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Cross-shelf transport of iron in the Oregon coast is dominated by the westward transport of non-lithogenic and lithogenic particulate iron in shelf bottom waters

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The Oregon coast is a dynamic Eastern Boundary Upwelling system where iron geochemistry is influenced by seasonal riverine discharge and upwelling-associated hypoxia across the broad continental shelf. In such systems, riverine-derived particulate iron (pFe) can be stored on shelf sediments until there is a remobilization of Fe in the dissolved phase (dFe)—controlled by reducing conditions or a physical resuspension event. The poleward flowing California Undercurent interacting with seafloor topographic features propagates westward flowing eddies that entrains and transports shelf bottom waters offshore. Regional Ocean Modeling Systems (ROMS) simulations show two 'hotspots' along the Oregon coast for benthic release and cross-shelf transport of Fe. Observational data show that while benthic release of dFe in these hotspots is dominated by dFe(II), pFe in the overlying bottom waters is ~10 x higher in concentration than the dissolved phase— approaching upwards of 100nM in some instances. The formation of non-lithogenic pFe as an oxidation product of Fe(II) could be an important mechanism in these Fe(II) enriched shelf bottom waters. Zonal transects show that the ratio of non-lithogenic pFe to lithogenic pFe is highest along slope sediments. This suggests that physical processes transport these material across the shelf-break, but particle settling will deposit this Fe along the continental slope where it is subjected to reductive remobilization under low oxygen conditions. This is an important component of the shelf to basin Fe shuttle in the Oregon margin system. It has been previously argued that particles in the benthic boundary layer are entrained via Ekman transport shoreward and towards the surface in the California Coastal Upwelling system [1]. We show that this mechanism is also likely off the Oregon coast, where high pFe in waters overlying nearshore sediments and the ROMS model indicates that these inshore bottom waters are transported eastwards and upwards. However, the transport of particulate-rich bottom waters in the outer shelf is primarily westward. To note, this research informs Fe speciation in system that is experiencing increased severity of hypoxia due to climate change which may influence offshore Fe transport.

[1] Johnson, Chavez & Friederich (1999), *Nature* 398, 697-700