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# Challenges in Characterizing Fault Sources in a Reactivated SCR Environment, Southern South Africa


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A major challenge in characterizing fault sources in stable continental region (SCR) environments often stems from the inability to distinguish the recency of displacement and slip rates between Quaternary reactivated portions of the fault system and other parts that do not show reactivation. Establishing these characteristics for all parts of a fault system is important for seismic hazard studies. Southern South Africa presents a unique opportunity to observe a Quaternary reactivated fault within a portion of a Mesozoic fault system. The late Paleozoic Cape Fold Belt dominates the structural configuration of southern South Africa having formed along the southern margin of Gondwana. Mesozoic extension associated with the breakup of Gondwana led to the superposition of an extensional fault system onto the fold belt. The 480 km long Mesozoic fault system includes the major basin-bounding Ceres-Kango-Baviaanskloof-Coega (CKBC) fault (Figure 1).

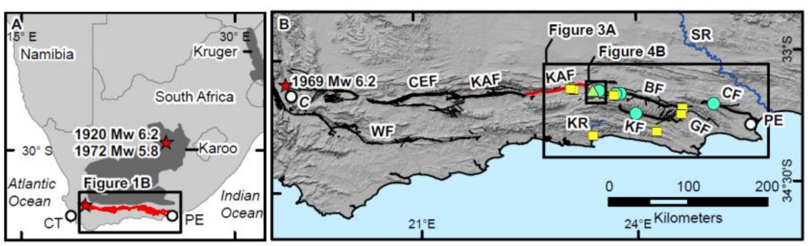


*Figure 1: Location maps. (A) Regional context. (B) Sample sites and faults. red line—Ceres-Kango-Baviaanskloof-Coega Fault System. Green circles—pediment samples; green triangle—fault scarp sample site; red stars—historical earthquakes; yellow squares—sediment samples. BF—Baviaanskloof Fault; C—Ceres; CEF—Ceres Fault; CF—Coega Fault; CT—Cape Town; GF—Gamtoos Fault; KAF—Kango Fault (Quaternary reactivated segment shown in red); KF—Kouga Fault; KR—Keurbooms River; PE—Port Elizabeth; SR—Sundays River; WF—Worcester Fault.*

Southern South Africa lies within a SCR; however, evidence of up to three Pleistocene and or Holocene normal faulting events along a 100 km reactivated portion of the Kango fault has been documented, including 10-33 m of normal slip of pediment surfaces. Along the extent of the CKBC, river drainages have incised 150 m into the Paleozoic quartzite, resulting in the abandonment of high-level pediment surfaces that are very resistant to erosion. The silcrete and underlying pediment surface are generally considered to be Miocene in age and have exposed surfaces that have been stable for 350 kyr to 3 Myr based on cosmogenic nuclide ($^{26}$Al /$^{10}$Be) dating [1], providing unique regional strain gauges for evaluating the presence or absence of fault deformation. To determine the recency and relation of fault timing of the reactivated Kango fault segment to major neighboring faults in the CKBC fault system, geologic mapping along pediment surfaces that overlie the Baviaanskloof, Western Coega, and Kouga faults was undertaken. Detailed mapping of the bedrock fault locations and the silcrete unconformity, and the surface itself reveals a demonstrable lack of surface rupture along these faults, thus confirming the lack of Quaternary reactivation along most of the CKBC fault system. The mapping studies provided data used to evaluate the seismogenic probability of these faults for seismic hazard analyses and they provide insights into the spatial and temporal reactivation of faults within this SCR.

*References:*

[1] Bierman, P. et al. (2014). GSA TODAY, v.24, number 9, doi:9.2014.