Paleomagnetism of the Ordovician Ellenburger Group Carbonates and Mississippian Barnett Shale, Fort Worth Basin: Preliminary Results

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The Mississippian Barnett Shale is currently a major U.S. onshore shale gas reservoir and unconformably overlies the extensively karsted and brecciated lower Ordovician Ellenburger Group carbonates throughout portions of the western half of the Fort Worth Basin, Texas. A preliminary paleomagnetic and rock magnetic study was conducted to better understand the nature and timing of diagenetic events in the unit. Samples from three oriented conventional drill cores of the Barnett Shale and from the uppermost Ellenburger Group carbonates were analyzed for their diagenetic and paleomagnetic properties. Thermal demagnetization of samples from both units reveals a low-temperature steeply-downward viscous remanent magnetization (VRM) as well as one of several components that are removed at higher temperatures (200-540°C). The higher temperature components reside in magnetite and are interpreted as chemical remanent magnetizations (CRMs) based on relatively low burial temperatures. Specimens from karst clasts in the Ellenburger contain a CRM with easterly declinations and shallow inclinations that fails a conglomerate test and has an Ordovician pole. This Ordovician CRM is interpreted to be related to relatively early diagenetic processes, perhaps associated with Ordovician dolomitization. Other Ellenburger specimens from near the Ouachita thrust zone contain a component with south-southeasterly declinations and shallow inclinations that has a Late Permian-Triassic pole. The higher temperature CRM in the Barnett has low inclinations and the declinations are scattered along a great-circle track from ~110° to ~180°. The modern VRM was used to re-orient the CRM data for one of the wells and the results conform to the CRM streak of directions. The directions, which show some facies-related control, fall into two groups. The mean directions for the two groups give Late Mississippian-Early Pennsylvanian and Late Permian-Early Triassic paleopoles, respectively. The Late Mississippian-Early Pennsylvanian CRM coincides with significant burial of the unit and is interpreted as forming from burial diagenetic processes. The Late Permian-Early Triassic CRMs in the Barnett and Ellenburger are interpreted as forming from externally-derived fluids that may have migrated from the Ouachita thrust zone.