Assessment of Quaternary Faulting near the Utah FORGE Site from Airborne Light Detection and Ranging (lidar) Data

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ABSTRACT

The characteristics and habit of surface-rupturing normal faults are critical to understanding active geothermal systems in the Great Basin. In 2016, an airborne survey of high resolution light detection and ranging (lidar) data was collected of ~520 km^2 of Milford valley and the western flank of Mineral Mountains as part of the Utah FORGE project. From this data, a 0.5 meter high resolution digital elevation model (DEM) was created that represents the surface without vegetation or infrastructure, and allows for detailed surface mapping of Quaternary geologic features. The high vertical resolution of the lidar data makes it possible to detect the subtle changes in slope that are critical to differentiating alluvial fan deposits, fault scarps, and surface morphology. The Quaternary geology of the FORGE area is characterized by west sloping, aggrading alluvial fans derived from igneous and metamorphic rocks in the Mineral Mountains. Quaternary fault scarps in the area consist of the Opal Mound Fault to the east of the FORGE site, and an approximately 8 km long graben and discontinuous scarp system initiating ~8.5 km to the south and continuing to the southern extent of the FORGE site. The Opal Mound fault is an approximately 5 km long east dipping normal fault with extensive opal and siliceous sinter deposits. Previous fault trenching found ~15 m of vertical throw on the Opal Mound fault, as shown from offset alluvial fan features (Nielson et al., 1986). The deposition of opal, sinter, and silica cemented alluvium may inflate vertical scarp height measurements based on high resolution topographic data. South of the Utah FORGE site, our mapping has shown an approximately 8 km long and approximately 700 – 1200 meter wide surface expression of a graben with internal horsts and grabens. Given the characterization of faulting in the area (Simmons et al., 2016; Nielson et al., 1986), we suspect that the surface scarps are a result of basement faulting and extension. Scarp heights in the graben range from <1 meter to 5 meters. The scarp height decreases moving north towards the FORGE site and fault scarps mapped just south of the site are <0.5 m. There are no well-located faults within the FORGE site. The

location and geometries of the Opal Mound fault and the graben system to the south, may indicate a history of strain transfer across these faults. Current work involves dating of relevant fan surfaces to better constrain age of faulting.

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