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.

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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 geophysicists. The popularity of the subject reflects the increased effort required to find new oil reserves and suggests the possibility that one group of professionals suspects the other of not doing all they can to make the job easier. This polite but definite pointing of the finger is a natural and human reaction to the necessity of facing an unexpected and unpleasant situation.

Any altercation between a geologist and a geophysicist can literally and figuratively be described as a family fuss—for a family we are. We feed from the same trough, we are subject to the same management, and we have exactly the same objectives; i.e., the discovery of more oil at less cost. In certain areas, we use the same tools and speak exactly the same language, but from the center lobby of subsurface interpretation, each of our two professions has built an extensive network of specialized branch structures between which there are few connecting hallways. We have in the oil industry, however, just one large building and if the geophysicists set fire to their end, your end will burn, and vice versa. If one group makes improvement in their part of the structure, the equity of the other group is equally enhanced, but no great stride forward will be possible until the whole structure is modernized.

The greatest weakness in our common structure is our lack of control of the basic plan. We geologists and geophysicists have been so engrossed in scientific endeavor, in gloating over our successes, or in crying over our failures, that we have abandoned exploration planning. We shoved aside this responsibility and left it to the accountants, the bankers, the mathematicians, the graduates of the School of Business Administration, or to conclusions drawn from data fed to electronic computers. Consequently we should not be surprised to find exploration programs now defined in terms of dollars instead of ideas, budget allocations determined by the size of the district office staff instead of program merit, and that a "deal" submitted by an outsider is more attractive to management than our own program because the outsider's deal can be fitted neatly into a fixed quarterly budget.

If we want a better building, then we must help design it. We may even be surprised to find that management will welcome our help.

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March 1, 1965*

PARKE A. DICKEY, Univ. of Tulsa, Tulsa

"Petroleum Hydrogeology"

Most geological processes take place in an environment saturated with water. The process of compaction of sediments is basically a downward motion of the sedimentary particles and an upward motion of the water contained in their interstices. This motion of water may be the basic mechanism in oil accumulation.

Imagine an anticlinal structure with the sand draped over it (Fig. 1). We don't know in what form the oil occurs in the shale or how it manages to get out of it, but let us assume that it comes out of the shale in a very fine disperse emulsion in the water. The water on its way to the surface encounters the sand bed, which is much more permeable than the shale, and follows it upward until it reaches the crest of the anticline. At this point the sand bed turns and goes down again, which is not the direction in which the water wants to go. On the contrary, it meets another stream of water coming up the opposite side of the anticline. Both currents then have to re-enter the shale at the crest in order to continue on their way to the surface. When this happens, the tiny oil droplets may be filtered out of the moving stream of water by the capillary barrier at the shale surface. If this idea is correct, anticlines are good places to find oil; not because they are high and because the oil collected by its buoyancy, but because they were capillary barriers favorably situated to segregate oil. This new thought somewhat alters our ideas in prospecting. An anticline perhaps is no good unless it was a capillary barrier at the time of oil migration.

The same can be said of wedge belts of porosity. Wedge belts, like anticlines, are excellent places to find oil, but every basin is surrounded by thousands of miles of wedge belts of porosity. Why do some contain oil and most do not? Possibly those contain oil which served as capillary barriers during the migration.

The pressures found in water of the subsurface can tell us a great deal about water motions. Thus all the pools of the Smackover in southern Arkansas had original bottom-hole pressures which were 0.500 psi per foot of depth. This indicates

**This paper is presented herewith essentially in its entirety, owing to its thought-provoking excellence.—Ed.*