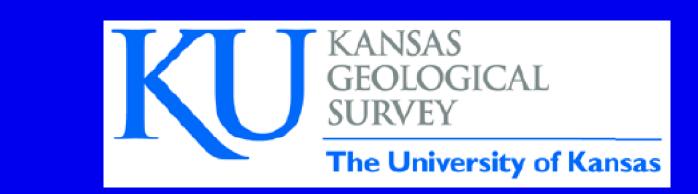
The Case of the Barren Basin: the Salina Basin of Kansas

KANSAS
GEOLOGICAL
SURVEY
The University of Kansas

K. David Newell and Daniel F. Merriam,

Kansas Geological Survey, University of Kansas, Lawrence, KS 66047-2736

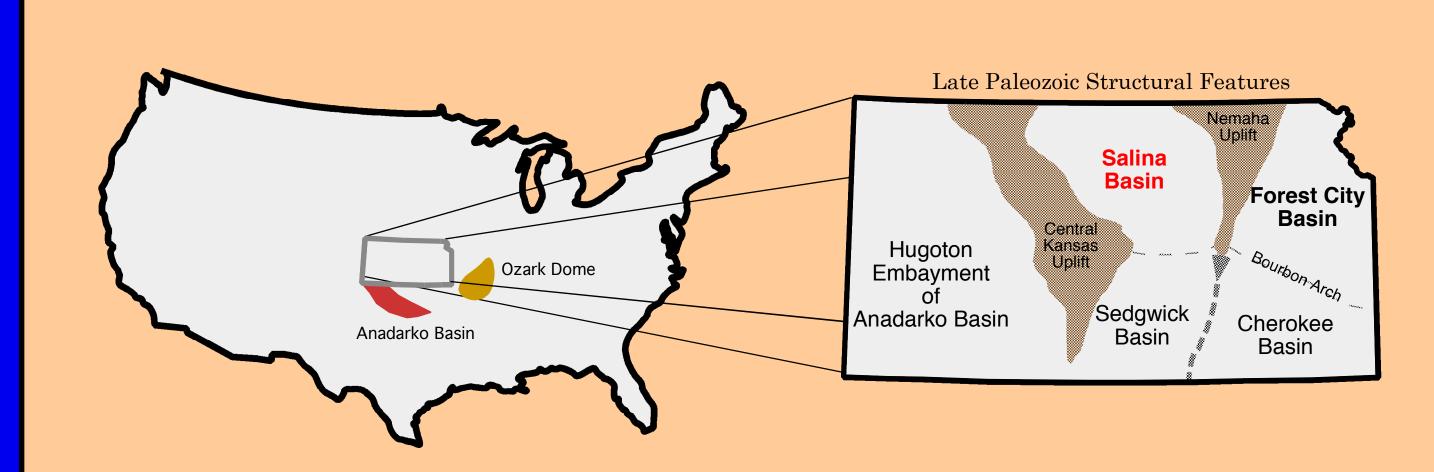
dnewell@kgs.ku.edu; 785-864-2183



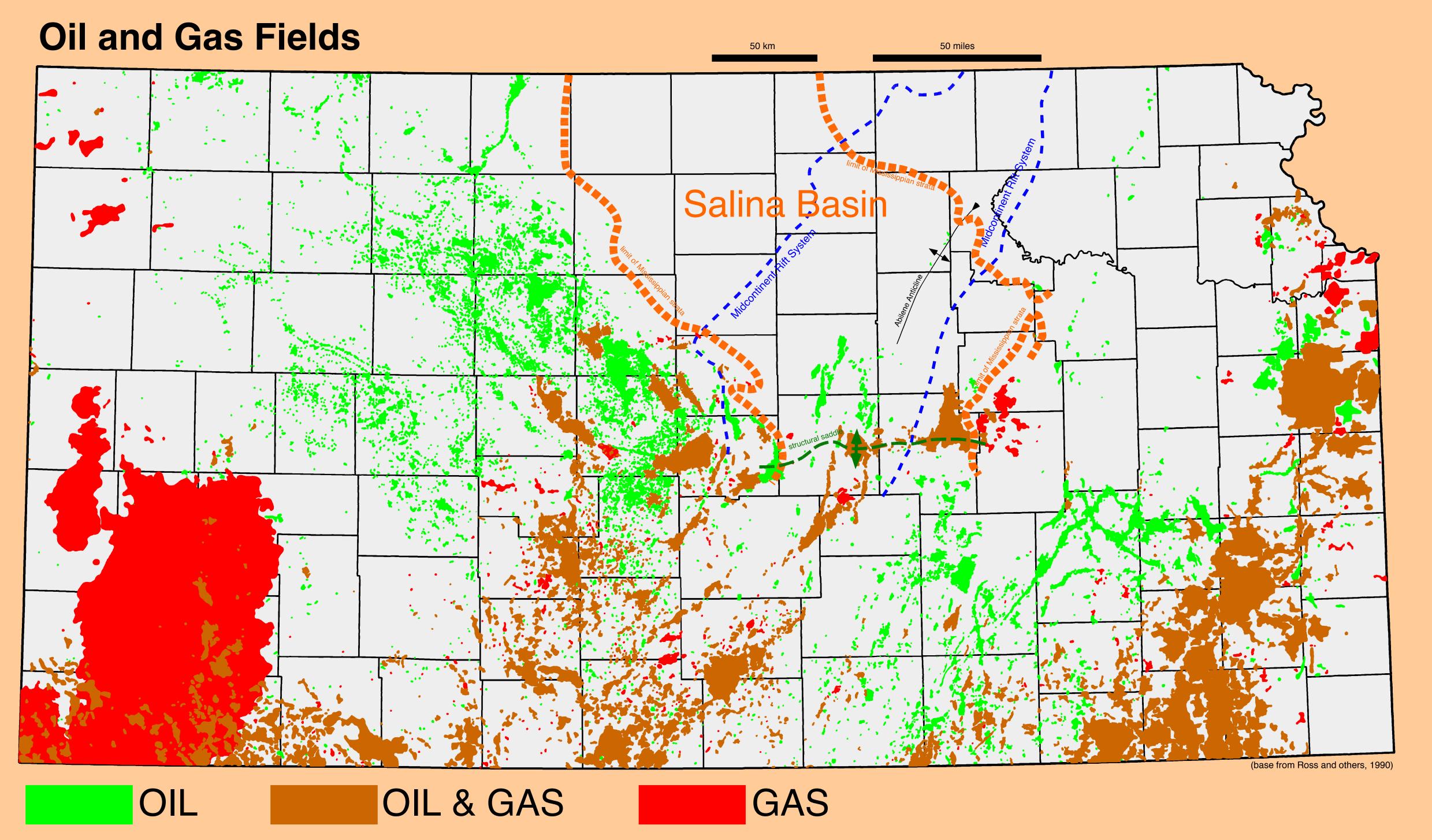
ABSTRACT

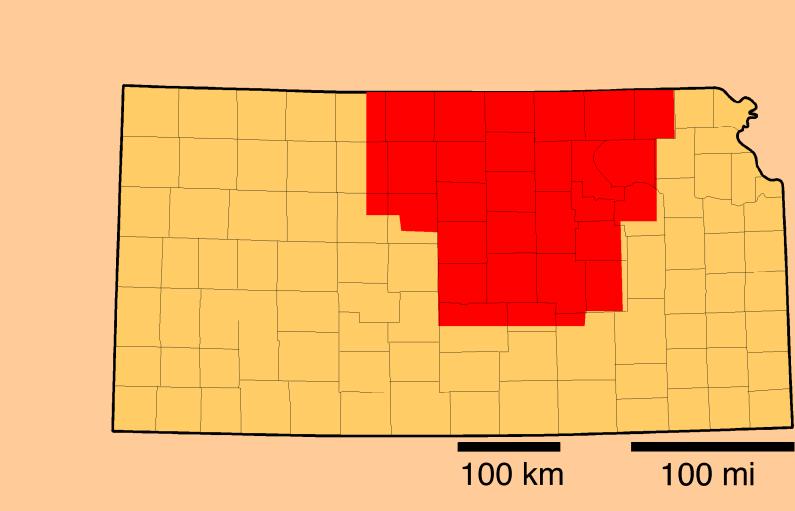
The 20,000 square mile, 4,800 feet deep Salina Basin in north-central Kansas and its extension as the Central Nebraska Basin in south-central Nebraska is an enigma: why is there no major oil or gas production in the basin? Although some oil production does occur on structure in the southern part and on the flanks of the basin: is the basin barren or just not explored adequately? The basin is bounded on the east by the Nemaha Anticline and on the west by the Central Kansas Uplift and Cambridge Arch. The southern limit is a vague saddle between the Salina Basin and Sedgwick Embayment of the Anadarko Basin, the northern limit is ill-defined in central Nebraska where the zero edge of Mississippian rocks usually is considered the limit of the basin. Overlying the Precambrian basement is a normal section of Paleozoic rocks, which include source beds, structure, and possible traps, capped by Cretaceous units. The structural history is similar to the adjacent Forest City Basin, which has production. The scenario for the Salina Basin then is: (1) the occurrence of petroleum on the flanks of the basin are the result of migration from adjacent areas up structural features that flank the basin; and (2) any undiscovered petroleum elsewhere in the basin has to be generated in situ and locally migrated. An exploration model for the latter scenario is that maturation will be maximized along the axis of the basin, and potential source rocks (primarily Middle Ordovician) will be present toward the southern end of the basin. NE-SW-oriented structures, resulting from of reactivation of Precambrian tectonic features, and crossing the axis of the basin, are suggested exploration targets.

GEOLOGIC SETTING



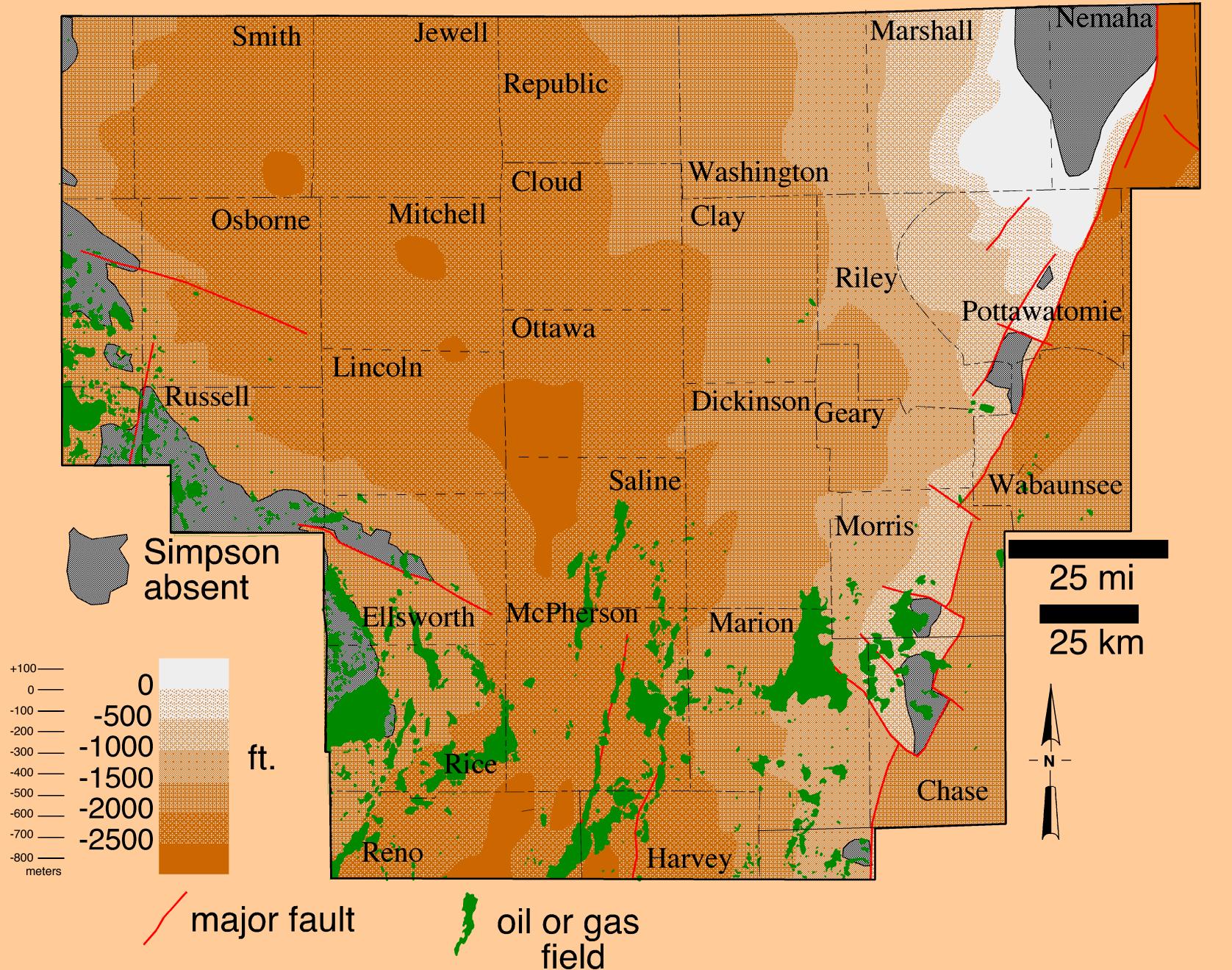
The Salina Basin was first defined in the AAPG Bulletin by Barwick (1928). This basin is largely devoid of petroleum production with exception of a few fields along its perimeter. Structural features to its west and south -- the Central Kansas Uplift, Nemaha Uplift, and Sedgwick Basin -- all have prolific oil and gas production. The lack of production in the Salina basin begs the question: Why the discrepancy?





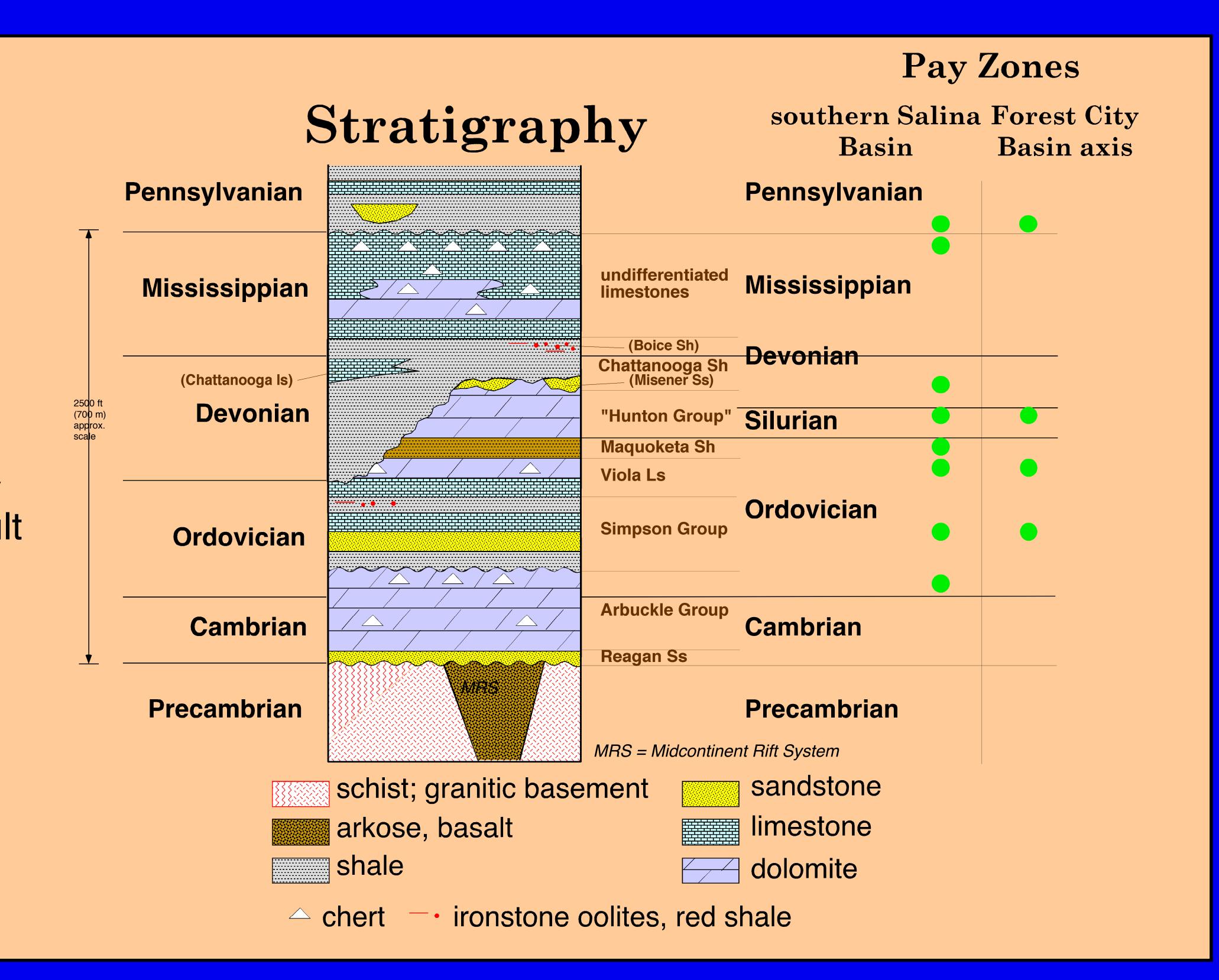
The axis of the Salina Basin trends northwest-southeast, with a steeper dipping west flank and a gentler east one. The northern end of the basin extends a short way into Nebraska. A total of about 4800 ft (1450 m) of sediment accumulated in the deepest part of the basin.

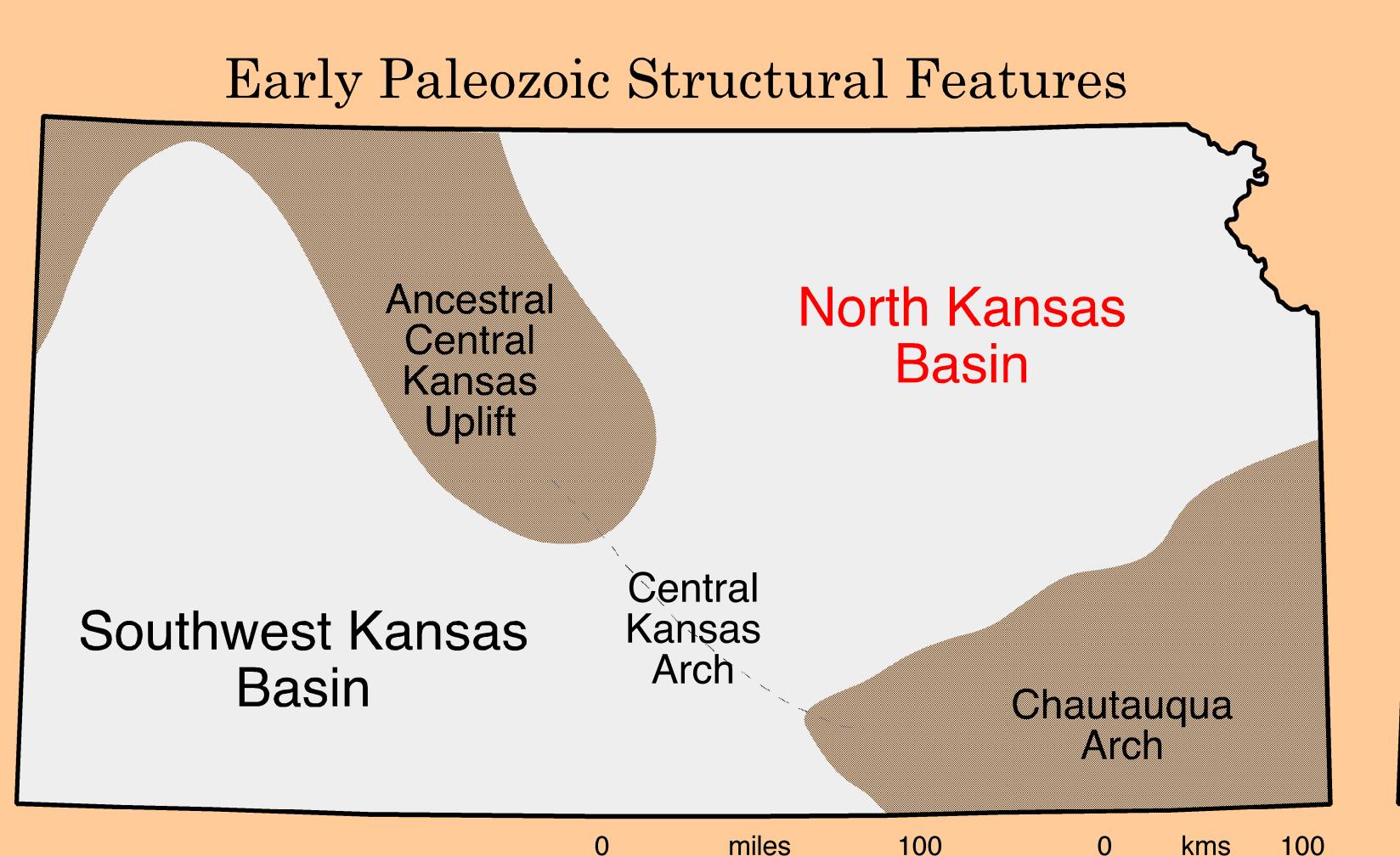
STRUCTURE MAP BASE MIDDLE ORDOVICIAN SIMPSON GROUP

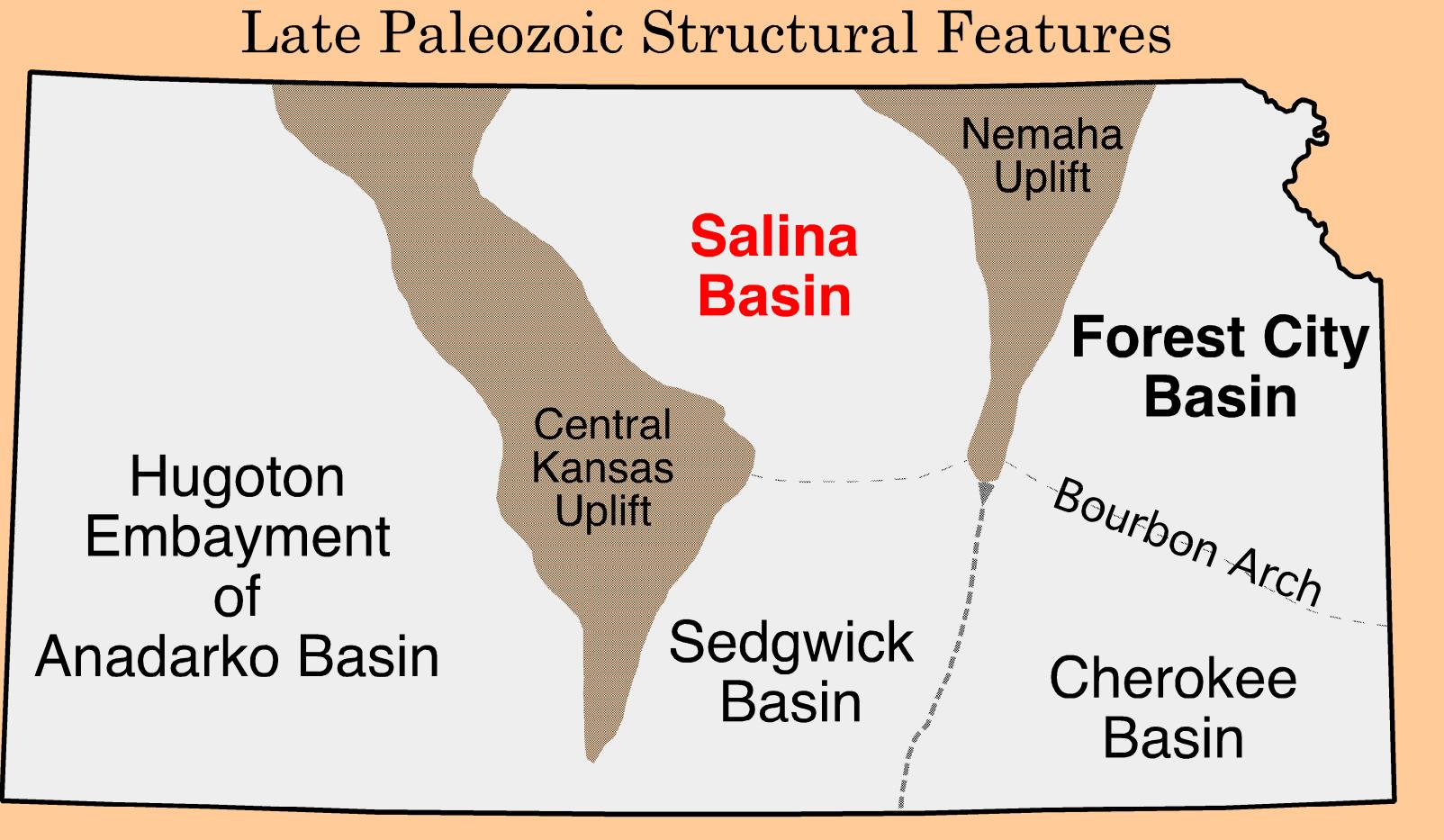


The Salina Basin is basically a Paleozoic structural feature developed on Precambrian cratonic basement. Thin, but widespread Paleozoic carbonates and shales, with local sandstones occur in the basin. The carbonates and sandstones are locally reservoirs for petroleum, usually associated with subtle anticlines.

These anticlines are known as *plains-type folds*, which developed slowly over the history of the basin by draping of strata over tilted fault blocks in the rigid Precambrian basement (Merriam, 1963). Structural movement accounting for the anticlines was intensive in the late Paleozoic, and periodic adjustments continuing through the Mesozoic until today (Merriam, 2005).







In pre-Mississippian -- post-Devonian time, the Salina Basin was linked to the Forest City Basin. Both regions were encompassed by the broad North Kansas Basin. Structural movement of the Nemaha Uplift separated the two basins in late Mississippian time. This major tectonic movement is associated with the Ouachita orogeny to the south. The form of the Salina Basin as it is know today was established after this period of tectonism (Merriam, 1963).