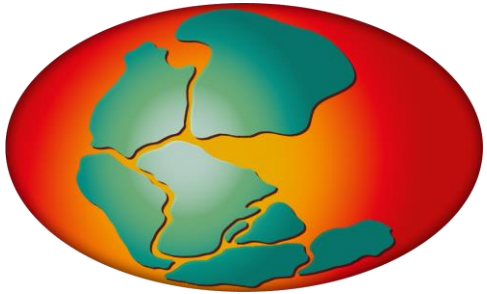


Linked Metadata

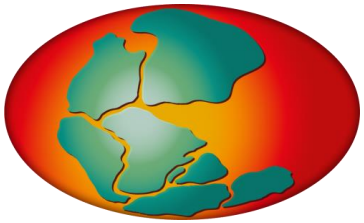
ESIP Winter Meeting 2019

Uwe Schindler

PANGAEA (MARUM, University of Bremen)

My Background

- Member of the **PANGAEA team @ MARUM, University of Bremen**.
- Studied **physics** long time ago.
- Responsible for **metadata** processing and **search engine** of PANGAEA (Elasticsearch).
- Long time Open Source software contributor; member of **Apache Software Foundation**: *Apache Lucene, Apache Solr, Apache TIKA, Apache POI,… also **Elasticsearch**.*



About PANGAEA

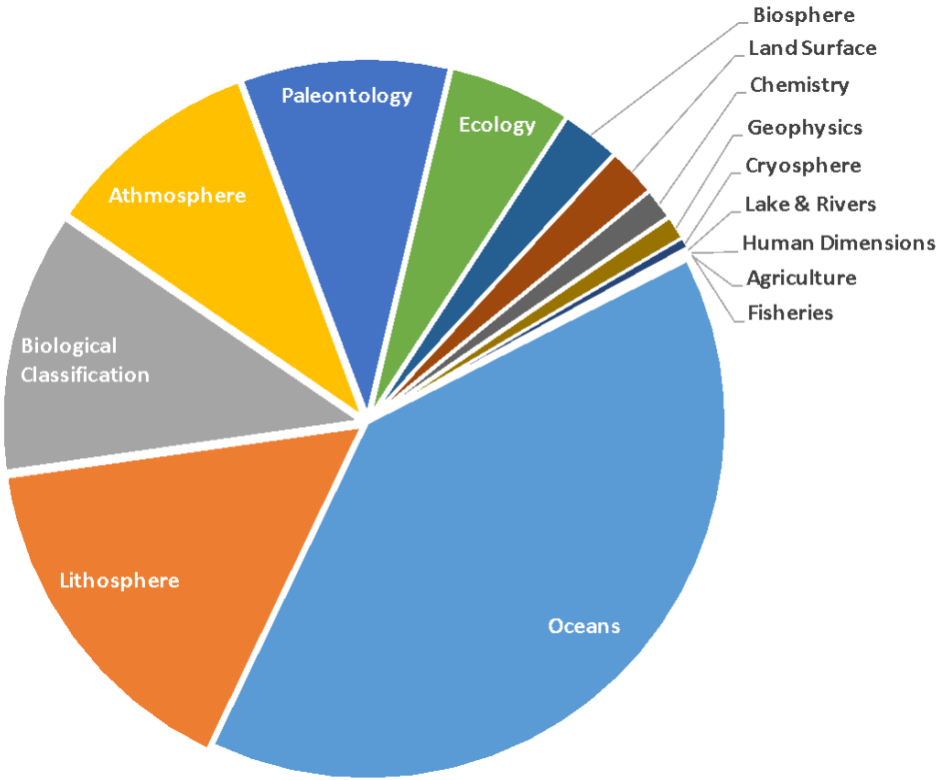
PANGAEA.

Data Publisher for Earth & Environmental Science

- Founded: **1993**
- Hosted by:

- **2001**: Accreditation by the „International Council for Science“ (ICSU) as „Publisher for Earth & Environmental Science“ (ICSU WDS World Data Center)
- **2007:** Accredited by the „World Meteorological Organisation“ (WMO) as „World Radiation Monitoring Center“ (WRMC) (since 2007)

Content



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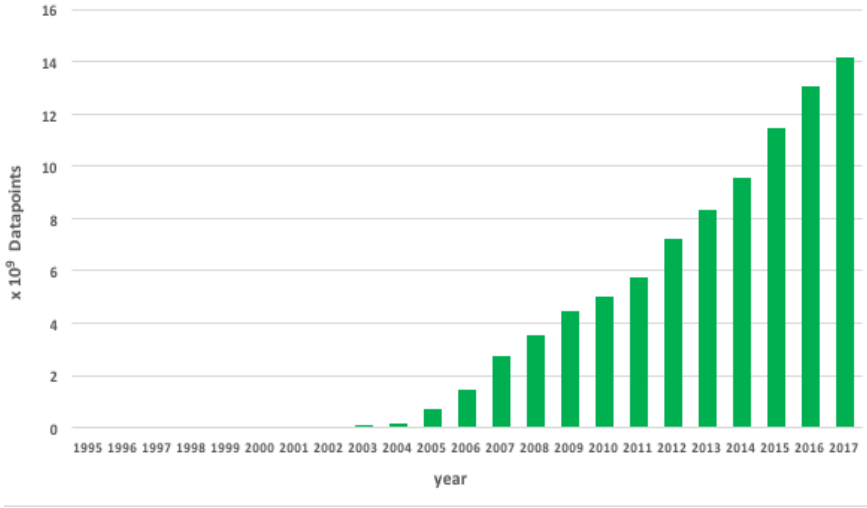
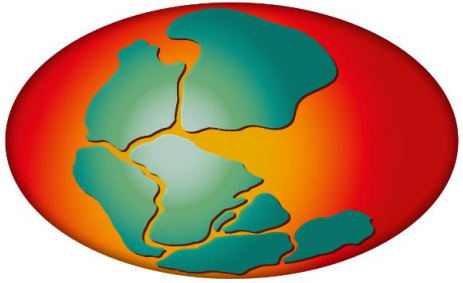
Data points: ~ 14 billion

New datasets per year: ~10.000



PANGAEA – Data/Metadata Dissemination



Google

World Meteorological Organization
Weather • Climate • Water

Europe PubMed Central

gfbio

ScienceDirect

GBIF
Global Biodiversity Information Facility

THOMSON REUTERS

GEO GROUP ON EARTH OBSERVATIONS

DataCite
FIND, ACCESS, AND REUSE DATA

ICSU
WORLD DATA SYSTEM

Scopus®

DataONE

OpenAIRE

Altmetric

What's inside?

PANGAEA Metadata Scheme

PANGAEA's Schema

- XML based
- Generic "Types":
  - Staffs/Persons
  - Citations (papers / books / other datasets)
  - Simple "Named" Entities
- Specific types:
  - Spatial / Temporal Coverage
  - Measurement Parameters

Capron, E et al. (2015): La

Sicher | https://doi.pangaea.de/10.1594/PANGAEA.841672

Uwe Schindler

PANGAEA.

Data Publisher for Earth & Environmental Science

SEARCH SUBMIT ABOUT CONTACT

Citation:

Capron, Emilie; Govin, Aline; Stone, Emma J; Masson-Delmotte, Valerie; Mulitza, Stefan; Otto-Bliesner, Bette L; Rasmussen, Tine Lander; Sime, Louise C; Wolff, Eric W (2015): Last Interglacial synthe… re: temperature anomalies and associ… ANGAEA, https://doi.org/10.1594/PANGAEA.841672,

Govin, Aline

https://orcid.org/0000-0001-8512-5571

aline.govin@lsce.ipsl.fr

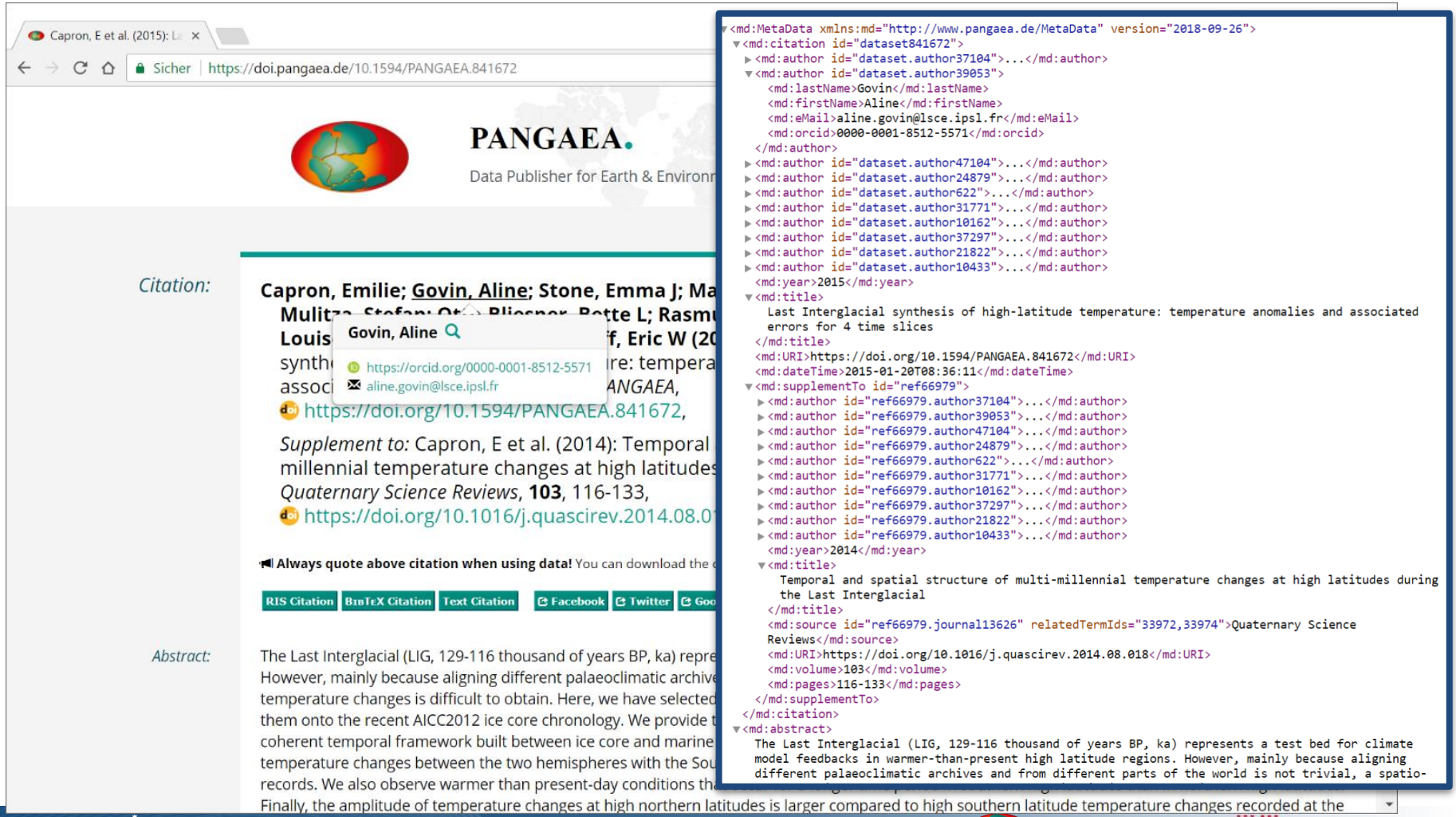
Supplement to: Capron, E et al. (2014): Temporal and spatial structure of multi-millennial temperature changes at high latitudes during the Last Interglacial. *Quaternary Science Reviews*, **103**, 116-133, https://doi.org/10.1016/j.quascirev.2014.08.018

Always quote above citation when using data! You can download the citation in several formats below.

RIS Citation | BibTeX Citation | Text Citation | Facebook | Twitter | Google+ | Show Map | Google Earth

Abstract:

The Last Interglacial (LIG, 129-116 thousand of years BP, ka) represents a test bed for climate model feedbacks in warmer-than-present high latitude regions. However, mainly because aligning different palaeoclimatic archives and from different parts of the world is not trivial, a spatio-temporal picture of LIG temperature changes is difficult to obtain. Here, we have selected 47 polar ice core and sub-polar marine sediment records and developed a strategy to align them onto the recent AICC2012 ice core chronology. We provide the first compilation of high-latitude temperature changes across the LIG associated with a coherent temporal framework built between ice core and marine sediment records. Our new data synthesis highlights non-synchronous maximum temperature changes between the two hemispheres with the Southern Ocean and Antarctica records showing an early warming compared to North Atlantic records. We also observe warmer than present-day conditions that occur for a longer time period in southern high latitudes than in northern high latitudes. Finally, the amplitude of temperature changes at high northern latitudes is larger compared to high southern latitude temperature changes recorded at the

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  different palaeoclimatic archives and from different parts of the world is not trivial, a spatio-
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Villanueva, Joan; Grimalt, Joan O; Cortijo, Elsa; Vidal, Laurence; Labeyrie, Laurent D (1998): Assessment of sea surface temperature variations in the central North Atlantic [illegible] the alkenone unsaturation index (U37k'). *Geochimica et Cosmochimica Acta*, **62(14)**, 2421-2427, ht[illegible]0180-X

Grimalt, Joan O
https://orcid.org/0000-0002-7391-5768
jgoqam@cid.csic.es

Wells, [illegible]ponse of nannoplankton to major changes in sea-surface temperature and movements of hydrological fronts over [illegible]utheastern New Zealand), during the last 130 kyr. *Marine Micropaleontology*, **32(3-4)**, 341-363, https://doi.org/10.1016/S0377-8398(97)00025-X

Winsor, Kelsey; Carlson, Anders E; Klinkhammer, Gary P; Stoner, Joseph S; Hatfield, Robert (2012): Evolution of the northeast Labrador Sea during the last interglaciation. *Geochemistry, Geophysics, Geosystems*, **13(11)**, n/a-n/a, https://doi.org/10.1029/2012GC004263

Project(s):

Center for Marine Environmental Sciences (MARUM)

Climate Change: Learning from the past climate (Past4Future)

Coverage:

Median Latitude: 6.892700 * *Median Longitude:* 20.668478 * *South-bound Latitude:* -78.464420 * *West-bound Longitude:* -51.060000 * *North-bound Latitude:* 77.450000 * *East-bound Longitude:* 177.990000

Date/Time Start: 1971-01-01T00:00:00 * *Date/Time End:* 2009-08-20T00:00:00

Minimum Elevation: -4620.5 m * *Maximum Elevation:* 3810.0 m

Event(s):

104-644 * *Latitude:* 66.678300 * *Longitude:* 4.576700 * *Date/Time Start:* 1985-08-08T00:00:00 * *Date/Time End:* 1985-08-10T00:00:00 * *Elevation:* -1226.0 m * *Penetration:* 380.5 m * *Recovery:* 342.1 m * *Location:* Norwegian Sea * *Campaign:* Leg104 * *Basis:* Joides Resolution * *Device:* Composite Core (COMPCORE) * *Comment:* 49 cores; 380.5 m cored; 0 m drilled; 89.9% recovery

162-980 * *Latitude:* 55.484933 * *Longitude:* -14.702267 * *Date/Time Start:* 1995-07-10T00:00:00 * *Date/Time End:* 1995-07-11T00:00:00 * *Elevation:* -2180.0 m * *Penetration:* 353.7 m * *Recovery:* 366.7 m * *Location:* North Atlantic Ocean * *Campaign:* Leg162 * *Basis:* Joides Resolution * *Device:* Composite Core (COMPCORE) * *Comment:* 39 cores; 353.7 m cored; 0 m drilled; 103.7% recovery

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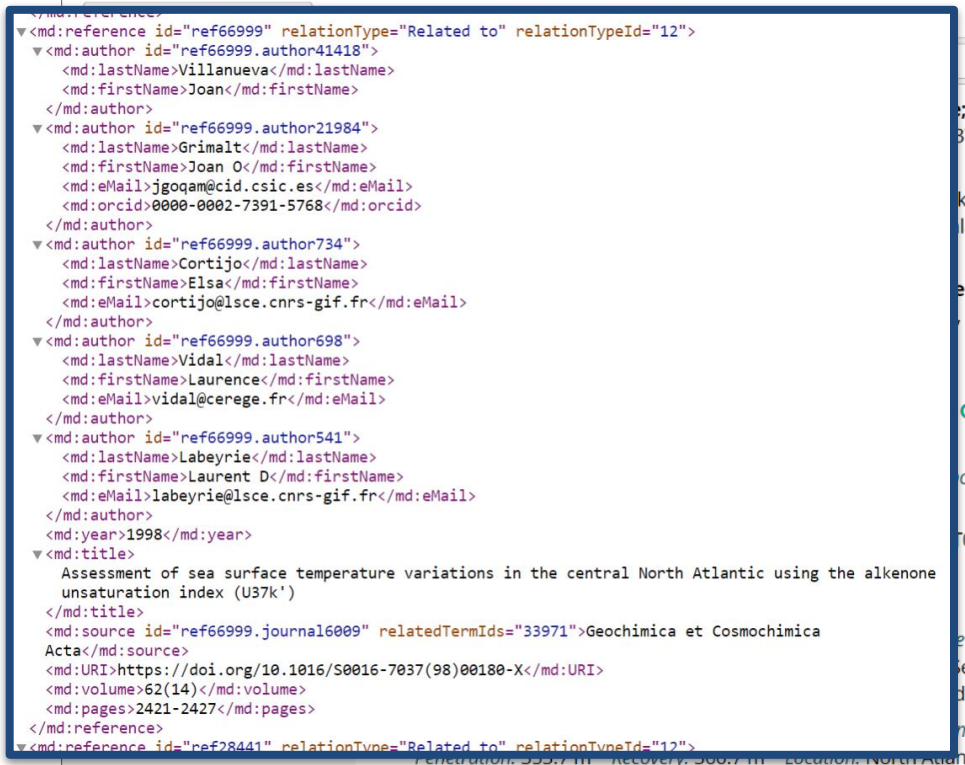
Show more...

Comment:

This dataset concerns the new synthesis of high-latitude temperature anomalies during the Last Interglacial published by Capron et al. 2014. It contains:

- the information of marine sediment and ice core sites included in the study: name, latitude, longitude, elevation, information of temperature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Location: South Atlantic Ocean * Campaign: Leg177 * Basis: Joides Resolution * Device: Composite Core (COMPCORE) * Comment: 86 cores;
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Show more...
Comment:
This dataset concerns the new synthesis of high-latitude temperature anomalies during the Last Interglacial published by Capron et al. 2014. It contains:

Capron, E et al. (2015): La

Sicher | https://doi.pangaea.de/10.1594/PANGAEA.841672

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Coverage:
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Show more...

Comment:
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the information of marine sediment and ice core sites included in the study: name, latitude, longitude, elevation, information of temperature

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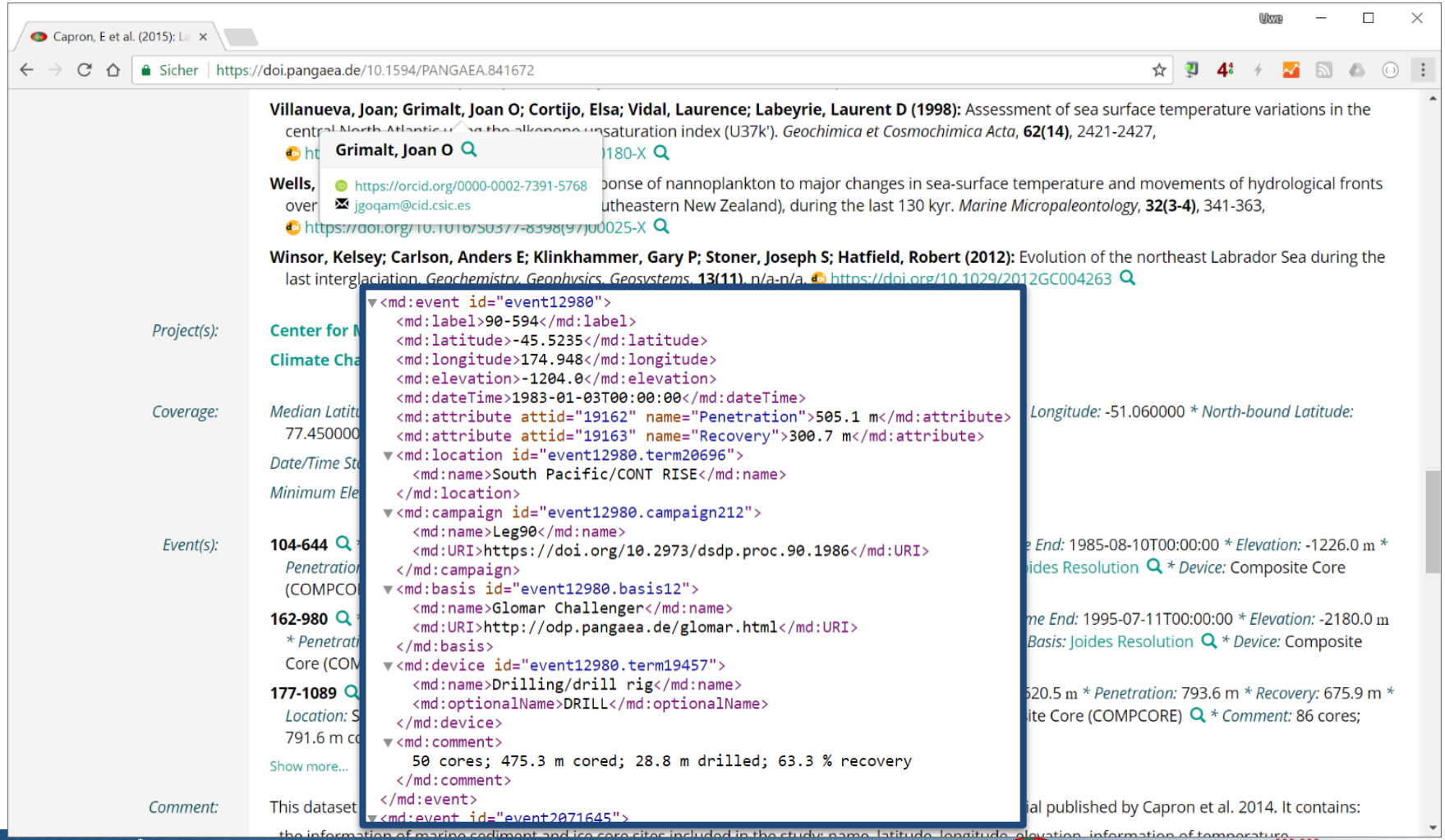
marum AWI PANGAEA. Data Publisher for Earth & Environmental Science Universität Bremen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PANGAEA.
Data Publisher for Earth & Environmental Science
Universität Bremen

Capron, E et al. (2015): La

https://doi.pangaea.de/10.1594/PANGAEA.841672

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13	Temperature, water, interpolated	Temp interp	°C	Capron, Emilie		WOA98 temperature (°C)
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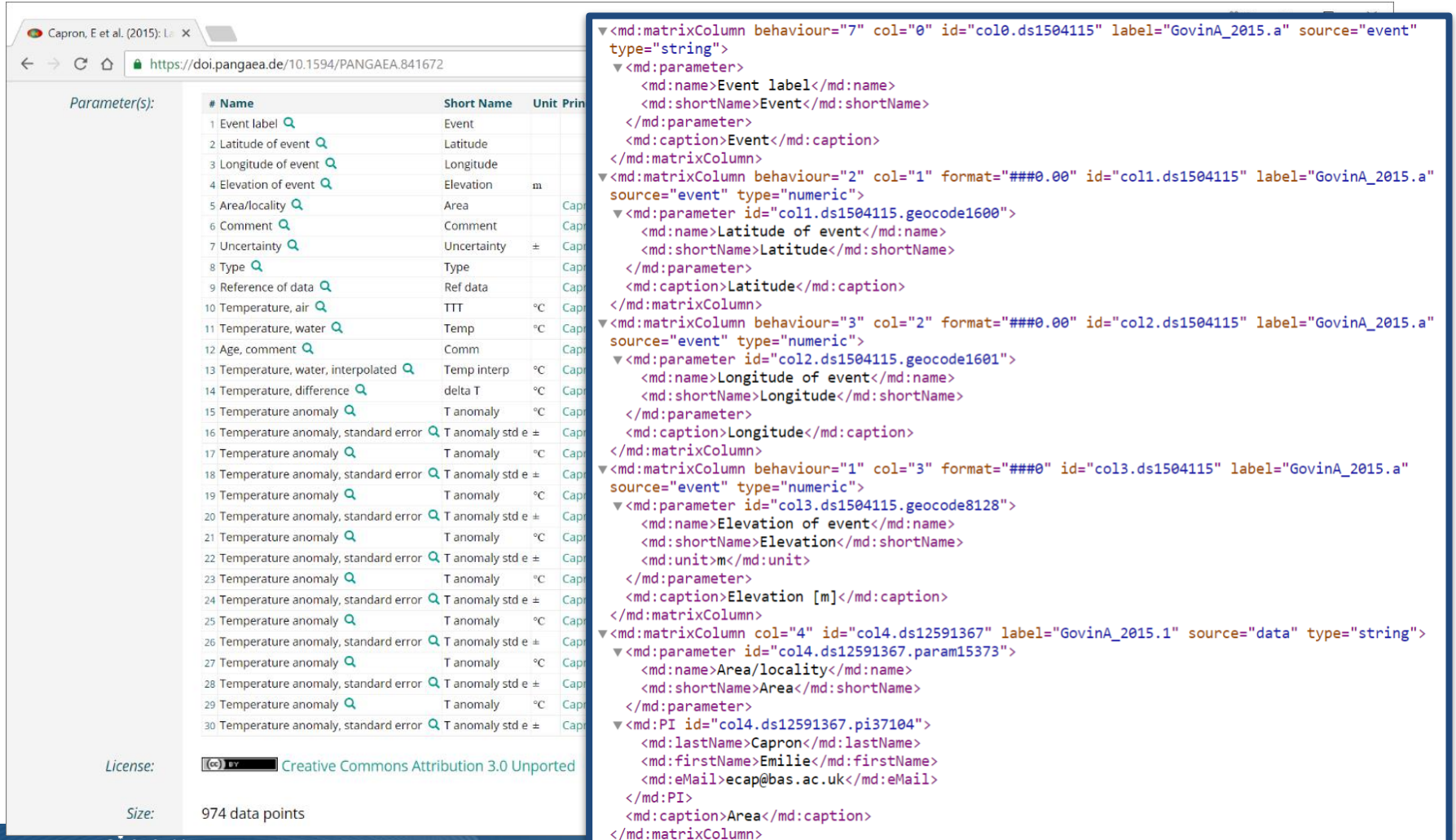
26	Temperature anomaly, standard error	T anomaly std e	±	Capron, Emilie		125 ka 2sigma (°C, versus core top value)
27	Temperature anomaly	T anomaly	°C	Capron, Emilie		120 ka (°C, versus core top value)
28	Temperature anomaly, standard error	T anomaly std e	±	Capron, Emilie		120 ka 2sigma (°C, versus core top value)
29	Temperature anomaly	T anomaly	°C	Capron, Emilie		115 ka (°C, versus core top value)
30	Temperature anomaly, standard error	T anomaly std e	±	Capron, Emilie		115 ka 2sigma (°C, versus core top value)

License: Creative Commons Attribution 3.0 Unported

Size: 974 data points

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<md:matrixColumn behaviour="7" col="0" id="col0.ds1504115" label="GovinA_2015.a" source="event" type="string">
  <md:parameter>
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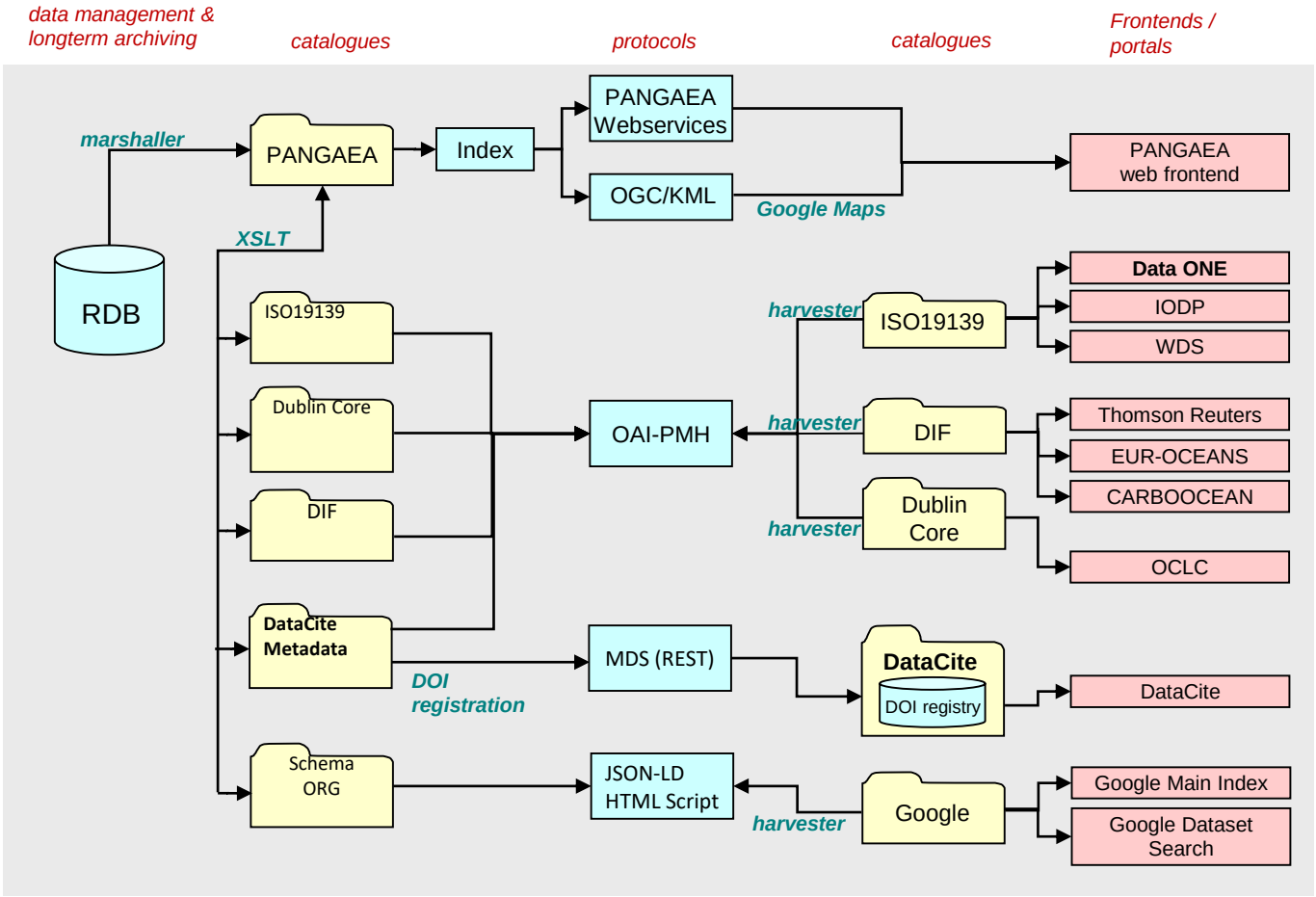
    <md:shortName>Event</md:shortName>
  </md:parameter>
  <md:caption>Event</md:caption>
</md:matrixColumn>
<md:matrixColumn behaviour="2" col="1" format="###0.00" id="col1.ds1504115" label="GovinA_2015.a" source="event" type="numeric">
  <md:parameter id="col1.ds1504115.geocode1600">
    <md:name>Latitude of event</md:name>
    <md:shortName>Latitude</md:shortName>
  </md:parameter>
  <md:caption>Latitude</md:caption>
</md:matrixColumn>
<md:matrixColumn behaviour="3" col="2" format="###0.00" id="col2.ds1504115" label="GovinA_2015.a" source="event" type="numeric">
  <md:parameter id="col2.ds1504115.geocode1601">
    <md:name>Longitude of event</md:name>
    <md:shortName>Longitude</md:shortName>
  </md:parameter>
  <md:caption>Longitude</md:caption>
</md:matrixColumn>
<md:matrixColumn behaviour="1" col="3" format="###0" id="col3.ds1504115" label="GovinA_2015.a" source="event" type="numeric">
  <md:parameter id="col3.ds1504115.geocode8128">
    <md:name>Elevation of event</md:name>
    <md:shortName>Elevation</md:shortName>
    <md:unit>m</md:unit>
  </md:parameter>
  <md:caption>Elevation [m]</md:caption>
</md:matrixColumn>
<md:matrixColumn col="4" id="col4.ds12591367" label="GovinA_2015.1" source="data" type="string">
  <md:parameter id="col4.ds12591367.param15373">
    <md:name>Area/locality</md:name>
    <md:shortName>Area</md:shortName>
  </md:parameter>
  <md:PI id="col4.ds12591367.pi37104">
    <md:lastName>Capron</md:lastName>
    <md:firstName>Emilie</md:firstName>
    <md:eMail>ecap@bas.ac.uk</md:eMail>
  </md:PI>
  <md:caption>Area</md:caption>
</md:matrixColumn>
<md:matrixColumn col="5" id="col5.ds12591368" label="GovinA_2015.2" source="data" type="string">
```

How does it work?

PANGAEA Metadata Dissemination

PANGAEA Metadata Services



Example: PANGAEA => DataOne

- uses OAI-PMH interface
- XSLT converts PANGAEA's schema to ISO-19139:
  - Static stuff (like datacenter contact, publisher)
  - Mappings for many types: Citations, Persons, Organizations, Roles

```
<MD_Metadata xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gmd="http://www.isotc211.org/2005/gmd" xmlns:gco="http://www.isotc211.org/2005/gco" xmlns:gml="http://www.opengis.net/gml" xmlns="http://www.isotc211.org/2005/gmd"
 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.isotc211.org/2005/gmd http://www.isotc211.org/2005/gmd/gmd.xsd" id="de.pangaea.dataset841672">
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          </date>
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              </individualName>
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                        codeListValue="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#CI_OnLineFunctionCode_information">information</CI_OnLineFunctionCode>
                      </function>
                    </CI_OnlineResource>
                  </onlineResource>
```

Problems: PANGAEA => DataOne

Some types are “unmappable”:

- Event information (inserted as formatted plain text into **“lineage/processStep/description”**)
- Measurement parameter / cols: **“contentInfo/coverageDescription”**

Problems: PANGAEA => DataOne

Some types are “unmappable”:

- Event information (inserted as formatted plain text into **“lineage/processStep/description”**)
- Measurement parameter / cols: **“contentInfo/coverageDescription”**

Probl

Some ty

- Event
  plain
  “linea
- Meas
  “contentInfo/coverageDescription”

Correct way:
For each column add an inner “child” metadata document in ISO19139, just describing the parameter, methods, PI

Bug in original ISO19139 version (2005):
Infinite loop in schema! Still there?

Future

- PANGAEA still supports ISO19139 *(and DIF)*
  - No maintenance *(kept on namespace and schema version 2005)*
- Full support for more generic schemas:
  - Dublin Core (“oai_dc”)
  - DataCite (“datacite4”, “datacite3”)
- Focus on **Schema.ORG** !!!

Future: Schema.ORG

- Metadata model behind Schema.ORG is similar to PANGAEA
- Better support for linking with PIDs (“Linked Data”)

PANGAEA transforms own XML schema to JSON-LD

How does it work?

XML metadata to JSON !?

Image: https://www.radbag.at/werkzeugkasten-grill-inkl-grillbesteck

Workflow

- Like all metadata transformations in PANGAEA: **XSL Transformations**
- Result: In memory DOM tree (Java `DOMResult`) produced by stylesheet with a simple key-value layout
- Serialization to JSON

XML DOM serialized to JSON

- Element names get JSON keys
- Character data: JSON strings
- Attributes get “@attribute” JSON keys with string value
- Repeated element names get JSON arrays
- Numeric types using “xsi:type” serialized by JAXB

Status

- JSON-LD `<script>` inserted into dataset splash pages
- Available via Content Negotiation
- Signposting-HTTP-Link (`rel="DescribedBy"`)

XSLT is 174 lines!

Capron, E et al. (2015): La

Sicher | https://doi.pangaea.de/10.1594/PANGAEA.841672

Uwe Schindler

PANGAEA.

Data Publisher for Earth & Environmental Science

SEARCH SUBMIT ABOUT CONTACT

Citation:

Capron, Emilie; Govin, Aline; Stone, Emma J; Masson-Delmotte, Valerie; Mulitza, Stefan; Otto-Bliesner, Bette L; Rasmussen, Tine Lander; Sime, Louise C; Wolff, Eric W (2015): Last Interglacial synthe… re: temperature anomalies and associ… ANGAEA, https://doi.org/10.1594/PANGAEA.841672,

Govin, Aline

https://orcid.org/0000-0001-8512-5571

aline.govin@lsce.ipsl.fr

Supplement to: Capron, E et al. (2014): Temporal and spatial structure of multi-millennial temperature changes at high latitudes during the Last Interglacial. *Quaternary Science Reviews*, **103**, 116-133, https://doi.org/10.1016/j.quascirev.2014.08.018

Always quote above citation when using data! You can download the citation in several formats below.

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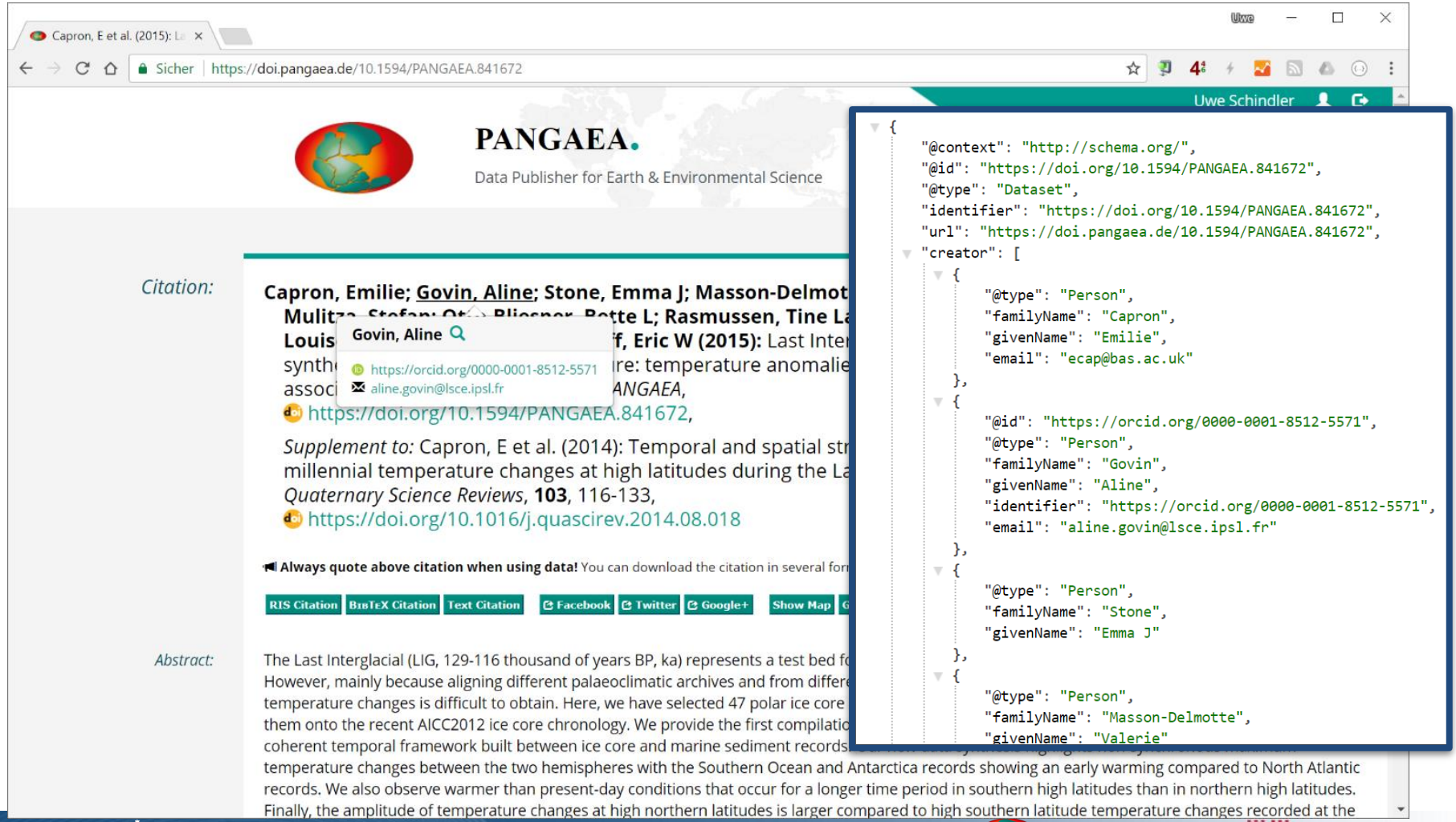
Abstract:

The Last Interglacial (LIG, 129-116 thousand of years BP, ka) represents a test bed for climate model feedbacks in warmer-than-present high latitude regions. However, mainly because aligning different palaeoclimatic archives and from different parts of the world is not trivial, a spatio-temporal picture of LIG temperature changes is difficult to obtain. Here, we have selected 47 polar ice core and sub-polar marine sediment records and developed a strategy to align them onto the recent AICC2012 ice core chronology. We provide the first compilation of high-latitude temperature changes across the LIG associated with a coherent temporal framework built between ice core and marine sediment records. Our new data synthesis highlights non-synchronous maximum temperature changes between the two hemispheres with the Southern Ocean and Antarctica records showing an early warming compared to North Atlantic records. We also observe warmer than present-day conditions that occur for a longer time period in southern high latitudes than in northern high latitudes. Finally, the amplitude of temperature changes at high northern latitudes is larger compared to high southern latitude temperature changes recorded at the


Capron, E et al. (2015): La
Sicher
https://doi.pangaea.de/10.1594/PANGAEA.841672
Uwe Schindler
PANGAEA.
Data Publisher for Earth & Environmental Science
Citation:
Capron, Emilie; Govin, Aline; Stone, Emma J; Masson-Delmot
Govin, Aline
https://orcid.org/0000-0001-8512-5571
aline.govin@lsce.ipsl.fr
https://doi.org/10.1594/PANGAEA.841672,
Supplement to: Capron, E et al. (2014): Temporal and spatial str
millennial temperature changes at high latitudes during the La
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Finally, the amplitude of temperature changes at high northern latitudes is larger compared to high southern latitude temperature changes recorded at the
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},
{
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"givenName": "Valerie"

European Commission
Horizon 2020
European Union funding
for Research & Innovation

PIDs everywhere!!

Connected Open Identifiers for Discovery, Access and Use of Research Resources

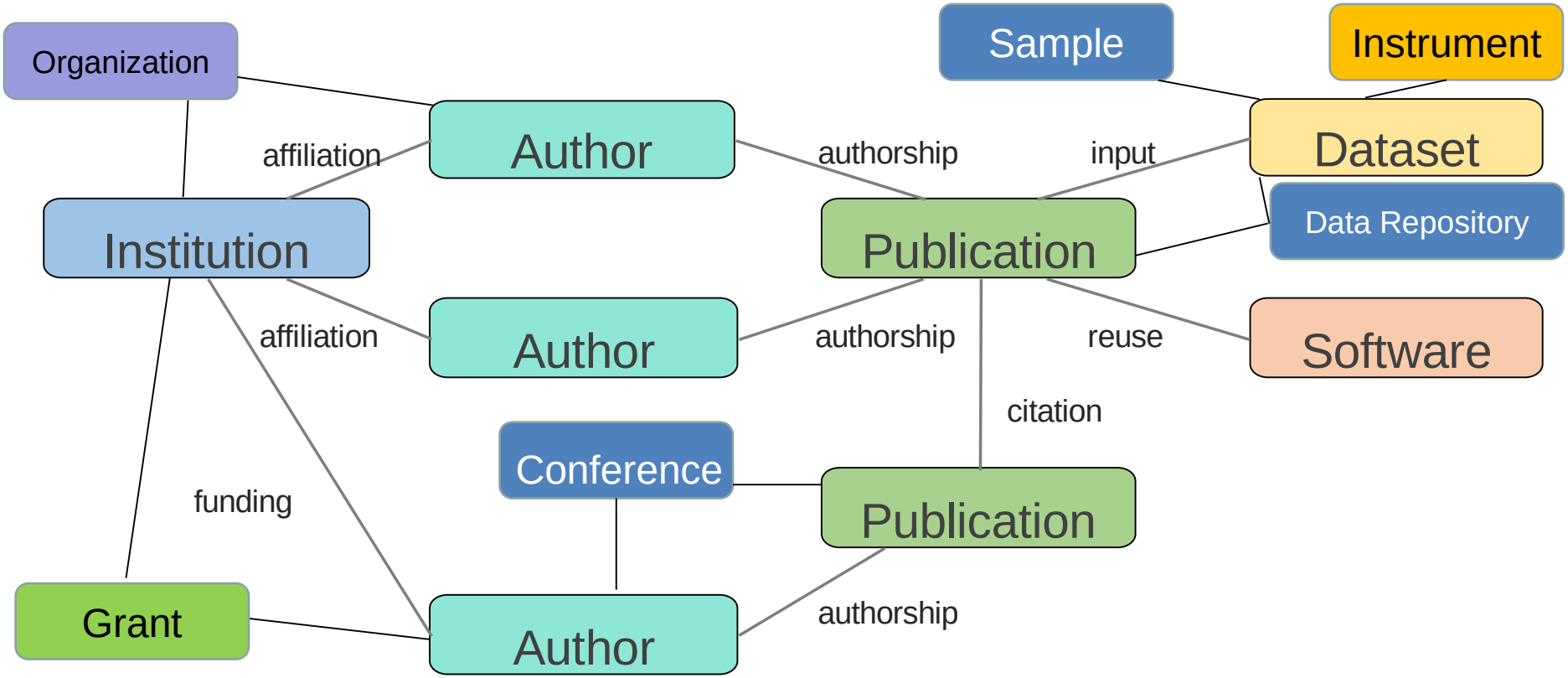
FREYA in a nutshell

- FREYA = persistent identifiers
  - "… **To extend the infrastructure for persistent identifiers (PIDs) as a core component of open research, in the EU and globally.** "
- H2020 Project funded the European Commission
- Builds on THOR (which in turn built on ODIN)
- Started 1 December 2017: www.project-freya.eu / twitter: @freya_eu

FREYA characteristics:

FREYA works interdisciplinary and draws on expertise from a very diverse group of Data repositories, Publishers, Research institutions, PID providers and libraries

PID Graph


Organization
Author
Sample
Instrument
affiliation
authorship
input
Dataset
Institution
Publication
Data Repository
affiliation
Author
authorship
reuse
Software
citation
Conference
funding
Publication
Grant
Author
authorship

Contents

25 entities

having or needing a PID

Contents

25 entities

having or needing a PID

Significant overlap among disciplines

Complicates determination of PID maturity

The Process of identifying new PIDs

PID MATURITY INDEX

Table 1 Entities, PID types and their maturity

Research entity	PID types used[5]	Maturity of PID Infrastructure
Publication	DOI, Accession number, Handle, URN, Scopus EID, Web of Science UID, PMID, PMC, arXiv Identifier, BibCode, ISSN, ISBN, PURL	Mature
Citation	OCI (secondary aggregation of information)	Emerging
Conference	DOI, Accession number	Emerging
Researcher (or Scholar)	ORCID iDs, ISNI (also DAIs, VIAFs, arxivIDs, OpenIDs, ResearcherIDs, ScopusIDs)	Mature
Organization	DOI; ISNI, GRID, Ringgold IDs	Emerging
Data	DOI, Accession number, Handle, PURL, URN, ARK	Mature
Data repository		Immature

The Process of identifying new PIDs

Only three entities **(researchers, publications and data)** have services that are deemed fully mature. The remaining are either emerging or immature

PID MATURITY INDEX

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Organization	DOI; ISNI, GRID, Ringgold IDs	Emerging
Data	DOI, Accession number, Handle, PURL, URN, ARK	Mature
Data repository		Immature

Identifying needs and requirements for new PIDs

Methods:

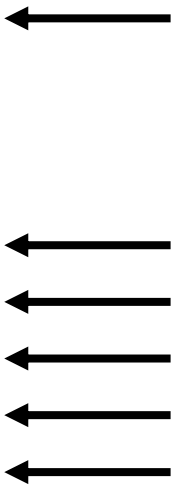
- Collecting Use-cases from the community
- Collecting Use-cases at conferences
- Identifying new PIDs in high demand
- Identifying requirements for the progress of new PIDs
- Matching Need and Requirements with FREYA expertise

Use cases

- **Cross-linking literature and data via instruments** PID Graph WP3 article data instrument publisher repository researcher user story
  #65 opened on 10 Aug 2018 by markusstocker
- **Linking published (meta)data with instrument metadata** PANGAEA PID Graph WP3 data center instrument researcher user story
  #64 opened on 10 Aug 2018 by markusstocker
- **Tracking reuse of software across versions** CERN DataCite PID Graph STFC WP3 next software software author user story
  #63 opened on 10 Aug 2018 by mfenner
- **Tracing outcome of Research cruise (campaigns)** PANGAEA PID Graph WP3 article data funder organization sample user story
  #62 opened on 9 Aug 2018 by Ketilkj

Identifying PID needs in Use-cases

Entity	**Popularity**
Instrument	**10**
data	**8**
article	**6**
person	**5**
Repository	**5**
Organisation	**4**
Sample	**4**
software	**4**
Grants	**3**
project	**1**
study	**1**
conference	**1**



Of the 25 PIDs identified in the landscape analysis 9 PIDs were chosen for further analysis and matched with expertise with in FREYA:

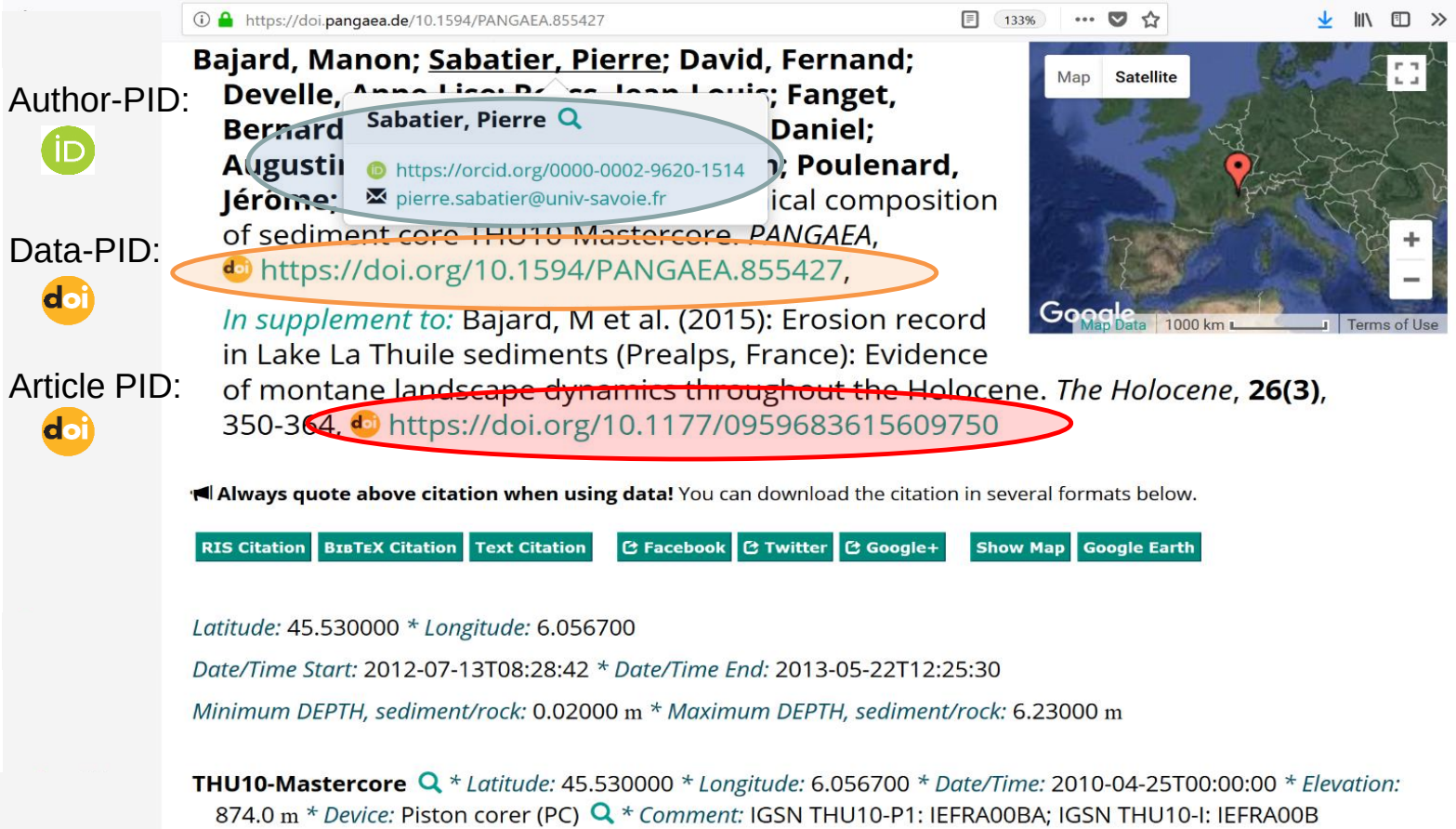
1. **Instruments**
2. **Repositories**
3. **Organizations**
4. **Physical samples**
5. **Grants**
6. **Software**
7. Research Campaigns
8. Data management plans
9. Facilities

Mature actionable PIDs available from PANGAEA

Author-PID:

Data-PID:

Article PID:

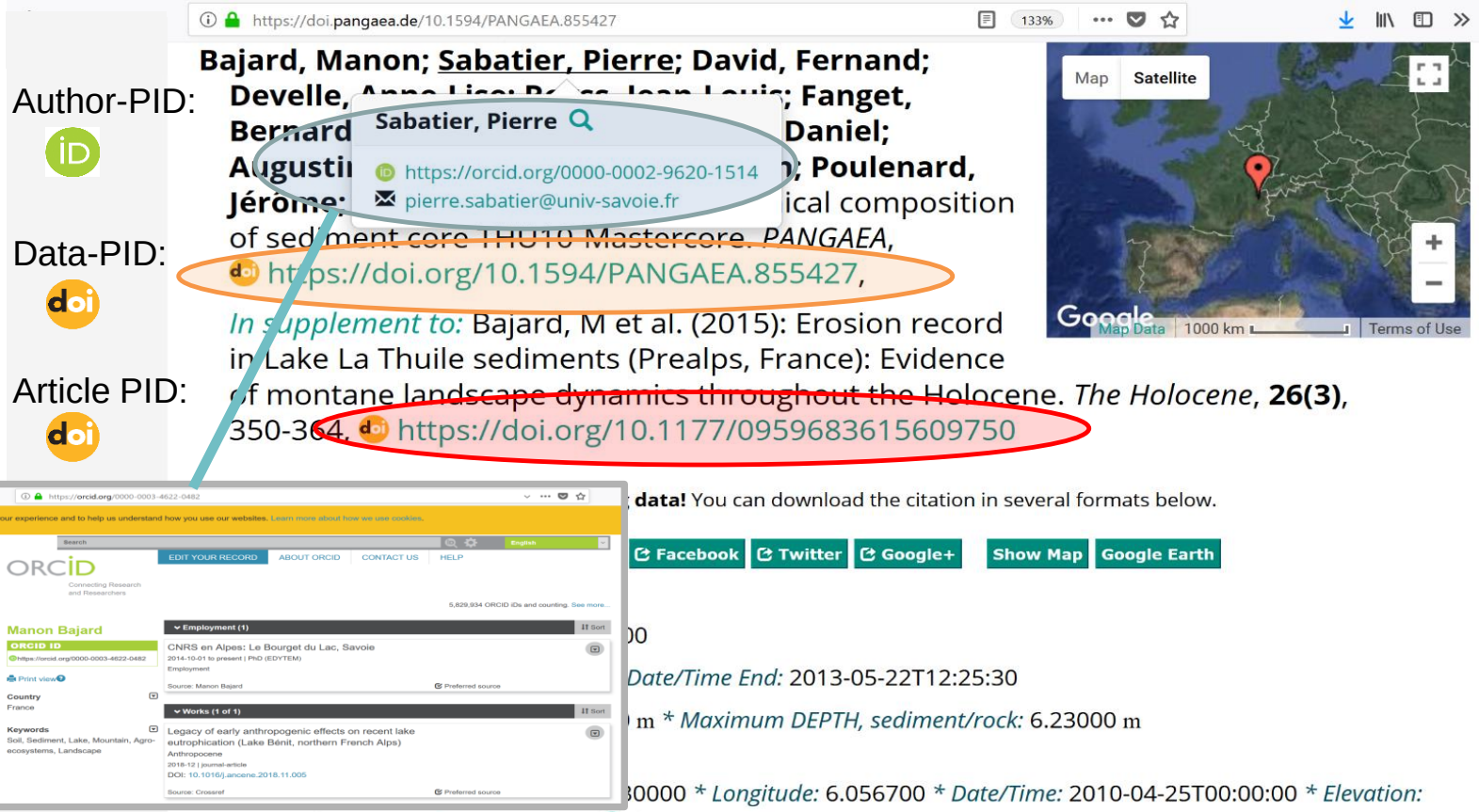


Mature actionable PIDs available from PANGAEA

Author-PID:

Data-PID:

Article PID:

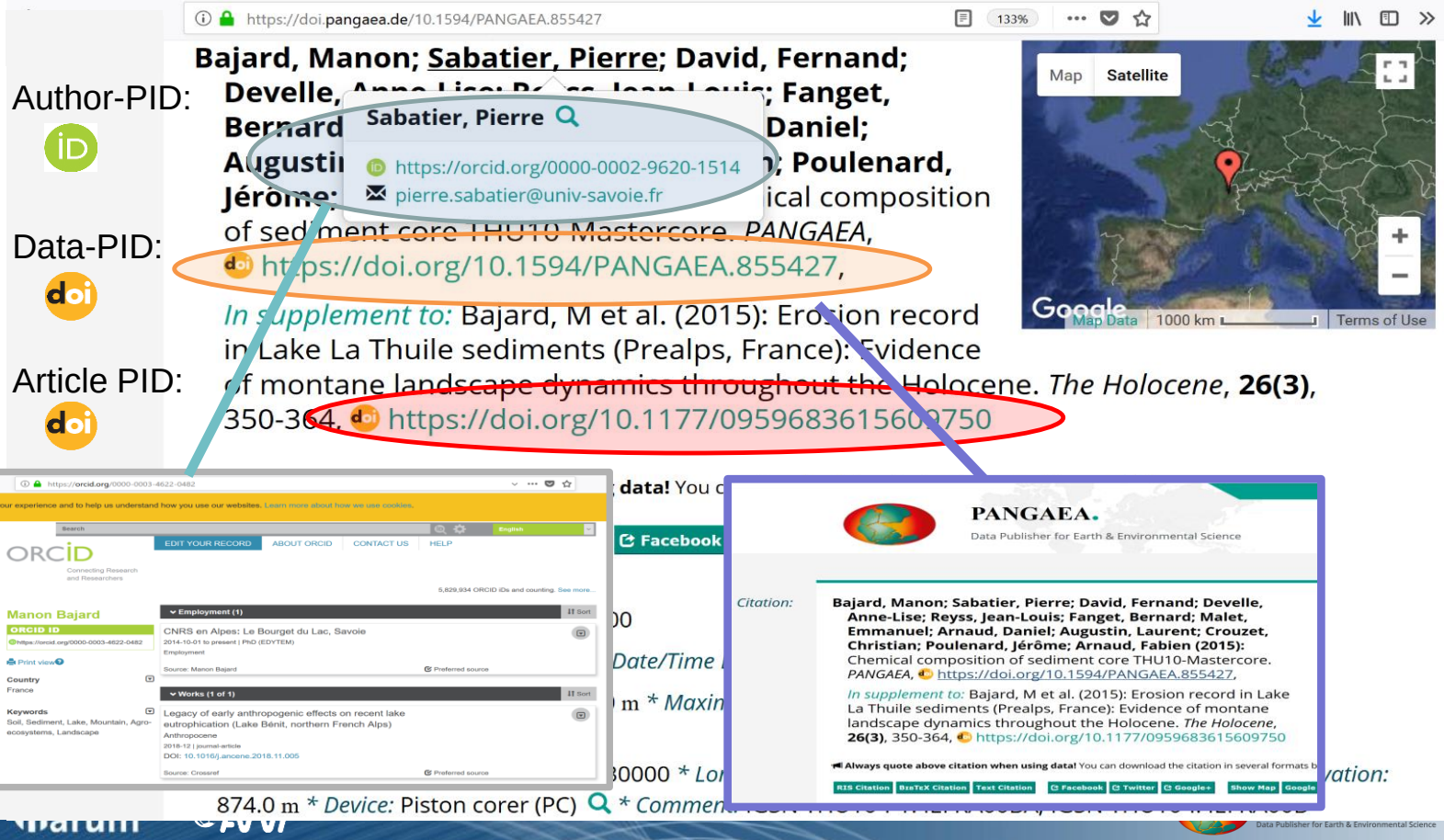


Mature actionable PIDs available from PANGAEA

Author-PID:

Data-PID:

Article PID:

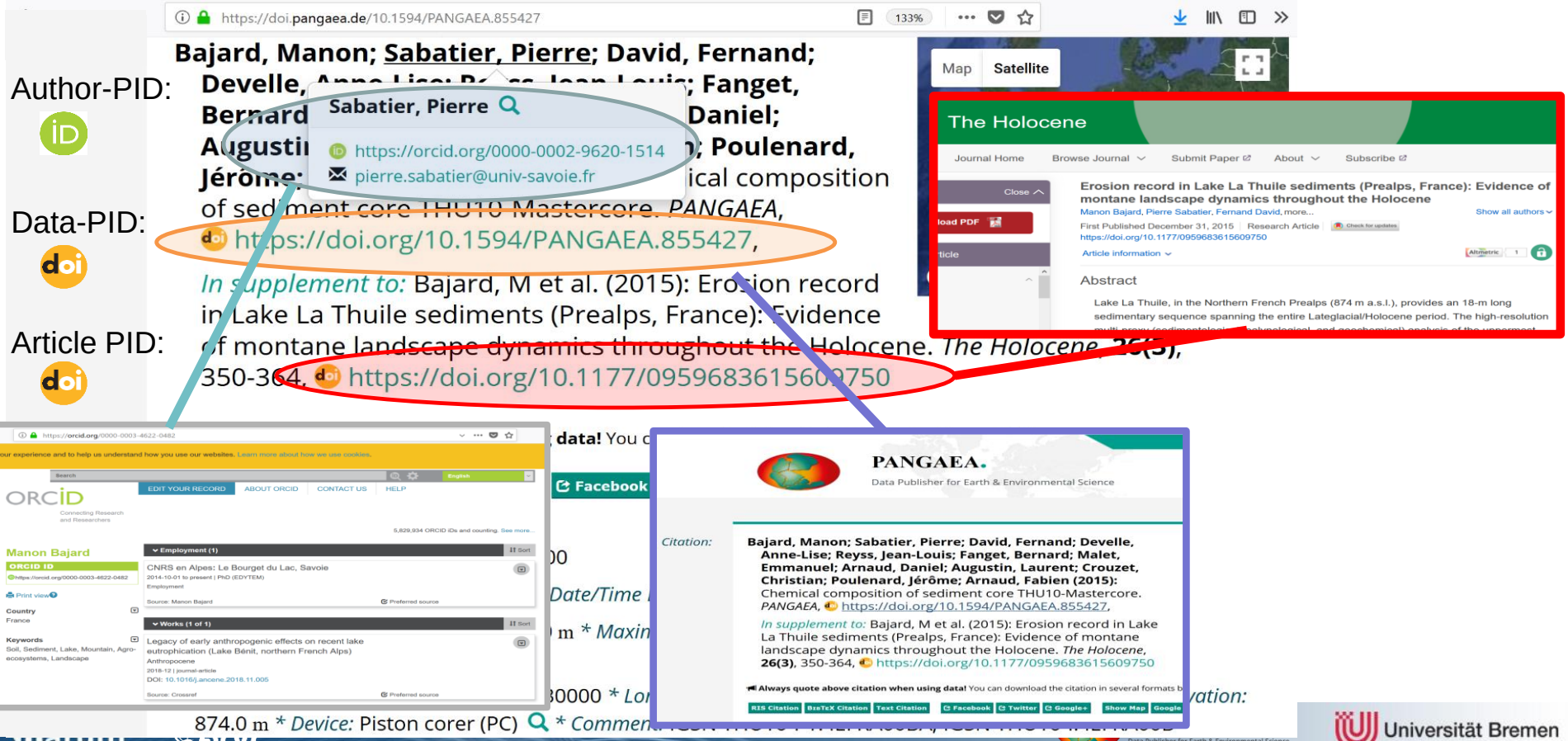


Mature actionable PIDs available from PANGAEA

Author-PID:

Data-PID:

Article PID:



The work of Bajard et al 2015 found on the PANGAEA webpage

https://doi.pangaea.de/10.1594/PANGAEA.855427

Bajard, Manon; Sabatier, Pierre; David, Fernand; Develle, Anne-Lise; Reyss, Jean-Louis; Fanget, Bernard; Malet, Emmanuel; Arnaud, Laurent; Crouzet, Christian; Ployon, Fabien (2015): Chemical composition of the THU10-Mastercore. *PANGAEA*, https://doi.org/10.1594/PANGAEA.855427,

Sabatier, Pierre
https://orcid.org/0000-0002-9620-1514
pierre.sabatier@univ-savoie.fr

In supplement to: Bajard, M et al. (2015): Erosion record in Lake La Thuile sediments (Prealps, France): Evidence of montane landscape dynamics throughout the Holocene. *The Holocene*, **26(3)**, 350-364, https://doi.org/10.1177/0959683615609750

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Latitude: 45.530000 * *Longitude:* 6.056700

Date/Time Start: 2012-07-13T08:28:42 * *Date/Time End:* 2013-05-22T12:25:30

Minimum DEPTH, sediment/rock: 0.02000 m * *Maximum DEPTH, sediment/rock:* 6.23000 m

THU10-Mastercore * *Latitude:* 45.530000 * *Longitude:* 6.056700 * *Date/Time:* 2010-04-25T00:00:00 * *Elevation:* 874.0 m * *Device:* Piston corer (PC) * *Comment:* IGSN of cores: THU10-P1: IEFRA00BA; THU10-I: IEFRA00BB

Sample - PID:

IGSN

The wo
PANGA

https://app.geosamples.org/sample/igsn/IEFRA00BA

Go Back

IGSN: IEFRA00BA

IGSN: IEFRA00BA
Sample Name: THU10_P1
Other Name(s):
Sample Type: Core
Parent IGSN: Not Provided

Description	
Material:	Sediment
Classification:	Not Provided
Field Name:	Not Provided
Description:	Not Provided
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Age (max):	150 years
Collection Method:	Coring>GravityCorer>Pilot
Collection Method Description:	Not Provided
Size:	1900
Geological Age:	Holocene
Geological Unit:	Not Provided
Comment:	Not Provided
Purpose:	Not Provided

Geolocation	
Latitude (WGS84):	45.530083
Longitude (WGS84):	6.056717

https://doi.pangaea.de

Bajard, Manon
Anne-Li
Emman
Christia
Chemica
PANGAEA,

In supplement
La Thuile sedi
landscape dy
26(3), 350-36

Always quote above

RIS Citation BibTeX Ci

Latitude: 45.530000

Date/Time Start: 201

Minimum DEPTH, sed

Sample - PID:

THU10-Mastercore * *Latitude:* 45.530000 * *Longitude:* 6.056700 * *Date/Time:* 2010-04-25T00:00:00 * *Elevation:* 874.0 m * *Device:* Piston corer (PC) * *Comment:* IGSN of cores: THU10-P1: IEFRA00BA; THU10-I: IEFRA00BB

Feedback?

Thank You!