Geophysical Research Abstracts
Vol. 15, EGU2013-12689, 2013
EGU General Assembly 2013

Mass-transport deposits: the role of gas in their triggering and final morphology

Patrice Imbert
Total, Pau, France (patrice.imbert@total.com)

Mass failure on continental slopes occurs when and where the shear stress at a certain level below the seafloor exceeds the resistance to shear of that level. A number of processes may cause this disequilibrium, including tectonic activity, excess sedimentation, etc.
In several cases that will be presented from both seismic and outcrop data, it seems that gas migration plays a crucial role in defining the morphology of the basal surface.
The clearest examples come from three separate sedimentary basins. In those three examples, the basal décollement of large-scale mass-transport deposits (MTDs), follows one stratigraphic level over most of the surveyed area, but locally jumps down to a ca. 100-m deeper level. These downward shifts in the basal surface occur right above the crest of underlying structural highs. The coincidence of this morphology with the deeper structure and in some cases with the presence of seismic indications of gas just below strongly suggest that gas did play a role in the location of the anomaly.
Another seismic example shows numerous bright amplitude patches at the base of an MTD. The distribution of these anomalies, below relative thins of the transported mass, may indicate degassing by pressure decrease during, and maybe for some time after the gliding.
Finally, a Cretaceous outcrop in SE France shows tubular carbonate concretions with a negative anomaly of 13C, interpreted to be diagnostic of methane-derived carbonates, just below the base of a 20-m thick slump.
The following processes are envisioned to account for the relationship observed or inferred between anomalies in MTD morphology and gas migration pathways, and may not be mutually exclusive:
• Processes initiated by the failure: local anomalies of the décollement surface
- Pressure decrease by the spreading out of a failing mass of sediment may cause gas exsolution below the failure along gas migration pathways. Exsolution would then induce local loss of shear strength, and cause the décollement to locally jump down to deeper stratigraphic levels
- The same process could account for the presence of high-amplitude anomalies below the parts of an MTD thinned by extension, the high amplitudes being then related to the presence of gas and/or methane-derived carbonates, precipitated at the point of exsolution
• Processes initiated by gas:
- Gas accumulation induces a pressure differential at the top of the accumulation through buoyancy. This pressure differential in slope settings may favor sharing and collapse rather than vertical leakage like in basin settings
- When thermodynamic conditions are compatible with hydrate formation, changes in pressure and/or temperature may lead to the dissolution / dissociation of hydrates, thereby releasing gas and increasing interstitial pore pressure
Gas migration is therefore interpreted to play a significant role in the detail morphology of mass transport deposits, in particular of their basal décollement.