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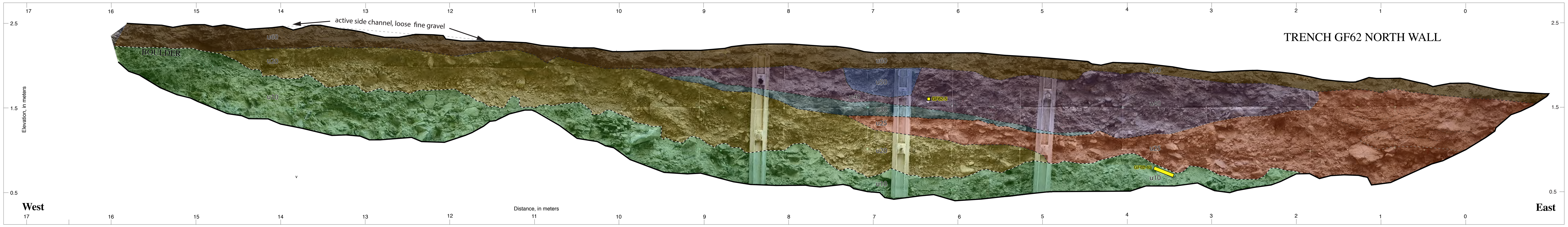

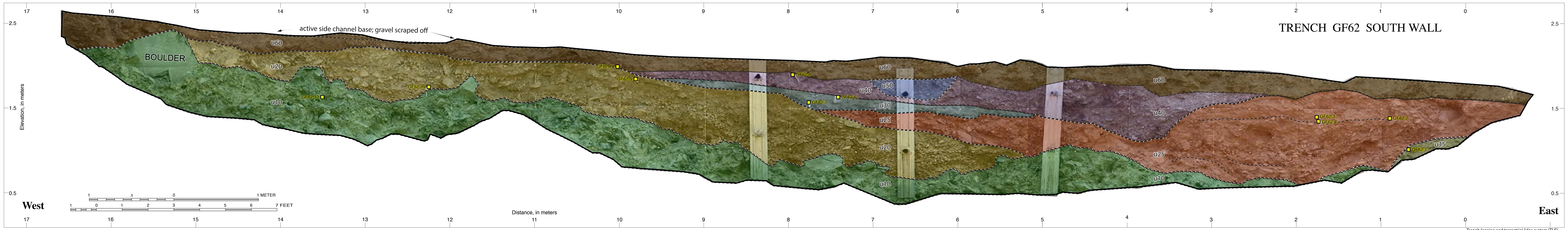

Trench logging and terrestrial lidar system (TLS) survey by Lienkaemper, DeLong, Pickering, and Avdievitch; TLS analysis by DeLong and Avdievitch; Drafting, mosaic, writing by Lienkaemper; Radiocarbon analysis by Guilderson

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EXPLANATION

- u60 — **Brown gravelly colluvium and alluvium**
- u50 — **Loose coarse gravel**
- u40 — **Coarse gravel, matrix-supported in places**
- u30 — **Light brown sandy silt**
- u25 — **Coarse gravel, mostly matrix supported with silt and sand interbeds**
- u20 — **Loose coarse gravel**
- u15 — **Massive sand and gravel with interbeds of sand and gravel**
- u10 — **Carbonate-cemented hardpan includes debris flow and fluvial deposits, grayish colored**

Contact—Dashed where approximated; dotted where inferred

Local contact—added to log to indicate local orientation of strata

Radiocarbon sample location— rectangles indicate area of bulk sample (00A21)

SUMMARY

In 2014, we investigated an abrupt 8.5-meter (m), right-laterally deflected stream channel located near the Greenville Fault in southeastern Alameda County, California (figs. 1–2, -121.56224° E, 37.53430° N) that we discovered using 0.5-m resolution, 2011 aerial lidar imagery flown along the active fault trace (U.S. Geological Survey, 2011). Prior to trenching we surveyed the site using a terrestrial lidar system (TLS, fig. 3) to document the exact geomorphic expression of this deflected stream channel before excavating a trench adjacent to it. We trenched perpendicular to the fault hoping to document the prehistoric history of earthquake ruptures along the fault. However, the alluvial stratigraphy that we document in these trench logs shows conclusively that this trench did not expose any active fault trace. Using other local geomorphic evidence for the fault location, a straight fault scarp immediately north of this stream projects slightly upslope of the west end of our trench and may be the actual location of the active fault trace. Five radiocarbon samples (table 1) establish age control for the alluvial sequence documented in the trench, which may in the future be useful in constraining the long-term slip rate of the Greenville Fault. The deflection had been caused by an abrupt nontectonic termination of unit u30, a relatively thick (0.15–0.35 m) silt that is more erosion resistant than the adjacent cohesionless sand and gravel.

GLOSSARY

lidar Word origin uncertain, either (1) a combination of "light" with "radar" or (2) an acronym, light detection and ranging; it is often used to obtain detailed elevation data for topographic mapping, geomorphic interpretation of faulting, and many other applications. Terrestrial lidar scanners are highly automated devices, based on laser rangefinding systems, and are often mounted on robotic pan-and-tilt heads. Data is generally collected from an instrument mounted on a stationary tripod, and the instrument can automatically survey as much as a 360-degree field of view around the instrument out to a distance of 1,500 m (~1 mile).

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Table 1. Radiocarbon ages of samples from the Kilometer-62 trench site near the Greenville Fault in Alameda County, California.
[^{14}C, Carbon-14; ^{13}C, Carbon; δ, delta as compared to standard for the isotope; yr, year; BP, Before Present]

Sample no.	Material dated[1]	^{14}C age (yr) BP[2]	Unit	Wall[3]	$\delta^{13}C$[4]	Fraction modern	$\delta^{14}C$	Lab. no.[5]
GF62-2	c	130±25	u25	s-1	-25.4	0.9841±0.0028	-15.9±2.8	167558
GF62-8	c	250±25	u40	s-8	-25.7	0.9692±0.0027	-30.8±2.7	167559
GF62-11	c	835±40	u20	s-12	-29.7	0.9012±0.0040	-98.8±4.0	167560
GF62-12	br?	modern	u10	s-13	-26.3	1.0530±0.0030	53.0±3.0	167561
GF62-13	CO_3	4,085±25	u10	s-4	-15.7	0.6012±0.0017	-398.8±1.7	167562

[1]br?, massive charcoal, burned root?; c, charcoal; CO_3, bulk soil carbonate.
[2]±1σ-age in radiocarbon years using Libby half-life of 5,568 years after conventions of Stuiver and Polach (1977).
[3]s, south wall, *x-coordinate*, nearest meter on log.
[4]All of the above $\delta^{13}C$ values are sample specific.
[5]All ages obtained by accelerator mass spectrometry (AMS) analysis at Center for Accelerator Mass Spectrometry (CAMS), Lawrence Livermore National Laboratory, Livermore, California.

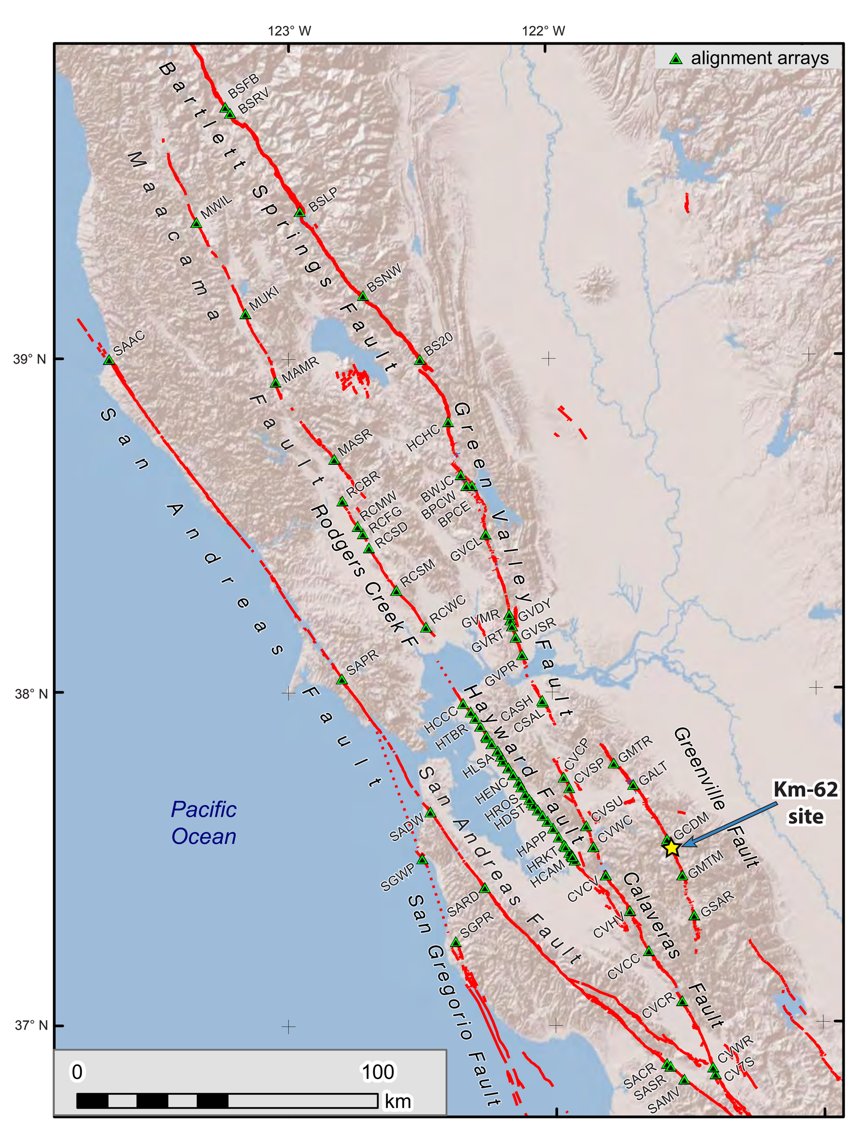

Figure 1. Map showing location of the Kilometer-62 (Km-62) trench site near the Greenville Fault, Alameda County, California (yellow star), and alignment arrays (green and black triangles) in the San Francisco Bay region used to monitor fault creep. Active faults in red (U.S. Geological Survey and California Geological Survey, 2006); locations of the Green Valley Fault (Lienkaemper, 2012), Bartlett Springs Fault (Lienkaemper, 2010), and Greenville Fault (Lienkaemper, unpublished mapping) are also shown (base image source, ESRI). km, kilometers.

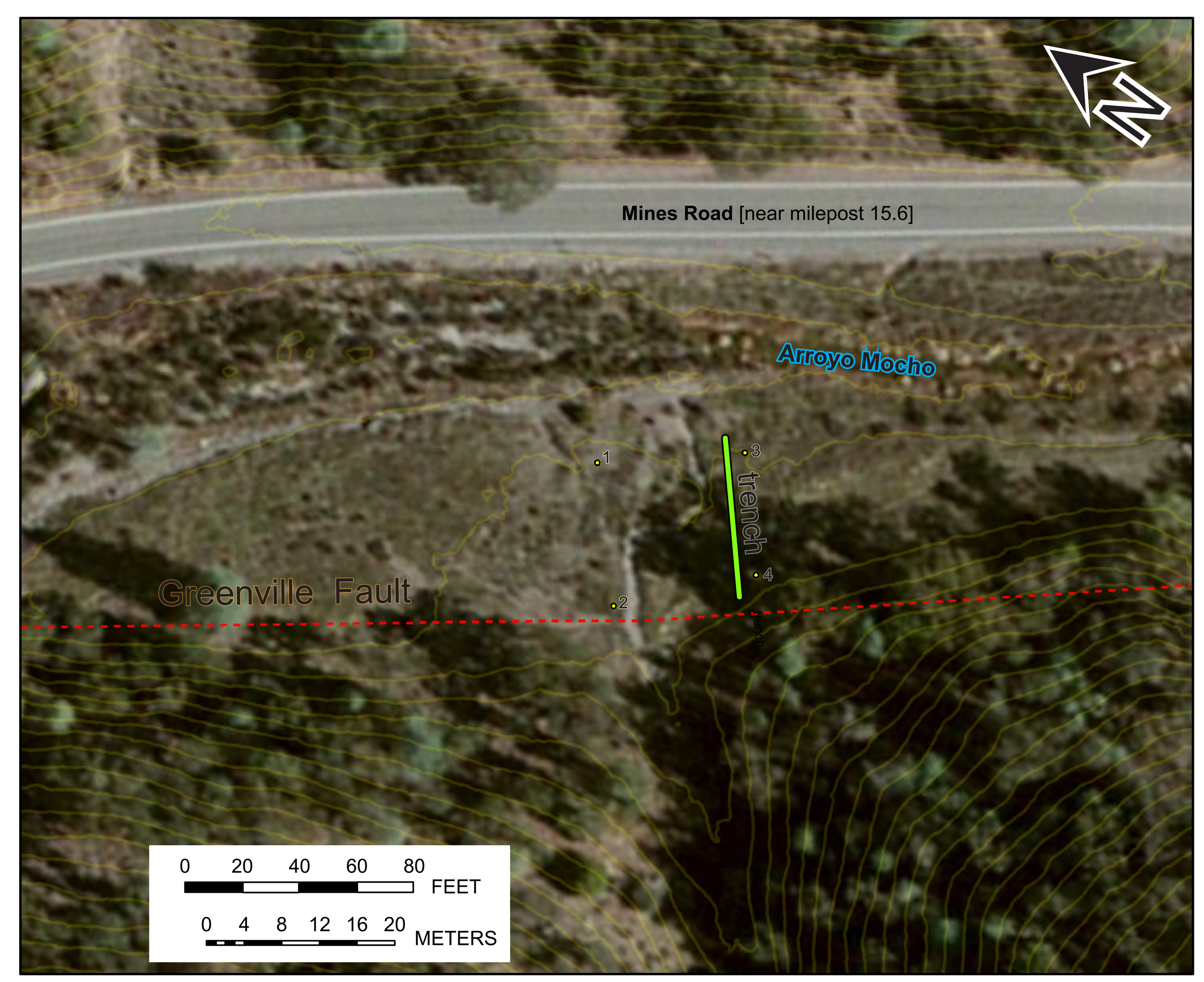

Figure 2. Orthophoto map imagery (source, ESRI) with contour overlay showing location of 2014 trench (lime-green line) at the Kilometer-62 site near the Greenville Fault, Alameda County, California. Survey markers (numbered yellow dots) were used as the control points for trench surveys; marker 1 served as base station of terrestrial lidar system survey. Topographic contours (yellow) are at 1-meter (m) intervals. Fault location inferred from geomorphology is based primarily on straight linear scarp northward of small stream channel (Arroyo Mocho). Scale is 1:500.

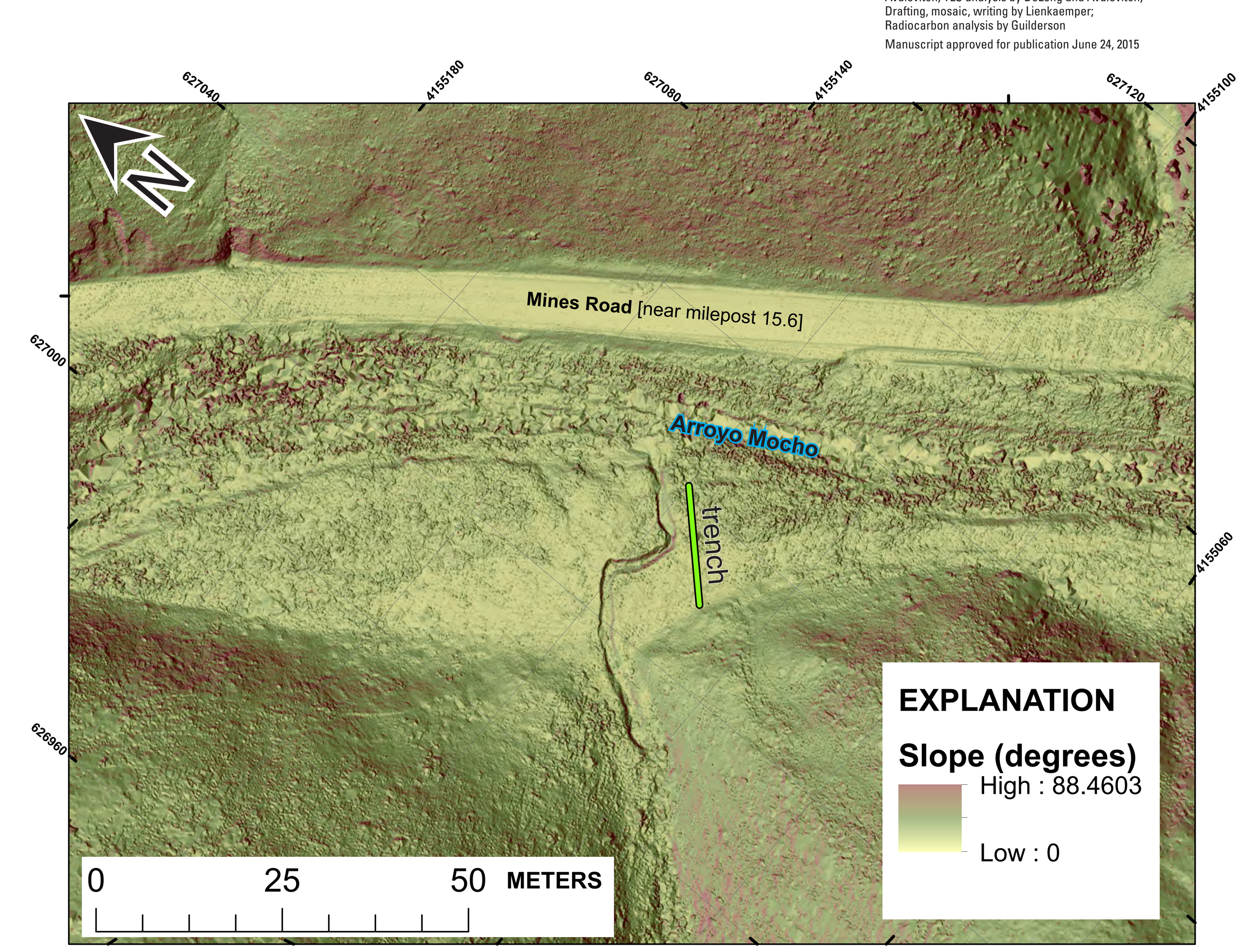

Figure 3. Terrestrial lidar system survey image of the Kilometer-62 trench site near the Greenville Fault, Alameda County, California. Area shown is the same as figure 2. Universal Transverse Mercator projection, Zone 10N; World Geodetic System 1984 datum.

Trench Logs, Terrestrial Lidar System Imagery, and Radiocarbon Data from the Kilometer-62 Site On the Greenville Fault, Southeastern Alameda County, California, 2014

By

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