INTEGRATED EARTH DATA APPLICATIONS
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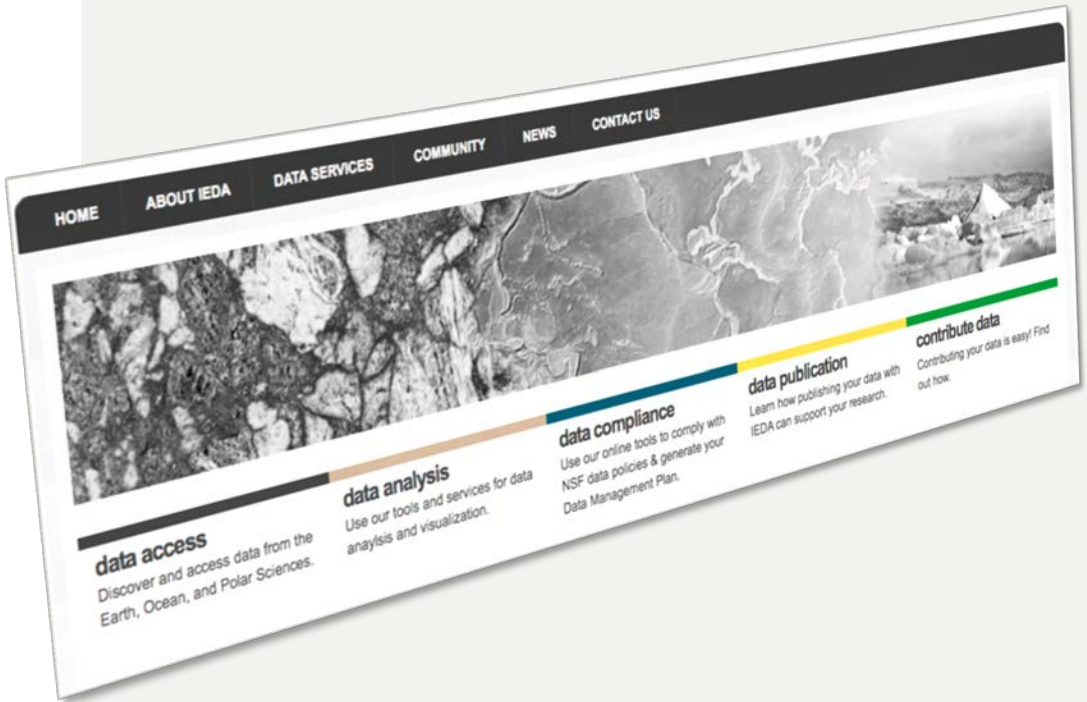
Integrated Earth Data Applications

Multi-Disciplinary Data Services for the Earth, Ocean, and Polar Sciences



Lamont-Doherty Earth Observatory
COLUMBIA UNIVERSITY | EARTH INSTITUTE

History

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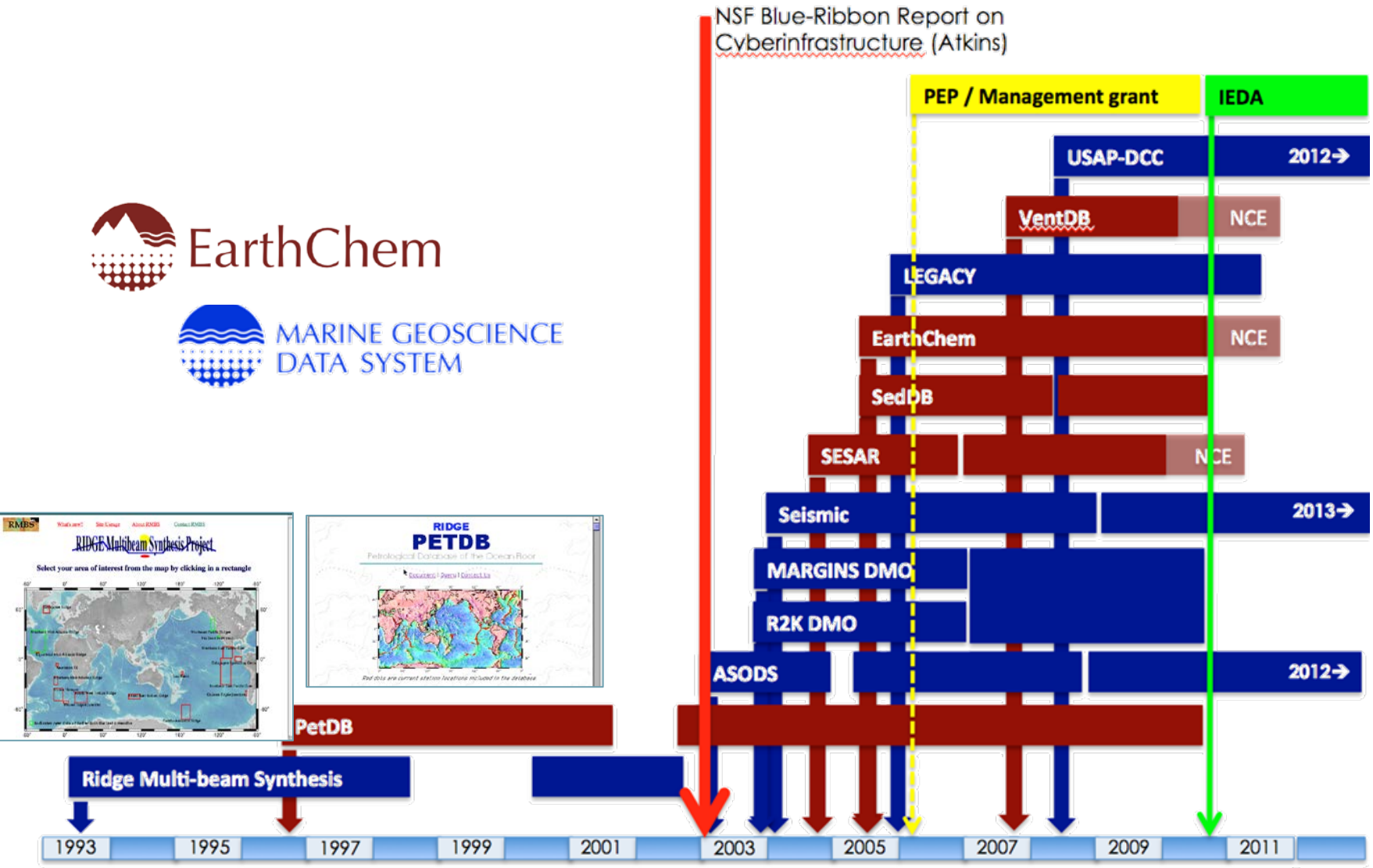
EarthChem

MARINE GEOSCIENCE DATA SYSTEM



IEDA

- Operate core services of the MGDS and EarthChem as an integrated effort
- Develop & operate new joint system capabilities
  - ☆ To facilitate and encourage user contributions.
  - ☆ To maximize integration and consistency among the MGDS and EarthChem systems

IEDA's Goals

- Promote the use of solid earth data for discovery, research, and education in the Ocean, Earth, and Polar Sciences, lower the barriers to data discovery & access.
- Preserve & facilitate the re-use of solid earth observational data, many of which are unique and expensive to acquire.
- Enable data attribution and facilitate transparency and verification of research results.
- Facilitate integration of data across the global geoscience community, both within and across scientific disciplines.
- Advance the culture of open data sharing in the Ocean, Earth, and Polar sciences.

IEDA Scope

Solid Earth Observational Data

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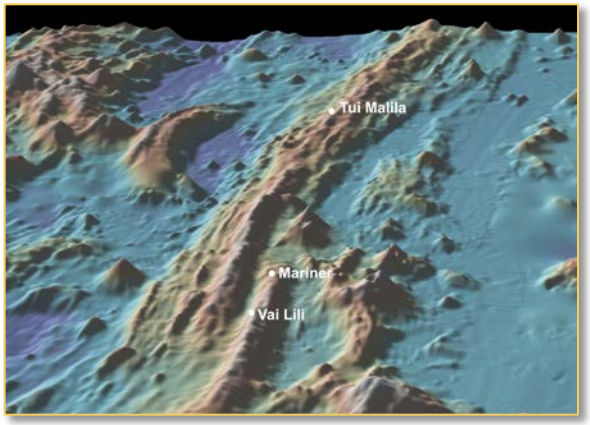
MARINE GEOSCIENCE DATA SYSTEM

EarthChem



Derived Data

Field Data

Sensor-based

Sample-based

IEDA Data Types

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- Sensor-based (MGDS)
  - ☆ Field data: 76 data types
    - o E.g.: sonar ping files, seismic reflection shot data, side-scan sonar, photographs, gravity field data, temperature
  - ☆ Derived data: 69 data types
    - o E.g.: bathymetric grids, side-scan sonar grids, micro-seismicity catalogs, migrated seismic reflection profiles, gravity MBA grids, magnetization grids
- Sample-based (EarthChem)
  - ☆ Sample profiles: rocks, sediments, liquids, soils
    - o E.g.: collection location, sampling method, archive
  - ☆ Analytical lab data: > 500 measured properties
    - o E.g.: major & trace element compositions, isotopic ratios, mineralogy, geochronology, age models, P/T model data, calculated end-member compositions

IEDA Data Holdings

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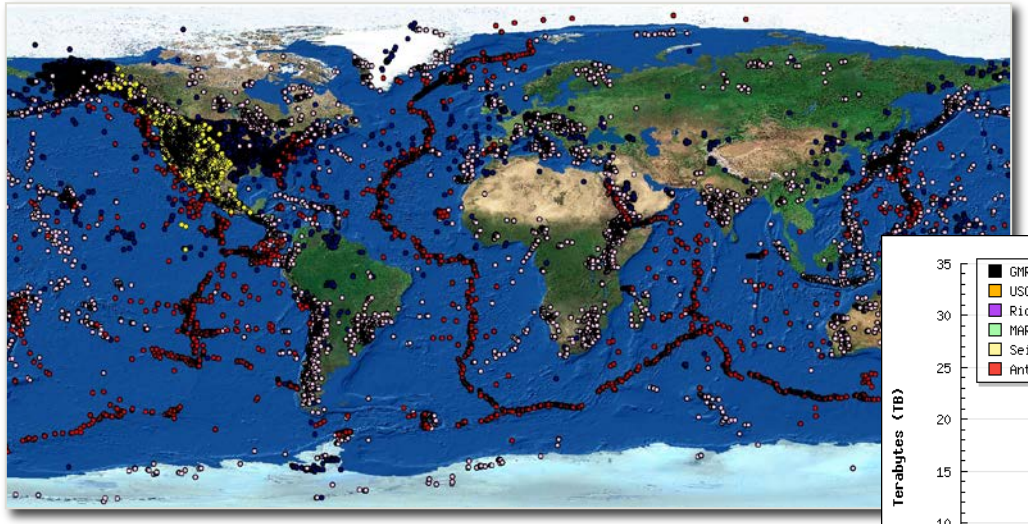
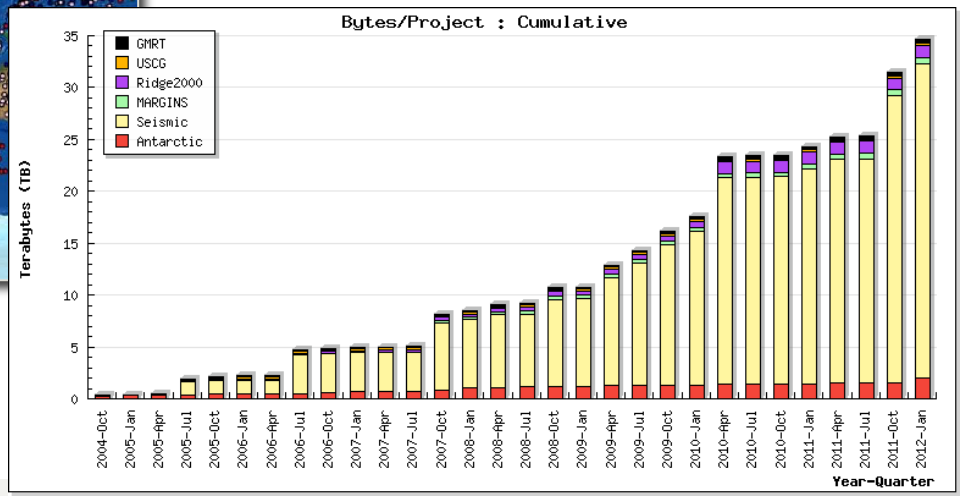
- nearly 35 terabytes, >370,000 files in **MGDS**
- 17 million geochemical values from 36,000 publications accessible at **EarthChem**
- ca. 3.8 million samples registered in **SESAR**



EarthChem Portal sample locations

MGDS Data Holdings



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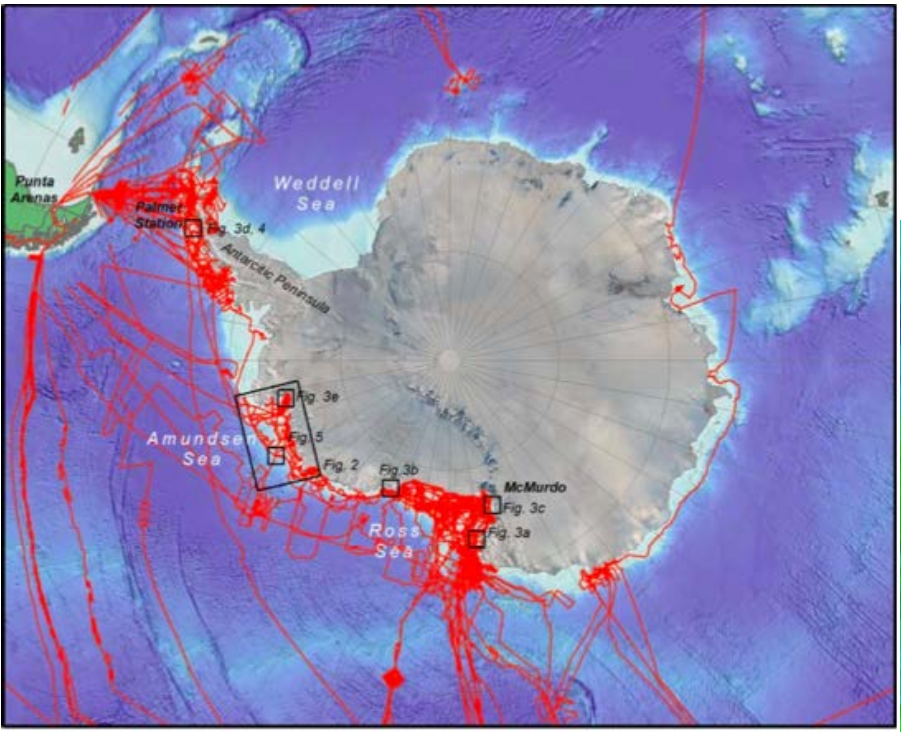
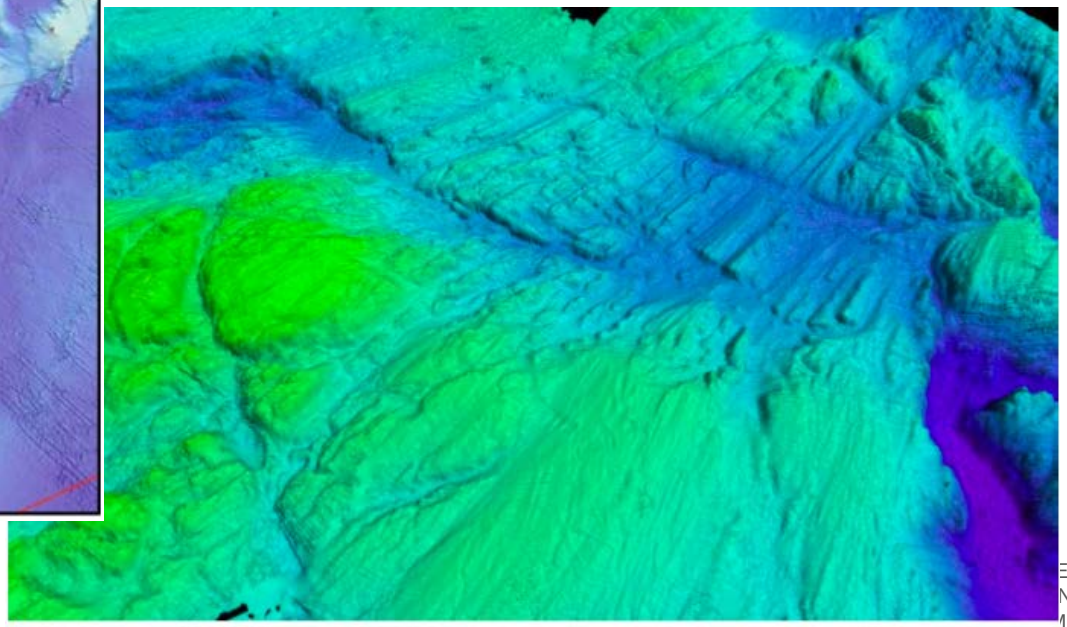
Rescue of high value multibeam sonar to routine management of all sensor data from Palmer since beginning operations.





Palmer 1994-2011

Provide Data System Services:

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IEDA Systems, Products & Services

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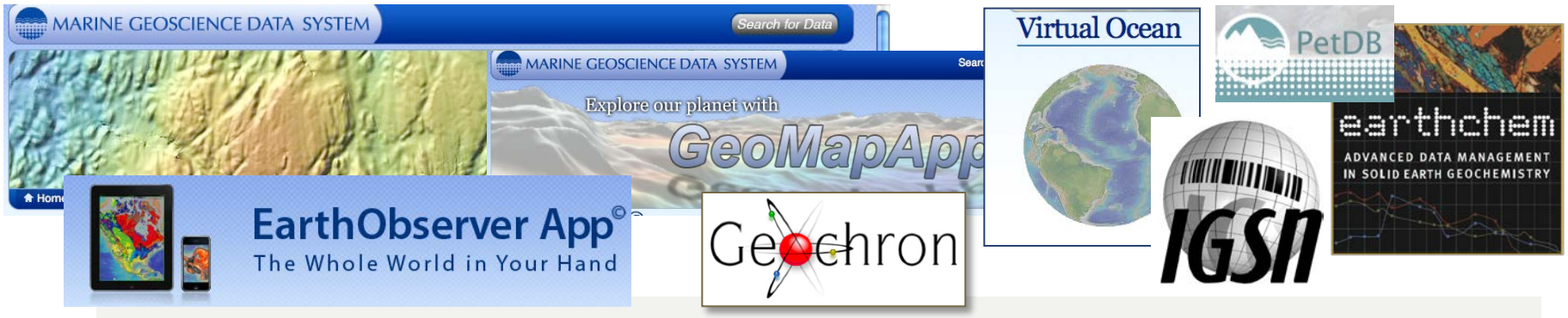
Data Repositories & Registries	Data Access Applications & Portals	Data Products & Syntheses	Community standards	Community Services
✧ Marine Geoscience Data System ✧ Mediabank ✧ Geochemical Resource Library ✧ System for Earth Sample Registration ✧ US Antarctic Program - Data Coordination Cntr	✧ GeoMapApp ✧ Virtual Ocean ✧ Earth Observer ✧ Web services ✧ EarthChem Portal ✧ GeoPrisms Portal ✧ Acad. Seismic Portal ✧ R2K Portal ✧ Antarctic & Southern Ocean Data System	✧ Global Multi-Resolution Topography ✧ Geochemical Synthesis Databases - PetDB - SedDB - VentDB - Geochron - NAVDAT	✧ Cruise/sample/seismic/multibeam metadata ✧ Geochemical metadata (data reporting) ✧ Unique sample identifier IGSN (International Geo Sample Number) ✧ EarthChemXML	✧ Data publication ✧ Investigator support: Data Management Plan Tool, Data Compliance Reports ✧ Science community outreach & training ✧ Educational modules



IEDA Foci

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Data Preservation & Curation

- QA/QC, documentation
- Persistent identification (DOI)
- Long-term archiving

Data Discovery & Access

- Web-based User interfaces
- Programmatic access interfaces
- GeoMapApp, GoogleEarth, etc.
- Links to the literature

Data Analysis

- Visualization tools (GeoMapApp, Virtual Ocean, Earth Observer)
- Syntheses & Products

Investigator Support

- Web-based data submission
- Data Management Plan tool
- Data Compliance Report tool
- Community

Data Preservation & Curation

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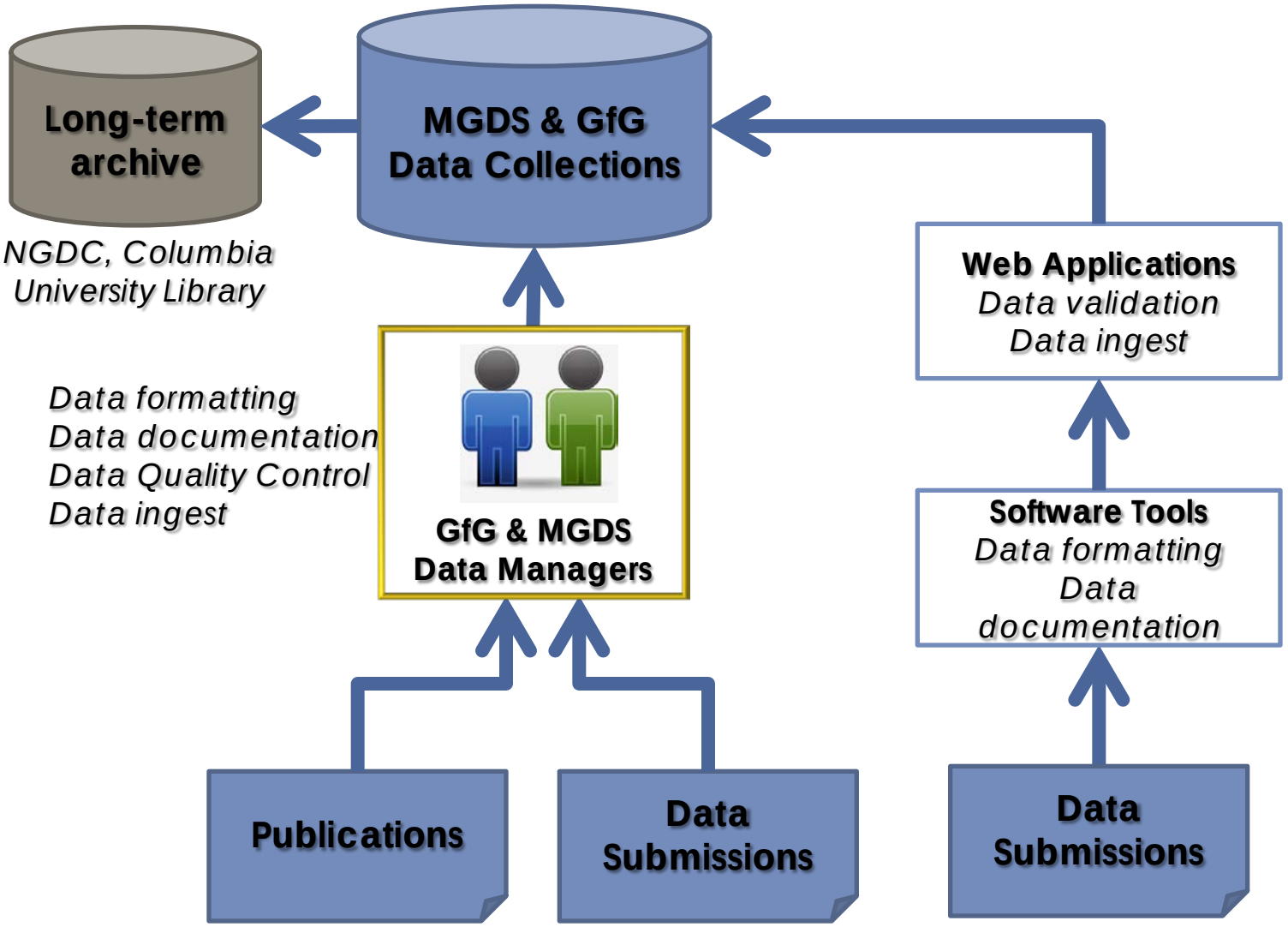
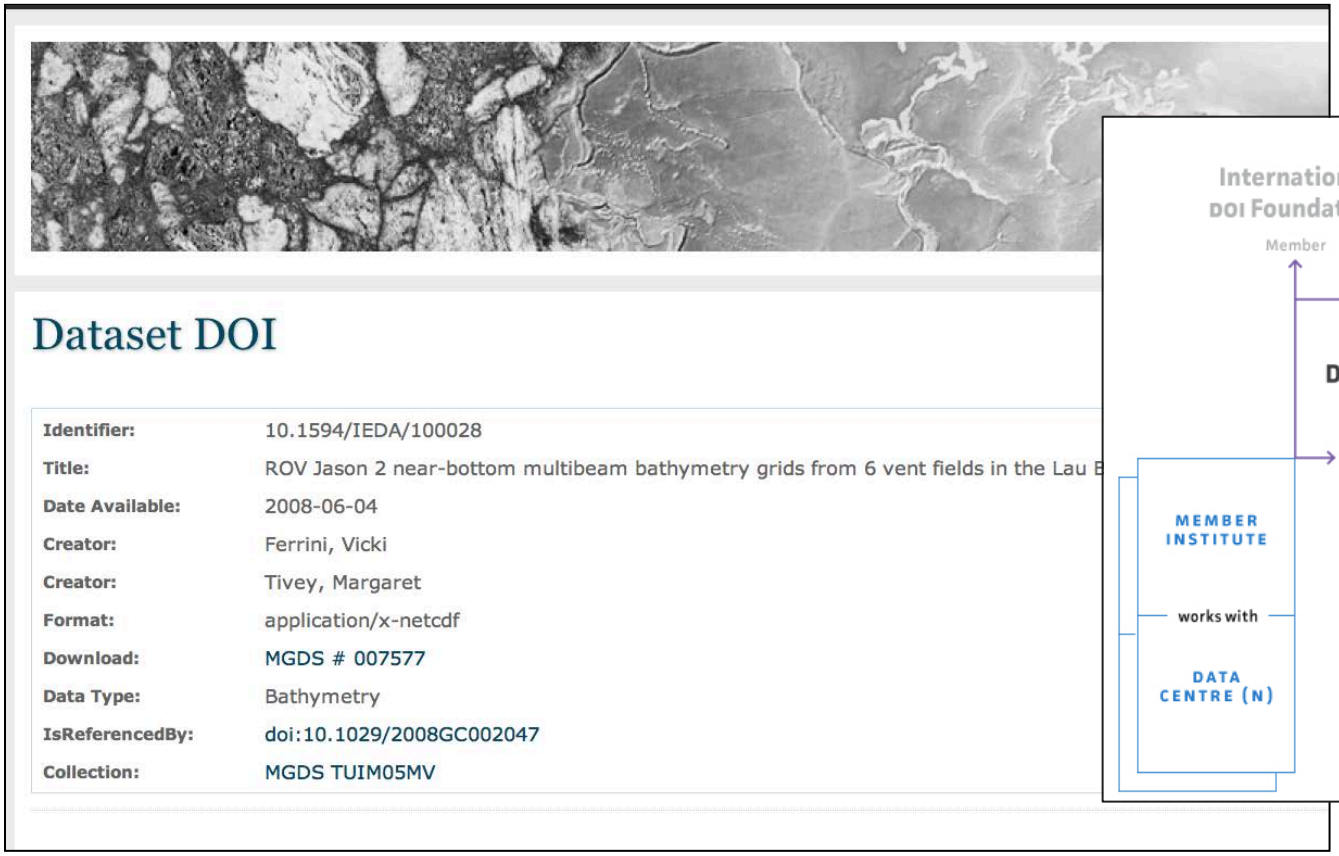


Persistent & Unique Identification

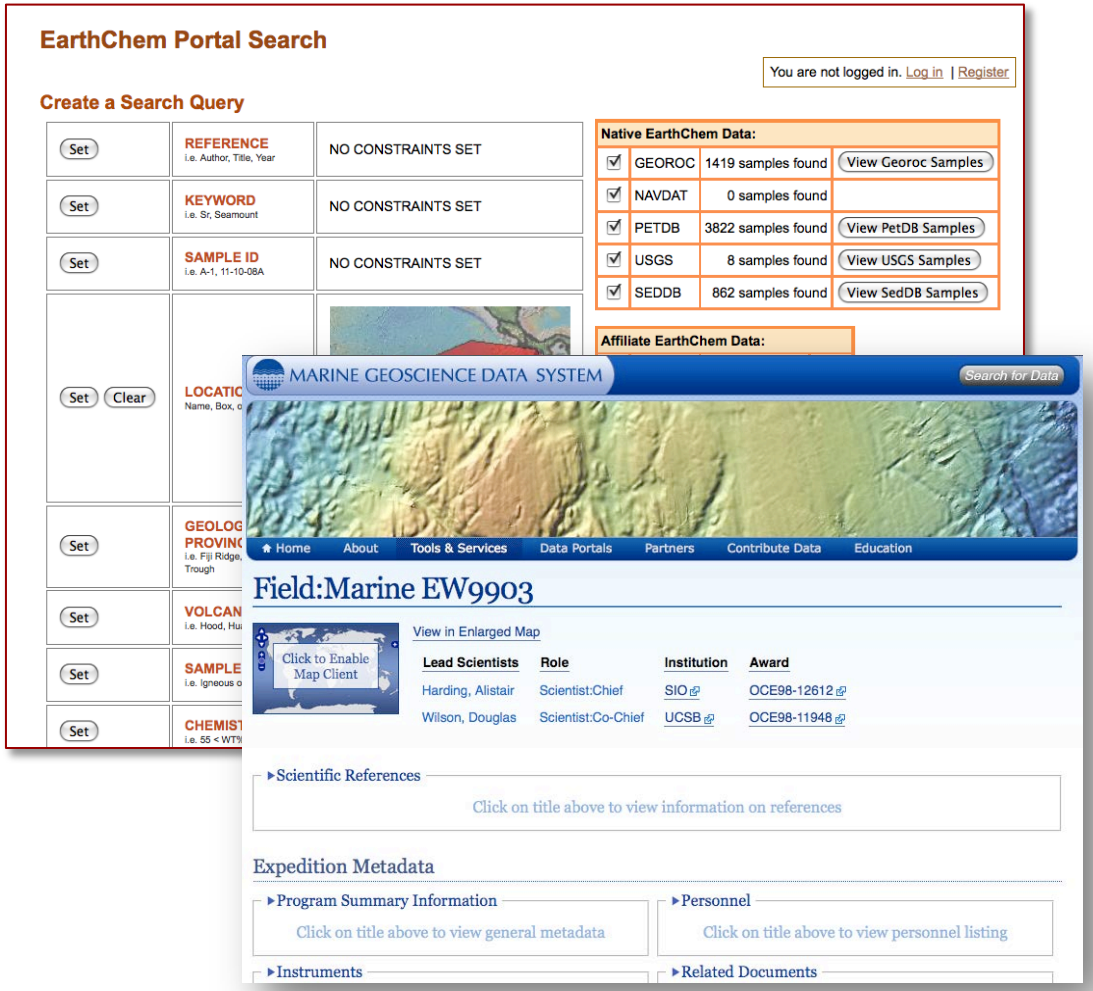
- Allows reliable citation, discovery, and access
- Ensure that data authors receive credit for data



Data Discovery & Access

- Web-based tools for flexible searches
  - ☆ Textual
  - ☆ Map-based
  - ☆ Community specific

- ☆ www.earthchem.org
- ☆ www.marine-geo.org



Graphical Tools for Access & Integration

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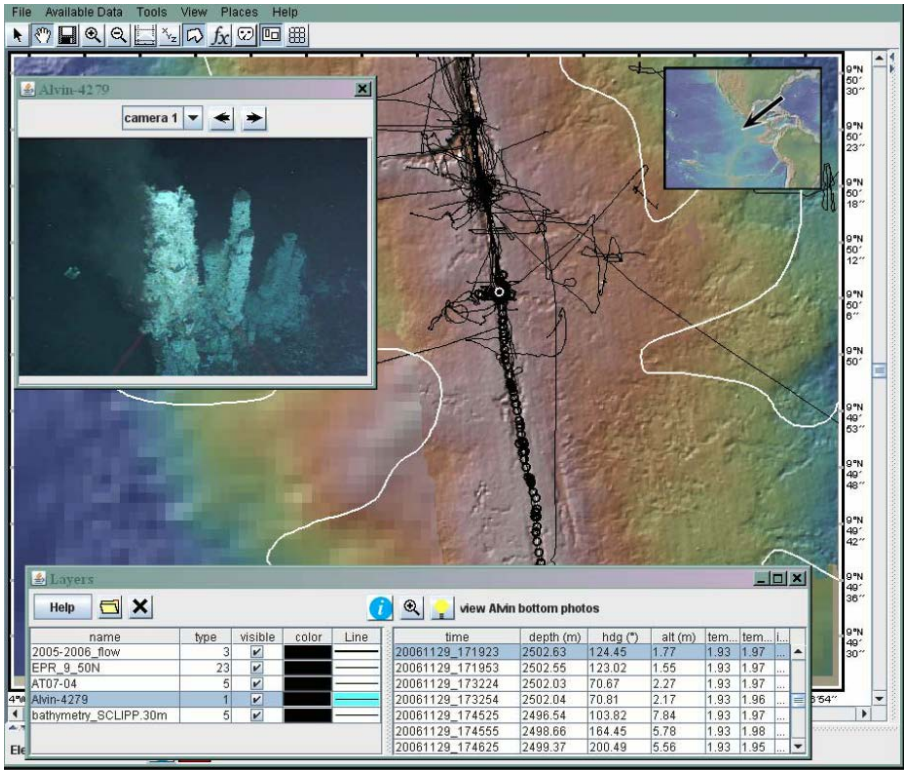
- Facilitate integration of multi-disciplinary datasets
- Provide access to complementary data from external sources
- Supports access and use of data by non-expert users



GeoMapApp

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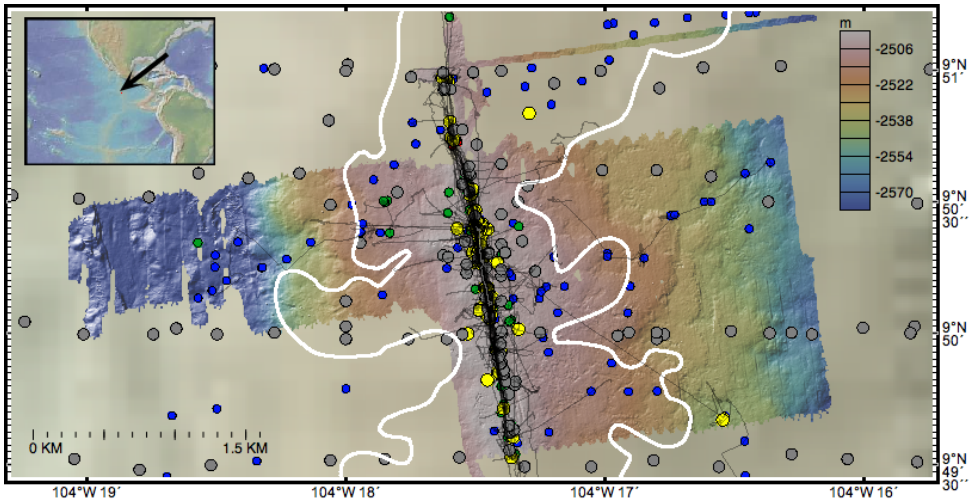
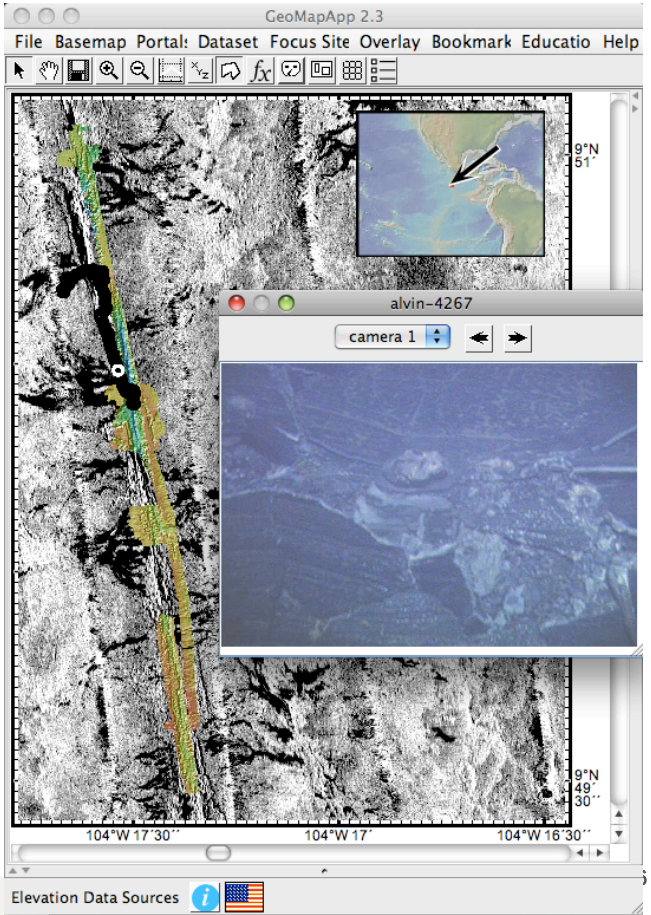
- Custom data portals and access via web services to other databases
- Analysis capability- grids, tabular data, seismic
- Import data (grids, tables, images)
- Create maps and export data





GeoMapApp~2500 users/mo

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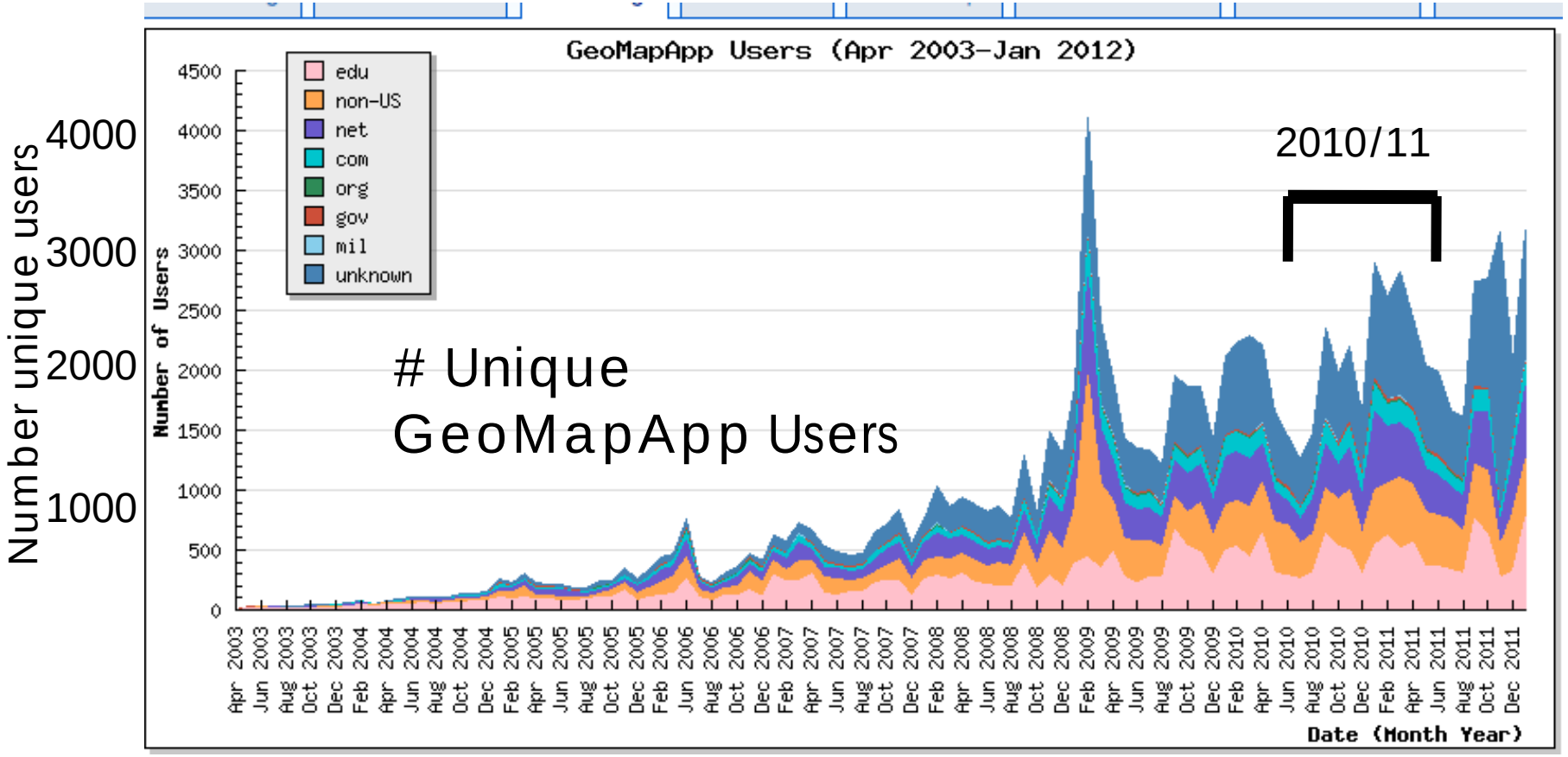
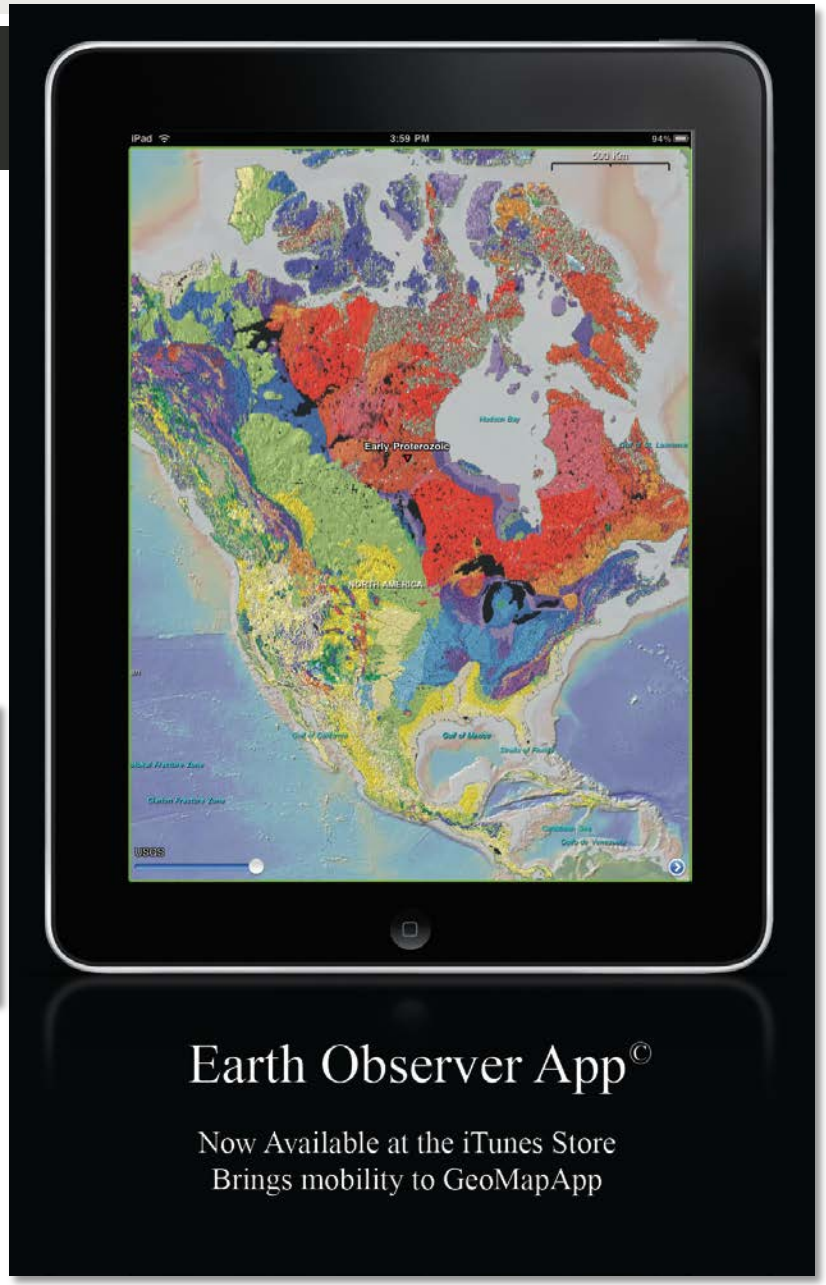


Data Access

- iPad/iPhone application to access Global Multi-Resolution Topography GMRT (and many more datasets)

Credit: W.F.B. Ryan et al.



Data Discovery & Access

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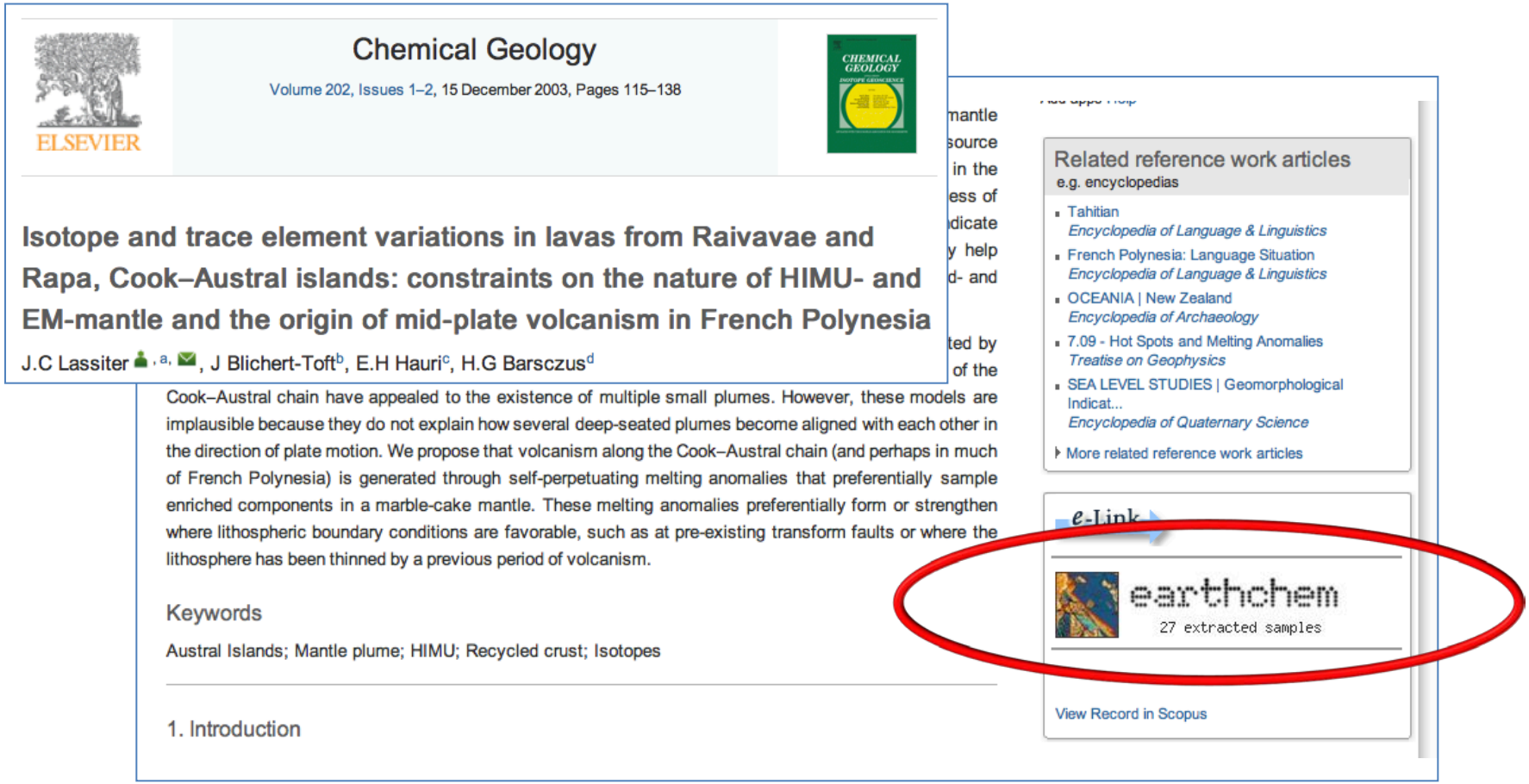
- Links between publications & data



ELSEVIER

Chemical Geology

Volume 202, Issues 1–2, 15 December 2003, Pages 115–138

Isotope and trace element variations in lavas from Raivavae and Rapa, Cook–Austral islands: constraints on the nature of HIMU- and EM-mantle and the origin of mid-plate volcanism in French Polynesia

J.C Lassiter [a], J Blichert-Toft[b], E.H Hauri[c], H.G Barsczus[d]

Cook–Austral chain have appealed to the existence of multiple small plumes. However, these models are implausible because they do not explain how several deep-seated plumes become aligned with each other in the direction of plate motion. We propose that volcanism along the Cook–Austral chain (and perhaps in much of French Polynesia) is generated through self-perpetuating melting anomalies that preferentially sample enriched components in a marble-cake mantle. These melting anomalies preferentially form or strengthen where lithospheric boundary conditions are favorable, such as at pre-existing transform faults or where the lithosphere has been thinned by a previous period of volcanism.

Keywords

Austral Islands; Mantle plume; HIMU; Recycled crust; Isotopes

1. Introduction

Related reference work articles
e.g. encyclopedias

- Tahitian
  Encyclopedia of Language & Linguistics
- French Polynesia: Language Situation
  Encyclopedia of Language & Linguistics
- OCEANIA | New Zealand
  Encyclopedia of Archaeology
- 7.09 - Hot Spots and Melting Anomalies
  Treatise on Geophysics
- SEA LEVEL STUDIES | Geomorphological Indicat...
  Encyclopedia of Quaternary Science

More related reference work articles

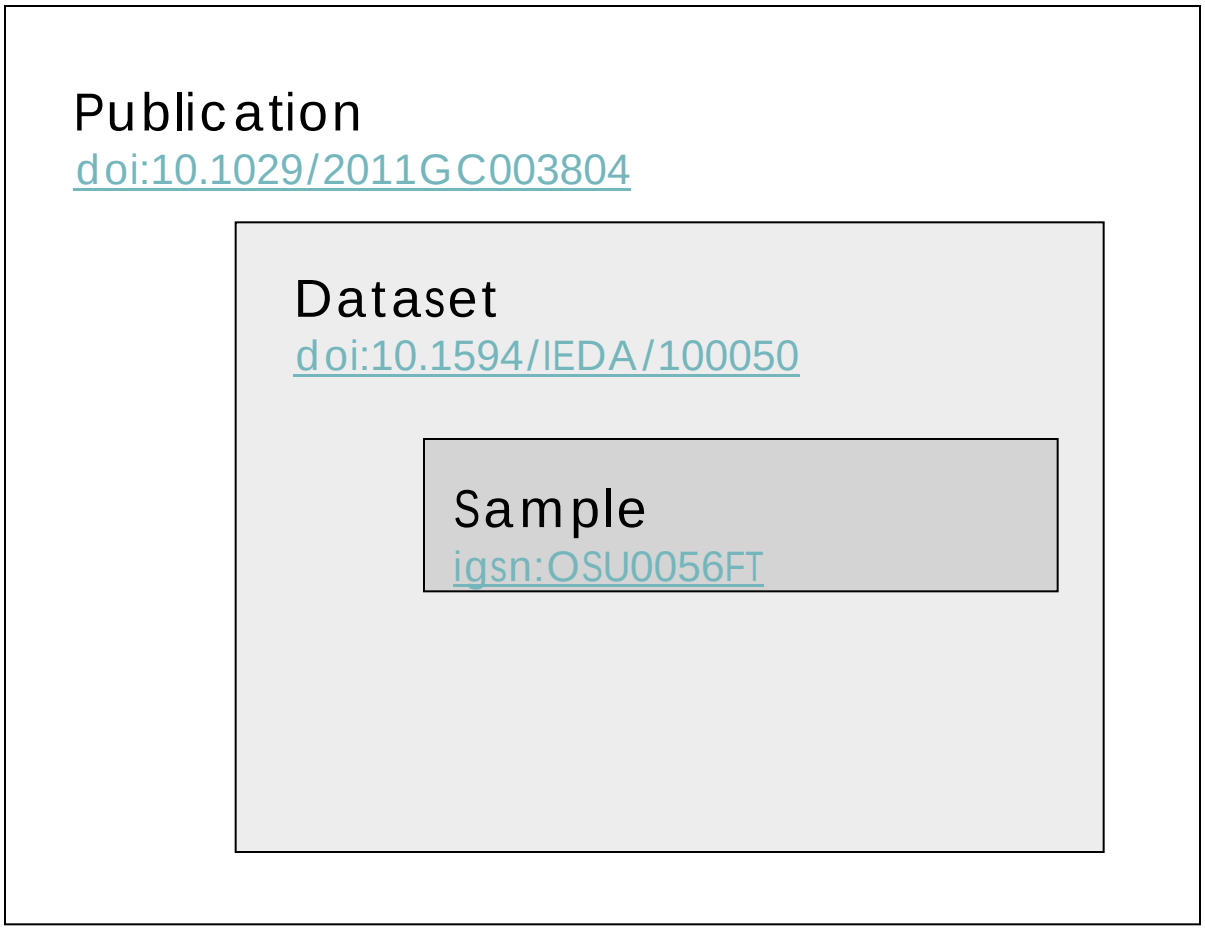
e-Link

earthchem

27 extracted samples

View Record in Scopus

Linking Samples, Data, & Publications



Data Synthesis

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- Geochemical Synthesis Databases (PetDB, SedDB)
  - ☆ Integrate and harmonize large number of small, disparate, & heterogeneous datasets
  - ☆ Comprehensive data documentation (DQ, provenance)
  - ☆ Users can generate new customized subsets of the data
  - ☆ Unique data integration by sample

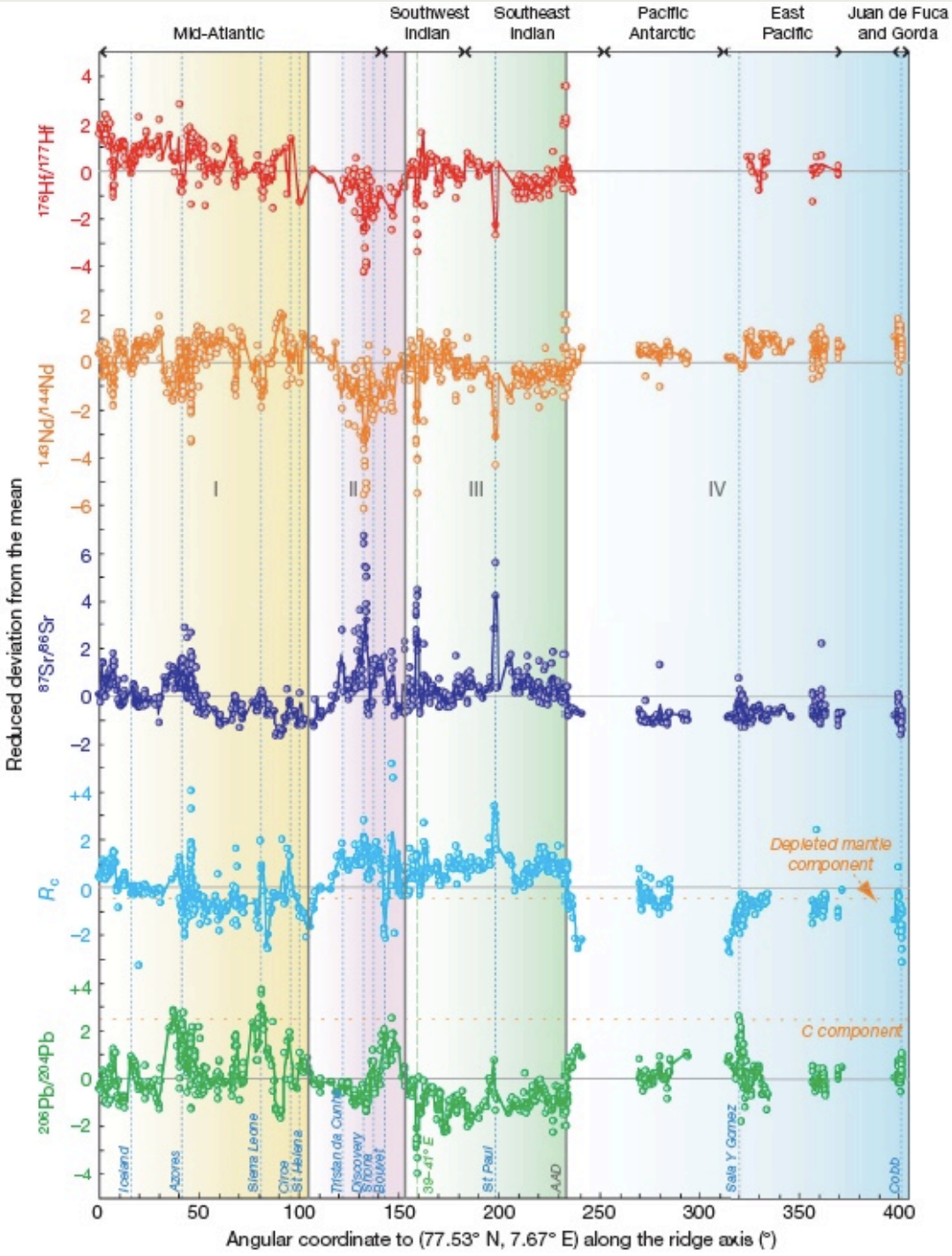
  - ☆ Revolutionized data access for igneous petrology
  - ☆ >400 citations in the literature
  - ☆ many new insights and discoveries based on mining of PetDB dataset

21

Global Isotopic Map of MORB Mantle

Meyzen et al., Nature (2007):

„Isotopic portrayal of the Earth's upper mantle flow field.“



Data Synthesis/Products

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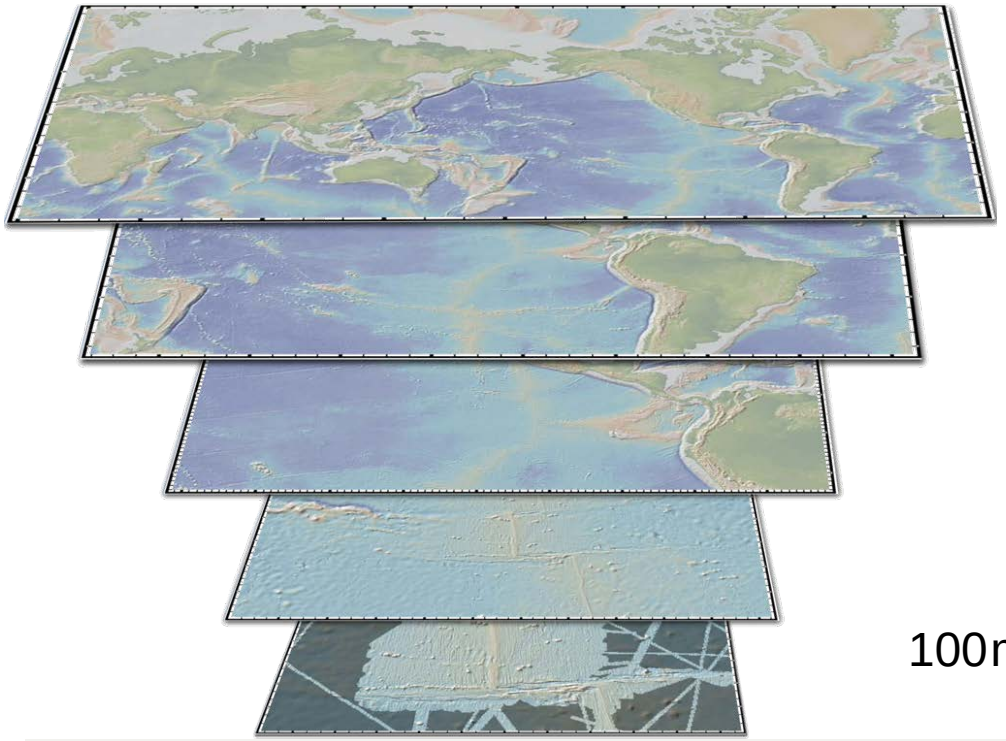
Global Multi-Resolution Topography Synthesis

- Unique synthesis of high resolution ocean bathymetry
- 10 resolution levels to 50 m, MB Swath and contributed grids
- -Regional land/ocean: ASTER, NED, GEBCO, IBCAO, BEDMAP

-



Regional
GEBCO
(~2 km)

100m swath data and grids

Back | Download Data | Get Expedition Info | Get Reference Info | Get Method Info | View Map

Your selection critera are:
Geographical Name:SPREADING_CENTER:EXPLORER RIDGE
Sample Name: ***CLASS: igneous:volcanic:mafic:BASALT, igneous:volcanic:mafic...***

first page | previous page | next page | last page Summary: 31 - 40 of 350 Rock Pre-Compiled Analysis

sample_id	reference	expedition	method	material	SiO2	TiO2	Al2O3	Fe2O3	FeO	FeOT	MnO	MgO	CaO	Na2O	K2O	P2O5	H2O	H2OP	S
ENV0085-008-002-2	MICHAEL, 1989	EN085	EMP	GL	50.56	1.52	14.95			10.36		7.35	12.38	2.74	.26	.16			
ENV0085-008-002-2	MICHAEL, 1989	EN085	XRF	WR	50.21	1.49	15.23		9.89		.19	7.76	12.38	2.55	.26	.18			
ENV0085-008-104	MICHAEL, 1989 ; MICHAEL, 1998	EN085	EMP	GL	50.74	1.27	15.29			9.29		8.02	12.83	2.18	.36	.16			
ENV0085-008-201	MICHAEL, 1989 ; MICHAEL, 1998	EN085	EMP	GL	51.49	1.64	14.75			10.51		6.7	11.69	2.51	.53	.21			
ENV0085-008-201	MICHAEL, 1989	EN085	XRF	WR	51.21	1.63	14.8		10.48		.2	7.26	11.63	2.63	.53	.25			
ENV0085-008-402	MICHAEL, 1998 ; SCOTT, 1990	EN085	EMP	GL	50.75	1.36	15.12			9.53		7.69	12.97	2.24	.37	.16			
ENV0085-008-402	MICHAEL, 1989	EN085	XRF	WR	49.95	1.29	15.12		9.02		.17	8.44	12.75	2.12	.35	.16			
ENV7025-002-007	MELSON, 2003	70-25	EMP	GL	48.41	1.4	16.77			9.46	.19	8.16	12.11	2.68	.08	.09			
ENV7025-002-008	MELSON, 2003	70-25	EMP	GL	48.46	1.38	16.81			9.49	.16	8.15	12.08	2.73	.08	.1			
ENV7025-002-008	COUSENS, 1984	70-25	XRF; MS; NN	WR	47.33	1.3	16.91	10.23			.16	9.5	12.36	2.29	.22	.09		.8	.7

first page | previous page | next page | last page

System for Earth Sample Registration

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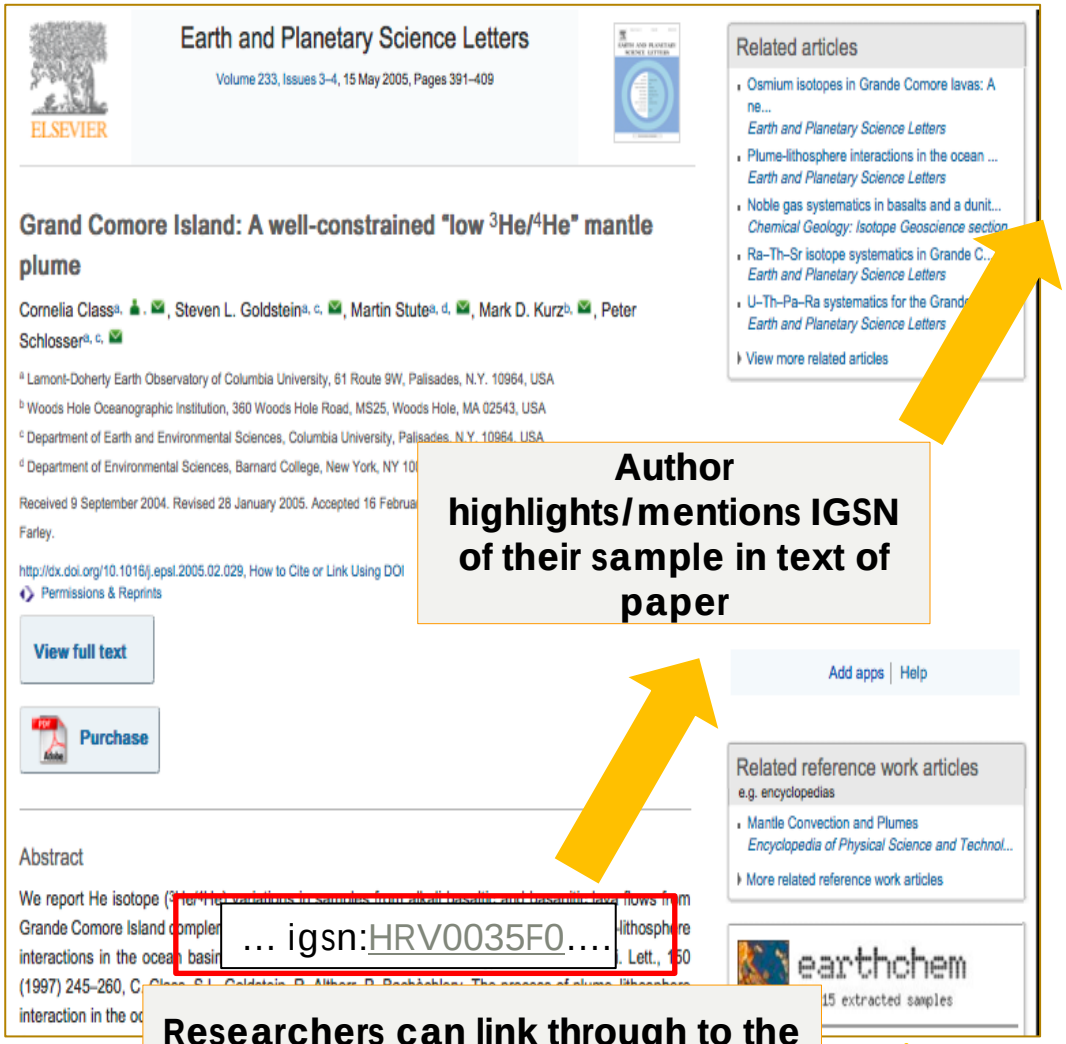
- Registry for the International Geo Sample Number (IGSN) as a unique and persistent identifier for physical objects in the Earth sciences
- International organization IGSN e.V. founded at AGU FM 2011 to implement and promote the IGSN as a standard method for locating, identifying, and citing physical samples
- new distributed infrastructure for international registration services under development

www.geosamples.org
www.igsn.org

Entity linking with SESAR through ScienceDirect

slide courtesy of Bethan Keall, Elsevier

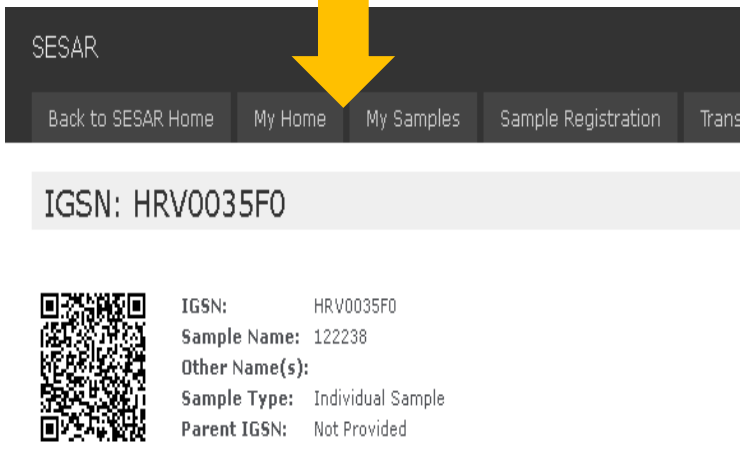


Author highlights/mentions IGSN of their sample in text of paper

… igsn:HRV0035F0….

Researchers can link through to the sample at SESAR in one click – more efficient

Elsevier creates a text link to http://www.geosamples.org/profile?igsn:HRV0035F0



Investigator Support

Contribute Data

IEDA welcomes and encourages
and in the future.

Sample-based Data

- Analytical geochemistry d
- Geochemical or petrologi
- Geochronological dataset
- Sample metadata (IGSN
- Technical reports (analyti

Sensor-based Data

- Derived Geophysical Data
- Photos and images
- Shipboard, airborne, and
- Seismic Reflection Field D
- Processed Seismic Data
- Technical reports (data re

Other Data Types

- Experimental datasets
- Software tools (e.g., mac
- Highlight images & videos

For assistance, please contact info@iedadata.org

Geochemical Resource Library: Submit

Begin Submission:

For a summary of the submission process, please read the Submission Guidelines.

Step 1:

Before entering the dataset information, please let us know if you would like to link your data submission to an NSF award. *Why should I do this?*

Do you want to enter an NSF award number for your data?

○ yes ○ no

Step 2:

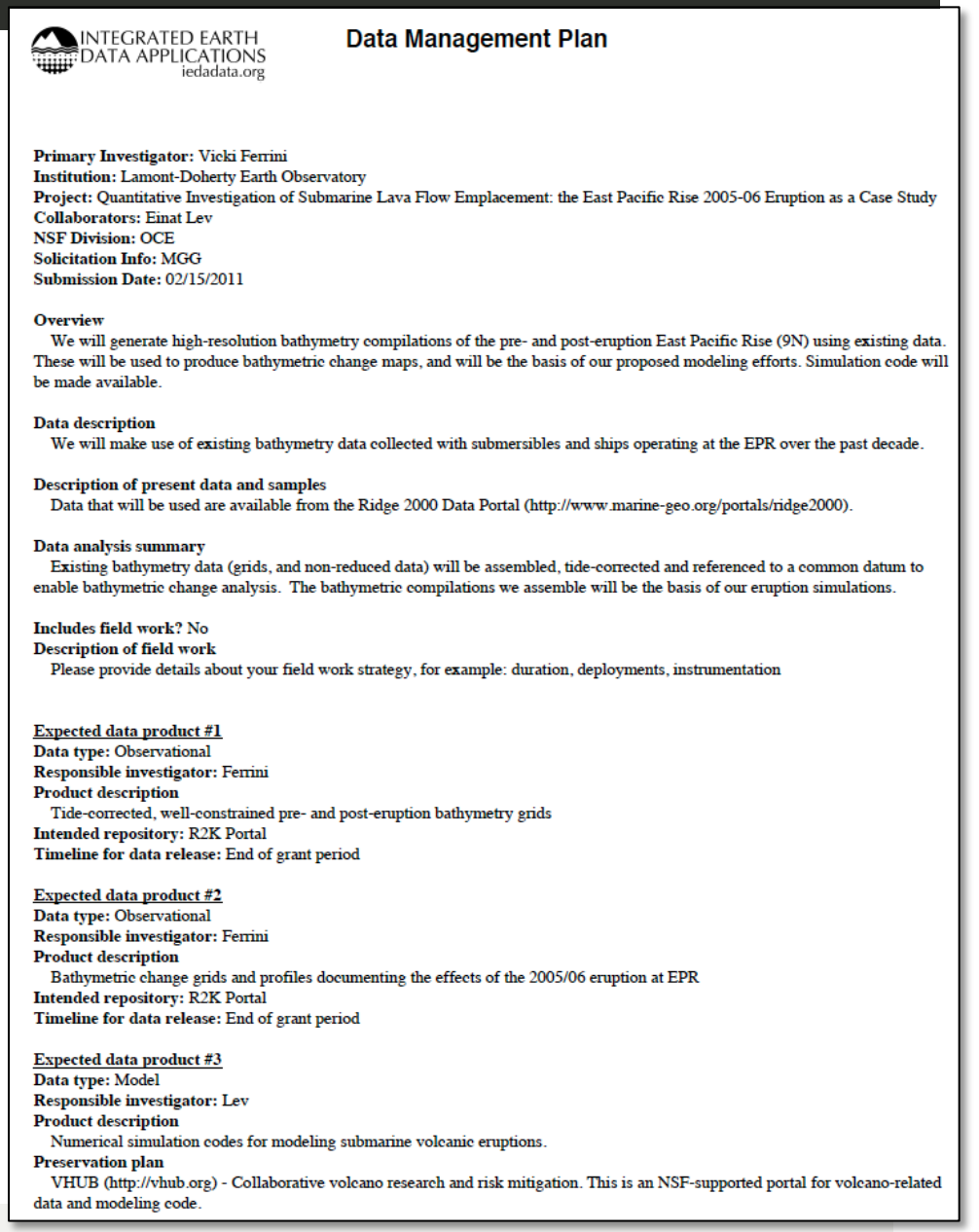
Click Continue to proceed.

You will be asked to login via GeoPass. *What is Geopass?*

Continue >

Investigator Support

- IEDA Data Management Plan Tool
  - ☆ Launched January 2011
  - ☆ Web form structured according to NSF DMP requirements
  - ☆ generates pdf
  - ☆ dashboard to store/edit DMPs
  - ☆ > 280 DMPS created
  - ☆ PIs from >20 Institutions
  - ☆ Design adopted by other repositories



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Data Management Plan

Primary Investigator: Vicki Ferrini
Institution: Lamont-Doherty Earth Observatory
Project: Quantitative Investigation of Submarine Lava Flow Emplacement: the East Pacific Rise 2005-06 Eruption as a Case Study
Collaborators: Einat Lev
NSF Division: OCE
Solicitation Info: MGG
Submission Date: 02/15/2011

Overview
We will generate high-resolution bathymetry compilations of the pre- and post-eruption East Pacific Rise (9N) using existing data. These will be used to produce bathymetric change maps, and will be the basis of our proposed modeling efforts. Simulation code will be made available.

Data description
We will make use of existing bathymetry data collected with submersibles and ships operating at the EPR over the past decade.

Description of present data and samples
Data that will be used are available from the Ridge 2000 Data Portal (http://www.marine-geo.org/portals/ridge2000).

Data analysis summary
Existing bathymetry data (grids, and non-reduced data) will be assembled, tide-corrected and referenced to a common datum to enable bathymetric change analysis. The bathymetric compilations we assemble will be the basis of our eruption simulations.

Includes field work? No
Description of field work
Please provide details about your field work strategy, for example: duration, deployments, instrumentation

Expected data product #1
Data type: Observational
Responsible investigator: Ferrini
Product description
Tide-corrected, well-constrained pre- and post-eruption bathymetry grids
Intended repository: R2K Portal
Timeline for data release: End of grant period

Expected data product #2
Data type: Observational
Responsible investigator: Ferrini
Product description
Bathymetric change grids and profiles documenting the effects of the 2005/06 eruption at EPR
Intended repository: R2K Portal
Timeline for data release: End of grant period

Expected data product #3
Data type: Model
Responsible investigator: Lev
Product description
Numerical simulation codes for modeling submarine volcanic eruptions.
Preservation plan
VHUB (http://vhub.org) - Collaborative volcano research and risk mitigation. This is an NSF-supported portal for volcano-related data and modeling code.

Investigator Support

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Data Compliance Reporting Tool (Beta)

Instructions: The IEDA Data Compliance Report Tool enables the easy preparation of reports to demonstrate compliance with NSF Data Policies. Enter a NSF award and this service will provide a list of related data sets and their release status. Note that data will only be returned for awards that are currently cataloged within IEDA, and data sets returned are based on data and metadata received to date. Please contact us with comments or questions, or to submit additional data or metadata.

Enter NSF Award

Submit

Locate a NSF Award through the Fastlane Award Search

- Documents all data sets registered in our systems
- Document status of data release

National Science Foundation
WHERE DISCOVERIES BEGIN

NSF Web Site

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IEDA
INTEGRATED EARTH

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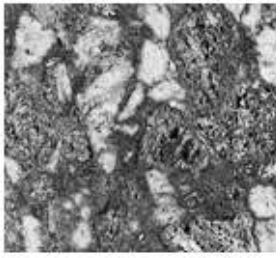
Award Search

Send Co

Awardee Information | Program Information | Search All Free-Text | Search All Fields | More



Hint: The text field below 'Search Award For' searches the title, abstract, and award number fields.

Search Award For:

Restrict to Title Only:

Awardee Information

Principal Investigator

First Name: Suzanne

Last Name: Carbotte

PI Lookup

Hint: Including CO-PI will result in slower searches.

Include CO-PI:

Organization:

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NSF Award Info

Award Title: Collaborative Research: A MCS Investigation to Study Axial Crustal Structure and Alteration of Upper Crust at the Juan de Fuca Spreading Center

Investigator(s): John Diebold, Suzanne Carbotte

Sensor Data Linked to Award

Archived with IEDA

Expedition/ Compilation	Data Type(s)	# of Data Sets	Instrument Info	Investigator(s)	Release Information	Citations
EW0207	Geophysical	1	*Maurice Ewing* Gravimeter Sonar:Multibeam	Carbotte, Suzanne	Released	Not Supplied
EW0207	Navigation:Primary	2	*Maurice Ewing* Navigation	Carbotte, Suzanne	Released	Not Supplied
EW0207	LayerThickness:Crust LayerThickness:SeismicLayer2A Seismic:Ancillary:MCS Seismic:Navigation Seismic:Reflection:MCS Seismic:SegyHistory:MCS Seismic:ShotTimes:MCS Seismic:ShotTimesStatus	9	Seismic:MCS	Canales, JuanPablo Carbotte, Suzanne Harding, Alistair Kent, Graham Nedimovic, Mladen	Released	Canales et al., 2005 Canales et al., 2006 Carbotte et al., 2008 Carbotte et al., 2006 Nedimovic et al., 2005 Van Ark, 2007 Nedimovic et al., 2008
EW0207	Bathymetry:Swath	3	*Maurice Ewing* Sonar:Multibeam	Carbotte, Suzanne	Released	Not Supplied

Archived at Other Repositories

Expedition/ Compilation	Data Type(s)	Repository	Instrument Info	Investigator(s)	Citations
EW0207	Bathymetry:Swath	NOAA:NGDC	*Maurice Ewing* Sonar:Multibeam	Carbotte, Suzanne	Not Supplied
EW0207	Seismic:Reflection:MCS	UTIG	Seismic:MCS	Carbotte, Suzanne	Canales et al., 2005 Canales et al., 2006 Carbotte et al., 2008 Carbotte et al., 2006 Canales et al., 2009

Focus: Community

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- Close links to science programs
- Development of community best practices & standards
- Workshops
- User surveys
- Short-courses

Thanks to the IEDA Team!

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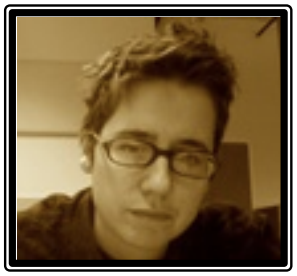
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