Experiment Report (PIC 202342): La Jencia Fault Zone Preliminary GPR Scans (May 7 2023)

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A pilot study using low frequency GPR scans to image and orient near surface fault geometry is underway. While the deep structure and orientation of faults is normally well constrained through seismic and other means, the near surface (upper tens of meters) orientation is often less well known. GPR is a well-established near surface imaging tool, up to ~5 m in most contexts with the available 250 MHz antenna. Though the very near surface environment, particularly in a fault zone, is challenging to image, developing GPR data processing and imaging methods may now be useful in this setting.

Site Description: The La Jencia Fault or Magdalena Mountain Fault zone runs generally N-S on the eastern side of the Magdalena Mountains. One scarp area located South of NM Hwy 60 just past mile marker 117 was scanned on May 7, 2023 in this project ("Project 1" in the default naming and file structure, Figure 1). GPR lines are collected with a 250 MHz Sensors and Software Noggin antenna with external GPS in the Smart Cart configuration. Scans are collected roughly perpendicular to the scarp at four locations, in both an up-scarp ("E-W") and down-scarp ("W-E") direction at each location (Figure 2).

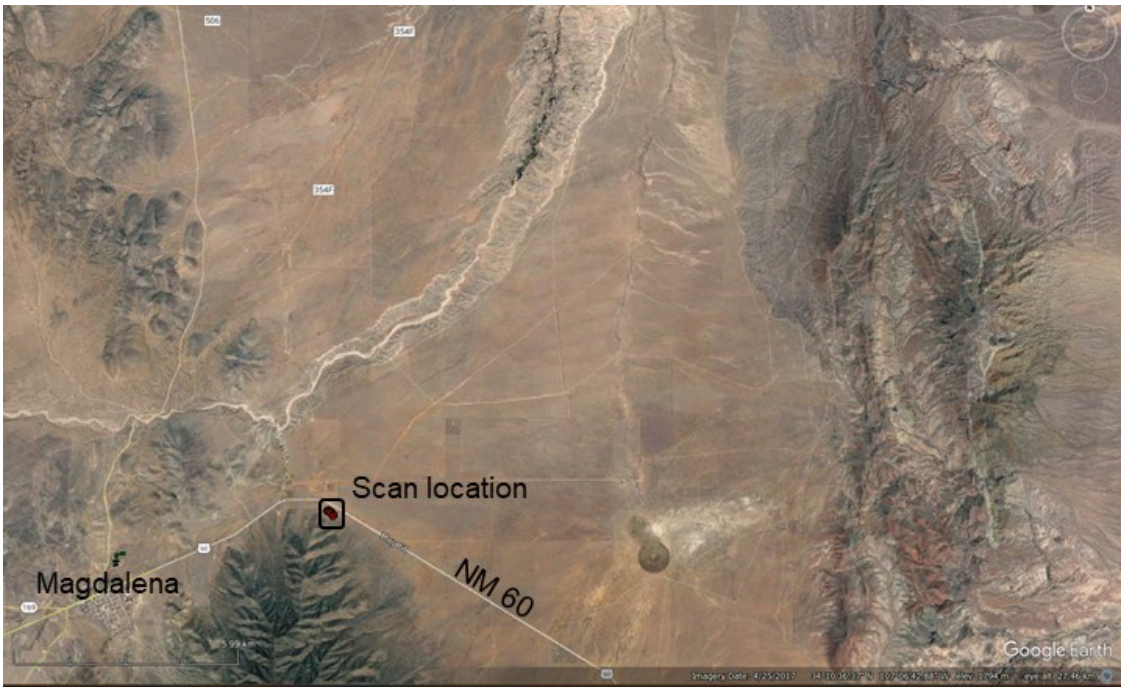

Figure 1: Google Earth imagery showing broader context of site location near Magdalena, NM

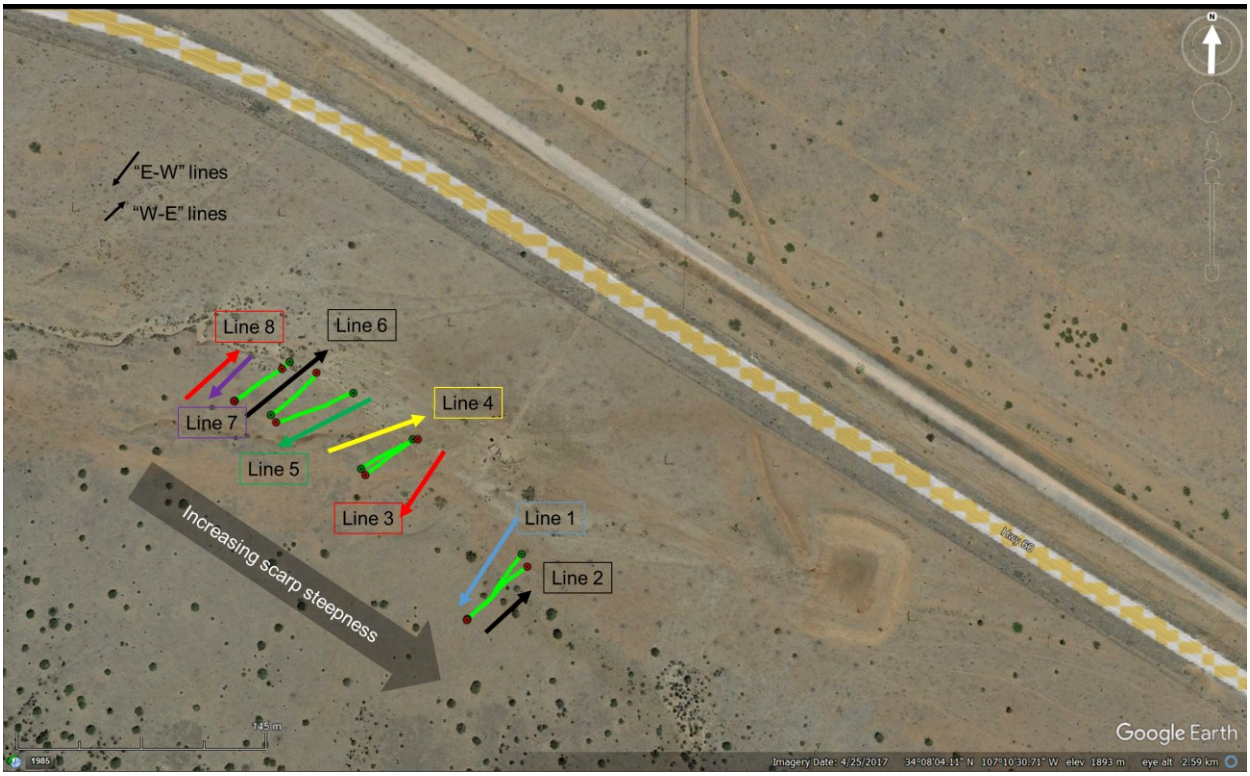

Figure 2: GPS traces (shown in bright green) of line scans across the fault scarp; the lines are collected in order of decreasing scaro steepness (the scaro increases going SE, with line numbers increasing to the NW). Line numbers and directions are indicated. Note that lines travel in a SW-NE direction but are refered to as "W-E" and, similarly, NE-SW lines are called "E-W." NM 60 is shown diagonally crossing the map NW to SE, roughly paralell to this section of the fault zone.

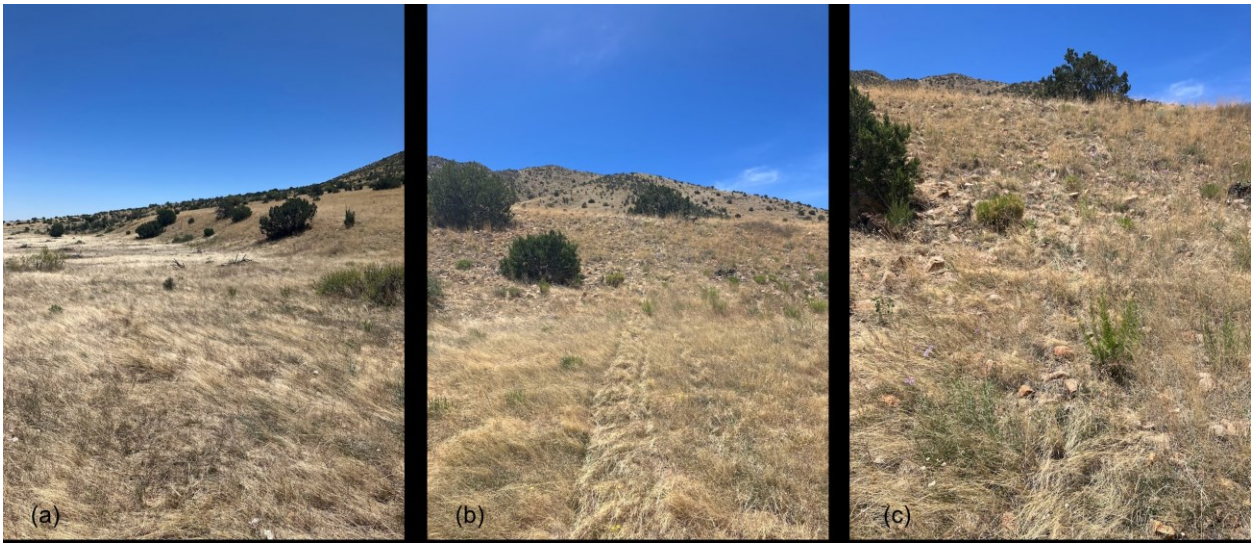

Figure 3: Ground cover and site photos: (a) Looking SE towards the steeper region of the scarp; (b) looking SW ("W") up scarp, showing GPR cart tracks and steeper SE portions of the scarp; (c) looking SW ("W") up the scarp showing vegetation and uneven, rocky ground surface.

Layout and Execution: Most default settings were kept on the DVL for data collection (linescans, not grids); velocity was set to .12 m/ns in Proj 1. GPS data were recorded using the external GPS. Actual resolution in the collected and processed data for the 250 MHz antenna is up to about 3m but 4m of data are recorded.

As a sample, Line 4 is shown in Figure 4 with Dewow, automatic SEC gain, background removal, and topography correction. Note presence of possible subsurface scarp on the right side.

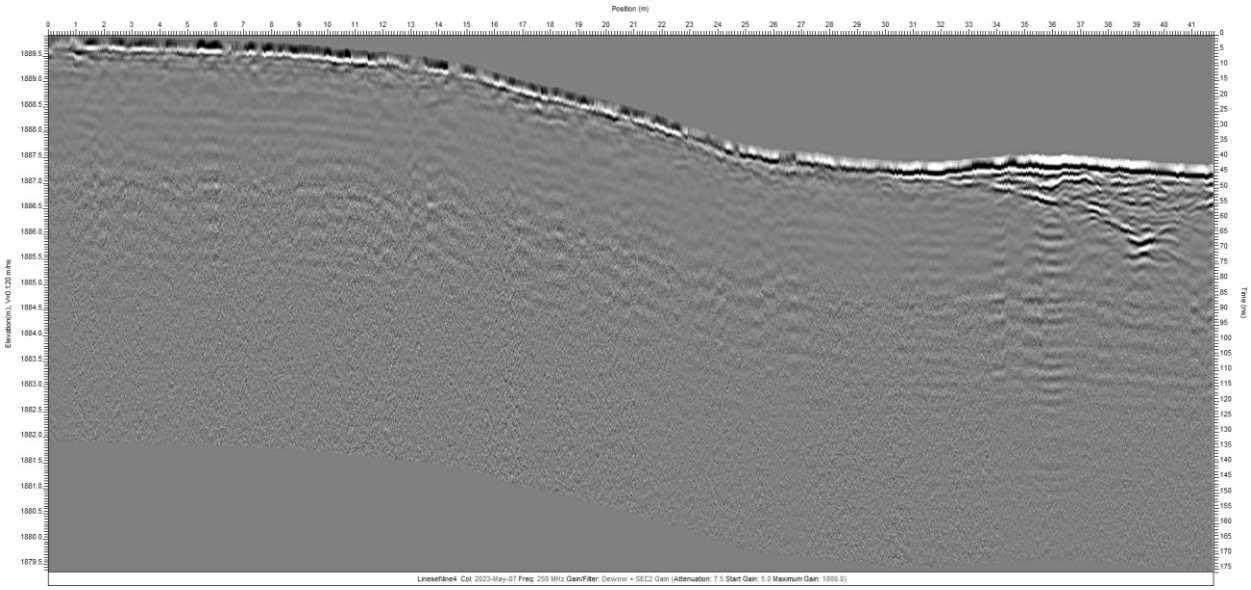

Figure 4: Line 4, collected down the slope ("W-E") with GPS used for topography correction. The automatic gain, dewow, and background removal are used.