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Geologic and Hydrogeologic Framework of the Española Basin -- Proceedings of the 3rd Annual Española Basin Workshop, Santa Fe, New Mexico, March 2-3, 2004

Mark R. Hudson, editor

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INTRODUCTION

By Mark R Hudson

This report presents abstracts of technical studies that pertain to the hydrogeologic framework of the Española basin, a major subbasin of the Cenozoic Rio Grande rift. Sediments and interbedded volcanic rocks that fill the Española basin comprise an aquifer system that is currently the primary source of water for most residents of the basin, including people in the cities of Santa Fe, Española, and Los Alamos as well as Native Americans in eleven Pueblos.

The abstracts describe results of technical studies that were presented either as poster exhibits or oral presentations at the third annual Española basin workshop, held March 2-3 of 2004 in Santa Fe, New Mexico. The principal goals of this workshop were to share information from ongoing studies and to seek input on important topics for further study.

The Española basin workshop was hosted by the Española basin technical advisory group (EBTAG) and sponsored by the U.S. Geological Survey, the New Mexico Bureau of Geology and Mineral Resources, Los Alamos National Laboratory, and the City of Santa Fe. The abstracts have been grouped into 6 information themes. Members of EBTAG developed five themes: Basic Water Data, Water Quality and Water Chemistry, Three-Dimensional Hydrogeological Architecture, Water Balance and Stream/Aquifer Interaction, and Data Integration and Hydrologic Model Testing. For details on these themes see http://climchange.cr.usgs.gov/ebtag/Espwk3_themes.html. A sixth theme, Geologic Framework, concerns geologic studies that provide background to the other themes, particularly the Three-Dimensional Hydrogeological Architecture.

Abstracts in this report submitted by U.S. Geological Survey authors have had their technical content peer reviewed before they were included in the report. There was no technical review requirement for abstracts submitted by non-USGS authors (although many did receive peer or agency review). Taken together, the abstracts in this report provide a snapshot of the current status of hydrogeologic research within the Española basin.

LITHOSOME S OF THE TESUQUE FORMATION: HYDROSTRATIGRAPHIC AND TECTONIC IMPLICATIONS OF A NEWLY DELINEATED LITHOSOME IN THE SOUTHERN ESPAÑOLA BASIN, NEW MEXICO

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Sedimentologic investigation of the Tesuque Formation in the southern Española basin supports the designation of a new lithosome called lithosome S. It is characterized by extensive channel deposits of pebbly sand with subordinate sandy gravel and sand. Floodplain deposits are present but comprise less than 5% of the strata observed in outcrop; however, these may become more abundant down-dip in the subsurface. The main differences of lithosome S ("S" standing for Santa Fe) compared to lithosome A (established by Cavazza, 1986) to the north are: 1) composition, 2) its paucity of silty sandstone extra-channel deposits, 3) its weaker consolidation and lesser degree of cementation, and 4) channel geometries. Lithosome S channels are stacked and generally comprised of thin, lenticular to broadly lenticular to planar beds with only minor ribbon forms; lithosome A channels are commonly thicker and have more discrete ribbon-like forms interbedded in extra-channel sediment. Whereas the gravel in lithosome A is typically greater than 90% granite south of the Santa Cruz River (with the remainder being quartzite and yellowish Paleozoic siltstone), lithosome S generally contains 35-65% granite, 10-30% Paleozoic clasts, 10-25% quartzite (including a distinctive black quartzite), and 1-5% chert. The sand fraction of lithosome S differs from lithosome A in that it has minor Paleozoic grains (estimated at 1-7%) and trace-2% chert and dark quartzite grains; these are much less abundant in lithosome A. Lithosome S grades laterally northward into lithosome A (over a distance of about 2 km) west of Tesuque Pueblo and just north of, and paralleling, the Rio Tesuque east of Tesuque Pueblo. Lithosome S grades upward into lithosome A (age of contact is ~13-14 Ma) north of Arroyo Calabasas. Near the mountain front, lithosome S is gradationally underlain by lithosome A (interpreted to be 25-28 Ma), which in turn is underlain by the Bishops Lodge Member (BLM) of the Tesuque Formation. Northeast of Bishops Lodge, the BLM is underlain by, and interfingers with, ~400 m of strata somewhat similar to lithosome S; these lower strata, however, differ from lithosome S above the BLM in that they have less than 5% quartzite and no or trace chert.

Lithosome S is significant for both geohydrologic and paleotectonic reasons. Its overall coarseness, channel connectivity, and lesser cementation likely make it a more productive aquifer than lithosome A. Lithosome S was deposited on an alluvial slope by a relatively large drainage that is interpreted to have crossed the present-day divide of the Santa Fe Range, so that it was sourced in the headwaters of the modern Pecos River. The tongue of lithosome A (thinning to the south) between the Bishops Lodge Member and lithosome S may represent uplift of the Santa Fe Range at approximately 26-29 Ma, during which the drainage depositing lithosome S was likely diverted to the south as the hanging wall of the Española basin bowed upwards. Lessening of uplift rates, perhaps combined with stream piracy, allowed the drainage associated with lithosome S to shift back to north of Arroyo Hondo. Comparison of the thickness of a measured interval of lithosome S along the Santa Fe River with an interpreted correlative section in the Yates #2 well differs by approximately 300-400 m (with a lower value in the well). This suggests that the structural high on which the well is situated was uplifted, at least in part, in the early to middle Miocene.