years eleven deep (Mississippian or Ellenburger) wildcat tests have been drilled in the Texas Panhandle part of the Anadarko basin. These have served to give some insight into what the structure and deposition in this part of the basin is going to be: a few questions have been answered and a great many more have been posed which only additional drilling can answer.

18. Eastern Colorado Oil and Gas Prospects, by Harry W. Oborne, Colorado Springs, Colorado.

Prospective regions of eastern Colorado are divided naturally into two main classes: the basins which have in the past, because of depths, been thought of as limited to Cretaceous possibilities; and those areas in which the Paleozoic formations present the principal, or only, chances of production. With the advent of deeper drilling techniques the phantom barrier to prospects below the Cretaceous in the basin areas tends to disappear. This barrier is also modified by the fact that excessive drilling depths, formerly predicated for the deeper parts of the basins, can be scaled down in line with sections measured along the Rocky Mountain front, and from a few scattered well logs in the east.

The areas of Cretaceous prospects are the three basins in the western part of the region. Oil and gas have long been produced from all three of these basins and the recent discovery in southwestern Nebraska has centered much attention on that and other parts of the Denver basin. Additional prospects exist within the Cretaceous, and beneath the Cretaceous, especially in large parts of the Denver basin.

The areas which have heretofore been considered the particular loci of Paleozoic prospects are the Sierra Grande uplift and the so-called Las Animas arch, plus the territory north and northeast toward the northeast corner of the state. The Apishapa uplift, connecting the Sierra Grande uplift with the Wet Mountains, and separating the Denver and Raton basins, has been included in this area of Paleozoic prospects. Parts of these areas still hold excellent prospects, especially on the flanks of the uplifts, and in areas east and north.

In the literature Sierra Grande uplift and Las Animas arch have been used as synonymous terms. The Sierra Grande uplift is a very old feature in New Mexico and southern Colorado, and the so-called Las Animas arch is a much younger feature due mainly to the subsidence of the Denver basin contemporaneous with Cretaceous sedimentation, and probably modified by later Laramide orogeny. The northwestward continuation of the Anadarko basin, in the older rocks, may be traced directly across the present surface expression of the Las Animas arch.

The geologic history and paleogeography are briefly traced to show what the writer believes to be excellent prospects in the Paleozoic formations in the deeper parts of the basins, especially the Denver basin, at what are not drillable depths.

19. Results of Hydrafrac Treatments, by W. D. Owsley, Halliburton Oil Well Cementing Company, Duncan, Oklahoma.

The Hydrafrac process, originally developed by the research department of Stanolind Oil and Gas Company, has now been in use throughout the industry for 10 months. The results during the research period and those in the succeeding months of commercial operation have been of great benefit in increasing the production of oil and gas. The Hydrafrac process generates new and increased effective permeability in the well. This is accomplished by hydraulic fracturing of the particular zone being treated. The fracture formed is held open by graded sand carried into it with the fracturing medium. This sand acts as a propping agent to hold open the fracture thus produced. While the Hydrafrac process is applicable to many types of formations it is, nevertheless, highly important that the well conditions be properly evaluated before a decision is made to use the process. Such factors as thickness of the zone, state of depletion, permeability and the general condition of the well with regard to isolation of the zone, must be taken into account in the planning of a job. Where applied in a properly planned manner, either as a completion method on new wells or for rejuvenation of existing wells, the Hydrafrac treatments have resulted in a high degree of success. It is believed that this method will give greater ultimate recovery, as well as a higher rate of recovery. A complete résumé of the Hydrafrac process treatments is given in the paper with regard to various areas, formations, and production history of the wells thus treated.

20. Geologic Responsibility in Seismic Exploration, by B. W. Beebe, Anderson-Prichard Oil Corporation, Oklahoma City, Oklahoma.

The seismograph, after more than 20 years of successful operation, remains the most important mechanical instrument available to assist in locating new petroleum reserves. However, it is evident that the "honeymoon" has been over for some time, that the seismograph in the hands of the geophysicist alone is not the most efficient method of operation. The seismograph as an instrument has proved its usefulness and is not on trial, but in far too many instances its employment and the interpretation of observations have either failed or left much to be desired. The primary responsibility in any geophysical exploration program with the object of locating commercial deposits of petroleum is and must be jointly that of the geologist and geophysicist. Geologists as a group have failed to recognize and assume their full share of the responsibility insofar as geophysical prospecting is concerned. Despite the fact that many geologists have successfully entered the field of geophysics, exploration geologists have not as a group assumed the responsibility for correlating their work with the work of geophysicists and assumed their full share of the direction of the exploratory program. Although this paper deals primarily with seismic prospecting, the same direction, cooperation, and integration is necessary in any geophysical program employing any technique. The fundamental problem is the interpretation of physical observations in terms of earth science.

The thesis of this paper is that the primary responsibility in exploration is geological, and responsibility of the geophysical department or contractor is limited to three essentials:

1. To furnish the most modern and sensitive instruments and auxiliary equipment available to perform the specific task.
2. To furnish skilled, efficient and experienced personnel to operate and maintain the instruments and equipment.
3. To furnish skilled and experienced technical and supervisory personnel to assist in planning, make necessary computations, preliminary interpretations and with the geologists make an integrated interpretation. The final interpretation on which decisions for action are based must be a matter of joint responsibility.

All other responsibility must be assumed by the geologist. It is, therefore, mandatory that he have a thorough understanding of the principles, problems, procedure and limitations of seismic exploration. It is not advocated that the geologist invade the field of the geophysicist, but if he is to use the results intelligently he must thoroughly understand their source and inherent strength and weakness. The need for this understanding is becoming more necessary as we are forced to prospect more marginal areas, areas where data are difficult to secure and interpret, and for prospects where the results are near the limit of accuracy. The easy areas and "fat" structures have been thoroughly prospected. To insure success in a seismic exploration program there is a certain procedure which must be followed. This procedure can logically be divided into five stages: preparation, briefing, execution, integration and review.

21. Résumé of Development of Forest City Basin of Northeast Kansas, by Ralph W. Ruwwe, Stanolind Oil and Gas Company, Wichita, Kansas.

The Forest City basin of northeast Kansas received widespread attention with the discovery of the Davis Ranch pool in Wabaunsee County this year. Nearly 750,000 acres were leased as a result of this discovery. Development of the pool and wildcat activity are reviewed. The major structural features are shown, and the stratigraphy in the basin is discussed. Approximately 20 surface parties, several seismograph crews, and core drills were at work in the basin this past summer. Surface formations, their limits, and the methods of exploration used in the basin are discussed.

22. Stratigraphic and Structural History of Sholem Alechem Oil Field, Southern Oklahoma, by H. R. Billingsley, Atlantic Refining Company, Shawnee, Oklahoma.

Although southern Oklahoma geology has received considerable study, little is actually known regarding subsurface details of local geologic structures such as the Sholem Alechem structure. This oil field was discovered in December, 1923, on a northwest-southeast trending anticlincal fold in the trough of the Anadarko-Ardmore geosyncline. It extends from Carter County into Stephens County.

Prior to August, 1947, Sholem Alechem was classed as a minor southern Oklahoma oil field. However, the discovery and subsequent development of the deeper Springer sandstone production has increased the total yearly output of the field from 706,853 barrels in 1947 to 4,989,845 barrels in 1948, thus ranking Sholem Alechem as second only to the Velma pool among Oklahoma's biggest and most active producers.

Rocks below the Pennsylvanian sequence of Springer shales have not been penetrated by the drill in this field; therefore, no evidence of the lower Wichita orogeny was found. It is believed, however, that deposition continued uninterrupted from Mississippian until after Springer time.

Thickening northeastward, the Springer sandstones show no indication of thinning on structure, thus suggesting that the anticlinal fold was not present in Springer time. The folding of the Sholem Alechem structure is believed to have been initiated by the post-Morrowan main Wichita orogeny, with the post-Springer pre-Deese unconformity caused by this movement, being partly equivalent to the widespread post-Mississippian pre-Deese unconformity of northern Oklahoma.

Emergent conditions are indicated by the absence of Dornick Hills rocks over the structure, with Deese sediments of a mixed lithologic character being deposited on the Springer.

A minor emergence at the close of Deese deposition, before the initiation of Hoxbar sedimentation is indicated by the disconformity below the County Line limestone. This limestone implies a restricted reef facies of local limestone deposition because it is well developed on the structurally high areas. Thrusting and compression from the south, suggested by the steeper dips on the north flank, occurred during the Arbuckle uplift of late Pennsylvanian time causing the final folding of the Sholem Alechem and other local structures.