

6. ASCARITE

One of the research projects that was being conducted by Kulp involved measuring the amount of radiocarbon in the dissolved inorganic carbon ($\text{CO}_2 + \text{HCO}_3^- + \text{CO}_3^{2-}$) contained in seawater. The primary objective was to determine the water renewal rate in the deep Atlantic Ocean. This was to be done by comparing the ^{14}C to total C ratio in deep water with that in surface waters. The difference between these ratios could be converted to an isolation time. Assuming that the renewal rate had remained the same, this age could be converted to the renewal flux. We now know that this flux is about equal to the annual rainfall over the entire globe (i.e. 15 million cubic metres per second)! However, in the early 1950s, this flux was poorly constrained. Obtaining the 50 gallons of water required to get enough carbon for the measurement presented a challenge. Maurice Ewing, Lamont's Director, joined Kulp in this enterprise. He supervised the construction of the first large volume water sampler from an oil drum and a ship's porthole. On the way down, the porthole was propped open, allowing the barrel to be flushed. Once at the desired depth, a messenger weight was sent down the wire triggering a release that allowed a stretched elastic cord to pull the porthole shut. Subsequent generations of this device manufactured in Lamont's machine shop, although sleeker, were patterned after Ewing's original design (Fig. 6a). Because it was impractical to store these large samples of water onboard the research vessel, *Vema* (Fig. 6b), the carbon was extracted at sea by circulating air in a closed loop through the acidified seawater. Acid was added to convert HCO_3^- and CO_3^{2-} ions to CO_2 gas. The CO_2 gas was removed by circulating the air around and around through a commercial solid absorbent called ascarite. Then small bottles containing the ascarite were shipped back to Lamont for the radiocarbon analyses.



Photo credit: Treve Johnson Photography

Figure 6a

A Gerard barrel used to collect the large volumes of water required for radiocarbon measurements by the decay counting method. With the advent of atom counting in the mid 1980s, the sample size was reduced by a factor of 1,000 and Gerard barrels were no longer needed.

