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# Paleoseismic Investigation of the Kango Fault, South Africa: Incorporating Temporal and Spatial Clustering Behavior into a Seismic Source Characterization Model

Hanson, K.L.[1], Slack, C.[2], Coppersmith, R.[3], Neveling, J.[4], Bierman, P.[5]
Forman, S.[6], Goedhart, M.[7], Black, D.[8]

[1]KLHanson Consulting LLC, Ely, MN, USA, kathryn@klhansonconsult.com
[2]Amec Foster Wheeler, I & E., Oakland, CA, USA
[3]Coppersmith Consulting, Inc., Walnut Creek, CA, USA
[4]Council for Geoscience, Pretoria, South Africa
[5]University of Vermont, Burlington, Vermont, USA
[6]Baylor University, Waco, Texas, USA
[7]Kainos South Africa, Port Elizabeth, South Africa
[8]Council for Geoscience, Port Elizabeth, South Africa

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Challenging aspects to the identification and characterization of active, seismogenic faults in intraplate or stable continental regions are: (1) low cumulative neotectonic displacement, (2) the apparent temporal clustering of surface-faulting events in which relatively short episodes of activity may be separated by quiescent intervals of tens to hundreds of thousands of years or longer, and (3) possible migration of the locus of activity.

The Kango fault (a Mesozoic basin-bounding fault) lies in a seismically quiescent region within the Eastern Cape Province of South Africa, but has evidence for three latest Pleistocene to Holocene surface-faulting events preceded by a long period of several tens of thousands of years of no activity — behavior typical of other stable continental region (SCR) faults. The 92–101 km long eastern segment of the Kango fault appears to be unique among the faults within the 600 km-long Ceres-Kango-Baviaanskloof-Coega fault system in that it shows evidence of repeated normal-slip surface-rupturing events in the Quaternary. The occurrence of these events —two events in the past 10–15 kyr along the western part of the approximately 100 km–long reactivated portion of the fault, and at least one event between 22.6 ka and 25.4 ka along the eastern part of the reactivated part of the fault— indicates that the Kango fault may be within a period of higher activity.

Low cumulative Quaternary displacements (10–33 m) and low long-term average slip rates are based on measured offsets of high pediment surfaces and a buried erosional strath surface that record long-term (350 kyr to 3 Myr) deformation rates on the reactivated part of the Kango fault. Paleoseismic trenching, geochronology investigations using both cosmogenic nuclide ($^{26}Al/^{10}Be$) and OSL dating methods, geomorphic mapping and analysis, drilling, and geophysical studies provide information on the size and timing of Quaternary faulting events.

The results of these studies were incorporated into a seismic source model that accounts for temporal and spatial clustering of surface ruptures along the reactivated Kango fault. The model includes adjacent faults within the Ceres-Kango-Baviaanskloof-Coega fault system and epistemic uncertainties in the size and location of future earthquakes on the entire Kango fault zone.