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Excess pore pressure within continental slope sediments in the Gulf of Lion: a piezocone approach

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Data from in situ piezocone tests (CPTU) and laboratory analyses have been used for the interpretation of the stress history of quaternary sedimentary sequences in the upper continental slope of the Gulf of Lion, northwestern Mediterranean Sea. CPTU based preconsolidation pressure profile referenced to the current effective stress indicates the soil deposit is underconsolidated from 12 meters below the seafloor (mbsf) down to the bottom of the borehole. The presence of an excess pore pressure below 12 mbsf is further supported by oedometer test results and dissipation tests. The existence of pockmarks in the subsurface and signs of free gas depicted in seismic profiles reveal three sources of overpressure in which sand content increases. We relate this overpressure situation to loss in the hydrostatic pressure caused during sea level lowerings of the last 300 kyr as no other overpressure source have been identified.

The current estimations of excess pore pressure are likely a part of the pore pressure generated during the previous sea level decreases and what it remains is proportional to this time period differences existent between sea level falls and sea level rises. Gas exsolution during sea level falls increases the degree of saturation in gas and generates upward migration of the free gas. Shallower layers are therefore submitted to local gas exsolution but also to the migration of deep over-pressured gas. The migration of the free gas is proportional to the time period of sea level falls. During the short period of sea level rises, residual excess pore pressure is possible because gas partially saturating upper sandy sedimentary layers has exceeded by gas migration the gas solubility under the new hydrostatic conditions (high sea level).

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