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1 Evidence of submarine sediment instability along Italian margins

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Continental margins offshore southern Italy (Strait of Sicily, Southern Adriatic and Thyrrenian Seas) present unstable areas charaterized by widespread mass wasting features and clear evidences of additional potential episodes of sediment instability. Most of these areas are only few tens of kilometers away from densely populated coasts and represent compulsory bypass zones for telephone cables, electrical wires and pipelines for gas or oil.

Multibeam bathymetry, seismic profiles, side-scan sonar imagery and sediment cores, collected within the Eurostrataform project (EC Contract EVK3-CT-2002-00079) and Italian GNDT, offer new insigths into the nature of the factors controlling these complex mass movements and their relation with bottom currents activity, long-term tectonic uplift/tilting and local tectonic deformation.

The datasets show widespread mass wasting features along streches longer than 100 km, locally affecting margins from the shelf edge to the base of the slope. The features include slide scars, canyons heads and extensive slide deposit (up to 2000 km^2) with, in some cases, noticeable run outs (up to 55 km).

As deep-sea survey technology evolves evidence of sediment instability is rapidly increasing on Italian margins defining potentially hazardous areas: active deformation during recent times, creeping zones and broad areas with incipient scarps reveal where continental margins are still prone to failure.

A potential failure could bring about ruptures in offshore structures, with consequent economic loss, environmental pollution and casualities, potentially damaging the coastal area through retrogressive failure and/or by triggering tsunami waves (such as those documented in historical chronicles along several coastal areas of Italy).

These submarine slope instabilities are, in most cases, triggered by seismicity while predisposing factors include combinations of large sediment loads (up to several mm/yr), tectonic activity and the occurence of weak layers.

One of the main results deriving from the studies of sediment failure in the Central Mediterranean region is the improved understanding of the role played by the architecture of the sedimentary bodies that are prone to failure (including the nature of the key bounding surfaces acting as potential detechment surfaces). Key stratigraphic surfaces, like unconformities and downlap surfaces, commonly act as weak layers and promote failure of the overlying deposits, even if the latter deposits have geothecnical characters that indicate normal or over-consolidation.

Most of these surfaces are directly related to sea level fluctuations (occurring at rates up to 120 m in 15 ky), like marine-onlap surfaces formed during the sea level rise or downlap surfaces formed during intervals of highstands. Generally, the geological litterature indicates that large-scale sediment failures concentrate during sea level lowstand; on the contrary, new studies reveal increasing evidence of sediment failure during sea level rise, leading to short intervals of excess hydrostatic pressure.

Interpretation of stratigraphy of submarine slide scars and deposits allow determine both the style and the timing of failure. This understanding can in turn be used to predict the presence of potential slip planes and define areas more susceptible to failure in the future.

Eventhogh most of the studies concerning submarine mass movements focus on the continental slope, new discoveries are interestengly revealing sediment instability also on the shelf, in particular, in deltaic environments.