AMT-8 Cruise Report:- Pigments, Chlorophyll *a* and Taxonomy

METHODS AND PROVISIONAL RESULTS

Chlorophyll *a*

Methods

Measurements of Chlorophyll *a* concentration were collected from the non-toxic seawater supply every 2 hrs (7m), and from 8-9 depths sampled during the daily CTD cast. Samples were filtered onto 25mm GF/F (0.7µm) glass fibre filters. Volume filtered varied between 250-500ml and were possible an idetical volume was filtered for Size Fractionated Chlorophyll measurements (see next Section). Concentration of Chlorophyll *a* was determined following the method of Welschmeyer (Limnology and Oceanography, 1994); filters extracted in 90% acetone for 24hrs in the dark, removed and defrosted in the dark for 30-40 minutes and then flourescence measurements made using a Turner Designs, Model 10-AU Fluorometer. Chlorophyll concentration was calculated using a standard equation incorporating volume filtered (ml), acetone volume (ml) and flourescence.

Results

Presented below are the Chlorophyll *a* concentrations found in the surface waters from the three legs of AMT-8 (as sampled from the non-toxic seawater supply). As an example of the depth distribution of Chlorophyll with depth the results from station A8c13 are also presented.

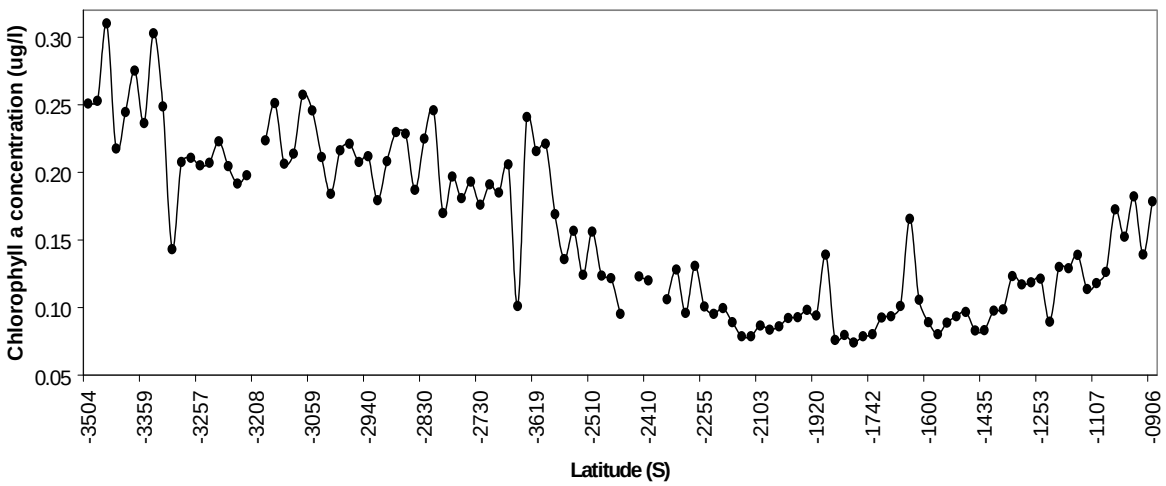

Figure 1a. Underway (Surface) Chlorophyll *a* measurements during Leg 2. (Montevideo to Ascension)

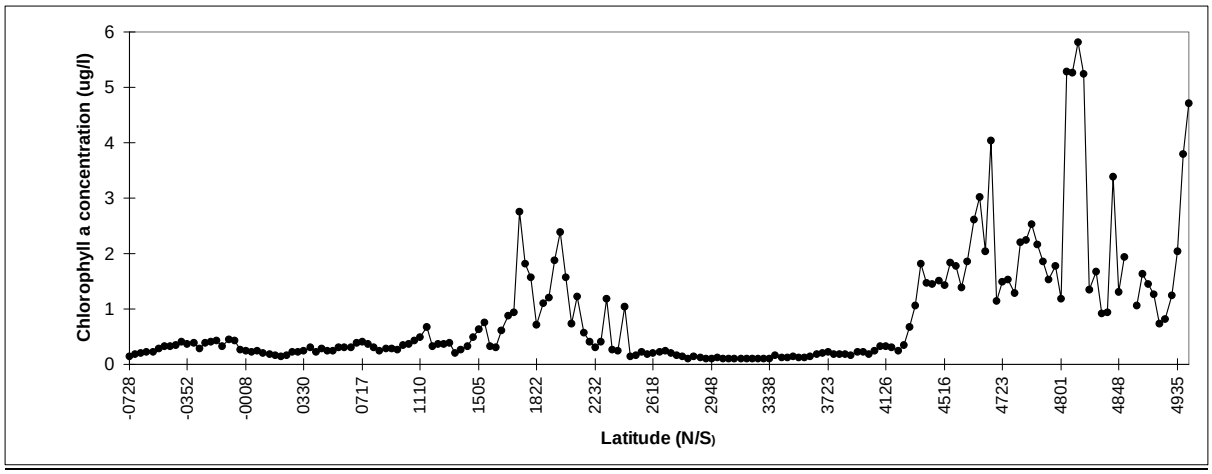

Figure 1b. Underway Chlorophyll *a* measurements during Leg 3. (Ascension to Grimsby)

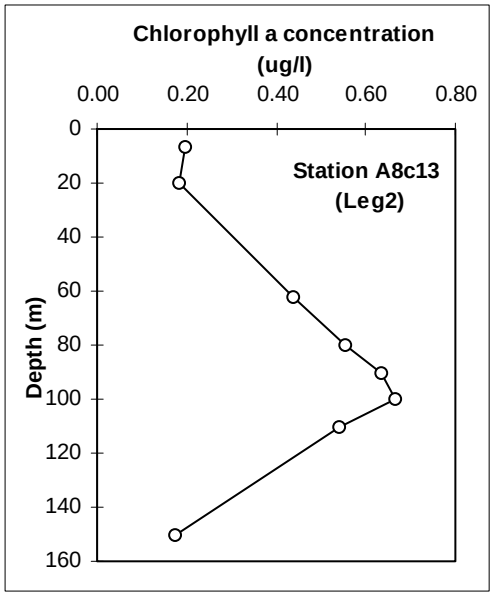

Figure 2a. Station A8c13 (Chlorophyll *a*)

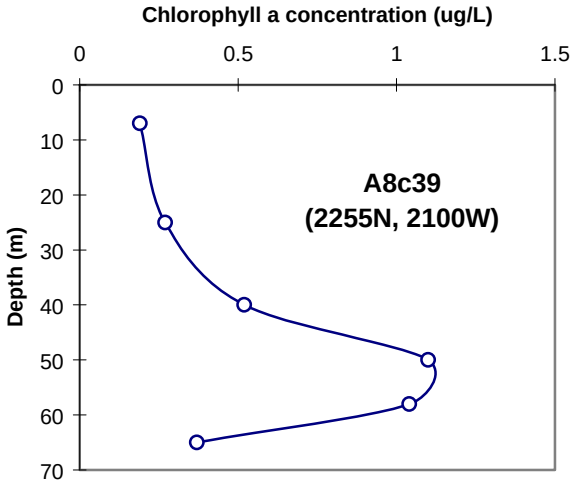

Figure 2b. Station A8c39 (Chlorophyll *a*)

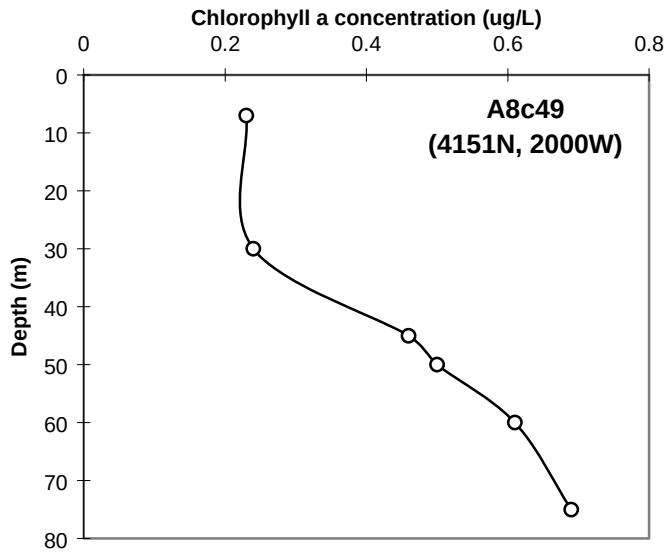

Figure 2c. Station A8c49 (Chlorophyll *a*)

Size fractionated Chlorophyll

Methods

Samples for Size Fractionated Chlorophyll measurements were collected from 5-6 depths from the daily CTD cast. The 6 depths sampled were selected to include a surface sample, the Transmisson Minimum (where present) and the Chlorophyll Maximum, as well as giving a good depth profile. Samples were successively filtered through 20µm, 2µm and 0.2µm polycarbonate filters (Poretics Ltd) in plastic 47mm filter housings. Two methods for determining chlorophyll concentration were used during AMT-8; during leg 2 chlorophyll concentration was determined following the Welschmeyer (1994) method (as described above), during leg 3 a new technique using sample sonication and centrifugation was tried. During leg 3 samples were collected and placed in 10ml 90% acetone, sonicated for 30 seconds and then centrifuged for 15 minutes at 6000rpm. Also during leg 3., samples were collected on 47mm GF/F (0.7µm) glass fibre filters and treated identically to the polycarbonate filter samples.

Results

As an example of the size fractionated chlorophyll data collected from AMT-8, results from Station A8c13 are plotted below. Figure 3 shows the depth distribution of chlorophyll within the size classes used; >20µm (net-plankton), 20-2µm (nanoplankton) and 2-0.2µm (picoplankton) (classifications follow Sieburth, 1979). The peak in chlorophyll within the nanoplankton at 62m represents a Transmission Minimum (i.e. high concentration of particulate matter) and is possibly due to large numbers of Coccolithophores. Figure 4 shows the same data but as percentages of the total chlorophyll concentration

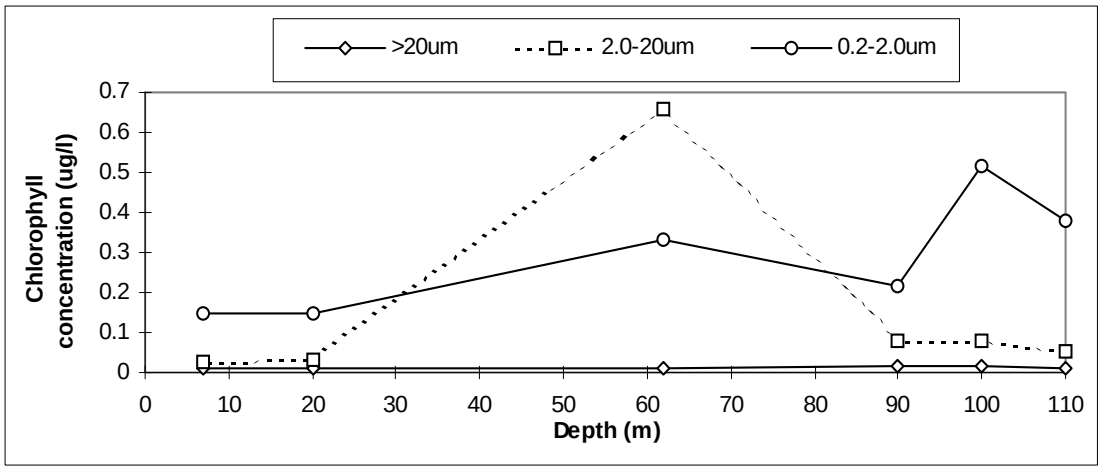

Figure 3a. Station A8c13 (Chlorophyll *a* in size fractions)

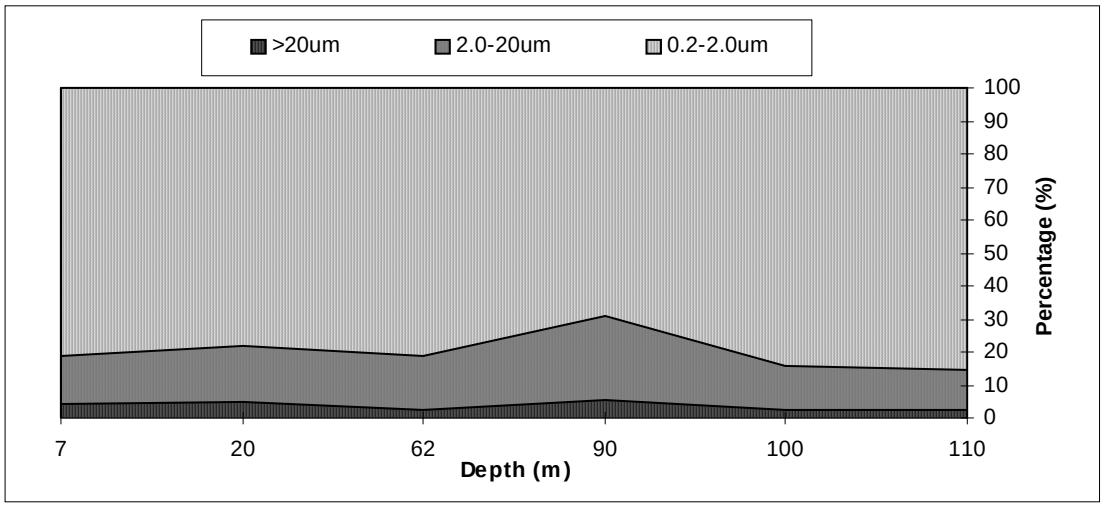

Figure 3b. Station A8c13 (Chlorophyll *a* in size fractions as percentage of total)

<u>Phytoplankton Pigments (High Performance Liquid Chromatography, HPLC)</u>

Methods

Sample collection

Samples for Pigment Concentration (HPLC) were collected from up to 9 depths from the daily CTD casts and every 2 hours from the non-toxic seawater supply. Between 2.1 - 4.3 litres was filtered through 25mm GF/F (0.7µm) glass fibre filters. Volume filtered depended upon the depth sampled (from deep CTD depths) or on Fluorescence readings from the in-flow Fluorometer. Filtering started with the deepest samples first, while waiting samples were covered with black plastic bags to slow degradation. Samples were stored in liquid-Nitrogen before being analysed by the HPLC.

HPLC Methodology

Results

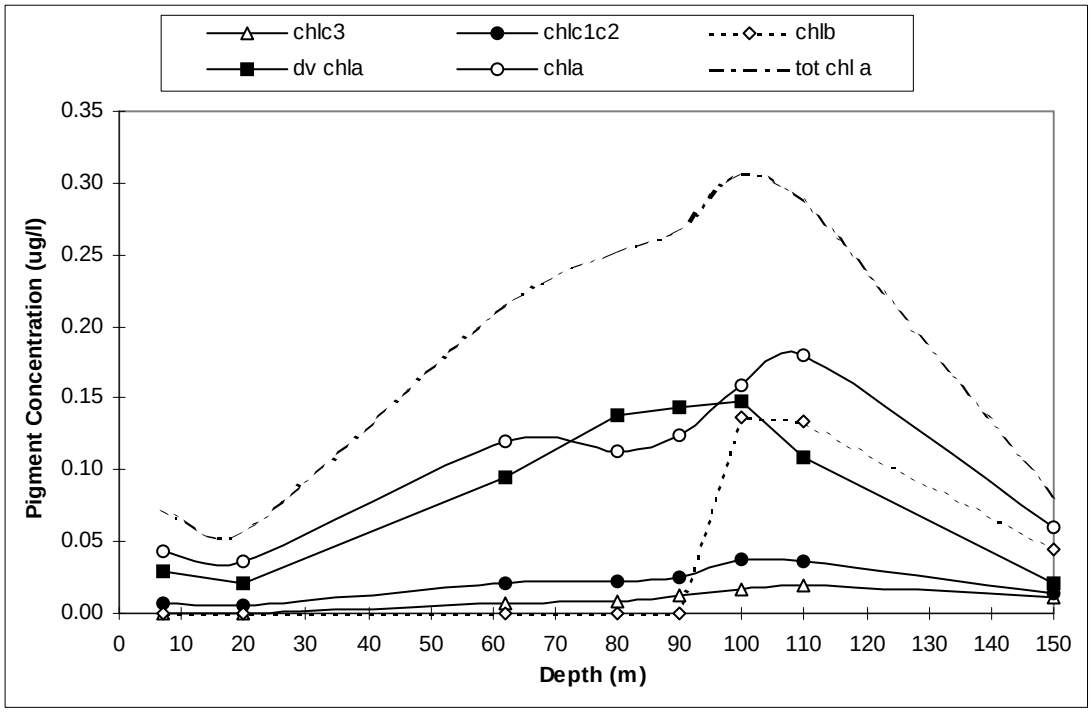

Figure 4a. Station A8c13 (Chlorophylls)

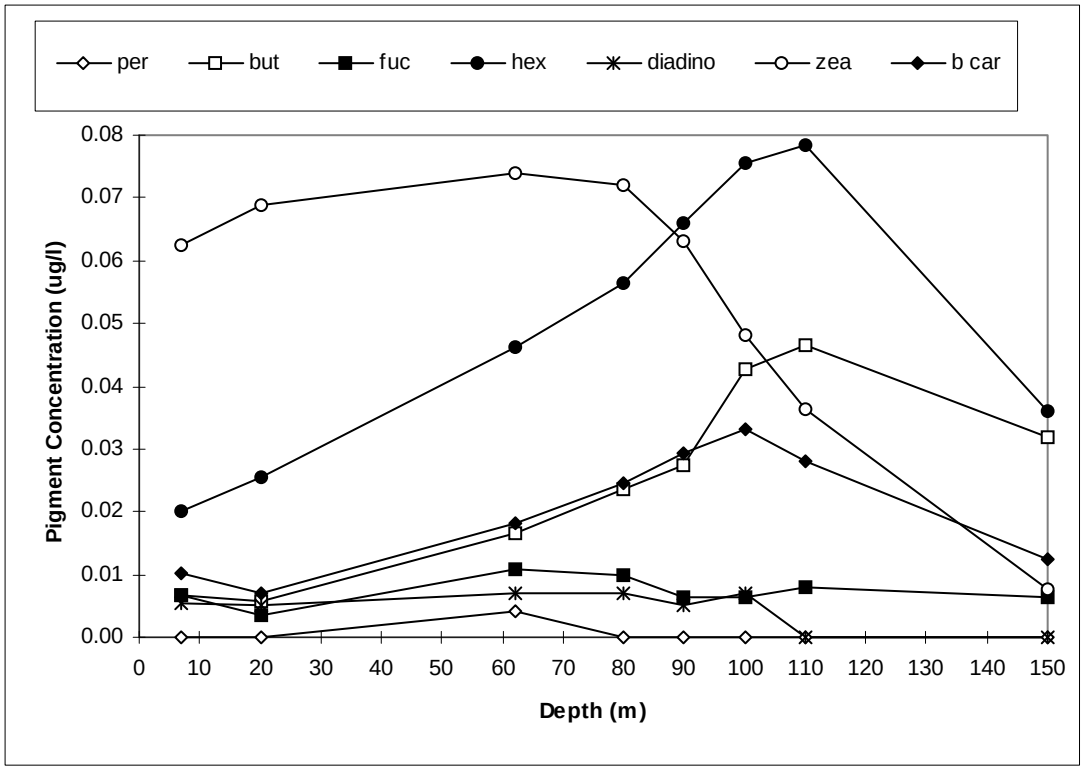

Figure 4b. Station A8c13 (Carotenoids)

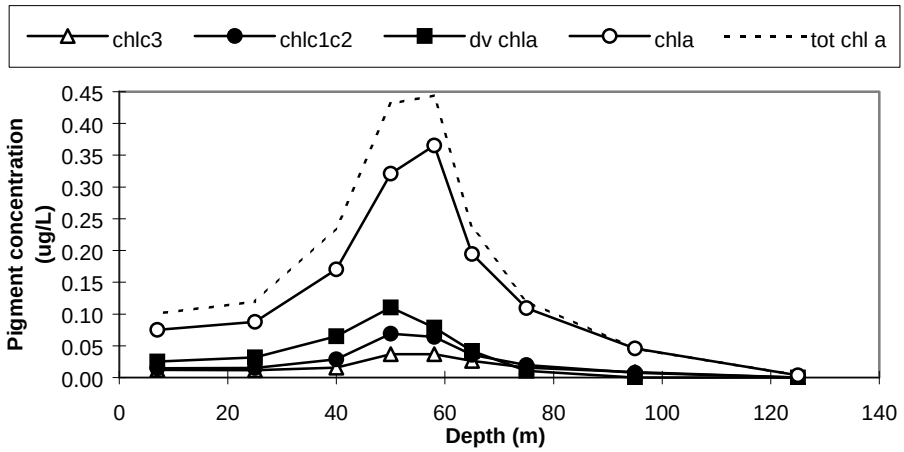

Figure 5a. Station A8c39 (Chlorophylls)

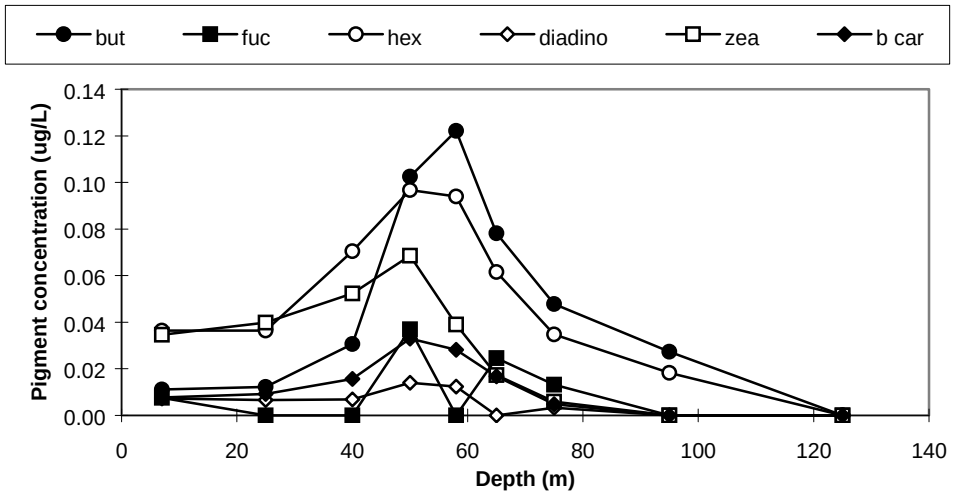

Figure 5b. Station A8c39 (Carotenoids)

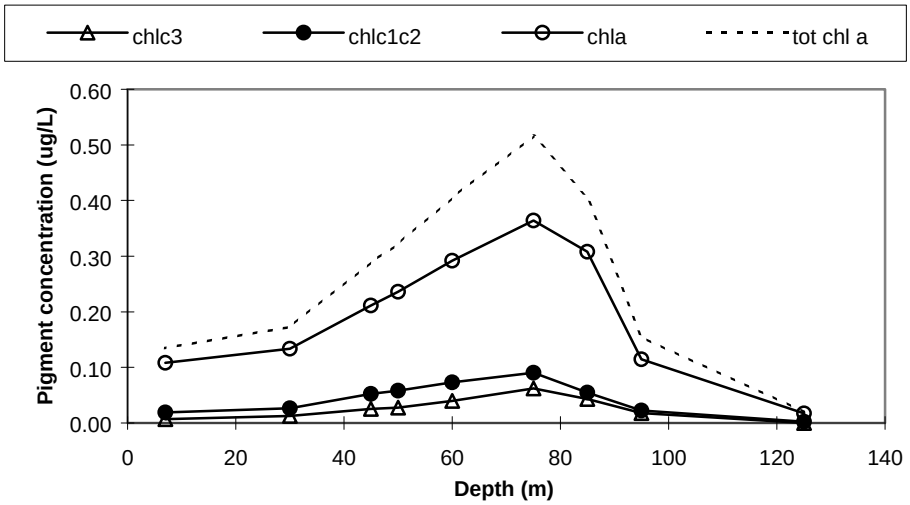

Figure 6a. Station A8c49 (Chlorophylls)

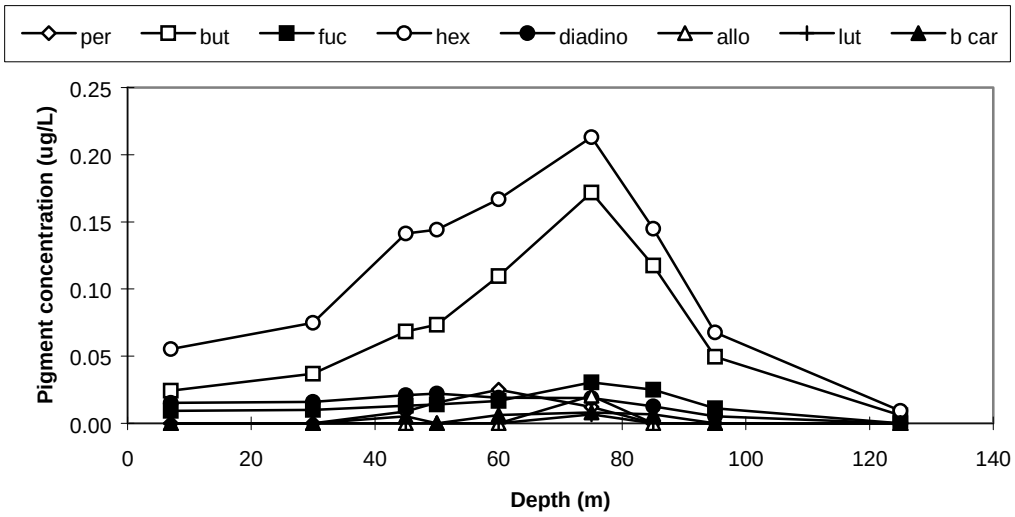

Figure 6b. Station A8c49 (Carotenoids)

Taxonomy (including Picoplankton sampling)

Taxonomy Samples

Samples for phytoplankton taxonomy were collected throughout AMT-8 from the daily CTD casts, although the frequency and depths sampled changed during the 3 legs. During leg 1. more horizontally spaced samples from the non-toxic seawater supply were collected, with a reduction in the number of depths sampled. During leg 2. and leg 3. samples were collected from three key depths sampled by the CTD; a surface 7m bottle, the Transmission Minimum and the Flourescence Maximum (as determined from real-time CTD data). Two samples were collected from each depth; 100ml preserved in 2% acidic Lugols solution and 100ml preserved in 4% phosphate-buffered formaldehyde. Samples were stored in the dark at room temperature and will be examined following the Uttermohl method.

Picoplankton (Mike Zubkov, PML)

Samples for picoplankton were also collected from the daily CTD cast, from all chlorophyll *a* depths. Approximately 3 ml of sample water was placed in a cryovial containing 0.1ml of 25% glutaraldehyde. All sample collection was carried out with separate ‘bulb’ pipettes to avoid contamination. Picoplankton samples were stored in the –80 °C freezer and wrapped, in bulk, in aluminium foil for return to the UK.