# Surface Fe values from R/V Tangaroa cruise 61TG_3052 in the Southern Ocean in 1999 (SOIREE project)

**Website**: https://www.bco-dmo.org/dataset/2834
**Version**: 11September2008
**Version Date**: 2008-09-11

**Project**
» Southern Ocean Iron Release Experiment (SOIREE)

**Program**
» Iron Synthesis (FeSynth)

| Contributors | Affiliation | Role |
|---|---|---|
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## Dataset Description

SOIREE Surface Fe Data

***Comments preserved from the original file:***
*SOIREE Surface Fe underway data*


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*SOIREE Fe data used in the preparation of the manuscript:*
*Bowie et al. (2001), The Fate of Added Iron during a Mesoscale Fertilisation Experiment in the Southern Ocean*

*This data was prepared by Andrew Bowie, whom the ownership rests with.*
*The data is for use for SOIREE participants only for research purposes.*
*Before using this data in any presentation or printed publication, please*
*contact the author and include full acknowledgements. All enquiries regarding*
*the sampling, analysis and data preparation can be directed to the address above.*

*Notes*
*1. Dissolved iron (DFe) underway data (nM).*
*2. All surface Fe analyses were performed using a flow injection - chemiluminescence (FI-CL) technique based on the luminol reaction using dissolved oxygen as the oxidant (Bowie et al., 1998).*
*3. All underway samples taken torpedo fish towed at 0.5-1 m below the surface.*
*4. The detection limit of the FI-CL method was 0.04 nM.*

*5. The analytical blank varied between 0.09 and 0.24 nM over 13 d with a mean standard deviation of 0.013 nM.*
*6. Contamination (suspected to be from the ship itself) resulted in a practical limit of detection for the underway mapping of 0.10-0.20 nM, which was monitored daily.*
*7. Out-of-patch locations determined by absence of SF6 signal. Nevertheless, continuous tracking between high Fe within patch and almost two orders lower Fe out of patch may lead to memory effect contamination of the low values for out of patch. Therefore rejections of 61 suspect out of patch "contaminated" samples*
*8. A '<' symbol indicates that the concentration was below the practical limit of detection.*
*9. The timing of samples collected from the underway system were adjusted for lag time delays due to surface water pumping and analysis (4.0-6.5 min).*
*10. Decimal time is given as days in February 1999 (GMT), with 1 February 1999 0:00 = 1.0000.*
*11. Latitudes and longitudes are taken from the DAS on RV Tangaroa (no Lagrangian correction).*
*12. Each worksheet corresponds to one mapping session.*

*References:*
*Bowie, A.R., Achterberg, E.P., Mantoura, R.F.C., Worsfold, P.J., 1998. Determination of sub-nanomolar levels of iron in seawater using flow injection with chemiluminescence detection. Analytica Chimica Acta 361, 189-200.*

*Bowie, A.R., Maldonado, M.T., Frew, R.D., Croot P.L., Achterberg, E.A., Mantoura, R.F.C., Worsfold, P.J., Law, C.S., Boyd P.W., The Fate of Added Iron during a Mesoscale Fertilisation Experiment in the Southern Ocean, Deep-Sea Research II (2001), SOIREE special issue, in the press.*

*Note*
*Values in brackets ('[ ]') were suspected to be contaminated*

***Data from original Pre-release Site Survey Notes columns below***

*date time Notes*
*19990208 0021 Ship moving slowly*
*19990208 0202 nd*
*19990208 0330 nd*
*19990208 0414 nd*
*19990208 0500 Ship moving slowly*
*19990208 0530 nd*
*19990208 0907 nd*
*19990208 0955 nd*
*19990208 1000 nd*
*19990209 1235 Below LOD*
*19990209 1243 Below LOD*
*19990209 1308 nd*

*Mean 0.08*
*Std. Dev. 0.03*
*n 10*
*2 rejections*

**Methods & Sampling**

See SOIREE Preliminary Voyage Report

**Underway Fe Mapping**
(Andrew R. Bowie, UoP / PML, UK)

**Objectives**
(i)To map the ambient concentration and investigate surface water changes in Fe2+,

dissolved (diss-Fe, <0.2mm) and total dissolvable (TD-Fe) iron during the experiment

(ii)To study the vertical distribution of Fe INside and OUTside the fertilised 16 patch via laboratory based analysis of sub-samples taken from daily Go-Flo casts

(iii)To perform an intercalibration exercise between FI-CL (AB) and solvent extraction GFAAS (RF) technologies from identical samples taken from Go-Flo casts

(iv)To study the surface water distribution of Fe and other trace metals along a latitudinal transect of the west coast of New Zealand

**Analytical and Sampling Methodologies**
Shipboard determinations were performed using a semi-automated flow injection chemiluminescence (FI-CL) analyser. The technique enabled real-time analysis of Fe2+, diss-Fe and TD-Fe fractions at the sub-nanomolar concentration level. The system is based on the oxidation of luminol, which is catalysed by Fe2+ ions, emitting blue light. A reduction step was performed to determine the Fe(II+III) fraction and in-line matrix elimination / sample preconcentration was achieved using a 8-hydroxyquinoline micro-column. Surface samples were taken from a torpedo-style fish deployed at 1-2 m and pumped directly into container designed for trace metal work. Vertical profiling samples were collected from 5L and 30L trace metal Go-Flo sampling bottles deployed on Kevlar rope.

**Preliminary Results**
The FI-CL system performed with only minor problems throughout the one-month cruise period. A minimum of 50 samples were analysed during each mapping period for Fe2+, diss-Fe and / or TD-Fe fractions. Ambient surface water diss-Fe levels (0.08 nM) were raised to ca. 2 nM on the first infusion, to 1 nM during infusions 2 and 3 and to 2nM on infusion 4. Rapid loss of diss-Fe INside the patch to near ambient levels was noted after the first 3 infusions; this was due to the conversion of the added iron sulphate heptahydrate to colloidal and particulate phases. However, >1 nM diss-Fe persisted INside the patch for the 5 days following the 4th infusion. Furthermore, significant concentrations of Fe2+ species existed INside the patch on days 12 and 13 of the experiment. Maximum surface water TD-Fe levels (>5 nM) were measured on day 8, following the 4th infusion.

**Data Processing Description**

See SOIREE Preliminary Voyage Report

**Underway Fe Mapping**
(Andrew R. Bowie, UoP / PML, UK)

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**BCO-DMO Processing Notes**
Generated from original file SurfaceFe.xls, Tabs: Notes, Pre_release, and map1-map13 provided on the Deep-Sea Research II 48 (2001) accompanying CD-Rom

**BCO-DMO Edits**
- parameter names modified to conform to BCO-DMO convention
- individual SOIREE Map, Yr, SDAY, etc record commented and added as columns to each data record
- added negative sign to latitude values
- 2 original column header records re-organized into one header line
- No data or Bad data flag changed to BCO-DMO standard of "nd"

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## Data Files

| File |
|---|
| **SurfaceFe.csv** (Comma Separated Values (.csv), 88.68 KB) MD5:3424799a67d008a7393559cbfb8f47cf<br>Primary data file for dataset ID 2834 |

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## Parameters

| Parameter | Description | Units |
|---|---|---|
| date | date | YYYYMMDD |
| time | time | HHMM |
| UncorrPosE | Eastward position of shiptrack | kilometers |
| UncorrPosN | Northward position of shiptrack | kilometers |
| DriftE | Eastward drift calculated from ADCP | kilometers |
| DriftN | Northward drift calculated from ADCP | kilometers |

| | | |
|---|---|---|
| CorrPosE | Corrected ship-track (Eastward component) | kilometers |
| CorrPosN | Corrected ship track (Northward component) | kilometers |
| lon | longitude, negative denotes West | decimal degrees |
| lat | latitude, negative denotes South | decimal degrees |
| Dfe | Dissolved Iron | nM |
| Year | Year of data | YYYY |
| Map | Map number of mapping session | integer |
| SDY | Day of the year | text |
| SOIREEDay | Day of SOIREE Experiment (Day 1=10Feb1999) | integer |
| DayDate | Day/Date of Data | DD-Mon |
| TimeDecimal | Days in February 1999 (GMT) with 1 February 1999 0:00 = 1.0000 | decimal days |
| Yr | Year of data | YY |
| Map_top | Toplevel Map number. | |
| SDY_top | Top level Day of the year. | dd |
| SOIREE_Day | Day of SOIREE Experiment (Day 1=10Feb1999) at the top level | integer |
| DayDate_top | Day and month combo | dd-bbb |

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## Instruments

| | |
|---|---|
| **Dataset-specific Instrument Name** | Undulator |
| **Generic Instrument Name** | SOIREE Undulator |
| **Dataset-specific Description** | On SOIREE, the undulator did not undulate. As a result, it was towed at a constant depth of 1-2 meters |
| **Generic Instrument Description** | The SOIREE Undulator was a torpedo-style fish used during the SOIREE cruise for the collection of underway water samples. A variety of sampling devices are housed within the fish, although little detailed information was provided. It was designed to undulate through a depth profile as it was being towed behind the research vessel. |

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## Deployments

**61TG_3052**

| | |
|---|---|
| **Website** | https://www.bco-dmo.org/deployment/57827 |
| **Platform** | R/V Tangaroa |
| **Report** | http://bcodata.whoi.edu/Fe_Synthesis/SOIREE/SOIREE_cruisereport.pdf |
| **Start Date** | 1999-01-31 |
| **End Date** | 1999-03-01 |
| **Description** | Cruise to the Southern Ocean as part of the Fe Sythesis project whose aim was to maintain a coherent patch of iron-enriched seawater for the duration of SOIREE and to interpret any iron-mediated effects on the patch by conducting measurements and performing experiments during this period. |

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## Project Information

**Southern Ocean Iron Release Experiment (SOIREE)**

**Coverage**: Southern Ocean

Project in the Southern Ocean aimed at maintaining a coherent patch of iron-enriched seawater for the duration of project and to interpret any iron-mediated effects on the patch by conducting measurements and performing experiments during this period of the project.

The Southern Ocean Iron RElease Experiment (SOIREE), was the first in situ iron fertilization experiment performed in the polar waters of the Southern Ocean. SOIREE was an interdisciplinary study involving participants from six countries, and took place in February 1999 south of the Polar Front in the Australasian-Pacific sector of the Southern Ocean.

Approximately 3800 kg of acidified FeSO4.7H2O and 165 g of the tracer sulphur hexafluoride (SF6) were added to a 65-m deep surface mixed layer over an area of ~50 km2. Initially, mean dissolved iron concentrations were ~2.7 nM, but decreased to ambient levels within days, requiring subsequent additions of 1550-1750 kg of acidified FeSO4.7H2O on days 3, 5 and 7 of the experiment.

During the 13-day site occupation, there were iron-mediated increases in phytoplankton growth rates, with marked increases in chlorophyll a (up to 2 µgl-1) and production rates (up to 1.3 gCm-2d-1). These resulted in subsequent changes in the pelagic ecosystem structure, and in the cycling of carbon, silica and sulphur, such as a 10% drawdown of surface CO2.

The SOIREE bloom persisted for >40 days following our departure from the site, as observed via SeaWiFS remotely sensed observations of Ocean Colour.

**BCO-DMO Note:**
All original data and metadata provided on a CD-Rom accompanying the Deep-Sea Research II 48 (2001) volume. The CD-Rom contains the main SOIREE datasets and ancillary information including the pre-experiment 'desktop' database study for site-selection, and satellite images of the SOIREE bloom.


## Related files

SOIREE Preliminary Voyage Report
SOIREE Introduction and Summary, Deep-Sea Research II 48 (2001) 2425-2438
SOIREE Cruise Track

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## Program Information

**Iron Synthesis (FeSynth)**

**Coverage**: Global

The two main objectives of the Iron Synthesis program (SCOR Working Group proposal, 2005), are:
1. Data compilation: assembling a common open-access database of the *in situ* iron experiments, beginning with the first period (1993-2002; Ironex-1, Ironex-2, SOIREE, EisenEx, SEEDS-1; SOFeX, SERIES) where primary articles have already been published, to be followed by the 2004 experiments where primary articles are now in progress (EIFEX, SEEDS-2; SAGE, FeeP); similarly for the natural fertilizations S.O.JGOFS (1992), CROZEX (2004/2005) and KEOPS (2005).

2. Modeling and data synthesis of specific aspects of two or more such experiments for various topics such as physical mixing, phytoplankton productivity, overall ecosystem functioning, iron chemistry, CO2 budgeting, nutrient uptake ratios, DMS(P) processes, and combinations of these variables and processes.

SCOR Working Group proposal, 2005. "The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling".
http://www.scor-int.org/Working_Groups/wg131.htm

See also: SCOR Proceedings Vol. 42 Concepcion, Chile October 2006, pgs: 13-16 2.3.3 Working Group on The Legacy of *in situ* Iron Enrichments: Data Compilation and Modeling.

The first objective of the Iron Synthesis program involves a data recovery effort aimed at assembling a common, open-access database of data and metadata from a series of *in-situ* ocean iron fertilization experiments conducted between 1993 and 2005. Initially, funding for this effort is being provided by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).

Through the combined efforts of the principal investigators of the individual projects and the staff of Biological and Chemical Oceanography Data Management Office (BCO-DMO), data currently available primarily through individuals, disparate reports and data agencies, and in multiple formats, are being collected and prepared for addition to the BCO-DMO database from which they will be freely available to the community.

As data are contributed to the BCO-DMO office, they are organized into four overlapping categories:
1. Level 1, basic metadata
(e.g., description of project/study, general location, PI(s), participants);

2. Level 2, detailed metadata and basic shipboard data and routine ship's operations
(e.g., CTDs, underway measurements, sampling event logs);
3. Level 3, detailed metadata and data from specialized observations
(e.g., discrete observations, experimental results, rate measurements) and
4. Level 4, remaining datasets
(e.g., highest level of detailed data available from each study).

Collaboration with BCO-DMO staff began in March of 2008 and initial efforts have been directed toward basic project descriptions, levels 1 and 2 metadata and basic data, with detailed and more detailed data files being incorporated as they become available and are processed.

## Related file

Program Documentation

The Iron Synthesis Program is funded jointly by the Scientific Committee on Oceanic Research (SCOR) and the U.S. National Science Foundation (NSF).


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