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Architecture of the damage zone of a fault from the Irish Variscides; distribution and growth of fractures

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The architecture of an excellently exposed fault and its hanging-wall damage zone in the Irish Variscides is examined in detail in order to study the fracturing distribution and relationships. The fault zone is composed of a three metres thick homogeneous fault gouge. The fault zone walls are characterised by a sinuous geometry that dips steeply east and west. Fault kinematics are shown by quartz fibres in tension gashes in the fault zone walls. The hanging-wall damage zone is deformed by two distinct shear fracture systems, an early-formed antithetic set and a subsequent synthetic set. We demonstrate the spatial density and throw of these fractures from four closely-spaced parallel scan-lines.

The data do not support a simple relationship of fracture density and throw decrease with distance from the fault. Instead, the presence of antithetic fractures highly influenced the distribution of later synthetic fractures. This relationship and observations in the field evidence strain weakening processes. We postulate that fracturing of the hanging-wall is due entirely to forces that result from fault bends. Therefore fracturing along the fault is uniquely dependant on fault surface topography.