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How lithology, tectonic setting, and fault size control normal fault growth: Using a large global database to find trends in fault kinematics

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Knowing how normal faults grow provides the basis of our understanding of rift basin development, and the distribution and size of potentially hazardous earthquakes. The growth of normal faults is commonly described by two main models: 1) the propagating fault model (isolated growth model), and 2) the constant-length model. The propagating fault model envisages a sympathetic increase between fault lengthening (L) and displacement (D), whereas the constant-length model states that faults reach their near-final length before accumulating significant displacement. Recently, a third, hybrid model has been suggested, where faults follow the propagating fault model for ∼20-30% of their lives, and the constant-length model for ∼70-80%. This poster critically examines these competing models by compiling D vs. L vs. time/strain data from >100 published outcrop, seismic reflection and physical modelling studies for which the partitioning of D and L are well-constrained. The first fundamental question we aim to answer is, what is the timing of displacement vs. lengthening stages of fault growth, and percentage of a fault's life is spent lengthening vs. time spent slipping and accumulating displacement? The second question we aim to answer is, how do factors such as lithology, pre-existing faulting, regional strain, and fault size affect normal fault growth? Previous studies have suggested that pre-existing faults or 'strong' barriers to rupture may cause faults to lengthen and be under-displaced. To answer these questions, we create a database of fault length, displacement, and timing, along with lithology, tectonic setting, and a range of other factors; this database will be open-access, available for analysis and manipulation by the broader structural geology community, and frequently updated. To the best of our knowledge, this is the first attempt at such a comprehensive, integrated study of the style of and these factors influencing the growth of normal faults.