



## The influence of topography on the functional exchange surface of soft sediments, assessed from sediment topography measured in situ

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Limnol. Oceanogr., 50(1), 2005, 106-112 | DOI: 10.4319/lo.2005.50.1.0106

**ABSTRACT:** We investigated the influence of small-scale topography on the exchange surface between sediment and water in two coastal marine sediments. One site was a sandy silt at Giglio Island, Italy. The sediment was rich in organic material, had a very active fauna, and a rich surface topography. The second site was an estuarine mud in Aarhus Bay, Denmark, which had a less active fauna and less surface topography. The topography at both sites was measured in situ, with a horizontal resolution of ~0.1 mm. The topographic data were used to calculate the area of the three-dimensional exchange surface, which was 12% larger than the projected base area on Giglio and 7% larger in Aarhus Bay. In addition to enlarging the surface area, topography also caused horizontal gradients that were not included in the vertical O<sub>2</sub> flux calculated from the concentration gradient in the diffusive boundary layer. To account for both effects, fluxes calculated from the vertical O<sub>2</sub> gradient in the diffusive boundary layer were corrected by a factor of 1.14 in the estuarine mud, and 1.25 in the nearshore sand. By considering the constraints on exchange surface enlargement and by comparing with previous studies, we argue that it is unlikely to find topographic influences much larger than this range. Topography had an even smaller effect on the area of the oxic-anoxic interface than on the exchange surface between sediment and water. In the nearshore sand, the oxic-anoxic interface was a factor of 1.06 larger than the projected horizontal area, and in the estuarine mud, the enlargement was by a factor of 1.03.

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