ABSTRACT

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QUATERNARY FAULTING IN THE WILLIAMS FORK VALLEY GRABEN, NORTH-CENTRAL COLORADO, AND COMPARISON WITH LATE QUATERNARY DEFORMATION NEAR SPINNEY MOUNTAIN, CENTRAL COLORADO

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The Williams Fork Valley graben is a wedge-shaped, late Cenozoic structure in north-central Colorado. The graben formed in the hanging wall of the pre-existing Laramide Williams Range thrust. Strong evidence of late Quaternary deformation, primarily tectonic scarps in surficial deposits, is present along most of the 18-km-long northern section of the Williams Fork Mountains fault, an east-dipping normal fault that bounds the western margin of the graben. No conclusive evidence of Quaternary activity was discovered on the 18-km-long southern section of the Williams Fork Mountains fault or on faults that form the eastern margin of the graben. However, the southern section of the Williams Fork Mountains fault lies within Proterozoic rocks along much of its length, and seldom crosses late Quaternary deposits.

Because the forest cover is dense and the valleys are very narrow along the northern section of the Williams Fork Mountains fault, it is difficult to discern on aerial photography whether topographic scarps exist in the young valley-fill deposits along the fault trace. Since the aerial photography is of limited use, we conducted foot traverses to search for tectonic scarps in young deposits. Prominent scarps are present in all of the valleys, but some scarps are suspected to be of non-tectonic origin. To distinguish tectonic scarps from non-tectonic ones, the fault was first located in bedrock on the interfluves, and then traced along the fault-line scarp to the valley floor. Scarps that coincided with the fault-line scarp were interpreted as tectonic features unless other evidence supported a non-tectonic origin for the scarp.

Geologic sketch maps were prepared for eleven sites with late Quaternary scarps along the Williams Fork Mountains fault. Nineteen topographic profiles were measured across the scarps at these sites to estimate scarp height, surface offset, and maximum scarp angle. Existing exposures of the faulted surficial deposits were rare, therefore six soil pits were excavated into faulted deposits at four of the sites. The soils data from the pits were used in conjunction with other relative age data to estimate the ages of faulted deposits. Evidence of Holocene fault rupture was documented at a few of the sites. Most estimated slip rates ranged from 0.1-0.3 mm/year.

Middle and possibly early Pleistocene alluvium caps several mesas within the interior of the graben. These deposits are displaced and tilted by Quaternary faults that strike obliquely across the graben, creating a series of northeast-trending tilted fault blocks or half grabens. Tributary streams flowing across these blocks follow the base of the fault scarps. Fluvial deposition and erosion along the scarps has altered the tectonic geomorphology of these Quaternary faults.

The original proposal was not fully funded. On the basis of the recommendation of the proposal review panel, the comparative analysis with late Quaternary deformation near Spinney Mountain was removed from the scope of work.