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Seabed Stability in the Alboran Sea -- Considerations for Offshore Exploration and Production

The Alboran Basin is a promising petroleum exploration frontier that has experienced convergence, volcanism, mountain building, and submergence over the last 44 million years. These processes combined with modern sedimentary and metocean systems necessitate a comprehensive seabed stability evaluation for responsible hydrocarbon exploration and development.

Examination of shallow cores, 2D seismic profiles, historical seismicity, and 15 years of meteorological and oceanographic data allow us to subdivide the basin into geohazard zones that delineate potential regions of seabed instability. A narrow shelf, relatively gentle slopes and few submarine canyons characterize the northern Alboran Sea. The southern portion consists of a broader shelf, steeper slopes, numerous canyons and an irregular topography related to halokinesis and mud diapirism. Late Pliocene and Pleistocene subsurface slip planes form zones of instability; downslope transport results in sedimentary sequences with non-uniform strength profiles on the middle and lower slope. Spatially-discontinuous, highly-reflective near-surface horizons represent thin pavements overlying weaker sediments that are potentially gas charged.

The basin is subdivided into western and eastern sectors by Cabo Tres Forcas and Alboran Island that are affected by two anticyclonic gyres dominating the Moroccan continental margin; vacillations occur on a period of weeks. Narrow buoyant jets of Atlantic surface waters enter via the Strait of Gibraltar with currents over 1 m/s. Smaller eddies are spun off the gyres that erode sediments along the shelf edge and upper slope. This comprehensive study of physical processes allows us to evaluate prospective regions and maximize data recovery while minimizing cost and potential hazards.