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COMPARISON OF PERMEABILITY AND GRAIN SIZE DIFFERENCES IN TESUQUE FORMATION DEPOSITS AT THE SANTA FE RIVER AND BUCKMAN WELL FIELD AREAS, ESPAÑOLA BASIN, NEW MEXICO

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In the eastern Española basin, Tesuque Formation sediments were deposited in an alluvial slope environment from streams of various sizes. Recent work demonstrates that a larger, westward-flowing drainage system deposited relatively coarse-grained channel sediments (called lithosome S) in the vicinity of the Santa Fe River and northwards to roughly the latitude of Tesuque Pueblo. Lithosome A was deposited north of lithosome S by relatively smaller drainages exiting the granite-cored Sangre de Cristo Mountains to the east. Near the Buckman well field, distal lithosome A interfingers with fluvial sediment deposited by a broad, southward-flowing axial river (SAR). Previous measurements of hydraulic properties for channel deposits in lithosome A and SAR show that permeability and grain size vary with magnitude of flow and are essentially bi-modal: high-permeability channel sands and gravels are interbedded within thick beds of low permeability silty, fine-grained sand. We present and compare new measurements of hydraulic properties for lithosome S, lithosome A, and SAR deposits, and discuss implications regarding aquifer yield at these two different areas.

Lithosome A and SAR were characterized by conducting a permeability – grain size transect along the deposits exposed in the west-flowing arroyo immediately south of Buckman Mesa, in the northern Buckman well field. Lithosome S deposits were characterized along a three mile reach of the Santa Fe River in the City of Santa Fe and the Village of Agua Fria, which are near several city water supply wells. Selected outcrops at both areas were mapped and photographed. In situ permeability measurements were collected on a 2 m² grid using a portable air mini-permeameter at each selected outcrop. Grain size distributions were determined by sieving following air permeability measurements.

Our results reveal that permeability is relatively greater in lithosome S deposits compared to lithosome A and SAR deposits in the northern Buckman well field. Lithosome S deposits are typically coarser grained and have larger mean and maximum permeability values than the Buckman area deposits. A notable exception is a coarse, upper unit of lithosome A, which was the coarsest-grained unit studied but has lower permeability than the coarsest lithosome S deposits. We observed in lithosome S several sizeable channel deposits that are greater in width and thickness values than typical lithosome A channels at Buckman. The large clast sizes in the lithosome S channels precluded air permeability measurements with our instrument; however, these coarse lithosome S channels are likely to have the greatest permeability of any of the Tesuque sands and gravels we studied. Unlike most gravel channels at the distal lithosome A outcrops, the lithosome S channels are poorly cemented. If the outcrops studied are representative of subsurface conditions, lithosome S deposits are significantly better aquifer material than the Tesuque deposits at the Buckman well field given the observed differences in grain size distributions, cementation, and permeability.