

THE WESTERN CHANNEL OBSERVATORY: BENTHIC FORAMINIFERA IN THE PLANKTON FOLLOWING STORMS



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The Western Channel Observatory was established by the Natural Environment Research Council (NERC), with Plymouth Marine Laboratory managing two autonomous buoys that are located to the south of Plymouth in the English Channel (Stations L4 and E1). These two locations are now monitored continually and there is regular sampling of the water column and the sea floor at both locations. At Station L4, despite being in waters with a depth of 50 m, benthic foraminifera are regularly found in the surface water plankton samples. Some of these benthic foraminifera appear to contain algal symbionts, indicating that they may have been living at the time of collection. The redistribution of benthic foraminifera within sediment samples by means of storm events has significant implications for the palaeoecological interpretation of 'fossil' sediments. Recolonization by foraminifera, following disturbance, could well be facilitated by this mechanism which has only rarely been reported in the literature. It is clearly limited to depths impacted by fair weather (~ 20 m) or storm wave base (>50 m). Data gathered thus far certainly indicate that the greater the severity of the storm, the larger the number of benthic foraminifera in the plankton tows and the greater their overall size.

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INTRODUCTION

In 2007, Plymouth Marine Laboratory (PML) was awarded the funds to construct two autonomous buoys as part of the 'Oceans 2025' programme of NERC. The buoys have been located at stations L4 and E1 (see Fig. 1), where they are recording a comprehensive data set, including sea surface temperature, salinity, oxygen, turbidity, etc. The data are transmitted to an on-shore station at Rame Head.

The Western Channel Observatory (WCO) – which was officially established in 2005 – uses a number of long-standing reference points, with Station E1 recording hydrographic data from 1903 and L4 for a comparable period of time. Both stations are now recording hourly data readings, to which can be added regular water sampling, plankton tows, CTD records and sediment samples. The science of the WCO has recently been described by Smyth *et al.* (2015).

Station L4 (50° 15' N, 4° 13.2' W; 50 m water depth) is located 13 km off Plymouth, while Station E1 (50° 02' N, 4° 23' W; 75 m water depth) is situated 40 km off-shore, south of the Eddystone Rock. The inner site, L4, is tidally influenced and also receives freshwater from the River Tamar and the River Plym (O'Brian *et al.*, 2013). L4 has been sampled on a weekly basis by PML since 1988, extending the earlier time-series maintained by the Marine Biological Association of the UK (Harris, 2010). Station E1, established in 1903 by the MBA, was re-started by PML/MBA in 2002 and is now the longest hydrographic series in the world (Karl, 2010). It is part of a transect that extends from off-shore Plymouth (Station E1) to west of Ushant (Station E5): see Smyth *et al.* (2015).

FORAMINIFERA

Sampling at Station L4 regularly includes the taking of sediment box-cores (Fig. 2) and sub-samples taken from the boxes have, occasionally, been studied for foraminifera; the last being in June 2016. These samples contain a diverse and abundant assemblage of benthic foraminifera consistent with the species recorded by Heron-Allen and Earland (1930), Murray (1965a, 1970, 1971, 1986), Castignetti (1997) and Manley (1997). Work on these assemblages is on-going and the changes down-core are being documented. There is, presently, no indication of how far back in time our sub-surface record extends.

In spring 2016, following severe storms, it was noted that significant numbers of benthic foraminifera were being found in surface water plankton tows and those collected at 10 m below the surface. That benthic foraminifera can be transported is not new as, once dead, the test is effectively a grain of sediment. This has previously been described by Jones (1958). In January 1962, however, plankton samples collected by R.V. *Sarsia* (by the Marine Biological Association of the U.K.) in the English Channel are recorded as containing significant numbers of dead benthic foraminifera (Murray, 1965b). These samples from offshore Lizard Head, Ushant and a location in the mid-Channel of the English Channel were from relatively deep-water sites (78 m, 107 m and 93 m respectively) and the plankton samples were from both near-surface and 10 m water depth: see Murray (1965b, table 1). Murray (1965b, p. 157) also noted that such re-working may well occur both during, and after, severe storms, with all the sites being within the range of storm wave-base.