angles; and nearly horizontal sheet deposits. These three deposit types are interpreted as representing in the order named an increase in the velocity of current flow tangential to the bottom.

The spectrum of sedimentary structures preserved at any one site is diagnostic of the geologic environment, although individual types commonly are not.

Structures similar to those found in the Bahamas may be seen in many ancient limestones. Examples from the Ordovician, Devonian, Mississippian, Permian, and Pleistocene are cited.

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"Current Financial and Management Appraisal of the Ohio Cambrian Play"

This discussion portrays what has happened in central Ohio since mid-1961, the date of the prolific Trempealeau discovery by United Producing Company in its No. 1 Myers in Morrow County, Ohio.

The Trempealeau is the uppermost member of the Cambrian of the western slope of the Appalachian basin. In this area the Cambrian is about 1,100 feet thick, the uppermost 100 to 200 feet of which is Trempealeau. The Trempealeau thickness found depends on its position on the erosional surface. Producing drilling depths are from 2,800 to 3,700 feet. Limited gas production is found deeper in the basin at a drilling depth of 5,300 to 6,300 feet.

Except for a marginal well — the Monk No. 1 Fee — drilled in 1959 in the southeastern part of Morrow County, and the old Caledonia pool, in Marion County adjacent to the northwest corner of Morrow County, there had been no prolific Trempealeau production in this area until June, 1961. United Producing Company assembled a block of about 30,000 acres generally between these two spots. Reconnaissance, gravity, magnetics, and seismic work was done, and what was thought to be a large gentle closure about eight miles north and south and three miles east and west was found. Critical relief was about 100 feet. The Myers No. 1 well was drilled on this sparse data and resulted in a well capable of making 2,000 BOPD or more. Net pay of 100 feet of vuggy, fractured, and intercrystalline dolomite porosity was found.

Good prolific production was found immediately and a period of about a year passed where exploration techniques, occurrence of traps, content of the traps, and subsequent completion of wells fell into a rather simple pattern. This pattern amounted to shooting an area with density of about 40 acres per shot point, finding relief of 50 feet or more in the form of an erosional remnant, further finding the overlying Ordovician Glenwood Shale missing, and then simply completing the well by setting casing through the pay and perforating on a gamma-neutron log.

The next year of the boom might be called "time of confusion," where this simplicity began to fade and events started taking place which began to make geologists and engineers scratch their heads in perplexity. Some wells which were high and had sufficient remnant thickness to produce contained water instead of oil. Other wells were found similarly with good relief but contained insufficient porosity to produce. The final perplexing situation came to light when a fractured section in the basal Trenton, commonly called Gull River, was found to produce.

The foregoing has been as background material but essential to this discussion. Early in the play one considered leasehold acquisition cost at a top of $3.00 per acre, geophysical cost at a top of $4.00 per acre, dry hole cost at $20,000 per well and completed producer cost at $45,000. At the present time leasehold acquisition cost can easily run at $10.00 per acre and recently a major oil company paid $100 per acre to gain a large regional position. Density of shooting has caused seismic expenditure to increase to a figure of around $15.00 per acre. Drilling and completion costs have changed very little.

In early 1963 production was about 1100 BOPD, there were 17 producing wells, and there was probably 5,000,000 barrels of recoverable reserve. In early 1964 there were 200 producing wells, 30,000 BOPD of production and about 20,000,000 barrels of reserve. These figures today are 350 wells, producing 35,000 BOPD with reserves of 30,000,000 barrels. The overall success ratio has been one producer out of three wells drilled.

As there is no involuntary curtailment of production by purchaser or governmental agency in Ohio, the pay-out rate on producing wells is extremely rapid as compared to production in other states. Approximately 20,000 barrels gross oil production is required for return of investment in a producing well; it is thus easy to see that a

100 barrel well will pay out in approximately 7 months, a 200 barrel well in just over 3 months, etc. As to the profit derived in relationship to the total investment made in the play, it should be necessary to consider that if one follows the average discovery frequency, the total investment costs charged to a producing well would be the cost of the producer equipped, plus the cost of two dry holes drilled with it in the exploration program. This would amount to a total of $85,000 spent, $45,000 for the producer, and $20,000 each for two dry holes. The cost per barrel developed would be 68¢, considering 125,000 barrels of recoverable oil for the average well. The 7/8ths working interest should receive $319,000 from pipeline runs of this reserve. If the overall lifting cost and local taxes (the latter being about 1% of gross production) total 50¢ per gross barrel or $62,500, then about $257,000 of net operating revenue should be derived per well. The ratio of net revenue to development cost would then be $257,000 divided by $85,000, or three to one.

There is a remarkably widespread viewpoint and disparity in final conclusions as to whether or not to enter into an exploration program in Ohio. The individual or small independent has been tremendously impressed with rapid payout of investment when being fortunate enough to find production. The risk in the amount of dollars spent seems to this group to be fairly small, because the shallow drilling depthhs result in cheap dry holes. The individual or small independent then is able to continue in the position of being wounded but not dead, as he would have been when taking even a relatively small interest in an 8,000- to 12,000-foot well. This prospecting group has found a great deal of oil in Ohio, whether or not the decision to drill a well was made on sound exploratory knowledge and judgment, or whether the location was made just because one could drill a cheap hole on a small amount of acreage available. This practice has resulted in operators with a great deal of acreage being able to give up a minimum acreage position and even impose high overriding royalties on the earned acreage.

Major oil companies seeking larger pools might be aware that there is an excellent chance, grading to reasonable certainty, that erosional remnants will not be the only available trap for accumulation of Cambrian oil in Ohio. The Beekmantown wedge of post-Cambrian and pre-Ordovician sequence offers a splendid opportunity for a stratigraphic trap in its updip limit of deposition in southern and central Ohio. Certain geophysical exploration has indicated structural features, possibly basement included, in east-central Ohio, deeper in the Appalachian basin. Northern Ohio offers the possibility of the truncation of the Trempealeau and occurrence of Franconia (the next oldest Cambrian bed) as the unconformable surface of the Cambrian. Facies change of the Glenwood Shale to a dolomite section is a fact in certain areas, and production has been found in this formation.

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"Stratigraphy of the Moon"

The U. S. Geological Survey is currently preparing a geologic map of the earthward hemisphere of the Moon at a scale of 1:1,000,000, using direct visual and photographic observations through large telescopes, and more recently, images transmitted by Ranger spacecraft. The purpose of the mapping is to develop and portray our understanding of the history of the Moon, to provide a basis for selection of favorable sites for lunar missions, and to serve as a framework for the much fuller geologic survey that will be carried out when manned landings are made. For this purpose a lunar stratigraphy is used that is closely analogous in principle to that used on Earth.

Both rock-stratigraphic and time-stratigraphic units are used. The fundamental rock-stratigraphic unit is the formation. In the absence of direct information on lithology, formations are characterized by homogeneity of physiographic expression and albedo. Some formations have been given formal binomial names; for others only the age designation and characterizing features are used. Related formations are assembled into groups, and facies within formations are distinguished, corresponding to members on Earth although not formally designated as such.

Although each formation has a distinctive composition and mode of origin, hypotheses concerning these can form no part of the definition of the formations. On the contrary, the stratigraphic assignments, based on observed appearances and rela-