the year's record of improved discovery rate is encouraging, and implies that we may reasonably expect discoveries to continue with perhaps an occasional one of major proportion.

The problem of diminishing rate of supply is briefly examined.

35. ROBERT L. BATES, New Mexico School of Mines, Socorro, New Mexico
Occurrence and Origin of Permian Evaporites

The deposits of Permian salt, anhydrite, and potash which occur in the southwestern Mid-Continent region are of considerable importance from both the economic and the scientific viewpoints. Although their presence has been known and their substance mined for years, there is no available comprehensive account of their occurrence and origin. It has been decided that a section of the Permian Volume be given over to a discussion of problems coming under the above title. This note is a report of progress on the preparation of the section on evaporites.

Procedure to date has been as follows. All pertinent articles on the subject at hand have been read and summarized by the writer of this note; these summaries have been assmbled and synthesized; and a number of copies of the assembled summaries have been made. It is now hoped that all geologists interested in this subject will procure copies of the digested abstracts, read them with care, and then let the present writer have their ideas, opinions, suggestions, hypotheses, theories, recommendations, and criticism in general. The purpose of all this will be, first, to summarize accurately the occurrence of Permian saline residues, and second, to test the published theories and hypotheses of evaporite formation against the facts as they are known by qualified workers in the field. If the theories now in existence explain everything satisfactorily, it will be worth while to know that; if not, then an attempt will be made to evolve something more generally applicable. The ultimate report will be the result of cooperation on the part of many geologists interested in evaporites. It is hoped that the report can be completed in a few months.

36. M. L. THOMPSON, New Mexico School of Mines, Socorro, New Mexico
C. E. NEEDHAM, New Mexico School of Mines, Socorro, New Mexico
The Pennsylvania-Permian Contact in New Mexico

The Pennsylvanian-Permian contact in New Mexico has generally been recorded as being between the marine Pennsylvanian "Magdalena formation" and the non-marine Permian Abo formation. Evidence is presented in this discussion to show that two unconformities of large magnitudes, with intervening marine deposits, are present between the Pennsylvanian "Magdalena formation" and the Permian Abo formation in many areas of New Mexico. One of these unconformities is at the base of the Abo formation and the other occurs lower in the section. Furthermore, evidence is presented to show that the lower of these two unconformities marks a contact between fusulinid-bearing marine Pennsylvanian and fusulinid-bearing marine Permian sediments. In extreme northern New Mexico, the Pennsylvanian-Permian contact seems to be between marine Des Moines Pennsylvanian sediments and non-marine Permian redbeds.

37. C. E. NEEDHAM, New Mexico School of Mines, Socorro, New Mexico
R. L. BATES, New Mexico School of Mines, Socorro, New Mexico
Permian of Central and Northern New Mexico

Formations in ascending order above an unnamed basal Wolfcamp formation are the Abo, Yeso, Glorieta, and San Andres. Relations across the state are shown by three cross sections.

The Abo consists of red and brown thin-bedded shales and medium-bedded sandstones, with arkoses; it shows ripple marks, mud cracks, salt casts, cross-bedding, tracks and remains of vertebrates, and plant impressions; it is non-marine. The thickness is about 650 feet near Socorro and increases to 900 or 1,000 feet near Alamogordo.

The Yeso consists of gypsum, pink and light-colored silts and sands, and limestones. Limestone increases from less than 6 per cent in the Zuni Mountains to more than 25 per cent in the Sacramento Mountains. Some of the members can be traced for scores of miles. The formation is mainly marine in origin. The thickness is about 620 feet at the type locality near Socorro and increases to more than 1,100 feet near Alamogordo.

The Glorieta is a clean light-colored heavy-bedded medium-grained resistant sandstone 135 feet thick at Rowe on Glorieta Mesa. It is about 70 feet thick east of Socorro

and thins to a feather edge in the San Andres and Sacramento mountains. It is probably marine in origin.

The San Andres is gray to pale-buff medium- to heavy-bedded limestone about 350 feet thick at the type locality in Rhodes Canyon. It thins to 20 feet on Glorieta Mesa and disappears north; its relations to the overlying Permian southeast are not well understood. A sand zone in the lower part is traceable from the Zuni Mountains to Hondo Canyon 225 miles southeast. At the north the San Andres is overlain by pink silts and sands of unknown age.

38. CHARLES P. MILLER, Consulting Geologist, Hobbs, New Mexico
Geological Factors Which Led to Discovery of Salt Lake Pool, Western Lea County, New Mexico

The Salt Lake pool is in southeastern New Mexico, approximately midway between Carlsbad and Hobbs. The discovery well was completed in June, 1941, at a total depth of 3,103 feet. As of February 1, 1942, the field contained six wells, producing oil that ranges in gravity from 26 to 30 degrees.

Microscopic study of the pay section reveals that much of the oil has accumulated in solution cavities within the dolomitic limestone and that the dolomitic limestone itself is not saturated. Two distinct "pays" are separated by approximately 75 feet of limestone yielding only minor showings of oil. The early appearance of water suggests that the solution cavities contain appreciable amounts of water as well as oil. Free gas is practically lacking and the oil is produced by pumping. The Cowden anhydrite member in the lower part of the Salado salt is believed to be the youngest reliable structural marker. It is believed that much of the structural adjustment that produced closure in the Salt Lake pool occurred during middle Salado time. Therefore, in searching for new pools within this area, the thickening and thinning of the Salado should be carefully studied. Isopach maps of the interval from the top of the Rustler anhydrite to the top of the Cowden anhydrite are very helpful in localizing structure. Isopach maps in the interval from the top of the Cowden to the top of the pay may be very useful in predicting pay characteristics.

The methods which were checked one against the other in locating the Salt Lake pool are given herewith in the order used.

1. Regional contouring on a bed below the base of the salt.
2. Preparation of isopach maps on the salt section.
3. Survey of local area by torsion balance.
4. Survey of local area by soil analysis.

39. MALCOLM C. OAKES, Oklahoma Geological Survey, Norman, Oklahoma
J. M. JEWETT, State Geological Survey of Kansas, Lawrence, Kansas
Upper Des Moines and Lower Missouri Rocks of Northeastern Oklahoma and Southeastern Kansas

Four major subdivisions of the Pennsylvania, separated by unconformities, are generally recognized in Oklahoma. From the base upward they are: Morrow, Des Moines, Missouri, and Virgil. The Morrow is not present in Kansas. Rocks herein discussed lie in the upper part of the Des Moines and lower part of the Missouri, and thus, roughly, in the middle part of the Pennsylvanian.

The unconformity between the Des Moines and the Missouri is indicated by absence of some Des Moines beds in northeastern Oklahoma and southeastern Kansas and by erosion and channeling of others. It is further indicated by a northward progressive overlap in the overlying basal Missouri beds, well shown in the Seminole formation of Oklahoma, whose lower part does not extend into Kansas but whose uppermost part is continuous with the Hepler sandstone of Kansas. The Checkerboard limestone of Oklahoma has been mapped into Kansas, and is the same as the limestone overlying the Hepler sandstone. Rocks in Kansas lying between the Checkerboard limestone, below, and the Dennis formation, above, exhibit marked facies changes as they extend southward into Oklahoma. Limestones disappear and shales are less dark and more sandy. The limestones have been mapped with care to their southernmost extent.

40. PHIL F. MARTYN, Houston Oil Company of Texas, Houston, Texas
The Greta Sands of South Texas

41. JOHN C. POOLE, Consulting Geologist, Corpus Christi, Texas
The Coletto Creek Field, Victoria County, Texas

42. W. K. ESGEN, Consulting Geologist, Houston, Texas