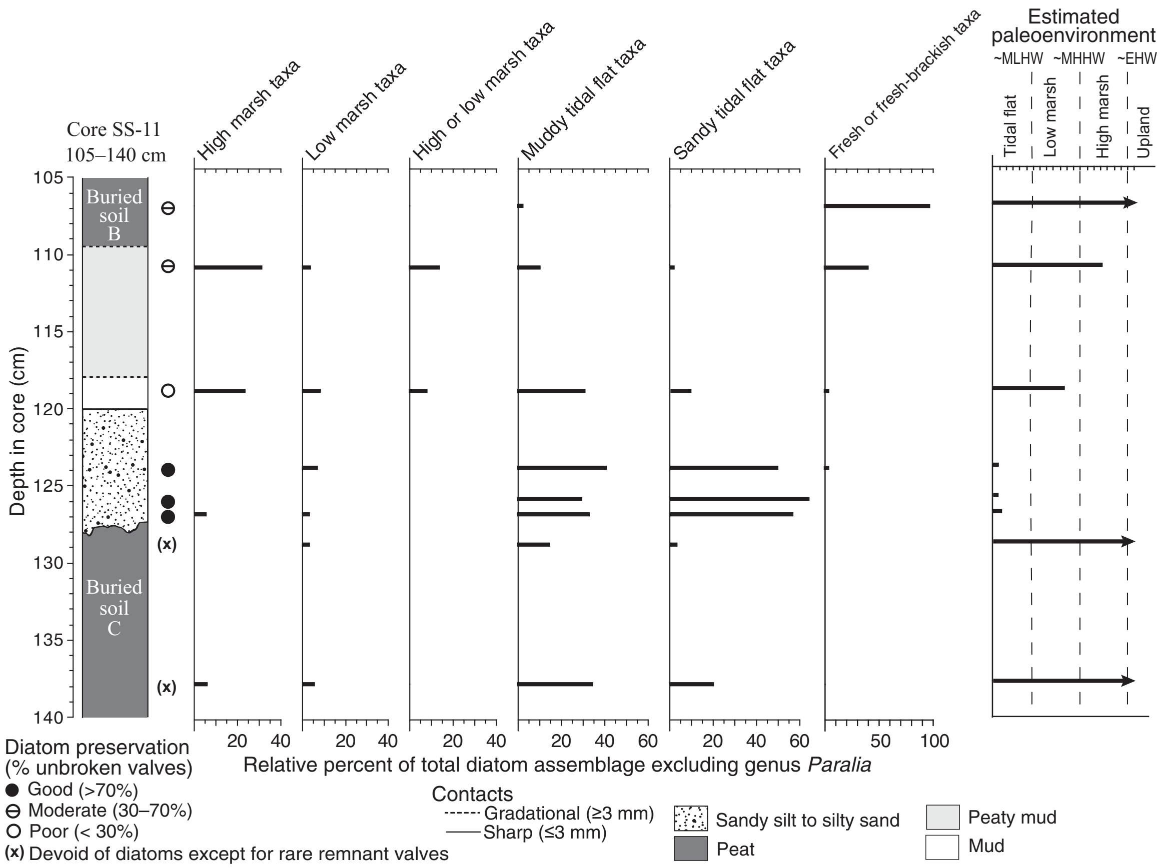

Figure 6. Diatom assemblage counts, diatom preservation, and inferred paleoenvironments for diatom assemblages, core 11, depth interval 105–140 cm. Tidal datums: MLHW—mean lower high water; MHHW—mean higher high water; EHW—extreme high water.

In addition, buried soils A, C, E, F, G, H, and I are widespread in the estuary, occurring along at least a 20 km reach of the estuary. The correlation of buried soils at Sallys Bend with buried soils 20 km up estuary is based on similarity in reported radiocarbon ages for buried soils at Sallys Bend with reported ages for buried soils at the Slack1 and OC-A core sites of Darienzo et al. (1994) (Figs. 2A and 10).

Two other buried soils, soils B and D, are documented in multiple cores, have abrupt upper contacts, and usually are overlain by a sandy unit (Figs. 4 and 5; Table 3), and each soil may be a signature of a subduction zone earthquake. However, these two buried soils do not usually have >10 cm of mud overlying them (Figs. 4 and 5), and therefore it is possible but inconclusive that soils B and D were buried as a consequence of a long-lasting submergence event. Other processes in addition to coseismic subsidence that could have produced soil burial for soils B and D include unusual floods or short-term elevated relative sea levels induced by oceanographic conditions (Nelson et al., 1996b).

Origin of Sandy Deposits on Top of Buried Soils

Constraints on Origin

Sandy deposits on top of buried soils have several characteristics that help constrain their origin. The sandy deposits decrease in thickness from the tidal flat edge inland (Figs. 4 and 5). The deposits are graded because the silty very fine sand to very fine sandy silt grades up section to muds (silt and clay) with no sand. The sandy deposits have foraminifera and diatom assemblages with tidal flat affinities (Fig. 7). Finally, in one sample near the top of the sandy deposit overlying soil C, there was a foraminiferal test of marine origin.

We infer that the process that produced the sandy deposits on top of soils C and G is the process responsible for the ubiquitous sandy deposits on top of every buried soil. The regularity of these sandy deposits overlying buried soils (Figs. 4 and 5) argues for a mechanism that happens every time a subduction zone earthquake occurs.

Tsunami as the Depositional Mechanism

One candidate mechanism to account for sandy deposits on top of buried soils is tsunami. Tsunamis accompany periodic subduction zone earthquakes, and these tsunamis leave characteristic deposits immediately on top of coseismically buried soils (Darienzo et al., 1994; Peterson and Priest, 1995; Kelsey et al., 2002; Witter et al., 2003; Nelson et al., 2004, 2008). However, did a tsunami lay down the diagnostic sandy deposit overlying buried soils at the Sallys Bend site, or was the deposit caused by another mechanism also related to a subduction earthquake?

River Flooding as the Depositional Mechanism

Coseismic shaking during earthquakes produces widespread landsliding, and the sediment products are transported to sites downstream (Hovius et al., 2011; Parker et al., 2011). Specifically in the case of the Yaquina River basin, widespread seismically induced slope failures could deliver sediment to channels, and, ulti-