

# Metadata and data standardization for analytical data publication

*Jose-Luis Fernandez-Turiel and Marta Rejas, CSIC  
EPOS TCS Multiscale Laboratories*

**EPOS | TCS Multi-scale laboratories Meeting**

12-14 June 2019 | Montpellier

*venue | Salle des colloques, CNRS, 1919 route de Mende, 34293, Montpellier, France*



**EPOS**  
EUROPEAN RESEARCH INFRASTRUCTURE CONSORTIUM

**ERIC**

is designed to DRIVE the INTEGRATION of Thematic and Integrated Core Services and to GOVERN the EPOS DELIVERY FRAMEWORK

GEO Week 2019 & Canberra Ministerial Summit, in Camberra (Australia), 4-9 November 2019 - The week's events will focus on ensuring data about our planet becomes a core input to our strategic economic decision making and our day-...

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### INTRODUCING EPOS

Viable solutions to tackle solid Earth grand challenges



### EPOS ERIC



EUROPEAN RESEARCH

## MULTI-SCALE LABORATORIES



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### OVERVIEW | CONTACT

TCS Multi-scale laboratories includes a wide range of world-class experimental laboratory infrastructures: from high pressure-temperature rock and fault mechanics and rock physics facilities, to electron microscopy, micro-beam analysis, analogue modelling and paleomagnetic laboratories.

OVERVIEW | CONTACT

OBJECTIVES

INTERNAL ORGANIZATION

SERVICES

NEWS & EVENTS

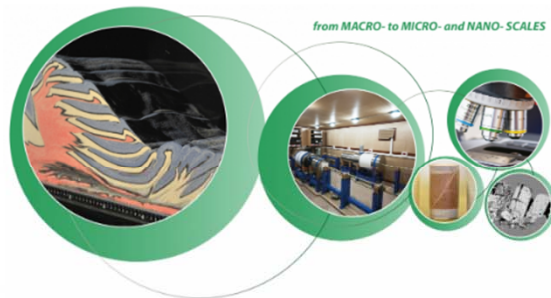
OUTREACH MATERIALS

About us

Consortium Partners

Laboratories

Contact



Understanding the processes that control the Earth's interior, and how these control phenomena ranging from earthquakes to volcanic eruptions to the formation of natural resources, requires a research approach that combines a vast range of spatial and temporal scales. For example, the catastrophic effects of an earthquake that lasts a few seconds, are intimately linked to the previous millions of years of geological history and to the properties of nanometre scale minerals within the fault zone. This multi-scale nature of processes that operate Earth is reflected in the huge diversity of methods

NEWS & EVENTS

Source: <https://epos-ip.org/tcs/multi-scale-laboratories/overview-contact>

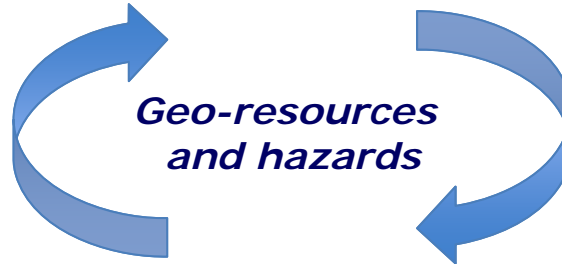
# TCS mission

- Creating a coherent and well-organized **network** of solid Earth Science laboratories
- Implementing dedicated **data services** that will guarantee laboratory data harmonization for re-usability and interoperability with other solid Earth Science data
- Developing a **Trans-national Access (TNA)** program, that will increase European state-of-the-art solid Earth science laboratories' attractiveness for researchers and contribute to increased researcher's mobility, cooperation and exchange





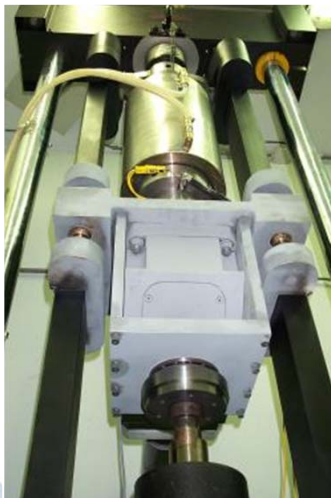
*Geological processes*



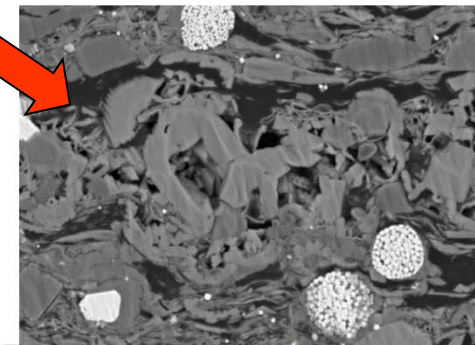
*Geo-laboratories*



**... covering the macro- to micro- and nano-scales**



main fracture sample holder



# Expertise & Beneficiaries

The Multi-scale laboratories infrastructures are grouped into four main application areas:

Analogue Modelling Laboratories

Paleomagnetism Laboratories

Rock & Melt Physics Experimental Laboratories

Analytical & Microscopy Laboratories

# Analogue modelling laboratories

Laboratory	Institute, city, country	Contact
lume Laboratory	Utrecht University, Utrecht, The Netherlands	Joris Eggenhuisen
Fragmentation Lab	Ludwig-Maximilians-University Munich, Munich, Germany	Corrado Cimarelli
GEOMODELS Lab	Universitat de Barcelona, Barcelona, Spain	Oriol Ferrer
HelTec - Helmholtz Laboratory for Tectonic Modelling	GFZ German Research Centre for Geosciences, Potsdam, Germany	Matthias Rosenau
Laboratorio de Deformació Experimental	Universitat Autònoma de Barcelona, Barcelona, Spain	Elena Druguet
Laboratorio de Modelización Analógica	Universidad de Zaragoza-IGME, Zaragoza, Spain	Teresa Román
Laboratorio de Modelización Analógica de Estructuras Geológicas	Universidad de Granada, Granada, Spain	Ana Crespo
Laboratory of Experimental Tectonics	Università degli studi Roma TRE, Rome, Italy	Francesca Funicello
Magma Chamber Analogue Modelling Laboratory	CSIC-ICTJA, Barcelona, Spain	Adelina Geyer
TecLab Bern	Bern University, Switzerland	Guido Schreurs
TecLab Utrecht	Utrecht University, Utrecht, The Netherlands	Ernst Willingshofer
TecMOD - FASTmodel	CNRS-Paris Sud Orsay University, Paris, France	Anne Devaille
TecMOD - GECmodel	CNRS-Cergy-Pontoise University, Pontoise, France	Pauline Souloumiac
TecMOD - GEOAZURmodel	CNRS-Nice Sophia Antipolis University, Nice, France	Stéphane Bouissou
TecMOD - Geoplax	CNRS-Maine University, Le Mans, France	Régis Mourgues
TecMOD - GETmodel	CNRS-Toulouse University, Toulouse, France	Stéphane Bonnet
TecMOD - Gmmodel	CNRS-Montpellier University, Montpellier, France	Stephane Dominguez
TecMOD - Grmodel	CNRS-Rennes 1 University, Rennes, France	Benjamin Guillaume
TecMOD - LMVmodel	CNRS-Clermont-Ferrand University, Clermont-Ferrand, France	Olivier Roche
TecMOD - LOGmodel	CNRS-Lille 1 University, Lille, France	Bruno Vendeville
Tectonics Modelling Laboratory	IGG-CNR, Florence, Italy	Marco Bonini

# Rock & Melt Physics Experimental Laboratories

Laboratory	Institute, city, country	Contact
Experimental rock deformation/HPT-lab	Utrecht University, Utrecht, The Netherlands	Chris Spiers
HP-HT Laboratory of experimental Volcanology and Geophysics	INGV, Rome, Italy	Piergiorgio Scarlato
Rock Deformation Laboratory	ETHZ, Zurich, Switzerland	Claudio Madonna, Alba Zappone
Melt and magma thermal analysis lab/High temperature melt lab	Ludwig-Maximilians-University Munich, Munich, Germany	Corrado Cimarelli
RMPL- The Rock Mechanics and Physics Laboratory	BGS British Geological Survey, Keyworth, UK	Helen Reeves, Audrey Ougier-Simonin
Rock Mechanics Laboratory	University of Portsmouth, Portsmouth, UK	Philip Benson
Rock & Ice Physics Laboratory	UCL University College London, London, UK	Philip Meredith
Experimental Geoscience Facility	The University of Edinburgh, Edinburgh, UK	Ian Butler, Ian Main
Rock Mechanics Laboratory	Durham University, Durham, UK	Stefan Nielsen
Geomechanics Laboratory, GEOLAB-CERENA	Instituto Superior Técnico, Lisbon, Portugal	Matilde Horta
Microseismology and Rock Physics Laboratory	ISEL - Physics Department, Lisbon, Portugal	Mário Moreira
Laboratoire de Géologie	CNRS-Ecole Normale Supérieure, Paris, Paris, France	Patrick Baud; Alexandre Schubnel
Laboratoire de mécanique des solides	Ecole Polytechnique, Paris, France	Patrick Baud
Georessources	CNRS-Université de Lorraine, Nancy, France	Patrick Baud
Laboratoire de déformation	CNRS-EOST/Université of Strasbourg, Strasbourg, France	Patrick Baud
Laboratoire 3S-R	CNRS-Université de Grenoble, Grenoble, France	Patrick Baud
ISTERRE	CNRS-Université de Grenoble Alpes, Grenoble, France	Patrick Baud
Laboratoire des fluides complexes et leur réservoirs	CNRS-Université de Pau, Pau, France	Patrick Baud
Geosciences Montpellier	CNRS-Université de Montpellier, Montpellier, France	Patrick Baud
Rock Deformation Laboratory	GFZ German Research Centre for Geosciences, Germany	Erik Rybacki
Experimental Petrology Laboratory	IGEO, CSIC	Antonio Castro Dorado



# Paleomagnetism laboratories

Laboratory	Institute, city, country	Contact
Paleomagnetic Laboratory Fort Hoofddijk	Utrecht University, The Netherlands	Mark Dekkers
Paleomagnetic Laboratory	INGV, Rome, Italy	Leonardo Sagnotti; Aldo Winkler
Paleomagnetic Laboratory	Università degli studi "Roma TRE", Rome, Italy	Francesca Cifelli
Laboratory of Paleomagnetism	CSIC-ICTJA and Universitat de Barcelona, Barcelona, Spain	Bet Beamud
Archeomagnetism Laboratory	CENIEH Burgos, Burgos, Spain	Josep M. Pares
Laboratory of Paleomagnetism	CSIC-IPNA, Santa Cruz de Tenerife - Islas Canarias, Spain	Vicente Soler
Laboratory of AMS (paleomagnetism) and Geophysical Prospection	IGME-Universidad de Zaragoza, Zaragoza, Spain	Emilio L. Pueyo
Laboratory of Paleomagnetism	Universidad Complutense de Madrid (UCM) and CSIC-IGEO, Madrid, Spain	Maria Luisa Osete
Paleomagnetic and Rock Magnetic Laboratory	Universidad de Burgos, Burgos, Spain	Juan José Villalaín
Laboratory of Paleomagnetism	Universidad de Vigo, Vigo, Spain	Daniel Rey García
Group of Magnetic Applications	Universitat Autònoma de Barcelona (UAB), Barcelona, Spain	Lluís Casas
Paléomagnétisme IPG Paris	CNRS-Sorbonne Paris Cité University, Paris, France	Lagroix France
Paléomagnétisme LSCE Gif sur Yvette	CNRS-Versailles St Quentin University, Versailles, France	Kissel Catherine
Paléomagnétisme Géosciences Rennes	CNRS-Rennes 1 University, Rennes, France	Roperch Pierrick
Paléomagnétisme Géosciences Environnement	CNRS-Toulouse University, Toulouse, France	Macouin Melina
Paléomagnétisme Géosciences Montpellier	CNRS-Montpellier University, Montpellier, France	Poidras Thierry
Paléomagnétisme CEREGE Aix en Provence	CNRS-Aix Marseille University, Aix en Provence, France	Rochette Pierre

# Analytical & microscopy laboratories

Laboratory	Institute, city, country	Contact
Electron Microscopy facilities	Utrecht University, Utrecht, The Netherlands	Martyn Drury
HP-HT Laboratory of experimental Volcanology and Geophysics	INGV, Rome, Italy	Piergiorgio Scarlato
Laboratory of X-ray diffraction	CSIC-ICTJA, Spain	Jordi Ibáñez Insa; Josep Elvira
Laboratory of Geochemistry labGEOTOP	CSIC-ICTJA, Spain	Marta Rejas; Jose-Luis Fernandez-Turiel
Laboratorios Analíticos	IGME-Universidad de Zaragoza, Spain	Pablo Valverde
C.A.I. of Geochronology and Isotope Geochemistry	Universidad Complutense de Madrid (UCM), Spain	María del Carmen Galindo
Laboratorio de Geocronología	Universidad de Cádiz, Spain	Luis Barbero
IBERSIMS Facility	Universidad de Granada, Spain	Fernando Bea; Antonio Azor
Laboratorios Analíticos de Geoquímica	Universidad de Oviedo, Spain	David Pedreira
Geochronology and Isotope Geochemistry Facility-SGIker	Universidad del Pais Vasco, Spain	José Ignacio Gil Ibarguchi
Laboratorios Analíticos de Geología	Universitat de Barcelona, Spain	Albert Soler
Laboratory of Stable Isotopes and Noble Gas NUCLEUS	Universidad de Salamanca, Spain	Antonio M. Alvarez Valero
ANDALCHRON	CSIC-IACT, Spain	Carlos J. Garrido
LCGM Laboratory for Characterization of Geological Materials	FCUP, Portugal	Alexandra Guedes
Electron Microprobe	LNEG-UCTM, Portugal	Adelaide Ferreira; Fernanda Guimares
Electron Microprobe, XRD, FTIR, and XRF	FCUL, Portugal	Mário Gonçalves
Geochronology and Isotope Geochemistry:	IGG-CNR, Italy	Gianfranco Di Vincenzo
Laboratory of Gas Geochemistry:	IGG-CNR, Italy	Chiara Boschi
Geochemical Microanalysis and Crystal-Chemistry:	IGG-CNR, Italy	Alberto Zanetti

Source: <https://epos-ip.org/tcs/multi-scale-laboratories/overview-contact>

# Purpose data services

- Full support of **suitable** work-flow for data dissemination (i.e., data publications) for **every** researcher or group of researchers involved in the Multi-scale laboratories community, all under the constraints of strict **quality** demands
- Securing **standards** and **harmonization**
- Share **FAIR**\* data via EPOS Portal

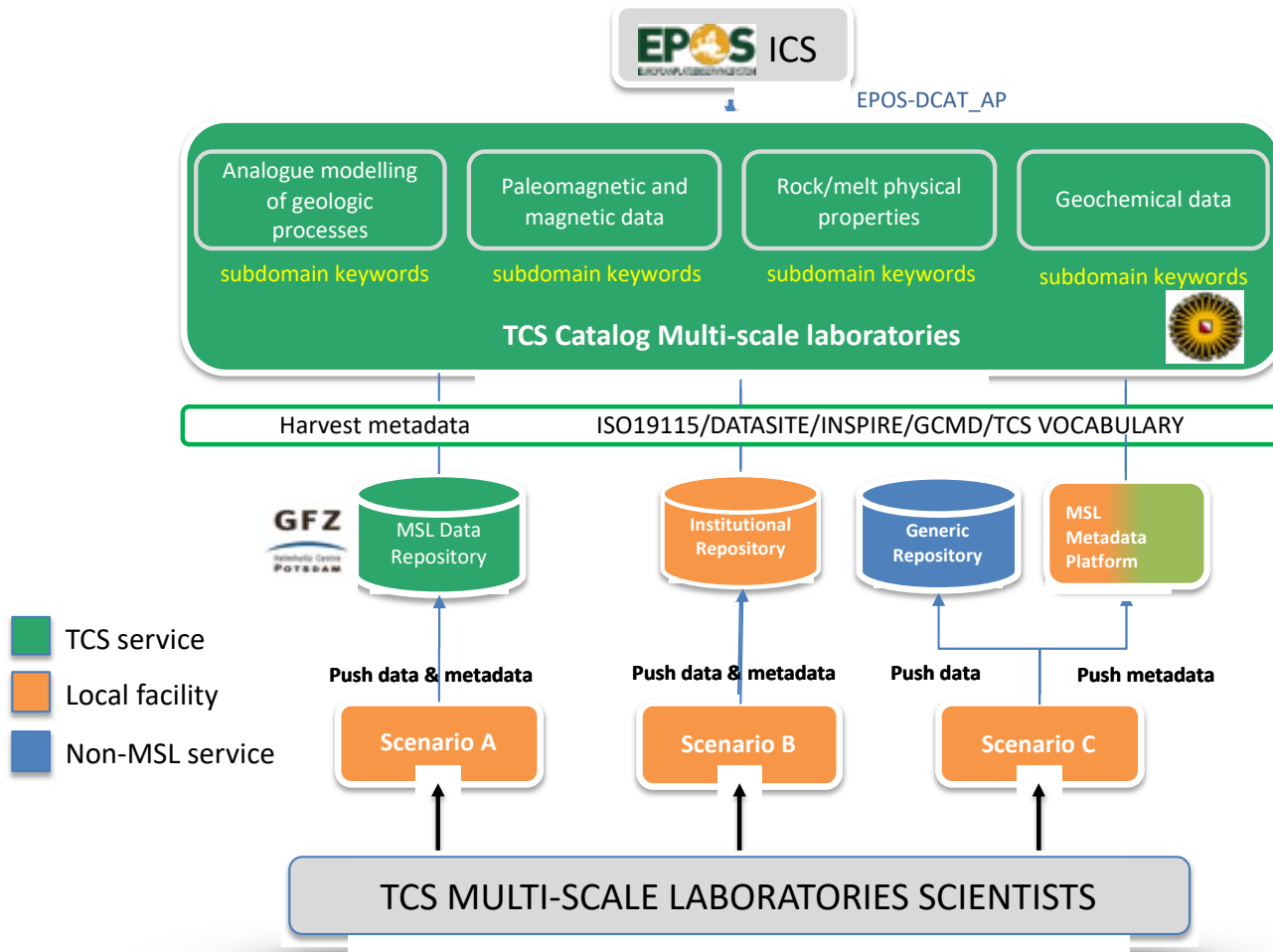
\* **F**indable, **A**ccessible, **I**nteroperable, **R**eusable

# Data publications

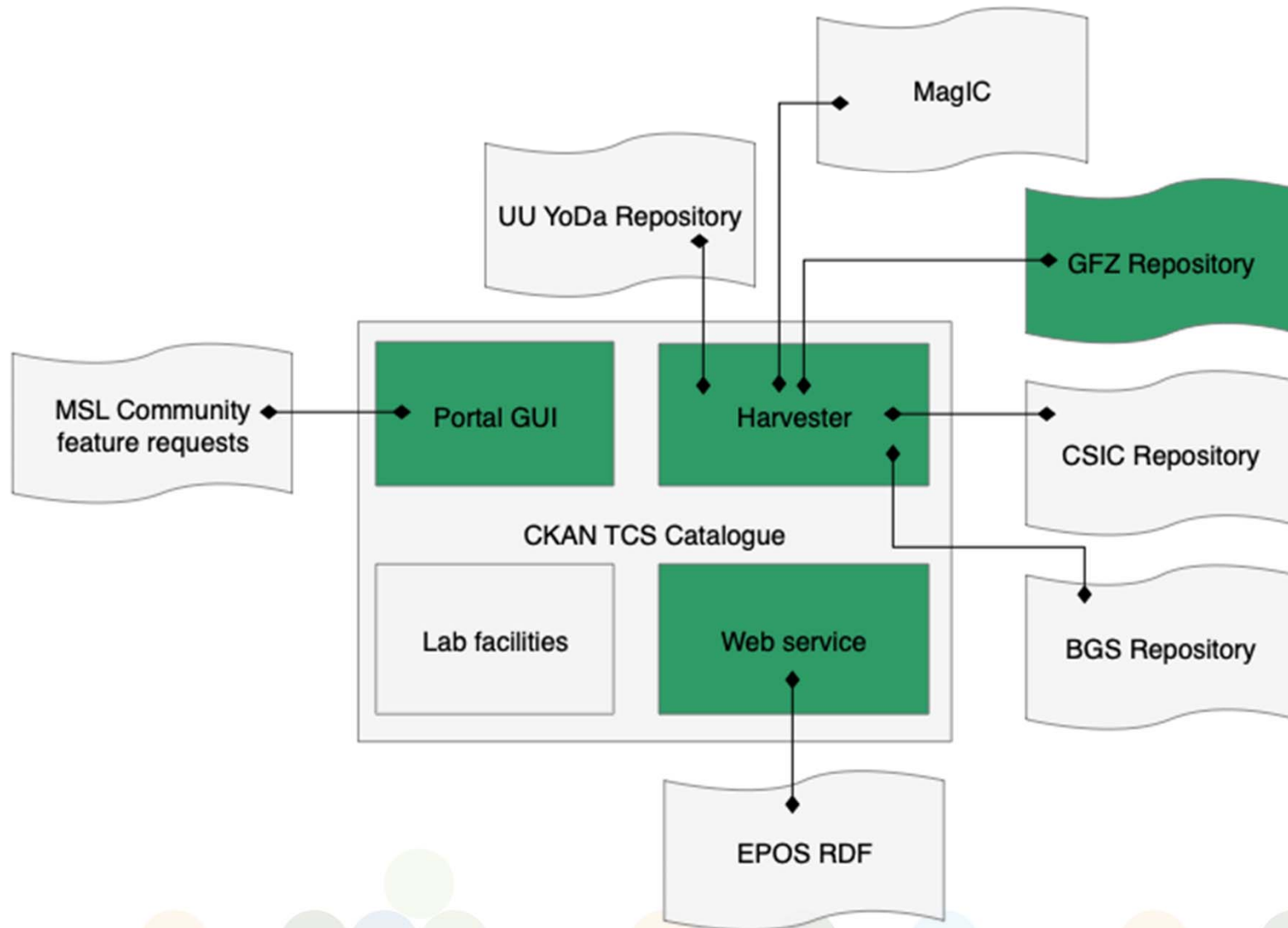
- **Accessibility:** open standardized protocols for metadata retrieval, uniquely referenced by DOI
- **Interoperability:** quality check on data packages (e.g., completion, understandability)
- **Reusability:** data policy prescribes open license and limited embargo period
- All covered by **sustainable repository**



# (IT-) Architecture



  
 CONSEJO SUPERIOR DE INVESTIGACIONES CIENTÍFICAS  
  
**British Geological Survey**  
 NATURAL ENVIRONMENT RESEARCH COUNCIL  
  
**Utrecht University**  

### Search data

E.g. environment

Popular keywords multi-scale laborat... TECTONICS  
EARTH SCIENCE SERVICES

### EPOS - Multi-scale laboratories data catalog statistics

49 datasets 24 labs 4 groups



This is the central data catalog of the EPOS Multi-scale laboratories community. Here you can find openly published data coming from a wide range of world-class experimental laboratory infrastructures: from high pressure-temperature rock and fault mechanics and rock physics facilities, to electron microscopy, micro-beam analysis, analogue modelling and paleomagnetic laboratories. More information about the Multi-scale laboratories community is to be found at <https://epos-ip.org/tcs/multi-scale-laboratories>.

### Experimental rock deformation/HPT-Lab (Utrecht University, The Netherlands)

HPT Laboratory, Faculty of Geosciences, Utrecht...

#### Mechanical and microstructural data used in the article Pijnenburg et al., De...

Hydrocarbon or groundwater production from sandstone reservoirs can result in surface subsidence and induced...

#### Discrete Element Method model data of biaxial shear deformation

Owing to their destructive potential, earthquakes receive considerable attention from laboratory studies. In friction...

### analogue models of geologic processes

analogue-

#### Supplementary material to "Rough subducting seafloor reduces interseismic cou..."

This dataset contains digital image correlation (DIC) data of eight seismotectonic analogue experiments that were...

#### Supplementary material to "Machine Learning can predict the timing and size o..."

This data set includes the results of digital image correlation of one experiment on subduction megathrust...

Portal TCS  
Multi-scale laboratories

<https://epos-msl.uu.nl/>

# Dataset of analytical results

- Common and specific metadata
- Analytical information
  - *Samples*
  - *Data*
  - *Methods*



# How to proceed ?

- Register your samples
- Upload the dataset to a repository
  - Add common metadata to dataset
  - Add specific metadata to data and methods
- Cite dataset in papers

# Register your samples

## Motivation: There is a need to...

- address requirements for **reproducibility** of sample-based data.
- ensure discovery, access, and re-usability of samples and data derived from them.
- **unambiguous citation of physical samples**
  - sample collectors need to get credit for the intellectual effort and resources they put into collection, preparation, and curation.
- **improve data Integration**
  - sample data are highly dispersed because a single sample is often studied in many different labs and over long periods of time with data published in multiple articles.
  - the utility of these data is substantially higher when combined.

Credit: Kirsten Elger, Damian Ulbricht (GFZ); Kerstin Lehnert (IEDA)

# Register your samples



HOME

MEMBERSHIP

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## Register Your Samples

Multiple organizations operate as Allocating Agents (AA) of the IGSN\*. Please review the scope and capabilities of each AA below to determine the most appropriate AA to register your samples with and obtain IGSNs from. If you are unsure about which AA is best for your samples, please contact [info@igsn.org](mailto:info@igsn.org).

- **System for Earth Sample Registration (SESAR)** <http://www.geosamples.org>
- **CSIRO Mineral Resources** <http://www.csiro.au/en/Research/MRF>
- **MARUM Centre for Marine Environmental Sciences, Univ. Bremen** <http://www.marum.de>
- **German Research Centre for Geosciences GFZ, Potsdam** <http://www.gfz-potsdam.de/en/section/centre-for-scientific-drilling/>
- **Geoscience Australia** <http://ldweb.ga.gov.au/igsn/>
- **Curtin University, De Laeter Centre for Geochemistry** <http://jdlc.edu.au/>

<http://www.igsn.org/register-your-samples>



EUROPEAN PLATE OBSERVING SYSTEM phone +39 06 51860.401 / 577 / 652 / 636 | fax +39 06 51860565 | [epos@ingv.it](mailto:epos@ingv.it) | [epos.secretariat@ingv.it](mailto:epos.secretariat@ingv.it) | [www.epos-eu.org](http://www.epos-eu.org)



# What is the International Geo Sample Number (IGSN)?

- Globally unique identifier for physical samples and materials
- Central registration based on the Handle system
- QR Code on the sample



5054\_1\_A 550- 3

Interval [cm from top of section]:  
52-68  
International GeoSample Number (IGSN):  
ICDP5054EX2Z501



Sample Requested by:  
COSC0042  
Sample Curated by:  
HL

- → Sample description online via IGSN Landing Pages
- IGSN citation in papers possible

<http://igsn.org/10273/ICDP5054EX2Z501>

Credit: Kirsten Elger, Damian Ulbricht (GFZ)



EUROPEAN PLATE OBSERVING SYSTEM

phone +39 06 51860.401 / 577 / 652 / 636 | fax +39 06 51860565 | [epos@ingv.it](mailto:epos@ingv.it) | [epos.secretariat@ingv.it](mailto:epos.secretariat@ingv.it) | [www.epos-eu.org](http://www.epos-eu.org)







### get your igsn

Register your samples with SESAR to obtain IGSNs for unique sample identification.

### search the catalog

Search the SESAR catalog to find registered samples and their current location.

### sample curation

Learn about the DESC initiative to build a Digital Environment for Sample Curation.

### interoperability

Access IGSN metadata profiles and register samples via web services.

### new user?

Get a MySESAR account to register your samples.

## How Do I Register My Samples to Obtain an IGSN?

Obtaining IGSNs for your samples is easy:

<http://www.geosamples.org/getigns>

1. **Become a SESAR user**
2. Go to GeoPass and sign up for an account.
3. **Login to MySESAR** with your GeoPass ID and password.
4. Select your 'user code' (a combination of three letters and numbers that each of your IGSNs will start with).
5. **Submit sample metadata** to SESAR.
  - 'Register Single Sample': Enter metadata into a web form one sample at a time, or
  - 'Register Multiple Samples': Upload metadata for multiple samples in a customized SESAR spreadsheet form (a tool is available on-line to generate this spreadsheet form).
6. SESAR will generate the IGSNs for your samples. You can also create your IGSNs using your unique user code.

# Upload the dataset to a repository

- Data and methods description with common and specific metadata: **vocabularies**
  - *On line editors*
  - *Templates*

# Vocabularies metadata harmonization

Common metadata	Specific metadata
Language name	Analytical data type
Licences and rights	Measured property
Roles for Authors and Contributors (mandatory if contributor is used)	Measured parameter
Related work	Method
Type of Identifier	Lithology
Funder ID Type	Mineral
	Inclusion
	Fluid
	Location site

# On line editors

Metadata Dataset Publication About/Help

DataCite Metadata

Resource Information

DOI (will be generated in the publishing process) Year

Resource Type Title Version Language of dataset

Licenses and Rights

Licence

Authors (Persons and/or Institutions)

Lastname	Firstname	Role	Author ID Type	Author Identifier (ID)	Affiliation
----------	-----------	------	----------------	------------------------	-------------

Contact Person(s) / Point of Contact

Author (Lastname Firstname)	Position	Email	Website	Affiliation
-----------------------------	----------	-------	---------	-------------

Clear

Load

Save As

Submit

Form Errors

<http://pmd.gfz-potsdam.de/panmetaworks/metaedit/>



## Envío: describa el trabajo (Mas ayuda...)

Por favor, rellene la información requerida sobre su envío. En la mayoría de los navegadores puede utilizar la tecla del tabulador para mover el cursor hasta el siguiente recuadro o botón para evitar usar el ratón cada vez.

Introduzca el nombre del autor/autores a continuación. Recuerde poner las tildes y escriba en mayúsculas sólo las iniciales.

Autor/es \*  + Añadir más

Introduzca el nombre del director/es de tesis a continuación. Recuerde poner las tildes y escriba en mayúsculas sólo las iniciales.

Director de tesis   + Añadir más

Introduzca el ORCID del autor poniendo primero su firma normalizada en DIGITAL.CSIC y a continuación en corchetes su identificador ORCID.  
Ejemplo: Chiara, José Luis [0000-0002-8153-1852]

ORCID de autores  + Añadir más

Introduzca el título principal del trabajo.

Título \*

<https://digital.csic.es/submit>

# Templates

Measured property #1

**Specific Metadata**

Bold headings indicate MANDATORY fields

Geochemical data - determined properties

Analytical data type #1

Analytical data type	Vocabulary	Measured property	Measured parameter
Fill more rows	Source	EPOS vocabulary	EPOS vocabulary
Fill more rows	Source URL 1		http://www
Measured property	Source URL 2		http://www
Measured property	Search date		11/06/201
Fill more rows	Notes	Vocabulary to be defined	Vocabulary to be defined
Measured property			COND
Measured property			DIC
Fill more rows			DELTA_47
Method #1			
Method #2			
Fill more rows			
Geochemical data			
Material #1			
Material #2			

Common Metadata

Bold headings indicate MANDATORY fields

DCMI Element

Comment

Resource Information

DOI

URI

Publisher

Publication date (AAAA-MM-DD)

Created

Resource type (always Dataset)

Title

Language of dataset (ISO 639-1 Code)

Citation

Licenses and rights

Licence

Rights

Embargo until (AAAA-MM-DD)

Authors and contributors (Persons and/or Institutions)

Author #1

Lastname, Firstname

ORCID Author ID

Affiliation

CSIC Author

dc.contributor.author

dc.contributor.orcid

unknown

dc.relation.csic

select Yes or No (mandatory for CSIC Repository for Digital.CSIC. If the author is

Instructions | 1 Common Metadata | 2 Specific Metadata | 3 CM Vocabularies | 4 SM Vocabularies

Vocabulary	Analytical data type	Measured property	Measured parameter	Method
	whole rock analysis	major oxides	AB	albite
	in situ - mineral or glass analysis	trace elements	AC	acmite
	in situ - inclusion analyses	trace elements - REE	ACC	accessory minerals
	fluid analysis - water	volatiles	ACETATE	acetate
	fluid analysis - leachate	volatiles - noble gas	ACT	actinolite
	fluid analysis - gas	isotope ratio	ACT-HORN	actinolitic hornblende
	fluid analysis - other	isotope ratio - U serie	AEG	aegirine
		isotope ratio - stable	Ag	silver
		water - major anions	Age	sample age
		water - physical prop	AIRTEMP	air temperature

Common and specific metadata vocabularies





# Templates

# Sample Data Methods

**Sample Information**

**Bold headings indicate MANDATORY fields**

IDENTIFICATION		LOCATION	
SAMPLE NAME	IGSN	LATITUDE	LONGITUDE
name given by collector	unique ID assigned by SESAR	decimal degrees with at least 4 decimal digits, negative to indicate S	decimal degrees with at least 4 decimal digits, negative to indicate W
ET129	DMO000002	40.0199	-111.062
TR-GT			

**Data**

This template contains several common examples for geochemical data.

**Bold headings indicate MANDATORY fields**

Example for elemental and isotope whole rock or mineral analysis

**Method Information**

**Bold headings indicate MANDATORY fields**

FROM DATA TAB	SAMPLE PREPARATION	ANALYTICAL PROCEDURE					
METHOD CODE	MEASURED PARAMETER	PHYSICAL PREPARATION	CHEMICAL PREPARATION	METHOD	INSTRUMENT	LABORATORY	ANALYST
must match a code in the tab 2 Data	must match a code in the tab 2 Data	e.g. crushed in agate mill, sieved at 500 microns	e.g. whole rock samples were dissolved in 0.1M HF + 5.0M HNO3	see 4 SM Vocabularies/Method, e.g. XRF	e.g. Thermo Scientific ELEMENT 2 ICP-MS	e.g. lab name, organisation, country	lastname, firstname
1	SiO2			XRF		BRIGHAM YOUNG UNIVERSITY, IDAHO	
1	TiO2			XRF		BRIGHAM YOUNG UNIVERSITY, IDAHO	
1	Al2O3			XRF		BRIGHAM YOUNG UNIVERSITY, IDAHO	
1	Fe2O3T			XRF		BRIGHAM YOUNG UNIVERSITY, IDAHO	
1	MnO			XRF		BRIGHAM YOUNG UNIVERSITY, IDAHO	

Measured parameter	Method
EarthChem Vocabularies (with items from some EarthChem templates)	EarthChem Vocabularies
<a href="http://www.earthchem.org/resources/vocabularies">http://www.earthchem.org/resources/vocabularies</a>	<a href="http://www.earthchem.org/resources/vocabularies">http://www.earthchem.org/resources/vocabularies</a>
<a href="http://www.earthchem.org/petdbWeb/search/vocabulary.jsp?category=MeasuredParameter">http://www.earthchem.org/petdbWeb/search/vocabulary.jsp?category=MeasuredParameter</a>	<a href="http://www.earthchem.org/petdbWeb/search/vocabul">http://www.earthchem.org/petdbWeb/search/vocabul</a>
11/06/2018	11/06/2018
The below mentioned terms were added to the vocabulary or modified by more used codes	These terms were added to the vocabulary or modified
conductivity (NASA GCMD Keyword Access Earth Science and Earth Science Services EARTH SCIENCE-TERRESTRIAL HYDROSPHERE-WATER QUALITY/WATER CHEMISTRY-CONDUCTIVITY-d14389d9-54f5-41a0-b8e8-dc9d8f87e4e2) [ <a href="https://wiki.earthdata.nasa.gov/display/CMR/GCMD+Keyword+Access">https://wiki.earthdata.nasa.gov/display/CMR/GCMD+Keyword+Access</a> ] (new term for EarthChem vocabulary)	http://wdcos.fh MOTHER MICROTHERMOMETRY (new term for EarthChem vocabulary)
dissolved inorganic carbon (new term for EarthChem vocabulary)	RAMANMICRO RAMAN MICROSCOPY (new term for EarthChem vocabulary)
delta 47 of clumped isotopes (new term for EarthChem vocabulary)	EA-IRMS ELEMENTAL ANALYZER CONTINUOUS
particle abundance in size fraction (volume %)	DI-IRMS DUAL INLET IRMS ISOTOPE RATIO M
	TC/EA-IRMS HIGH TEMPERATURE CONVERSION E
	GC/C/IRMS GAS CHROMATOGRAPHY COMBUSTION
	LC/IRMS LIQUID CHROMATOGRAPHY-ISOTOPE
	CRDS CAVITY RINGDOWN SPECTROSCOPY
	CEAS CAVITY-ENHANCED LASER ABSORPTION
	NGA NOBLE GASES ANALYSIS (new term for EarthChem vocabulary)
	NG-LA NOBLE GASES ANALYSIS- LASER-ABLATION
	NG-C NOBLE GASES ANALYSIS- CRUSHING
	NG-SH NOBLE GASES ANALYSIS-FURNACE/S
	XRD X-RAY DIFFRACTION (new term for EarthChem vocabulary)
	ICP-MS INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY
	ICP-MS-ID INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY- ION BEAM
	LA-ICP-MS LASER ABLATION INDUCTIVELY COUPLED PLASMA MASS SPECTROMETRY
	LA-MC-ICP-MS LASER ABLATION MULTICollector ICP-MS
	PSA PARTICLE SIZE ANALYSIS (new term for EarthChem vocabulary)
Measured parameter	Method
AB albite	AAS ATOMIC ABSORPTION
AC acmite	ALPHA ALPHA COUNTING
ACC accessory minerals	ALPHA-ID ALPHA COUNTING ISOTOPE DILUTION
ACETATE acetate	ANC ANION CHROMATOGRAPHY
ACT actinolite	AR_AR AR40_AR39 AGE DETERMINATION
ACT-HORN actinolitic hornblende	CALC CALCULATED
AEG aegirine	CEAS CAVITY-ENHANCED LASER ABSORPTION
Ag silver	CHN CARBON HYDROGEN NITROGEN ANALYSIS
Age sample age	CHN-G CARBON HYDROGEN NITROGEN GAS ANALYSIS
AIRTEMP air temperature	CHS CARBON HYDROGEN SULFUR ELEMENTAL ANALYSIS

# Metadata Vocabularies

SiO2	TiO2
7	7
wt%	wt%

IGSN: IEJLF0004



IGSN: IEJLF0004  
Sample Name: CB106  
Other Name(s):  
Sample Type: Individual Sample  
Parent IGSN: Not Provided

Description

Material: Sediment  
Classification: Not Provided  
Field Name: tephra  
Description: Not Provided  
Age (min): Not Provided  
Age (max): Not Provided  
Collection Method: Manual  
Collection Method Description: Not Provided  
Size: Not Provided  
Geological Age: Holocene  
Geological Unit: Not Provided  
Comment: Alternating layers of m sorted, rhyolitic pumice Plinian fall deposit.  
Purpose: Not Provided

Geolocation

Latitude (WGS84): -27.1140555555556  
Longitude (WGS84): -67.681  
Northing (m) (UTM NAD83): Not Provided  
Easting (m) (UTM NAD83): Not Provided  
Zone: Not Provided  
Vertical Datum: Not Provided  
Elevation: 2239 meters  
Nav Type: GPS  
Physiographic Feature: outcrop  
Name Of Physiographic Feature: Not Provided

Location Description: Southern Puna, Catamarca, Tucumán, Santiago del Estero, NW Argentina and neighbouring areas, NW Argentina  
Locality: Not Provided  
Locality Description: Not Provided  
Country: Not Provided  
State/Province: Not Provided  
County: Not Provided  
City: Not Provided

# Samples

Sample Information								
IDENTIFICATION	LOCATION		ANALYSED MATERIAL DESCRIPTION					
SAMPLE NAME	IGSN	LATITUDE	LONGITUDE	ELEVATION	LOCATION KEYWORDS	LITHOLOGY	CHRONOESTRATIGRAPHY	
<small>Name given by collector</small>	<small>unique ID assigned by SESAR</small>	<small>decimal degrees with at least 4 decimal digits, negative to indicate S</small>	<small>decimal degrees with at least 4 decimal digits, negative to indicate W</small>	<small>in meters with respect to sea level</small>	<small>Keywords for searches e.g.: North Atlantic, Canary Islands, Iceland</small>	<small>see 4 SM Vocabularies/Lithology, e.g. basalt</small>	<small>see 4 SM Vocabularies/Chronostratigraphy, e.g. Holocene</small>	
CB104E	IEJLF0001	-27.126278	-67.707778	2119	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB105A	IEJLF0002	-27.110389	-67.709000	2196	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB105D	IEJLF0003	-27.110389	-67.709000	2199	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB106	IEJLF0004	-27.114056	-67.681000	2239	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB107A	IEJLF0005	-27.226750	-67.616639	1935	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB107C	IEJLF0006	-27.226750	-67.616639	1935	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB111B	IEJLF0007	-27.299972	-67.898722	2862	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB111C	IEJLF0008	-27.299972	-67.898722	2862	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB1701	IEJLF0009	-26.738763	-67.746453	4089	Southern Puna, Catamarca, Tucum	rhyolite	Holocene	
CB0901	IEJLF000A	-26.794678	-67.769911	4495	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB1001	IEJLF000B	-26.790921	-67.772919	4503	Southern Puna, Catamarca, Tucum	rhyolite	Holocene	
CB1101	IEJLF000C	-26.790631	-67.772771	4500	Southern Puna, Catamarca, Tucum	rhyolite	Holocene	
CB1201	IEJLF000D	-26.773860	-67.767762	4607	Southern Puna, Catamarca, Tucum	tephra	Holocene	
CB0701	IEJLF000E	-26.800581	-67.769886	4448	Southern Puna, Catamarca, Tucum	rhyolite	Holocene	
CB0801	IEJLF000F	-26.795614	-67.780000	4591	Southern Puna, Catamarca, Tucum	rhyolite	Holocene	
CB1301	IEJLF000G	-26.775122	-67.764439	4600	Southern Puna, Catamarca, Tucum	rhyolite	Holocene	

<https://app.geosamples.org/sample/igsan/IEJLF0004>

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- Bulk Elemental Analyses (example)
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- In Situ Mineral or Glass Analyses (EMP) (example)
- In Situ Melt Inclusion Analyses (EMP) (example)
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# Templates

- Elemental and isotope whole rock or mineral analysis
- In situ - mineral or glass analysis
- In situ - inclusion analysis
- Fluid - water or fluid - leachate analysis
- Fluid - gas analysis (e.g., volcanic fumarole)

H12

**Data**

This template contains several common examples for geochemical data, please choose the most appropriate

**Bold headings** indicate MANDATORY fields

**Example for elemental and isotope whole rock or mineral analysis**

							MEASURED PARAMETER see 4 Data Vocabularies/Measured property, e.g. TiO2	SIO2	TIO2
							METHOD CODE (defined in tab 3 Methods)	1	1
							UNIT (e.g. mg/kg, wt%)	wt%	wt%
	<b>SAMPLE NAME</b>	<b>IGSN</b>	<b>ANALYTICAL DATA TYPE</b>	<b>MEASURED PROPERTY</b>	<b>MATERIAL DESCRIPTION</b>	<b>GRAIN/SPOT ID</b>	<b>ANALYSIS COMMENT</b>		
	must match a sample on 1 SAMPLES tab column A	must match an IGSN on 1 SAMPLES tab column B	see 4 Data Vocabularies/Analytical data type, e.g. whole rock analyses	see 4 Data Vocabularies/Measured property, e.g. major oxides, trace elements	free keywords, e.g., lithology, mineral or glass, inclusion (melt, fluid, mineral), fluid (surface or groundwater, seawater, gas, other fluid)	for in situ analysis, e.g. 1A	free text, e.g. grain type (phenocryst, xenocryst, etc.), spot location (core, rim); for inclusion analysis, e.g. inclusion size, heating temperature; for volcanic gas, e.g. air dry; likely contaminated by helicopter exhaust		
13	Example Elemental-ET129	DMO000002	whole rock		TRACHYANDESITE			58.39	1.08
14	Example Isotopes-TR-GT	RIV000005	whole rock		tholeiitic basalt				
15	Example Isotopes-TR-GT	RIV000005	mineral		Pl				
16									
17									
18	<b>Example for in situ - mineral or glass analysis</b>								
19							MEASURED PARAMETER see 4 Data Vocabularies/Measured property, e.g. TiO2	SIO2	TIO2
20							METHOD CODE (defined in tab 3 Methods)	7	7
21							UNIT (e.g. mg/kg, wt%)	wt%	wt%
22	<b>SAMPLE NAME</b>	<b>IGSN</b>	<b>ANALYTICAL DATA TYPE</b>	<b>MEASURED PROPERTY</b>	<b>MATERIAL DESCRIPTION</b>	<b>GRAIN/SPOT ID</b>	<b>ANALYSIS COMMENT</b>		

**Data**

# Templates

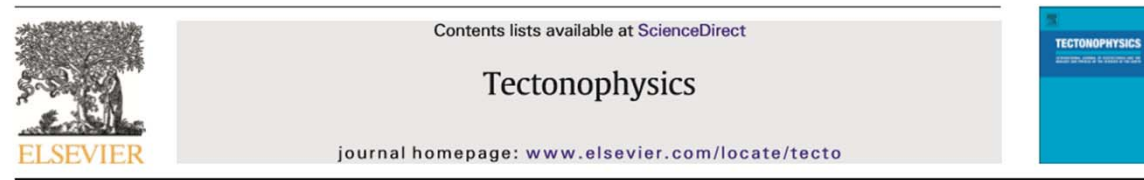
Method Information							
<b>Bold headings indicate MANDATORY fields</b>							
FROM DATA TAB		SAMPLE PREPARATION		ANALYTICAL PROCEDURE			
METHOD CODE	MEASURED PARAMETER	PHYSICAL PREPARATION	CHEMICAL PREPARATION	METHOD	INSTRUMENT	LABORATORY	ANALYST
must match a code in the tab 2 Data	must match a code in the tab 2 Data	e.g. crushed in agate mill, sieved at 500 microns	e.g. whole rock samples were dissolved in 0.1M HF + 5.0M HNO3	see 4 SM Vocabularies/Method, e.g. XRF	e.g. Thermo Scientific ELEMENT 2 ICP-MS	e.g. lab name, organisation, country	lastname, firstname
1	SiO2			XRF		BRIGHAM YOUNG UNIVERSITY, IDAHO	
1	TiO2			XRF		BRIGHAM YOUNG UNIVERSITY, IDAHO	
1	Al2O3			XRF		BRIGHAM YOUNG UNIVERSITY, IDAHO	
1	Fe2O3T						
1	MnO						

## Methods

Method Information						
<b>Bold headings indicate MANDATORY fields</b>						
FROM DATA TAB		ANALYTICAL PROCEDURE				
METHOD CODE	MEASURED PARAMETER	METHOD	INSTRUMENT	LABORATORY	ANALYST	
must match a code in the tab 2 Data	must match a code in the tab 2 Data	see 4 SM Vocabularies/Method, e.g. XRF	e.g. Thermo Scientific ELEMENT 2 ICP-MS	e.g. lab name, organisation, country	lastname, firstname	
1	SiO2	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	TiO2	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	Al2O3	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	FeOT	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	MnO	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	MgO	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	CaO	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	Na2O	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	K2O	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		
1	B2O3	EMP	CAMECA SX-50 / JEOL J)	EPM Laboratory, CCIT Services; Un Llovet, X.		



# Citing Datasets in papers



## Properties of granular analogue model materials: A community wide survey

M. Klinkmüller<sup>a</sup>, G. Schreurs<sup>a,1</sup>, M. Rosenau<sup>b</sup>, H. Kemnitz

<sup>a</sup> Institute of Geological Sciences, University of Bern, Baltzerstrasse 1 +3, CH-3012 Bern, Switzerland  
<sup>b</sup> Helmholtz-Zentrum Potsdam, GFZ Deutsches GeoForschungsZentrum, Telegrafenberg, D-14473 Potsdam

presented as grain size distribution curves, in which particles are plotted against cumulative weight percentage (Fig. 2).

The original sieve data have been published openly available (in Klinkmüller et al. (2016b)).

### References

- Heilbronner, R., Keulen, N., 2006. Grain size and grain shape. *Tectonophysics* 427, 199–216.
- Hubbert, M.K., 1951. Mechanical basis for certain familiar geologic structures. *Am. Bull.* 62, 1259–1273.
- Klinkmüller, M., Schreurs, G., Rosenau, M., 2016a. GeoMod2008 materials benchmark: The ring shear test data set. GFZ Data Services. <http://dx.doi.org/10.5880/GFZ.4.1.2016.002>.
- Klinkmüller, M., Schreurs, G., Rosenau, M., 2016b. GeoMod2008 materials benchmark: The sieve data set. GFZ Data Services. <http://dx.doi.org/10.5880/GFZ.4.1.2016.003>.
- Klinkmüller, M., Kemnitz, H., Schreurs, G., Rosenau, M., 2016c. GeoMod2008 materials benchmark: The SEM image data set. GFZ Data Services. <http://dx.doi.org/10.5880/GFZ.4.1.2016.004>.

**1. Data in repository**

**Link to paper**

**3. Dataset-DOI in the References**

Credit: Kirsten Elger (GFZ)

# Citing Datasets in papers

## The large eruption 4.2 ka cal BP in Cerro Blanco, Central Volcanic Zone, Andes: Insights to the Holocene eruptive deposits in the southern Puna and adjacent regions

*La gran erupción de hace 4.2 ka cal en Cerro Blanco, Zona Volcánica Central, Andes: nuevos datos sobre los depósitos eruptivos holocenos en la Puna sur y regiones adyacentes*

J.L. Fernandez-Turiel<sup>1</sup>, F.J. Perez-Torrado<sup>2</sup>, A. Rodriguez-Gonzalez<sup>2</sup>, J. Saavedra<sup>3</sup>, J.C. Carracedo<sup>2</sup>, M. Rejas<sup>1</sup>, A. Lobo<sup>1</sup>, M. Osterrieth<sup>4</sup>, J.I. Carrizo<sup>5</sup>, G. Esteban<sup>5</sup>, J. Gallardo<sup>3</sup>, N. Ratto<sup>5</sup>

Institute of Earth Sciences Jaume Almera, ICTJA, CSIC, Sole i Sabaris s/n, 08028 Barcelona, Spain. Email: [jlfernandez@ictja.csic.es](mailto:jlfernandez@ictja.csic.es) ORCID ID: <https://orcid.org/0000-0002-4282-7001> <http://dx.doi.org/10.22354/0002-3256-0027> <https://orcid.org/0000-0002-3256-0027>

### Methods

Identification, logging, and sampling of 62 outcrops of tephra sections and lava domes were performed during several field campaigns in a wide region of northwest Argentina (Fig. 1b), providing a set of more than 230 samples. The lithofacies descriptions are based on published methodologies (Branney & Kokelaar, 2002; Cas *et al.*, 2008).

Petrography was studied by optical and scanning electron microscopy on polished thin sections and grain mounts on carbon stubs. Groundmass glass, phenocrysts, microphenocrysts, and microlites of glass shards were analysed on polished thin sections by electron probe microanalyser (EPMA) (Fernandez-Turiel *et al.*, 2018a). Particle size distributions were determined in ash samples by laser diffraction (Fernandez-Turiel *et al.*, 2018b).

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Título: Dataset of glass and mineral geochemical data of Holocene volcanic ashes of NW Argentina

Autor: Fernandez-Turiel, J. L.; Rejas, Marta; Perez-Torrado, Francisco José; Saavedra Alonso, Julio; Rodriguez-Gonzalez, Alejandro

Palabras clave: in situ - m; major oxids; EMP; glass

1. Data in repository

URI: <http://hdl.handle.net/10261/167757>

DOI: <http://dx.doi.org/10.20350/digitalCSIC/8553>

Referencias: Fernandez-Turiel, J.-L.; Saavedra, J.; Perez-Torrado, F. J.; Ro holocene eruption of the Central Andes found. AGU Fall Meetin V13D. Geochronology, Correlation, and Climatic Significance c <http://hdl.handle.net/10261/84582>  
Fernandez-Turiel, J.-L.; Saavedra, J.; Perez-Torrado, F. J.; Ro J. I.; Esteban, G.; Martinez, L. D.; Gil, R. A.; Ratto, N.; Baez, V Central Andes. EGU General Assembly 2015, 12-17 April, Vier <http://hdl.handle.net/10261/130983>

### References

Fernandez-Turiel, J.L.; Perez-Torrado, F. J.; Rodriguez-Gonzalez, A.; Saavedra, J.; Carracedo, J. C.; Rejas, M.; Lobo, A.; Osterrieth, M.; Carrizo, J. I.; Esteban, G.; Gallardo, J. & Ratto, N. (2019). Dataset of SEM images, modelled isopach map and topographic profiles, radiocarbon ages and data of parameters of Tephra2 and AshCalc codes of Holocene volcanic ashes of NW Argentina. In: DIGITAL.CSIC, <http://hdl.handle.net/10261/179003>.

Fernandez-Turiel, J.L.; Rejas, M.; Perez-Torrado, F.J.; Saavedra, J. & Rodriguez-Gonzalez, A. (2018a). Dataset of geochemical data of Holocene volcanic ashes of NW Argentina. DIGITAL.CSIC, <http://hdl.handle.net/10261/167757>.

Fernandez-Turiel, J.L.; Rejas, M.; Perez-Torrado, F.J.; Saavedra, J. & Rodriguez-Gonzalez, A. (2018b). Dataset of particle size distribution data of Holocene volcanic ashes of NW Argentina. DIGITAL.CSIC, <http://hdl.handle.net/10261/167764>.

2. Citation in the text

3. Dataset DOI or HANDLE in the References



# IGSN link in text of an article

## NanoSIMS results from olivine-hosted melt embayments: Magma ascent rate during explosive basaltic eruptions

Alexander S. Lloyd<sup>a</sup>, Philipp Ruprecht<sup>a, 1</sup>, Erik H. Hauri<sup>b, 2</sup>, William Rose<sup>c, 3</sup>, Helge M. Gonnermann<sup>d, 4</sup>, Terry Plank<sup>a, 5</sup>

5. METHODS

<http://doi.org/10.1016/j.jvolgeores.2014.06.002>

### 3.1. Sample preparation

During sample preparation, special care was taken to consider the size of each pyroclast and the effect on post-eruptive cooling. Samples were divided into three sizes: volcanic ash (particles with a diameter < 2 mm); lapilli (diameter between 2 mm and 64 mm); and volcanic bombs (clasts with a diameter > 64 mm). The ash sample (VF-132 - IGSN: ASL000001) was sieved without crushing, and loose olivine grains were selected from 250-500 µm and from 500-1000 µm size fractions. The lapilli sample (VF-129 - IGSN: ASL000002) was collected as a mix of ash and lapilli ranging in size from 30 mm to less than 0.1 mm. Only pyroclasts greater than 20 mm in diameter were selected; and of this set, the five largest lapilli were chosen. The bomb sample (VF-137B - IGSN: ASL000003) was selected from a diverse collection for its uniform spherical shape and relatively large size (60-mm diameter). The bomb was cut so that the material sampled for olivine-hosted embayments was derived from the inner 20 × 20 × 20 mm<sup>3</sup> of the bomb. The vesiculation in these pyroclasts was relatively uniform between clast types and ranged from 40% to 55% (estimated by bubble size distribution techniques, Gray A.L., pers comm, 2012); groundmass color was observed to be consistent among all the samples.

Credit: Kerstin Lehnert (IEDA)

# What's the role of the MULTI-SCALE LABORATORIES in data publication?

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  - Methods
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- Coordination with EarthChem portal



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- European Database of Seismogenic Faults**
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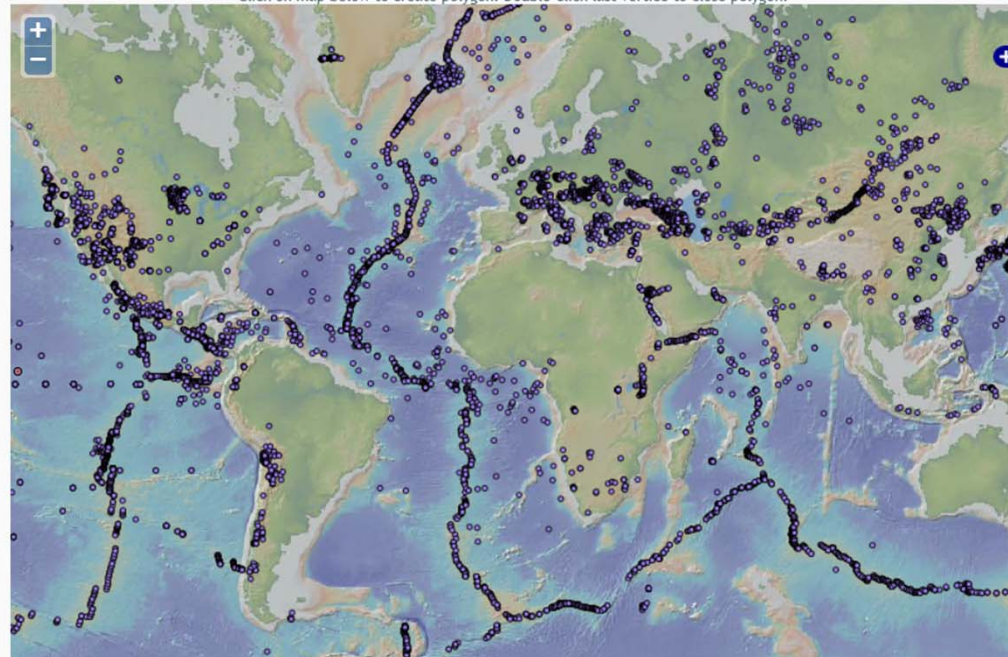
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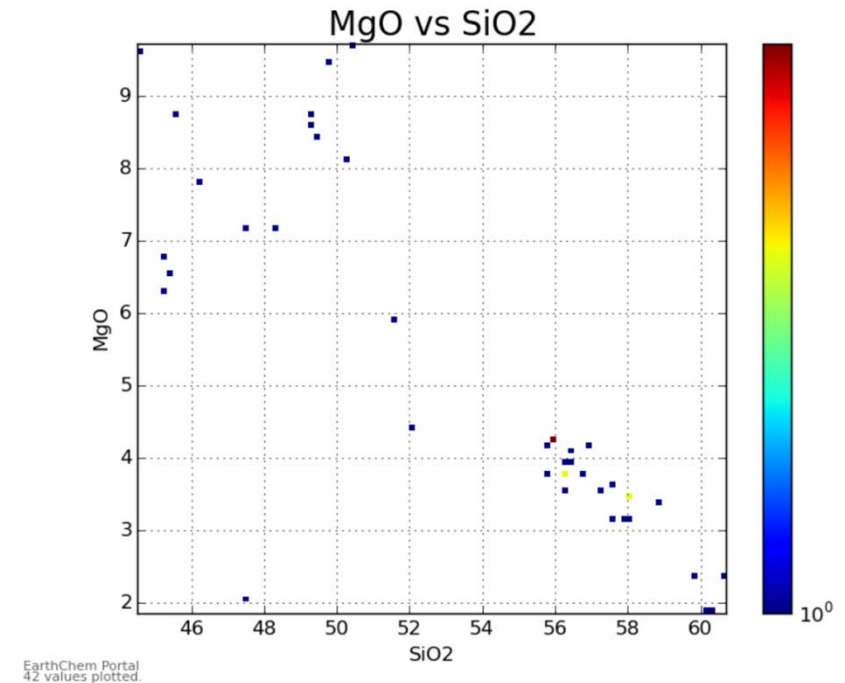
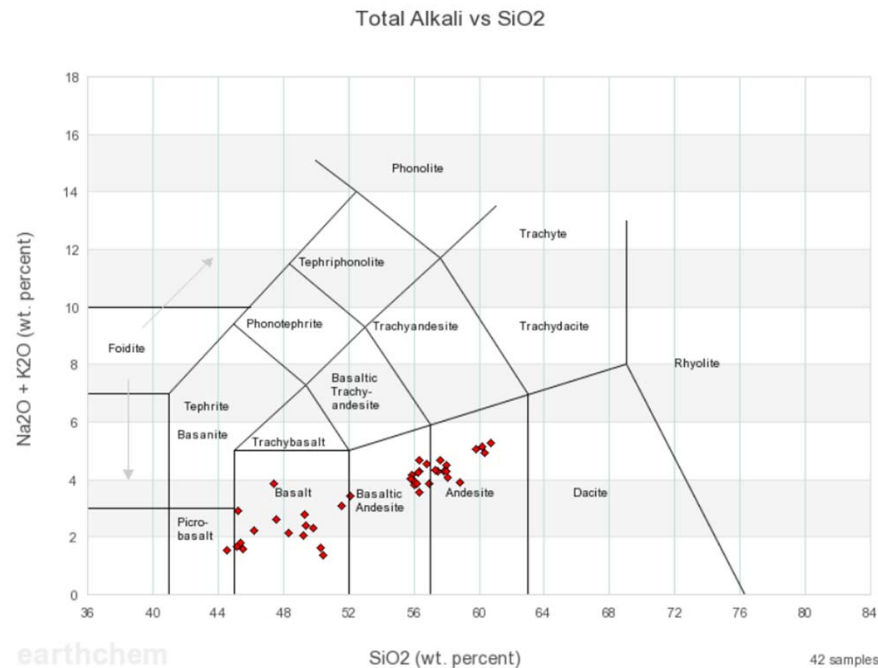


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