

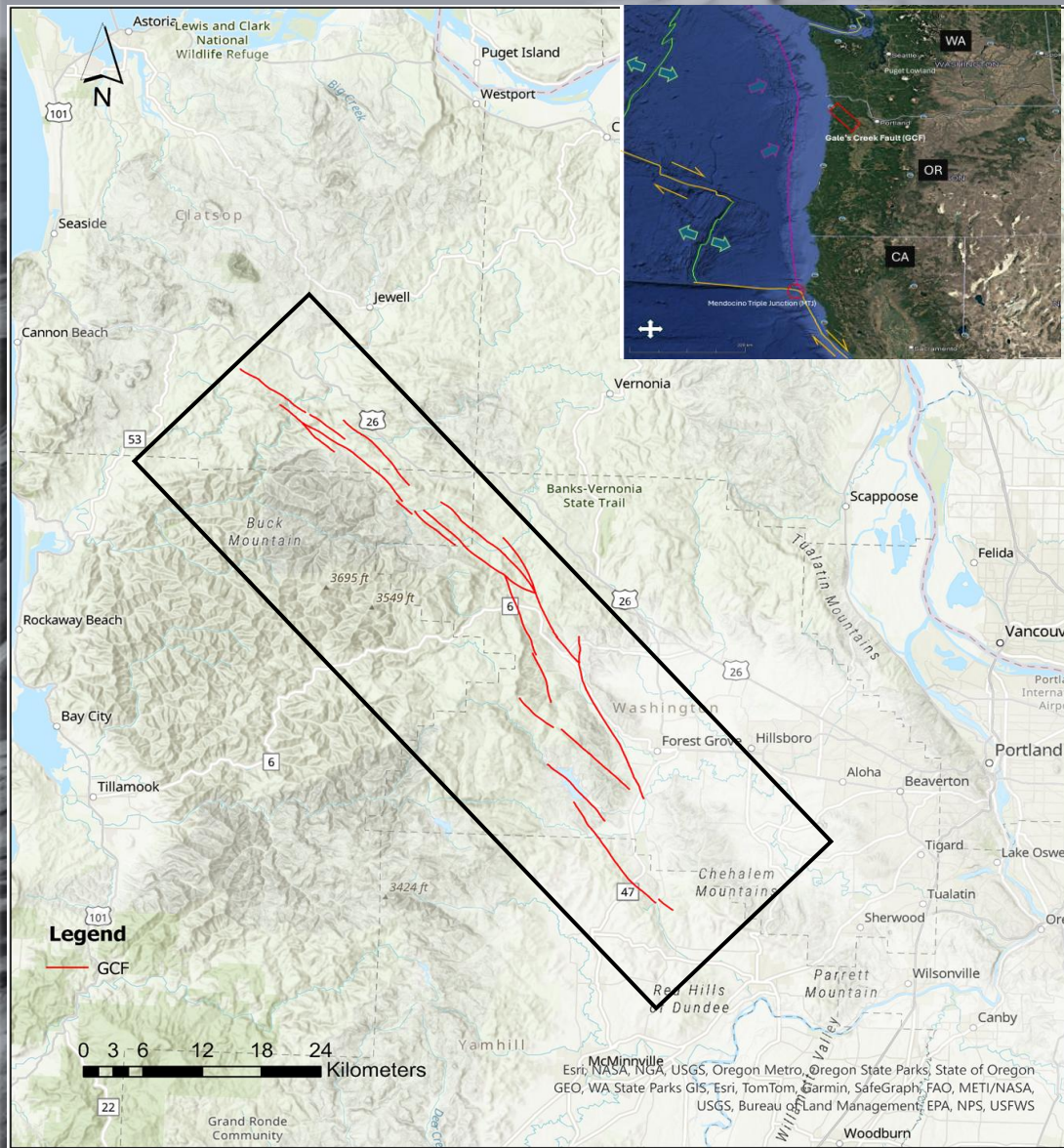
An aerial photograph of a rugged, mountainous landscape. The terrain is characterized by steep, rocky slopes and a prominent, winding river valley that cuts through the center of the image. The overall color palette is muted, with shades of brown, tan, and grey, suggesting a semi-arid or high-altitude environment. The lighting creates strong shadows, emphasizing the topography.

**Constraining Paleoseismic Characteristics from Landslide  
Geomorphology for the Crustal Gales Creek Fault, Oregon**

**By:**

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April, 2026**

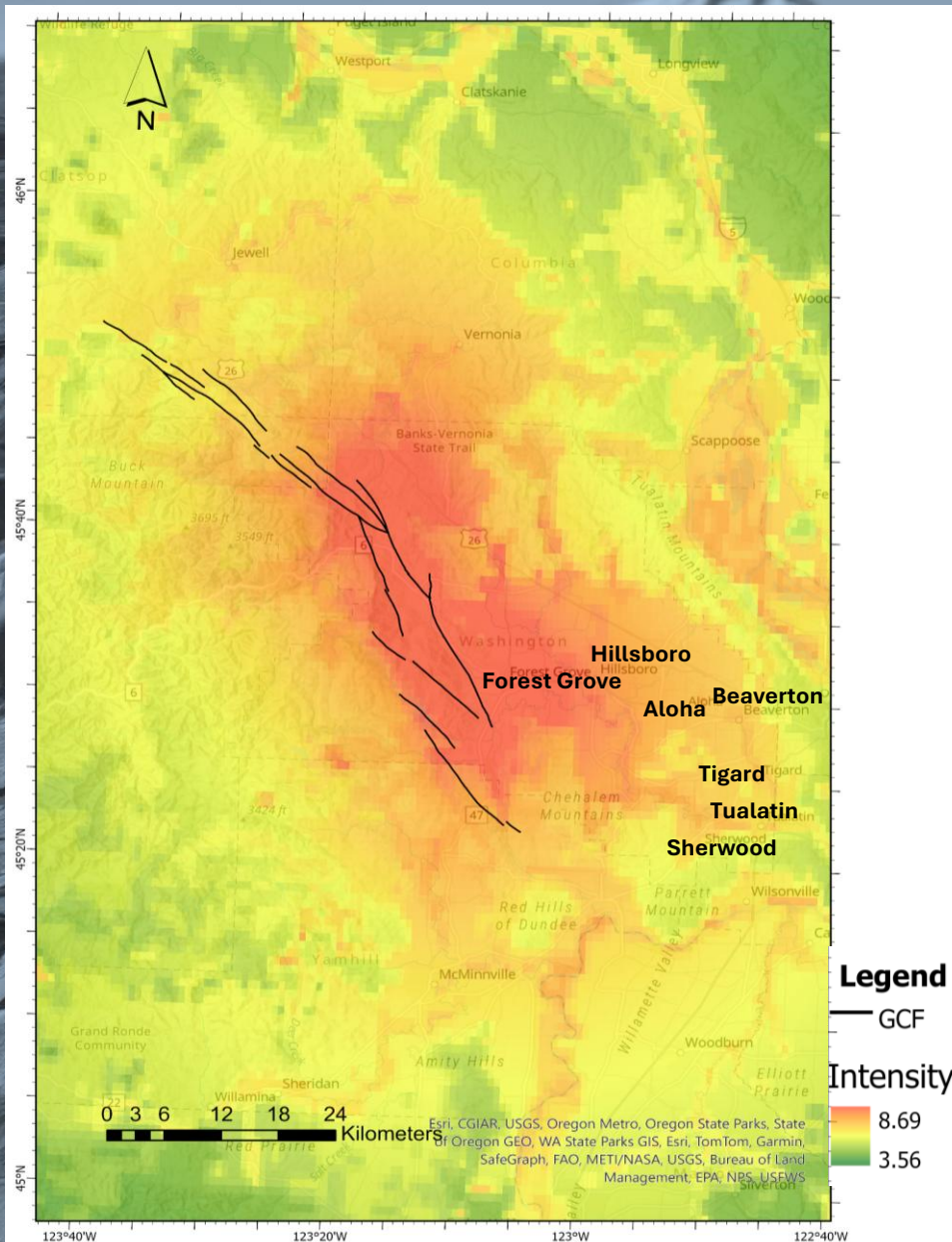
# Study Area



- 73km long, NW-trending dextral strike-slip fault
- 10–12 km of cumulative dextral offset since the middle Miocene
- Accommodates clockwise rotation of the Oregon forearc
- Long-term slip rate  $\approx 0.62 \pm 0.12$  mm/yr (post-15 Ma)

Horst et al. (2021); Wells et al. (2020); McCaffery et al., (2013).

# Motivation



- Can generate  $M_w > 7.0$  earthquake
- A source of seismic hazard to the Portland Metropolitan Area
- Three surface-rupturing earthquakes in the last ~8000 yrs,
- Most recent rupture: **1168 to 853 Cal yrs BP** (Horst et al., 2021)
- **Extent of ground shaking by the most recent earthquake is not known.**

# Landslides as Shaking Proxy



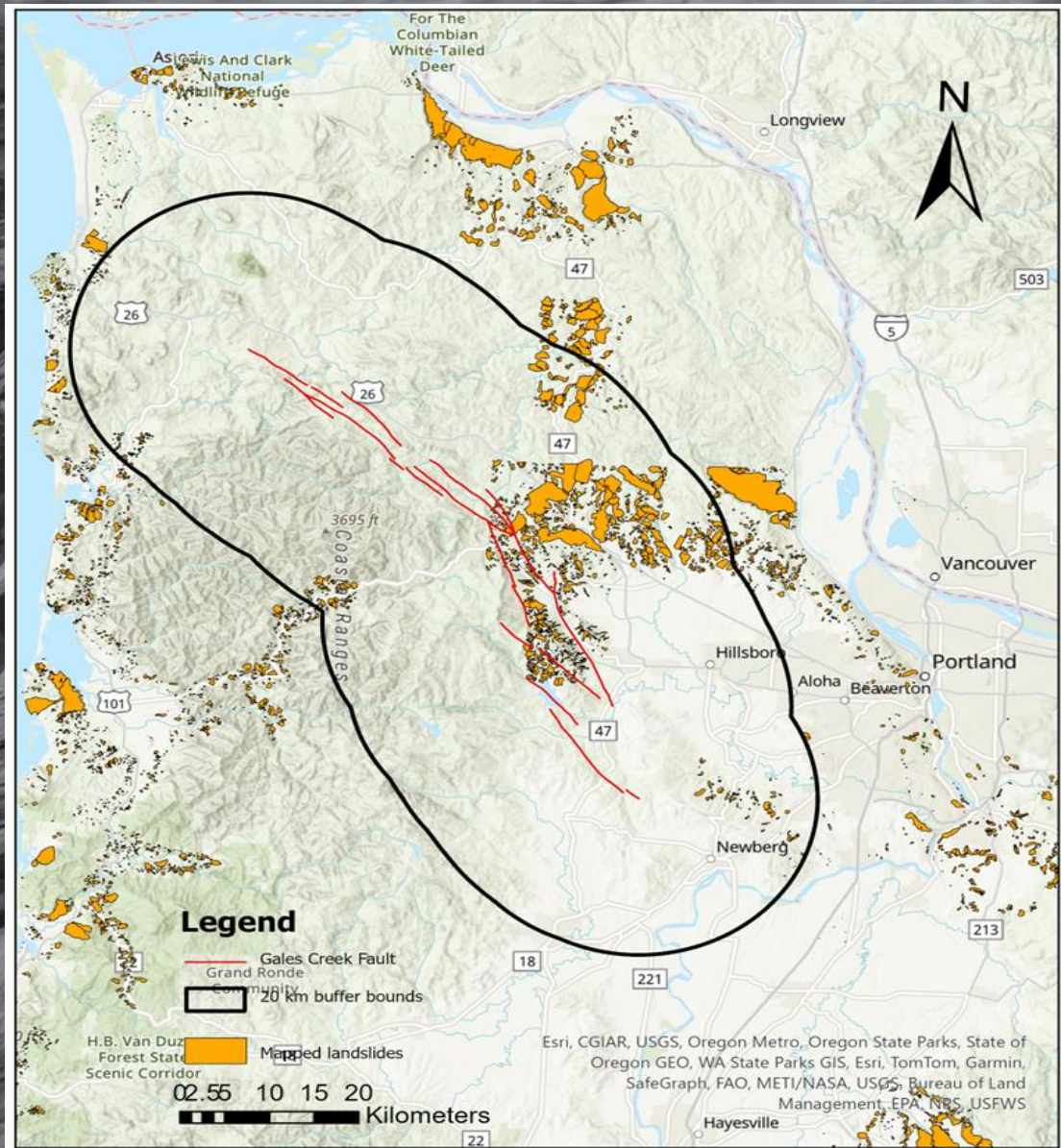
**What was the spatial extent and intensity of ground shaking produced by the most recent surface-rupturing earthquake on the Gales Creek Fault?**

## **Hypothesis:**

**H1:** Coseismic landslides will cluster close to the fault.

**H2:** Paleoseismic magnitudes inferred from coseismic landslide will provide a minimum magnitude estimate.

# Landslide Mapping



Complete gaps in landslide mapping within 20 km of the GCF

- ❖ Refine Lahusen et al. (2020) age-roughness model and infer the ages of all mapped landslides.
- ❖ Isolate probable Coseismic landslides using morphometric analysis
- ❖ Assess fault proximity analysis on probable coseismic landslides
- ❖ Infer paleomagnitude from landslide-magnitude scaling relationship (Keefer 1984); Malamud et al. 2004)

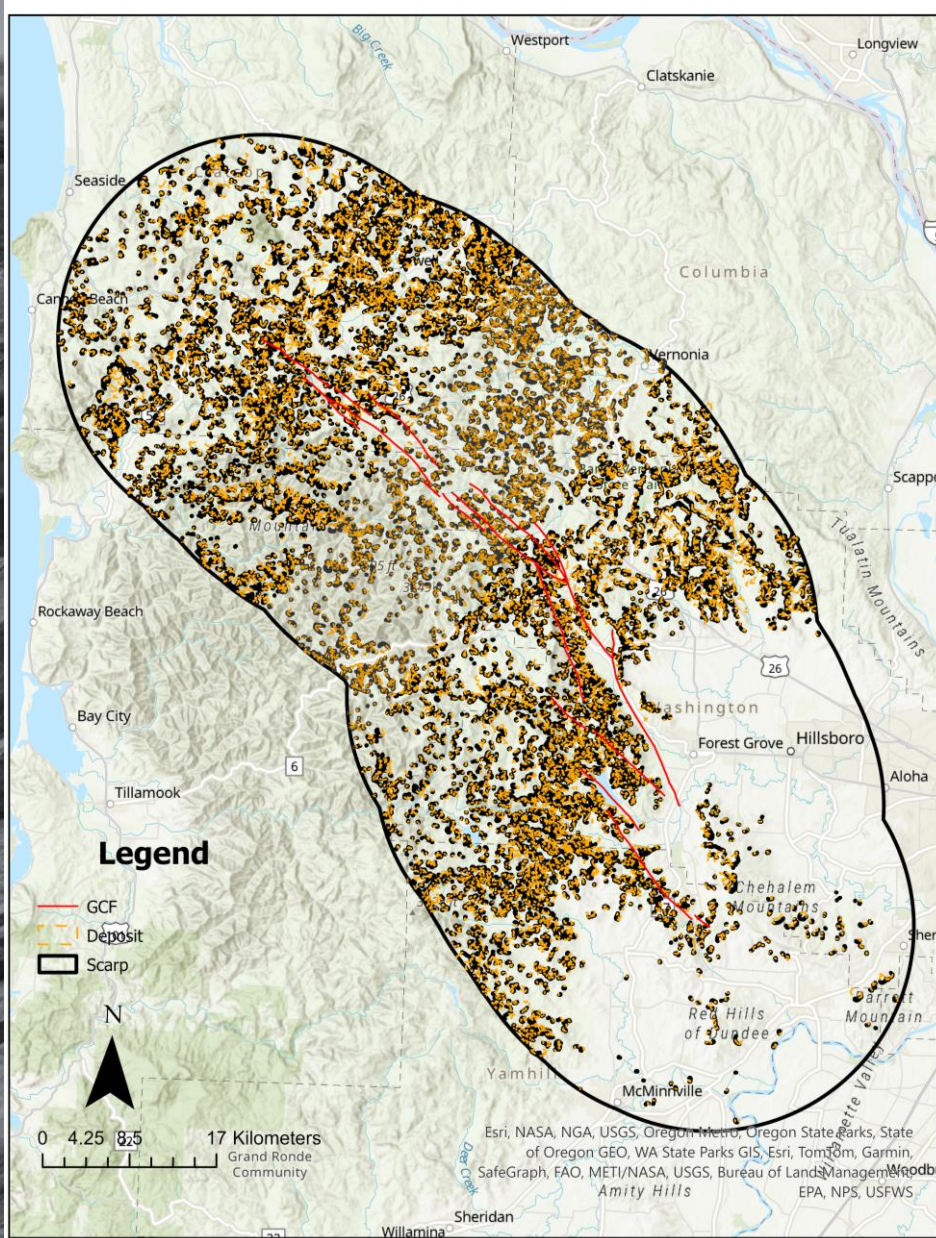
# State of Research

## Completed Landslide Mapping

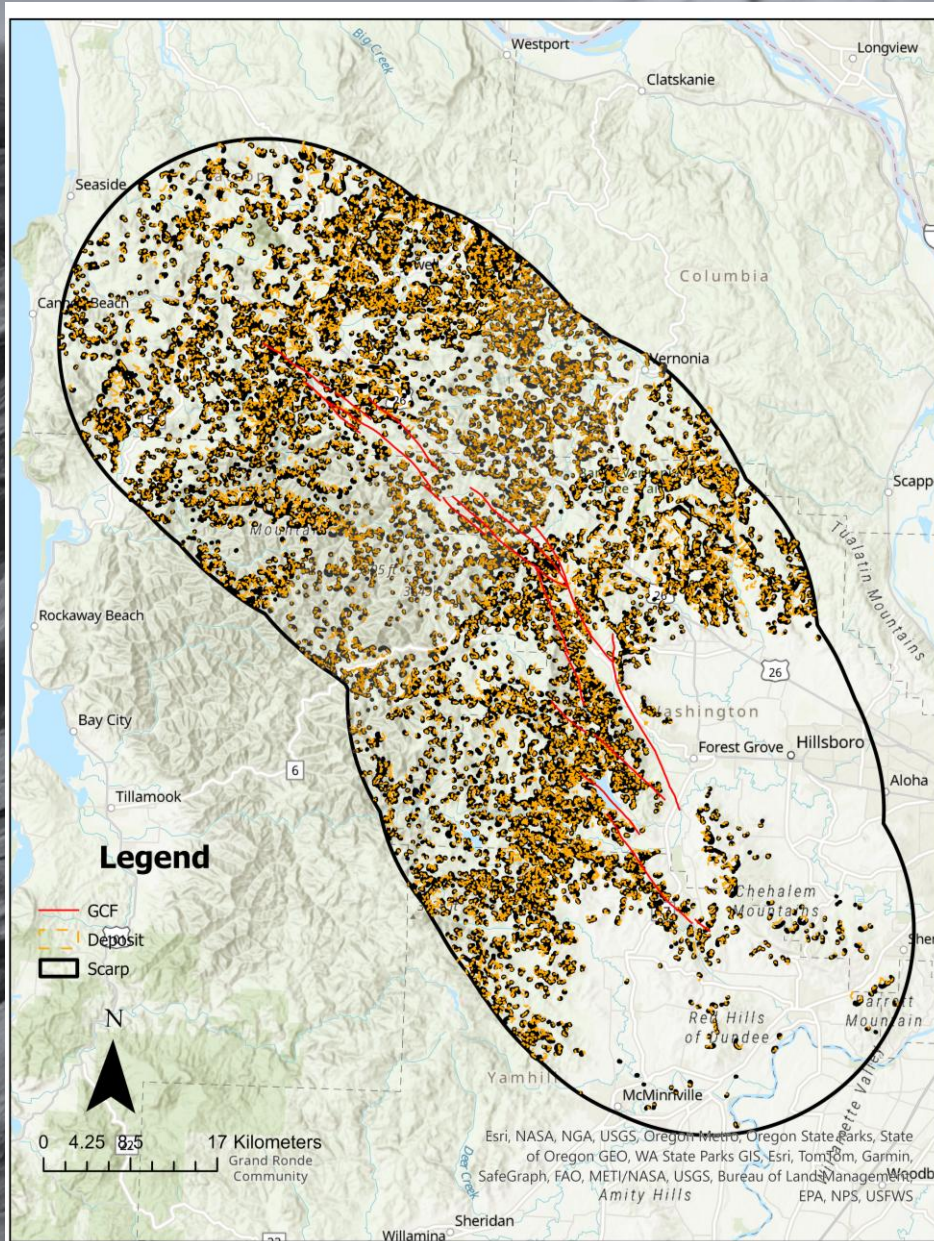
- 8906 Landslides mapped

## Field work done

- 5 new landslides dated



# Next Steps



- Quantify surface roughness, create age-roughness model and infer landslide ages.
- Apply morphometric filtering to isolate possible coseismic landslides.
- Quantify spatial extent and paleomagnitude using magnitude scaling relationships

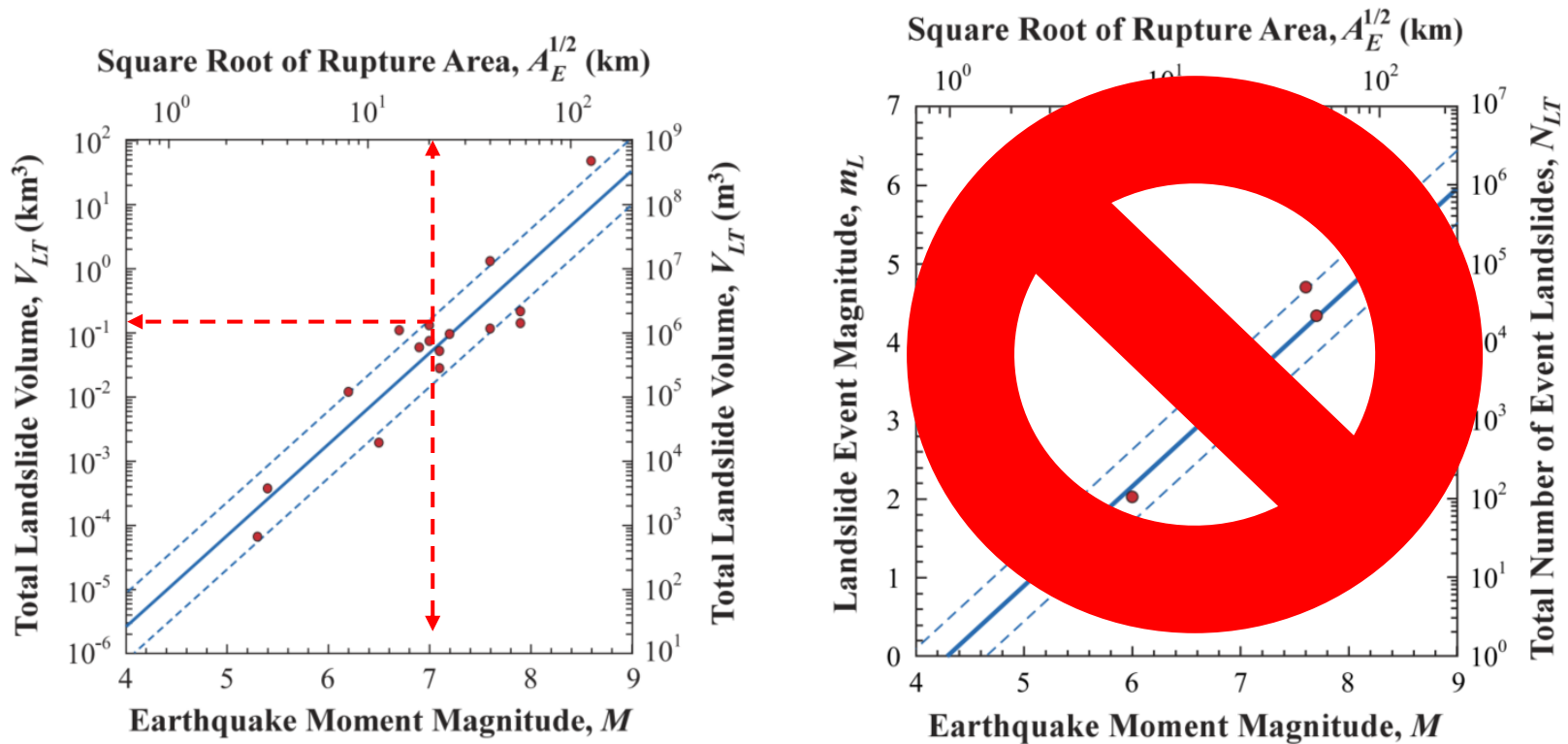
Thank you for listening



## H2:

Paleoearthquake magnitudes inferred from coseismic landslide distributions represent minimum magnitude estimates.

- E.Q magnitude exerts a strong control on the spatial extent, density, and total area of coseismic landslides



# Morphometric Filtering

## 1. Mobility ( $L/H$ ) - (Grant and Culhane, 2025)

- Coseismic landslides follow a bilinear mobility trend

## 2. Index of potential trigger (IPT) – Baroň et al., (2024).

$$\text{IPT} = ((I_d + H_{\text{rel}}) / 2) - \tan(\varphi_S)$$

- $I_d = L_d / L_s$
- $H_{\text{rel}} = h / H$
- Source area angle ( $\varphi_S$ )
- $\text{IPT} > 0.2$  - Coseismic landslides

