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Paleoseismic re-interpretation of a trench across the Geleen fault near Born (The Netherlands), Lower Rhine graben area

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We challenge the conclusions drawn by Houtgast et al. (2003) from a trench across the Geleen fault in the Roer Valley graben near Born (The Netherlands). Our analysis of the trench record based on the original description and figures, complemented with our own field observations and photographs, contradicts the interpretation that the fault offsets observed in this trench result from so-called delayed-response, post-seismic relaxation creep following moderate to large earthquakes not rupturing the Earth's surface. We provide several paleoseismic arguments for the co-seismic nature of faulting. Besides the arguments based on trenching, we present new geodetic evidence that does not support the high present-day a-seismic slip rates of the border faults of the Roer Valley graben, which were inferred from older levelling data, and interpreted by Houtgast et al. (2003) as a modern analogue of past post-seismic creep. Applying the basic principles of paleoseismology, we can reconstruct an alternative, event-driven faulting history, explaining the observations in a simple and consistent way. We thus identify five paleoearthquakes in the Late Pleistocene. The most recent event post-dates the Late Glacial or Holocene soil, the penultimate event occurred just before a regionally known deflation phase around 15 kyr BP, and the three earlier events most likely occurred at a time when periglacial conditions prevailed in the area. The age constraints are very poor, but this record of surface-rupturing earthquakes shows a remarkable similarity to that obtained on the Bree fault scarp, further north on the same fault. This suggests that the Geleen fault may define a single, 30-km-long segment, capable of generating earthquakes up to M 6.8.

Reference: Houtgast, R. F., Van Balen R. T. , Kasse C. and Vandenberghe J., Late Quaternary tectonic evolution and postseismic near surface fault displacements along

the Geleen Fault (Feldbiss Fault Zone - Roer Valley Rift System, the Netherlands), based on trenching, Netherlands Journal of Geosciences / Geologie en Mijnbouw, 82(2), 177-196, 2003.