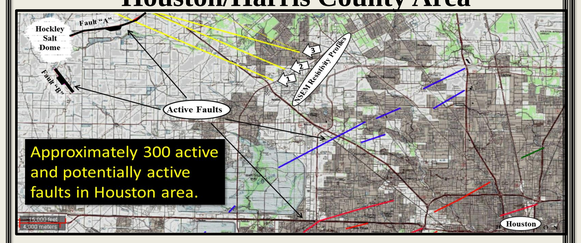
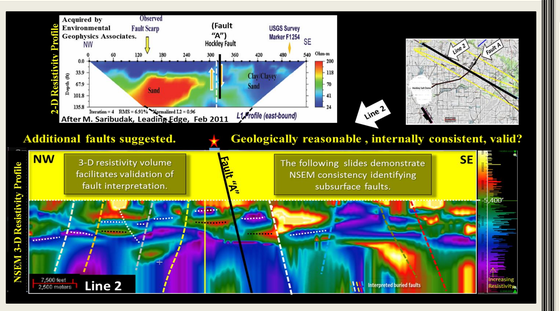
Mapping Subsurface Faults with Lightning and Resistivity

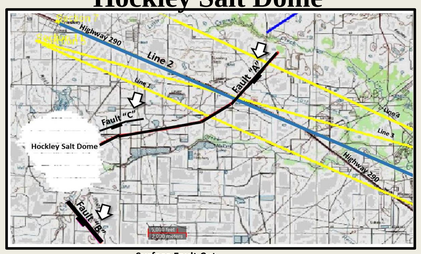
1 Active Faults Houston/Harris County Area

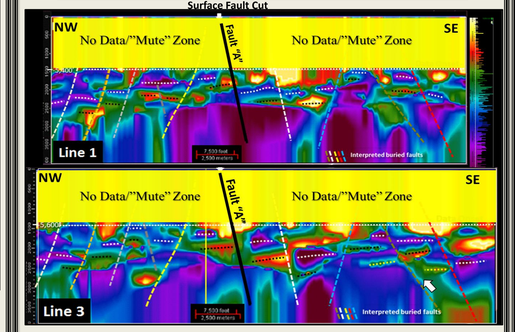




Subsurface fault interpretation of Fault "A" on NSEM apparent resistivity (lower image) is validated by tie to surface fault trace on 2-D resistivity imaging (white arrow, upper image). Resistivity profile provided by Mustafa Saribudak of EGA.

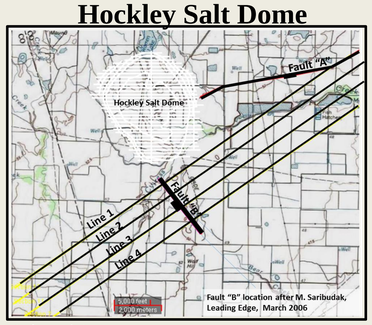
2 Radial Fault "A" Hockley Salt Dome

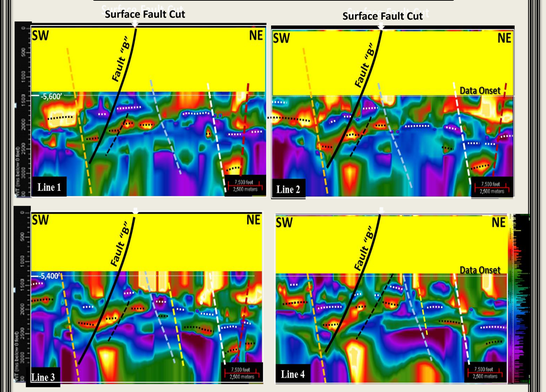




Hockley Fault "A" identified in subsurface on two arbitrary NSEM apparent resistivity profiles. Both fault interpretations validated via tie to surface fault trace.

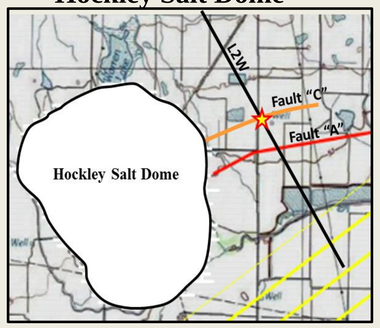
3 Radial Fault "B" Hockley Salt Dome

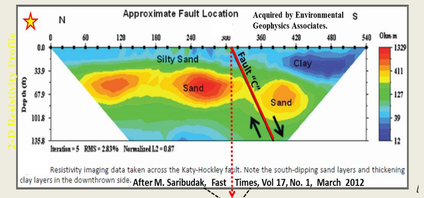


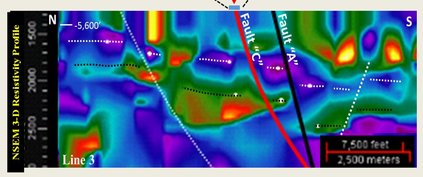


All four NSEM profiles reveal presence of active Fault "B" validated at surface.

4 Radial Fault "C" Hockley Salt Dome

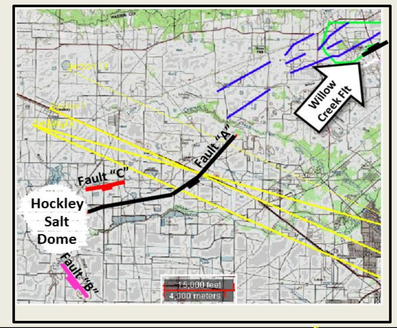


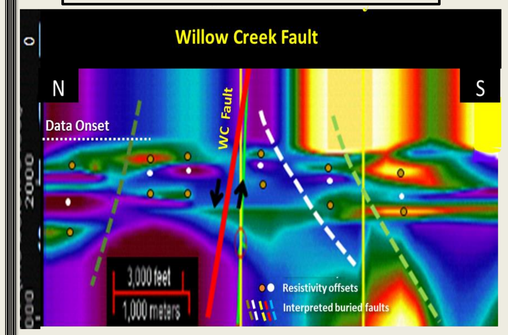




This NSEM profile shows both Faults "A" & "C".

5 Willow Creek Fault Northwest Houston





Another active fault in NW Houston (FM 249, south of Tomball) was clearly identified with NSEM resistivity.

<u>Panels 1-2:</u> The same nine color-coded faults can be identified on all three lines . NSEM demonstrates internal interpretive & structural consistency & an ability to map faults at the prospect level. Of the twenty faults displayed on these three profiles, nineteen are defined by two resistivity layer offsets & one fault is defined by three (see white arrow line 3). 3-D NSEM enables structural & fault plane mapping for comprehensive interpretive quality control, similar to seismic interpretation.

<u>Panel 3:</u> shows consistent fault criteria on all four profiles._As many as seven faults could be consistently identified on four resistivity profiles spanning 1.5 miles.

<u>Panels 4-5</u>: NSEM apparent resistivity profiles identify two additional active faults that are confirmed by near-surface geophysics. The NSEM resistivity profile intersecting radial Fault "C" also intersects Fault "A" shown in panels 1 & 2 and confirms NSEM's ability to reliably identify faults. Both panels , along with the first three, show how NSEM could be used to map subsurface structure.

<u>Observations</u>

- **3-D NSEM resistivity data was able to tie surface faults and extend fault interpretations to deeper than 5,600'.**
- **3-D NSEM fault criteria was credible and at least as good as conventional 2-D resistivity imaging.**
- **In most cases NSEM fault criteria was based on the offset of at least two resistivity layers.**

<u>Hockley Fault Conclusions</u>

- **3-D NSEM resistivity can be interpreted similar to 3-D seismic data to build structural frameworks.**
- **It can be integrated with & calibrated to other near-surface & potential field geophysical data to expand the depth & aerial extent of investigated areas.**
- **NSEM is scalable – providing reconnaissance data in support of exploration or it can focus on specific faults & electrical rock properties in support of development drilling projects.**