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Oceanographic currents and the convexity of the uppermost continental slope

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Immediately below the shelf edge where sea-level lay during the Last Glacial Maximum (LGM), the uppermost continental slope in many areas has a smooth, convex-upwards rounded shape in profile. This shape is an example of a clinoform "rollover", a sedimentary feature that arises in general terms from how declining "energy" with water depth allows sediments to steepen. Computer models using the diffusion transport equation with mobility K declining with depth can produce rollover shapes, but the models have yet to be properly justified and the controls on K have been unclear. In this contribution, aspects of morphologic datasets from the USA and Iberian Atlantic margins are shown to be indeed compatible with the diffusion model. From experiments and theory, the gravity effect on saltating particles leads to a downslope flux that is proportional to local bed gradient, as required by the diffusion model, if the bed is agitated by oscillating currents of small residual current, by contour-parallel currents, or by a combination of both. The predicted mobility K is then an increasing function of the current's average speed. Near-bottom current-meter data reveal how currents, enhanced around the shelf edge, decline with water depth in a way that is generally compatible with the rollover morphology. During the LGM, bed currents due to tides and surface waves were stronger than at present. Although difficult to predict, they are expected to produce a more sharply declining mobility with depth that

would be compatible with the limited depth range below the shelf edge over which sand and gravel have deposited.