THE HOGPEN BRANCH FAULT IN THE CAHABA SYNCLINORIUM

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ABSTRACT

Recent mapping has clarified structural relations along the Hogpen Branch fault, an enigmatic structure along the southeast flank of the Cahaba synclinorium in the central part of the Appalachian thrust belt in Alabama. The fault is a southeast-dipping, divergent thrust-fault splay in the footwall of the Helena fault. Cambrian through Pennsylvanian rocks in the hanging wall of the fault plunge southwestward in a series of folds dominated by the Little Cahaba syncline, which forms the deepest part of the Cahaba synclinorium in this area. The southwest end of the Hogpen Branch fault is marked by the Gumsuck Branch anticline, to which displacement on the fault is transferred as the fault apparently goes blind. The Hogpen Branch fault has an unusual structural style, because it truncates a fold in its hanging wall and there is no significant development of a syncline in the footwall.

INTRODUCTION

The Hogpen Branch fault is located along the southeast flank of the Cahaba synclinorium in the central part of the Appalachian thrust belt in Alabama. Its mapped trace roughly parallels the southeastern "boundary fault" (Helena fault) of the Cahaba coalfield within the Cahaba Heights, Irondale, and Leeds 7.5-minute quadrangles in Jefferson County, Alabama (fig. 1). The fault is an unusual and enigmatic structure that has been interpreted in a number of different ways. Squire (1890) recognized displaced "Silurian" (Cambrian, Ordovician, and Silurian) rocks near Leeds at the northeast terminus of the structure, but placed them southeast of the boundary fault. Smith (1894) followed this interpretation in his geologic map of Alabama. In the Birmingham Folio, Butts (1910) merely depicted the structure as a fault, with no further elaboration. In contrast, on the geologic map and cross section of the Vandiver Quadrangle in the Bessemer–Vandiver Folio, Butts (1927) showed the structure as a normal fault that is structurally high on the northwest side. However, the coal stratigraphy shown on the economic geology map of the Vandiver Quadrangle (Butts, 1927) indicates the fault is structurally high on the southeast. Blair (1929, p. 197) stated that the fault "is typical of the Appalachian type of overthrust fault," surely implying a southeast-dipping thrust fault. Kidd (1979) questioned the type of fault, but noted that at the northeast end where pre-Pennsylvanian rocks on the southeast side are juxtaposed with Pennsylvanian rocks on the northwest side, the fault must be upthrown on the southeast side. When I compiled this area for the recent geologic maps of Alabama (Osborne and others, 1988; Osborne and others, 1989), I recognized that the fault must be structurally high on the southeast side, but followed Butts' (1927) published interpretation that the fault has normal displacement. Based on repeated coal stratigraphy, the structure was shown as a southeast-dipping thrust fault on the map of the Cahaba coalfield by Pashin and others (1995). Recent 7.5-minute scale mapping in the area (Osborne, 1995 and unpublished; Rindsberg and others, 1999) in conjunction with unpublished coal outcrop maps at the Geological Survey of Alabama document that the fault is structurally high on the southeast side and is associated with typical northwest-verging Appalachian folds in its hanging wall. Furthermore, unpublished mining records locally show coal mines opened northwest of the Hogpen Branch fault were driven southeast of the mapped trace of the fault before mining was terminated, requiring that the fault dips to the southeast (David Kendrick, personal commun., 1999). These data indicate the structure is a southeast-dipping thrust fault.

STRUCTURAL GEOMETRY

The outcrop trace of the Hogpen Branch fault has the geometry of a diverging splay (Boyer and Elliot, 1982) (fig. 1). The fault diverges from the Helena fault west of the city of Leeds, and trends parallel to the Helena fault southwestward toward the central part of the Cahaba Heights Quadrangle. Interestingly, the northeast divergent end of the fault is within the Harpersville transverse zone (Osborne, 1994), a cross-strike alignment of significant along-strike structural changes in the Appalachian thrust belt in Alabama (Thomas, 1994). At its southwest end, the fault trace apparently is deflected southward, and the last vestige of it reportedly is near the old Pumping Station on the Cahaba River (Butts, 1910). Anomalous dips southwest of there (Osborne, unpublished data) may reflect the southwesternmost vestige of the fault. The generally straight surface trace and typically steep dips in the immediate hanging wall suggest the Hogpen Branch fault has a relatively steep southeast dip.

At the northeast end, the hanging wall includes Cambrian–Ordovician through Pennsylvanian rocks, and is characterized by a series of southwest-plunging,