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Seismically-induced liquefaction and/or fluidization features: laboratory and field analyses on seismites

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Earthquake-induced liquefaction and/or fluidization deformational structures are connected to seismic shocks with M $>$ 5 and with critical acceleration depending on the actual magnitude of the earthquakes (for M $>$ 5, a = 0.2 g; for M $>$ 8, a = 0.03 g). Soft-sediment deformation structures interpreted as being induced by earthquakes (seismites) have been reported by a large number of authors in sedimentologic and palaeoseismic studies. A genetic relation between seismic shaking and liquidization processes has been supposed in ancient and recent sediments; features interpreted as seismites have been reported in sediments ranging in age from Meso-Neoproterozoic to Recent (see palaeoseismic studies in the Charleston area and in the New Madrid seismic zone) and in all sedimentary environments. Nevertheless, liquefaction and fluidization processes (and soft-sediment deformation structures with morphologies very similar to the seismically-induced deformations) can be induced by different natural agents (including overloading, unequal loading, wave-induced cyclical and/or impulsive stresses, sudden changes in groundwater level, etc.).

Aim of this work is to suggest a methodology for a reliable interpretation of soft-sediment deformation structures as seismites using laboratory analyses and field examples.

Laboratory reproduction of seismites was deemed useful for two main reasons: (1) the identification of the trigger agent for soft-sediment deformation in the geological record using field data may only be deduced; (2) similarly, actualism criteria are limited for this purpose since liquefaction and fluidization processes during present time

seismic shocks may be directly observed only as superficial manifestations in continental environments (sand boils, ground fissures, building damages). Therefore, laboratory seismites modelling, by simulating the 'real' behaviour of saturated sediments during seismic events, is a possible way to confirm field interpretations regarding the seismic origin of some soft-sediment deformation structures. The first aim of this work is to show the results of laboratory reproduction of a specific genetic category of soft-sediment deformation structures (seismites) using for the first time a realistic trigger agent.

Field examples have been analysed in various tectonic settings (Foreland areas - Apulian Foreland, Southern Italy; Intramontane basins - Cullar-Baza Basin, SE Spain; - Santa'Arcangelo Basin, Southern Italy; Foredeep areas - Bradanic Trough, Southern Italy), in different palaeoenvironments (continental, transitional and marine), and in successions of variable age (from Mesozoic to Holocene).