QUARTERLY PROGRESS REPORT

June to August, 1974

HYDROLOGIC SIGNIFICANCE OF LINEAMENTS IN CENTRAL TENNESSEE

(Formerly Hydrologic Significance of Faults in the Great Smoky Mountains National Park)

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TITLE: Hydrologic Significance of Lineaments in Central Tennessee (Formerly Hydrologic Significance of Faults in the Great Smoky Mountains National Park).

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OBJECTIVE OF STUDY: To determine the feasibility of mapping lineaments on S-190 photography of central Tennessee and to determine the hydrologic significance of these lineaments, particularly as concerns the occurrence and productivity of ground water.

PROGRESS AND OVERALL STATUS: A combination of two methods was used to delineate lineaments on SKYLAB photographs: stereo viewing and projection. For the projection method, 35 mm color slides of S-190B photos were projected on a large screen. The slides were viewed both in sharp focus and slightly out of focus; also, the slides were viewed at several different distances from the screen. Some slides were of an entire SKYLAB photo; other slides were enlarge-

ments of a small portion of one photo. Finally, linear features were enhanced by slow rotation of a Ronchi ruling, which was held against and in front of the projector lens.

For the method of stereo viewing, lineaments were drawn by viewing 9 X 9 inch transparencies of S-190B photos at both 1.5X and 4.5X magnifications. Stereo viewing of the small area of overlap on alternate photos results in a model with much more relief than that obtained with adjacent photos; a few additional lineaments were found by this procedure.

More but shorter lineaments were mapped by stereo viewing than by projection. Some lineaments were found by both methods. The Beech Grove lineament was obvious by both methods, and a number of intersecting lineaments that were not apparent on ERTS imagery were delineated on the SKYLAB photos.

A Bausch and Lomb Zoom Transfer Scope was used to transfer the lineaments from photos to maps and proved to be very good for this purpose. During this process, a new interstate highway and parts of two new reservoirs were added to the maps.

Multispectral black-and-white and color photos from the S-190A experiment were received from NASA (Houston). High altitude aircraft photos of the eastern two thirds of the test site were received from NASA (Huntsville). The quick response of NASA in providing these photos of the new test site is appreciated by the investigators.

High altitude aircraft photos were used as a form of ground truth to check the lineaments that had been mapped from SKYLAB photos.

Three lineaments proved to be pipeline or power line right-of-ways and were deleted from the maps. Most lineaments are topographic depressions; the rest are formed by cultivation and vegetation patterns.

The test site was decreased slightly in size, because few lineaments were mapped near the edges of the area that was analyzed. The new boundaries and coordinates of the test site are shown on the attached map (fig. 1). This area contains 2,140 square miles. In comparison, the original Smoky Mountains test site contained 1,500 square miles.

The locations and trends of the lineaments were compared with the locations and trends of anomalies on a Bouguer gravity map and a magnetic map of the test site. There does not seem to be a correlation.

The distribution of yields of wells that are located along the lineaments was compared with two distributions of wells that were drilled at random in central Tennessee. A significantly larger percentage of wells along the lineament yield more than 20 gallons of water per minute. This conclusion is both preliminary and tentative, however.

Prime and alternate sites for test drilling have been selected from the SKYLAB and aircraft photos.

In summary, significant progress on this study was made during the quarter. At the end of the quarter, the study was only slightly behind the schedule that was specified in the milestone plan. There is good reason to believe that the study can be completed by June 30,

1975, as originally planned.

REQUIRED DECISIONS AND ACTIONS: None.

EXPECTED ACCOMPLISHMENTS IN NEXT QUARTER: Detailed analyses will be made of: (1) locations, azimuths, lengths, and interpretation method of the lineaments, (2) the locations of the lineaments in comparison with streamflows and in comparison with locations of anomalies on geologic structure maps, and (3) the yields of wells along and near the lineaments in comparison with other wells in the study area. Also the trends of the lineaments will be compared with the trends of joints and faults on published, large scale geologic maps.

Selected lineaments and proposed sites for test drilling will be examined in the field. Agreements for test drilling will be made with land owners. A drilling contract will be issued, and test drilling will begin.

Preparation of illustrations for the final report will begin.

SIGNIFICANT RESULTS: None.

SUMMARY OUTLOOK: The investigators plan to complete this study by June 30, 1975, as originally proposed. No additional funds will be needed or requested.

TRAVEL PLANS: A trip to Nashville, TN is scheduled for the week of September 9. Data for the planned analyses will be obtained at this time. A trip to the test site is planned for late September or October, in order to make an examination of lineaments on the ground and to arrange for test drilling.

MISCELLANEOUS: None.

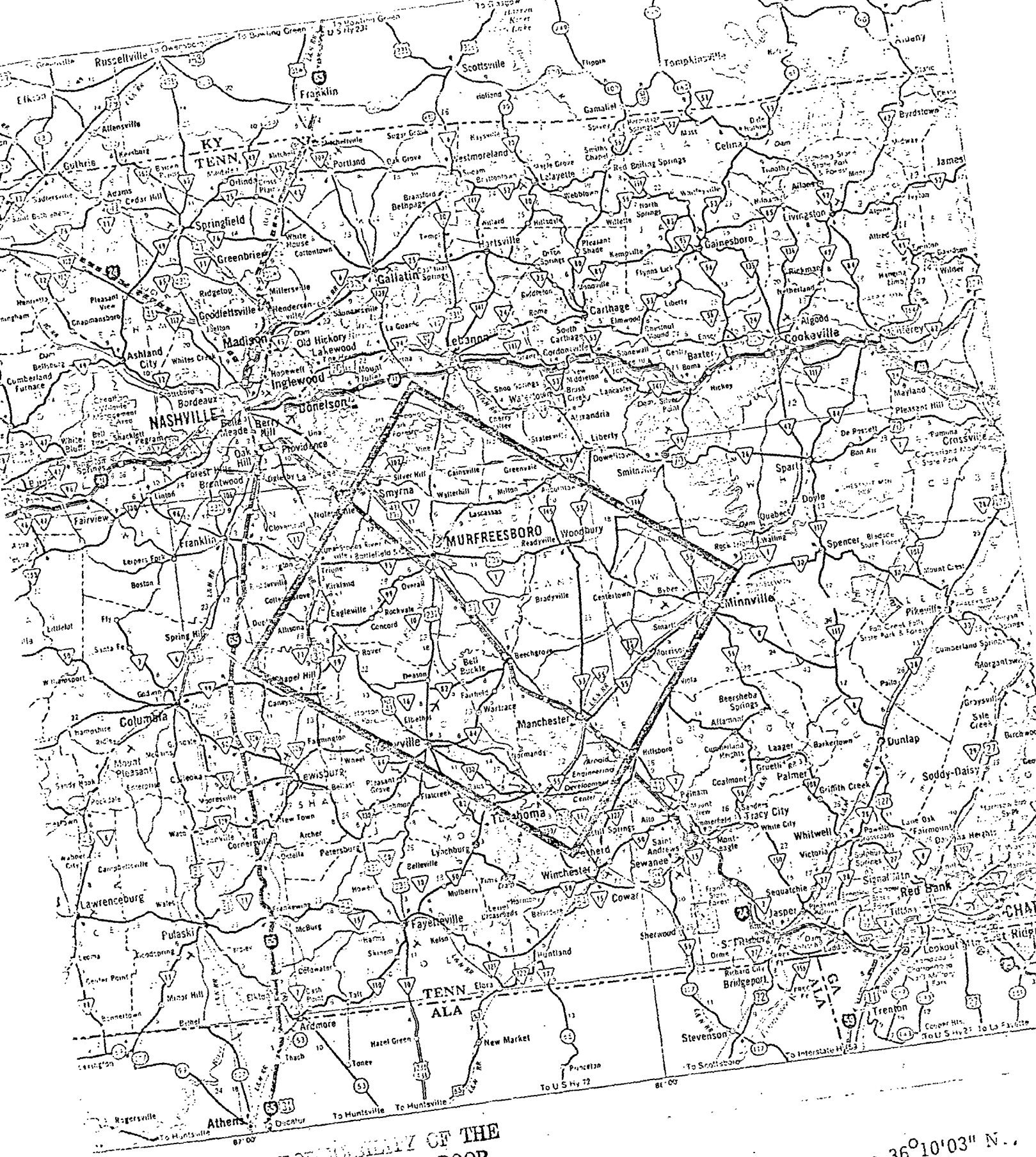

Figure 1.--The Murfreesboro, Tennessee test site. Corner coordinates $36^{\circ}10'03"$ N., $86^{\circ}22'24"$ W.; $35^{\circ}40'03"$ N., $86^{\circ}50'48"$ W.; $35^{\circ}14'06"$ N., $86^{\circ}09'06"$ W.; $35^{\circ}43'57"$ N., $85^{\circ}40'36"$ W.