GSA DR Item **2013139** accompanies Koning, D.J., Grauch, V.J.S., Connell, S.D., Ferguson, J., McIntosh, W., Slate, J.L., Wan, E., and Baldridge, W.S., 2013, Structure and tectonic evolution of the eastern Española Basin, Rio Grande rift, north-central New Mexico, *in* Hudson, M.R., and Grauch, V.J.S., eds., New Perspectives on Rio Grande Rift Basins: From Tectonics to Groundwater: Geological Society of America Special Paper 494, p. 185–219, https://doi.org/10.1130/2013.2494(08).

Appendix F. Supporting data for throw and tilt rate calculations

Table F-1. Data used to calculate throw rates on the Cañada del Almagre fault

Approx. age interval	Stratigraphic offset of lower marker bed	Age of lower marker bed	Stratigraphic offset of upper marker bed	Age of upper marker bed	Differ-ence in strat offset & age	Rate
3-10 Ma	60-67 m (Lobato Fm)	9.2-10.2 Ma	0 m (Puye Fm)	3-5 Ma	60-67 m / 4.2-7.2 m.y.	8-16 m /m.y.
9.2-13.4 Ma	430-480 m (upper Chama-El Rito Mbr contact)	13.4-13.6 Ma	60-67 m (Lobato Fm)	9.2-10.2 Ma	100-120 m / 3.2-4.4 m.y.	23-38 m /m.y.

Notes:
More information and illustrations given in Koning and Kempter (2007).

Table F-2. Data used to estimate throw rates on the Main Pajarito fault near St. Peter's Dome*

Approx. age interval	Stratigraphic offset of lower marker bed	Age of lower marker bed	Stratigraphic offset of upper marker bed	Age of upper marker bed	Differ-ence in strat offset & age	Rate
0-1.2 Ma (west strand)	60-90 m (base of Tshirege Mbr)	1.2 Ma	No upper bed	Present	60-90 m / 1.2 m.y.	50-75 m / m.y.
6.8-11 Ma (west strand)	550 m (Keres Group/Santa Fe Group contact) east of Boundary Pk	10-11 Ma	60-90 m (Base of Tshirege Mbr)	1.2 Ma	460-490 m / 8.8-9.8 m.y.	40-60 m /m.y.
11-13 Ma (fault A)	Thickness of Vallito Member on immediate hanging wall of fault A – correlates to lower buff sand in Guaje well field (>190 m; age range of 10-11 to 13-13.5 Ma)				>190 m / 2-3.5 m.y.	50-100 m/m.y.

Notes:
* See geologic map in Appendix G.

Table F-3. Data used to calculate throw rates on west strand(s) of Puye fault in the Guaje well field and environs

Approx. age interval	Stratigraphic offset of lower marker bed	Age of lower marker bed	Stratigraphic offset of upper marker bed	Age of upper marker bed	Differ-ence in strat offset & age	Rate
After 1.2 Ma	5-10 m* (Tshirege Mbr)	1.2 Ma	No upper bed	N/A	5-10 m / 1.2 m.y.	3-4 m /m.y.
1.2-10.2 Ma	16-26 m (Base of western Hernandez Mbr tongue)	10.0-10.5 Ma**	5-10 m* (Tshirege Mbr)	1.2 Ma	6-21 m / 8.8-9.3 m.y.	1-2 m /m.y.
10.2-12.4 Ma	64-70 m (base of upper Vallito Mbr, above 12.3 Ma basalt)	12.3-12.5 Ma	16-26 m (Base of western Hernandez Mbr tongue)	10.0-10.5 Ma**	38-54 m / 1.8-2.5 m.y.	15-30 m /m.y.
12.4-13.7	75-95 m Base of Vallito Mbr***	13.6-13.8 Ma	64-70 m (base of upper Vallito Mbr, above 12.3 Ma basalt)	12.3-12.5 Ma	5-31 m / 1.1-1.5 m.y.	3-30 m /m.y.

Notes:
* Offset estimated from mapping of Dethier (2003) in the mesa between Chupaderos Canyon and Canada de las Latas.
** Age from comparison with base of Hernandez Member in the Gaucho stratigraphic section of Koning and Aby (2005)
*** Age obtained from extrapolation of depositional rates calculated between the lower basalts in the GR-1 well.

Table F-4. Data used to calculate throw rates on the North Pajarito fault

Approx. age interval	Stratigraphic offset of lower marker bed	Age of lower marker bed	Stratigraphic offset of upper marker bed	Age of upper marker bed	Differ-ence in strat offset & age	Rate
After 1.2 Ma	100-150 m* (Tshirege Mbr)	1.22-1.26 Ma	No upper bed	N/a	100-150 m / 1.22-1.26 m.y.	79-123 m /m.y.

Notes:
- Offset value from Golombek (1983) and Kempter et al. (2005)

Table F-5. Data used to calculate throw rates on the Santa Clara fault

Approx. age interval	Stratigraphic offset of lower marker bed	Age of lower marker bed	Stratigraphic offset of upper marker bed	Age of upper marker bed	Differ-ence in strat offset & age	Rate
0-0.6 Ma	10-13 m (Terrace deposit with Lava Creek B ash)	0.62 Ma	No upper bed	Present	10-13 m / 0.62 m.y.	15-20 m / m.y.
0.6-3.5 Ma (North of Rio Chama)	130-150 m (Servilleta Basalt)	3.5-3.8 Ma	10-13 m (Terrace deposit with Lava Creek B ash)	0.62 Ma	117-140 m / 2.9-3.2 m.y.	35-48 m / m.y.
3.5-8 Ma (North of Rio Chama)	510-570 m (minimum offset of CLTZ)***	8.1-8.5 Ma	130-150 m (Servilleta Basalt)	3.5-3.8 Ma	360-440 m / 4.3-5.0 m.y.	72-102 m /m.y. Ψ
8-10.2 Ma (South of Rio Chama)	360-380 m (phreatomag-matic bed)	10.2 Ma	260 m*** (minimum offset of CLTZ)	8.1-8.5 Ma	100-120 m / 1.7-2.1 m.y.	48-71 m /m.y.**
8-10.6 Ma (North of Rio Chama)	580-640 m* (upper green coarse white ash bed)*	10.6 Ma	510-570 m* (minimum offset of CLTZ)	8.1-8.5 Ma	10-130 m / 2.1-2.5 m.y.	4-62 m /m.y.**

Notes:
CLTZ = Chamita lower tuffaceous zone.
*Offset measured immediately west of the western fault strand of the Santa Clara fault zone using cross-section C-C' of Plate 1.
** Only maximum plotted in Figure 13 because the minimum offset of CLTZ results in a maximum throw rate (i.e., increasing the CLTZ offset results in a smaller numerator).
*** Faulting has removed the CLTZ along cross-section D-D,' although it is exposed locally to the north on the footwall.
Ψ Only the minimum rate was plotted in Figure 13 because minimum offset of CLTZ results in a minimum rate (i.e., increasing the CLTZ offset results in a larger numerator).

Table F-6. Data used to calculate throw rates on the Black Mesa fault

Approx. age interval	Stratigraphic offset of lower marker bed	Age of lower marker bed	Stratigraphic offset of upper marker bed	Age of upper marker bed	Differ-ence in strat offset & age	Rate
After 3.5-3.8 Ma	34-40 m (Servilleta Basalt flows)	3.5-3.8 Ma	No upper bed	Present	34-40 m / 3.5-3.8 m.y.	9-11 m /m.y.
3.5-10 Ma	60-70 m (base of Chamita Formation)	8.7-10 Ma*	34-40 m (Servilleta Basalt flows)	3.5-3.8 Ma	20-36 m / 4.9-6.5	3-7 m /m.y.
10-30(?) Ma	1500-2000 m (base of Santa Fe Group)	25-30 Ma	60-70 m (base of Chamita Formation)	8.7-10 Ma*	1430-1940 m / 15-21 m.y.	68-129 m / m.y.

Notes:
Stratigraphic offset values taken from north slope of Black Mesa.
* We use an age of 8.7-10 Ma because early Hemphillian fossils (e.g., the sloth *Pliometanastes*) were found in the Chamita Formation (Tedford and Barghoorn, 1993) but the Chamita lower tuffaceous zone is not present.

Table F-7. Data used to calculate throw rates on the Rio de Truchas fault

Approx. age interval	Stratigraphic offset of lower marker bed	Age of lower marker bed	Stratigraphic offset of upper marker bed	Age of upper marker bed	Differ-ence in strat offset & age	Rate
After ca. 10 Ma	65-100 m	10 Ma	No upper bed	N/a	65-100 m / 10 m.y.	7-10 m /m.y.
10-30 Ma	350-400 m	25 Ma	65-100 m	10 Ma	250-335 m / 15 m.y.	17-22 m/ m.y.

Notes:
Stratigraphic offset values taken from mapping (Koning and Aby, 2003) and seismic reflection interpretations (see text) where the Rio de Truchas fault passes under its namesake.

Table F-8. Data used to calculate tilt rates in the northeast Espanola Basin

Approx. age interval*	Mean dip of lower interval	Age of lower interval	Mean dip of upper interval	Age of upper interval	Differ-ence in dip & age	Approx Rate
3-12 Ma (Martinez)	2.4° (B/t ATZ and LCWAZ)	10-12 Ma	1°* (distal Oso and Truchas surfaces)	3-5 Ma**	1.4° / 7 m.y.	0.2° /m.y.
10-13 Ma (Martinez)	3.7° (within LCWAZ)	12-13 Ma	2.4° (B/t ATZ and LCWAZ)	10-12 Ma	1.3° / 1.5 m.y.	0.9° /m.y.
12-13 Ma (Martinez)	4.0° (basal Cejita Mbr tongue)	13.0-13.2 Ma	3.7° (within LCWAZ)	12-13 Ma	0.3° / 0.6 m.y.	0.5° /m.y.
12-13 Ma (C. de Vaqueros)	4.9° (basal Cejita Mbr tongue)	13.0-13.2 Ma	3.2° (within LCWAZ)	12-13 Ma	1.7° / 0.6 m.y.	2.8° /m.y.
13-14 Ma (Martinez)	4.6° (within PWAZ)	13.2-14.0 Ma	4.0° (basal Cejita Mbr tongue)	13.0-13.2 Ma	0.6° / 0.5 m.y.	1.2° /m.y.
13-14 Ma (C. de Vaqueros)	5.8° (within PWAZ)	13.2-14.0 Ma	4.9° (basal Cejita Mbr tongue)	13.0-13.2 Ma	0.9° / 0.5 m.y.	1.8° /m.y.
13.2-15.0 Ma (Martinez)	7.0° (Pojoaque Mbr below PWAZ)	15.0-14.0 Ma	4.6° (within PWAZ)	13.2-14.0	2.4° / 0.9 m.y.	2.7° /m.y.
13.2-15.4 Ma (C. de Vaq.)	6.1° (B/t WA4 and PWAZ)	15.4-14.0 Ma	5.8° (within PWAZ)	13.2-14.0 Ma	0.3° / 1.2 m.y.	0.3° /m.y.
14.0-15.4 Ma (Martinez)	7.0° (SR above WA4)	15.4-15.0 Ma	7.0° (Pojoaque Mbr below PWAZ)	15.0-14.0 Ma	0° / 0.75 m.y.	0° / m.y.
14.0-15.4 Ma (Arroyo Seco)	5.2° (SR above WA4)	15.4-15.0 Ma	4.6° (Pojoaque Mbr below PWAZ)	15.0-14.0 Ma	0.6° / 0.75 m.y.	0.8° /m.y.
15.0-15.8 Ma (Martinez)	8.5° (B/t WA4 and WA2)	15.8-15.4 Ma	7.0° (SR above WA4)	15.4-15.0 Ma	1.5° / 0.4 m.y.	3.8° /m.y.
15.0-15.8 Ma (Arroyo Seco)	6.4° (B/t WA4 and WA2)	15.8-15.4 Ma	5.2° (SR above WA4)	15.4-15.0 Ma	1.2° / 0.4 m.y.	3.0° / m.y.

Notes:
See text and Figure 12 for more information regarding the age- and dip-related datasets. These calculations averaged dips within intervals whose boundaries had age control (Figure 12). We utilized attitudes depicted in Plate 1. For calculating rates, the median of a given age interval was used.
*Text in paranthesis denote dip dataset locality used (see Figures 5 and 12)
** Utilized distal Oso and Truchas surfaces of Manley (1979, fig. 5).
WA4 = No. 4 white ash of Galusha and Blick (1971)
WA2 = No. 2 white ash of Galusha and Blicka (1971)

Table F-9. Data used to calculate tilt rates on the Northern Barrancos monocline

Approx. age interval	Dip of datum	Age of datum	Apparent dip of upper marker bed	Age of upper marker bed	Differ-ence in dip & age	Rate
0-13.2 Ma	14-28° (base of Cuarteles Member)	13.2 Ma	1°*	3-5 Ma*	14-28°/8.2-10.2 m.y.	1.4-3.4° /m.y.

Notes:
* Utilized distal Oso and Truchas surfaces of Manley (1979, fig. 5).

Table F-10. Data used to calculate tilt rates on the Southern Barrancos monocline

Approx. age interval	Apparent dip of older marker bed	Age of lower marker bed	Apparent dip of younger marker bed	Age of upper marker bed	Differ-ence in dip & age	Rate
3-5 Ma	1.3-1.9° (Tga1 and Tga2 terrace straths)	4-5 Ma	0.9-1.0° (Tga3 terrace strath)	ca. 3 Ma	0.3-1.0° / 1-2 m.y.	0.2-1.0° /m.y.
5-10 Ma	2-4° (pumiceous interval)	8.5-10 Ma	1.3-1.9° (Tga1 and Tga2 terrace straths)	4-5 Ma	0.1-2.7° / 3.5-6.0 m.y.	0.02-0.8° / m.y.
8.5-13.2 Ma	5-6° (Cuarteles Mbr base)	13.1 Ma	2-4° (pumiceous interval)	8.5-10 Ma	1-4°/ 3.1-4.6 m.y.	0.2-1.3° / m.y.
13.2-15 Ma	8-9° (Pojaque Mbr base)	15 Ma	5-6° (Cuarteles Mbr base)	13.1 Ma	2-4°/ 1.9 m.y.	1-2° / m.y.
14.5-23(?) Ma	17°	19-23(?) Ma	8-9°	15.0 Ma	8-9°/4-8.5 m.y.	0.9-2° / m.y.

Notes:

Dip values came from limb of monocline, west of west-down fault (see Figure 15).
The pumiceous interval is located in the Cuarteles Member near Cañada Ancha.

Table F-11. Data used to calculate throw rates on the West Arroyo Seco fault

Approx. age interval	Stratigraphic offset of lower marker bed	Age of lower marker bed	Stratigraphic offset of upper marker bed	Age of upper marker bed	Differ-ence in stratigraphic offset & age	Rate
0-15.8 Ma	123	15.8 Ma (No. 2 white ash)	None	0	123/15.8 m.y.	8 m/m.y.
3-15.8 Ma	123	15.8 Ma (No. 2 white ash)	None (Terraces of Manley, 1979b)	3-5	123/12.8-10.8	10-11 m/m.y.
15.4-15.8 Ma	N/A	15.8 Ma (No. 2 white ash 2)	None	15.4 Ma (No. 4 white ash)	3 m of thickening/0.4 Ma	8 m/m.y.

Note:

No.2 and No. 4 white ashes belong to the Skull Ridge Member of the Tesuque Formation (Galusha and Blick, 1971)

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