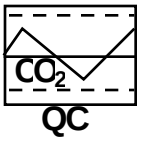

University of California, San Diego
Marine Physical Laboratory, 0902
9500 Gilman Drive
La Jolla, CA 92093-0902

Certificate of Analysis

Reference material for oceanic CO_2 measurements

Batch #15 (Bottled on November 30, 1992)

This reference material consists of natural sea water sterilized by a combination of filtration, ultra-violet radiation and addition of mercuric chloride.

Analysis Results

The various procedures used for these analyses are detailed overleaf.

Salinity	33.199	
Total dissolved inorganic carbon	2031.65 ± 1.12 μmol·kg^{-1}	(11)
Total alkalinity *	2202.38 ± 0.33 μmol·kg^{-1}	(10)
Phosphate	0.347 μmol·kg^{-1}	
Silicate	2.13 μmol·kg^{-1}	
Nitrite	0.0098μmol·kg^{-1}	
Nitrate	0.298 μmol·kg^{-1}	

The cited uncertainties represent the standard deviation. Figures in parentheses are the number of analyses made. The nutrient levels may change on storage, their stability has not been examined; CO_2 analyses were performed over a period of time to confirm that the batch is stable.

The 95% confidence limits for the mean of these certified analyses are thus:

Total dissolved inorganic carbon	2031.65 ± 0.75 μmol·kg^{-1}
Total alkalinity *	2202.38 ± 0.24 μmol·kg^{-1}

STORAGE: The bottles should be stored out of direct sunlight, and preferably at or below room temperature (25 °C). They should not be allowed to freeze!

Andrew Dickson

Andrew G. Dickson
April 28, 1993

* Total alkalinity was not measured when the batch was originally certified; the total alkalinity value is based on measurements performed on archived samples of the batch.

Analytical Methods Used

Salinity

The salinity was determined by measuring its conductivity relative to IAPSO Standard Sea Water using a Guildline Model 8410 Portasal® conductive salinometer. The procedure is described in an in-house technical manual of the Marine Life Research Group, Scripps Institution of Oceanography, entitled, "Portasal Instructions for Guildline Portasal Model 8410".

Total dissolved inorganic carbon

The total dissolved inorganic carbon was assayed in Dr. C. D. Keeling's laboratory at the Scripps Institution of Oceanography by the vacuum extraction/manometric procedure. The weighed sample is acidified with phosphoric acid; the CO_2 evolved is then extracted under vacuum and condensed in a trap cooled by liquid nitrogen. The water and CO_2 are separated from one another by sublimation and the CO_2 is transferred into a mercury column manometer. There its pressure, volume and temperature are measured and the amount of CO_2 separated is computed from the virial equation of state.

Alkalinity

The total alkalinity was assayed by a two-stage, potentiometric, open-cell titration using coulometrically analyzed hydrochloric acid. A weighed sample of reference material is acidified to a pH between 3.5 and 4.0 with an aliquot of titrant. The solution is stirred for a period of time to allow the evolved CO_2 to escape. The titration is then continued to a pH of about 3.0 and the equivalence point evaluated from titration points in the pH region 3.0–3.5 using a modified Gran procedure that corrects for the reactions with sulfate and fluoride ions.

Nutrients

Nutrient levels were determined by standard manual colorimetric techniques. The procedures are similar to those described in Parsons T. R., Y. Maita & C. M. Lalli (1984) *A manual of chemical and biological methods for seawater analysis*, Pergamon Press, Oxford, 173 pp.