# Problems in Geologic Mapping in Western Arkansas[1]

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*Introduction:*

The location of the area to be discussed is approximately 50-75 miles east of Fort Smith, Arkansas, between Ozark and Russellville, Arkansas. The Arkansas River flows in an almost east-west direction a short distance south of the area.

Mapping was done as a project of structural reconnaissance and the equipment used consisted mainly of aerial photographs and Brunton compass.

**Physiography:** The Boston Mountains are on the south flank of the Ozark uplift. The area under discussion is on the southern edge of the Boston Mountains which are bordered on the south by the Arkansas Valley.

The rather obvious topographic alignment is in a generally east-west direction. Near the Arkansas River the land is fairly flat, but toward the north the surface becomes progressively more hilly. In this area the foot-hills end rather abruptly, to the north, at a south-facing escarpment which marks the beginning of mountainous topography.

Peneplanation has probably occurred one or more times and the area is in a mature stage of a new cycle of erosion. Many of the streams, however, have definitely youthful characteristics. Commonly, in some part of their courses, the streams flow in narrow bed-rock channels with vertical rock-walled sides. In places, the high rock-walls occur on only one side of a stream, but in other places rock-walls are on both sides and these gorges are from 50 to 100 feet or more in depth.

A number of small streams not confined to gorges have terraces composed in great part of boulders and cobbles. These large rocks are commonly imbricated and show the direction of flow of the water that deposited them. In most places these loose deposits only recently have been cut through so that the streams are flowing on bed-rock, but the valley walls are of loose unconsolidated material. These observations suggest a recent uplift, but do not prove it and no special study of this was attempted.

**Stratigraphy:** The bed-rock in the area is all of Pennsylvanian age and four formations are represented.

*Youngest* — Savanna
McAlester
Hartshorne
*Oldest* — Atoka

All the formations consist principally of monotonous sequences of sandstone and shale with some coal beds. The only fossils seen in the formations were plant remains which are particularly abundant in association with coal horizons.

The formational names are all carried a good distance from their type locality and proper correlation is uncertain. The present state of knowledge of the local stratigraphy is one of indefiniteness. It is quite difficult to establish a good marker horizon on any basis except the coals and they have only limited value in this respect. Where the beds are laid out in orderly succession the various formations can be distinguished more or less

[1] Presented with the permission of the Gulf Refining Company.

readily. However, in an area of structural complications, it is commonly virtually impossible to assign the sandstones and shales to a specific formation.

**Structure:** There is probably a regional dip to the south away from the Boston Mountains, but this is largely masked by local folding and faulting. The principal structures strike east-west or nearly so, but a number of smaller structures have divergent trends.

**Folds:** The length of mappable folds is commonly measurable in miles and in places, small folds occur on the flanks of larger folds. In one area there is a series of small domes, one-half mile to a mile or so in map diameter.

Dips along the flanks of folds are usually low; 2° or 3° dips are not uncommon. In places, however, dips range up to 10° or 12° but rarely higher except near a fault. Dips are difficult to obtain on many outcrops, both small and large, because of cross-bedding and almost ubiquitous rumpling of beds.

**Faults:** Faults are difficult to detect in the field partly because of the similarity of the lithologies of the several formations. Aerial photographs are of considerable help because many faults show up on the photographs as "distinct alignments."

Most of the faults present are normal or gravity faults with relatively small stratigraphic displacement and the hanging wall (downthrown side) is commonly to the south. Most of the faults have a disturbed zone that is only a few feet wide, but at least one rather long fault has a zone of movement more than 100 feet in width. This disturbed zone has broken rock, sheared material and rotated blocks that not uncommonly show drag. The smaller faults commonly have sandstone against sandstone and if the fault itself is covered it is almost impossible to locate it with any degree of accuracy.

Some cross faults are present which extend from one normal fault to another and movement along these cross-faults seems to be largely strike-slip. In places, the combination of east-west trending normal faults and northeast-southwest trending strike-slip faults results in rotated blocks bounded by faults.