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## The temporal evolution of syn-sedimentary normal faults and the possible role of tip retreat

**Bailey Lathrop**<sup>1</sup>, Christopher Jackson<sup>1</sup>, Rebecca Bell<sup>1</sup>, and Atle Rotevatn<sup>2</sup>

<sup>1</sup>Imperial College London, Earth Science and Engineering, London, United Kingdom of Great Britain and Northern Ireland (b.lathrop17@imperial.ac.uk)

<sup>2</sup>University of Bergen, Department of Earth Science, Bergen, Norway

We need to understand how normal faults grow in order to better determine the tectono-stratigraphic evolution of rifts, and the distribution and size of potentially hazardous earthquakes. The growth of normal faults is commonly described by two 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 (Walsh et al., 2002). Several relatively recent studies agree that faults generally follow a constant-length model, or a “hybrid model” of the two, where most faults reach their near final length within the first 20-30% of their lives, and accrue displacement throughout. Furthermore, in the past 20 years, much research has focused on how faults grow; relatively few studies have questioned what happens to the fault geometry as it becomes inactive, i.e. do faults abruptly die, or do they more gradually become inactive by so-called tip retreat. We here use a 3D seismic reflection dataset from the Exmouth Plateau, offshore Australia to support a hybrid fault growth model for normal faults, and to also determine the relationship between length and displacement as a fault dies. We show that the studied faults grew in three distinct stages: a lengthening stage (<30% of the faults life), a displacement accrual stage (30-75%), and a possible tip retreat stage (75%-end). This work has important implications in our understanding of the temporal evolution of normal faults, both how they grow and how they die.