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Cataclasis and silt smear on normal faults in weakly lithified turbidites

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11
12 **Abstract**

13 Fault-seal analysis in sand-shale multilayers emphasises the role of shale smear
14 without explicitly accounting for cataclasis. These processes produce low-
15 permeability fault rock and are examined here for small displacement (0.001 to 70 m)
16 normal faults displacing weakly lithified turbidites comprising ~55-80% lithic grains.
17 Late Miocene Mount Messenger Formation (MMF) turbidites from the North Island
18 of New Zealand provide fault rock data over a range of scales from individual grains
19 (~0.1-350 μm) to the height of coastal cliffs (~10-20 m). Fault rock and unfaulted
20 source beds has been analysed using thin sections, SEM images, particle-size
21 distribution (PSD) measurements and outcrops of faults mainly in cross section.
22 Cataclasis associated with particle size and macroscopic porosity reduction of
23 protolith sandstones commences at low fault shear strains (<1) and continues as fault
24 displacement accrues. The relationship between particle-size reduction and
25 displacement is non-linear with initial rapid cataclasis facilitated by disaggregation of
26 weak lithic and altered feldspar grains along pre-existing grain defects (e.g., grain

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