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The Origin and Nature of the Uncompahgre Fault

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Many of the core issues concerning the origin and character of the Uncompahgre Fault are the same ones involved in any discussion of the late Paleozoic Ancestral Rocky Mountain orogeny. A lack of data in some critical areas and the fact that many details of the Ancestral Rocky Mountain orogenic features were obscured by the early Tertiary Laramide orogeny have been significant obstacles to the resolution of many of these issues. The long history of petroleum exploration and production in the Paradox basin has provided a large amount of subsurface data throughout the basin and particularly along the fault, making this a key area of study.

Along with the Ancestral Rocky Mountain orogeny, the origin and tectonic history of the Paradox basin and Uncompahgre Fault are still the subjects of considerable debate. The basin has been described as an aulacogen (Baars, 1976), a foreland basin (Frahme and Vaughn, 1983), a pull-apart basin (Stevenson and Baars, 1986), and a flexural foreland basin (Barbeau, 1999). Much of the discussion has been focused on the nature of the Uncompahgre Fault that forms the northeastern basin margin, specifically, whether it is a normal fault (Baars, 1976), a thrust fault (Frahme and Vaughn, 1983; White and Jacobson, 1983), or a wrench fault (Stevenson and Baars, 1986).

Measurable movement on the Uncompahgre Fault is approximately 10 km of Wolfcampian southwest-vergent thrusting (Frahme and Vaughn, 1983). No measurable lateral offset has yet been documented. Huffman and Potter (1993) interpreted structures northwest of the uplift in the southern Uinta basin to indicate late Paleozoic left-lateral displacement of less than 11 km across the entire uplift. Isopach and facies maps of the Cambrian and Mississippian systems on either side of the uplift (Baars, 1988) support this amount and direction of movement. These interpretations led Huffman and Potter (1993) to describe the Uncompahgre Fault as an oblique left-lateral southwest-verging reverse fault.

Based on a reevaluation of seismic and well log data, Huffman and Taylor (1994) interpreted the structure to actually comprise two phases of thrusting, the well-documented Wolfcampian phase and an earlier Atokan-Desmoinesian phase. The Middle to Late Pennsylvanian faulting produced a thrust duplex comprising at least two horses with a total shortening of at least 10 km and correlative clastic wedges shed into the Paradox basin (Figure 1). Resulting salt flowage westward into the Paradox Valley diapir produced an anomalously thick (4,900 m) and coarse Pennsylvanian section in the Nucla Syncline between the Uncompahgre Fault and the salt diapir. Although the exact timing of this earlier phase of thrusting is not well established, the Middle to Late Pennsylvanian time frame correlates with deformational events in other areas of the orogen and with tentative dates on volcanic activity southwest of the Chihuahua basin (Ye et al, 1996).

An increasing accumulation of data supports the interpretation of the Uncompahgre Fault as a thrust fault and the Paradox basin as a foreland basin. Although the total amount of Late

Paleozoic shortening across these two structures is unknown, the geometry is consistent with the interpretation by Woodward et al. (1999) of right-lateral Late Paleozoic offset along north trending faults, including the Picuris-Pecos Fault that formed the eastern margin of the ancestral Uncompahgre uplift, in north central New Mexico and south central Colorado. It is also consistent with the shallow slab model of Ye et al (1996)

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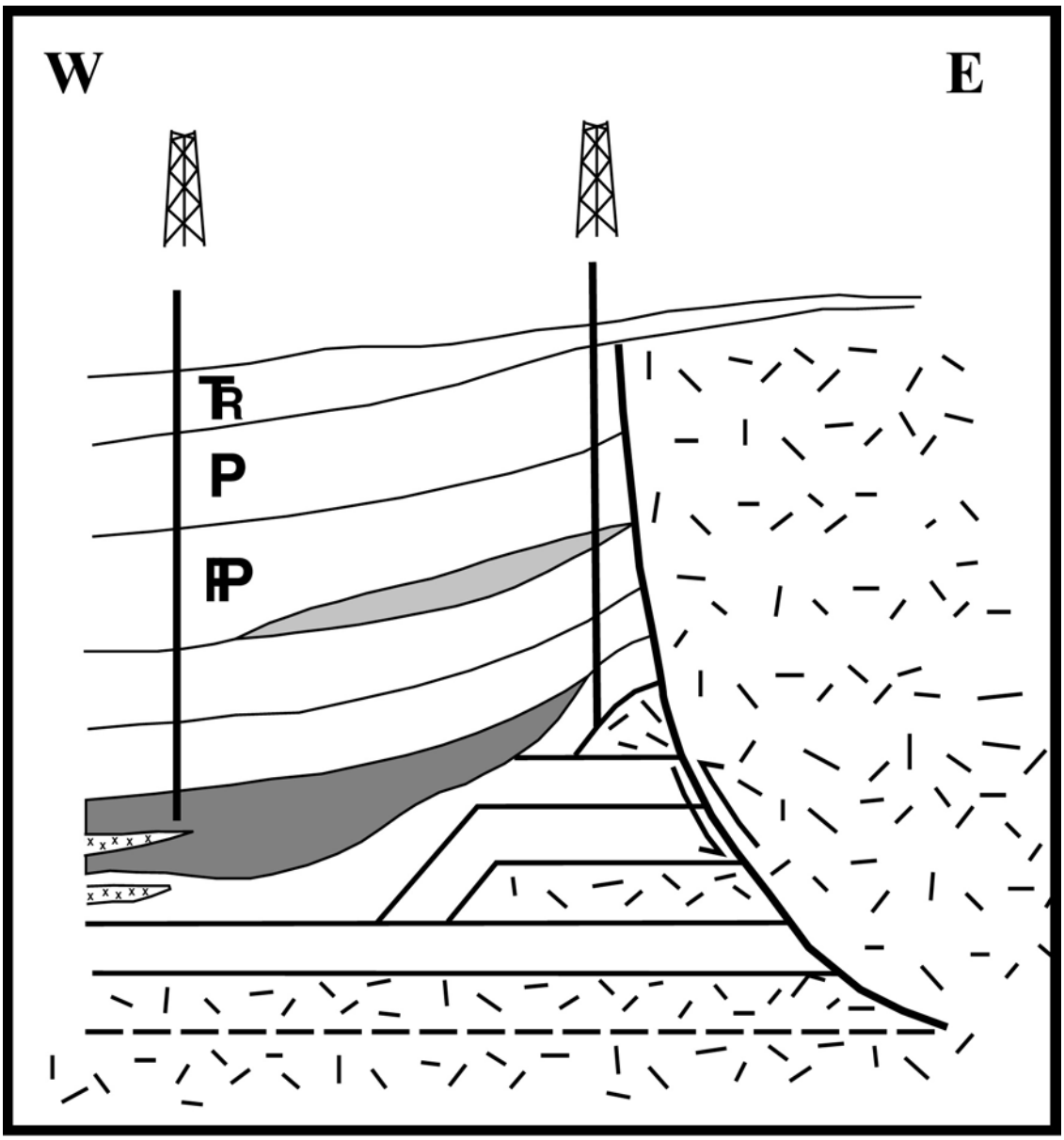

Figure 1. Diagrammatic representation of interpreted thrust duplex comprising two horses beneath the Wolfcampian Uncompahgre thrust fault in the vicinity of Uravan, Colorado. Clastic wedges (shaded) that prograded west into the Paradox basin document the age of thrusting as Middle to Late Pennsylvanian.