The Black Hills Fault, Clark County, Southern Nevada

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The Black Hills fault (BHF), a Holocene fault, cuts Quaternary alluvial fan deposits in western Eldorado Valley, Nevada. The purpose of this study is to document the geometry, kinematics, and Quaternary history of the BHF, as well as to assess seismic hazards.

Previous work documented a single continuous fault with a surface rupture length (SRL) of ~ 14 km and a maximum scarp height of 2.8 m. In this study, 14 strands with a total SRL of ~ 22 km were mapped. The maximum SRL of the youngest, most prominent strand is ~ 4.5 km with a maximum composite scarp height of 3.49 m. Scarp diffusion models suggest an age of 6.3 – 3.5 ka for last surface rupture, although an excavation of the BHF suggests that the scarp has a composite history, negating diffusion model ages.

A 100 m long, 1.5-4 m deep trench was excavated across a 2.96 m scarp along the southern exposure of the main trace. The main trace consists of a zone of 3 fault strands that dip 75 - 85° in the trench. These strands are present in a ~ 2.5 m wide zone characterized by fractures, clast alignment along the faults, and an unconsolidated matrix lacking sedimentary features. An offset stage II $CaCO_3$ soil forms a marker horizon. This soil sits near the surface in the footwall and is down dropped ~ 2.5 m and buried by colluvium in the hanging wall. The marker soil is also offset ~ 1.5 m along another strand 3 m to the east. Moderately developed stage I carbonate in colluvium suggests that the 2 most recent events are Holocene.

The trench revealed 5 areas of significant normal offset that represent 2 Holocene and 4-6 total surface rupturing events. Cumulatively, 10 exposed fault strands strike ~ N30E and dip 70- 85°SE. An additional 6 antithetic strands dip 60-80°NW. Offset along individual strands ranges between ~ 5.0 cm and ~ 2.5 m.

This study provides valuable information necessary for a complete evaluation of this fault. We documented a complex fault zone with multiple strands and confirmed the composite history hypothesis. Inferred slip rates of 0.4 – 0.5 mm/yr calculated in this study are higher than the 0.01 – 0.1 mm/yr rates previously reported. The data also suggest that the BHF is capable of generating a M6.8 – 7.2 earthquake. The composite history and calculated earthquake magnitudes indicate that the BHF may pose a greater seismic risk to communities in southern Nevada than previously recognized.