### Lithologic and hydrologic characteristics of Tesuque Formation piedmont deposits in the Santa Fe area, N.M.

### Daniel Koning, Peggy Johnson, and John Hawley





# Santa Fe Group

- Definition (Spiegel and Baldwin, 1963): Sediment and intercalated volcanic flows that fill the Rio Grande rift above the extensive Oligocene-age intermediate-felsic volcanic rocks (Espinaso Fm)
- Constitutes the basin-fill for the Española basin
- In Española basin east of Los Alamos, strata generally dip to west and exposed strata becomes younger to west



Quaternary deposits not shown

### West-east cross-section at the latitude of Buckman



NE-SW cross-section ~1 mile south, and parallel to, Arroyo Hondo

# Santa Fe Group near S.F.

 Age: 26 Ma to 1.5 Ma (Baldridge et al., 1980; Koning et al., 2002; Koning, 2013)

 Two formations: Ancha Formation that overlies the Tesuque Formation (Galusha and Blick, 1971; Spiegel and Baldwin)



## Subdividing the Santa Fe Group

- Formalized members up north are difficult to recognize south of Tesuque Pueblo.
- Lithosome nomenclature, expanded from Cavazza (1986), provides a hydrologically relevant way of subdividing the Tesuque Fm. Lithosomes are relatively uniform and distinctive bodies of sediment that intertongue with one another.
- Lithosomes correspond to unique paleo-drainage systems in the Santa Fe area.

### **Tesuque Formation Lithosomes**







Lithosomes A, S, and E were deposited in specific paleodrainage system tracts.

A marked coarsening of sedimentation occurs at 13.2-13.0 Ma; this coarser, younger sediment correlates to the Chamita Fm west of the Rio Grande

### **Tesuque Formation Lithosomes - lower-middle A**





Coarse lower-middle lithosome A (media proximal alluvial slope)

Muddy very fine to very coarse sand with minor silt and clay beds

Greater than ~15% coarse channel sediment; ribbon to broadly lenticular beds

Sand is arkosic; gravel dominated by granite with <2% Paleozoic clasts and <3% quartzite clasts

Color: Pink to light brown to very pale brown



## Fine lower-middle lithosome A (distal alluvial slope)

- Silty very fine- to medium-grained sand with subordinate silt and clay beds
- Coarse channel sediment generally minor; ribbon to broadly lenticular beds
- Gravel dominated by granite with <2% Paleozoic clasts and <3% quartzite clasts
- Sand is arkosic
- Color: light brown to pink





### **Tesuque Formation Lithosomes - finer and coarser S**



# Lithosome S



fault zone

View to approx. north



## Lithosome S clast composition





# Coarse sediment near fan axis and near mtn front





Pebbly sand and sand channel deposits with minor clay and silt beds Channel complexes are very thick and possess very thin to medium, planar to lenticular internal bedding Sand is arkosic Reddish color Gravel is composed of granite with 3-40% Paleozoic clasts and 5-30% quartzite

## **Coarser lithosome S (ancestral Santa Fe River)**

Pebbly sand and sand channel deposits with minor clay and silt beds

Channel complexes are very thick and possess very thin to medium, planar to lenticular internal bedding

Sand is arkosic

**Reddish color** 



## Finer lithosome S (ancestral Santa Fe River)

Pebbly sand and sand channel deposits with about subequal very fine to fine sand, clay, and silt beds

Channel complexes are thick and possess very thin to medium, planar to lenticular internal bedding

Sand is arkosic

**Reddish color** 



Interfingering zone between northern lithosome S and southern lithosome A

### **Tesuque Formation Lithosomes**



# Lithosome S



## Lithosome S upward coarsening

La Cañada exploratory borehole









### Tesuque Fm hydrogeology

Potentiometric surface and groundwater flow regimes



### **Tesuque Fm hydrogeology**

### Hydrogeologic cross section through the Agua Fria well, Canada borehole, Baca St well, and Hickox well.



Plate 5 is a hydrogeologic cross section with a base elevation of 4,000 ft. amsl, that extends Plate 3- Section FF 2,125 ft. into the TBA-SFRA study area between the Saint Francis Drive Corridor and the Hickox Street well. This allows

### Hydrogeologic differences between lithosomes

