dicates that 1965 will be an active exploration year in the state.

One well, in Montgomery County, drilled to the Cambrian basal arkose, and several wells drilled into the Knox dolomite in eastern and central Kentucky, have provided new subsurface information. The geological significance of recent drilling results is illustrated by structure and isopach maps, and by cross sections.

The Trapp gas field in Clark County is soon to be connected to central Kentucky markets by pipeline. This will be Kentucky's first commercial production from the St. Peter Sandstone. Possibilities of extending St. Peter production in the area are shown by isopach and structure maps.

Relationship of recent leasing activity to regional geology is discussed, and the need for geophysical surveys emphasized.

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January 18, 1965

ROBERT L. FOLK, Univ. of Texas, Austin

"Electron Microscopy of Carbonate Muds and Carbonate Rocks"

Electron microscopy reveals that modern caronate muds show great variation in properties and origin. Mud examples are shown from Yucatan, Florida Bay, Bahamas and the Deep Caribbean. Lithified limestones show many curious features, most of which are at present not easy to explain.

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February 1, 1965

J. A. KORNFELD, Kornfeld International, Tulsa

"Geology and Economics of North Sea Basin"

The North Sea basin represents the most active geophysical and drilling exploration area today in northern Europe. This petroliferous province comprises the offshore waters of seven nations which share offshore mineral rights including: England, Scotland, The Netherlands, Belgium, West Germany, Denmark and Norway.

The area encompassed by the North Sea basin comprises 220,000 square miles, comparable in size to the State of Texas.

The depth of water ranges from 100 feet in the south to 320 feet in the central portion, to 840 feet in the extreme northern portion.

Economic factors leading to the heavy concentration of exploration, exploitation, and capital investment in this vast, undrilled basin are:

1. Proximity to rich petroleum markets in the EEC (European Economic Community) and EFTA (European Free Trade Association) in the bordering countries;

2. Proximity to major crude-oil tanker terminals for marketing such as the port of London, Rotterdam-Europoort, Amsterdam, Antwerp, Hamburg, and Wilhelmshaven;

3. Existence of a series of major Paleozoic, Mesozoic, and Cenozoic basins with a maximum thickness of sedimentary beds of possibly 20,000 feet to the Precambrian basement;

4. Existence of a new, undrilled salt-dome province, comprised principally of piercement-type domes which are interspersed with highly-faulted horsts and grabens, accompanied by numerous facies occurrences in the Permian and Carboniferous systems, which are hydrocarbon-bearing peripheral to the basin in land areas in West Germany, The Netherlands, England, and Scotland; and

5. Existence of relatively shallow waters, averaging only 180 feet.

By the end of 1965, 14 rigs are expected to be active in the North Sea, of which 3 lie off West Germany, and the remainder off Great Britain. By the summer of 1966, at least 20 rigs will be at work.

Paleozoic targets range between 8,000 and 16,000 feet and up to 20,000 feet.

As to the overall investment, $300,000,000 has been pledged to date. This figure could rise to $500,000,000 for a single year in the event of successful and commercial discoveries of hydrocarbons.

Western European crude-oil demand, which exceeded 6,000,000 barrels a day during 1964, is expected to reach 10,000,000 barrels a day during 1975, and 13,500,000 barrels a day during 1985.

Western Europe consumes more than a billion barrels of petroleum a year or more than ten times as much hydrocarbons as she produces. Europe holds less than one per cent of the world's proved developed petroleum reserves and produces less than two per cent of the world's oil.

Discovery in 1959 by N. A. M., a Dutch company owned jointly by Jersey Standard and Royal Dutch-Shell, of one of the world's largest natural-gas fields at Groningen province, which borders the sea, aroused interest in the adjacent underwater area.

Three major sedimentary and structural basins are known from geophysical surveys: the Zechstein basin extension from West Germany, the British basin, and the Norwegian basin. Maximum depths to the

basal Permian may range up to 15,000 feet in the Zechstein basin, to 14,000 feet in the British basin, and to 12,000 feet in the Norwegian basin.

Cyclic development of the Zechstein evaporite basin of northwestern Europe is reflected in the Upper Permian stratigraphy of northeastern and eastern Netherlands where the four classic cyclothems are more or less completely developed.

Rhenish direction prevailed during deposition of the first cyclothem, while during the last cycle, the basin rim followed the hercynic trend.

Principal natural gas producing beds in The Netherlands are the dolomites of Zechstein or Upper Permian age.

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February 8, 1965

W. A. BECKMAN, JR.[1] and L. L. SLOSS[2]

"Possible Pre-Springeran Unconformity in Southern Oklahoma"[3]

Since the relationships among post-Devonian, pre-Morrowan units (Woodford, Sycamore, Caney, Goddard and Springer) in southern Oklahoma are apparently of a conformable nature, previous reports on this complex area have attributed any interruption of the normal succession of these strata to faulting. In the Madill-Aylesworth area of Marshall and Bryan Counties, Oklahoma, the writers find a systematic pattern at the base of the Goddard Shale such as would be formed by deep erosion of a pre-Springerian anticline. Thick sections of Goddard are found in off-structure positions and in a belt presumed to occupy a deep valley along the axis of the old anticline. Detailed cross sections and reconstructions to an early Pennsylvanian datum indicate an axial valley over 2500 feet deep (cut largely in Simpson and Arbuckle) between strike ridges formed by the limbs of the anticline. Confirmation of this interpretation is seen in the localization of sand accumulation over presumed topographic highs on the buried erosion surface. Possible relationship between the postulated erosional episode and the boulder beds of the Johns Valley Shale (Ouachita province) is suggested.

1. Evanston Exploration Corporation, Evanston Illinois
2. Northwestern University, Evanston, Illinois.
3. Manuscript received August 5, 1965. Modified from a paper presented before the Mid-Continent Regional Meeting, American Association of Petroleum Geologists, Oklahoma City, November 1963; and before the Tulsa Geological Society, February 8, 1965.

February 15, 1965

ALLEN M. FEDER, Texas Instruments, Dallas

"Airborne Multisensing for Reconnaissance and Production"

Technical and economic factors have led to acceptance and use of photogeology as an important tool for preliminary reconnaissance and certain detail work. Photogeology remained for many years completely dependent upon capabilities of visible spectrum sensor systems composed of various camera, film and filter combinations. However, restricting data collection to visible spectrum wavelengths (0.4 to 0.76 microns) was not mandatory. Development and application of film and filters sensitive to near infrared energy, out to 1.35 microns, proved valuable additional information was available, when properly sought.

Near infrared sensing having proved useful, it is obvious that even more valuable geologic information should be available through data collection in the many other decades of wavelengths of the electromagnetic spectrum.

Equipment more advanced than the classical aerial camera is required for this. Such equipmentf particularly for infrared and radar imaging devices, was developed and has been used successfully in contract operations for nearly two years. Images collected by these advanced sensors are presented and include examples of sub-surface and sub-vegetation geologic structure, ground water patterns, geothermal deposits, stream and current thermal and sediment transport patterns and buried pipelines. This imagery, while significant for reconnaissance, is indicative of the value of advanced multisensing for production problems such as thermal flooding and pipeline maintenance.

A special capability of these advanced sensors is their high mobility and near independence from time-of-day and meteorological conditions.

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February 22, 1965

H. M. THRALLS, Geo Prospectors, Inc., Tulsa

"Geology, Geophysics, and Their Common Ground"

During the past ten to fifteen years many subjects for papers and topics for symposiums have hinged about pleas for closer cooperation between geologists and geo-