



**National Oceanography
Centre, Southampton**

UNIVERSITY OF SOUTHAMPTON AND
NATURAL ENVIRONMENT RESEARCH COUNCIL

UNIVERSITY OF
Southampton
School of Ocean and
Earth Science

Carbonate Chemistry Facility for UK Ocean Acidification Research Programme

Eric Achterberg, Cynthia Dumousseaud



Objectives of the facility

The UK carbonate system facility is operational and provides:

- High quality measurements of dissolved inorganic carbon (DIC) and total alkalinity (TA)
- Guide for best practices (including details on sampling, transport and use of the facility's online sample logging and receipt system)
- Training workshops at the National Oceanography Centre (Southampton) for sampling, storage, transport and data analysis (dates to be announced)
- Telephone and email technical support to the UK OA RP researchers

Prof. Eric Achterberg (eric@noc.soton.ac.uk; +44 23 8059 3199)

Dr. Cynthia Dumousseaud (cd6@noc.soton.ac.uk; +44 23 8059 3641)

Instrumentation

For experimental work samples: Apollo SciTech instruments

- Small volume (0.2-1.5 ml for DIC; 1-25 ml for TA)
- Precision: ± 0.1 % or better (precision reduced at lower sample volumes)
- TA: Acid-Base titration (open-cell titration)
- DIC: Infrared analysis (Li-Cor analyser)
- Use of Certified Reference Materials (Prof. A. Dickson; Scripps) to assess accuracy of the measurements



Front view of the DIC Analyser (Apollo SciTech) in use at NOC, Southampton (left); Total Alkalinity Titrator system (Apollo SciTech; right)

Instrumentation

For oceanic samples: VINDTA 3C (Marianda, Germany)

- Larger volumes (~150 ml total for both measurements)
- Precision: ± 0.1 % or better
- TA: Acid-Base titration (closed-cell titration)
- DIC: Coulometric analysis
- Use of Certified Reference Materials (Prof. A. Dickson; Scripps) to assess accuracy of the measurements

Front view of the VINDTA 3C and the UIC coulometer in use at NOC, Southampton



Sampling procedures and transport

Practical guide now available at <http://www.noc.soton.ac.uk/ukoacf>
(includes recommendations for sampling, storage and transport of samples)

Sampling:

- Borosilicate glass bottles (100 or 250 ml)
- Silicon tubing used to prevent bubbles in the sample (if possible)
- Samples poisoned with mercuric chloride (saturated solution; 0.02% v/v)
- Samples stored in dark until analysis

For more information on recommended procedures:

Dickson et al. 2007: Guide to best practices for ocean CO₂ measurements

EPOCA: Guide to best practices for ocean acidification research and data reporting

Carbonate System Facility

LIMS Software

Username and password protected

Input by user:

- sample information (ID, number...)
- ancillary data: salinity, temperature, pressure, phosphate and silicate concentration
- optional: pH (including pH scale), $p\text{CO}_2$

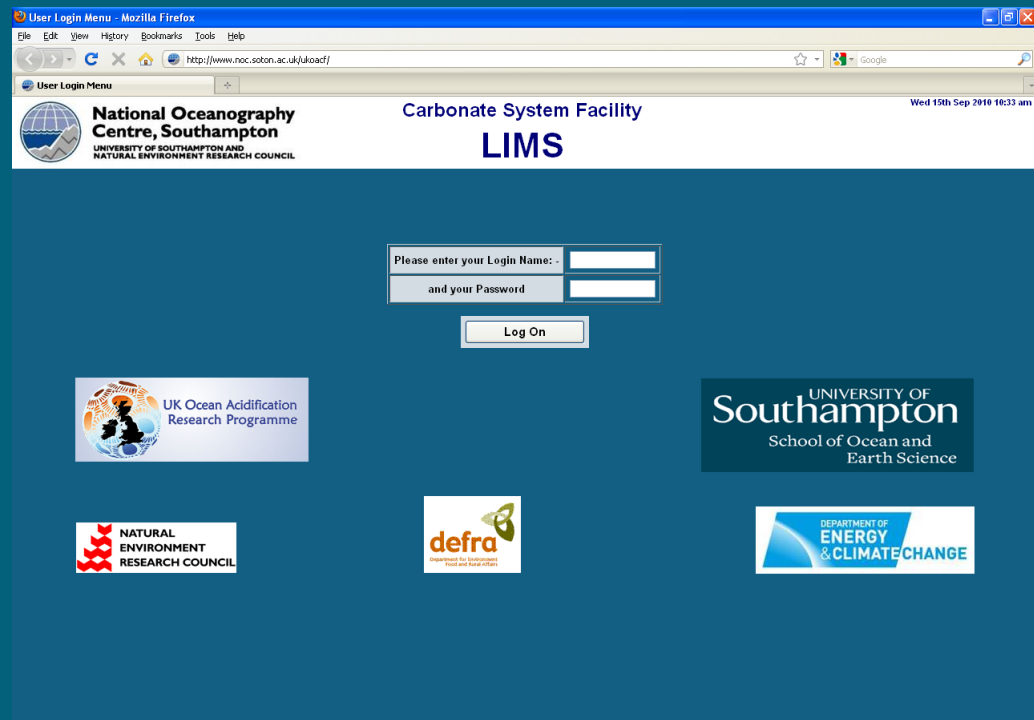
Output by Carbonate System Facility (once samples analysed):

- analysed TA and DIC
- calculated pH (total scale)
- calculated $p\text{CO}_2$
- carbonate and bicarbonate ion concentration
- calcite and aragonite saturation state

Carbonate System Facility LIMS Software

Software available at: <http://www.noc.soton.ac.uk/ukoacf>

Cost of analysis: £12 per sample (for both DIC and TA) for UK OA projects



Carbonate Facility LIMS website