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John C. Ludlum, West Virginia University

"Prospects and Structural Problems in Exploration for Natural Gas in the Appalachian Area"

Abstract

Drilling during the current second phase of exploration and production in the Appalachian Basin has provided structural information which must be considered in the third phase of deep exploration which has recently been initiated. Classical textbook descriptions and generalizations are misleading unless qualified and modified in light of existing but poorly publicized and relatively new information.

There is a Siluro-Devonian mobile zone beneath the Appalachian Plateaus which approaches the structural pattern and complexity of the surface structures of the Valley and Ridge province to the southeast. The less-couples post-Devonian surface anticlines of the Plateaus therefore may not be reliable guides to the position of the disharmonic Siluro-Devonian structures. There is even the possibility that productive subsurface highs will be found beneath surface lows to mark the terminal discovery period of second phase production.

Rasp-type gravens are along the axes of the Siluro-Devonian anticlines in some areas, whereas southeast-dipping thrust faults are characteristic of others. Experimental analogies exist for explaining the origin of these patterns from either lateral or vertical stresses.

q There appears to be no sudden termination of "southern type" thrust faulting northeastward along the trend of the Appalachians in southeastern West Virginia or neighboring Virginia.

Conformity of Siluro-Devonian structures to the Cambro-Ordovician structures which are the main targets of the third phase exploration has not been established. With known vertical and lateral disharmonies, it appears that intelligent completion of prospecting of the Siluro-Devonian structures, and location of third phase prospects in the Cambro-Ordovician must depend on successful adaptation of geophysical prospecting to Appalachian conditions.

February 12, 1962

Miss Suszanne Takken, Mobile Oil Company, Oklahoma City

"Subthrust Production from Springer Sands on the North Flank of the Wichita Mountain Complex"

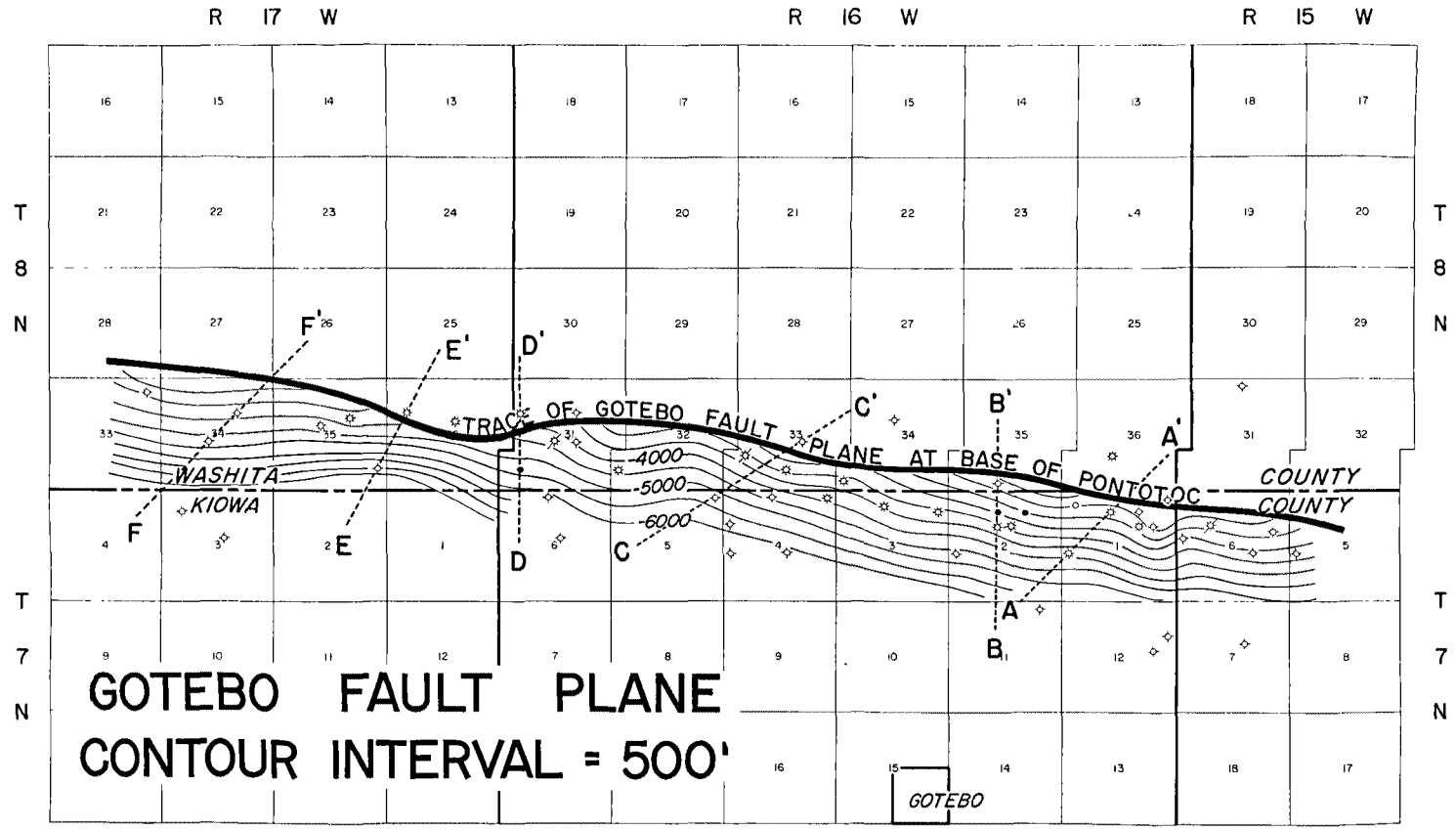
Author's Note: The following is an abstract of a talk given before the Tulsa Geological Society February 12, 1962. The full paper is to be published under the title "Subsurface Geology of the North Gotebo Area, Kiowa and Washita Counties, Oklahoma.

The producing area is in Townships 7 and 9 North, Ranges 16 and 17 West, in Kiowa and Washita Counties, Oklahoma. Several field names were given because of irregular development but it is now convenient to use the name North Gotebo for the whole producing trend which is approximately nine miles long by one-half mile wide. (See illustration)

Located regionally on the north flank of the subsurface expression of the Wichita Mountain complex, this area is characterized by thrust faulting, overturned folds, and upside-down producing sands.

The principal thrust fault, here called the Gotebo Fault, dips to the south at the rate of 5000 feet per mile. The oldest rocks so far encountered in the overthrust block are Hunton, of Siluro-Devonian age, resting on Springer, of probable Mississippian age.

The entire area is overlain by Permian rocks, at the base of which occurs


R 17 W
R 16 W
R 15 W
T 8 N
T 7 N
F'
E'
D'
C'
B'
A'
F
E
D
C
B
A
TRACE OF GOTEBO FAULT PLANE AT BASE OF PONTOTOC
-4000-
-5000-
-6000-
WASHITA
KIOWA
COUNTY
COUNTY
GOTEBO FAULT PLANE
CONTOUR INTERVAL = 500'
GOTEBO

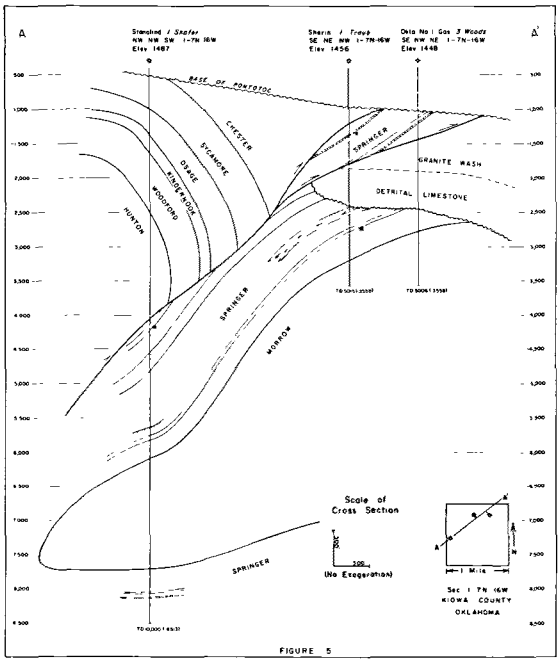


FIGURE 5

the Pontotoc conglomerate. The erosion prior to the deposition of this conglomerate has erased much of the record so that the maximum extent of the thrusting cannot be accurately determined. The present trace of the Gotebo Thrust where it meets the unconformity is a convenient boundary to use between the Wichita Mountains and the Anadarko Basin.

North Gotebo is principally a gas field but oil is also produced from Springer sands beneath the thrust. There are four sand zones identifiable and in most wells they are upside-down due to overturn folding. Springer sands also occur in normal attitude, in the overthrust block, but are not productive.

Inconsistent bottom-hole pressures and oil production structurally higher than gas in correlative sands, indicate discontinuous reservoirs. This may be due to permeability barriers or minor faulting but in either case, the per-well gas reserves are therefore rather low, and variable, ranging from one billion to six billion cubic feet. Average porosity of the sands is twelve to fifteen per cent and permeability is estimated to be 100 millidarcies since most of the wells flow naturally, without fracture treatment.

The formations involved in the thrust faulting are primarily the Morrow-Springer-Chester section whose rocks are relatively incompetent. They lend themselves readily to overturned folding which ultimately results in thrust faulting. The thrusting is considered to have occurred originally at the end of Morrow time and to have been rejuventated in late Pennsylvanian time.

The Gotebo thrust, or one like it, can be traced for some miles in either direction from the North Gotebo production. It is probable that similar geologic conditions exist adjacent to any mountain complex, particularly if relatively incompetent beds are present.