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The Bandon marsh experiment - a modern analogue to a megathrust earthquake at the central Cascadia subduction zone

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Marsh sediments fringing estuaries provide a unique record of plate-boundary earthquakes at the Cascadia subduction zone during the Holocene. Stratigraphic sequences preserved in these estuaries provide geologic evidence of coseismic subsidence, recognized as a rapid rise in relative sea-level, and interseismic uplift characterized by a gradual fall in sea-level, during an earthquake cycle. The tidal restoration of the Ni-les'tun Unit of the Bandon Marsh National Wildlife Refuge (Oregon), starting in August 2011, simulates sudden subsidence occurring during a great earthquake. This tidal restoration provides a unique opportunity to observe and measure the physical and biological changes that occur during a "coseismic" sea-level rise and of "interseismic" changes as simulated by the stabilization of the marsh and give an excellent opportunity to understand sedimentation processes and the re-colonization of benthic foraminiferal faunas analogous to changes during past earthquake cycles. Surface sediment samples from 10 stations covering the intertidal zone from mudflat to high marsh were collected before restoration of tidal flow and are collected periodically after the restoration of the Ni-les'tun (NM) unit and the Bandon Marsh (BM) control unit. During the first four months after the marsh restoration, our data show changes in the grain size distribution at three stations with lower elevation - with a change to finer grained sediment at NM stations 6 and 7 as well a change to slightly coarser grained sediment at NM station 2. At station 2 only a few dead benthic specimen of Milliamina fusca have been found, while at the other two stations living specimen of Balticammina pseudomacrescens, Trochammina irregularis and M. fusca have been identified. The comparable high marsh stations in the BM control unit are characterized by low numbers of living M. fusca and higher numbers of living specimens of Jadammina macrescens, B. pseudomacrescens, Trochammina inflata and T. irregularis at the same time. Highest standing stocks with 176 specimens per 10cm3 and 22 specimen per 10cm3 at NM stations 6 and 7, respectively, have been observed one month after the flooding. The standing stocks in the BM control stations ranged between 220 and 990 specimens per 10cm3 at a similar time. These first observations show a slowed benthic foraminiferal re-colonization of the Ni-les'tun marsh within the first four months after the flooding.