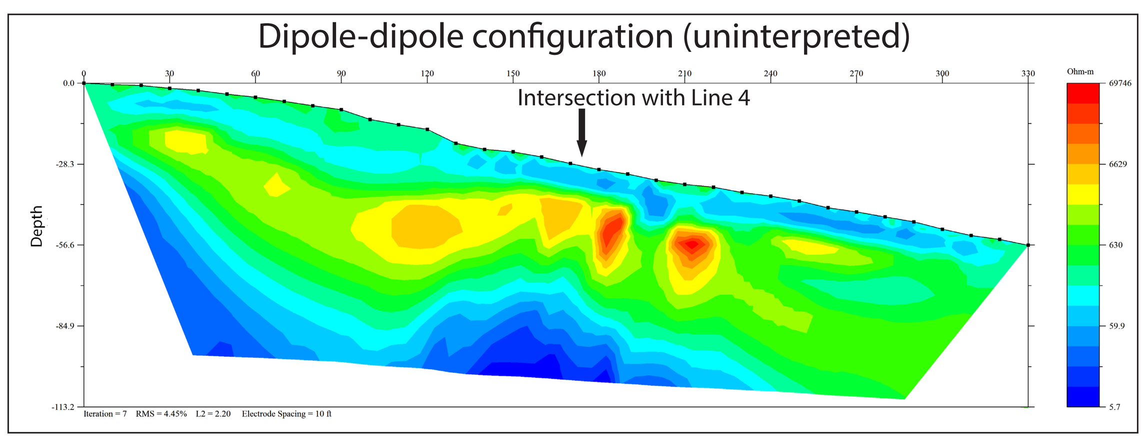
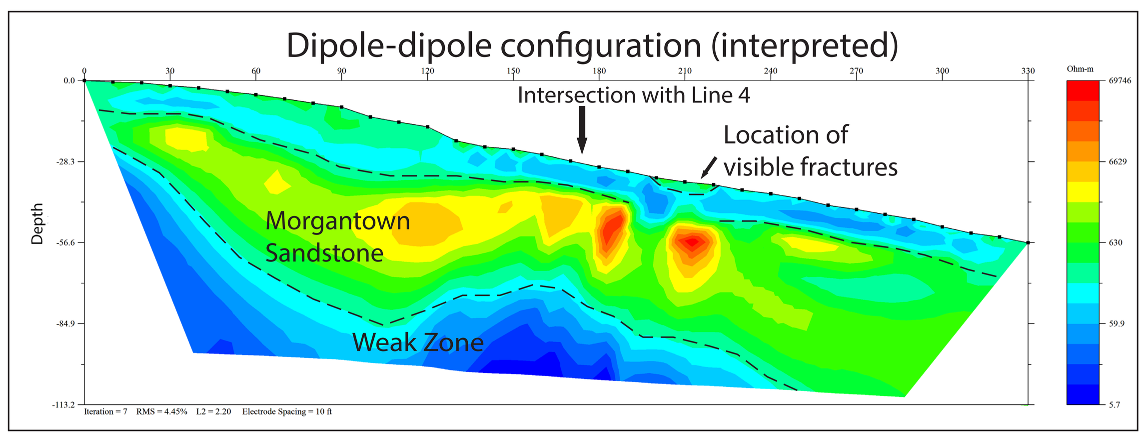
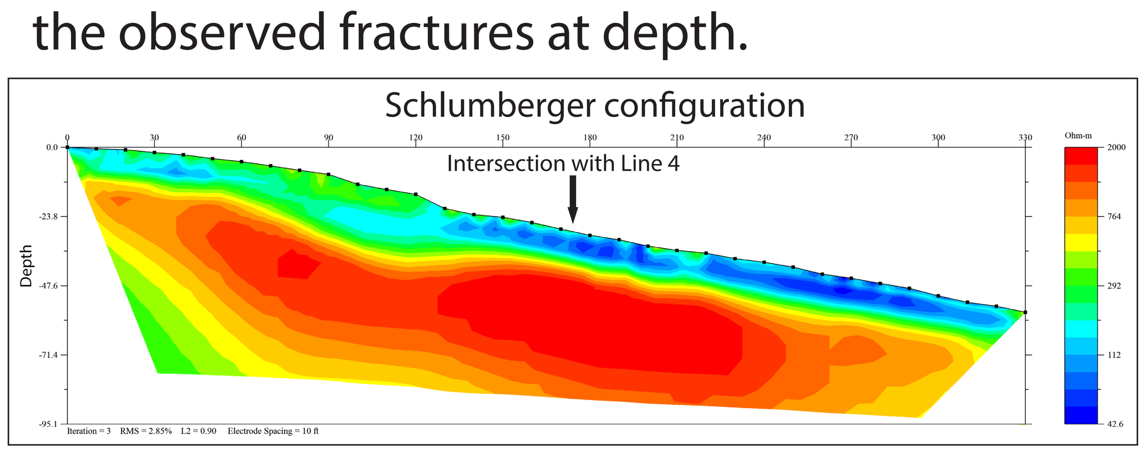
Line 2: Transverse, upper slope

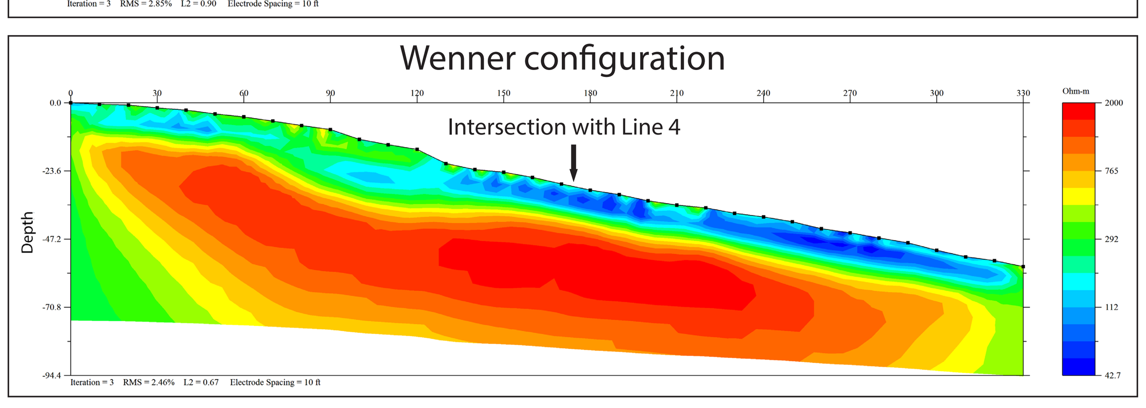
← SW NE →



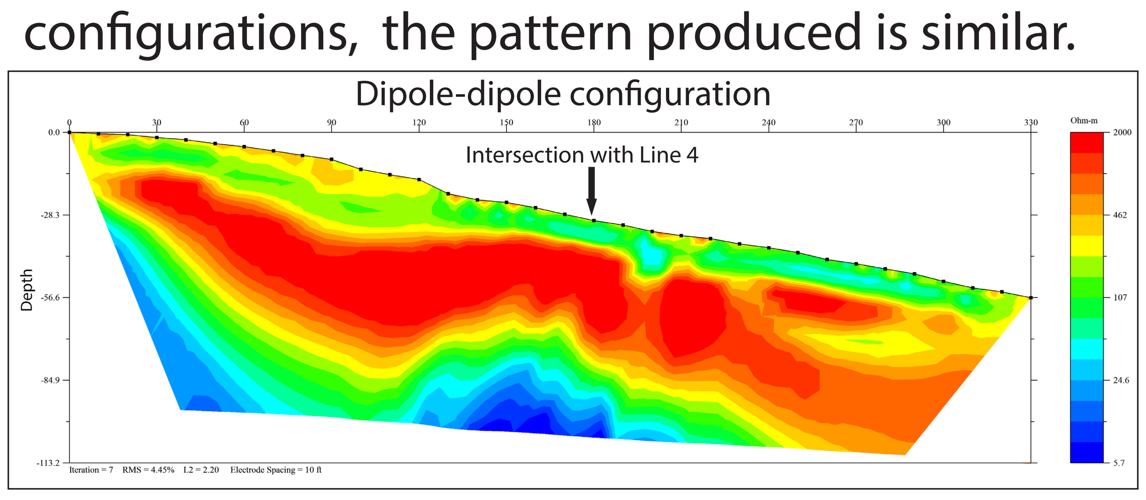


- Survey line oriented parallel to exposed Morgantown Sandstone main headscarp.
- Medium resistivity layer in middle we interpret as Morgantown Sandstone that has detached and moved downslope.
- Deeper, undulating surface with lower resistivity values likely represents the weak zone.
- Large, air-filled fractures observed at surface correspond with a higher resistivity shallow anomaly at the surface.
- Two spherical high resistivity anomalies within the Morgantown Sandstone may be related to lithologic inhomogeneities or to the presence of the observed fractures at depth.



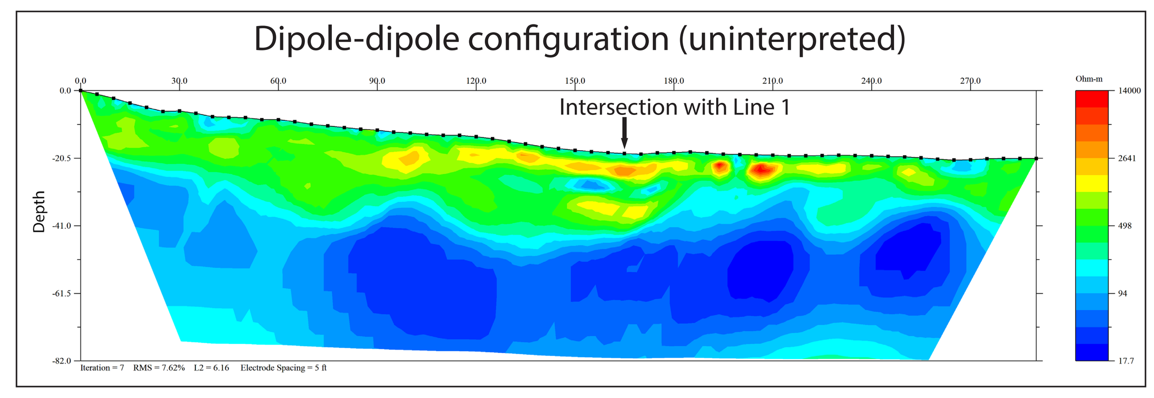


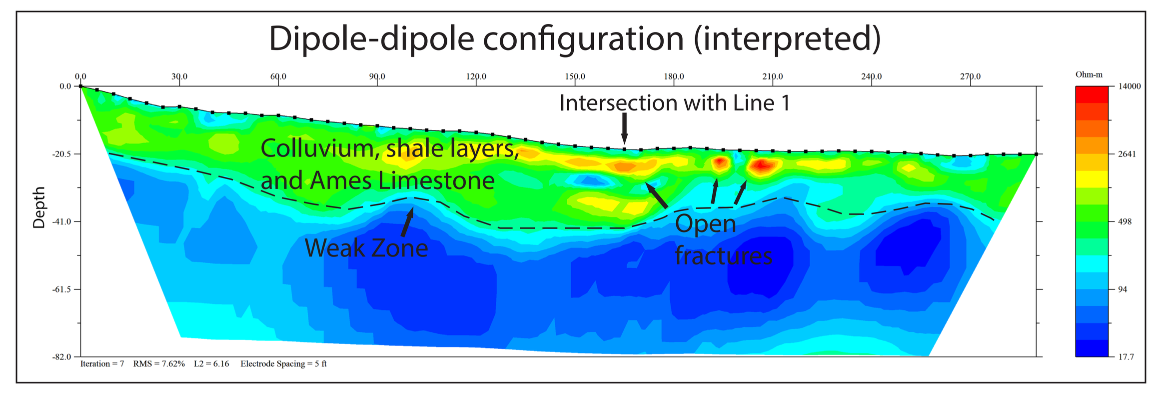
- Schlumberger and Wenner configurations (above) are less sensitive to lateral variation in a more lithologically homogenous transect. Instead, these array types show a single, central high resistivity feature relating to the relatively uniform Morgantown Sandstone.
- Decreased lateral sensitivity could also be exaggerated by a larger electrode spacing.
- Note below, if scale on dipole-dipole configuration is changed to more closely reflect the scales of the Schlumberger and Wenner configurations, the pattern produced is similar.



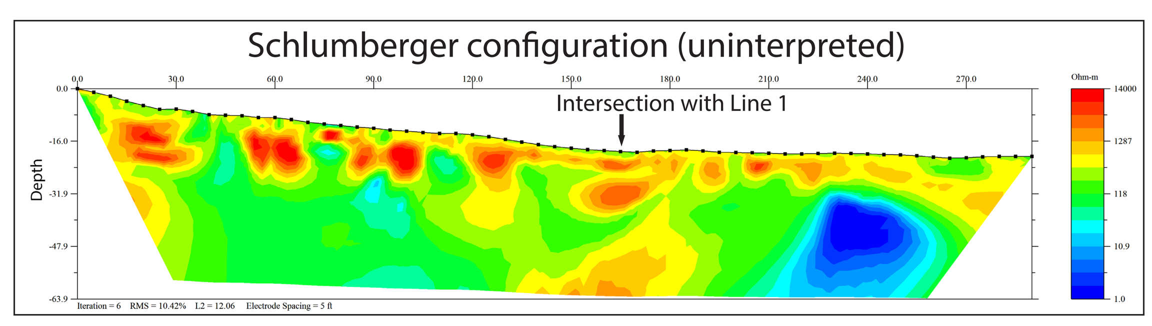
Line 3: Transverse, lower slope

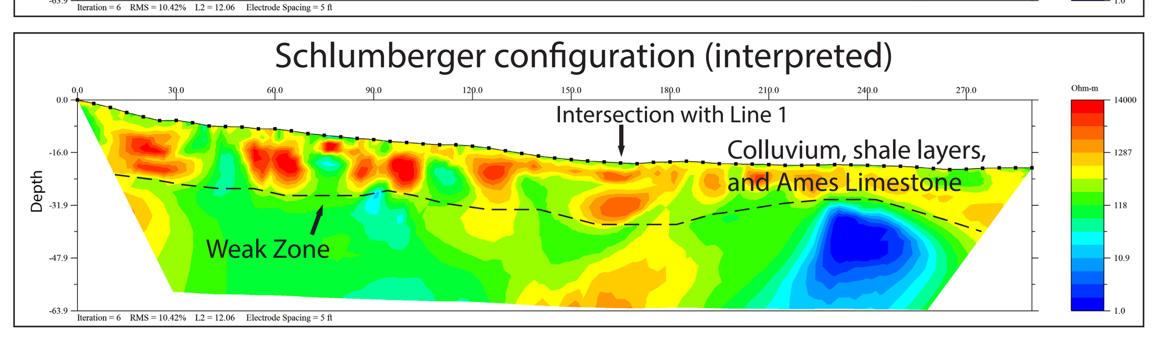
← NE SW →



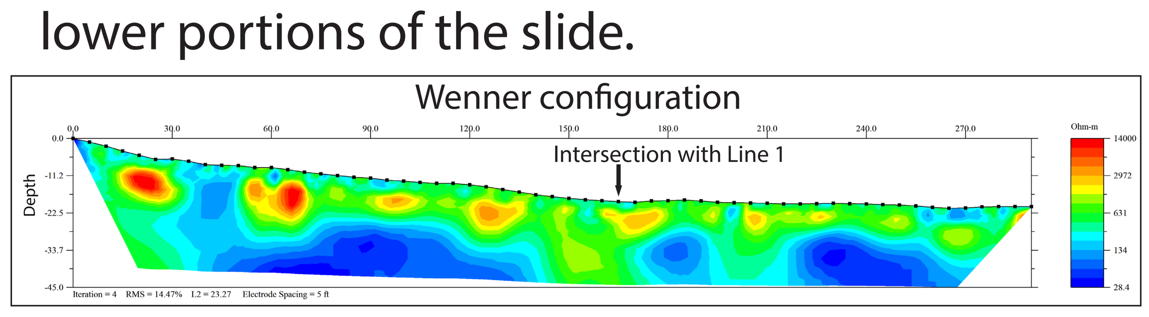


- Several deep, open fractures and wide, shallow depressions were observed at the surface.
- The medium resistivity upper layer we interpret as a geoelectric unit consisting of colluvium, thin shale layers, and Ames Limestone.
- The deeper, low resistivity zone most likely corresponds to Pittsburgh red beds within the "weak zone". Pittsburgh red beds are exposed along this section of I-79.
- This layer may also have a higher water content, contributing to lower resistivity values.





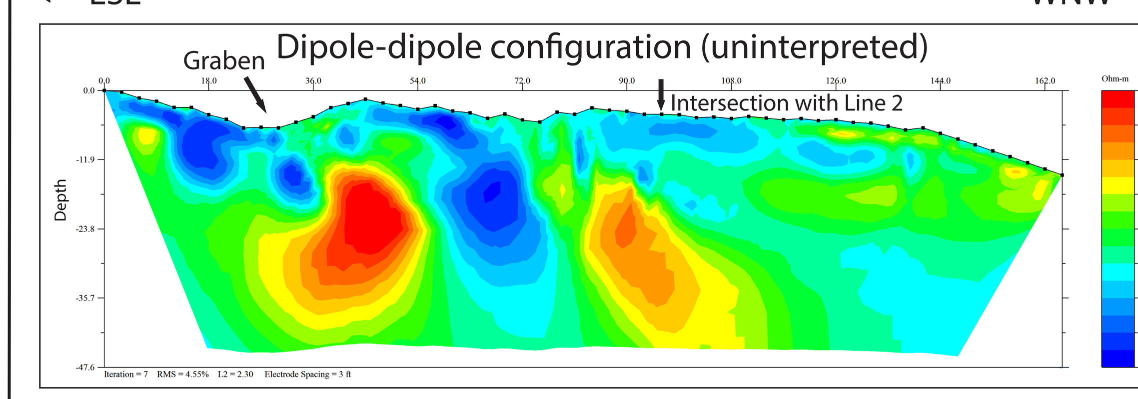
- Patterns of shallow, high resistivity anomalies in the Schlumberger (above) and Wenner (below) configurations are prominent, yet are more coarsely resolved. This is most likely a result of the vertical nature of the features being imaged.
- A large, rounded, low resisitivity anomaly is apparent towards the southwest, which may represent a greater amount of water in the strata here, as springs are known to have existed in the lower portions of the slide.

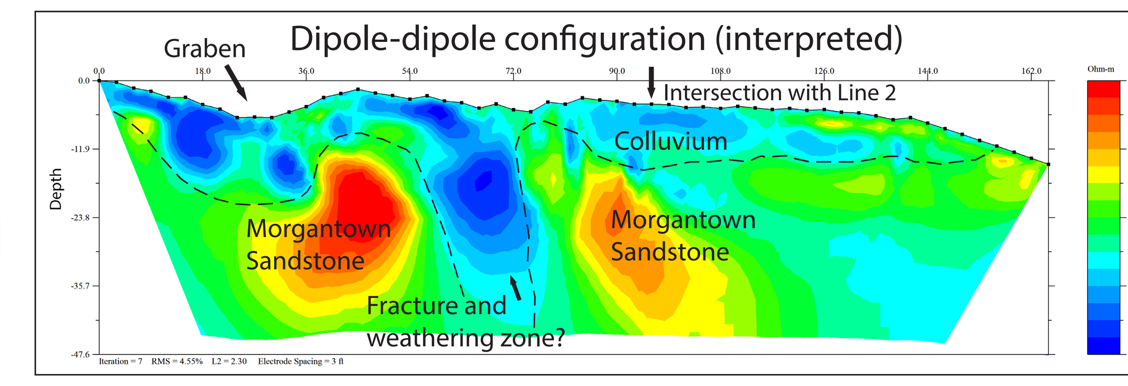


- The Wenner configuration captured the same overall trend, including the red beds, but was most limited in depth.

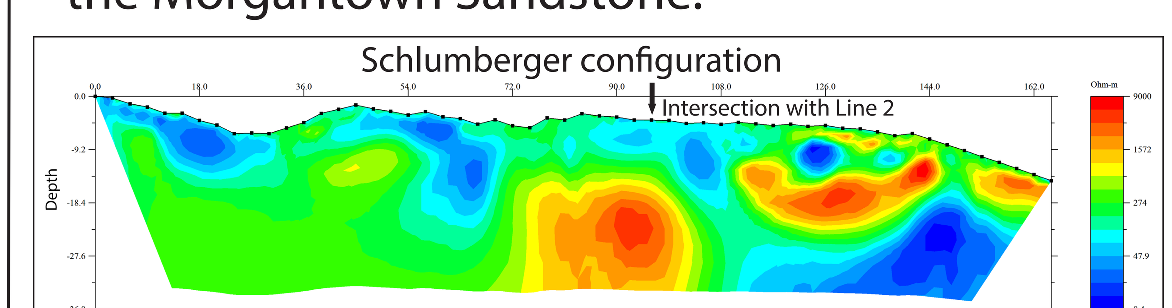
Line 4: Longitudinal, upper slope

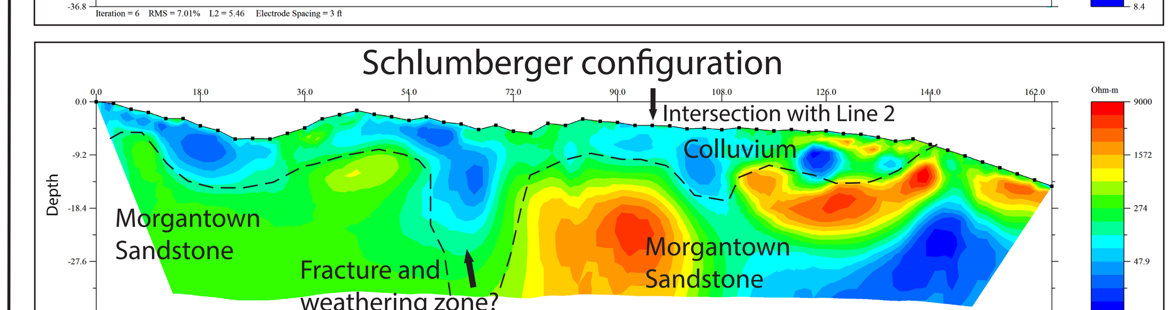
← ESE WNW →

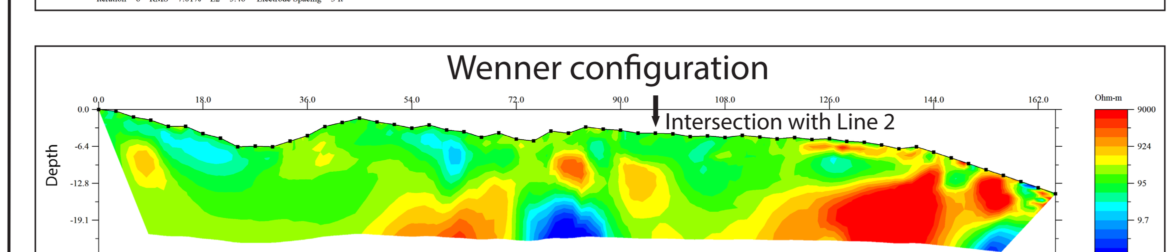




- Southeast end of survey line is near edge of Morgantown Sandstone main headscarp. Northwest end of line is near a secondary scarp.
- Large high resistivity feature directly beneath horst-like feature we interpret as detached Morgantown Sandstone.
- A second high resistivity feature is also Morgantown Sandstone underlying line 2.
- Between the Morgantown Sandstone is a low resistivity zone that we interpret as possibly a vertical fracture along which weathering and associated mineralogical changes occurred.
- The thin low resistivity layer at the surface is colluvium and/or variable thin units of lithologies overlying Morgantown Sandstone, which is exposed at the northwest end of the line at the secondary scarp.
- The low resistivity area near the northwest end of the line may be related to increased moisture or the interfingering of smaller shale units within the Morgantown Sandstone.







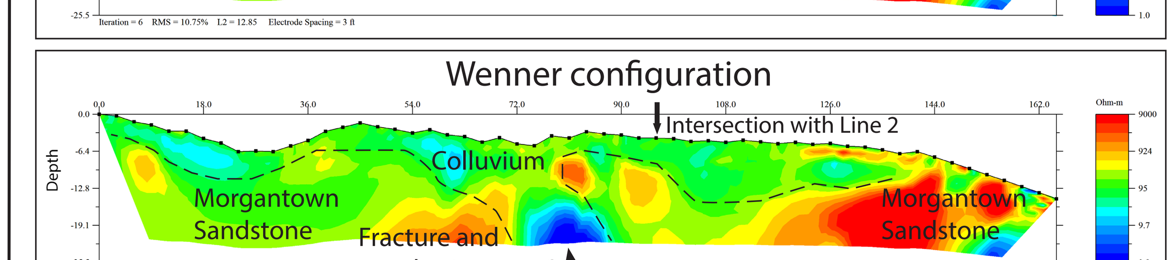


Figure 7. Panoramic view of Morgantown Sandstone head scarp and adjacent graben-like feature.

Conclusions

- Resistivity surveys captured the rockslide weak zone, the inferred failure surface.
- Resistivity profiles confirmed the presence of large, rotated blocks of Morgantown Sandstone that moved downslope away from the head scarp.
- Dipole-dipole configuration images to greater depth and is more sensitive to lateral variation. Schlumberger and Wenner configurations better highlight shallow features.
- ER surveys can cover large areas in a short period of time, and reach parts of the landscape that may be inaccessible to vehicles and heavy machinery, all of which is important to studying geologic hazards.
- Acquiring ER profiles with several different electrode configurations aids interpretation in the following ways:
  - Allows cross-checking of interpretations from one configuration against another, especially useful for determining whether anomalies are real or artifacts.
  - Mitigates problem of nonunique solutions to geophysical data, especially where alternative datasets are rare, limited, or unavailable.
  - Examination of differences among inversion profiles spurs further investigative questions.

Future Questions

- What is the morphology of the fractures at depth? How might they interact with the weak zone below, particularly as a conduit for infiltration?
- What are the temporal variations in moisture conditions within the open fractures and within the weak zone?
- What interpretations and conclusions are most useful for future geotechnical investigations?

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