytes of data?

10 years of efforts in curating lake sediment cores and their associated results

« *French Zones Ateliers* » are the French contribution to the international *Long Term Environmental Research* (eLTER) network

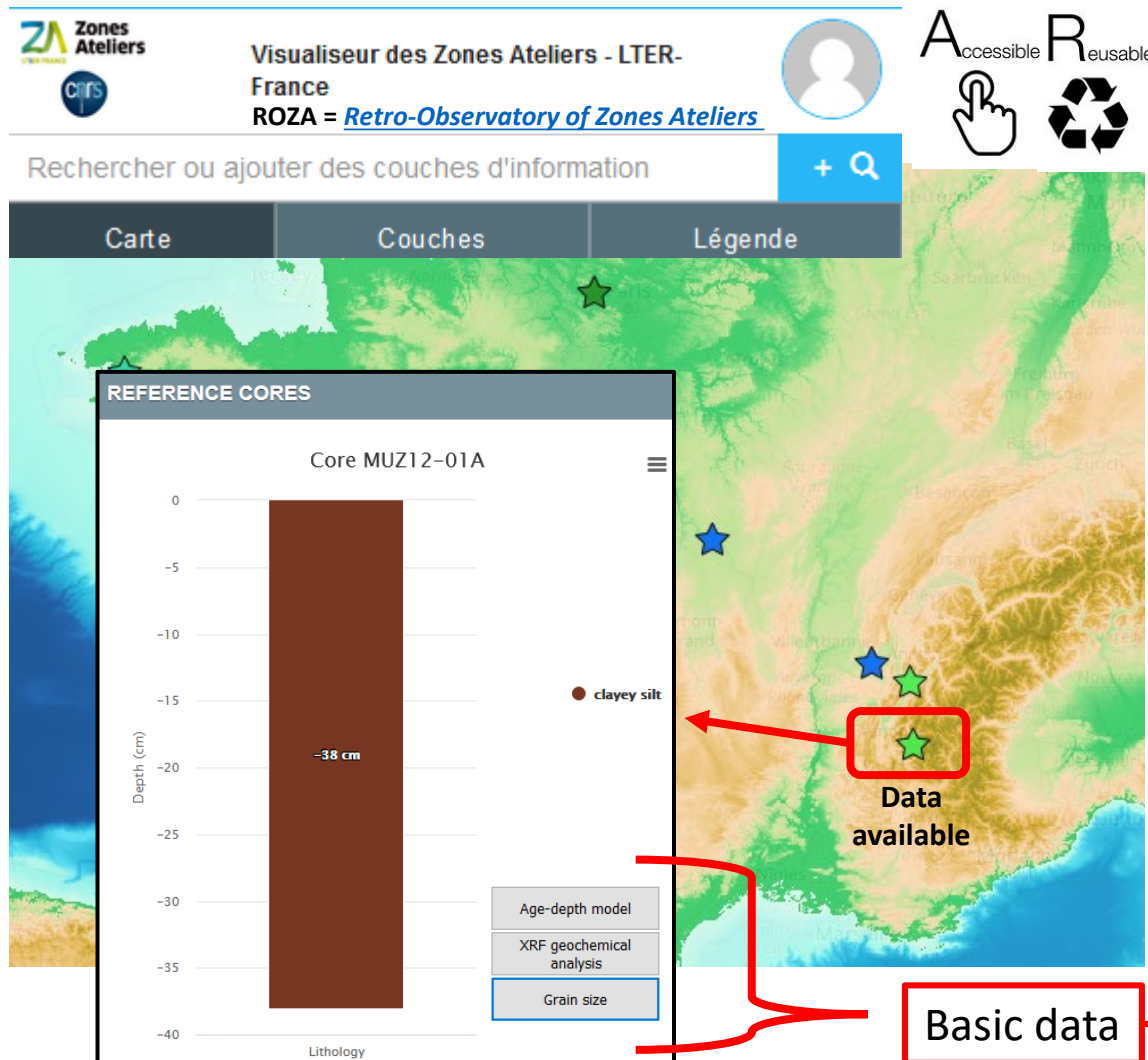
ROZA = Retro-Observatory of Zones Ateliers portal



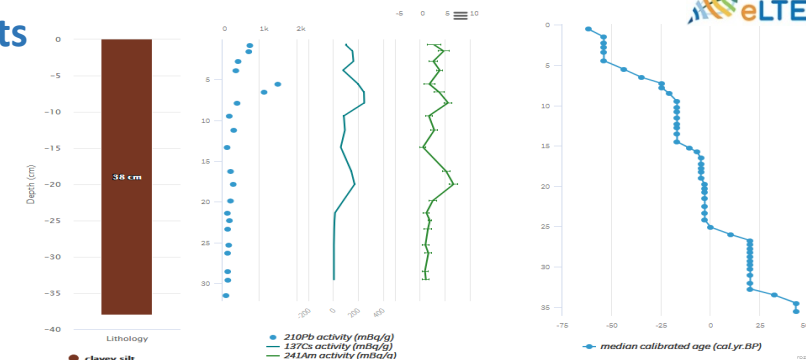
All Marines,
continentals and
ice 's cores
by harvesting WFS
From Cyber Core
Repository



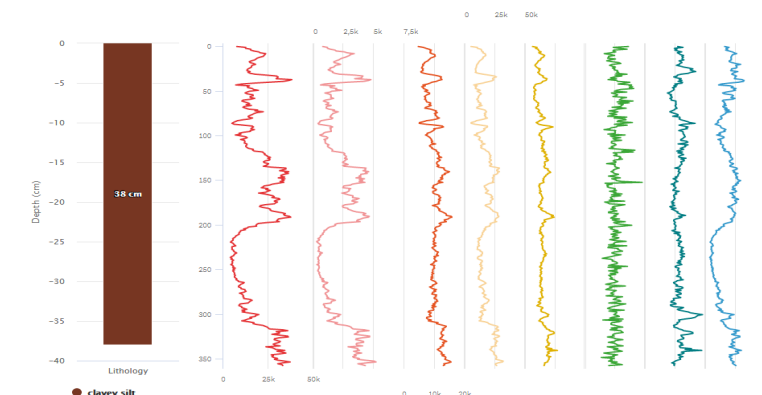
★ = Basic
Data available



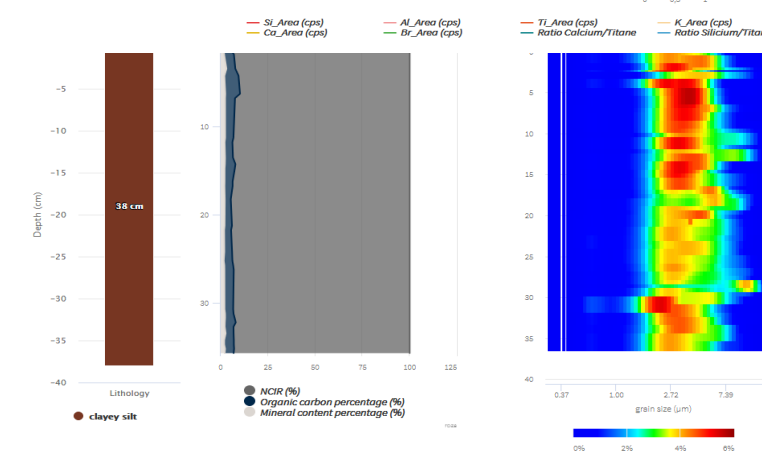
Dating information



XRF core scanner



Loss on Ignition & Grainsize



➔ ROZA aims at providing homogenised basic data to promote the re-use of sites, samples and data within the ZA network

ROZA : standardised data & metadata template

Usual name

IGSN

Usage license

NOMCAROTTE		POU14P1w		SESAIR IGSN		IGSN:EDYFER0025		LICENCE UTILISATION (Creative Commons)		CC-BY-NC-SA																																					
METADONNEES / REFERENCES																																															
Version fichier Reference EDYTEM_XRF_data_12/06/2015																																															
WHAT KIND OF ANALYSE		XRF core scanning																																													
WHERE / LAKE		Poule																																													
WHO / NAME RESEARCHER		Pierre Sabatier																																													
WHEN		25/01/2016																																													
WHY		Application																																													
DOI		PALAS																																													
Tube lenght (mm)		890																																													
Top sediment (mm)		38																																													
Bottom sediment (mm)		889																																													
Sediment lenght (mm)		851																																													
Tube Diameter		63mm																																													
INTRUMENT & SETTINGS		AVAATECH Core Scanner																																													
Source		Rhodium																																													
Voltage (kV)		10																																													
Intensity (mA)		1,2																																													
LiveTime (s)		30																																													
Step (mm)		1																																													
Measured Area (Crosscore*DownCore)		15*1																																													
Filter		No filter																																													
ELEMENTS concerned :		<table border="1"> <tr> <td>Al_Area</td> <td>Cu_Area</td> <td>Ag_Area</td> </tr> <tr> <td>Si_Area</td> <td>Zn_Area</td> <td>Ba_Area</td> </tr> <tr> <td>P_Area</td> <td>Ga_Area</td> <td></td> </tr> <tr> <td>S_Area</td> <td>Br_Area</td> <td></td> </tr> <tr> <td>Cl_Area</td> <td>Rb_Area</td> <td></td> </tr> <tr> <td>K_Area</td> <td>Sr_Area</td> <td></td> </tr> <tr> <td>Ca_Area</td> <td>Y_Area</td> <td></td> </tr> <tr> <td>Ti_Area</td> <td>Zr_Area</td> <td></td> </tr> <tr> <td>Cr_Area</td> <td>Nb_Area</td> <td></td> </tr> <tr> <td>Mn_Area</td> <td>Mo_Area</td> <td></td> </tr> <tr> <td>Fe_Area</td> <td>Pb_Area</td> <td></td> </tr> <tr> <td>Rh_Area</td> <td>Bi_Area</td> <td></td> </tr> </table>										Al_Area	Cu_Area	Ag_Area	Si_Area	Zn_Area	Ba_Area	P_Area	Ga_Area		S_Area	Br_Area		Cl_Area	Rb_Area		K_Area	Sr_Area		Ca_Area	Y_Area		Ti_Area	Zr_Area		Cr_Area	Nb_Area		Mn_Area	Mo_Area		Fe_Area	Pb_Area		Rh_Area	Bi_Area	
Al_Area	Cu_Area	Ag_Area																																													
Si_Area	Zn_Area	Ba_Area																																													
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Ti_Area	Zr_Area																																														
Cr_Area	Nb_Area																																														
Mn_Area	Mo_Area																																														
Fe_Area	Pb_Area																																														
Rh_Area	Bi_Area																																														
Standards (Yes/No, Local Number Certified standards Names)		YES																																													
Operator		Anne-Lise develle (orcid:00000328244106)																																													
Processing softwares		Winaxil, Winaxilbatch (Avaatech)																																													

Sample characteristics
(from Cyber-core repository)

Measurements settings

Measurement variables
(here: list of elements)

Operator's
acknowledgement
(with ORCID)



Ongoing effort

When possible, use
thesaurus/controlled
vocabularies (CHEBI; IUPAC;
QUTD; ...) to provide
unambiguous variables and
units (interoperability)


➔ Referenced in
metadata catalogs

Promote visibility & interoperability

by metadata geocatalogue (ISO19.115)*



Feature variables catalogue



 LTER France Metadata Node
 Rechercher
Visualiser

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Mode affichage

Lac de la Muzelle - Carottage Muz12-1 – Plant cover and erosion dynamics : impacts of pastoral activities and climatic changes over the last 1600 years - 2017 – (IGSN:IEFRA00A4)






The reconstruction of human and climate-driven Earth-shaping dynamics is important for understanding past human/environment interactions and for helping human societies that currently face global changes. However, it is often challenging to distinguish the effects of the climate from human activities on environmental changes such as erosion dynamic and plant cover. Here we evaluate an approach based on DNA metabarcoding used on lake sediments to provide high-resolution reconstruction of plant cover and livestock farming history over the last 1600 years. By comparing these data with reconstructions of erosive event frequency and glacier fluctuations, we can show that the erosion dynamic was primarily driven by climatic changes. The tree/shrub cover decreasing and the associated development of grazing activities in the last 500 years had no noticeable impacts on the erosive event frequency. However, this period corresponds to the development of herbaceous plants with different and various ecological preferences, which shows the presence of a mosaic landscape. Tracking plants using lake sediment DNA (lake sedDNA) is an emerging and promising method for tracing past plant cover dynamic and better understand the roles of climatic changes and human activities on landscape changes. Composite coring sequence : site Muz12-1 – avril 2012 (IGSN:IEFRA00A4). The sequence covered period from 303 to 2012 (-year). LTER platform Lautaret-Oisans / Zone Atelier Alpes

Aucune évaluation ★
[Voir tous les commentaires](#)
[Ajouter votre commentaire](#)

Étendue spatiale
 Étendue temporelle

Téléchargements et liens

 Zone Atelier Alpes
 LTER-ZAA <http://www.za-alpes.org/> [Ouvrir le lien](#)


 LTER Zone Atelier Alpes - Mastersite Lautaret-oisans
 LTER-site <https://deims.org/79d6c1df-570f-455f-a929-6cfe5c4ca1e9> [Ouvrir le lien](#)

GitHub API

Link with vocabulary

Thesaurus / Vocabulary

(multi-language)



GENERAL

- Agroecology
- Biodiversity
- Farming practices
- Catchment
- Hydrology

INSPIRE

- Géology
- Habitats_and_biotopes
- Land_use

GEMET

- recherche scientifique
- donnée environnementale
- recherche sur l'environnement et développement
- étude de milieu
- données géoréférencées
- banque d'échantillons de l'environnement
- échantillonnage
- technique d'échantillonnage
- sédimentologie
- sédimentation
- glacier
- vase
- argile
- datation
- spectroscopie
- élément chimique

ENVTHES

- environmental analysis
- experimental research
- biodiversity
- core
- cores
- sampling date and time
- sampling parameter
- sediment
- sediment chemistry
- chemical analysis

NCBI

- Pinus
- Rumex
- Plantago

LINKED-EARTH

- flood frequency
- age modele

Feature catalog

Dictionnaire de données (Inter-ZA ROZA) : SHORT LIVE NUCLIDES

Technical information

Name	Definition
210 Pb Energy (keV) (FLOAT)	Grainsize
210Pb_ACTIVITY (mBq/g) (FLOAT)	
210Pb_ACTIVITY_uncert (mBq/g) (FLOAT)	
226Ra_ACTIVITY (mBq/g) (FLOAT)	
226 RaEnergy (keV) (FLOAT)	
226Ra_ACTIVITY_uncert (mBq/g) (FLOAT)	
137 CsEnergy (keV) (FLOAT)	
137Cs_ACTIVITY (mBq/g) (FLOAT)	
137Cs_ACTIVITY_uncert (mBq/g) (FLOAT)	
241 Am Energy (keV) (FLOAT)	
241Am_ACTIVITY (mBq/g) (FLOAT)	

Dictionnaire de données (Inter-ZA ROZA) : Classement, Q90, Q99)

Technical information

Name	Definition
Grain moyen (REAL)	Measurement variables
Classement (FLOAT)	
Q90 (REAL)	
Q99 (REAL)	

Dictionnaire de données (Inter-ZA ROZA) : Scanner"


Technical information

Name	Definition
Si_Area (INTEGER)	Fluorescence X
P_Area (INTEGER)	
S_Area (INTEGER)	

List of values

* Create by R workflow « Geoflow »


Interoperability by Geocatalogue métadonnées (ISO19115)

 LTER France Metadata Node
 Rechercher Visualiser

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Lac de la Muzelle - Carottage Muz12-I – Plant cover and erosion dynamics : impacts of pastoral activities and climatic changes over the last 1600 years - 2017 – (IGSN:IEFRA00A4)

The reconstruction of human and climate-driven, Earth-shaping dynamics is important for understanding past human/environment interactions and for helping human societies that currently face global changes. However, it is often challenging to distinguish the effects of the climate from human activities on environmental changes such as erosion dynamic and plant cover. Here we evaluate an approach based on DNA metabarcoding used on lake sediments to provide high-resolution reconstruction of plant cover and livestock farming history over the last 1600 years. By comparing these data with reconstructions of erosive event frequency and glacier fluctuations, we can show that the erosion dynamic was primarily driven by climatic changes. The tree/shrub cover decreasing and the associated development of grazing activities in the last 500 years, had no noticeable impacts on the erosive event frequency. However, this period corresponds to the development of herbaceous plants with different and various ecological preferences, which shows the presence of a mosaic landscape. Tracking plants using lake sediment DNA (lake sedDNA) is an emerging and promising method for tracing past plant cover dynamic and better understand the roles of climatic changes and human activities on landscape changes. Composite coring sequence : site Muz12-I – avril 2012 (IGSN:IEFRA00A4). The sequence covered period from 303 to 2012 -year). LTER platform Lautaret-Oisans / Zone Atelier Alpes

Téléchargements et liens

 Zone Atelier Alpes LTER-ZAA http://www.za-alpes.org/	Ouvrir le lien
 LTER Zone Atelier Alpes - Mastersite Lautaret-oisans LTER-site https://deims.org/79d6c1df-570f-455f-a929-6cfe5c4ca1e9	Ouvrir le lien

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Étendue spatiale

Étendue spatiale

Étendue temporelle


Date de création
2020-11-13

Fourni par



Mis à jour :


Discover eLTER Data Visualization Time Series Data Discovery Service

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Section de carottage MUZ12-01A - LAC DE LA MUZELLE, Date carottage (04/2012)


Core MUZ12-01A is the first run/section (0-36cm) of the MUZ12-I sequences (Maximum DEPTH, sediment/rock: 2.835 m)

Keywords : climate, Holocene, montane lake, Floods, LTER Zone Atelier Alpes ZAA, Projet ROZA

Keywords (Analytics) :
 XRF,
 DRY-MATTER,
 LOI,
 GRAIN SIZE,
 RADIOCARBON,
 SHORT LIVED RADIONUCLIDES,
 PHOTOGRAPHY

[En cours de création](#)

Spatial extent
 • France 44 95069400 6 09669400
 Spatial extent

Temporal extent
Creation date
 2017-07-01
Period
 Sun Apr 01 2012 00:00:00 GMT+0200 → Sun Apr 01 2012 00:00:00 GMT+0200
Provided by

Updated:



Harvesting (CSW)

10 years of efforts in curating lake sediment cores and their associated results

Achievements

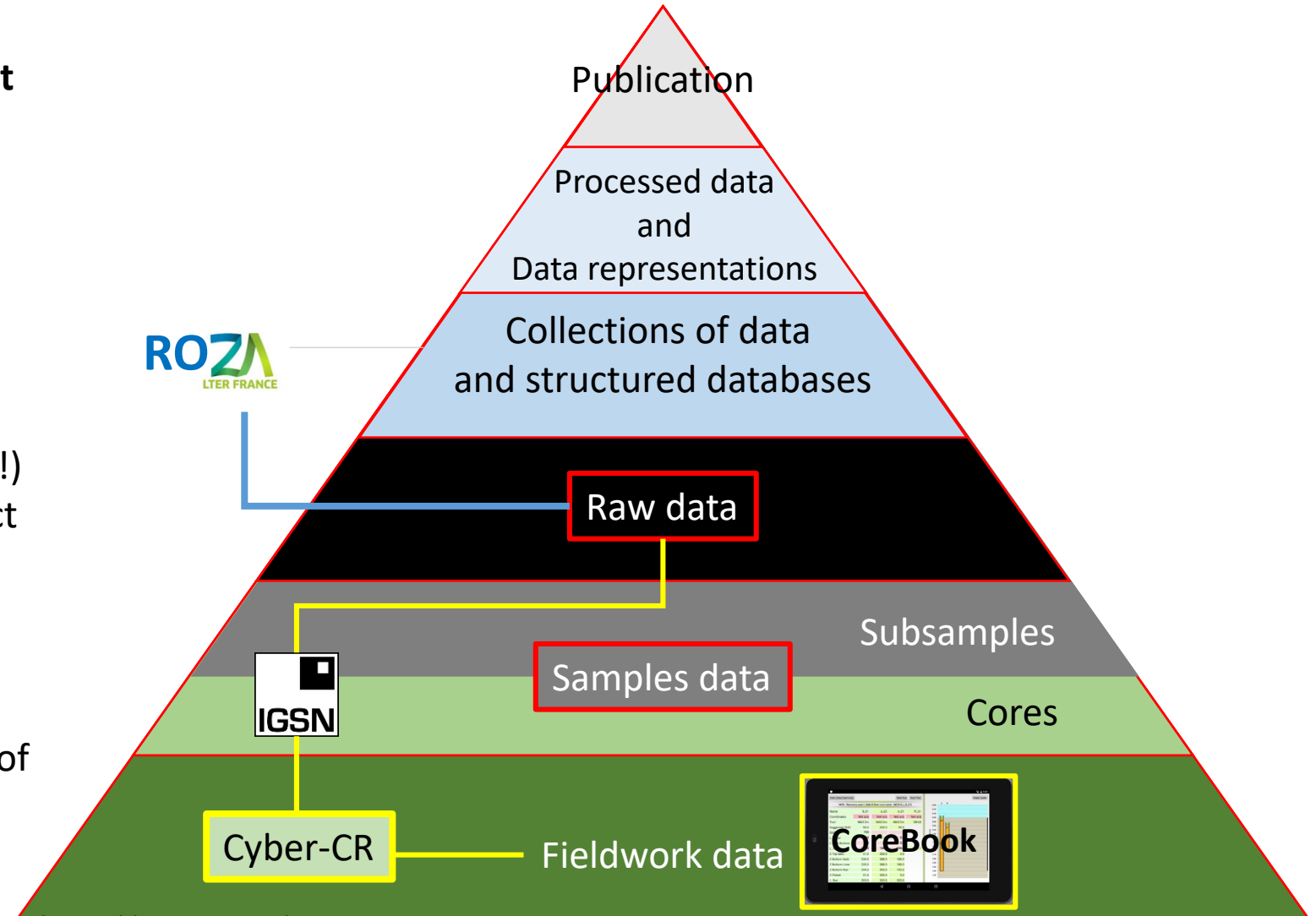
With ROZA, it is possible to get a dataset that is linked to its:

- measurement metadata (LTER catalogue)
- sample data (IGSN)
- Fieldwork data (Cyber-Core repository)

Remaining challenges are :

- **ROZA is just a prototype** (with lot of flaws!)
- Propose an user-friendly workflow to inject data
- Deal with sub-samples (currently, only the core level is treated)
- Extend the database (only 4 cores...)
- **Include treated data:** age-models instead of dating data → **SERAC**

The pyramid of data: case of field-based (geo)sciences

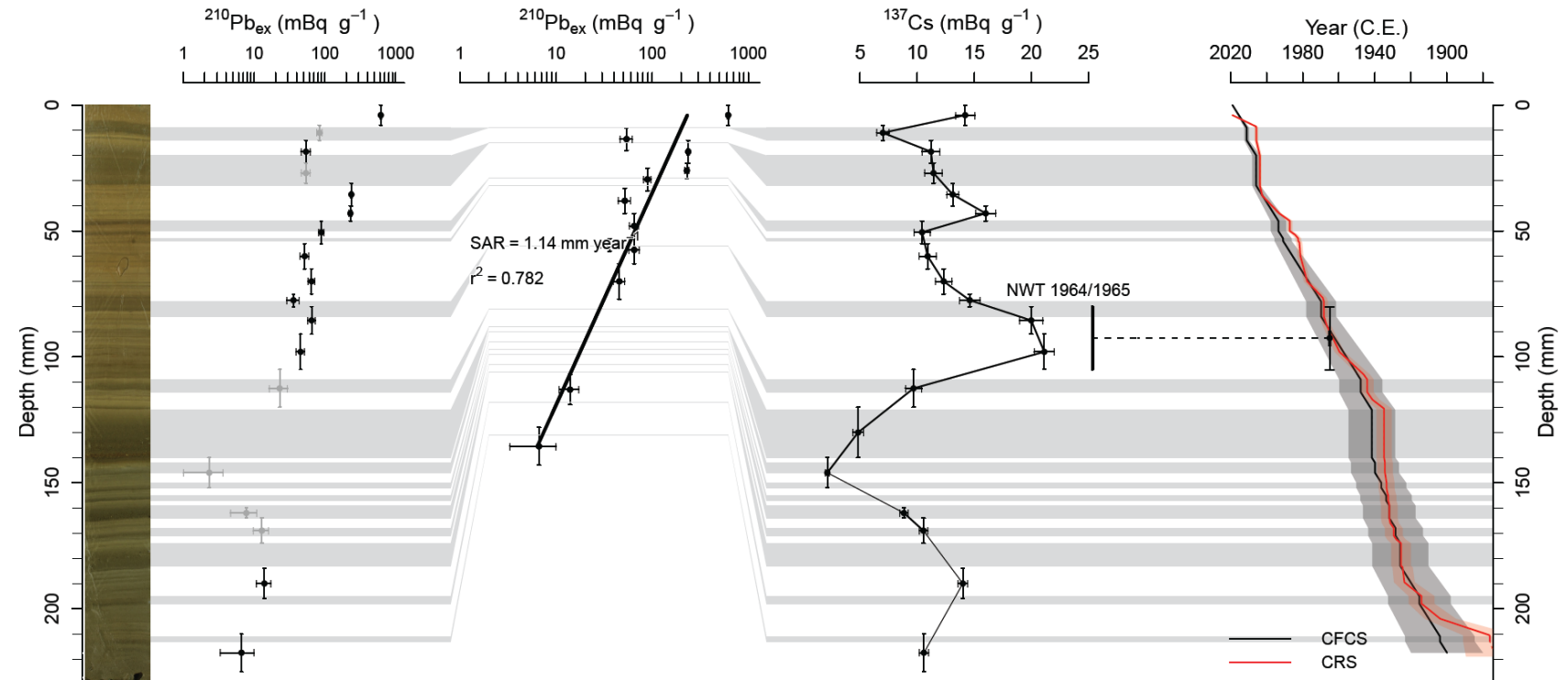


Metadata fields
including IGSN
and cyber-core
repository
references

ROZA-like
standardised
data template

SERAC

Standardised data representation



Standardised treated data with reproducible protocol

Corebook

- Gathers standardised fieldwork data

Cyber-core repository

- Banks fieldwork data
- Links rich fieldwork data with IGSN

IGSN

- Provides unique identifier for upper levels

ROZA

- Standardised dataset linked with:
 - measurement metadata (LTER catalogue)
 - sample data (IGSN)
 - Fieldwork data (Cyber-Core repository)

SERAC provides:

- A **publishable** standardised representation of radionuclide data
- A standardised age model file with a **reproducible** protocol
- Links to underlying levels of the pyramid



In the case of radionuclide dating, it is possible to link all levels of the pyramid

Limits



- ROZA is just a prototype, not used in routine
- Not yet satisfying management of subsamples
- No generalised use of Lab. Information systems
 - No ongoing projects to standardize other types treated of paleo-data
 - **Needs more integration within international projects**

