

Metadata Report for Vaillancourt, Lance & Hargreaves
aboard RV Ron Brown
SO GasEx, Feb 28-April 10, 2008

- I. **BOTTLE CAST DATA**: 6 to 8 depths sampled during ctd/bottle casts at 1100 and 2300 hrs daily or every-other day. Depths between surface and 100 m.
- a. ***C-14 Photosynthesis-irradiance*** (PvsE) experiments (Vaillancourt). At 8 depths from surface to 100 m. Sample captured only during morning cast (~1100 hrs, shiptime). Method is after Babin & Morel 1996 using the radial photosynthetron. Incubation time is 1 to 2 hrs under artificial light. Samples are filtered through Gf/f filters at low vacuum pressure (~ 5 inHg) to capture only particulate-C14; assimilated and excreted C14 is not counted. Products are: α , photosynthetic efficiency at depth z, units $\text{mgC m}^{-3} \text{h}^{-1} (\mu\text{mol photons m}^{-2} \text{s}^{-1})^{-1}$; P_{max} , maximum photosynthetic rate at depth z, units $\text{mgC m}^{-3} \text{h}^{-1}$; E_k , saturation irradiance at depth z, units $\mu\text{mol photons m}^{-2} \text{s}^{-1}$.
 - b. ***C-14 On-deck productivity*** (Lance). At 6 to 8 depths from surface to 100 m. Samples captured only during evening cast (~2300 hrs shiptime), every day approximately. Method is after Barber, et al. 1996. Samples are incubated in on-deck incubator cooled with flowing surface seawater and shielded with blue sheet filters and window screening to simulate in-situ light levels. Incubation times are 12 and 24 hours. Product is daily net primary production at depth z, units $\text{mmol C m}^{-3} \text{d}^{-1}$. Samples are filtered through Gf/f filters (nominal pore size ~0.7 μm) and on some occasions through polycarbonate filters (2, 5 and or 20 μm pore sizes) at low vacuum pressure (~ 5 inHg) to capture only particulate-C14; assimilated and excreted C14 is not counted.
 - c. ***Fluorometric Chlorophyll a analysis***: Measured at 6 to 8 depths from surface to ~ 100m from 200 to 500 ml seawater. Samples filtered onto Gf/f filters (nominal pore size ~0.7 μm) and on some occasions through polycarbonate filters (2, 5 and or 20 μm pore sizes) under low vac pressure (~5 inHg). Methanol extracted chlorophyll a pigment after method of Welshmeyer, 1994 and chapters within ***Phytoplankton pigments in oceanography*** : guidelines to modern methods edited by Jeffrey et al. . Product is chlorophyll a concentration at depth z, units mg_m^{-3} .
 - d. ***HPLC pigment analysis***: Measured at 6 to 8 depths from surface to ~100m. Samples filtered onto Gf/f filters under low vac pressure (~5 inHg) and filters stored in liquid N2 for later

analysis of suite of phytoplankton pigments. Products are pigment concentrations at depth z , in units of mg m^{-3} .

- e. **Particle absorption** (Hargreaves). at 6 to 8 depths from surface to $\sim 100\text{m}$. Samples filtered onto Gf/f filters under low vac pressure (~ 5 inHg) and analyzed same day aboard ship. Products are particle absorption (a_p), detrital absorption (a_d), and phytoplankton absorption (a_{ph} ; all units $1/\text{m}$) at 3 nm resolution from approx $300 - 750\text{ nm}$, at depth z . Method is transmission-reflectance integrating sphere method with dilute bleach in buffered seawater used to remove pigments, adapted for diode array spectrophotometer (with addition of 515 nm highpass optical filter correction for sample fluorescence) from the method of Tassan & Ferrari, 1995. The spectrophotometer calibration is checked regularly during the cruise with a holmium wavelength standard (Starna, calibrated November 2007). The working spectralon reflectance standard is checked periodically against a factory-calibrated primary spectralon (calibration November 2007).
- f. **CTD cast fluorometric data (Hargreaves)**. The Turner Designs model C6 fluorometer (described below) can be deployed as a self-contained instrument (internal logging and battery power) to accompany routine CTD casts. In profiling mode the package with battery pack is rated to 600 meters and has been used by Hargreaves to 580 m in freshwater. Data are downloaded after the instrument is retrieved from the CTD/rosette lowering frame.

II. UNDERWAY DISCRETE AND CONTINUOUS DATA

Sampled intermittently from ship's clean seawater line from various exit points through ship. (Veronica & Bruce, devise notation for which sink was sampled and note whose underway instruments the samples exited).

- a. **Fluorometric Chlorophyll a analysis**: Samples filtered onto Gf/f filters under low vac pressure (~ 5 inHg). Methanol extracted chlorophyll a pigment after method of Welshmeyer, 1994 and chapters within **Phytoplankton pigments in oceanography**: guidelines to modern methods edited by Jeffrey et al. Product is chlorophyll a concentration at depth z , units mg/m^3 . Time (GMT) and location of sample capture noted. Seawater was collected from

Main Lab starboard sink from offset plumbing which provided water upstream of any underway continuously sampling instrumentation.

- b. **Particle absorption** (Hargreaves). Samples filtered onto Gf/f filters under low vac pressure (~5 inHg) and analyzed same day aboard ship. Some samples preserved in LN2 and returned to lab for method comparison experiments. Products are particle absorption (ap), detrital absorption (ad), and phytoplankton absorption (aph; all units $1/m$) at 1 nm resolution from approx 300 – 750 nm, at depth z. Method is transmission-reflectance method after XXX.
- c. **HPLC pigment analysis**: Samples filtered onto Gf/f filters under low vac pressure (~5 inHg) and filters stored in liquid N2 for later analysis of suite of plant pigments. Products are pigment concentrations at depth z, in units of $mg\ m^{-3}$. Samples will be analyzed by [Analytical Services of Horn Point Laboratory Pigment Analysis Facility, HPL-UMCES](#).
- d. **C-14 Photosynthesis-irradiance** (PvsE) experiments (Vaillancourt). At several time during daylight period to determine diurnal trend in surface waters. Sample seawater was collected from Main Lab starboard sink from offset plumbing which provided water upstream of any underway continuously sampling instrumentation. Method is after Babin & Morel 1996 using the radial photosynthetron. Incubation time is 1.5 to 2 hrs under artificial light. Samples are filtered through Gf/f filters at low vacuum pressure (~ 5 inHg) to capture only particulate-C14; assimilated and excreted C14 is not counted. Products are: α , photosynthetic efficiency at depth z, units $mgC\ m^{-3}\ h^{-1}\ (uE\ m^{-2}\ s^{-1})^{-1}$; P_{max} , maximum photosynthetic rate at depth z, units $mgC\ m^{-3}\ h^{-1}$; E_k , saturation irradiance at depth z, units $uE\ m^{-2}\ s^{-1}$.
- e. **Surface continuous PAR irradiance** (Hargreaves). Twin LiCor cosine underwater Par sensors (MODEL UWQ; not calibrated since 1990's but will be intercalibrated with other ship irradiance data and with post-cruise intercalibrations) mounted on top of aft-end of radiation van on fantail of ship. Sensors mounted approx 2 m apart. Data are collected by a LI-COR LI-1000 data logger programmed with in-air sensor calibration factors, storing 15 minute averages from sampling at 5 second intervals. Units $microEinsteins\ m^{-2}\ s^{-1}$. The datalogger accuracy is included in intercalibrations of the sensors to determine overall accuracy of irradiance data.

- f. Scalar PAR irradiance (Hargreaves). A scalar (omnidirectional) submersible PAR sensor is used in combination with the PAR irradiance measurements described above to determine the percent of surface PAR irradiance inside experimental chambers used in on-deck C-14 productivity experiments (described above). The underwater sensor calibration factor for the scalar sensor is used with the LI-1000 math channel to provide an instantaneous readout of % surface irradiance.
- g. **Turner Designs model C6 multichannel fluorometer** (Hargreaves). This instrument is equipped with five Cyclops 7 optical sensors (chlorophyll-a, CDOM, phycocyanin, phycoerythrin, and turbidity), plus water temperature and depth. It is deployed using a 1.5L internal volume flowcell in the ship's Wetlab sink (partially filled with constant flux of seawater to an overflow pipe in the sink drain) where it monitors the uncontaminated seawater line downstream from a debubbler that was completely disassembled and cleaned with bleach before the start of the cruise. The flow through the instrument is approximately one liter per minute. Periodically the instrument is cleaned and sensor response is recorded using solid standards. Data are recorded either at 1 or 11 second intervals with a clock regularly synchronized to GMT. The product of these measurements is a daily summary table of all data plus ship GPS coordinates binned to 1 minute averages and combined with the incident PAR measurements described above (to account for daylight quenching of pigment fluorescence).