An International study of the marine biogeochemical cycles of trace elements and their isotopes

http://www.geotraces.org/

Sponsored by

And many national agencies.

Guiding 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.

Timeliness

Widespread interest in trace elements and isotopes

Now 30 years since last global program in marine geochemistry (GEOSECS)

Improved ability to sample the ocean without contamination

Increased sensitivity of analytical instrumentation

Advances in modeling permit rates and fluxes to be derived from modeling

Programmatic Themes

Theme 1: Fluxes and processes at ocean interfaces

- Atmospheric deposition
- Continental run-off
- The sediment-water boundary
- Ocean crust

Theme 2: Internal cycling

- Uptake and removal from surface waters
- Uptake and regeneration in the sub-surface ocean
- Regeneration at the seafloor
- Physical circulation

Theme 3: Development of proxies for past change

- Factors controlling ‘direct’ proxy distribution in the ocean
- Factors influencing the distribution of ‘indirect’ proxies in the ocean
- Palaeoceanographic tracers based on sediment flux

GEOTRACES

Nations involved in planning

USA
Canada
Mexico
Brazil
Chile

UK
France
Germany
Netherlands
Sweden
Spain
Belgium

Japan
China
Australia
India
S. Korea
Taiwan
New Zealand
Hong Kong

GEOTRACES

<www.geotraces.org>

U.S. GEOTRACES - Scientific Steering Committee

Bob Anderson, LDEO, Chair
Kathy Barbeau, Scripps
Ed Boyle, MIT
Roger Francois, Univ. British Columbia
Chris German, WHOI
Bill Landing, FSU
Jim Moffett, U Southern California
Keith Moore, UC Irvine
Pete Sedwick, Bermuda
Tina van de Flierdt, LDEO

Charged with implementing a U.S. program that stays focused on the objectives defined in the Science Plan

Program Elements to achieve Objectives

Enabling Activities

Standards and intercalibration
Data protocols, management, archiving
Modeling
Baseline stations

Ocean Sections

Core activity - requires international cooperation
12-15 sections
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
Many will focus on coastal regions

GEOTRACES

Historical Timeline

Informal discussion -> first town meeting Dec. 2001

International workshop - Toulouse 2003

SCOR sponsorship - 2004

Science Plan written by Planning Group with extensive input from wider community - 2004/5

Science Plan reviewed (SCOR) & published - late 2006

2007 Basin Planning Workshops: Pacific, June; Atlantic, Sept; Indian, October

First cruises - Intercalibration and IPY cruises in 2007 -2009

Program Completion - Decade-Plus Time scale

GEOTRACES

GEOTRACES Intercalibration

Intercalibration – *The process, procedures, and activities used to ensure that the several laboratories engaged in a monitoring program can produce compatible data. When compatible data outputs are achieved and this situation is maintained, the laboratories can be said to be intercalibrated* (Taylor, 1987).

Intercalibration therefore is an active process between laboratories that includes all steps from sampling to analyses, with the goal of achieving the same accurate results regardless of the method or lab.

US GEOTRACES Intercalibration

(1) Develop and test the US GEOTRACES sampling systems and procedures for dissolved and particulate TEIs. This equipment will be a community resource for use in all future US GEOTRACES cruises;

(2) Using these systems, conduct a thorough intercalibration for all the key GEOTRACES TEIs, and as many others as possible, in the dissolved and particulate phases through the participation of the worldwide TEI community;

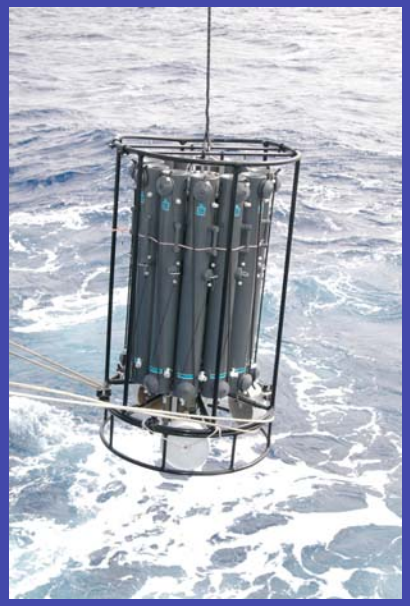
(3) Establish GEOTRACES Baseline Stations in the western North Atlantic and eastern North Pacific Oceans as part of the Intercalibration Cruises; and

(4) Fully document the intercalibration results and create "US GEOTRACES Users Manuals and Procedures" for future US-sponsored GEOTRACES cruises.

US GEOTRACES Sampling Systems

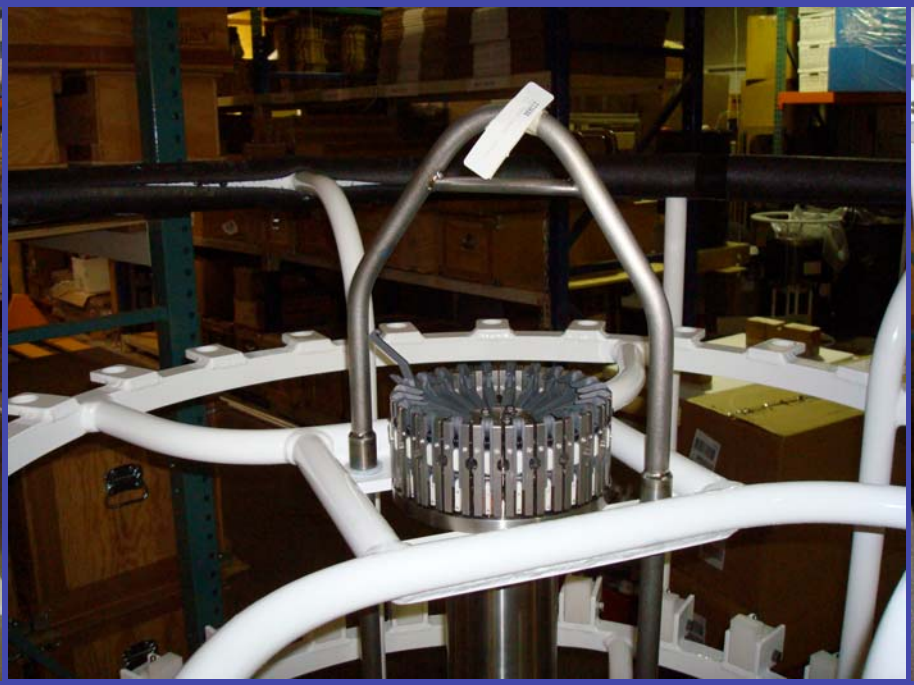
Criteria: usable on long transects (rapid), off-the-shelf, >30L per depth, dissolved and particulate (small vol.)

- Super-size the CLIVAR Trace Element rosette to have (24) 12L Teflon-coated GO-Flo bottles capable of simultaneously firing 3 during up-cast, CTD with O_2, transmissometer, and fluorometer
- Electro-mechanical winch with composite sheaves and 8000 m Kevlar conducting cable



US GEOTRACES Sampling Systems – cont.

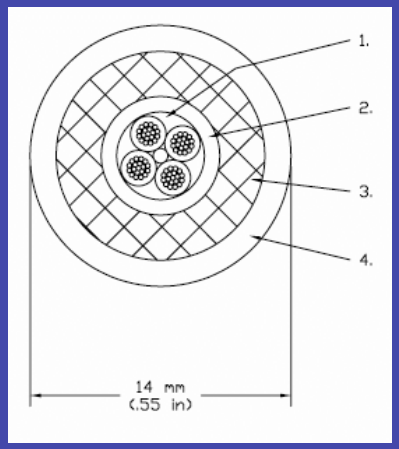
Newly designed Seabird Trace Element Carousel: Aluminum frame with polyurethane powder coat, no sacrificial anodes due to titanium pressure cases, maximum bottle flushing, 1800 lbs with 24 full 12L GO-Flos



US GEOTRACES Sampling Systems – cont.

Dynacon winch w/ composite sheaves and line monitoring, composite overboarding sheave

Cortland 8000m x 14mm Kevlar conducting cable



US GEOTRACES Sampling Systems – cont.

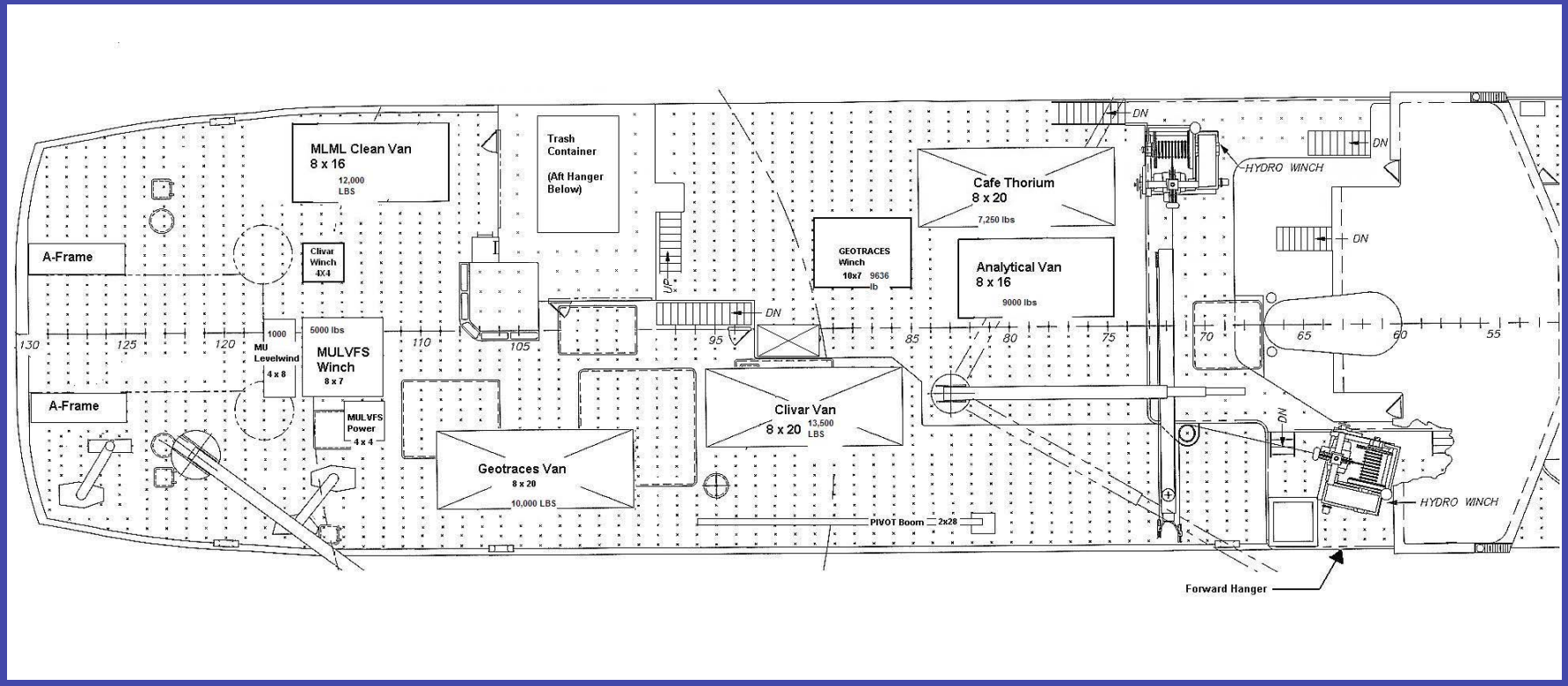
Towed sampling fish for underway clean sampling and surface sampling on station; water pumped to clean lab

US GEOTRACES Sampling Systems – cont.

Clean sampling van for sub-sampling the bottles, changing filters, acidifying samples, etc., and storage of all GO-Flos

US GEOTRACES Intercalibration Cruise 1: R/V Knorr, 8 June – 12 July 2008

- Test the new carousel sampling systems against known methods, and modify as needed (ship board trace metal analyses).
- Test particle sampling: small volume GO-Flo filtration vs. in-situ pumps (McLane and MULVFS).
- Perform intercalibration sampling (2 depths, 1000L) and vertical profiles at BATS and Shelf Break Stations.



US GEOTRACES – Time Line

2007 Purchase, assembly, and testing of systems

Fall AGU – Workshop for pre-cruise planning

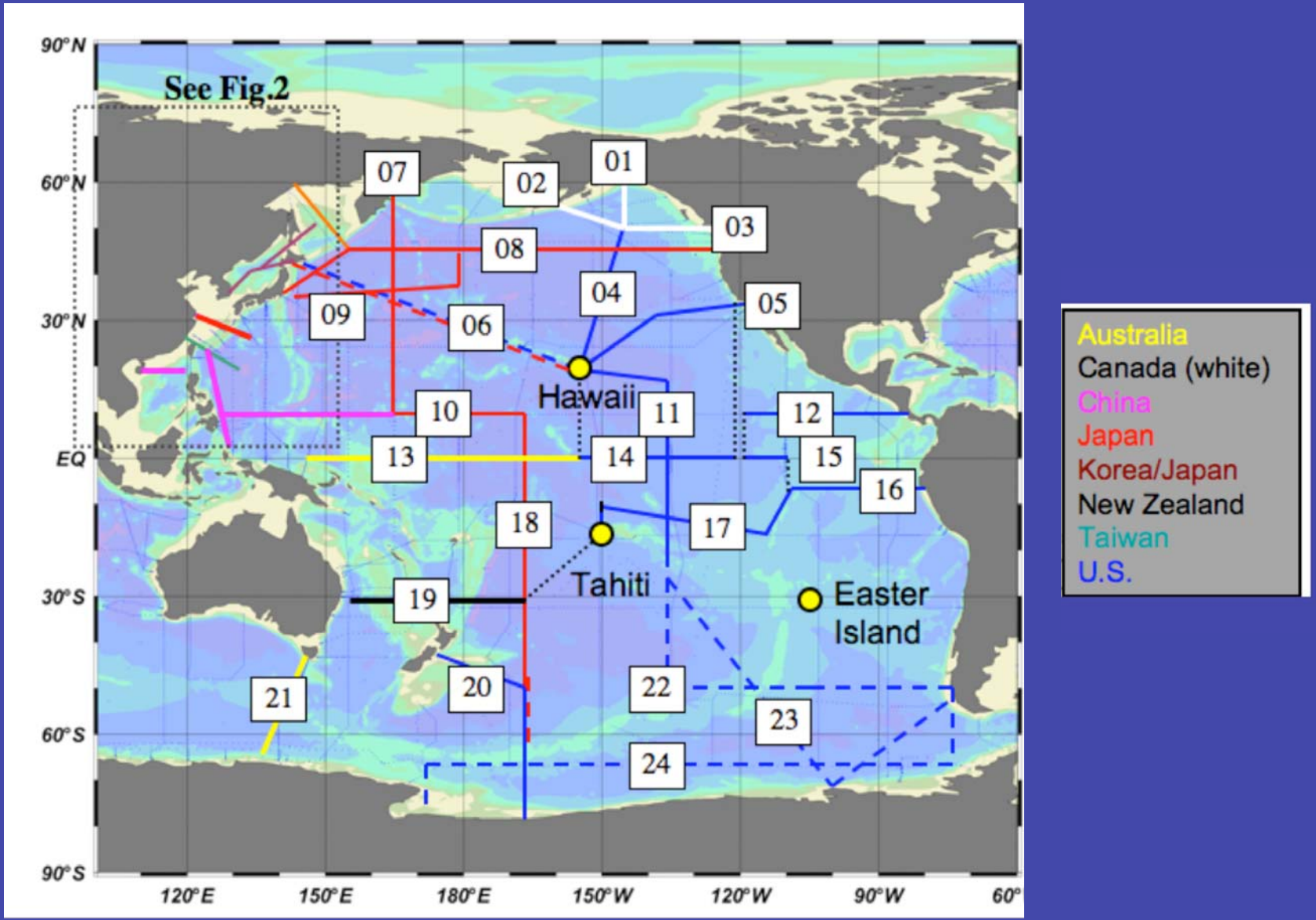
2008 June-July, Cruise 1, North Atlantic (BATS): systems testing/modifications, collect large volume mixed layer and deep waters for intercalibration, sample storage, establish Baseline Station

Fall AGU – Workshop for Cruise 1 data discussions and synthesis; planning for Cruise 2

2009 June, Cruise 2, North Pacific (SAFe Station): intercalibration using deep and mixed layer waters, perfecting GEOTRACES sampling protocols

2010 February, Synthesis Workshop: intercalibration and storage results, preparing GEOTRACES manuals, publications

Pacific


See Fig.2
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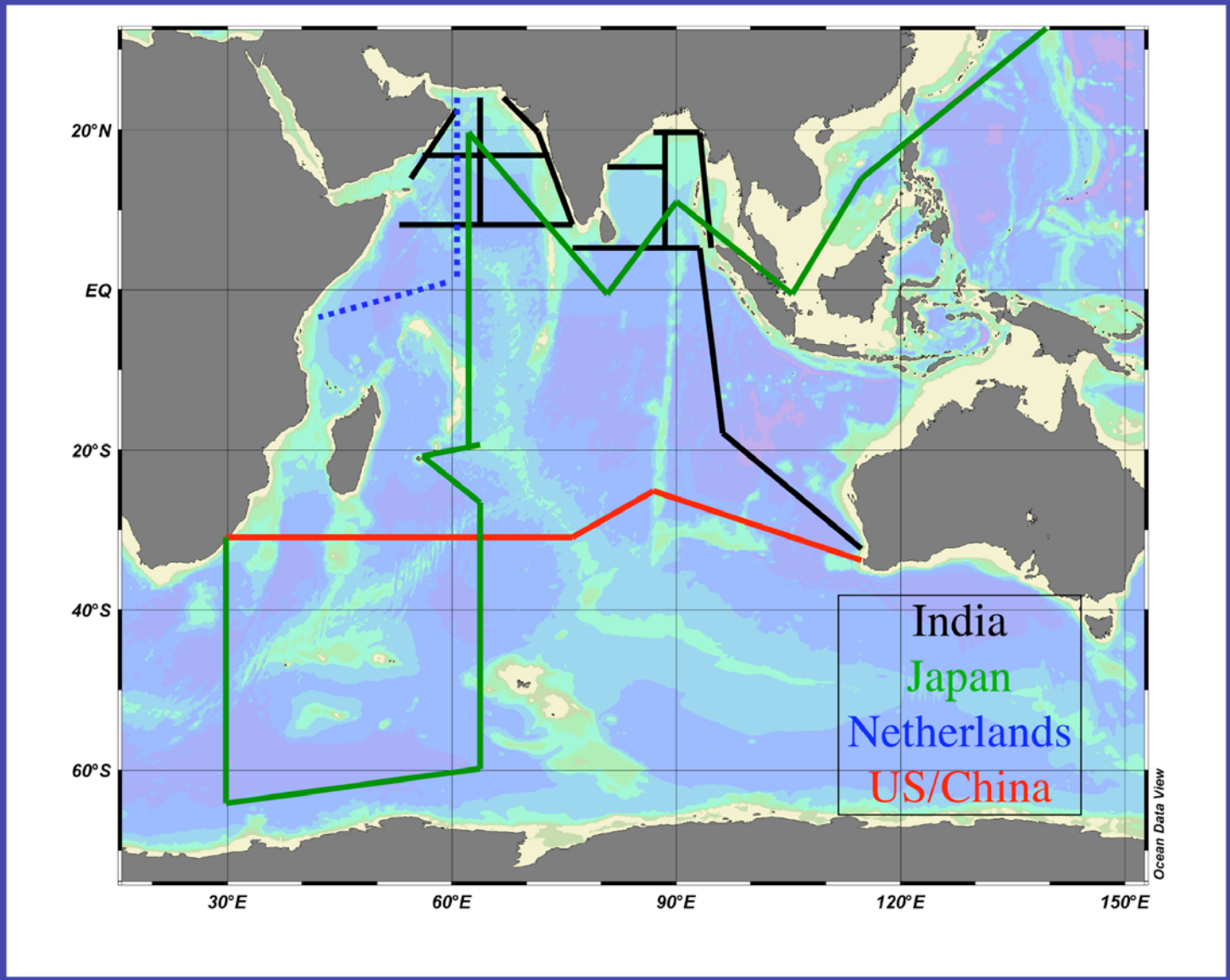
Tahiti
Easter Island
Australia
Canada (white)
China
Japan
Korea/Japan
New Zealand
Taiwan
U.S.

Indian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Ocean Data View