ABSTRACT

The Quaternary glacial and interglacial cycle controlled the drainage system in the Northern Mississippi Embayment by draining the melt-water from retreating Laurentide ice sheet through midcontinent. The Mississippi River changed from the braided system during the initial glacial cycle to the meandering system during the Holocene. The advance and retreat of the ice sheet caused the avulsion of Mississippi River for a couple of times and created Pleistocene river terraces both in Western and Eastern Lowlands. These Pleistocene terraces of Eastern Lowland were used as a geomorphic marker for the evaluation of Pleistocene and Holocene deformation. The topography of this area is mostly flat. High-resolution LiDAR imagery of the terrace surfaces was analyzed to collect elevation data, and high order polynomial surface was constructed to look for subtle deformation on top of the terraces. From the third-order polynomial surface of Sikeston, the tectonic bulge of Lake County uplift can clearly be identified.

INTRODUCTION

• Exhibits intraplate seismicity (New Madrid Seismic Zone)
• No recognized significant surface expression of tectonics except Reelfoot fault scarp.
• Thick alluvial sediments covering the area.
• Seismic energy release recorded since 1811-1812 series of earthquakes.
• High resolution LiDAR dataset from USGS (1m and 10m).

BACKGROUND

Location

- West of the east of Mississippi Embayment
- Situated north-eastern Arkansas, south-eastern Missouri, and north-western Tennessee, south-eastern Kentucky, west of Mississippi
- East of the Crowley’s Ridge

Tectonic Setting

- Reelfoot Rift, a failed rift graben lies in Eastern Lowland
- Bounded by Eastern Reelfoot Rift Margins to the east, Western Reelfoot Rift Margins to the west
- New Madrid Seismic Zone
- New Madrid North fault (NMNF) does not show deformed surface on Sikeston Ridge.
- Reelfoot North thrust probably deforms Sikeston at its southwestern corner.

Surface and subsurface faults

- New Madrid North thrust probably deforms Sikeston at its southwestern corner.

Pleistocene Terraces

- Formed throughout last glacial cycle
- Due to meltwater discharge fluctuation and route diversion (Rittenour, 2007)
- Ages range from 64 k to 11 k
- Terraces deviate from expected non-tectonic geomorphology (concave upward) due to tectonics.
- Terraces deviate from expected non-tectonic geomorphology (concave upward) due to glacial sedimentary processes.

METHODOLOGY

The 1m USGS LiDAR Data Elevation Model (DEM) of the Eastern Lowlands has been used to crop out the luminescence-dated Sikeston terrace for analysis. Shapefiles of the terrace boundary were created from the terrain map from Rittenour (2007). The cropped terrace raster contains spatial references as well as the elevation data of the terrace surface. The converting tool was used to convert the raster files to ASCII files in ArcMap. ASCII files created earlier have been transformed into Comma-Separated Values (CSV) format using MATLAB script to construct a polynomial surface (Figure 8). The polynomial surface of the terrace is used to analyze the general trend, and subtle deformation of the Sikeston terrace was identified by comparing the topographic profiles with polynomial surface profiles.

RESULTS

- New Madrid North fault (NMNF) does not show deformed surface on Sikeston Ridge.
- Reelfoot North thrust probably deforms Sikeston at its southwestern corner.

REFERENCES

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