



The Mixed Layer Pump.

The Mixed Layer Pump (MLP) corresponds to mechanisms whereby organic carbon, produced photosynthetically at the ocean surface, is physically transported and subsequently isolated in deeper layers via the alternation of mixing and stratification periods.

In subpolar environments as illustrated here (e.g. Labrador Sea), the MLP is essentially at work during the winter to spring transition. Even during the period of intense deep winter mixing (up to 1000 m and sometimes more), calm meteorologic periods (low wind stress and reduced loss of heat by the ocean) can initiate a temporary stratification, characterized by a shallow mixed layer. This transient situation creates light and nutrient conditions conducive to phytoplankton growth at the ocean surface, resulting in ephemeral blooms. Storms will then eventually destroy stratification and dilute this newly formed phytoplankton biomass within a larger mixed layer. Subsequent stratification will isolate part of this organic material under the new mixed layer, possibly permanently (*i.e.* in favor of carbon sequestration) if no new mixing intervenes before spring-summer stratification finally sets in place.

Note that this description traces only one stratification-mixing cycle but the winter to spring transition is obviously characterized by numerous successions of cycles. In low-latitude environments (e.g. subtropical gyres) the MLP can operate on a daily-scale cycle with diurnal stratification following nocturnal convection, so acting as a recurrent mechanism for pushing organic matter below the mixed layer.