GEOTRACES

AN INTERNATIONAL STUDY OF THE MARINE BIOGEOCHEMICAL CYCLES OF TRACE ELEMENTS AND THEIR ISOTOPES

PAGES

PAST GLOBAL CHANGES

Trace elements and isotopes in paleoceanography: A synthesis workshop

December 3-5, 2018, Aix-Marseille, France

Charge to workshop Participants

Bob Anderson
& Workshop Organizing Committee

Why hold a synthesis workshop?

Insight from a fortune cookie

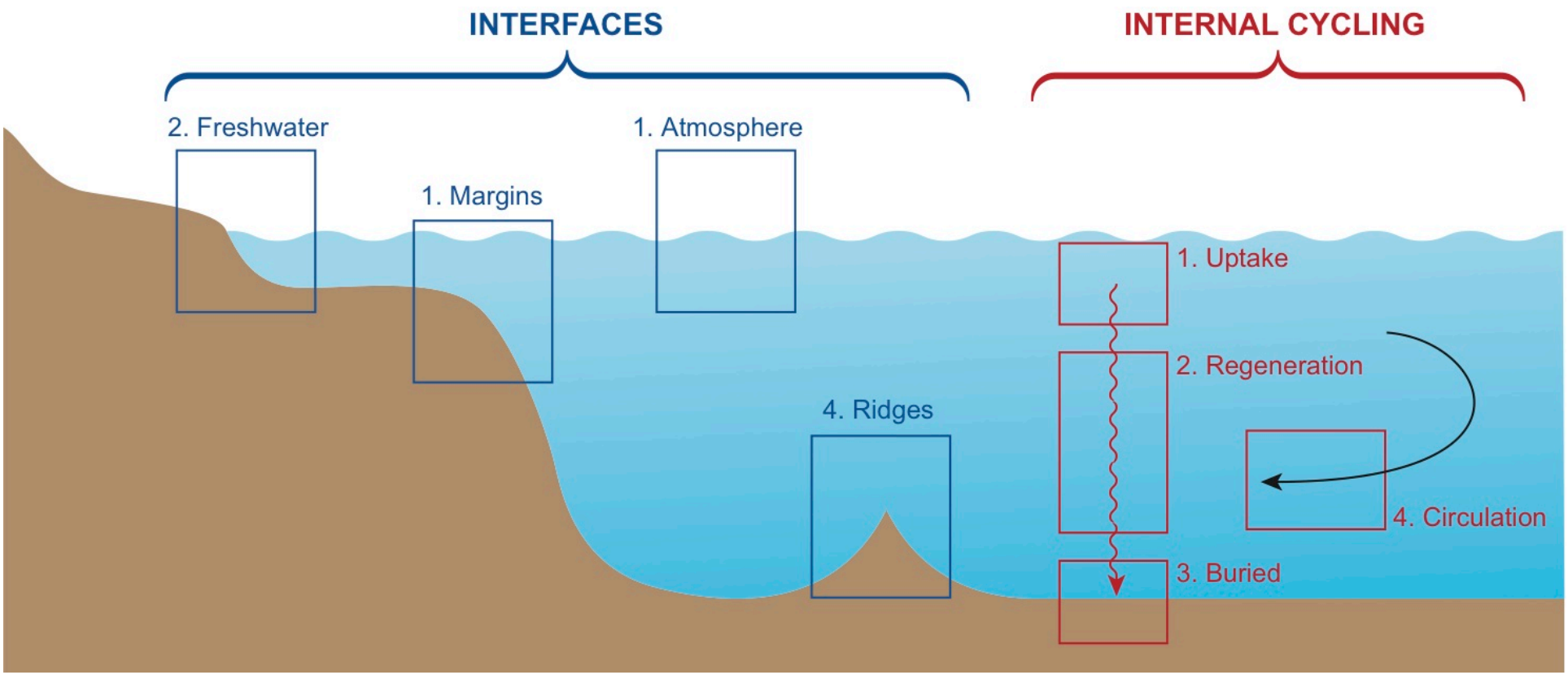
Insight from a fortune cookie

Engage in group activities that further transformation.

Insight from a fortune cookie

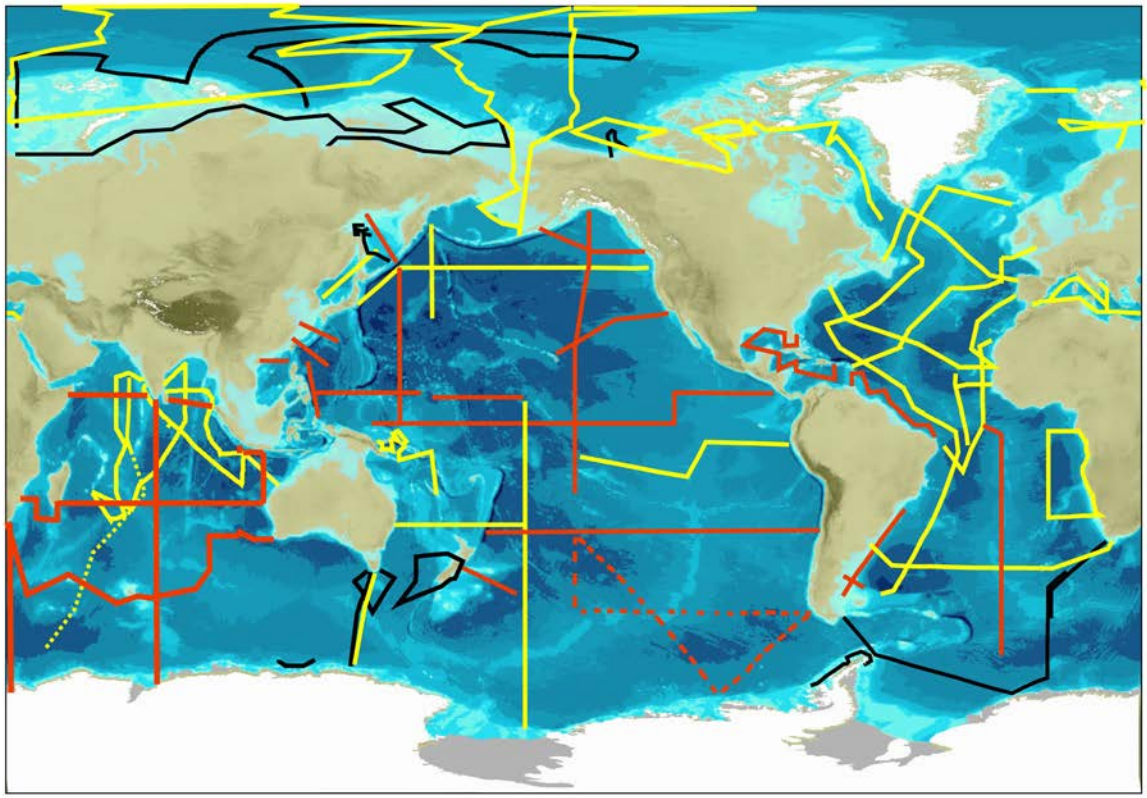
Engage in group activities that further transformation.

GEOTRACES Synthesis in three phases



- Supply and removal of trace elements at ocean boundaries
- Internal cycling
- Geochemical proxies used in paleoceanography – partnering with PAGES

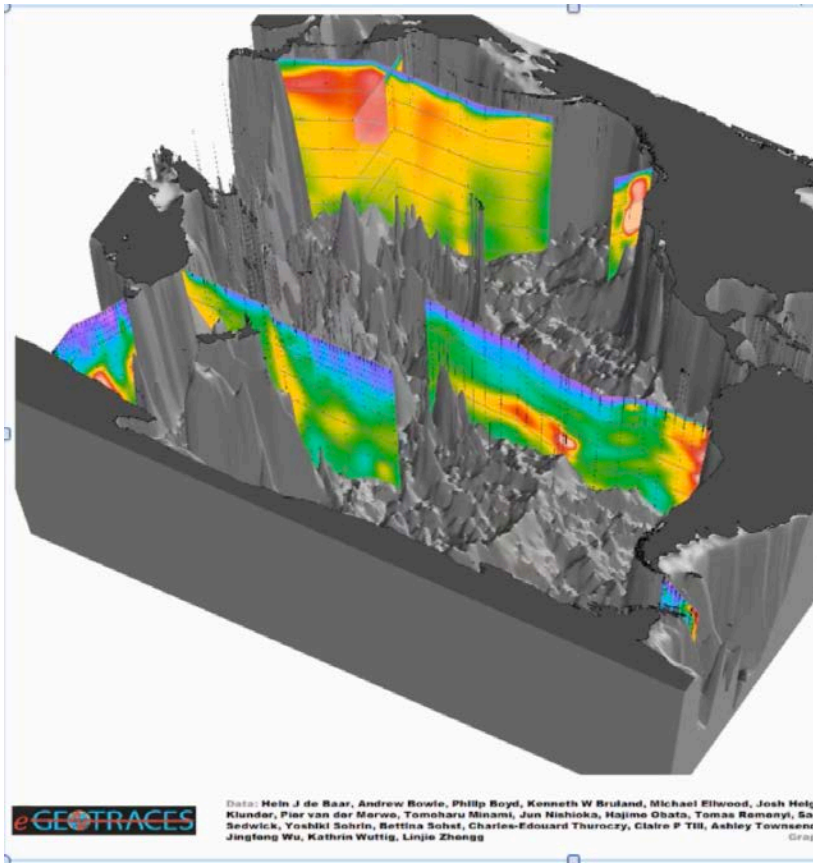
GEOTRACES is producing a global data set

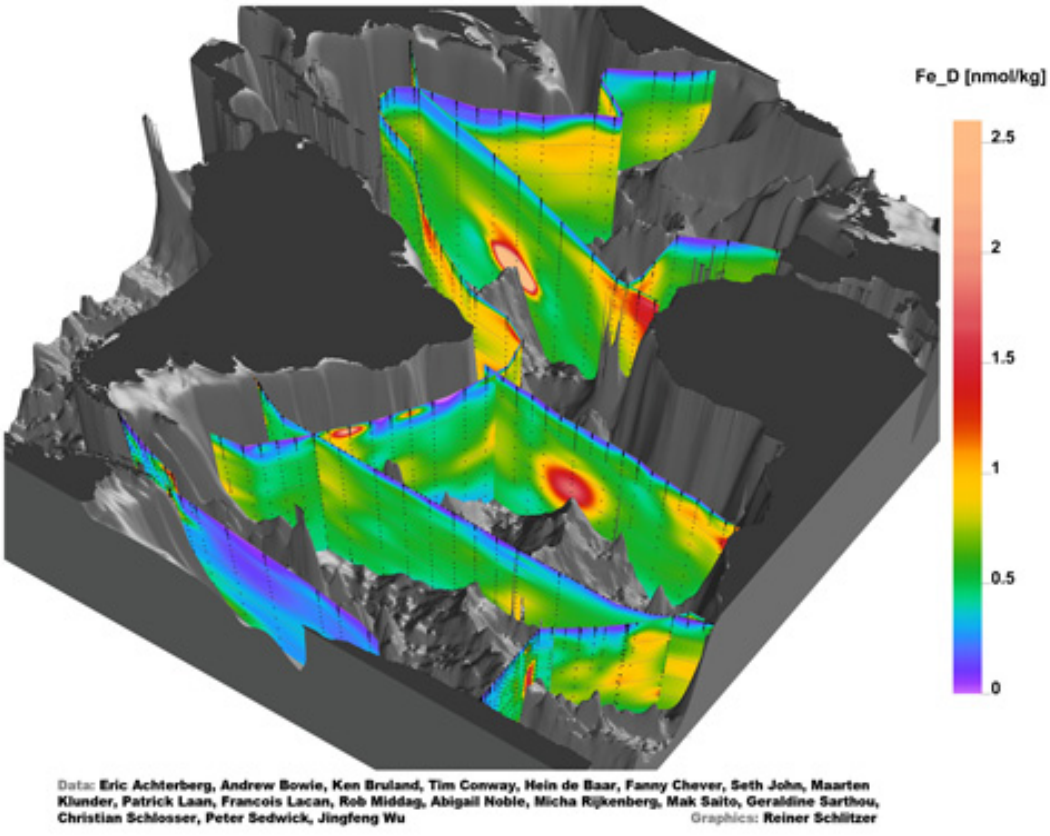


- Yellow lines – sections completed to date
- Black lines – partial sections, International Polar Year
- Red lines – Planned cruises, with or without funding commitment

A wealth of data to develop unprecedented insights into ocean processes

Distributions provide insight into sources, cycling and removal





- Dust
- Margin sediments
- Marginal Seas
- Hydrothermal plumes
- Patchy iron distribution requires a short residence time

Synthesis Workshop Objectives

Identify major unknowns, uncertainties & disagreements

- Proxies & their relationship to processes/conditions

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Synthesis Examples

Synthesis Examples – Supply and removal at ocean boundaries

PHILOSOPHICAL TRANSACTIONS A

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Research

Cite this article: Anderson RF *et al.* 2016 How well can we quantify dust deposition to the ocean? *Phil. Trans. R. Soc. A* **374**: 20150285. http://dx.doi.org/10.1098/rsta.2015.0285

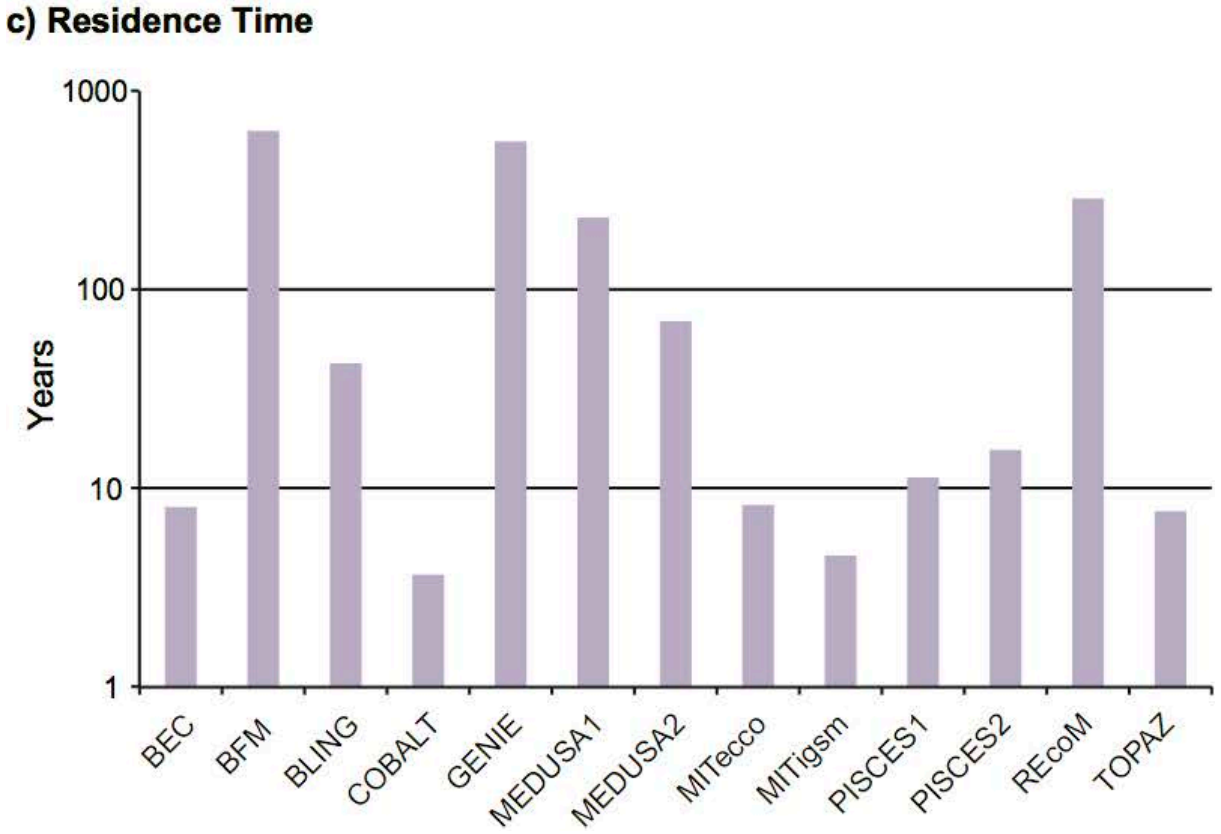
How well can we quantify dust deposition to the ocean?

R. F. Anderson[1,2], H. Cheng[3,4], R. L. Edwards[3], M. Q. Fleisher[1], C. T. Hayes[5], K.-F. Huang[6], D. Kadko[7], P. J. Lam[8], W. M. Landing[9], Y. Lao[10], Y. Lu[11], C. I. Measures[12], S. B. Moran[13], P. L. Morton[9], D. C. Ohnemus[14], L. F. Robinson[15] and R. U. Shelley[16]

[1]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964, USA

Dust fluxes to the eastern tropical Atlantic Ocean estimated using 8 published methods span two orders of magnitude! Inconsistencies reveal errors in assumptions and/or incomplete knowledge about behavior of tracers

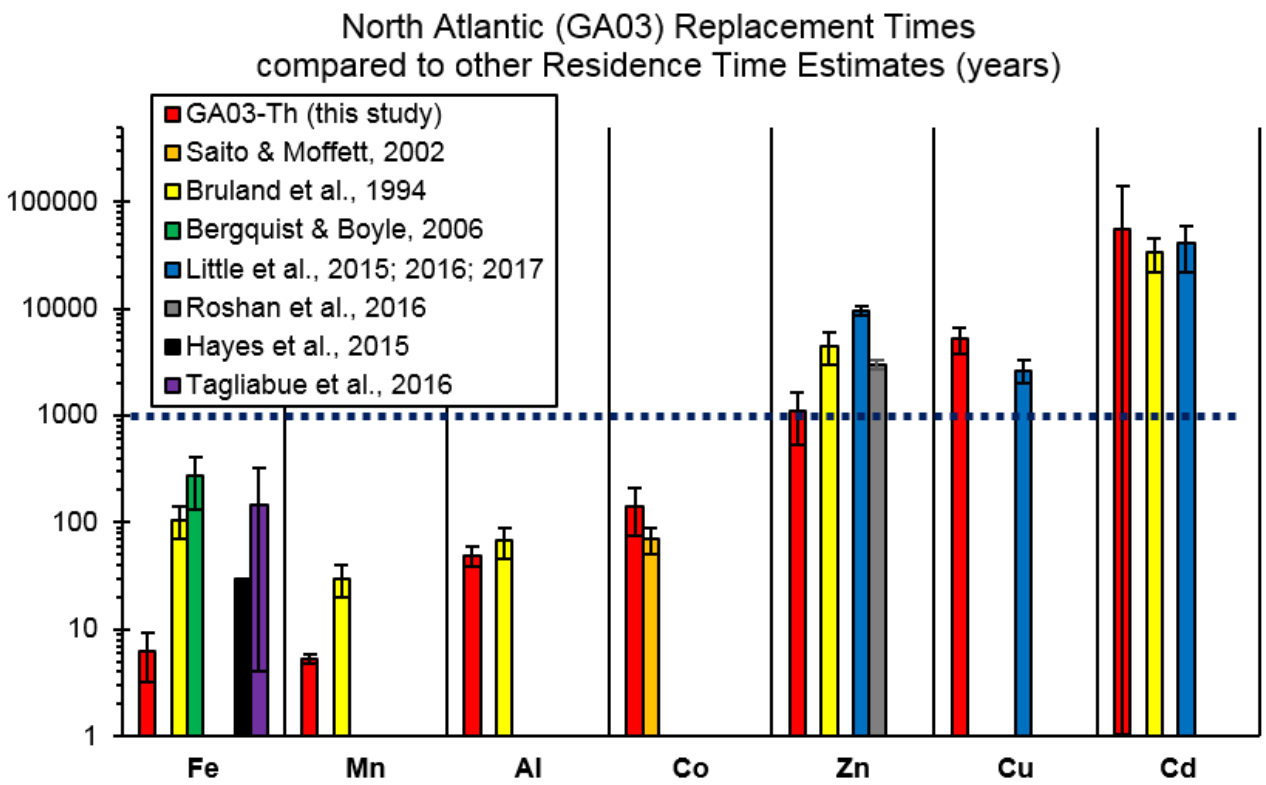
Synthesis Examples – Internal cycling

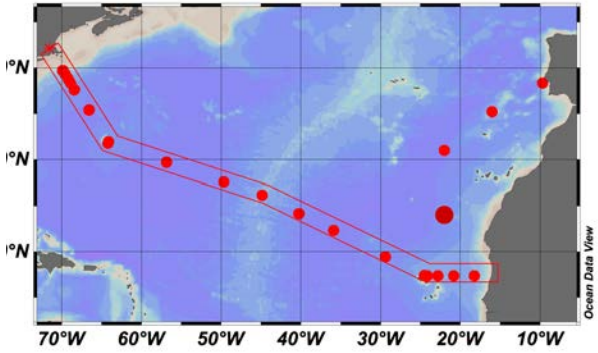


The residence time of Fe in the ocean remains highly uncertain! Estimates among 13 global biogeochemical models span two orders of magnitude.

Tagliabue, OCB News, Summer 2016 - Results of FeMIP-1;
Tagliabue et al., Global Biogeochemical Cycles, 2016

Synthesis Examples – Internal cycling



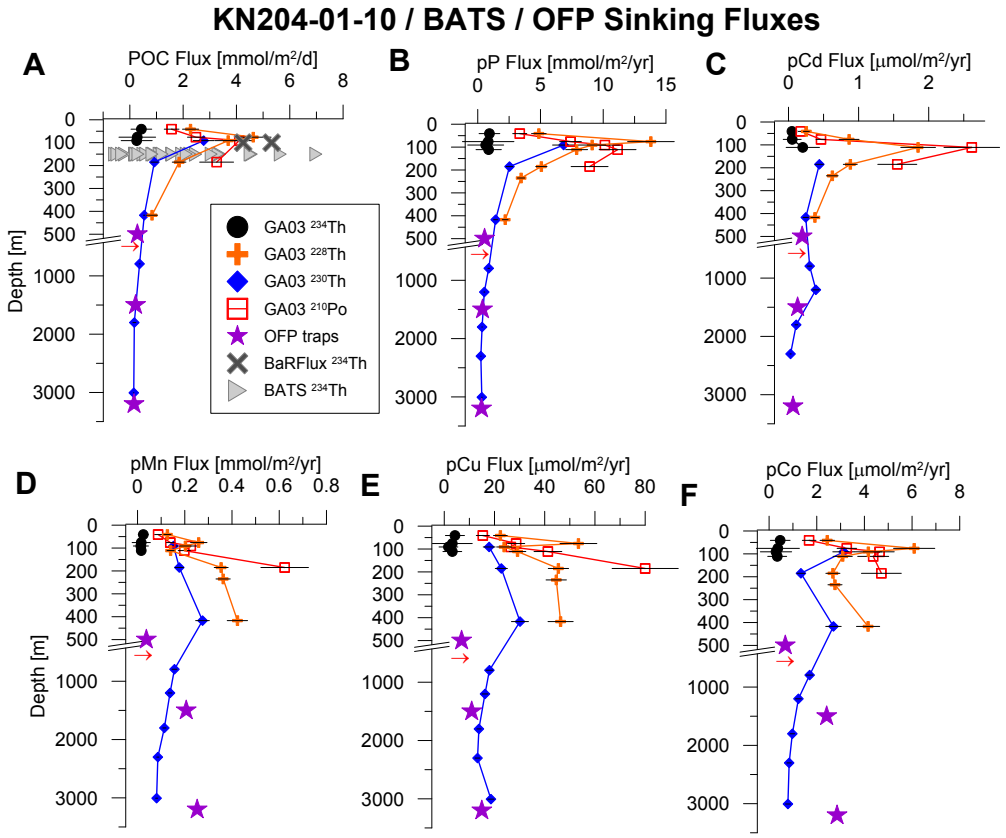


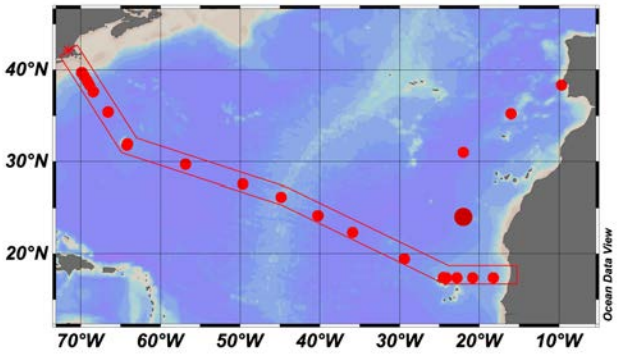
Combining <u>dissolved</u> trace elements and radionuclides from GEOTRACES provides new constraints on trace element residence times.

Product of the 2016 GEOTRACES – OCB Internal Cycling synthesis workshop

Hayes et al., Global Biogeochemical Cycles, 2018

Synthesis Examples – Internal cycling





Not the end,
but the beginning of a new area of research

Combining <u>particulate</u> trace elements and radionuclides from GEOTRACES provides new constraints on sinking fluxes of C, P and trace elements.

Product of the 2016 GEOTRACES – OCB Internal Cycling synthesis workshop

Hayes et al., Global Biogeochemical Cycles, in press

Synthesis Examples − Internal cycling

Ongoing synthesis efforts

Bioavailability of Fe (and other micronutrients)

Sources, composition and binding characteristics of ligands

Ongoing planning efforts

New program linking molecular biology (TARA Oceans) with micronutrients (GEOTRACES) to study chemical − biological coupling −
Originated at 2016 “internal cycling” workshop.

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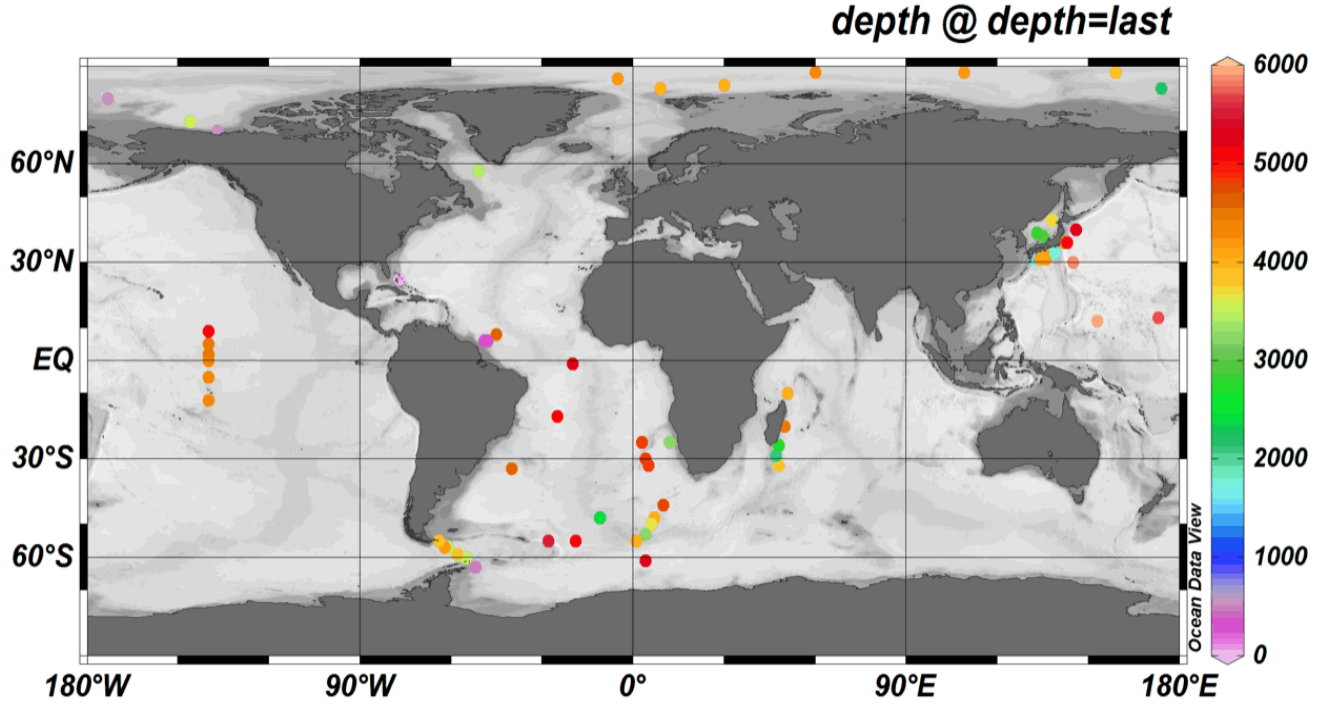
Example: Revisiting proxy interpretations with new data from GEOTRACES



Dissolved ^{231}Pa profiles as of 2012

From compilation by Gideon Henderson

Inadequate to test predicted response of ^{231}Pa to AMOC

Some profiles of total (dissolved + particulate) ^{231}Pa are not shown

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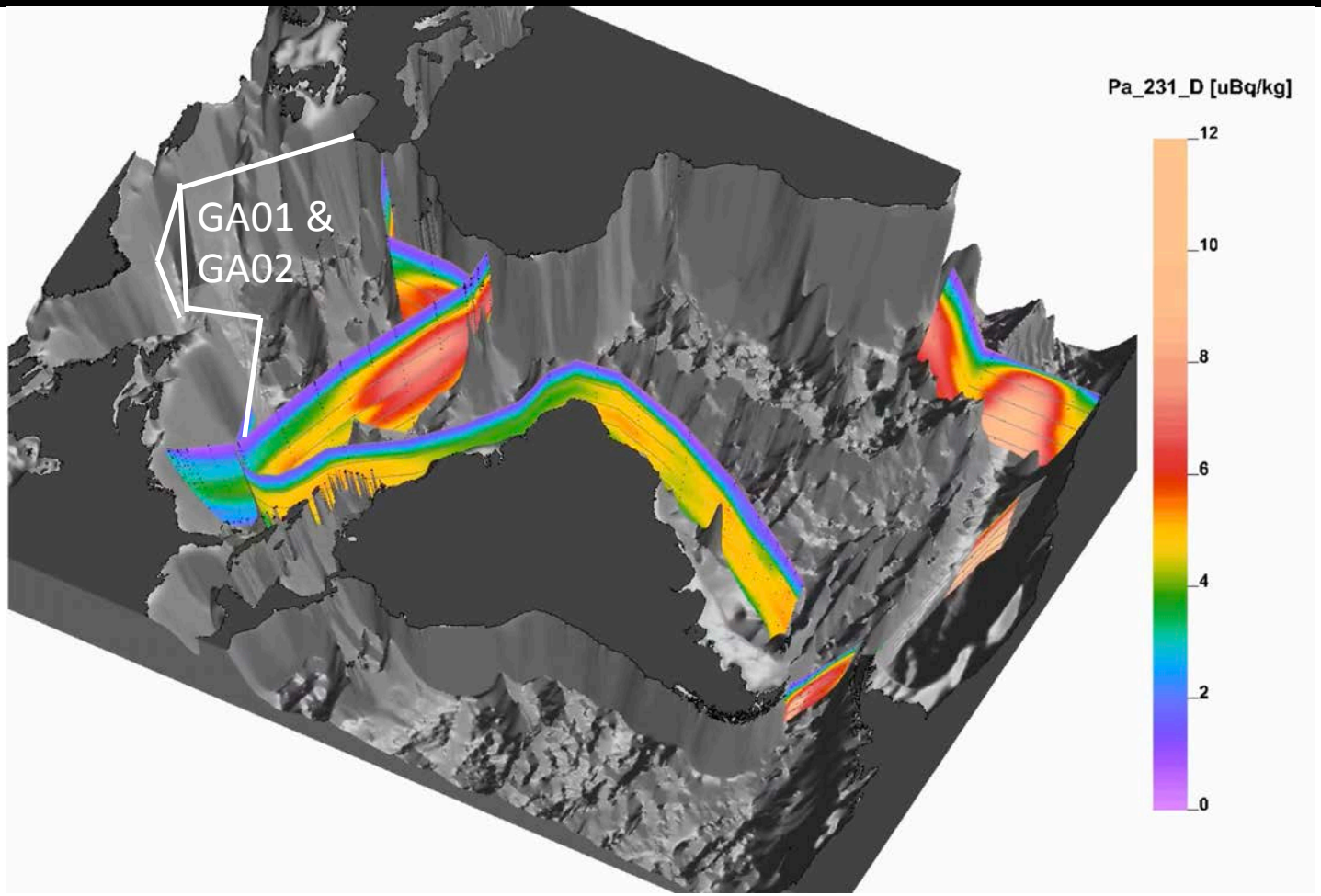

Dissolved ^{231}Pa available now

From GEOTRACES IDP2017 + additional existing data (e.g., Deng et al., 2018; AWI unpubliushed)

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Other Considerations

Sediment data

What kinds of sediment data from GEOTRACES cruises would be useful?

Intercalibration

What intercalibration strategies are available to ensure that sediment data pass the GEOTRACES test for internal consistency (reliability)?

End

Logos


NSF


International Council for Science
SCOR
Scientific Committee on Oceanic Research