Scale dependency of segmentation along the strike of normal faults.

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The present study provides insights on the segmented nature of normal faults as a function of scale, and attempts to identify whether segmentation is scale invariant, scale dependent or hierarchical. This is a topic of critical importance for studies of fault development and in modelling exercises where one needs to extrapolate observations at one scale to other scales.

Results are based on data observed in the Blue Lias in Somerset (UK), in Fumanya mine (Spain) and in a 3D seismic reflection survey in the Bonaparte Basin (Australia). Fault segmentation is investigated quantitatively based on previously established methodologies and we focus on neutral relay zones observed between fault segments along the strike of the normal faults.

We found that there are quantitative indications that the shape of the relay zones, the breaching of the relays and the degree of segmentation are all scale independent in Kilve and Fumanya. We propose that this is related to the low variability across scales in the geological parameters controlling segmentation, due to the relative homogeneity of the rock medium across the studied scales, the lack of influence of pre-existing faults or fractures, and the similar deformation histories for all studied faults. By contrast, faults show scale dependency in the Bonaparte Basin where large faults are under the influence of an oblique reactivation of pre-existing faults. Independently of the area, segmentation observed continuously through scale stresses the need to take into account resolution of observation in discussing fault development.