

The Ocean's Biological Pump Determined from In Situ  
O<sub>2</sub> Measurements on Profiling Floats

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I (SE) learned most everything I know about air-sea gas exchange and the ocean's carbonate system from Wally Broecker, but more importantly, he helped me to think critically and appreciate the importance of teaching. He was a great scientist and an engaged mentor, and we will miss him. I think he would appreciate the advances geochemists have recently made in determining the flux of organic carbon from the euphotic zone to the ocean's interior using O<sub>2</sub> data obtained from profiling floats. The organic carbon flux, the ocean's biological pump, is the centerpiece of the marine organic carbon cycle influencing the pCO<sub>2</sub> of the atmosphere and the oxygen deficit in the deep ocean. We have deployed 45 Argo floats with Aanderaa in-situ oxygen sensors that are calibrated against atmospheric pO<sub>2</sub> throughout the world's oceans over the past 7 years. Most, but not all of our deployments have been in the subtropical and subarctic gyres, and we are presently in the process of deploying floats around the equator. From a full year of oxygen data and a model of upper ocean oxygen and carbon fluxes, we are beginning to see the global mosaic of the biological pump. There are two striking results beginning to emerge from these measurements: (1) The distribution of the biological pump in the northern hemisphere is much more subtle geographically than suggested by ocean GCMs and satellite remote sensing. In the locations of the subtropical and subarctic oceans that we have studied the observed carbon flux is  $2.5 \pm 1$  mole C m<sup>-2</sup> yr<sup>-1</sup> whereas the global models would suggest variability of up to a factor of 5. (2) As we begin to populate the southern hemisphere with floats we find, in contrast to the north, that air-sea O<sub>2</sub> fluxes in many subtropical areas are low or into rather than out-of the ocean, which implies net heterotrophy in these regions. At the conference we will speculate about reasons for the differences between subtropical northern and southern hemisphere biological pump.