Geophysical Characterization of Mississippian Carbonates of South Central Kentucky and Northern Tennessee

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ABSTRACT

Use of geophysical tools is one of the best options for collection of subsurface data over broad areas between boreholes or drill wells. Such tools are minimally invasive and applicable in several geologic subdisciplines. Combination of geophysical data with petrofacies and petrophysical data permits the most accurate interpretative view of reservoirs. Instrumentation used in this study includes: Electrical Resistivity Tomography (ERT), Refraction Microtremor (ReMi), and Ground Penetrating Radar (GPR). Testing of the GPR has proven it to be efficient at defining several geological features such as folds and faults, stratigraphic framework (bedding planes), anthropogenic (mining voids), and karst features. Minimally, GPR can be used to define fault zones and possibly fracture zones from the surface down 100 to 200 meters below ground surface. Testing is being conducted at several sites however, the Salem-Warsaw limestone units are the primary focus in this study. These limestones, despite being nearly exposed or exposed at the surface, are nonetheless charged with hydrocarbons. The Salem-Warsaw stratigraphic interval has been an important hydrocarbon producer in the southeastern Illinois Basin and remains prospective today. The oil in place creates a unique opportunity to study these saturated lithofacies in the context of 1) resistivity profiles from nearby wireline logs as well as 2) in the context of ERT profiles generated near the surface. The Salem-Warsaw in the study area is also moderately dissolved, creating karst plain geohazards (flooding, collapse) that are challenging for engineers and city planners. Integration of geophysical and geological data is providing an expanded view of important Mississippian reservoirs and simultaneously is aiding in locating voids or conduits responsible for karst geohazards at the surface.