MISSISSIPPI MINERAL RESOURCES INSTITUTE
UNIVERSITY OF MISSISSIPPI
SCHOOL OF ENGINEERING

GEOLOGIC MAPPING OF THE CHARLESTON MISSISSIPPI 7.5 MINUTE QUADRANGLE AND RESOURCE ANALYSIS OF PRE-LOESS GRAVEL

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INTRODUCTION

This project resulted in the training of a student to perform geologic mapping of the Charleston Quadrangle, produced a 1:24,000 scale surficial geologic map, and performed a preliminary resource evaluation of the pre-loess gravel reserves in the quadrangle (Figure 1). These gravels are important because sand and gravel makes up the largest portion of the non-fuel mineral commodity production in the state of Mississippi. Sand and gravel deposits are needed for construction and industry. These deposits typically range from 0 to 20 meters thick, but locally can be up to 35 meters thick. Mapping was conducted by compiling existing research for the study area, and using basic field mapping techniques that included sample collection, outcrop descriptions, paleocurrent measurements, shallow borehole drilling, as well as using ground penetrating radar (GPR), and the date were compiled using digital mapping techniques in the ArcGIS software platform. Cores were also drilled for the project using the MMRI Giddings drill. Field work was primarily done June 2019 through June 2020, and included numerous trips to the Charleston quadrangle.

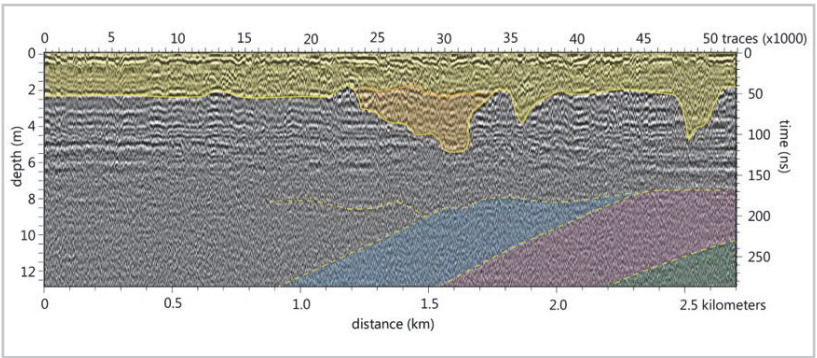

Figure 2. Image of an alluvial fan from a GPR radargram.

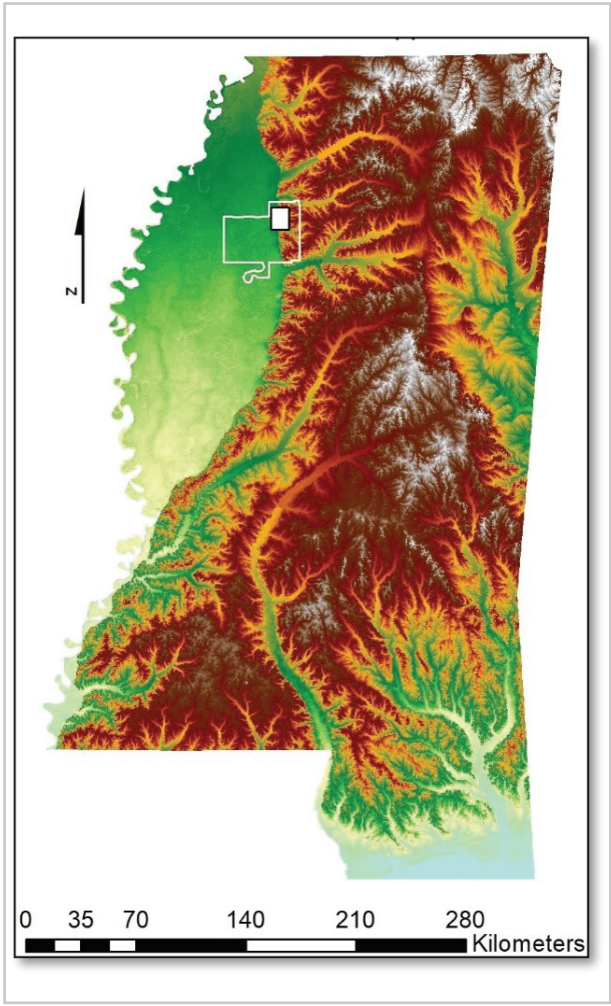

Figure 1. Mapping area shown on a digital elevation model of Mississippi

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Gravel Deposits in the Quadrangle

The gravel, regionally known as Pre-Loess terrace deposits, is discontinuous throughout the uplands in the Charleston Quadrangle. This investigation revealed the gravel is thickest in the northern half of the quadrangle, and towards the central of the quadrangle the gravel appears to be missing, likely from erosion, and in its place is sand and interlayered clays of the Kosciusko formation.

MMRI students measure a section of gravel and collect samples for laboratory analysis.

Typically, there is about 3 to 8 m of loess overlying the upland gravel deposits. The Hornet Hill location has about 5.5 m of loess overburden and about 5.5 m of gravel, with an unknown depth of sand below. At the Logan Quarry, the overburden ranges from about 3-5 m of loess and about 7-24 m of gravel. The sieve analysis for the Hornet Hill gravel sample resulted in 47% by weight larger than the No. 10 sieve, or coarse aggregate, and 53% by weight passing the No. 10 sieve, or fine aggregate. Based on the sieve results, the gravel classifies under fine aggregate (ASTM C33), cold bituminous pavement binder C and surface D, and within gradation classes 3-10. These classifications are from section 703 in the Mississippi Standard Specifications for Road and Bridge Construction (2017). These classifications allow use of the the gravel as fine aggregate in concrete cement, as a drainage/filtration medium, pea gravel, or as aggregate for cold bituminous pavement. Drainage medium is typically used for erosion control or in driveways or non-paved roads. Pea gravel is typically used in playgrounds or in decorative landscaping. Cold bituminous pavement is used in patchwork on less trafficked highways.

Using the average thicknesses of 5.5 m and 7 m for loess overburden and gravel, respectively, provides a stripping ratio for the quadrangle of 1:1.22. Ideally, one would need an average gravel thickness of 10 m and an area of at least 10 hectares (100,000 m^2) to mine the gravel profitably.