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A geomechanical approach for the genesis of sediment features on the Adriatic shelf

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The main objectives of the 32m-long PRAD2 borehole (EC project PROMESS-1, central Adriatic shelf, 56 m w.d.) were to obtain continuous sediment cores, in situ cone penetration measurements (CPTU) and downhole logging of a stratigraphic succession on the Adriatic continental shelf in order to elucidate the genesis of the sediment crenulations. This sedimentary succession of marine mud represents the deposit of the last sea level highstand (HST, aged 5.5 kyr to present) and part of the previous transgression (Trincardi et al., 2004). Geochronologic data indicate that the unit at the base of the HST, above the maximum flood surface (mfs), marks a condensed interval between approximately 5.5 and 3.7 kyr (Correggiari et al., 2001). Above this condensed unit, characterized by discontinuous seismic reflectors at the top, the sediment accumulation rate is higher and the succession is characterised by seafloor and subsurface undulations interpreted ambiguously as either sediment deformation features with limited displacement, muddy bedforms, or a combination of the both (Correggiari et al., 2001; Lee et al., 2002; Cattaneo et al., 2004).

To test the hypothesis of sediment deformation, geotechnical targets chosen on the basis of seismic profiles and multibeam bahymetry include: 1) a possible shear plane in the HST, and 2) the seismic unit at the base of the sedimentary succession characterized by the undulations interpreted as a potential weak layer (Sultan et al., 2004). The integration of the stratigraphic information (geometry, sedimentary facies, chronology), in situ geotechnical measurements (CPTU), laboratory measurements of the physical and mechanical properties of the sediment (tests of classification and identification, oedometer/permeability, static and cyclic triaxial compression tests) allows a

rigorous interpretation of the mechanical behaviour of the sediment in terms of triggering mechanism for the observed undulations. It seems that liquefaction of silty-clay sediment above the maximum flooding surface (mfs) was possible at a depth around 5 mbsf inducing deformation and creeping of the upper clayey sediments. These deformation and creeping have probably predisposed the seafloor for a subsequent differential deposition rates characterized as described by Lee et al. (2002) by a continuity of acoustic reflections across crenulations and by a regular, rhythmic bedding and seafloor morphology.

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