

LOWER PALEOZOIC ISOPACH MAPS OF SOUTHERN NEW MEXICO AND THEIR IMPLICATIONS FOR LARAMIDE AND ANCESTRAL ROCKY MOUNTAIN TECTONISM

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Abstract—New isopach maps for four lower Paleozoic sedimentary successions (Bliss Sandstone–El Paso Formation, Montoya Formation, Fusselman Dolomite, and Devonian strata) in southern New Mexico indicate the presence of pronounced dextral deflections in the isopach patterns for these strata, particularly in data-rich areas near their northern pinchouts. These deflections occur across faults of known or suspected Laramide and, in the east, Ancestral Rocky Mountain ancestry. The magnitude and interpreted origin of the best-defined of these dextral deflections are: Hot Springs fault system near Truth or Consequences (~26 km, mostly Laramide); Engle Basin (32–36 km, mostly Laramide; includes ~26 km value for Hot Springs fault system); Palomas Basin (57–60 km, ~26 km of which is attributable to Laramide slip on the Hot Springs fault system; the remainder is of unknown origin); and the Tularosa Basin (~40 km, largely tectonic in origin but the relative contributions of Laramide and Ancestral Rocky Mountain slip are unknown). Additional deflections may exist across the Pedernal uplift but are in need of further study.

Note: Abstract and figures are excerpted from an upcoming paper in the New Mexico Geological Society 53rd Annual Field Conference Guidebook.

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FIGURE CAPTIONS

Figure 1. Schematic map showing importance of control-point density and contouring method in determining strike-slip offset of a stratigraphic piercing line (here shown as a pinch-out). (A) Smooth contouring of isolated, widely spaced control points fails to detect strike-slip offsets. (B) The presence of multiple control points on each structural block allows delineation of the true pinch-out trend except in areas where contour crosses bounding faults. (C) Contouring method utilized in this report. Contours are delineated using multiple points wherever possible, and each structural block is treated as an individual contouring domain. Contouring mismatches between adjacent blocks are then analyzed to determine if apparent lateral separation (i.e., deflection) of contours is of structural or stratigraphic origin.

Figure 2. Tectonic map of New Mexico showing principal Laramide structures (both known and inferred) and selected mid-Tertiary volcanic fields and intrusives. MPfs, Montosa-Paloma fault system; Cf, Chupadera fault, Ma, Mescalero arch; SBs, Sierra Blanca syncline; Rfs, Ruidoso fault system; DTa, Duncan-Tinnie anticlinorium; PSb, Pecos Slope buckles. SRHa, Santa Rita-Hanover axis; Chf, Chloride fault; Wf, Winston fault, CCf, Chavez Canyon fault; WPBf?, western Palomas Basin fault (hypothetical Laramide fault or faults beneath western Palomas and Engle basins); HSWCf, Hot Springs fault system; BPf, Bear Peak fault; SAf, San Andres fault; Jf, Jarilla fault; Af, Alamogordo fault; Gf, Guadalupe fault; Hm, Huapache monocline. Note some Laramide structures in south-central and southeastern New Mexico, particularly the Duncan-Tinnie

anticlinorium and the Huapache monocline, are reactivated Ancestral Rocky Mountain structures.

Figure 3. Isopach map of combined Bliss Sandstone and El Paso Formation, and equivalent units. Contour domains for this and subsequent figures are defined by Laramide fault system (Fig. 2). Contours for which trend and orientation are relatively well defined are shown as solid lines and are emphasized in our analysis. Pedernal uplift of late Paleozoic age is defined by the Pennsylvanian zero isopach of Meyer (1966, fig. 48). Control points west of Pedernal uplift are from Foster (1978), Kottlowski (1963), R. H. Broadhead (2002, written commun.), Furlow and Kelley (1965), and Bauer and Lozinski (1991). Pinch-out exposures are from McCleary (1960) and Bachman (1968). Contour lines east of the Pedernal uplift are from Greenwood et al. (1977) and Hayes and Cone (1975). Contour interval is variable. A'-A' is line of section for Figure 4.

Figure 4. North-northwest cross section of lower Paleozoic strata on the Jornada del Muerto block. Datum is base of Pennsylvanian. Vertical exaggeration is ~165x.

Figure 5. Isopach map of Montoya Formation. Control points for areas west of the Pedernal uplift are from Kottlowski (1963), Foster (1978), Furlow and Kelley (1965), and R. H. Broadhead (2002, written commun.). Pinch-out exposures from McCleary (1960) and Bachman (1968). Contours east of the Pedernal uplift are from Hayes (1975) and Greenwood et al. (1977). Contour interval is variable. A'-A' is line of section for Figure 4.

Figure 6. Isopach map of the Fusselman Dolomite. Control points west of the Pedernal uplift are from Kottowski (1963), and Foster (1978). Pinch-out exposures are from Kottowski et al. (1956) and Seager and Mack (in press). Contours east of Pedernal uplift are from Greenwood et al. (1977). Contour interval is variable. A'-A' is line of section for Figure 4.

Figure 7. Isopach map of Devonian strata. Control points west of Pedernal uplift are from Kottowski (1963), Foster (1978), and King and Harder (1985). Pinch-out exposures are from Bachman (1968) and Seager and Mack (in press). Contours east of the Pedernal uplift are from Greenwood et al. (1977). Contour interval is variable.

Fig. 1
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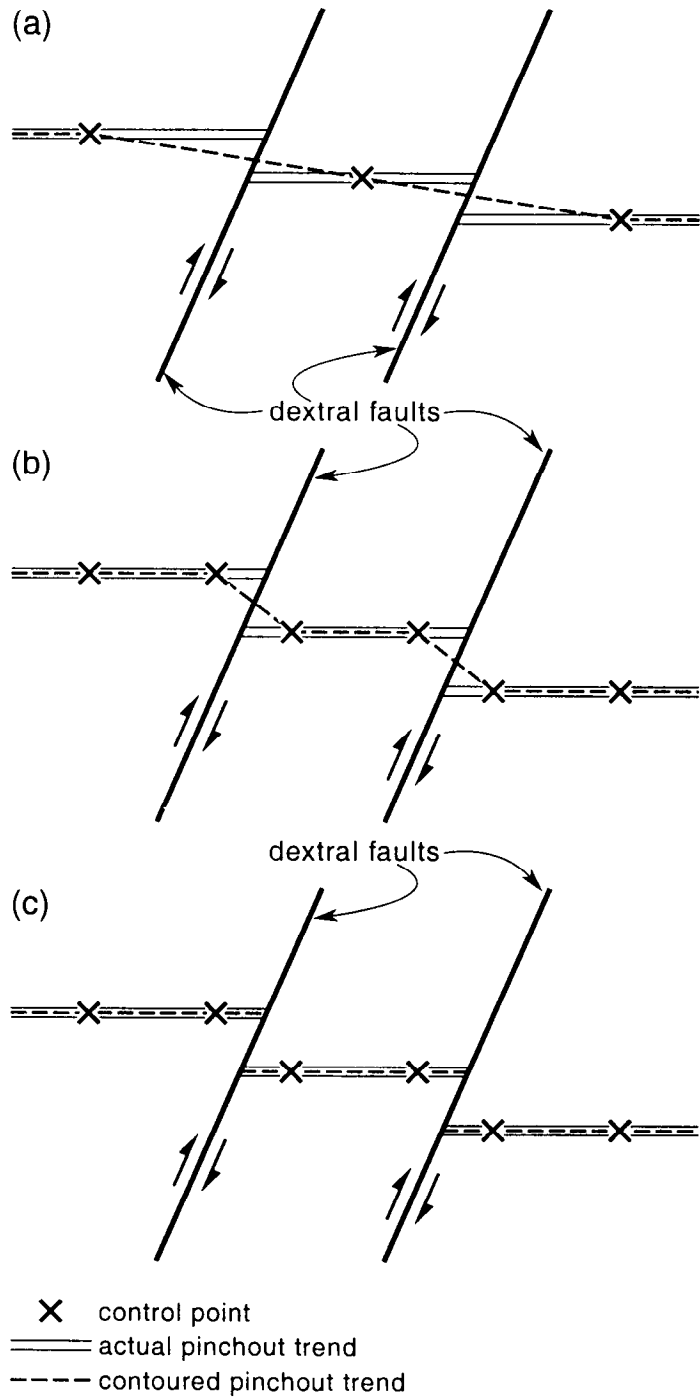
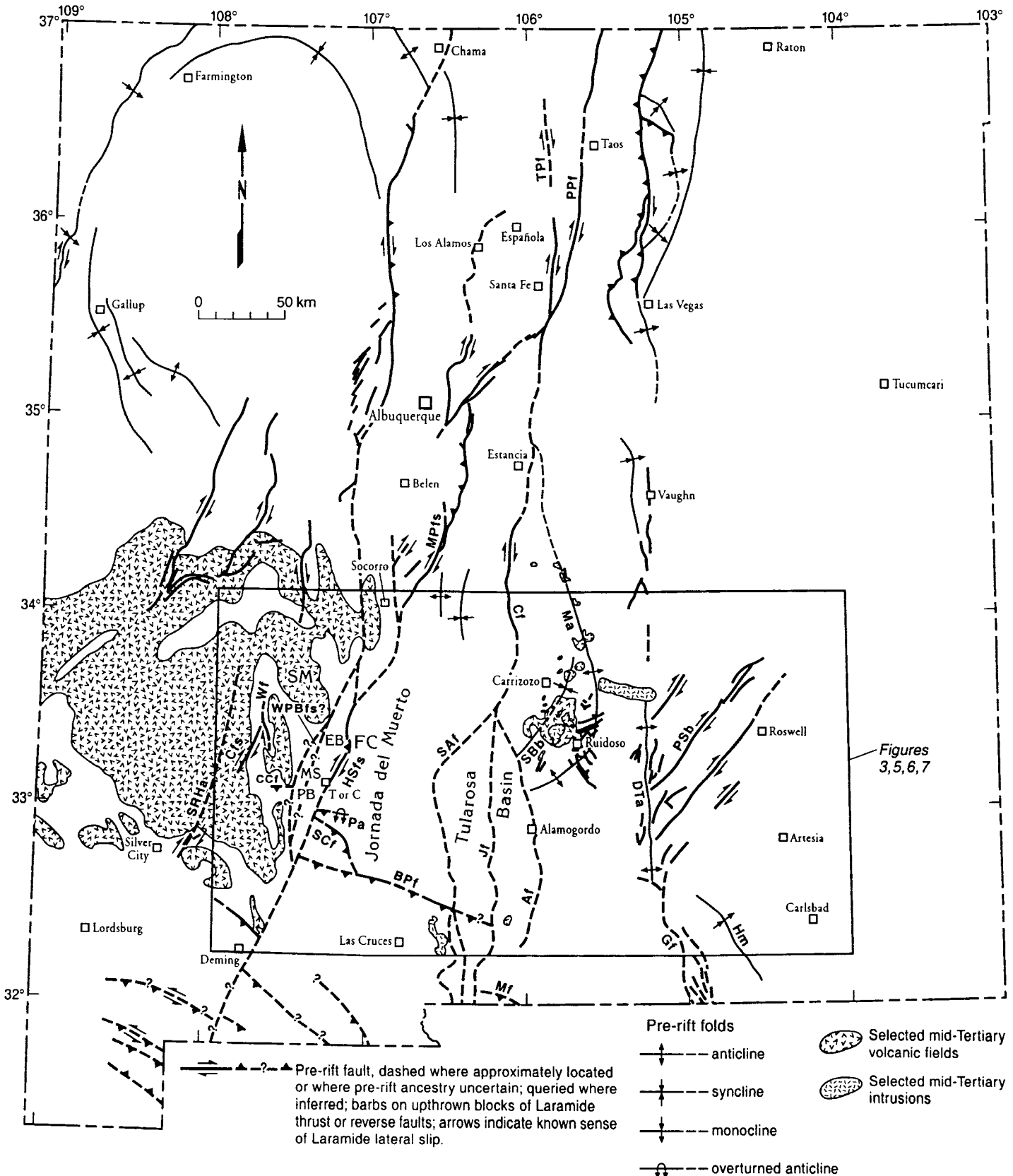
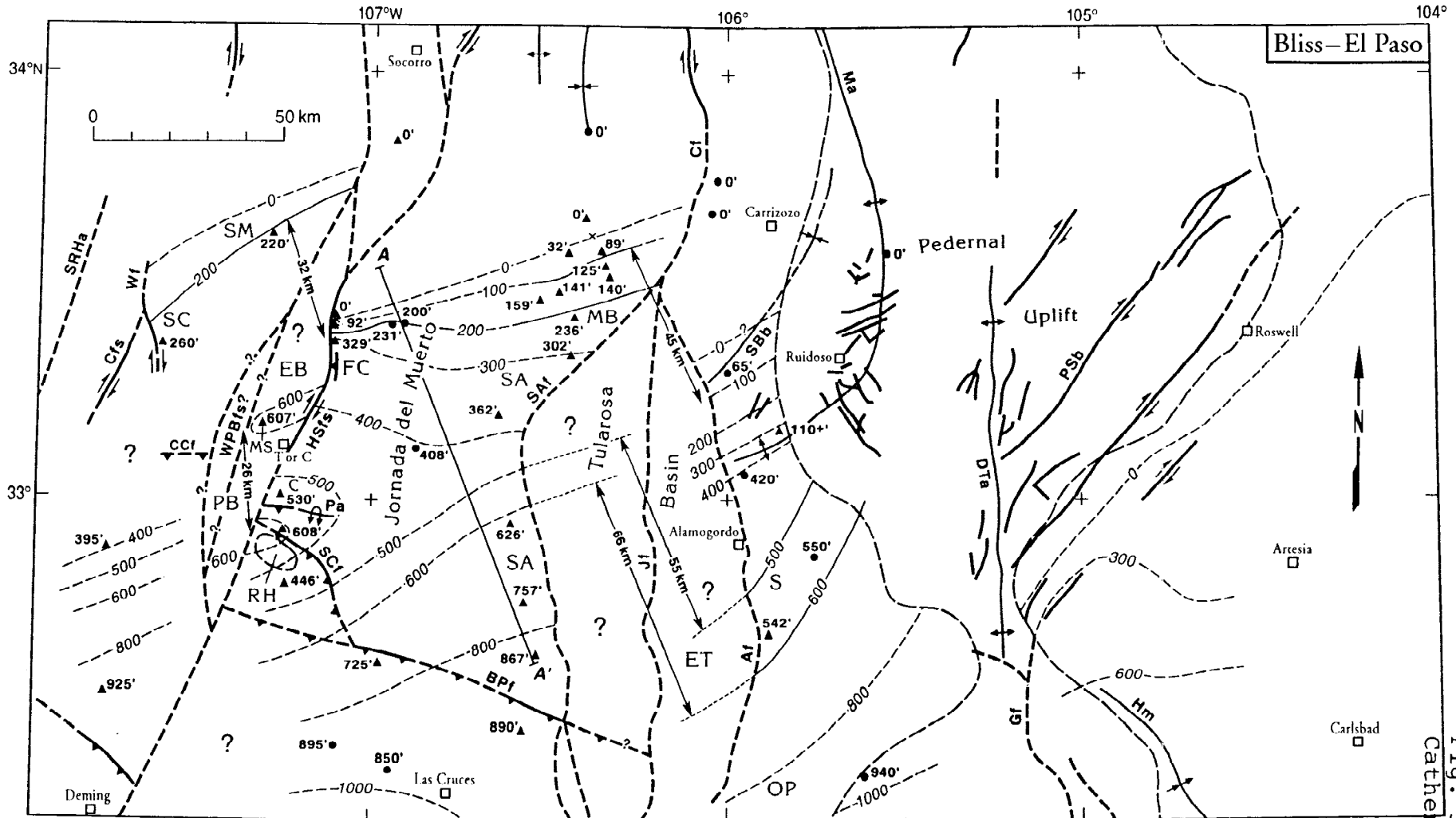


Fig. 2
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Pre-rift fault, dashed where approximately located or where pre-rift ancestry uncertain; queried where inferred; bars on upthrown blocks of Laramide thrust or reverse faults; arrows indicate known sense of Laramide lateral slip.

Pre-rift folds

 anticline

 syncline

 monocline

 overturned anticline

Late Paleozoic uplifts of Ancestral Rocky Mountains. Pedernal uplift delineated by zero isopach of Pennsylvanian rocks (Meyer, 1966, fig. 48). Red Hills (RH) area of uplift shown where Pennsylvanian strata locally overlie El Paso Formation (Seager and Mack [in press]).

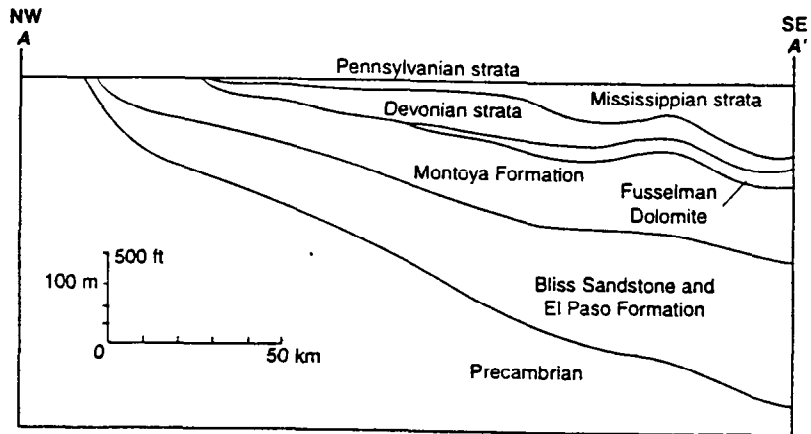
Control Points
 ▲ outcrop ● well × exposure of pinchout

 Isopach contour (feet); solid where trend and location are well constrained; dashed where trend uncertain; queried where trend and location uncertain.

 Deflection estimate using best-defined isopach contours

Fig. 3
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FIG. 4
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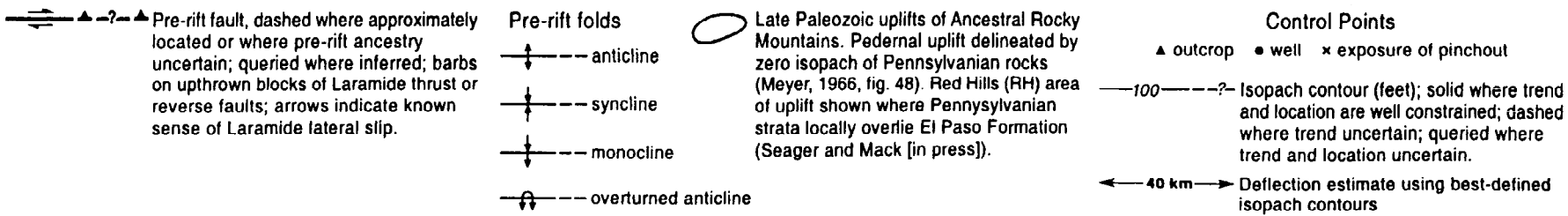
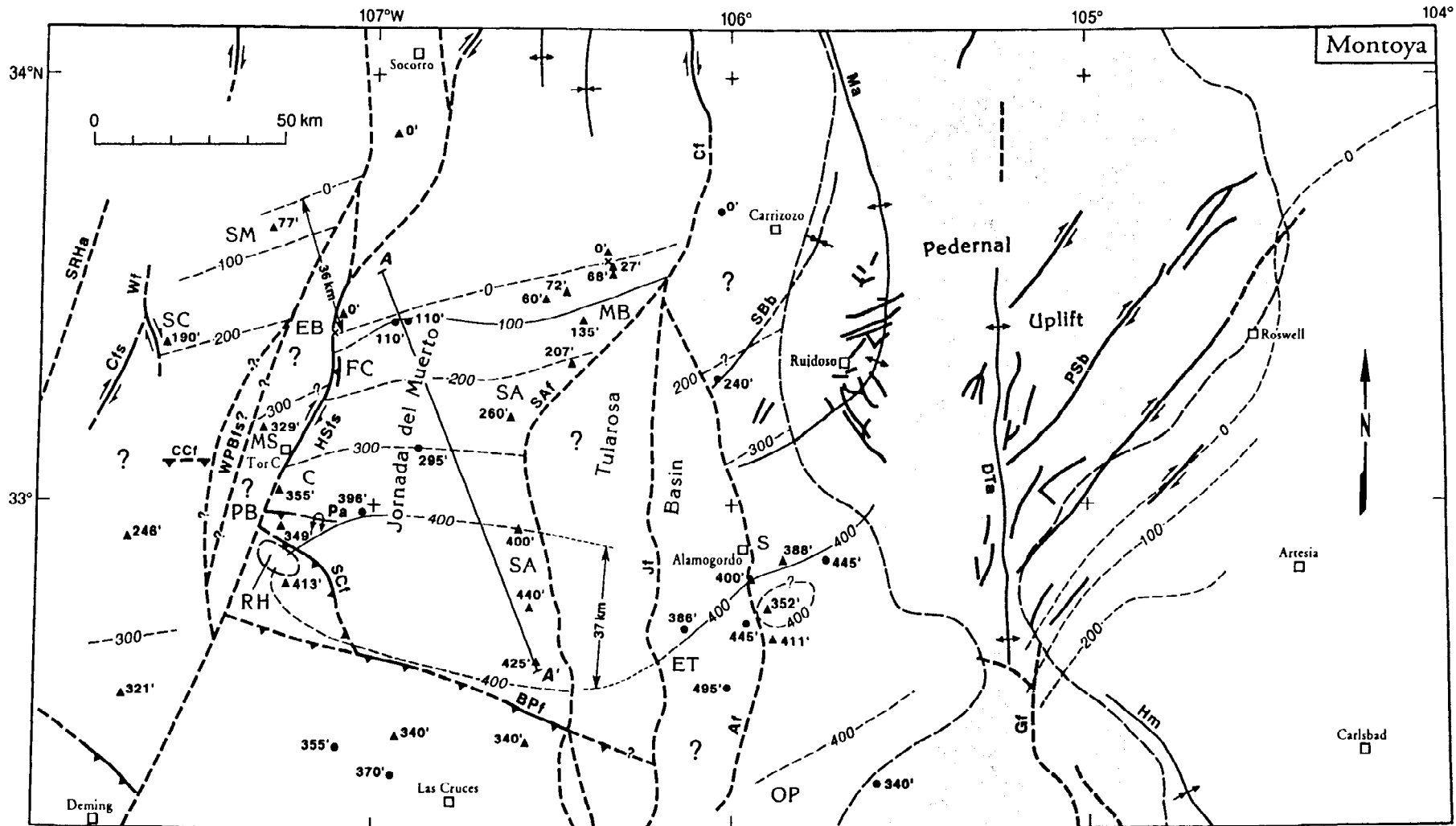


Fig. 5

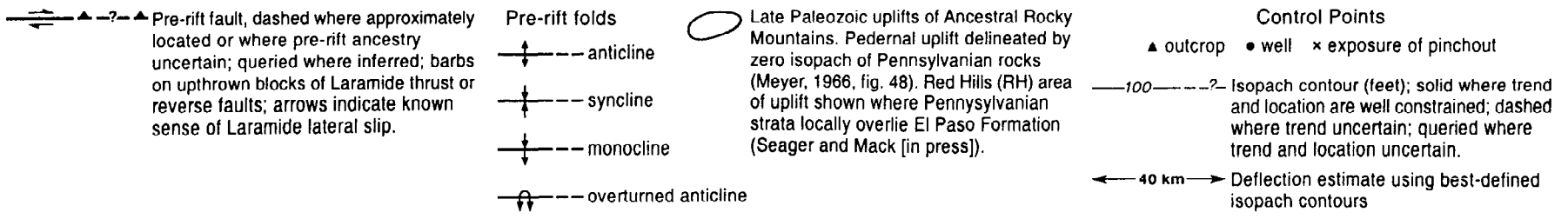
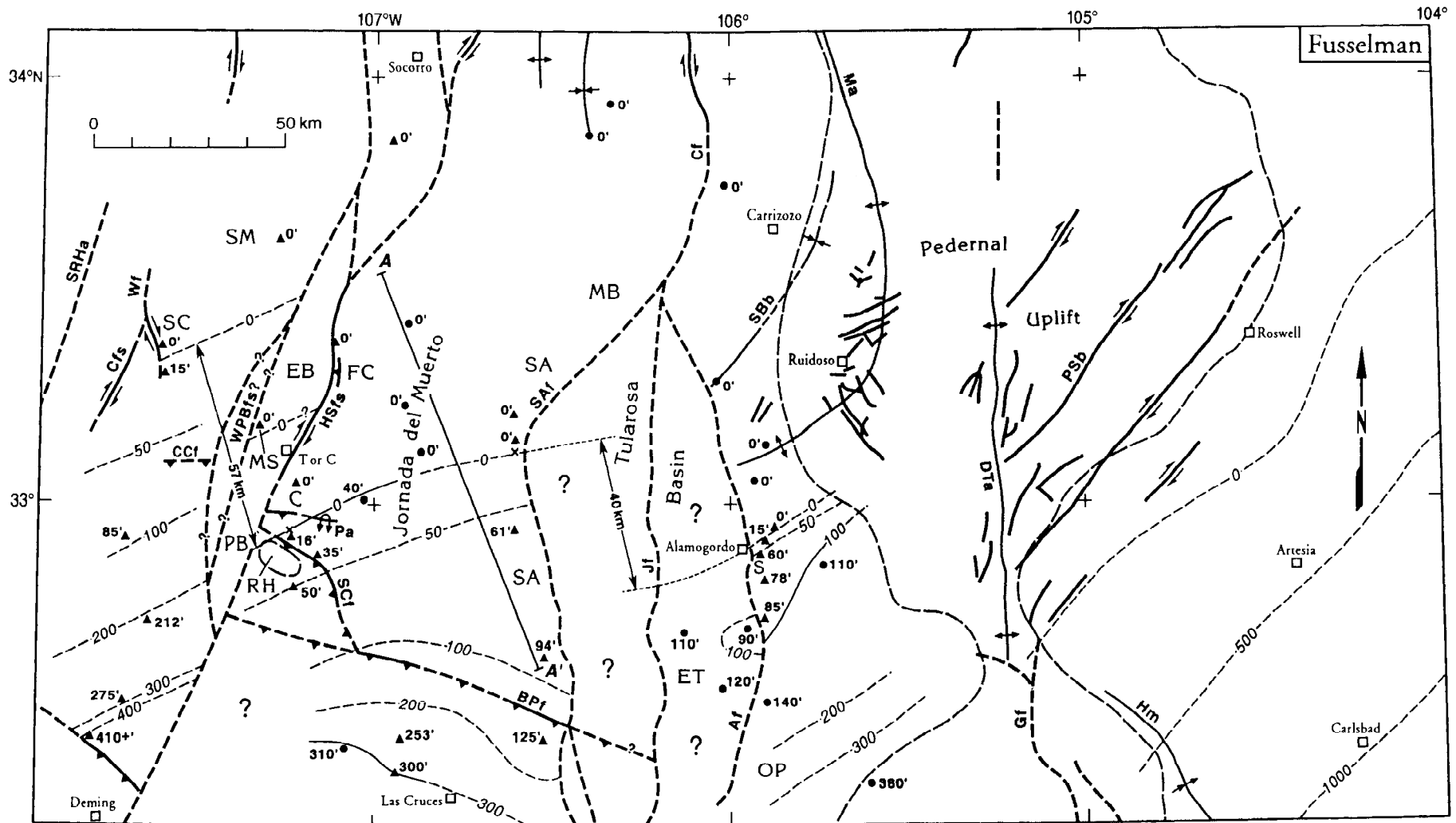
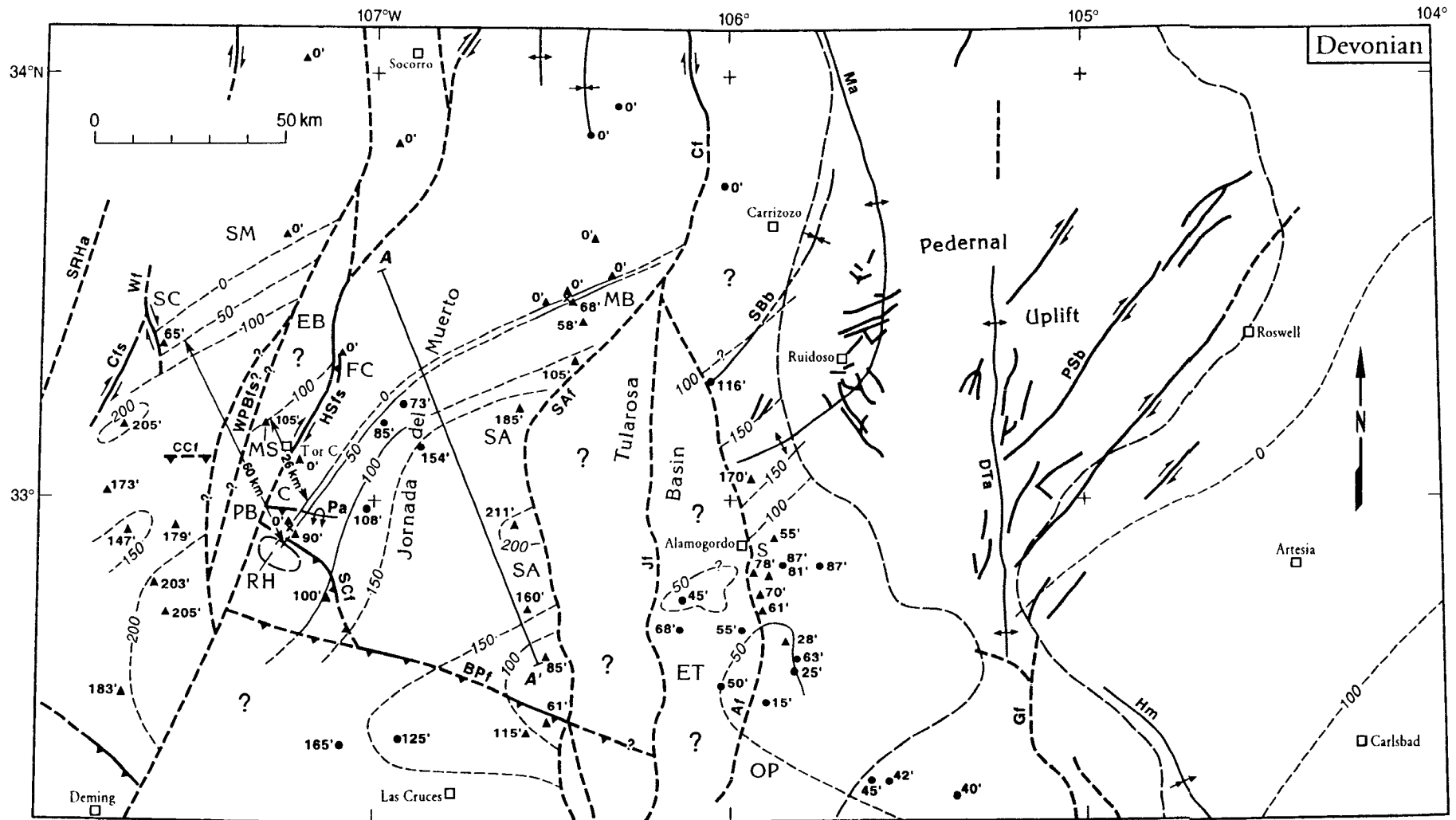


Fig. 6



Pre-rift fault, dashed where approximately located or where pre-rift ancestry uncertain; queried where inferred; barbs on upthrown blocks of Laramide thrust or reverse faults; arrows indicate known sense of Laramide lateral slip.

Pre-rift folds
 anticline
 syncline
 monocline
 overturned anticline

Late Paleozoic uplifts of Ancestral Rocky Mountains. Pedernal uplift delineated by zero isopach of Pennsylvanian rocks (Meyer, 1966, fig. 48). Red Hills (RH) area of uplift shown where Pennsylvanian strata locally overlie El Paso Formation (Seager and Mack [in press]).

Control Points
 ▲ outcrop ● well × exposure of pinchout
 100 ---? Isopach contour (feet); solid where trend and location are well constrained; dashed where trend uncertain; queried where trend and location uncertain.
 40 km Deflection estimate using best-defined isopach contours

Fig. 7