# Data Repository for "Coexisting Seismic Behavior of Transform Faults Revealed by High-Resolution Bathymetry"

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## 1. Supplemental Text

Processing of CHIRP data:

To image the steep slopes at the escarpment, we applied a post-stack migration to reposition diffractions visible in the sub-bottom profiler data (Bull et al., 2003). To reduce the artifacts caused by migrating single fold data, we selected a profiler line in which there was minimal vertical movement of the AUV. The migrated data shows diffractions and truncated stratigraphy relocated into positions that agree with the multibeam bathymetry at the waterbottom.

Calculation of maximum offset from Wells and Coppersmith (1994)

Wells and Coppersmith (1994) provide empirical relationships relating rupture length, area, magnitude, and surface displacement to one another. To provide broad bounds on the offset magnitude possible along a particular transform structure in a given earthquake that might offset the depositional features within Tile 4, we made the following assumptions. First, the Ballenas transform is approximately 240 km long from end-to-end. The maximum magnitude surface offsets would thus be bounded by a scenario in which the entire transform ruptured in a single event. As with continental strike-slip faults, we assumed a rupture depth of 10 km (although deeper hypocentral depths have been modeled based on broadband seismic data; Abercrombie and Ekstrom, 1994), producing a total rupture are of 2400 $km^2$. In this scenario, the value of the moment magnitude (Mw) of such an earthquake would be equal to Mw = 3.98 + 1.02*log(2400 km2) = 7.4. In this case the log(maximum displacement) = -7.03 + 1.03 * Mw. For this scenario, the maximum displacement was calculated as 3.9 meters. Alternatively, Wells and Coppersmith (1994) provide regressions for strike-slip faults that relate surface rupture length to maximum displacement as log(maximum displacement) = 1.16*log(surface rupture length) - 1.69. Given a 240 km rupture length, this produces 11.8 m of offset. Thus, we regard 11.8 meters as the maximum offset that can possibly produced by an earthquake that ruptures the entirety of the Ballenas transform.

Measurement of wavelengths of mapped scarps

The mapped features were fit with a windowed template function based on fault scarp curvature (Hilley, et al., 2010; Sare et al., 2018; Sare and Hilley, 2018). An amplitude and morphologic age were assigned to each mapped feature based on the best-fitting

template function oriented in the direction of the mapped trace. The wavelength of the best-fitting scarp template at each point were calculated by taking the square root of the morphologic age (which has units $L^2$). Only high- and moderate-confidence features were assigned a wavelength. Low-confidence features may be modified by non-diffusive processes (diffusion modelling not appropriate), or discontinuous (profiles extracted across feature highly variable). Wavelength estimates for each tile are shown in Figures DR1-DR6.

## 2. Tables

**Table DR1: Criteria for confidence mapping of scarp-like landforms in bathymetry**

| | **High Confidence Criteria** | **Low Confidence Criteria** |
|---|---|---|
| **Primary Classification Attributes** | • Lateral continuity of slope break (i.e., on the scale of track width)<br>• Consistent trend over length<br>• Similar trend to transform fault zone | • Slope break not continuous<br>• Trend highly variable<br>• Trends oblique to fault zone |
| **Secondary Classification Attributes** | • Restorable offset bathymetry along fault<br>• Secondary evidence for offset (e.g., shutter ridge) that may be non-restorable | • Feature modified by depositional (e.g., covered by fan drape) and/or erosional processes (e.g., headscarp of slump deposit)<br>• Feature crossed by major track-parallel artifact |

## 2. Figures

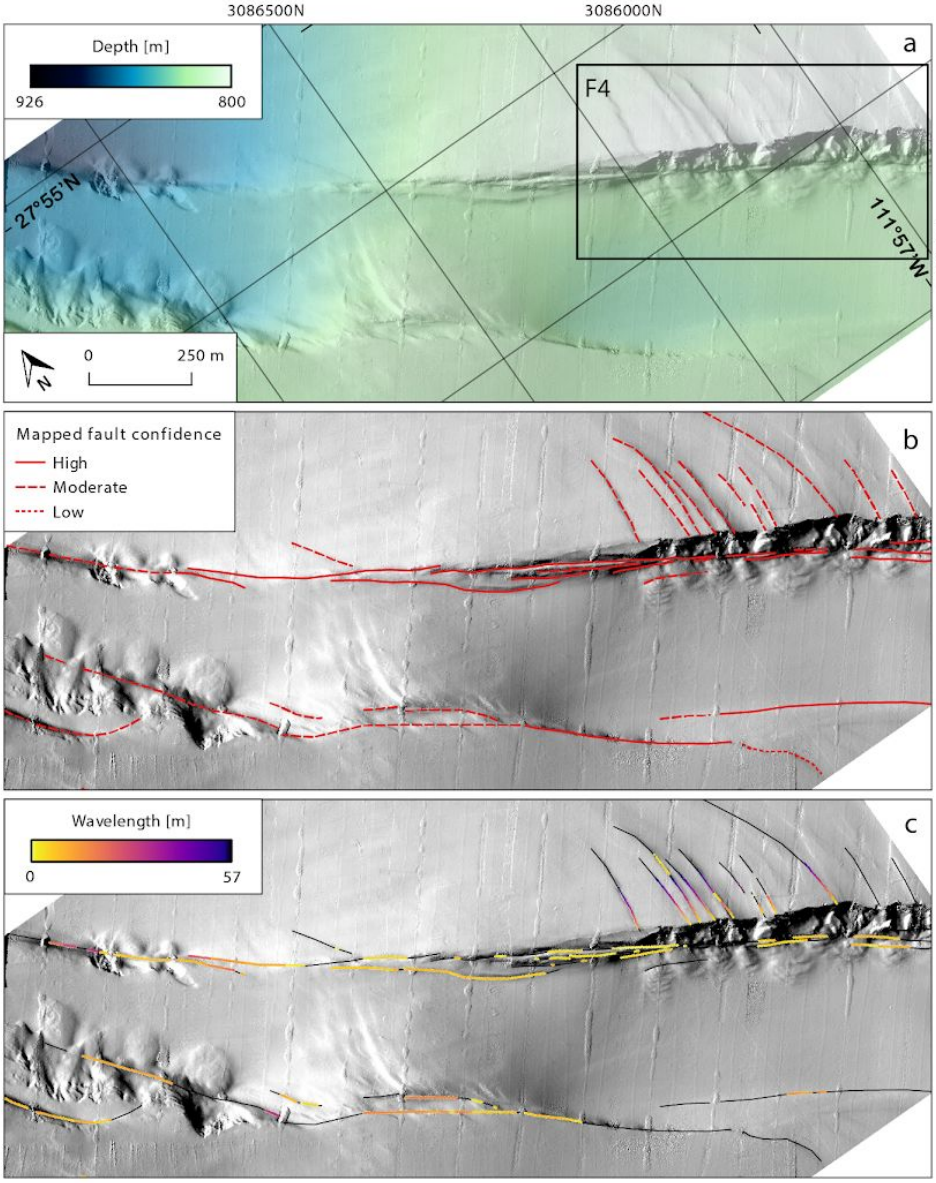


**Figure DR1.** Mapped area of tile 4. a) Bathymetry, b) Mapped features with mapping confidence rating, c) Estimated wavelength of mapped features. Wavelength is defined as the square root of the morphologic age in the single-event scarp diffusion model used here. Estimates from valid profiles are shown as thick lines and segments with low SNR as thin black lines. See text for details. Coordinates are reported in UTM Zone 12.

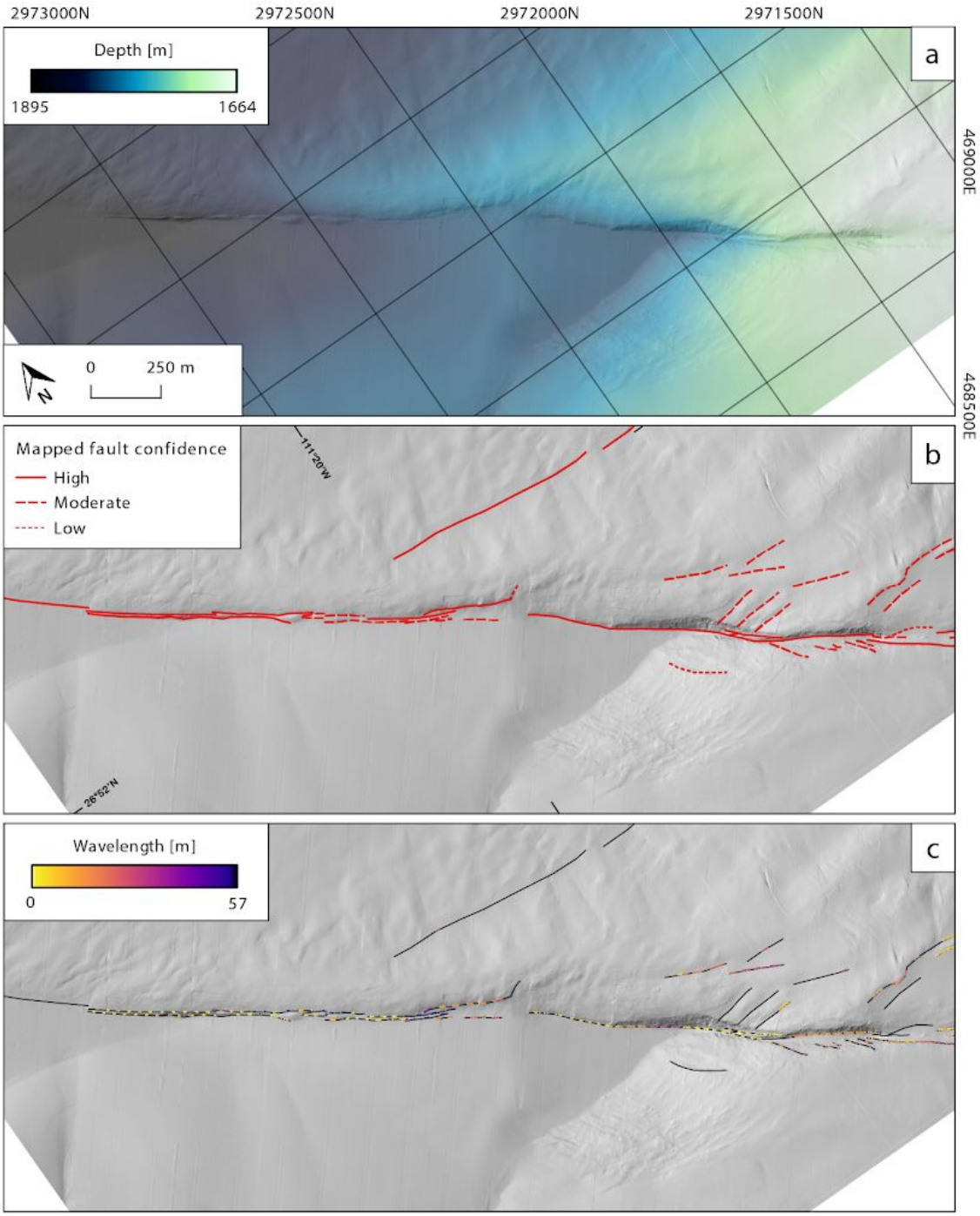


**Figure DR2.** Mapped area of tile 6. a) Bathymetry, b) Mapped features with mapping confidence rating, c) Estimated wavelength of mapped features. Wavelength is defined as the square root of the morphologic age in the single-event scarp diffusion model used here. Estimates from valid profiles are shown as thick lines and segments with low SNR as thin black lines. See text for details. Coordinates are reported in UTM Zone 12.

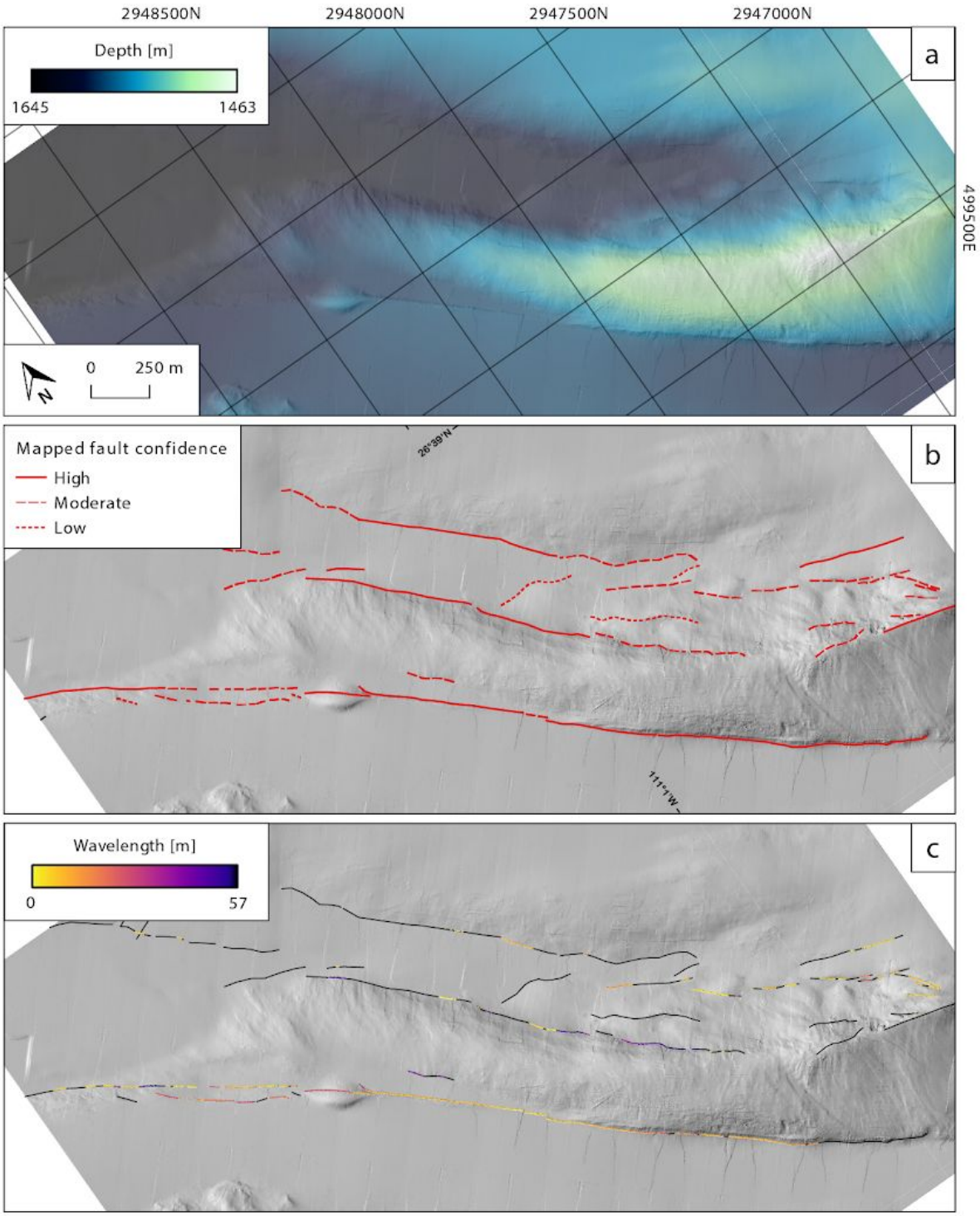


**Figure DR3.** Mapped area of tile 8. a) Bathymetry, b) Mapped features with mapping confidence rating, c) Estimated wavelength of mapped features. Wavelength is defined as the square root of the morphologic age in the single-event scarp diffusion model used here. Estimates from valid profiles are shown as thick lines and segments with low SNR as thin black lines. See text for details. Coordinates are reported in UTM Zone 12.

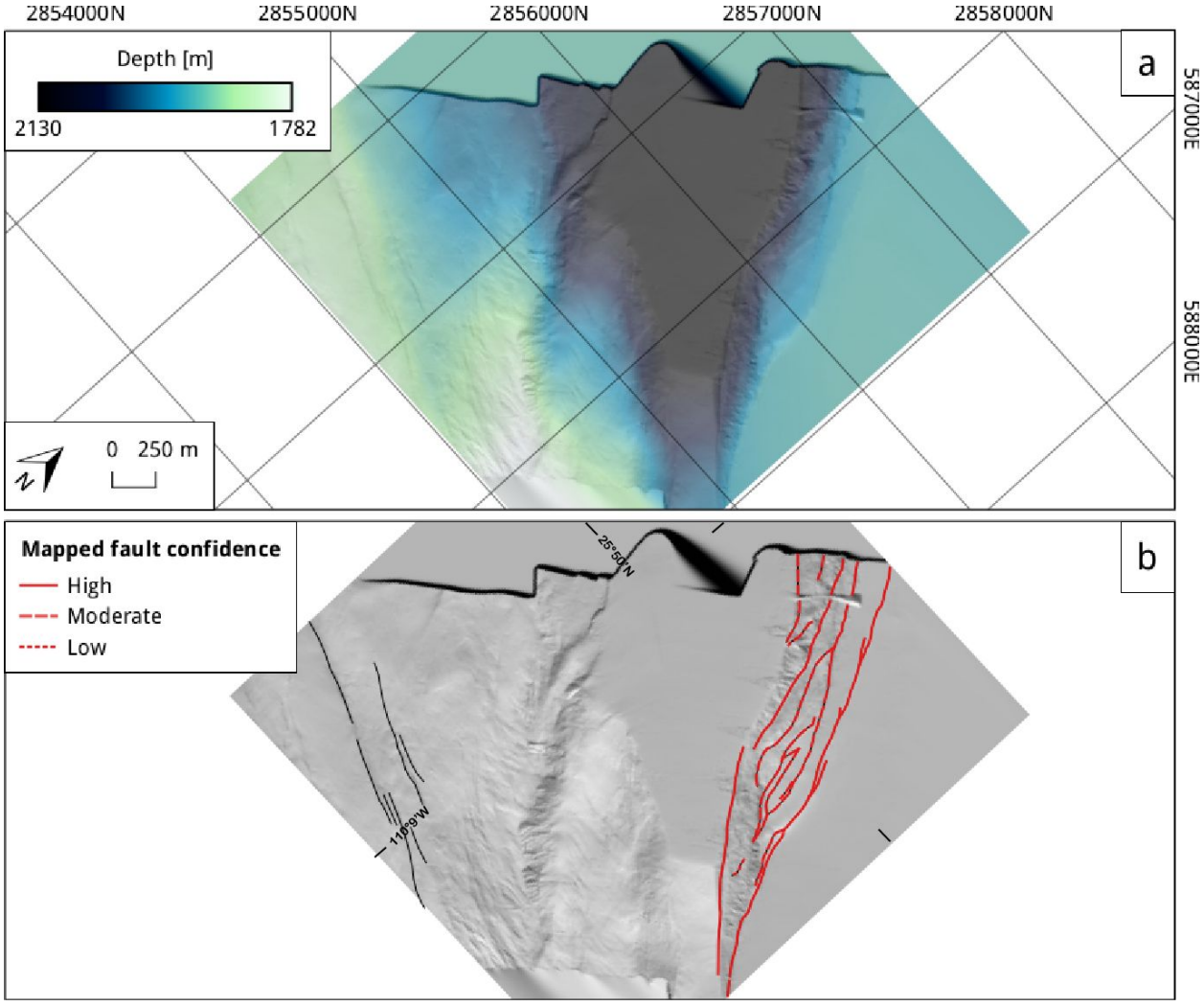


**Figure DR4.** Mapped area of tile 12. a) Bathymetry, b) Mapped features with mapping confidence rating. Questionable lineaments shown as thin black lines. No significant mapped fault segments on this tile yielded wavelength estimates with high SNR. See text for details. Coordinates are reported in UTM Zone 12.

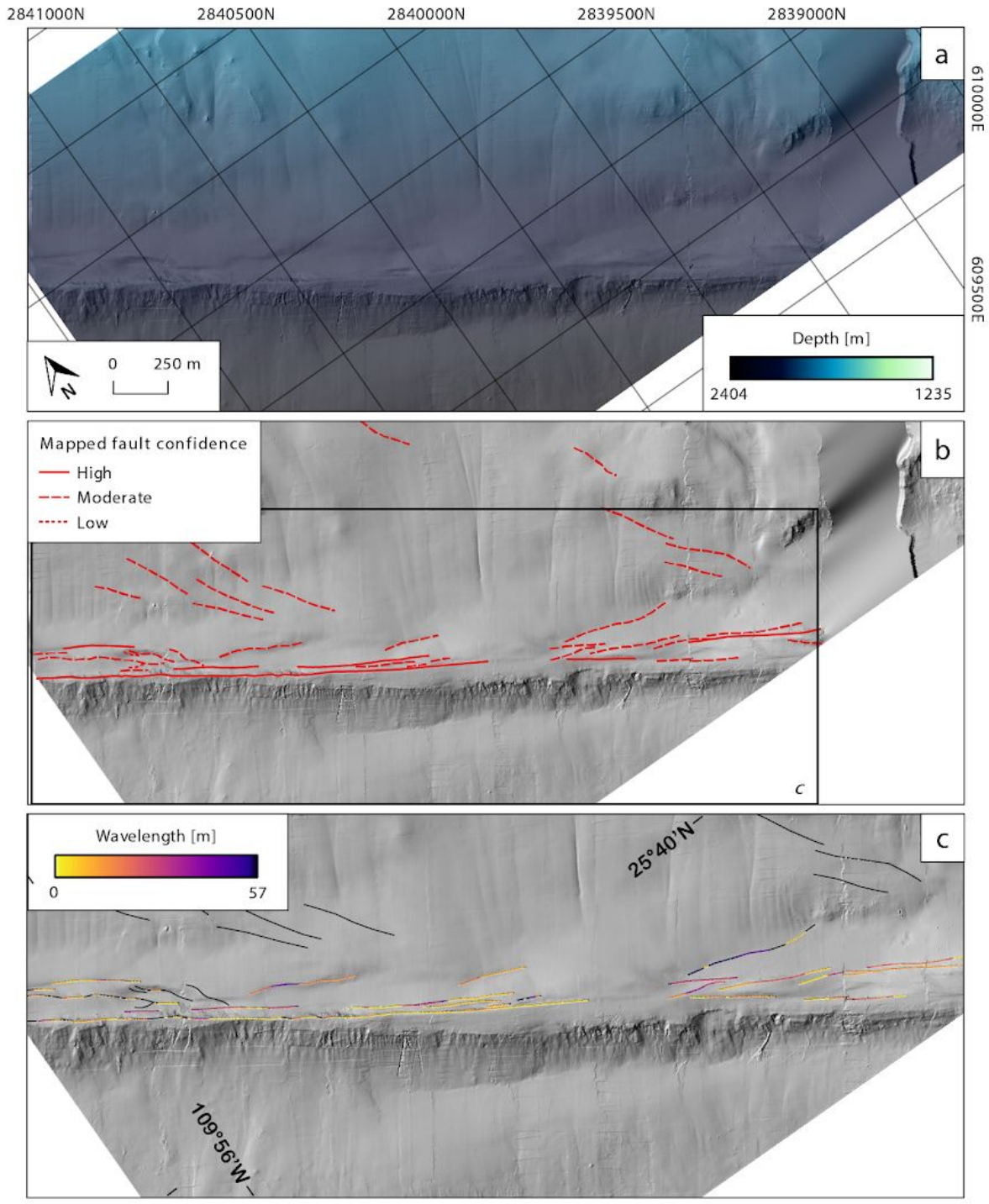


**Figure DR5.** Mapped area of tile 13. a) Bathymetry, b) Mapped features with mapping confidence rating, c) Estimated wavelength of mapped features. Wavelength is defined as the square root of the morphologic age in the single-event scarp diffusion model used here. Estimates from valid profiles are shown as thick lines and segments with low SNR as thin black lines. See text for details. Coordinates are reported in UTM Zone 12.

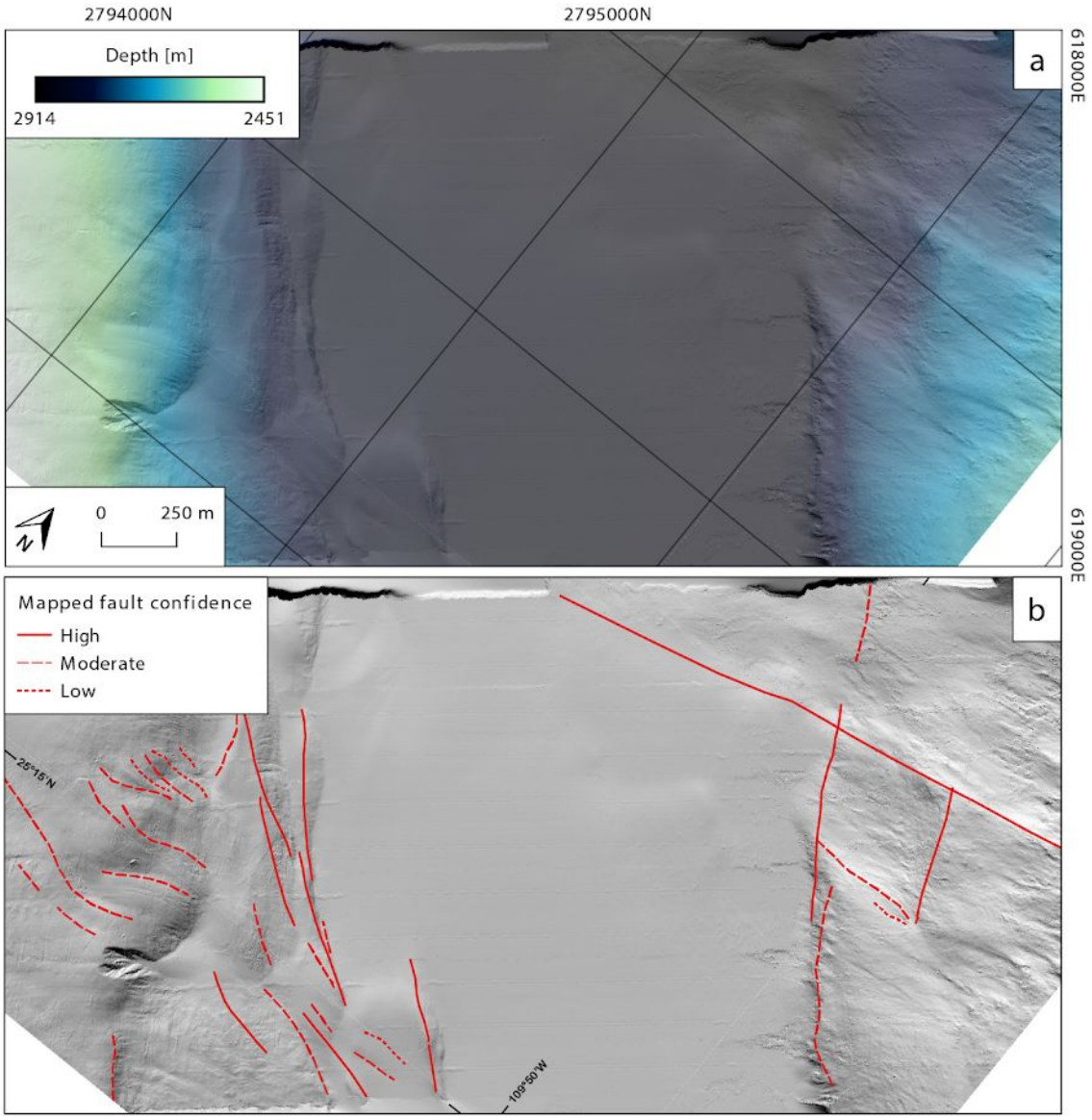


**Figure DR6.** Mapped area of tile 14. a) Bathymetry, b) Mapped features with mapping confidence rating, No significant mapped fault segments on this tile yielded wavelength estimates with high SNR. See text for details. Coordinates are reported in UTM Zone 12.

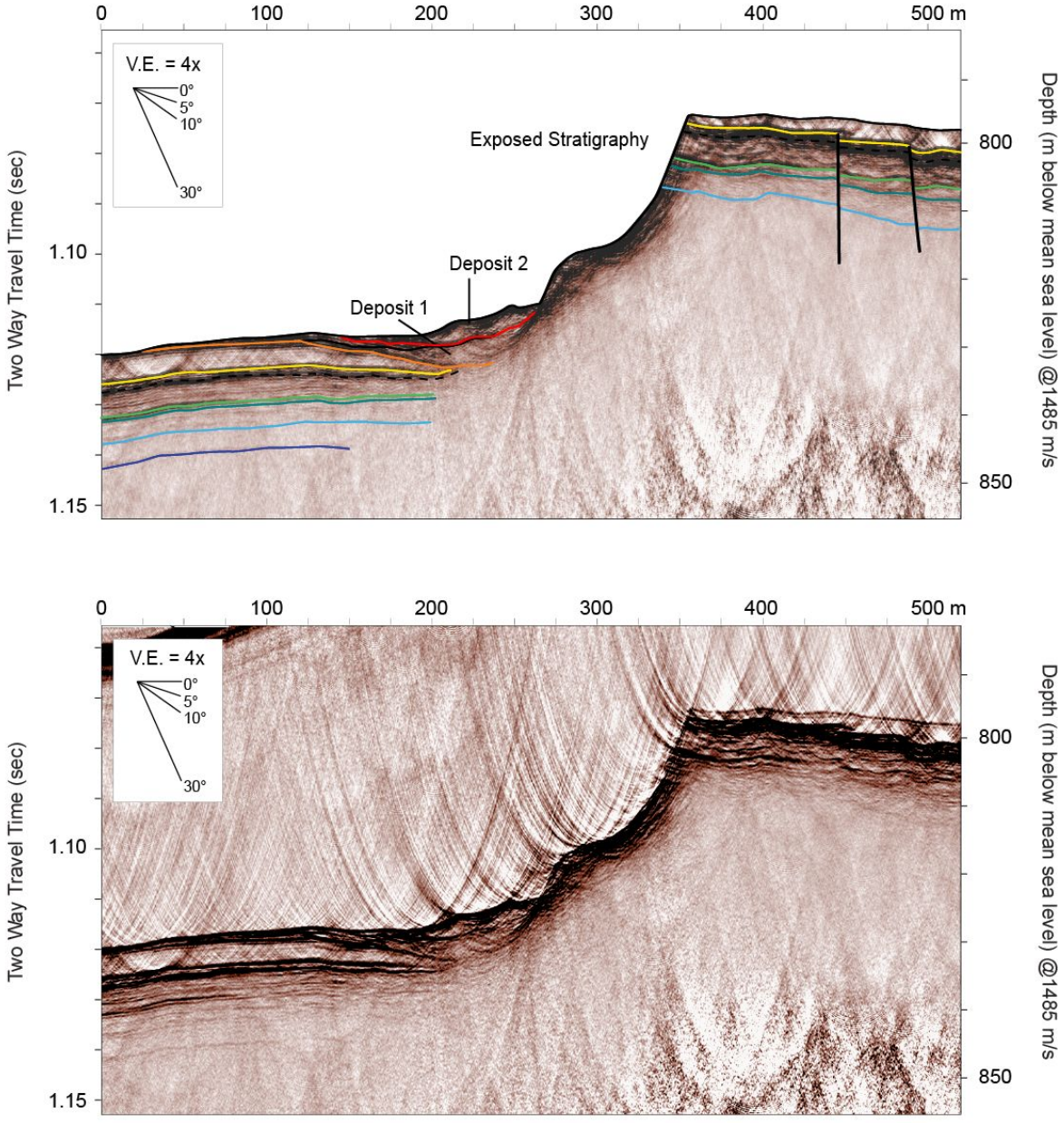


**Figure DR7**: Interpreted (top) and uninterpreted (bottom) CHIRP lines from line 33, tile 4.

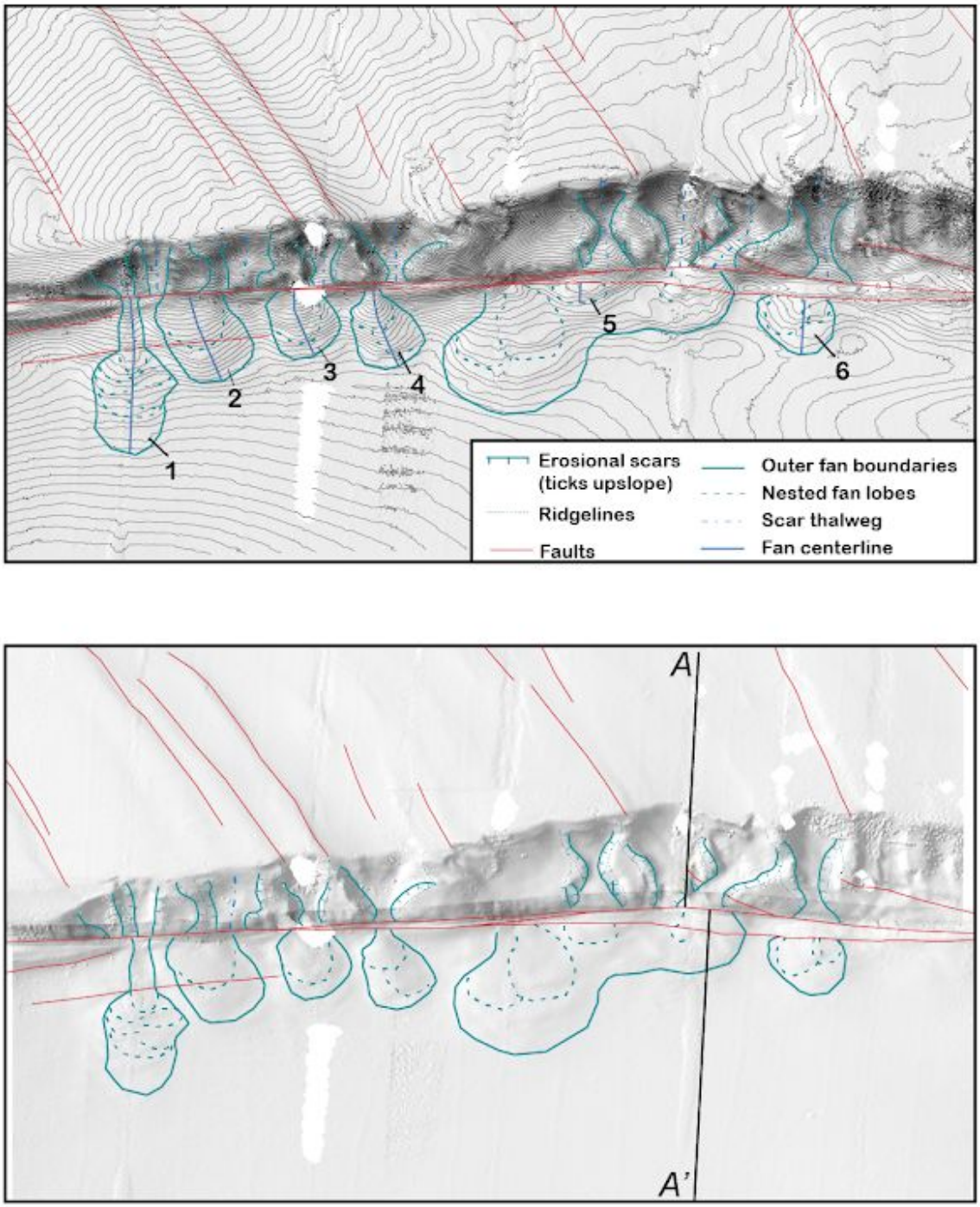


**Figure DR8**: Map enlarged version of main text Figure 3, excising colored background meant to highlight paired offset features.

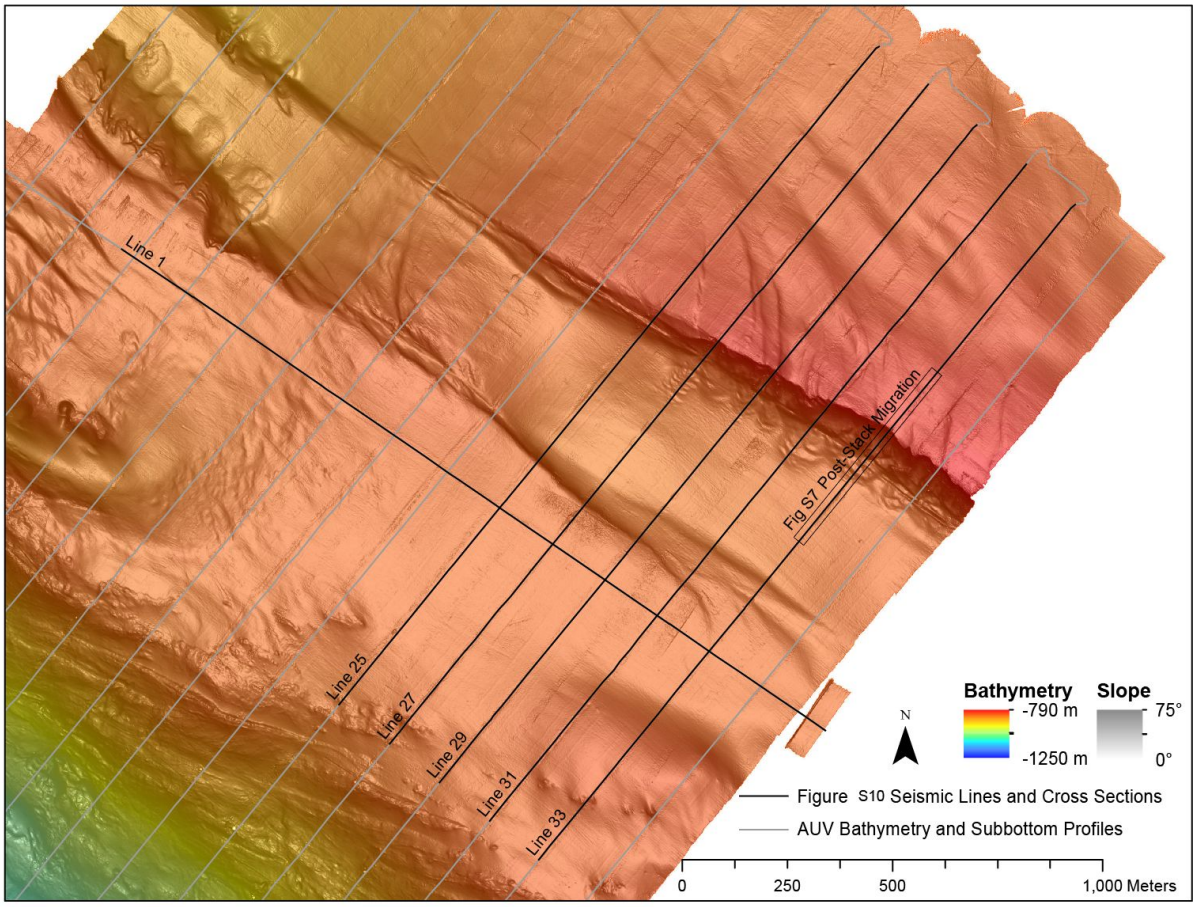


**Figure DR9**: Map of Tile 4, showing location of navigation lines. Line numbers correspond to CHIRP profiles shown in Figures DR10-11.

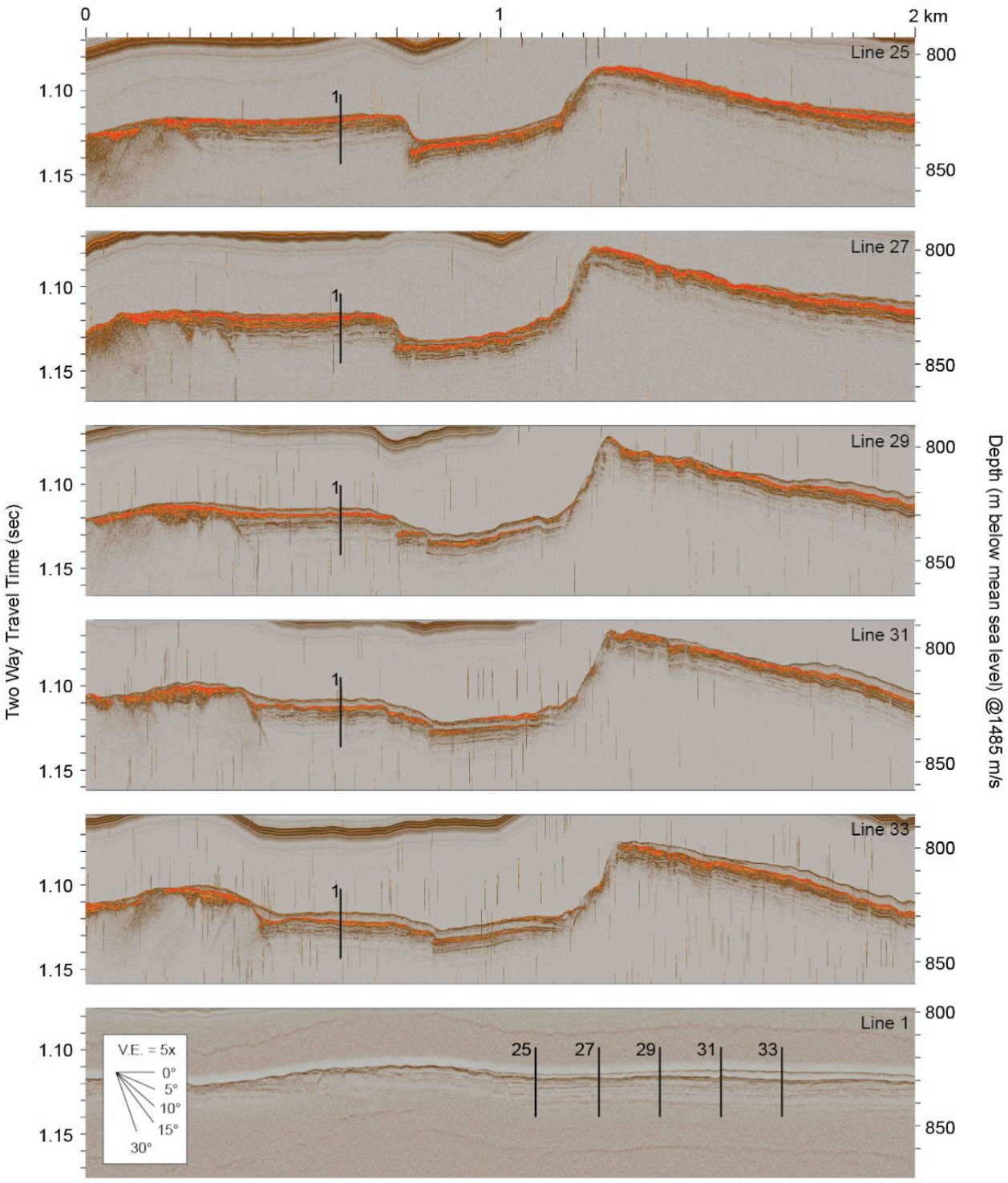


**Figure DR10**: Uninterpreted CHIRP lines from Tile 4, showing location of tie-lines.

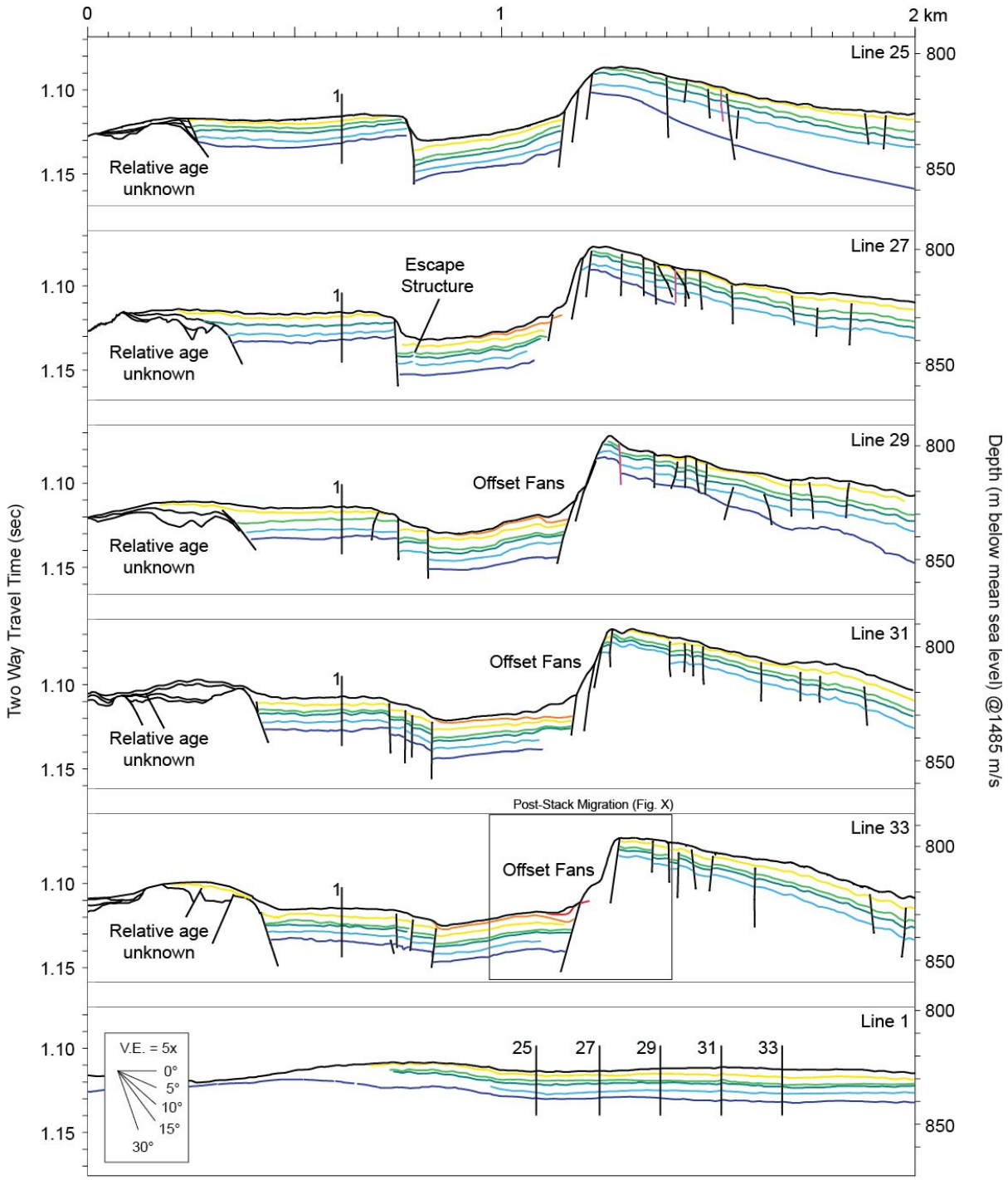


**Figure DR11**: Interpretation of reflectors imaged in CHIRP lines from Tile 4 (Figure DR10).

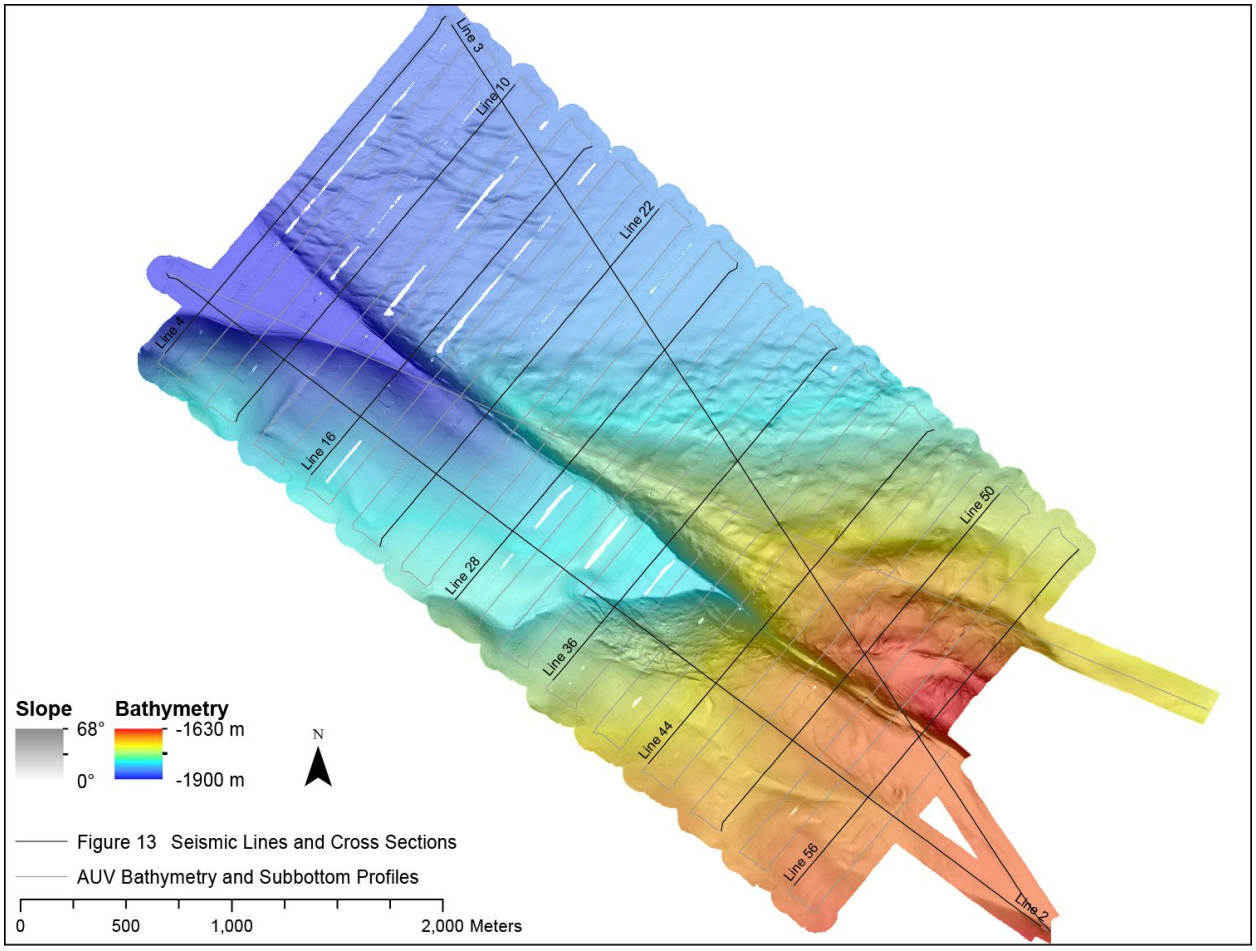


**Figure DR12**: Map of Tile 6, showing location of navigation lines. Line numbers correspond to CHIRP profiles shown in Figures DR13-14.

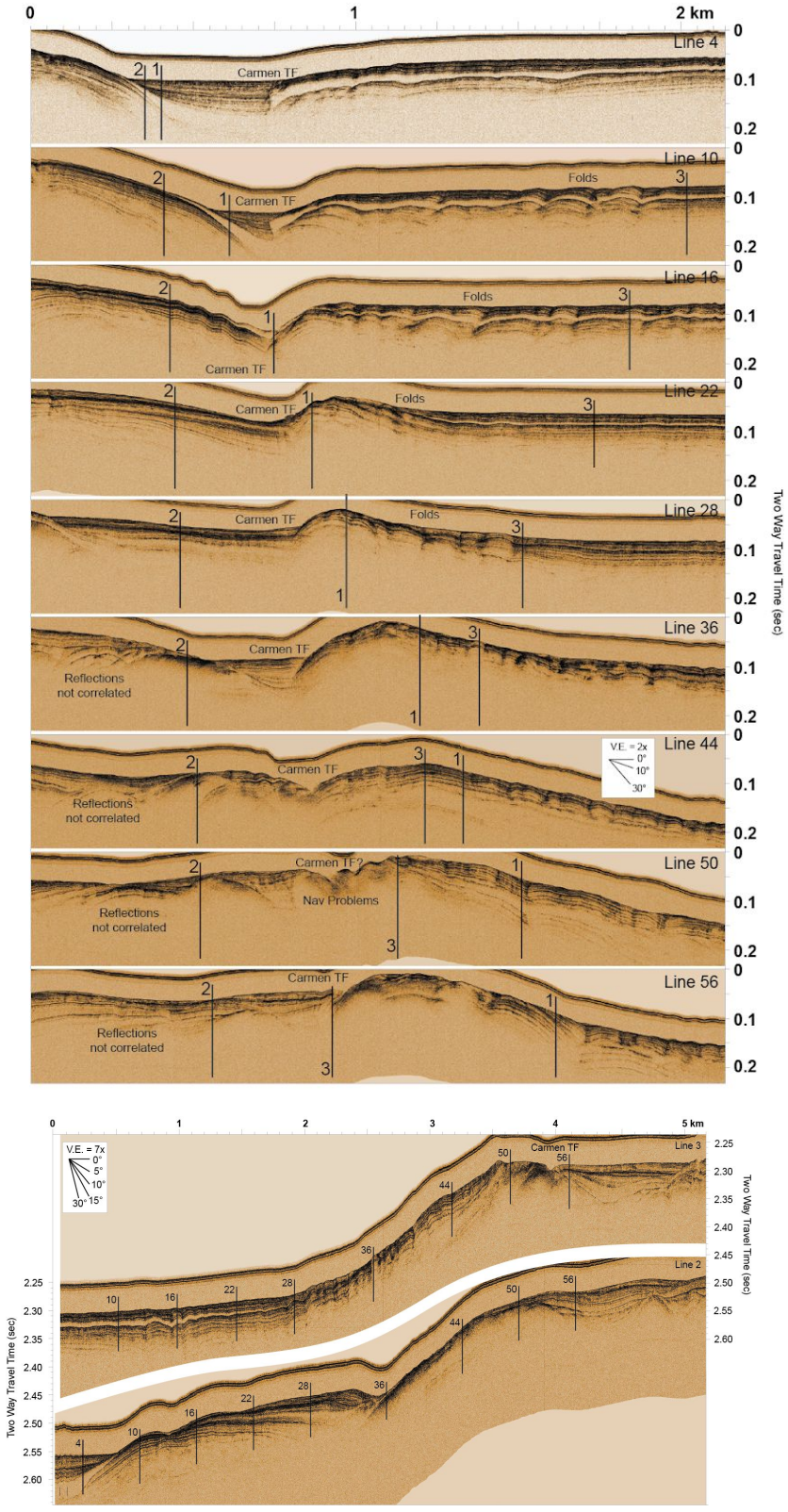


**Figure DR13**: Uninterpreted CHIRP lines from Tile 6, showing location of tie-lines.

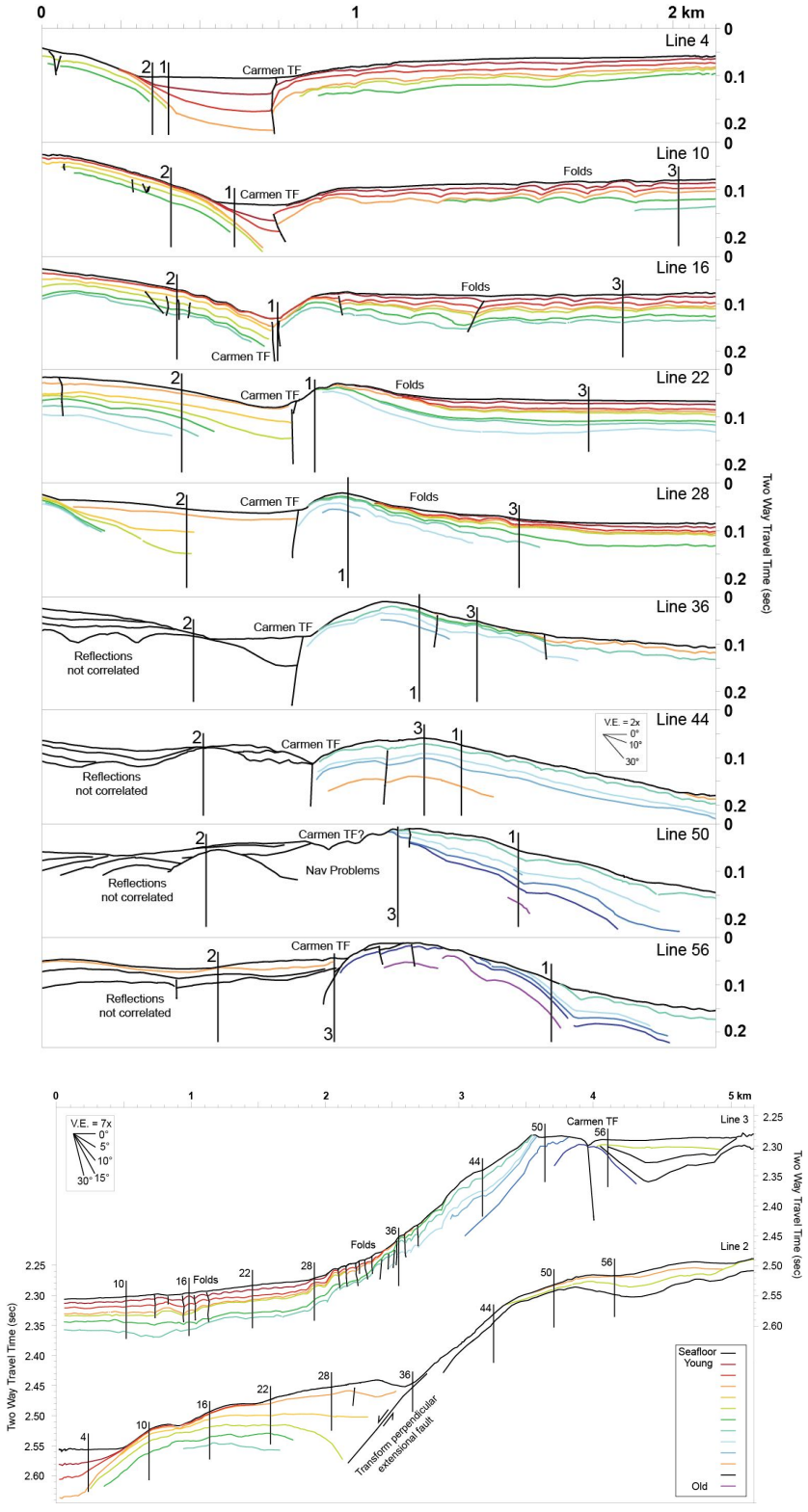


**Figure DR14**: Interpretation of reflectors imaged in CHIRP lines from Tile 6 (Figure DR13).