"Research at the Interface between Ocean Chemistry and Biology"

Purpose:

Assess the interest within the OCB community for developing a program to investigate metal-biota interactions, including the implications for marine ecosystems and the impacts on marine biogeochemical cycles of carbon and related compounds.

"Research at the Interface between Ocean Chemistry and Biology"

Context:

1980's - Martin's Fe incubations

1990's - Mesoscale Fe enrichments

2000's - Growing evidence for co-limitation.

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Agenda:

- GEOTRACES overview
- Micronutrient-Biota Interactions
- IMBER
- SOLAS
- Organic GEOTRACES
- Advocacy talks
- Discussion
- Scoping Workshop?

"Research at the Interface between Ocean Chemistry and Biology"

SOLAS:

"Atmospheric control of nutrient cycling and primary production in the Surface Ocean"

Special Session: SOLAS Open Science Conference
16 - 19 November, 2009, Barcelona

GOAL: Develop white paper leading to future research program

http://www.solas-int.org/aboutsolas/organisationaandstructure/midtermstrategy/midtermstrategy.html

Marine Biogeochemical Cycles of Trace Elements and their Isotopes

http://www.geotraces.org/

Sponsored by

22 July, 2009 Presentation by Bob Anderson, OCB Annual Workshop

GEOTRACES: Mission

To identify processes and quantify fluxes that control the distributions of key **trace elements and isotopes** (□TEIs) in the ocean, and to establish the sensitivity of these distributions to changing environmental conditions.

GEOTRACES: Anticipated Benefits

1) Identify sources and sinks and quantify internal cycling of essential micronutrients (e.g., Fe, Zn, Co, Cd, Cu).

2) Calibrate geochemical tracers used to reconstruct past ocean conditions (e.g., circulation, chemistry, biological productivity, carbon fluxes) for more reliable applications.

3) Quantify groundwater supply of dissolved materials.

4) Improve predictions of the transport and fate of contaminants.

GEOTRACES: Program Elements

Enabling Activities
- Standards and intercalibration
- Data protocols, management, archiving
- Modeling (2nd model-data synergy workshop, Paris, 7 - 10 Dec. 2009)
- Capacity Building

International Polar Year

Ocean Sections
- **Core activity - requires international cooperation**
- Covering regions dominated by major processes
- National cruises with international collaboration

Process Studies
- Targeted at processes known to be important
- Targeted at “anomalies” detected in ocean sections
- Some will focus on ocean boundaries (e.g., coastal regions)
- Some will exploit time-series stations

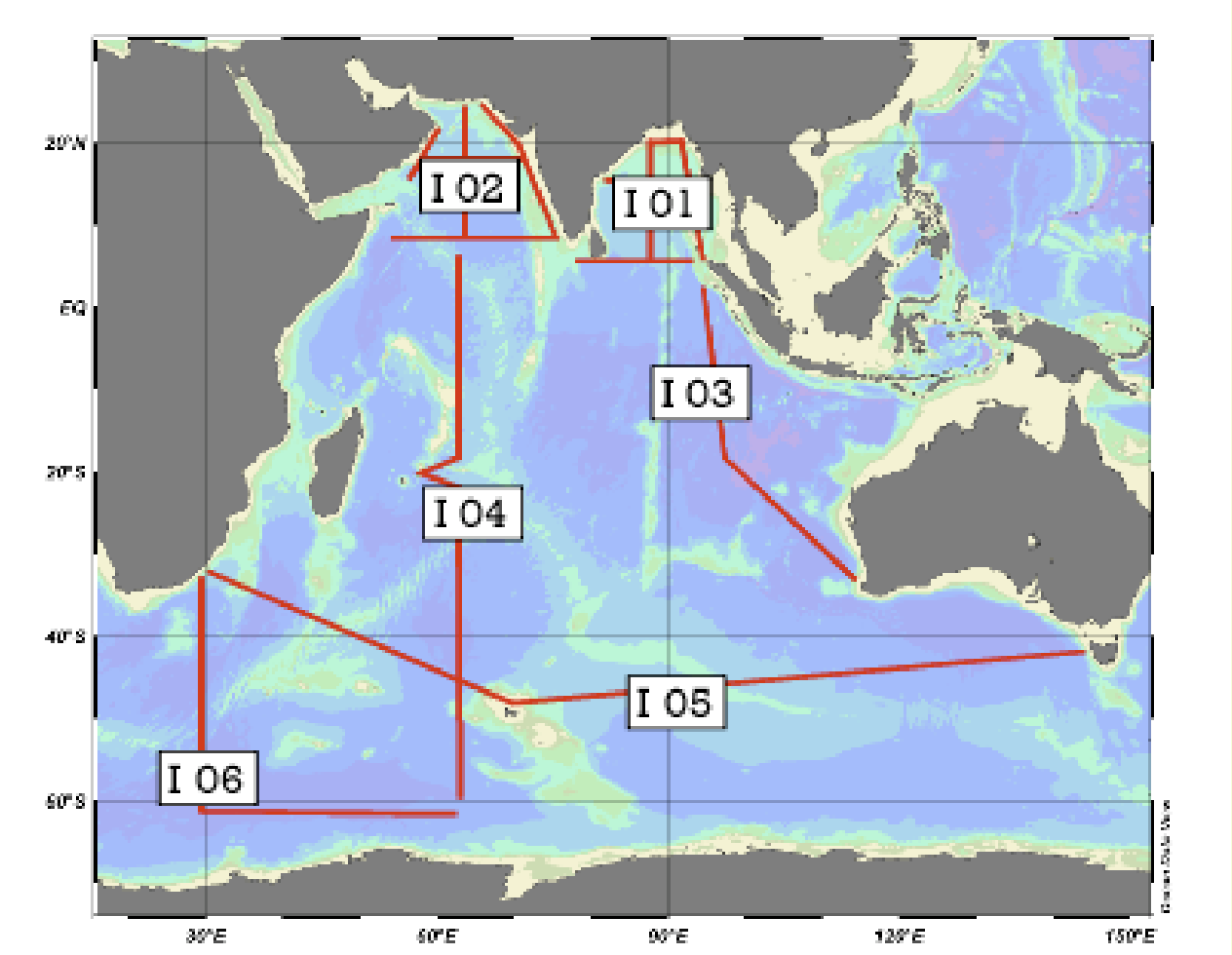
GEOTRACES

Nations represented at Planning Workshops

Argentina	UK	Japan	Kenya
Canada	France	China	
Mexico	Germany	Australia	
Brazil	Netherlands	India	
Chile	Sweden	Korea	
Peru	Spain	Taiwan	
USA	Belgium	New Zealand	
Venezuela	Switzerland	Hong Kong	
	Cyprus		

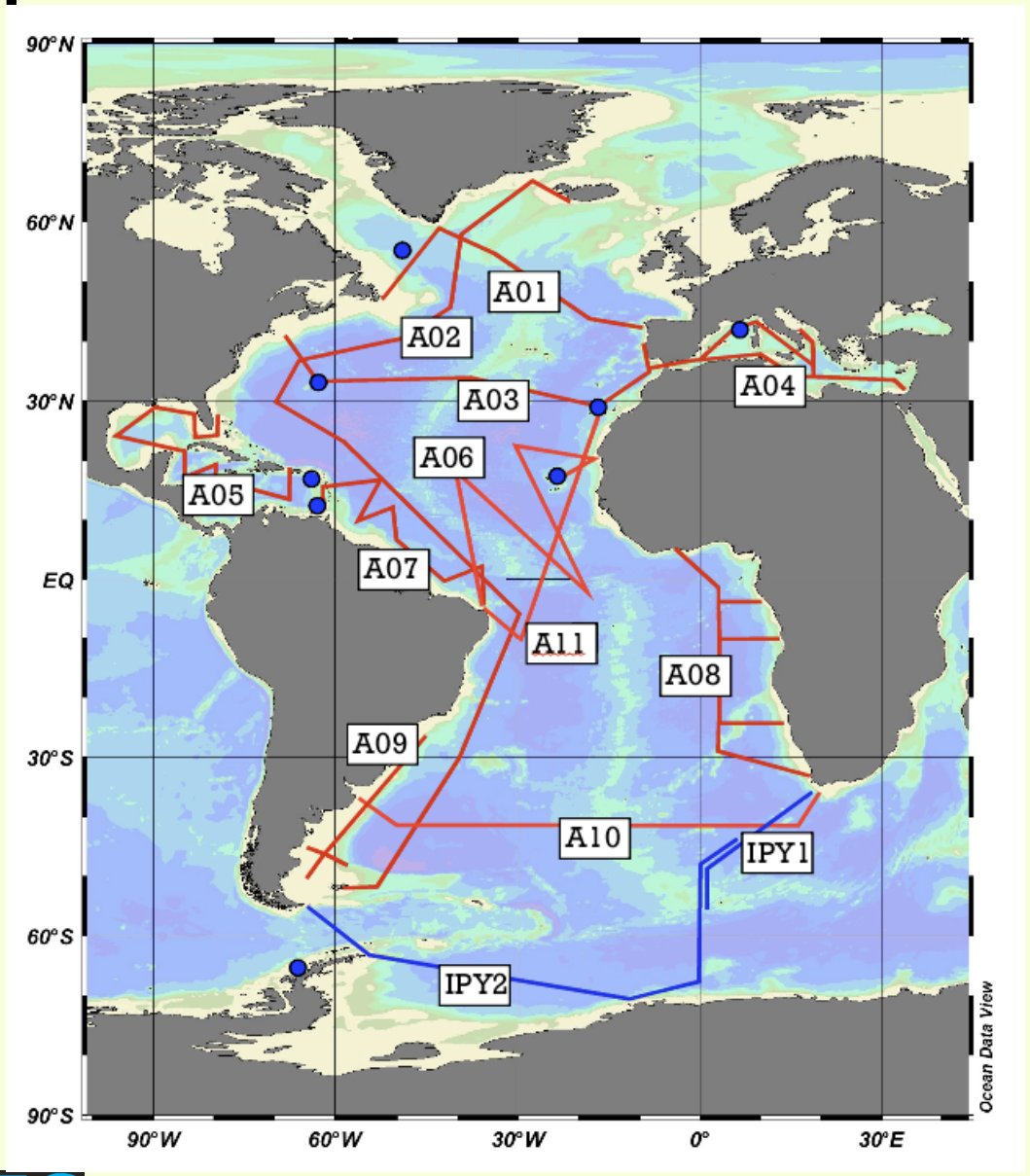
GEOTRACES

Proposed Indian Sections

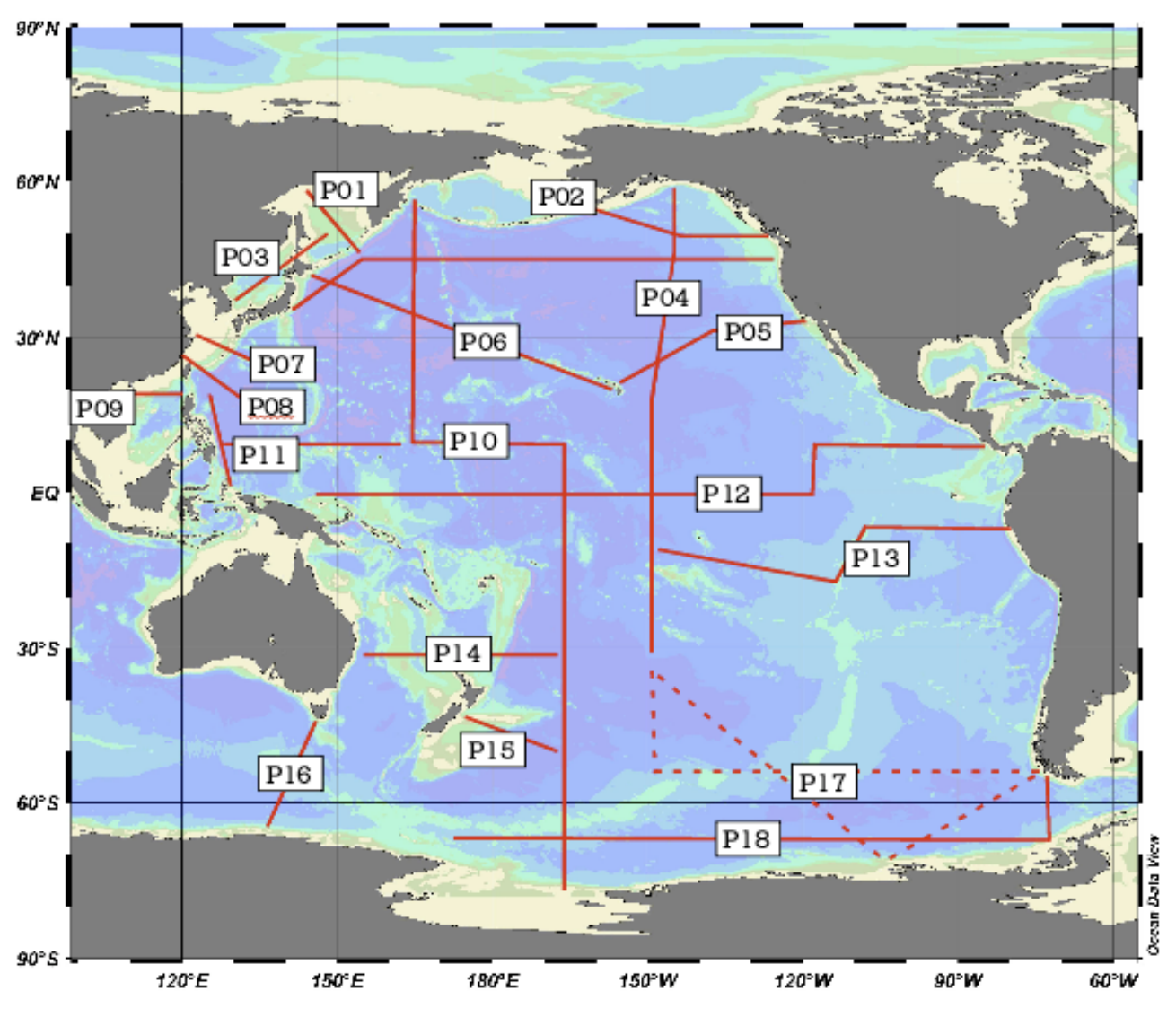


Anticipated European Collaboration:
France - Bay of Bengal
Germany - Arabian Sea

Proposed Atlantic Sections

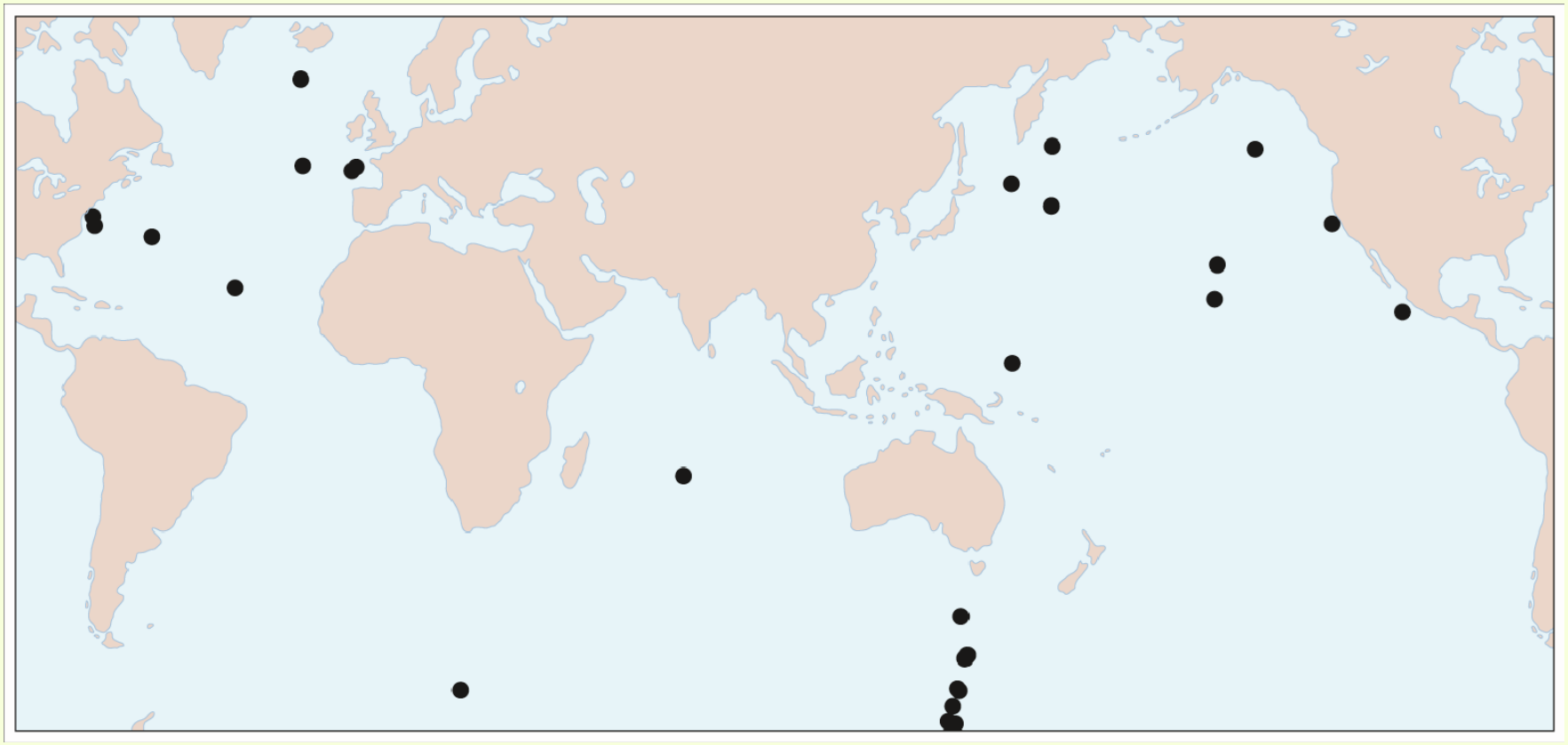


Proposed Pacific Sections



GEOTRACES

Limitation: Pre-GEOTRACES deep ocean Fe data



Paucity of information about deep Fe distribution limits understanding of upwelling supply and internal cycling.

Stations with Fe concentrations at depths > 2000 m.
As of 2003. From P. Parekh (MIT)

GEOTRACES: Capacity Building

Trace metal - clean sampling technology and methods

Many nations lack infrastructure and expertise for clean sampling

Principal barrier is sampling at sea, not analyses

GEOTRACES offers international assistance in design, construction and use of clean sampling systems

Clean (contamination free) systems designed to facilitate sampling

Systems capable of sampling full water column depths:

- Japan
- Netherlands
- U.S.A.
- New Zealand (limited depth)
- France (under construction)
- Germany (funded)
- Canada (funded)
- India (anticipated)
- Australia (anticipated)

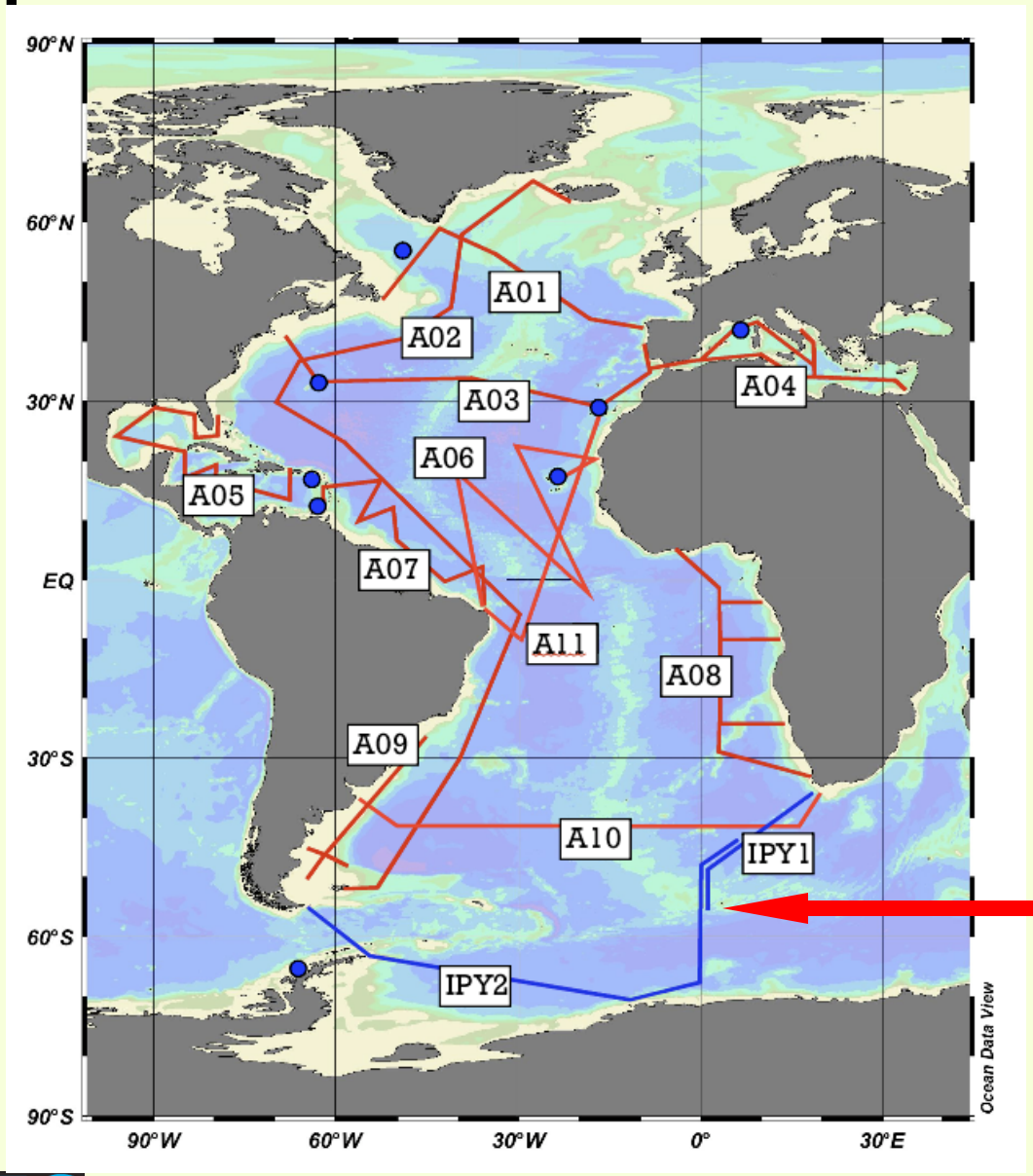
U.S. GEOTRACES Sampling System

Test of “Clean” Rosette

GEOTRACES

Clean for Fe, Zn, Pb and Hg

Proposed Atlantic Sections



Iron and Mn indicate hydrothermal vents on Mid Ocean Ridge

Fe

Africa

Antarctica

QuickTime™ and a
decompressor
are needed to see this picture.

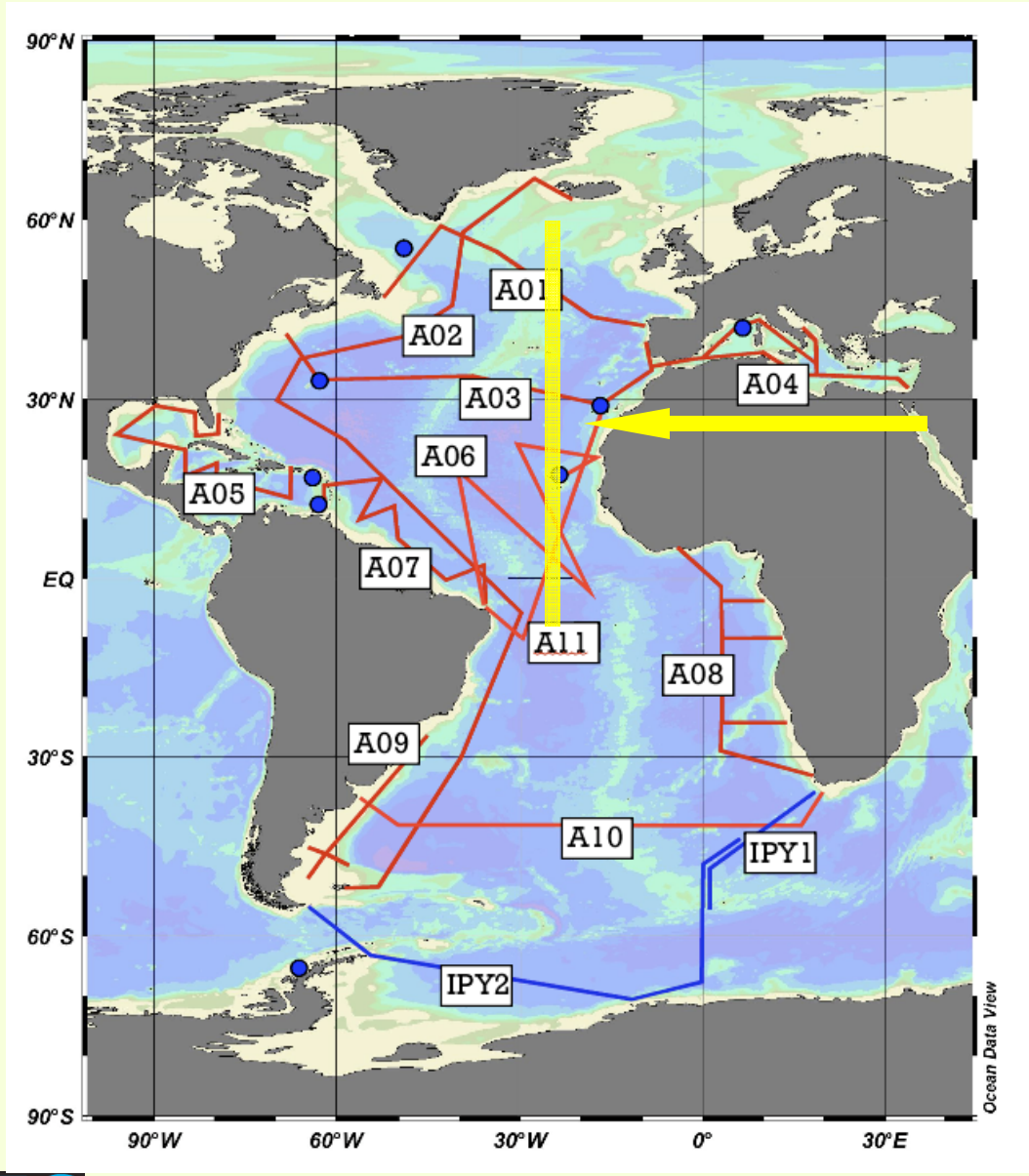
Mn

Unpublished data of Maarten Klunder, Patrick Laan, Rob Middag and Hein de Baar

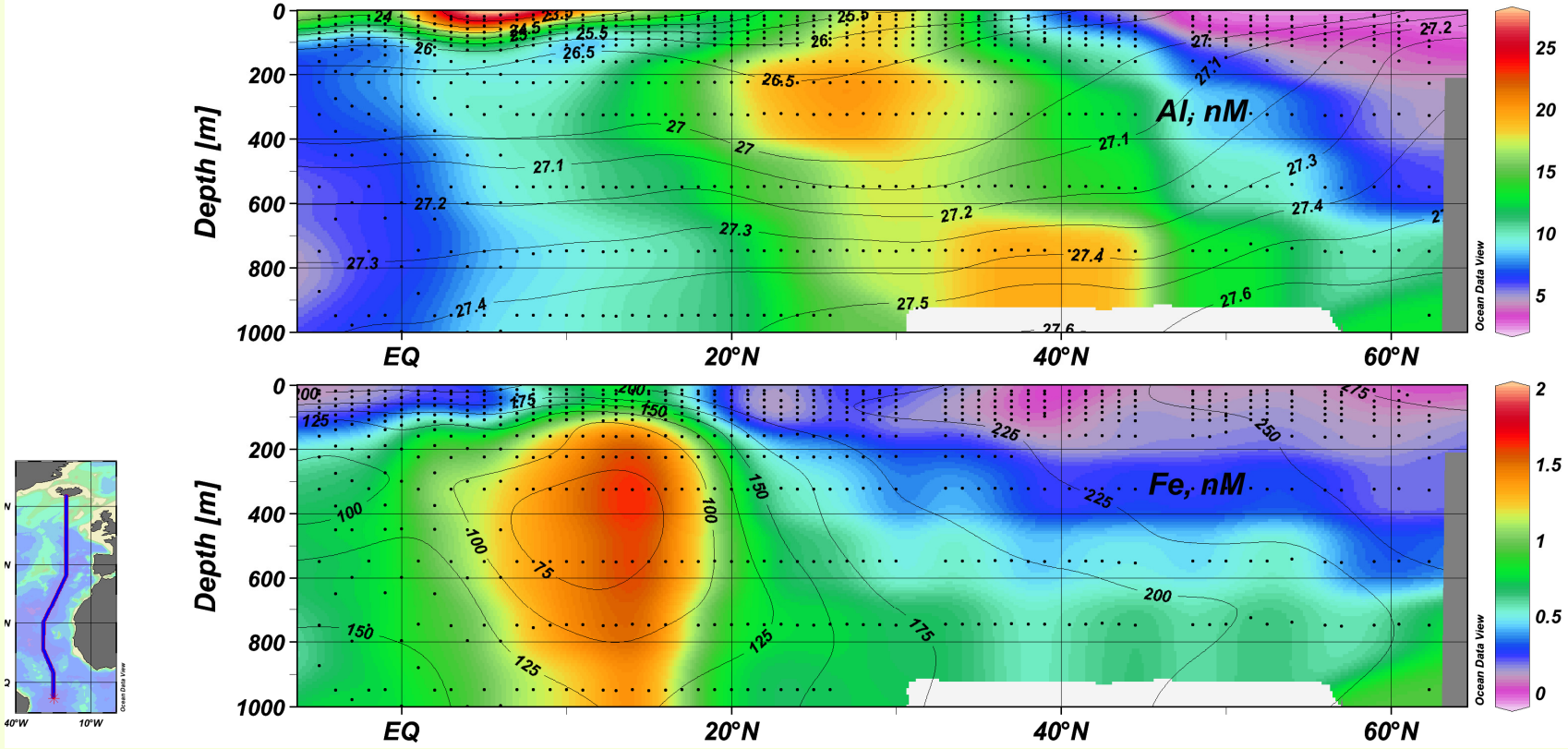
Al

GEOTRACES

Pre-GEOTRACES Atlantic Section



Aluminum traces supply of dust, a source of iron



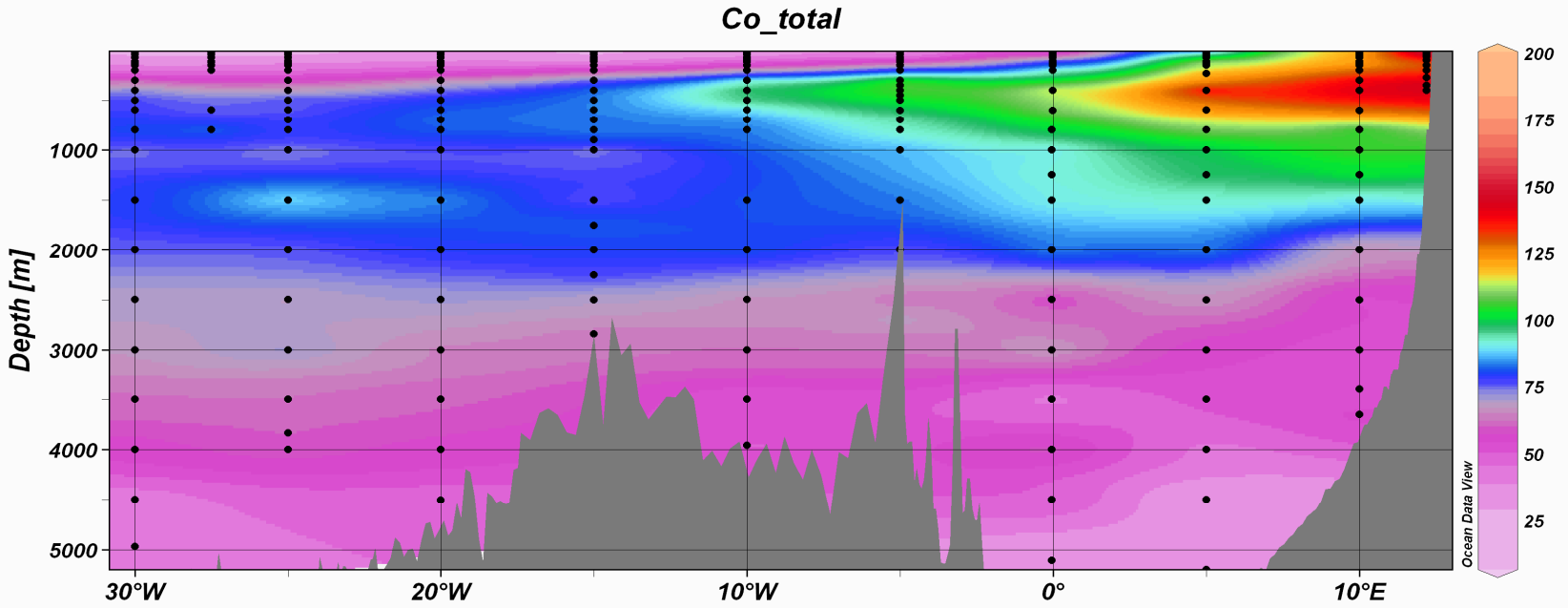
- Al traces source of Fe
- Fe distribution reflects biological uptake and regeneration

Measures et al., 2008

GEOTRACES Strategy

- High sampling resolution reveals features not previously identified
- Multi-element approach aids in establishing sources and removal mechanisms

Cobalt released from African sediments



Unpublished data of Abigail Noble and Mak Saito

Cobalt and iron limit phytoplankton

- Phytoplankton growth is limited by Fe and Co
- “Co-limitation” may be more prevalent than previously thought
- Impact on marine ecosystems needs to be assessed
- Possible future partnerships between GEOTRACES, SOLAS and IMBER.

Thank you!

For More information Contact
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GEOTRACES - Scientific Steering Committee (SCOR)

Bob Anderson, Lamont-Doherty Earth Observatory, USA, Co-Chair
Gideon Henderson, University of Oxford, UK, Co-Chair
Per Andersson, Swedish Museum of Natural History, Sweden
Philip Boyd, University of Otago, New Zealand
Ken Bruland, University of California Santa Cruz, USA
Minhan Dai, Xiamen University, China
Hein de Baar, Netherlands Institute for Sea Research, The Netherlands
Martin Frank, IfM-GEOMAR, Germany
Toshitaka Gamo, The University of Tokyo, Japan
Catherine Jeandel, LEGOS (CNRS/CNES/IRD/UPS), France
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Jing Zhang, University of Toyama, Japan

<www.geotraces.org>