Geophysical Research Abstracts
Vol. 13, EGU2011-4597, 2011
EGU General Assembly 2011


# Polygonal fault networks and pockmarks in fine-grained series: timing and mutual relationships

Patrice Imbert (1), Aurelien Gay (2), Maxime Guiraud (3), Sutieng Ho (4), and Sebastien Nahan (5)

(1) Total CSTJF, Pau, France, (2) Université Montpellier 2, Montpellier, France, (3) Université Montpellier 2, Montpellier, France, (4) Cardiff University, Cardiff, Wales, (5) Ecole Normale Supérieure, Lyon, France

Layer-bound, polygonal patterns of normal faults have been described in thick shale series for almost 20 years now (Cartwright et al., 1993 and many papers since), but some details of their mode of formation are still controversial. It seems well established that they correspond to the lateral contraction of fine-grained lithologies and that their layer-bound character indicates a lithologic control. Many papers focus on the origin and development of these faults, but the timing of their activity is not commonly addressed. Pockmarks have also been the object of many publications, but few so far have addressed their association with pockmarks.

Recent data from various sedimentary basins show that the "polygonal faults" are actually arranged in doublets defining narrow grabens that widen upwards. The bottom part of the studied polygonal tiers are characterized by well-organized doublets of parallel faults, which become less easy to decipher upwards as the grabens widen and faults begin to cross-cut those coming from another facet of the polygon. The continuity of the graben pattern is then lost visually. Whatever the vertical evolution of the throw, the fact that faults are arranged in couplets originating from a single line is interpreted to reflect the fact that they started propagating from the bottom upwards, irrespective of the level at which their throw is maximum. Put in a simple way, it is difficult to think of a physical process whereby faults would nucleate "two by two" somewhere in the middle of the faulted series just at the right distance so as to all converge exactly at the same level upon completion of the process.

Good quality data also show a primary fault network with well-resolved throws and a secondary one, much more subdued, visible on coherency maps and not on amplitude sections. The primary faults have a typical spacing of a few hundred meters, and the individual grabens they define extend for kilometers. These grabens are commonly gently sinuous with an apparent random orientation on the whole. In contrast, the secondary network essentially develops as segments orthogonal to the primary set with a spacing close to seismic resolution, i.e. a few tens of meters.

In addition, polygonal faults and pockmarks often occur in association. Two types of situations have been observed: in some cases where pockmarks are scarce, the early faults at the bottom of the interval commonly "avoid" the pockmark and curve around them at some distance, so that the few pockmarks are enclosed initially between two or three fault doublets. In cases where pockmarks are abundant, a common situation is to have one pockmark in the centre of each polygon. In both cases, this is interpreted to indicate that the apex of the pockmark in a way plays the same role as the faults themselves by providing a natural fluid escape pathway.