Phosphorus and Hydrocarbons in the Atlantic (PHAT)

R/V *Neil Armstrong*, Cruise AR16

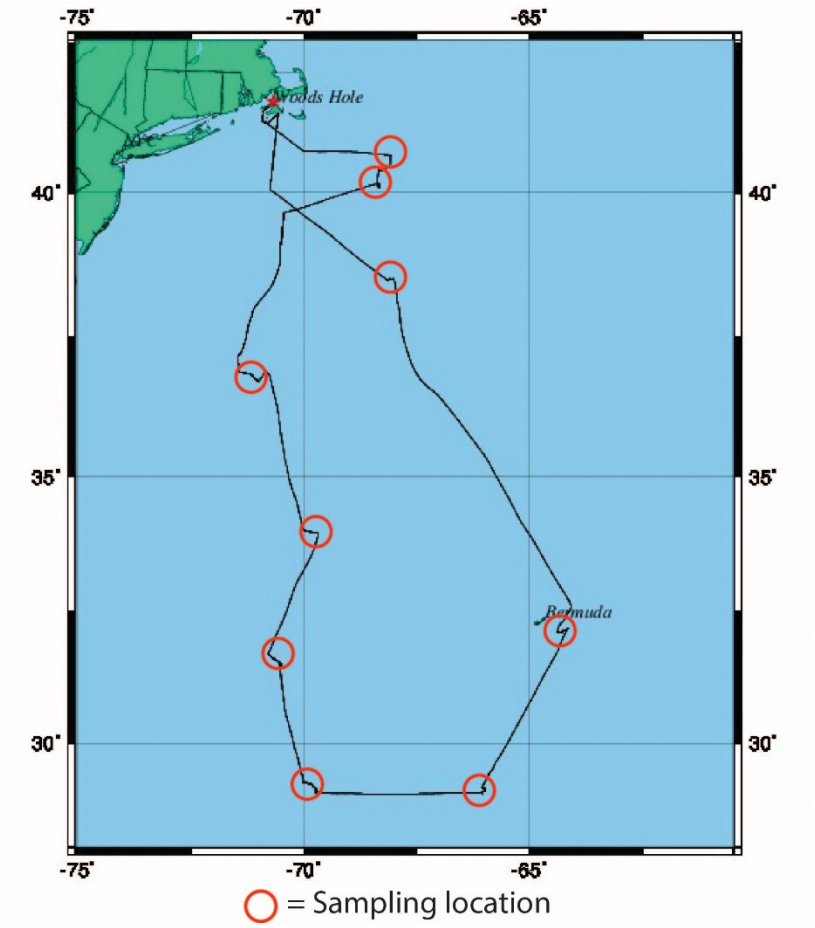
Benjamin Van Mooy, Chief Scientist, Woods Hole Oceanographic Institution

List of Participants:

Stephanie Anderson (University of Rhode Island; URI), Ellie Arrington (University of California Santa Barbara; UCSB), Lars Behrendt (ETH-Zurich), Timothy Burrell (University of Hawaii; UH), Dani Cox (UCSB), Alina Ebling (Woods Hole Oceanographic Institution; WHOI), Helen Fredricks (WHOI), Kelsey Gosselin (WHOI), Matt Harke (Columbia University), Jon Hunter (WHOI), Bethany Jenkins (URI), Na Liu (UCSB), Connor Love (UCSB), Justin Ossolinski (WHOI), Emily Peacock (WHOI), Dan Repeta (WHOI), Oscar Sosa (UH), Bob Swarthout (Appalachian State), Jonathan Tarn (UCSB), Luis Valentin (WHOI), David Valentine (UCSB), Benjamin Van Mooy (WHOI).

Cruise overview:

The R/V *Neil Armstrong* departed Woods Hole on May 3, 2017 for a research cruise designated as AR16. The area of operation was the western North Atlantic. There were 9 primary sampling locations. The R/V *Neil Armstrong* returned to Woods Hole on May 22.



Primary research objectives:

The primary objective of this cruise was to link the redox cycling of phosphorus to the distribution and partitioning of biogenic hydrocarbons in the ocean. The sampling methods used were very straightforward: seawater was collected at multiple depths using a CTD detector equipped with a Niskin bottle sampler. We also collected samples using small plankton nets. Samples were frozen or filtered, and stored for latter analysis at WHOI, UCSB, URI, and Columbia. Some samples were be used in simple experiments to measure how plankton respond to changes in seawater chemistry. The laboratory methods we used were ion-chromatography (for phosphorus analysis) and gas chromatography (for hydrocarbon analysis). Recent discoveries about chemistry of phosphorus and hydrocarbons in seawater has renewed interest in them. Both play an important role in the ocean and governing the ocean's part in regulating global climate

Our three main hypotheses were that: 1) phosphorus in the ocean undergoes redox cycling by plankton, which is dependent on the amount of phosphorus in the water; 2) hydrocarbons are cycled by plankton, and their chemical composition varies based on the type of plankton in the water; and 3) hypotheses 1 and 2 are linked.

List of CTD casts:

Cast (#)	Date (UTC)	Time (UTC)	Latitude (deg)	Longitude (deg)
1	5/4/2017	10:50	40.42	-68.20
2	5/4/2017	12:34	40.42	-68.20
3	5/4/2017	14:35	40.40	-68.19
4	5/4/2017	17:10	40.37	-68.23
5	5/4/2017	18:25	40.37	-68.26
6	5/4/2017	19:58	40.37	-68.30
7	5/4/2017	21:09	40.38	-68.32
8	5/4/2017	22:38	40.38	-68.33
9	5/5/2017	03:31	40.08	-68.33
10	5/5/2017	04:26	40.09	-68.33
11	5/5/2017	11:05	40.09	-68.33
12	5/5/2017	14:35	40.14	-68.33
13	5/5/2017	17:30	40.15	-68.33
14	5/5/2017	18:26	40.15	-68.33
15	5/5/2017	19:27	40.15	-68.35
16	5/7/2017	11:31	36.87	-71.42
17	5/7/2017	12:37	36.87	-71.40
18	5/7/2017	14:36	36.86	-71.34
19	5/7/2017	17:12	36.85	-71.28

20	5/7/2017	19:19	36.84	-71.18
21	5/7/2017	22:36	36.77	-71.10
22	5/8/2017	00:06	36.74	-71.07
23	5/8/2017	02:57	36.72	-71.03
24	5/8/2017	05:00	36.71	-71.01
25	5/8/2017	10:59	36.86	-70.83
26	5/8/2017	12:18	36.85	-70.82
27	5/9/2017	10:50	34.01	-69.97
28	5/9/2017	12:19	34.00	-69.97
29	5/9/2017	14:36	34.00	-69.95
30	5/9/2017	17:09	34.00	-69.93
31	5/9/2017	22:35	33.99	-69.87
32	5/10/2017	00:05	33.98	-69.87
33	5/10/2017	03:05	33.98	-69.84
34	5/10/2017	06:03	33.97	-69.79
35	5/10/2017	10:43	33.97	-69.74
36	5/10/2017	12:24	33.97	-69.72
37	5/10/2017	15:06	33.96	-69.69
38	5/10/2017	16:36	33.94	-69.69
39	5/10/2017	17:31	33.93	-69.68
40	5/11/2017	10:35	31.70	-70.79
41	5/11/2017	12:14	31.69	-70.77
42	5/11/2017	14:35	31.68	-70.76
43	5/11/2017	18:06	31.66	-70.75
44	5/11/2017	22:35	31.64	-70.71
45	5/11/2017	23:38	31.63	-70.70
46	5/12/2017	02:59	31.60	-70.64
47	5/12/2017	10:39	31.52	-70.51
48	5/12/2017	12:42	31.49	-70.50
49	5/12/2017	17:09	31.45	-70.53
50	5/13/2017	10:56	29.24	-70.02
51	5/13/2017	13:40	29.23	-69.97
52	5/13/2017	16:55	29.23	-69.95
53	5/13/2017	18:15	29.23	-69.92
54	5/13/2017	20:08	29.22	-69.89
55	5/13/2017	22:34	29.20	-69.83
56	5/14/2017	00:00	29.19	-69.82
57	5/14/2017	04:32	29.16	-69.80
58	5/14/2017	06:05	29.12	-69.74
59	5/14/2017	07:42	29.12	-69.73
60	5/14/2017	10:33	29.08	-69.74

61	5/14/2017	12:42	29.04	-69.73
62	5/15/2017	10:49	29.03	-66.05
63	5/15/2017	12:07	29.04	-66.05
64	5/15/2017	14:40	29.06	-66.04
65	5/15/2017	16:56	29.06	-66.04
66	5/15/2017	18:41	29.07	-66.02
67	5/15/2017	19:33	29.07	-66.02
68	5/15/2017	22:34	29.08	-65.99
69	5/16/2017	00:00	29.08	-65.99
70	5/16/2017	03:58	29.08	-66.00
71	5/16/2017	10:39	29.13	-66.03
72	5/16/2017	17:37	29.54	-65.79
73	5/17/2017	10:41	32.19	-64.16
74	5/17/2017	12:01	32.18	-64.16
75	5/17/2017	14:32	32.14	-64.19
76	5/17/2017	16:56	32.13	-64.21
77	5/17/2017	18:06	32.14	-64.22
78	5/17/2017	22:36	32.13	-64.27
79	5/17/2017	23:37	32.12	-64.28
80	5/18/2017	02:10	32.11	-64.30
81	5/18/2017	10:41	32.11	-64.36
82	5/18/2017	12:19	32.11	-64.37
83	5/18/2017	14:32	32.11	-64.37
84	5/18/2017	15:37	32.12	-64.37
85	5/18/2017	16:36	32.12	-64.38
86	5/20/2017	12:47	38.51	-68.00
87	5/20/2017	14:47	38.51	-68.02
88	5/20/2017	16:41	38.50	-68.05

Data availability:

All data from the AR16 cruise are available to the public free of charge. These data are located on the website of the Biological and Chemical Oceanography Data Management Office (BCO-DMO).

CTD profile data: https://www.bco-dmo.org/dataset/747051/data

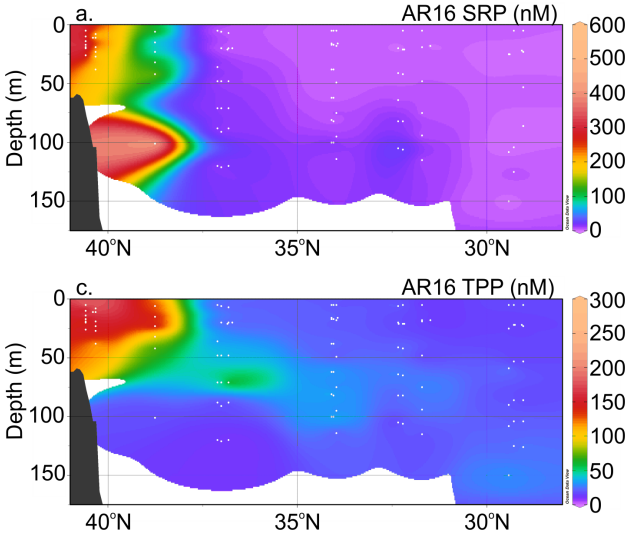
Bottle metadata: https://www.bco-dmo.org/dataset/747267/data

Standard nutrient data: https://www.bco-dmo.org/dataset/762849/data

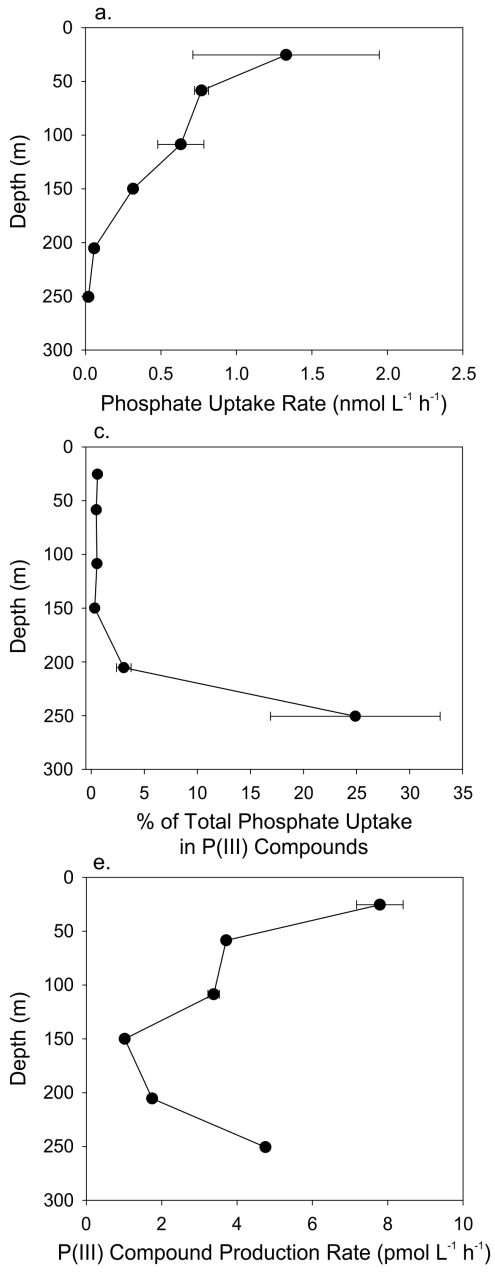
Phosphorus redox data: https://www.bco-dmo.org/dataset/754508/data

Hydrocarbon data: http://www.bco-dmo.org/id/dataset/769203

Preliminary results on phosphorus redox chemistry:



Soluble reactive phosphorus (SRP) concentrations and total particulate phosphorus (TPP) concentrations along the AR16 2017 cruise section. Plots were made in Ocean Data View (ODV) using the weighted average smoothing. White dots represent sample locations with respect to depth and latitude. Data are available at https://www.bco-dmo.org/dataset/754508/data



Phosphate uptake rates, percentage of the total phosphate uptake incorporated in the P(III) fraction, and absolute rates of phosphate uptake incorporated into the P(III) fraction at Station 6 of the AR16 cruise. Plots were made in Ocean Data View (ODV) using the weighted average smoothing. White dots represent sample locations with respect to depth and latitude. Data are available at https://www.bco-dmo.org/dataset/754508/data