**Method for the DIC and delta 13C analyses of the GOSHIP samples:**

We undertook this study with our newly developed – precise, rapid, and sea-going analyzer – to simultaneously measure DIC concentration and δ13C-DIC, by combining sample acidification and Picarro CO2 isotope analyzer. The method uses a whole water CO2 extraction device coupled to a Cavity Ring-Down Spectroscopy (CRDS) CO2 and isotope analyzer to simultaneously measure DIC and δ13C-DIC in a 3-5 mL sample, over an ~11 min cycle. With an average precision of 2 µmol kg-1 for DIC and 0.1 ‰ for δ13C-DIC, the system can also be used in the underway mode for continuous analysis of DIC and δ13C.

**Sample collection:** Samples were collected directly from Niskin bottles into 60 ml tinted glass vials with septa top. A quarter inch sampling tube connected to the Niskin bottle was inserted in the vial and after flushing the vial with 3 to 4 vial volumes, the vial was filled to the brim and immediately closed. Following collection, vials were moved into the lab, 0.5 ml sample withdrawn to create a headspace and 12.5 uL of saturated mercuric chloride solution was added to preserve the sample, and closed using a hard polypropylene cap with Teflon liner.

Underway samples were collected from the underway line in the lab in a similar manner as the samples from Niskin bottles. Corresponding times of collection, location, surface temperature, and salinity were recorded for each underway sample. After removing 0.5 mL sample to create a headspace, 12.5 uL of HgCl2 was immediately added and vial closed with the hard polypropylene cap with Teflon liner.

All samples were maintained at the ambient temperature – between 16 and 25 oC until their return to the UD lab at Newark, DE, where they were processed for DIC and δ13C following the technique presented in Su et al (2019). The maximum time lag between collection and analysis in the lab at UD was about 3 months.

CRM standards obtained from Andrew Dickson were used for DIC calibrations and two NaHCO3 standards of known δ13C values for the δ13C calibrations. Three volumes of CRM (3, 3.5, and 4 ml) were used for the DIC calibrations in order to cover the range of sample DIC concentrations. All standards were measured once every 24 hours.

Once a week over the duration of analyses, aliquots of standards were taken in 12 mL vials and sent to the Stable Isotope Laboratory at UC Davis for the confirmation and recalibration of our measured δ13C.

Results of the analyses of the GOSHIP samples are presented in Table 1. DIC concentrations and the respective uncertainty on the measurement (Columns L and M of the attached CTD worksheet) are in uM/kg and the δ13C and uncertainty (Columns N and O) in ‰ units. Formats of Date, Time, Latitude, and Longitude are as given on the columns.

Ref: Su et al, Simultaneous determination of Dissolved Inorganic Carbon (DIC) concentration and stable isotope (δ13C-DIC) by Cavity Ring-Down Spectroscopy: Application to study carbonate dynamics in the Chesapeake Bay, Mar. Chem. **215** (2019) 103689