

# Geomorphic and structural mapping in pursuit of a slip rate for the Santa Susana Fault, southern California

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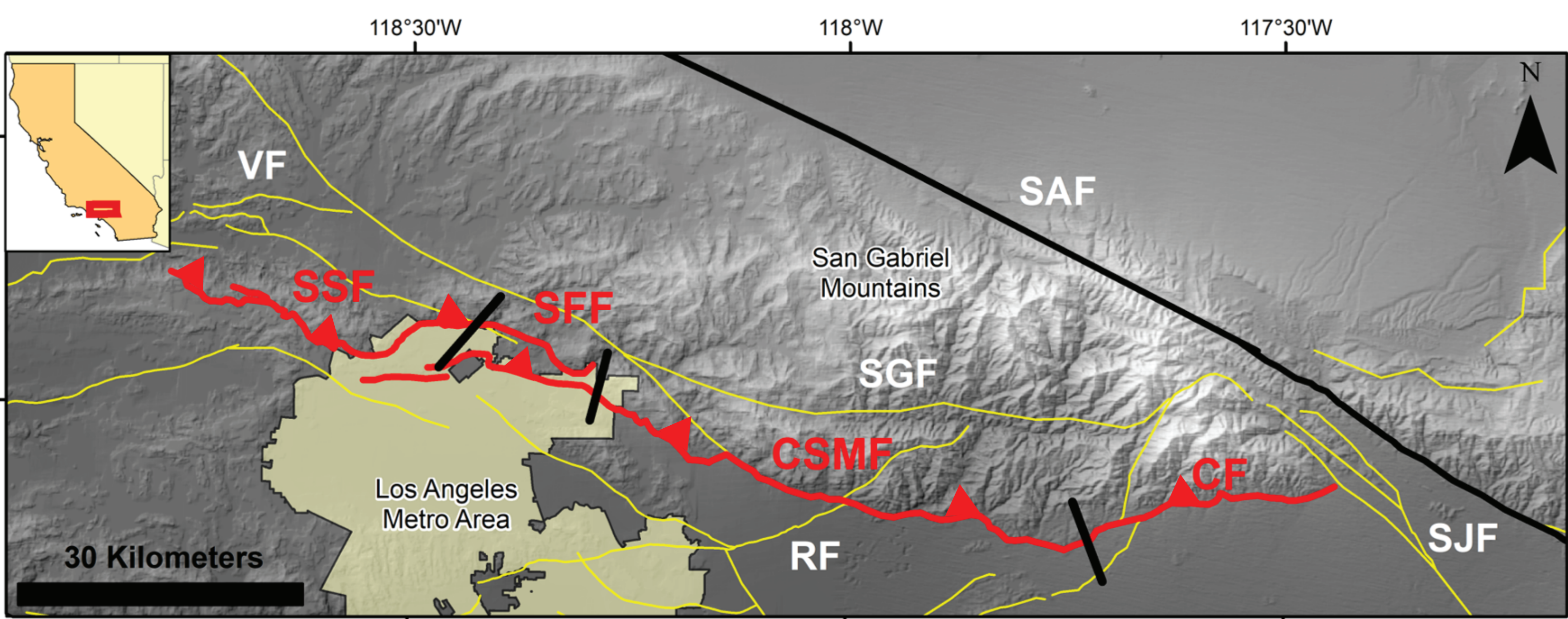
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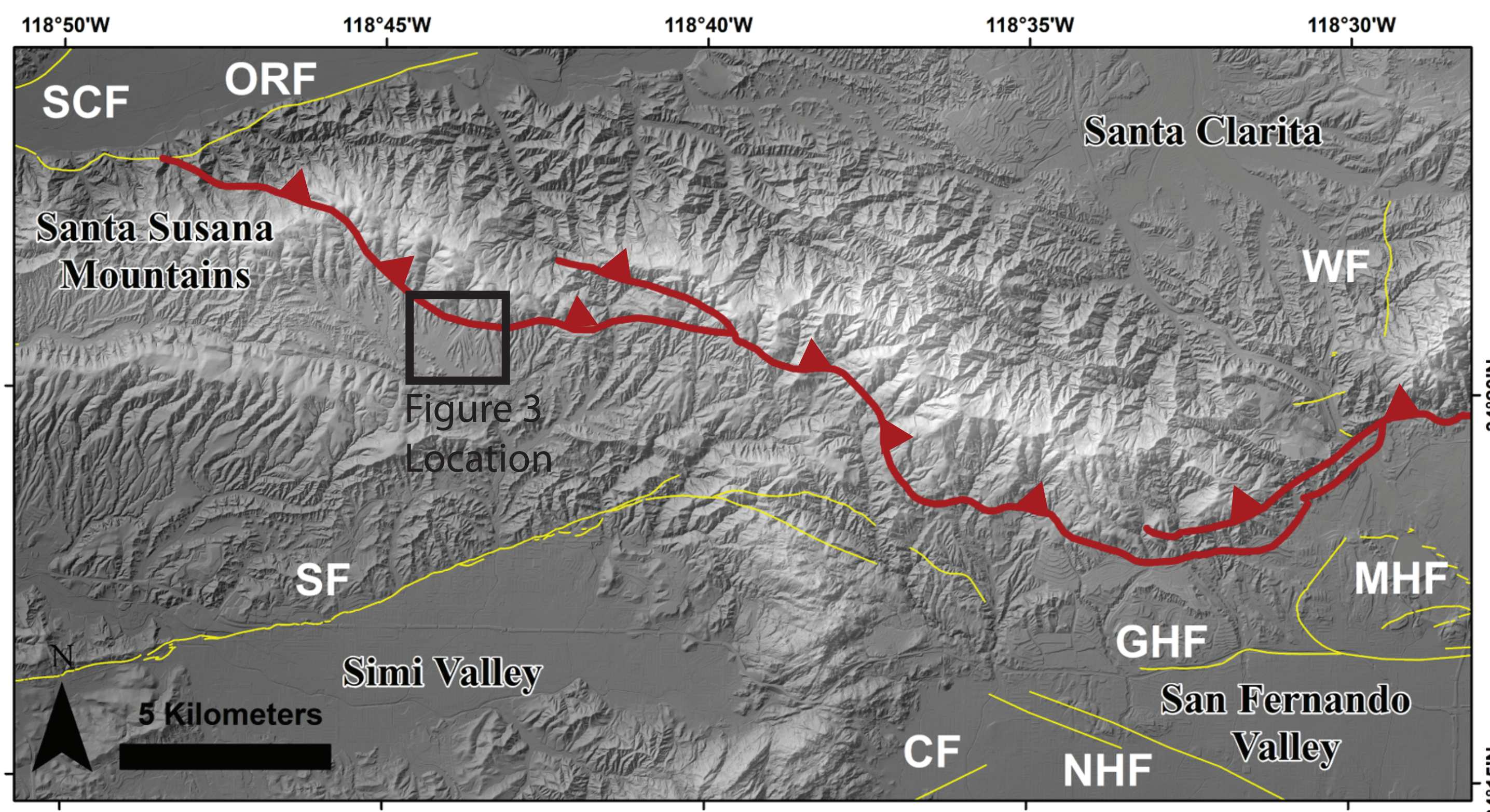
## Key Points

1. The Santa Susana Fault (SSF) at the western extent of the Sierra Madre fault zone (SMFZ) has one of the poorest slip rate constraints in southern California at 0.5-10 mm/yr
2. Updated Quaternary mapping at a higher resolution in the west-central region has constrained fault location and fault dip for future work on slip rate estimates
3. Preliminary assessments of vertical offset and Monte Carlo simulations predict a slip rate skewed towards the lower end of its current slip rate range
4. Future age constraints from TCN and radio-carbon dating will yield further insight into the slip rate along the SSF and provide insight to strain distribution within the SMFZ and the western Transverse Ranges

## Sierra Madre Fault Zone and Santa Susana Fault

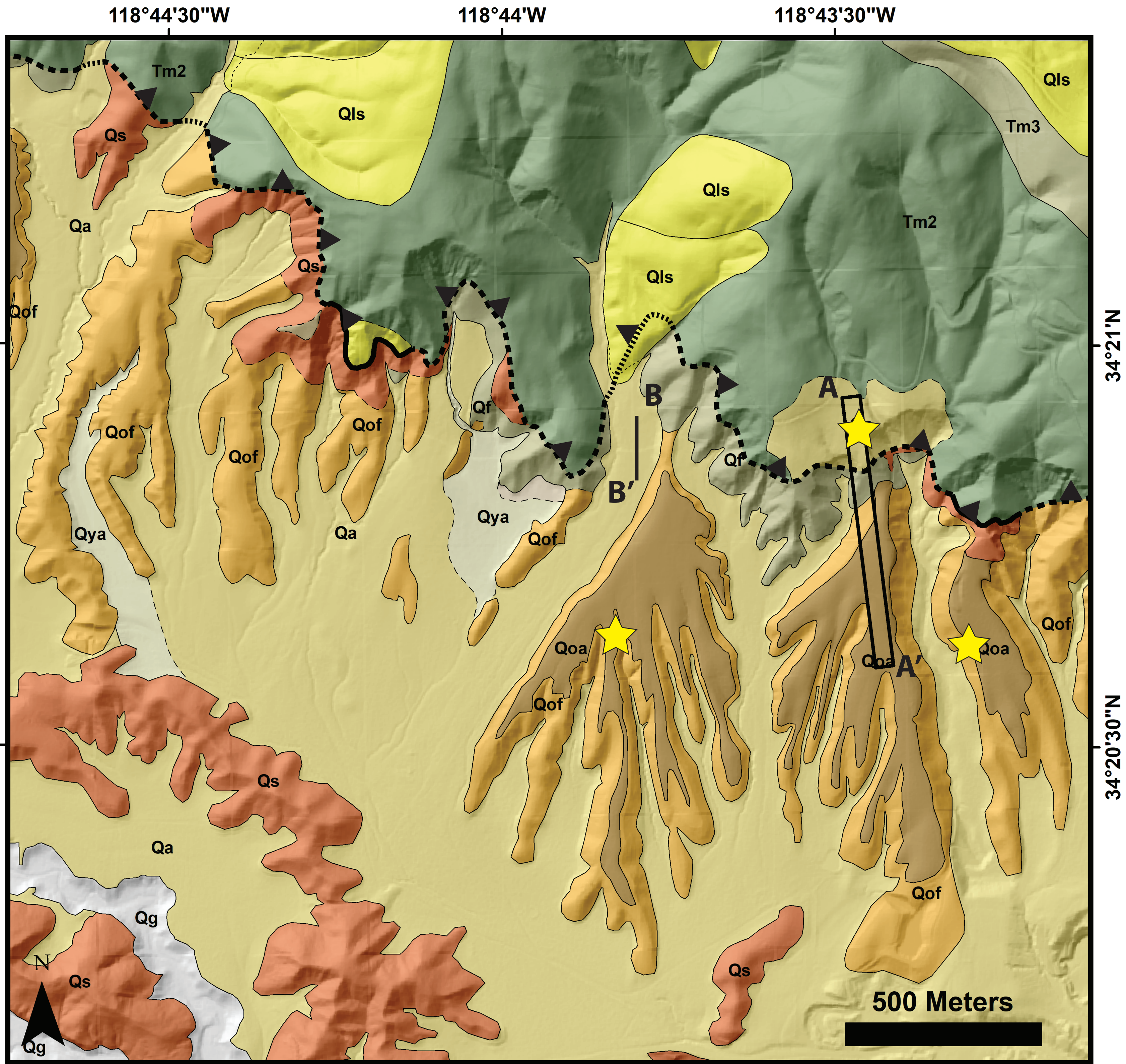


**Figure 1.** Location of the SMFZ within southern California. The SMFZ is represented in red here on the map and separated by its four strands denoted from W to E: Santa Susana (SSF), San Fernando (SFF), Central Sierra Madre (CSMF), and the Cucamonga faults (CF). Also labeled is the San Andreas fault (SAF) in black to the NE. Other faults labeled in yellow, including the San Gabriel (SGF), Raymond (RF), Verdugo (VF), and the San Jacinto faults (SJF). The “Great Bend” of the SAF is just to the NW of this area and leads to contraction and subsequently thrust faults, including those of the SMFZ



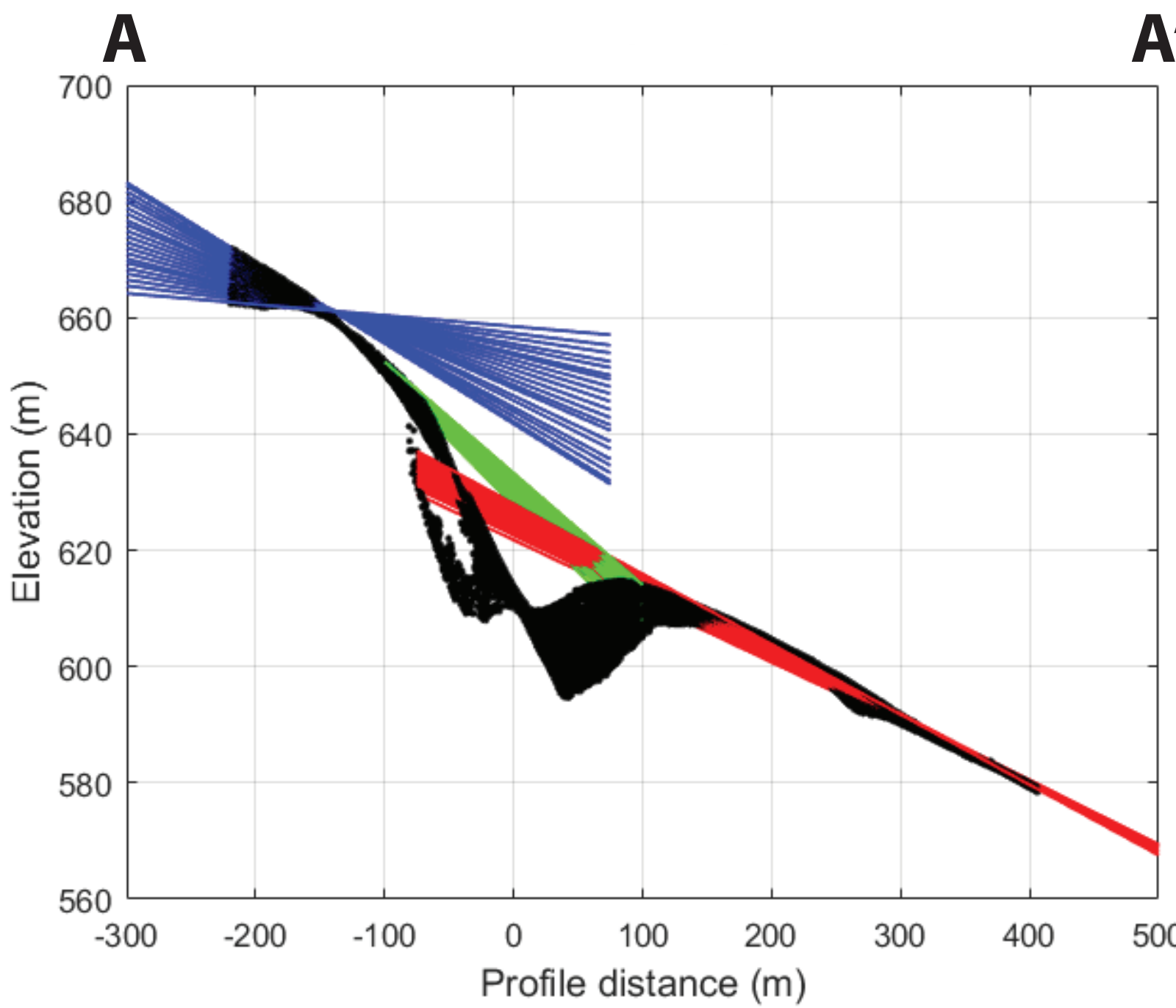
**Figure 2.** Zoomed in location of the SSF among the Santa Susana Mountains and just north of Simi Valley and the western portion of the San Fernando Valley. Other nearby faults on the map include the San Cayetano (SCF), Oak Ridge (ORF), Simi (SF), Chatsworth (CF), Northridge Hills (NHF), Granada Hills (GHF), Mission Hills, and Whitney faults (WF). The mapped trace of the fault does not mark a basin boundary and, little geomorphic expression of recent movement is visible

## Big Sky Ranch Mapping

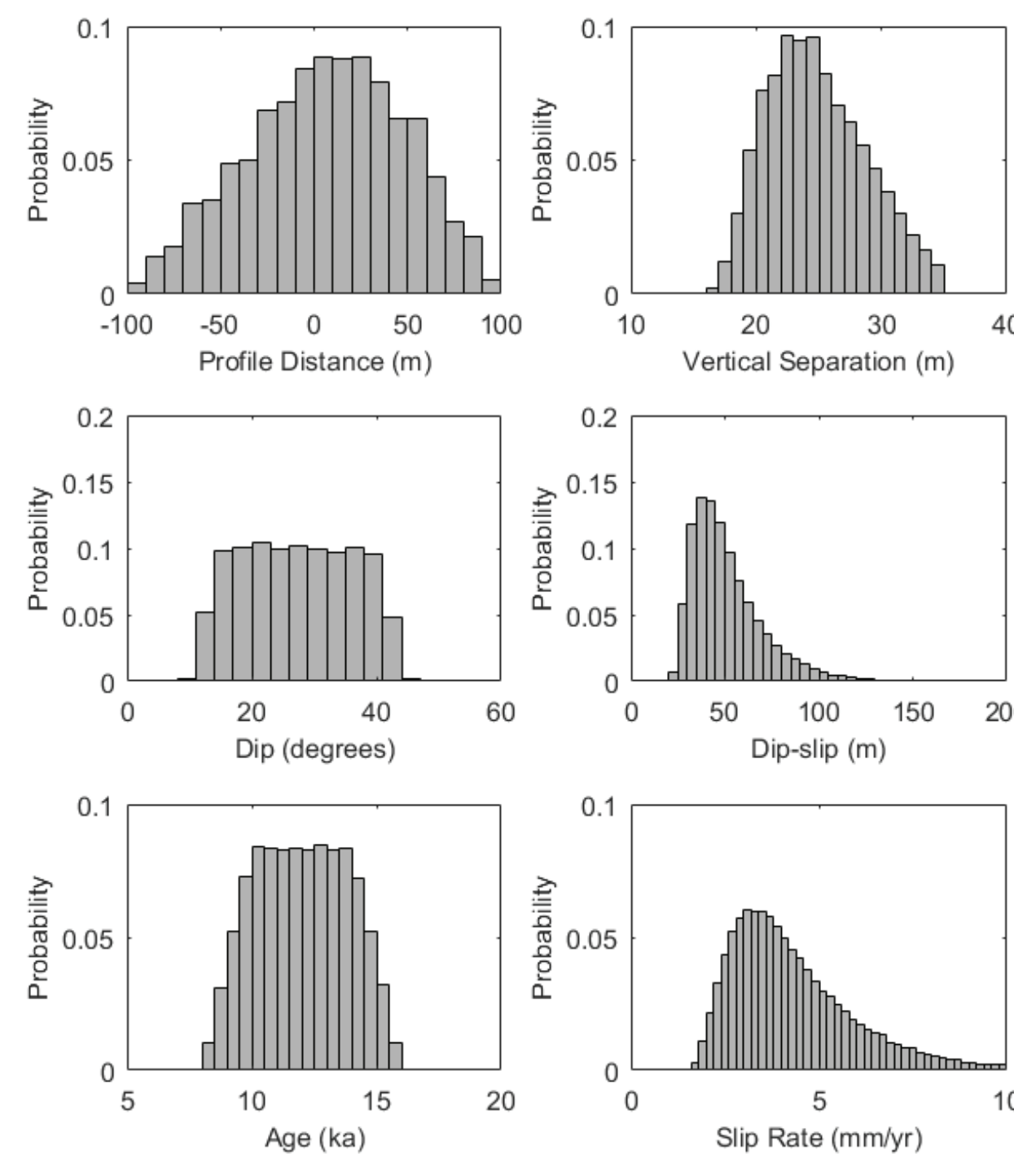


**Figure 3**

## Preliminary Slip Assessment



**Figure 4.** Profile along transect A-A' using lidar point cloud data. This transect contains both alluvium in the hanging and footwall and where representative samples were collected for TCN dating. Vertical offset is approximately 25 m here. Hanging wall profile is short and the slope is more uncertain in preliminary analysis.

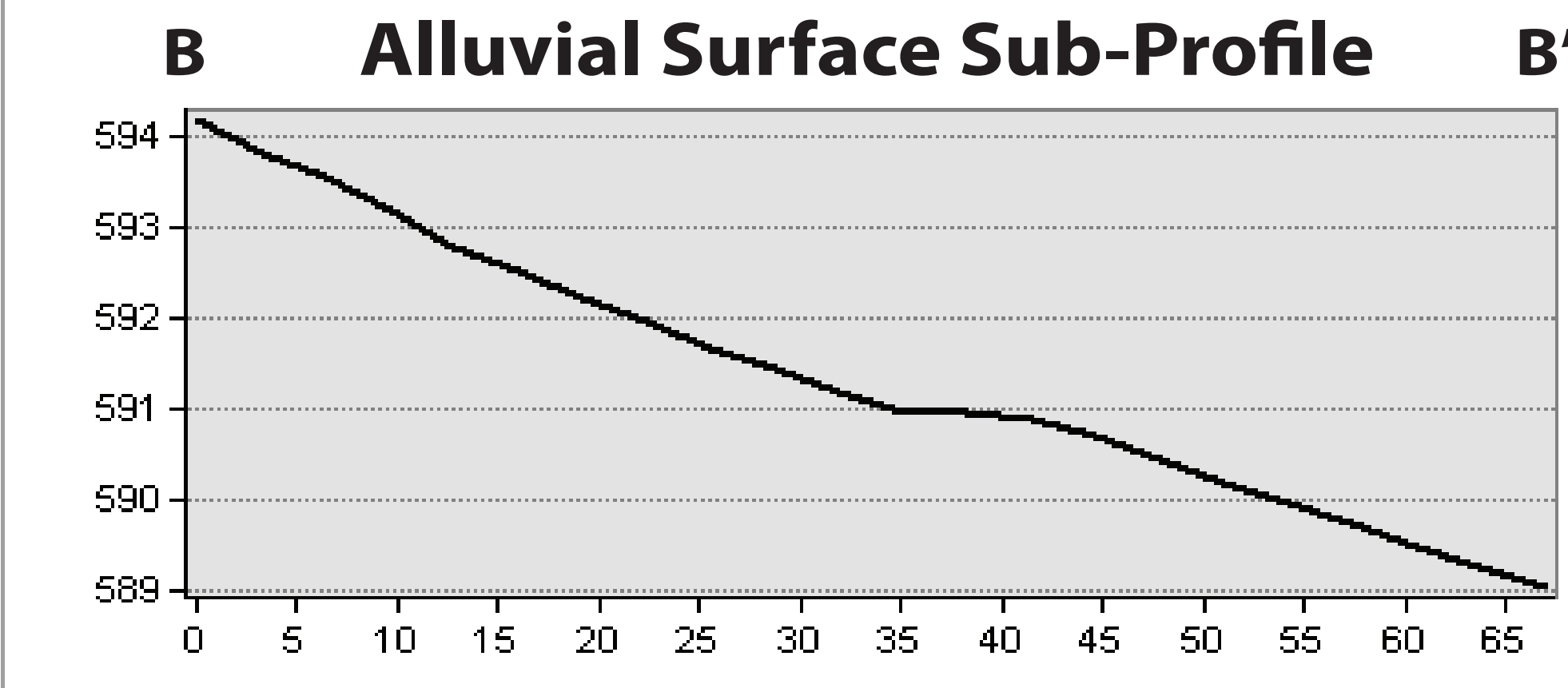


**Figure 5.** Monte Carlo simulations to determine slip rate along the SSF. The current age constraint is preliminary based on a minimum possible age of the alluvium during the Younger Dryas period, due to similar stratigraphy as evidenced in Fig. 6, and represents a maximum slip rate. The estimate of 3.96 +5.04/-1.64 mm/yr indicates that rates of slip are likely lower than earlier predictions (see Ingram et al., this meeting).

## Future Work and Quaternary Dating



**Figure 6.** Pit sites (stars on Fig. 3) from field work in Summer 2018, with sample horizons for <sup>36</sup>Cl depth profile dating indicated by the ledges. Samples will be processed at the PRIME Lab at Purdue University soon. The right image is the pit from the alluvium in the hanging wall where the bright white, calcareous lower units are capped by a black and organic-rich layer. <sup>14</sup>C samples were collected from this horizon and will be processed. The appearance appears similar to “Black Mat” features associated with the Younger Dryas period and provided our minimum age from Fig. 5



**Figure 7.** Portion of a profile along an alluvial surface using the Ventura County lidar dataset where a linear surface is observed throughout the DEM. Ground-truthing has indicated this is not real and an artifact of the data that needs to be removed since this falls within our vertical offset profiles.

## Acknowledgments

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