Annual Report – South Africa

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Geotraces South Africa

CENTRE FOR TRACE & EXPERIMENTAL BIOGEOCHEMISTRY
STELLENBOSCH UNIVERSITY

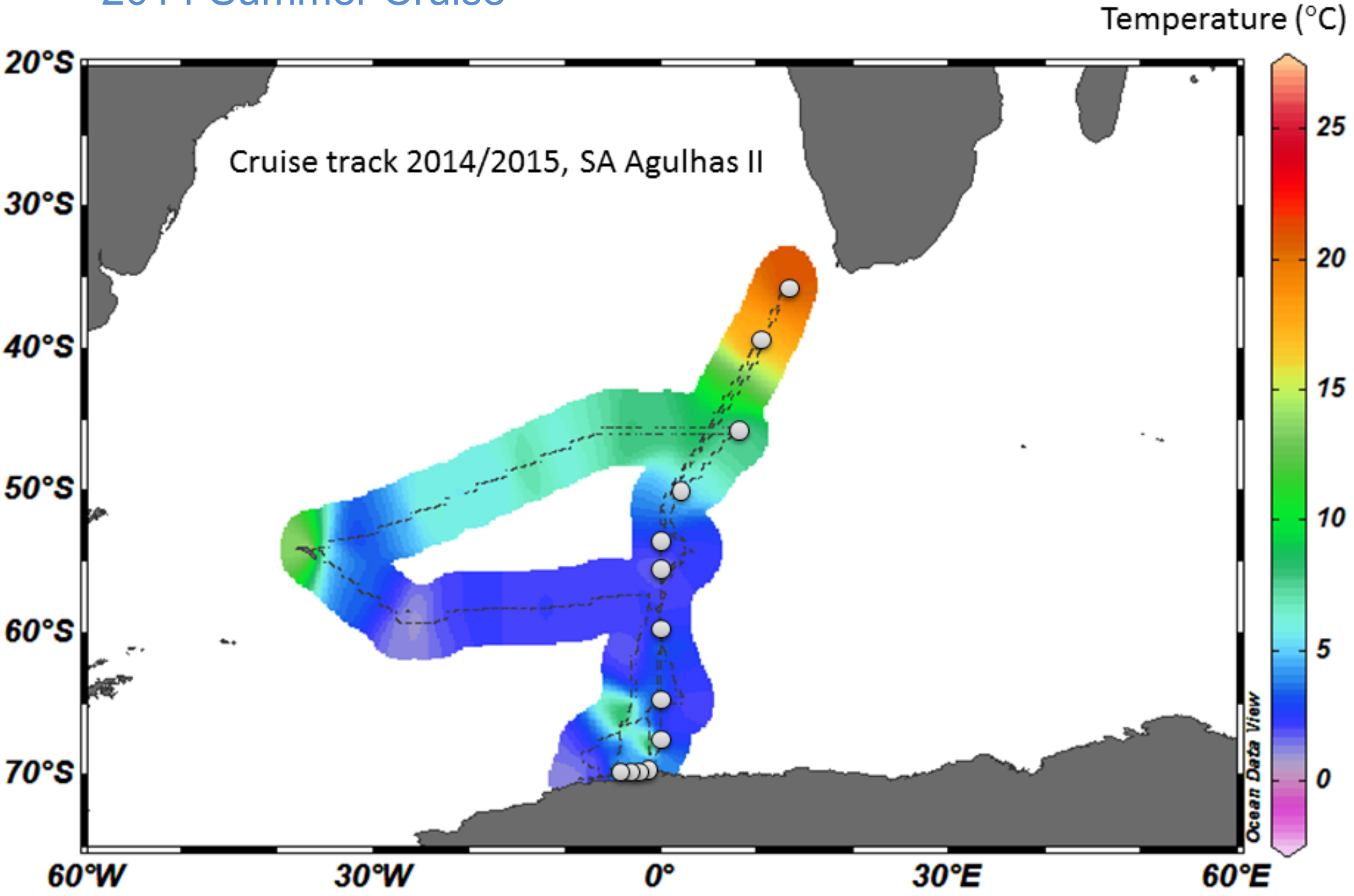
News

Establishment of Antarctic Polar Research Institute

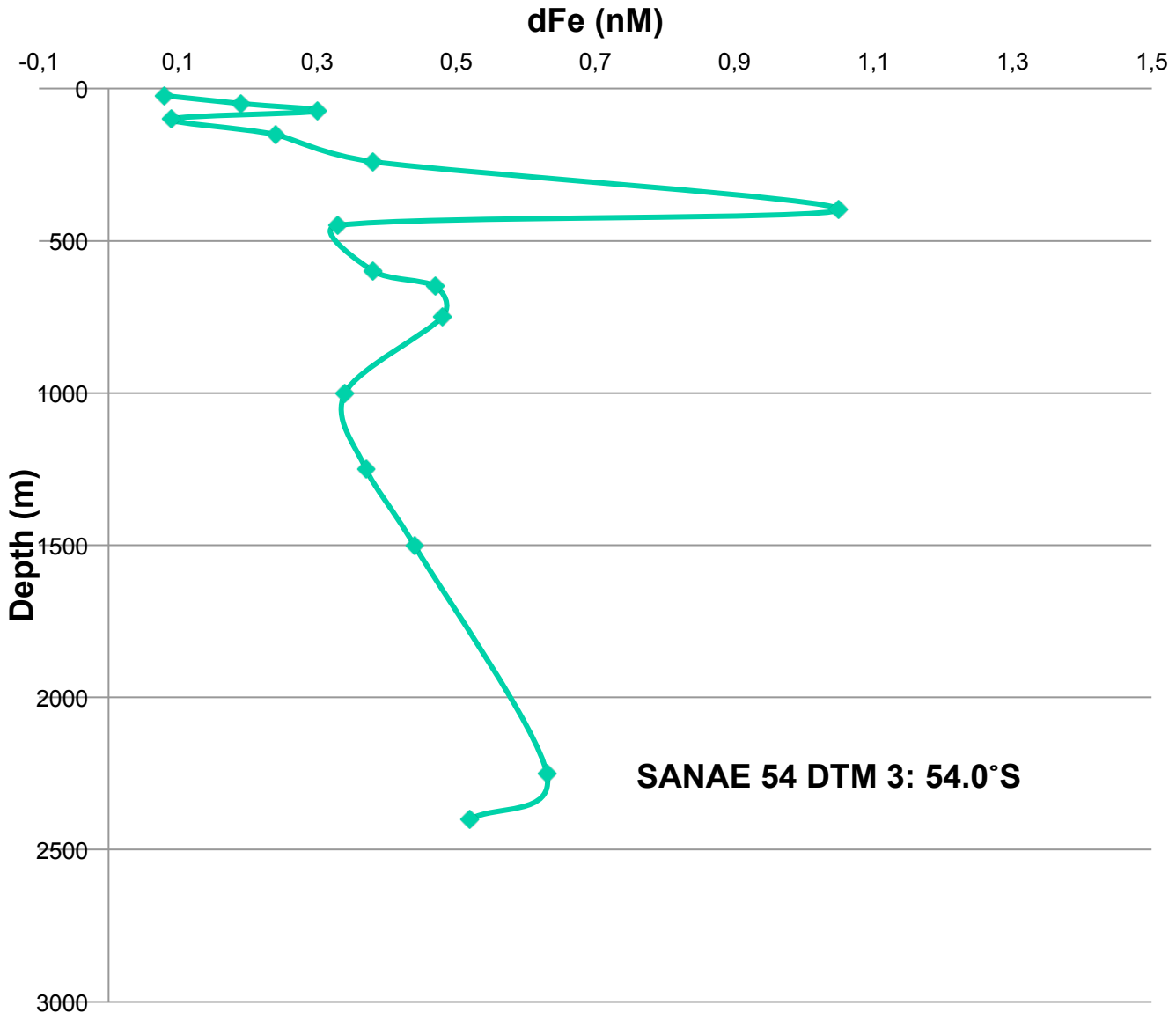
Proposal approved in the first phase.

We are asked to submit a detailed proposal.

2014 Summer Cruise

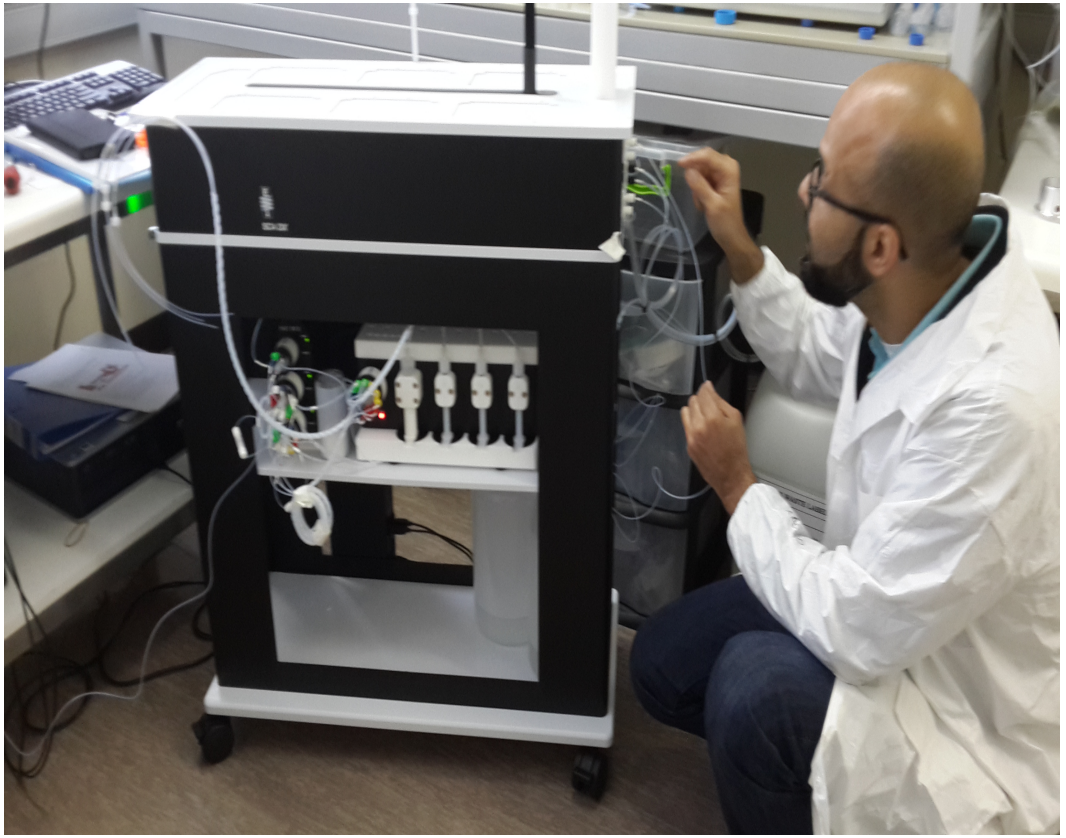


New Results



Validation of clean sampling protocol using of Go-Flo bottles and Trace CTD rosette.
The reproduced profile matches well with data from Klunder et al., (2011). Samples were analyzed in the laboratory of Maeve Lohan, Plymouth, UK.

New Measurement Capabilities



A pico-Fast® system has been acquired for pre-concentration of sea-water samples for trace elemental analysis using ICP-MS. The system is currently undergoing installation and validation for measurement of bioactive trace elements.

Analytical data – 40x pre-concentration

	Mn	Fe	Co	Ni	Cu	Zn	Cd
NASS5 Std	0.919	0.207	0.011	0.253	0.297	0.102	0.023
NASS5 Analyzed	0.911	0.206	0.011	0.245	0.297	0.106	0.022
% RSD	1.6	0.4	1.1	2.5	1.5	3.5	2.4

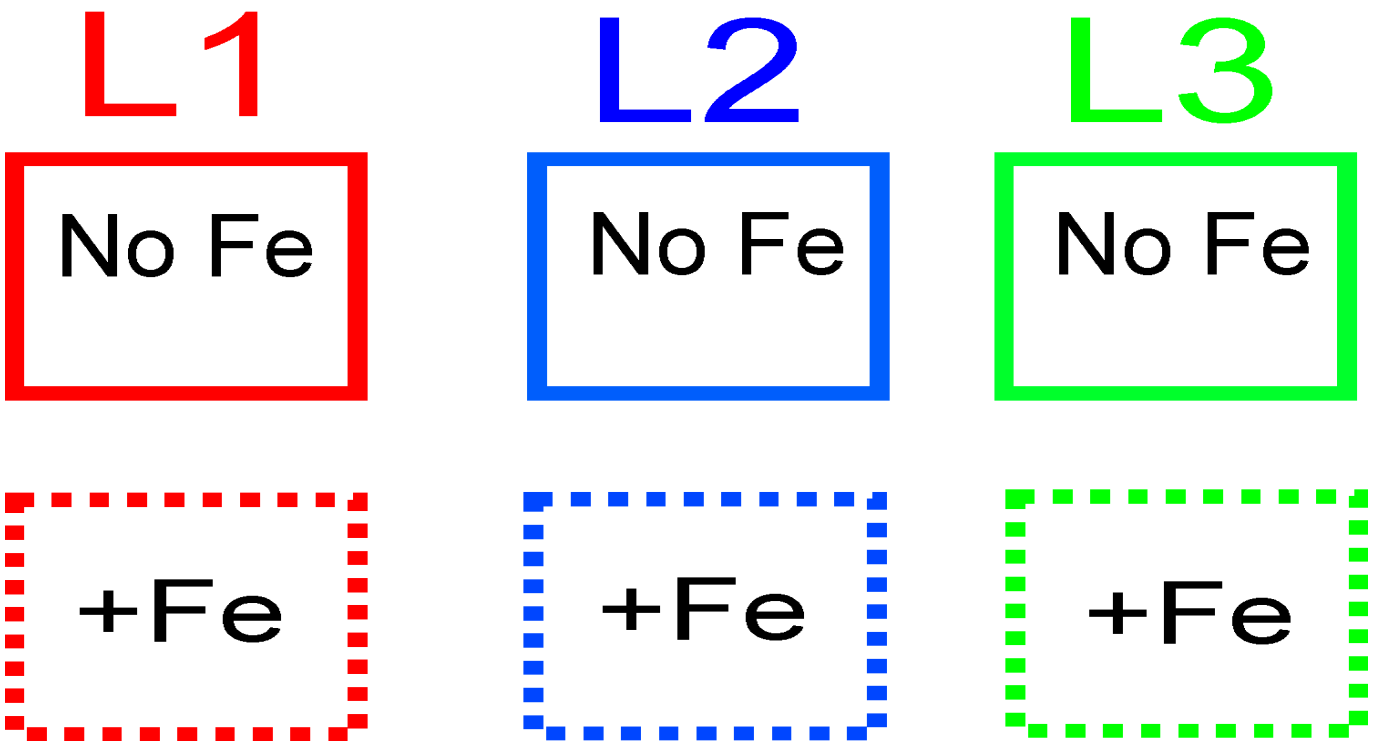
3 Replicates – all concentrations in µg/L

Reproducibility

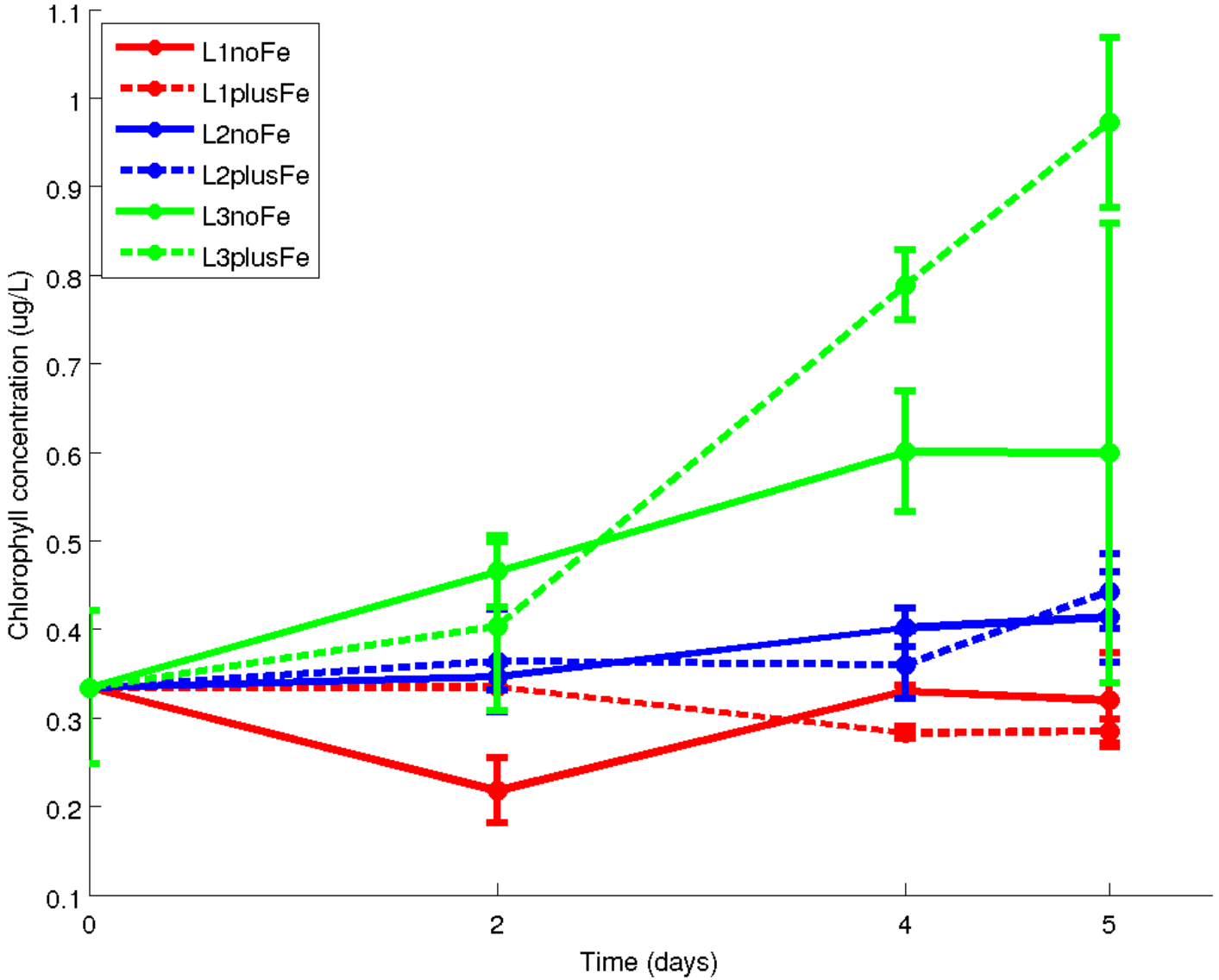
	Fe	
	[µg/L]	*3 Repl % RSD*
Lab SW 1	0.022	*6.2*
Lab SW 2	0.012	*5.5*
Lab SW 3	0.056	*17.6*
Lab SW 4	0.022	*3.0*
Lab SW 5	0.033	*2.9*
Lab SW 6	0.015	*3.7*
Lab SW 7	0.040	*5.4*
Lab SW 8	0.018	*4.8*
Lab SW 9	0.012	*5.0*
Lab SW 10	0.014	*10.9*

Iron and light limitation

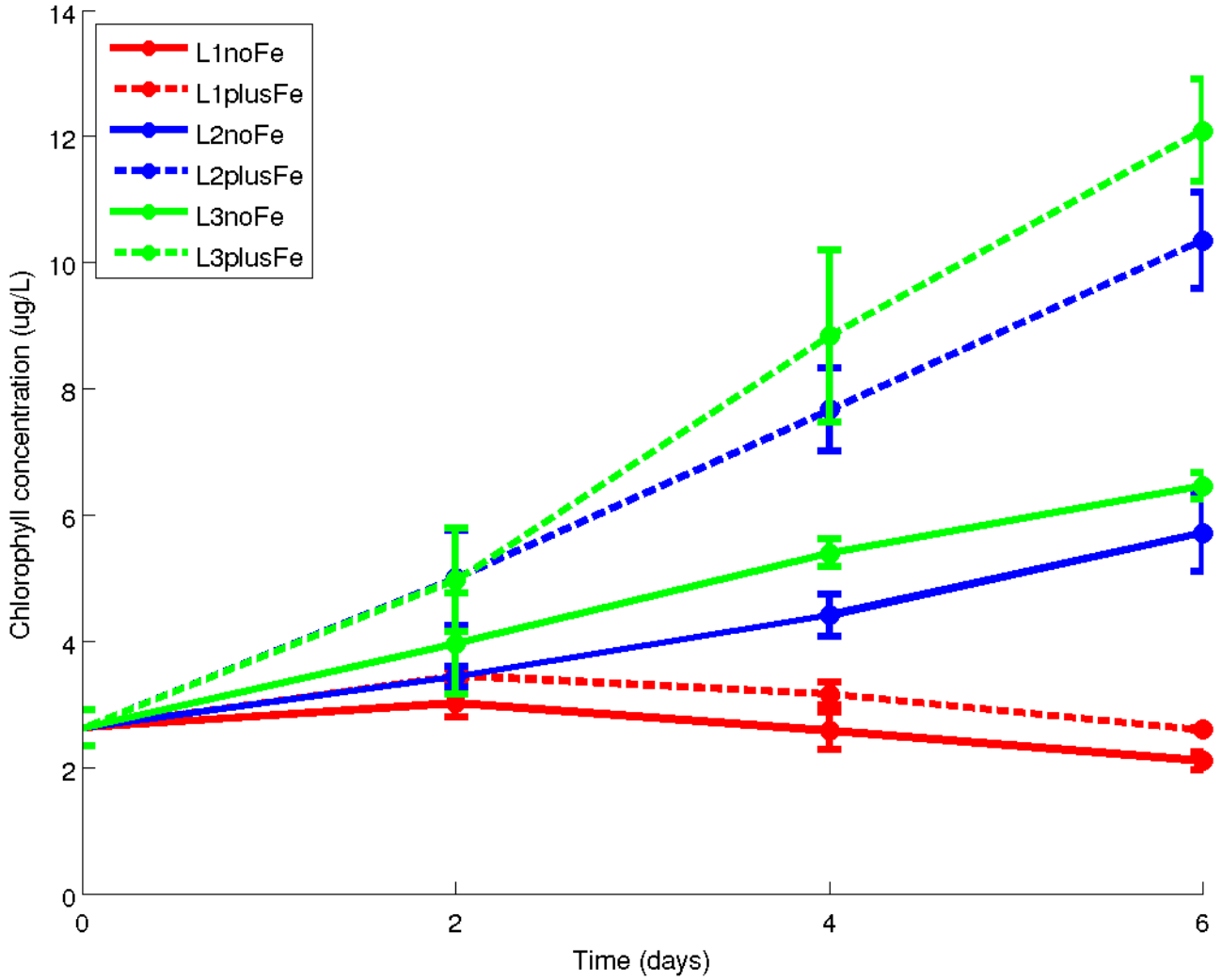
- Samples from Chlorophyll-max at 2 stations (46S and 65S)
- Incubated for 5/6 days at constant temperature



DTM 2 – 46S
Changes in total Chl-a

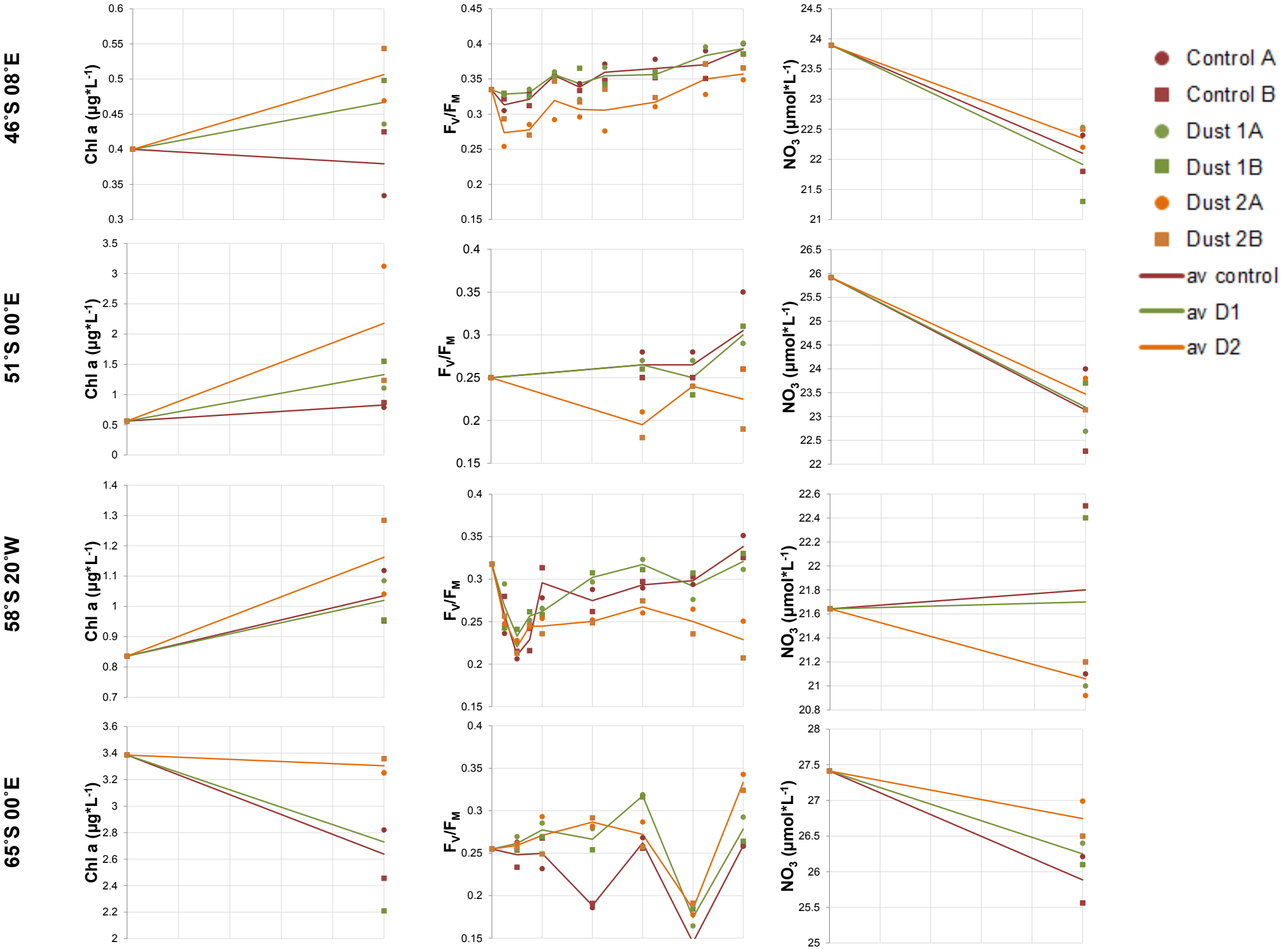


DTM 1 – 65S
Changes in total Chl-a



Summary

- Changes in Fv/Fm corroborate those in Total Chlorophyll
- At 46S, increased light favored growth more than added iron
- At 65S, added iron favored growth more than increased light.
- Future work: Characterising the community structure using HPLC samples as well as genetic analyses.

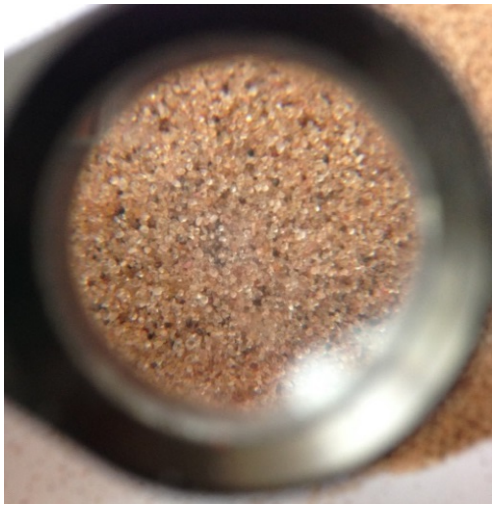

46°S 08°E
51°S 00°E
58°S 20°W
65°S 00°E
Chl a (µg*L-1)
FV/FM
NO3 (µmol*L-1)
Control A
Control B
Dust 1A
Dust 1B
Dust 2A
Dust 2B
av control
av D1
av D2

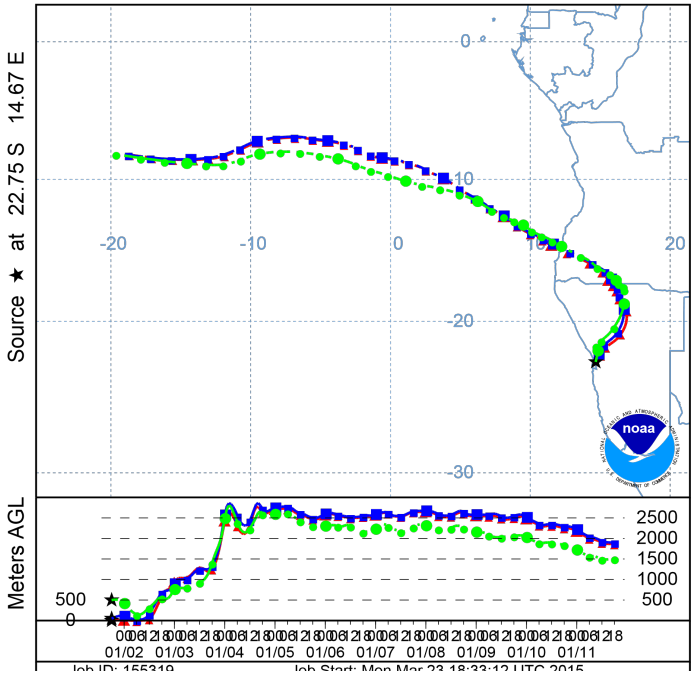
“Dust” type 1,
Navachab dune;
iron-rich sandstone

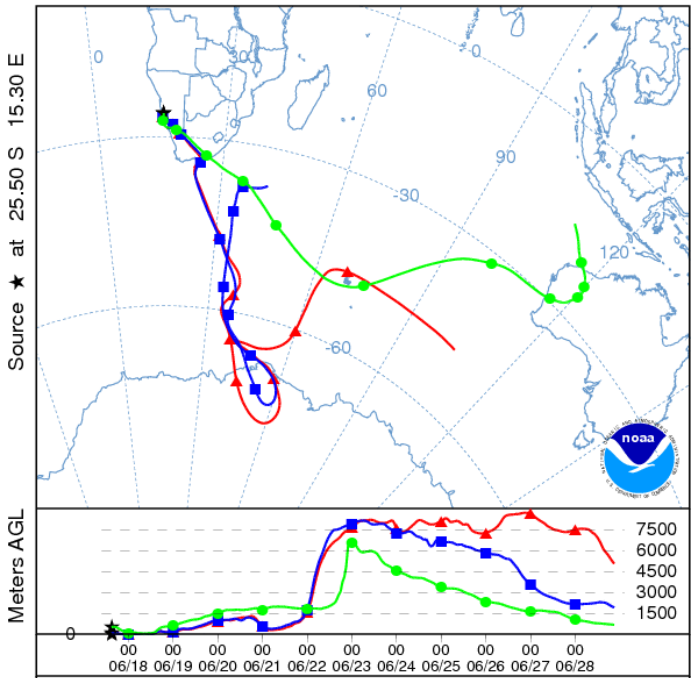
“Dust” type 2,
Navachab river sed;
arkose sandstone

“Dust” type 3,
Navachab river sed;
mud-flakes greywacke

“Dust” type 4,
Swakopmund dune;
lithic-sandstone

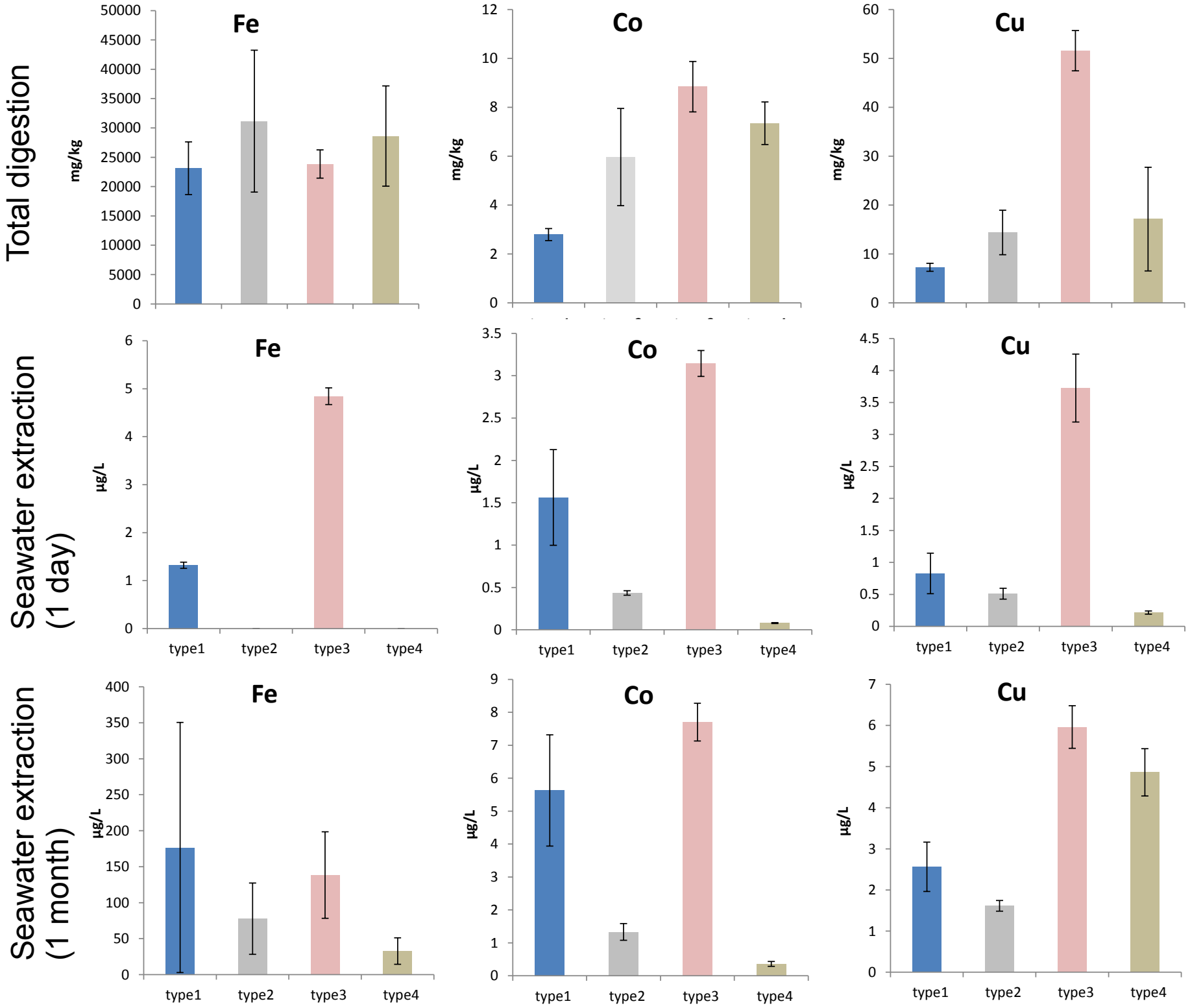




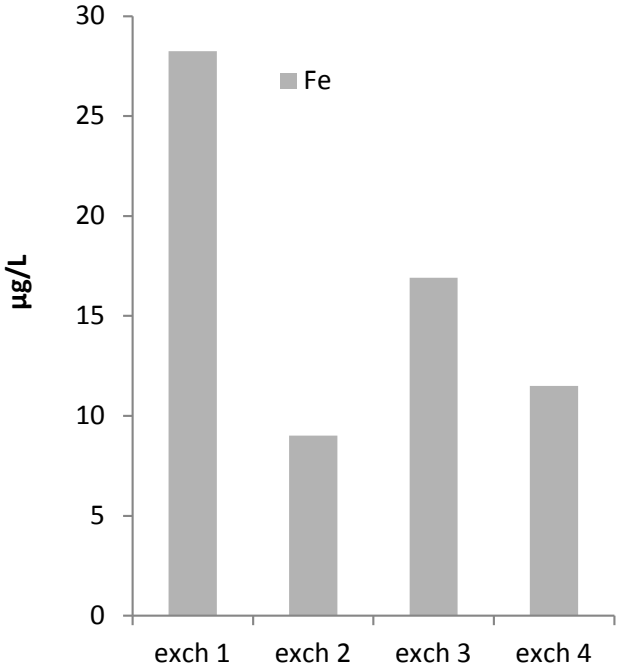


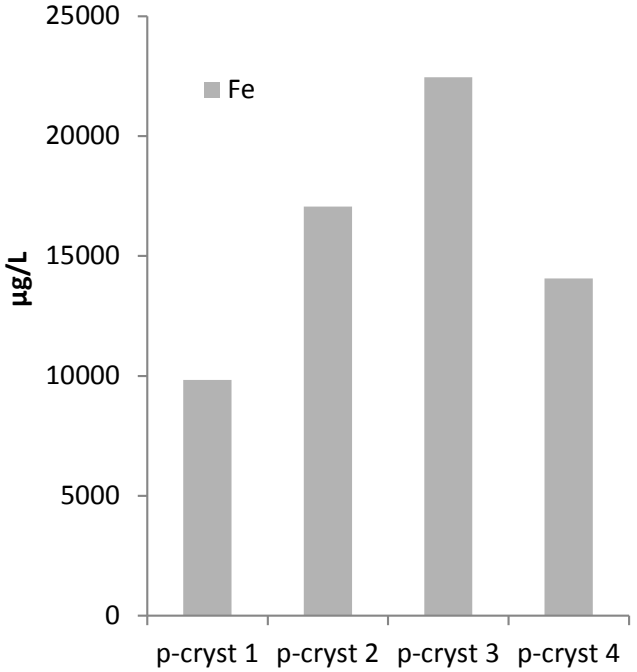
NOAA HYSPLIT
Forward air trajectories
models for
29 Jan 2015 (summer)
17 Jun 2013 (winter)

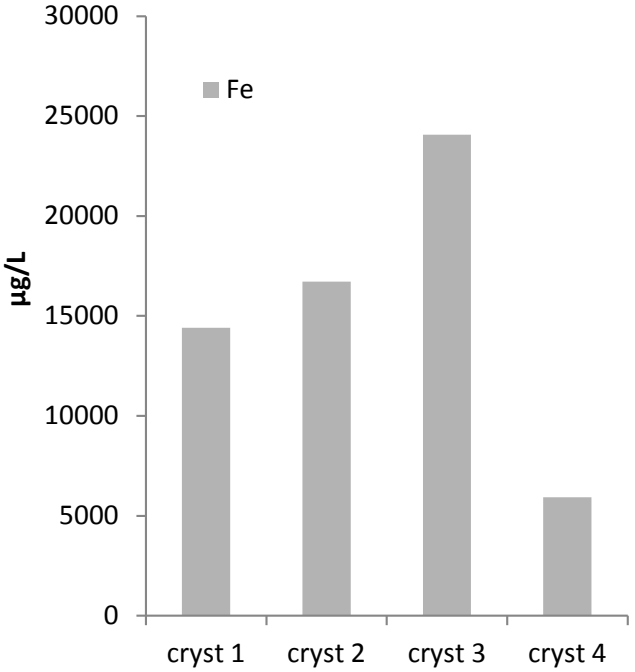
Note: along GHL, dust originates (most certainly) from Patagonia

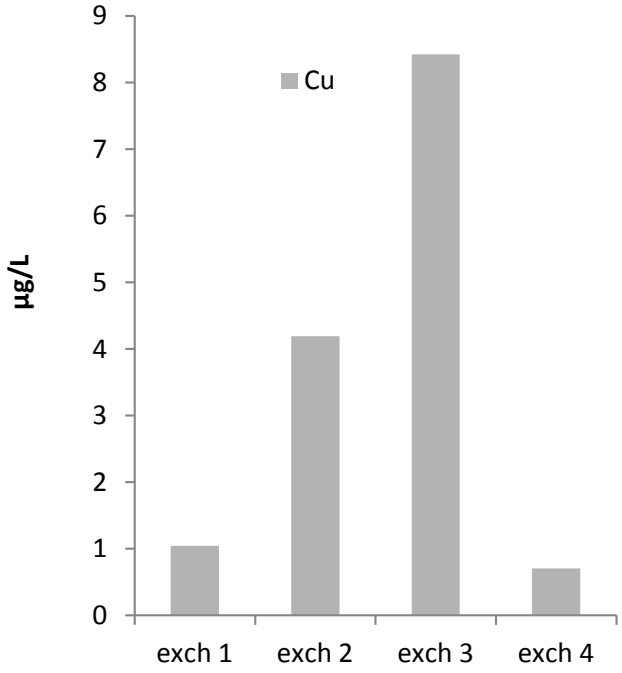

Total digestion
Seawater extraction (1 day)
Seawater extraction (1 month)
Fe
Co
Cu
mg/kg
μg/L
type1
type2
type3
type4

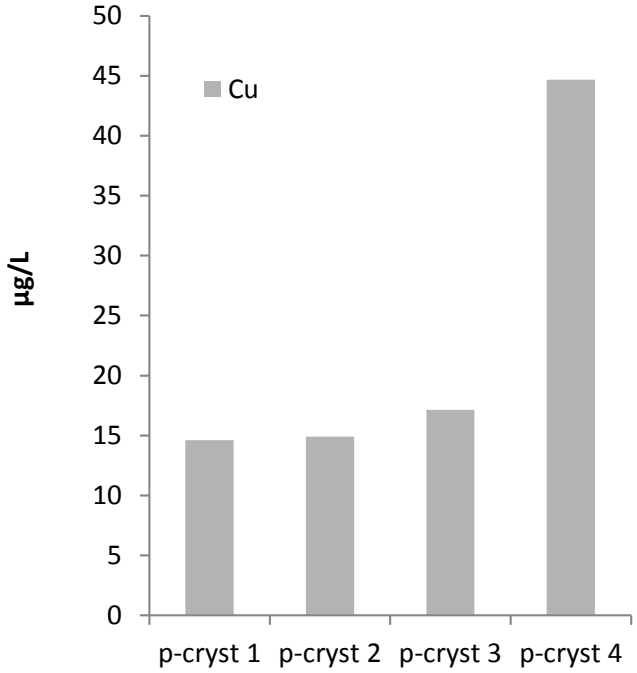
Sequential extraction: exchangeable, poorly crystalline, crystalline; In the 4 dust types

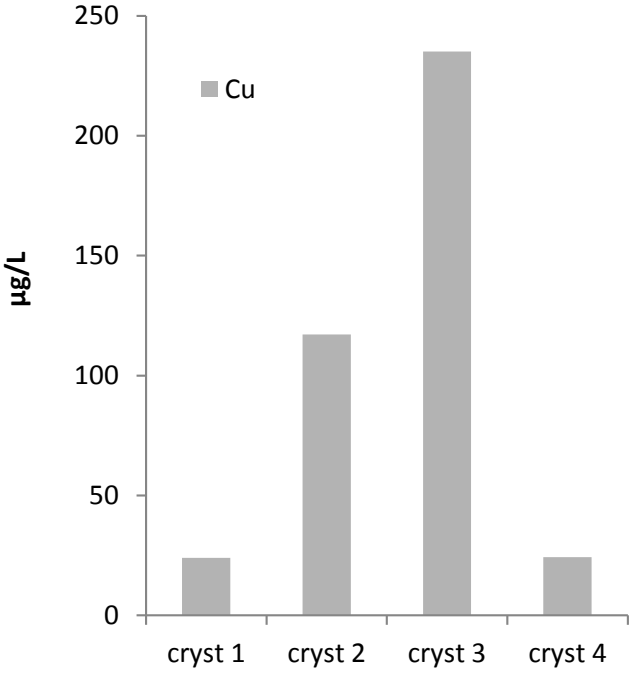












Cruises

SANAE 54 (Southern Ocean physics and biogeochemistry) cruise was undertaken along the BONUS-GOODHOPE line in the Southern Ocean to support the following projects (Dec 2014 – Feb2015):

Seasonal Cycle of Carbon in Southern Ocean – SNA2011112600001

Fe and light limitation in Southern Ocean phytoplankton – SNA2011120600005

Bioactive trace elements in Southern Ocean – SNA2011110100001

Stratification dynamics in the Southern Ocean mixed layer: a high resolution approach – YREF 0000005441

Southern Ocean Phytoplankton Adaption to mimicked future changes in light and iron availability - Molecular bases and modelling – SANCOOP 234229

Bio-optics - SNA2011120800004

New publications

Bjorn P. Von der Heyden and Alakendra N. Roychoudhury (2015) A review of colloidal iron partitioning and distribution in the open ocean, *Marine Chemistry*, doi:10.1016/j.marchem.2015.05.010

P. J. Lam, B. S.Twining, C Jendel, A.N. Roychoudhury, J. Resing, W. Geibert, P. Santschi, R. F. Anderson (2015) Methods for analyzing the composition and speciation of marine particles, *Progress in Oceanography,* 133; pp 32-42

Bjorn P. Von der Heyden, Emily J. Hauser, Bhoopesh Mishra, Gustavo A. Martinez, Andrew R. Bowie, Tolek Tyliszczak, Thato N. Mtshali, Alakendra N. Roychoudhury, Satish C.B. Myneni (2014) Ubiquitous presence of Fe(II) in aquatic colloids and its association with organic carbon. *Environmental Science & Technology, Letters*, 1; pp 387 – 392

New funding

Roychoudhury AN (2015) ICP-MS mass spectrometer for ultra-trace metal analysis. National Equipment Program, NRF, R 2,699,000

Roychoudhury AN (2015-2017) Speciation and interaction of iron nanoparticles in Southern Ocean, SANAP, R 1,353,500

Roychoudhury AN (2014 – 2016) Iron nanoparticles in environment, NRF Competitive Rated Researcher Grant, R 1,427,220

Fietz, S and Roychoudhury, AN (2014- 2016) Southern Ocean Phytoplankton adaption to mimicked future changes in light and iron availability – molecular bases and modeling, South Africa – Norway bilateral grant, R2,421,712 + NOK1,453,027