Geophysical Research Abstracts
Vol. 20, EGU2018-8904, 2018
EGU General Assembly 2018

Field evidence for shallow, clay layer-bound compaction faulting

Mark Verschuren
Petrotechnical Data Systems BV, Netherlands (mark.verschuren@pds.group)

Thick clayey sequences can be pervasively fractured and faulted by an entirely compaction driven process at burial depths of no more than a few hundred metres. Field work in two Belgian clay pits in the Ypresian Clay, only slightly tilted on top of the tectonically inactive Brabant Massif, revealed several generations of hydrofractures and faults, equivalent to Eo-Miocene polygonal faults in the North Sea. The earliest of them formed when the silty smectite clay was still very weak, as is evident from intense folding of some of these faults. Stress analysis of outcropping, often randomly oriented and slickensided faults has shown that the faulting was not driven by any tectonic stress field nor by slumping. Compositional, microscopical and micro-paleontological analyses of the gouge from the upper third of the Ypresian Clay show that its material is derived from the host but injected upwards from as deep as the base of the clayey sequence. Microscopic structure indicates at least two injection events along both hydrofractures and faults. The oxidating fluids that blackened the fault and fracture gouge barely affected the host silts and clays. This suggests that compaction was punctuated by dewatering events of short duration and partially sourced from the sands below.
These data support a model of episodic compaction that is proposed to explain the phenomenon of intraformational faults in what were still soft clays. Upward dewatering of this under-compacted clayey sequence started along steeply inclined hydrofractures that periodically released over-pressure. This lead to a multi-phased collapse along normal faults that may also have served as intermittent dewatering conduits. Under- and overlaying formations remained unaffected because there was no bulk extension.