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Episodic earthquake swarms in the Mineral Mountains, Utah driven by the Roosevelt hydrothermal system

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The Mineral Mountains are located in south-central Utah within the transition zone from the Basin and Range to Colorado Plateau physiographic provinces, near the Roosevelt Hot Springs. First evidence of swarm-like activity in the area was found in 1981, when a six-station temporary network detected a very energetic swarm of ~1,000 earthquakes. More recently, in mid-2016, a dense local broadband seismic network was installed around the Frontier Observatory for Research in Geothermal Energy (FORGE) in southcentral Utah, ~10 km west of the Mineral Mountains. Beginning in 2016, the University of Utah Seismograph Stations detected, located, and characterized 75 earthquakes beneath the Mineral Mountains. In this study, we build an enhanced earthquake catalog to confirm the episodic swarm-like nature of seismicity in the Mineral Mountains. We use the 75 cataloged earthquakes as templates and detect 1,000 earthquakes by applying a matched-filter technique. The augmented catalog reveals that seismicity in the Mineral Mountains occurs as short-lived earthquake swarms followed by periods of quiescence. Earthquake relocation of ~800 earthquakes shows that activity is concentrated in a <2 km long E-W striking narrow zone, ~4 km east of the Roosevelt hydrothermal system. Two fault orientations, both N-S and E-W parallel to the Opal Mound and Mag Lee faults, respectively, are observed after computing composite focal mechanisms of highly similar earthquakes. After examining the spatial and temporal patterns of the best recorded earthquake swarm in October 2019, we find that a complex mechanism of fluid diffusion and aseismic slip is responsible for the swarm evolution with migration velocities reaching 10 km/day. We hypothesize that these episodic swarms in the Mineral Mountains are primarily driven by migrating fluids that originate within the Roosevelt hydrothermal system.