the key factor in localization of petroleum in most regions.

Cenozoic sedimentary rocks are present only in thin sequences on the south and west coasts. Their possible extent and thickness in offshore areas is hardly more than conjectural. Where presently known, they are generally of only poor to moderate quality from the standpoint of oil prospects.

Mesozoic formations are also relatively small in area and extent. Fairly thin Cretaceous formations, of moderately favorable to unfavorable facies, occur in the Great Artesian, Murray, and Western Australian basins. Marine Jurassic strata are known in the Perth and Carnarvon basins whereas marine to paralic sequences occur in parts of the Great Artesian basin and in the southern coastal basins of Victoria. Triassic sequences are present in several areas in eastern Australia but, again, the lithofacies are generally unfavorable.

Paleozoic sedimentary rocks are widespread. In eastern Australia these sequences possess considerable thickness and variable lithic character but, except for the Permian and part of the Carboniferous, they are commonly altered sufficiently to be judged non-prospective. In central and western Australia, early to middle Paleozoic strata of generally favorable facies are well preserved in several basins.

Late Precambrian (Eocambrian) sedimentary sequences are also widespread in central and western Australia. They are partly of favorable lithofacies, are unmetamorphosed to moderately deformed, and demonstrably contain hydrocarbons and an evaporitic sequence in the Amadeus basin.

Structural traps abound in the basins but, as yet, the key to petroleum accumulations is unknown. Severe deformation does not appear to be responsible for the apparent absence of hydrocarbons on structures tested to date. Time of folding, on the other hand, may be a significant factor in this respect.

**Summary:**

Cenozoic and Mesozoic prospects are generally slight to moderate; they appear to be best offshore on the western continental shelf, in the Torrens and Bass Straits, and possibly in the Timor Sea. Paleozoic prospects are zero to slight in easternmost Australia; they are poor to good in the Paleozoic basins of the Great Artesian region. Lower to middle Paleozoic prospects are moderate to good in the central and western Australian basins and in the southwestern portion of the Great Artesian basin. Late Proterozoic (Eocambrian) prospects are fair to good in a few basins of central and northwestern Australia.

November 18, 1963

J. H. GILREATH, Schlumberger
New Orleans

"Use of Dipmeter as an Aid in Integrating Subsurface, Structural, and Depositional Features"

Recently developed methods of dipmeter interpretation, utilizing patterns of formation bedding plane dips, define both structural and stratigraphic dips. By using these methods, structural dips of less than 1° can be recognized.

Faults may be recognized and defined, both as to direction of dip and strike. Characteristic dip patterns identify bars and channels and define both the strike and direction of shale out of such sand bodies.

Unconformities and disconformities normally exhibit characteristic weathering patterns which makes them readily identifiable. Foreset beds are also readily identified by characteristic dip patterns.

Reef structures can be located and defined by interpretation of the dip patterns found in the overlying beds.

Dipmeter results are currently being used as additional evidence for the confirmation of the presence of shale diapirs.

Confirmation of the subsurface interpretations applied to dipmeter data is supplied by a multitude of outcrop studies from the Rocky Mountain, West Texas and Gulf Coast Provinces.

December 2, 1963

WAREN B. WEEKS, Phillips
Bartlesville, Okla.

"The Future of Petroleum Geologists in the United States"

The future for the petroleum geologist in the United States lies wholly in his own hands. If he is waiting for "better times," he has lost the battle. If he is constantly expanding his knowledge and maintains faith in his ability to exploit that knowledge, he has a rosy future.

We as professional petroleum geologists are inseparably tied to an increasingly complex industry. The foremost objective of the oil industry, as with all industries, is to serve the public. To do so it must make a profit that will justify the amount of capital or investment required to establish and maintain the industry. Sometimes we, the hunters, may forget that this industry is entirely dependent upon the raw material which we are continually trying to discover. We can't forget, nor can we let the industry and the
public forget, that oil and gas are the prime requirements for fuel and petrochemicals.

At the turn of this century, U. S. developed reserves were less than 3 billion bbls. of oil and we had produced less than 1 billion bbls. Total accumulated production and reserves were less than 3.4 billion bbls. This figure had only doubled by the end of 1910, when the professional petroleum geologist was beginning to make his presence felt. During the next 52 years, it rose 16 times to more than 115 billion bbls, over half of which has been developed during the past 20 years. The years 1957, 1962 and 1963 were the only years since 1943 in which newly developed reserves of liquid hydrocarbons did not equal production.

On the other hand, by 1910 we had only recorded production of some 35 trillion cu. ft. of natural gas. During the next 52 years, gas production amounted to over 200 trillion cu. ft. and reserves stood at 274 trillion.

Although the professional petroleum geologist can take a reasonable share of the credit for the discovery and development of these reserves, they represent the teamwork of invested capital, proficient management, diverse professions, and labor.

It appears that in this country we may have reached or neared the peak of petroleum productive capacity following some 30 years of very efficient discovery capacity. You can hear estimates of ultimate recoverable oil reserves for the U. S. running from 140 to 2,000 billion bbls. Future gas reserves have been estimated at from twice to eight times the present reserve (274 trillion cu. ft.).

It can be reasoned that the shallower and more cheaply found and developed reserves have largely been discovered. Not all, but most, future discoveries of importance must come (a) from the deeper portions of known basins, (b) obscure stratigraphic traps, (c) costly offshore exploration, and (d) remote unexplored areas. The petroleum geologist need have little worry about his place in the scheme of things. He will be, in increasing quantity and quality, an operating necessity to the well being of the petroleum industry and the nation. There are certain clear signs for his future. First, he can rest assured there will be an increasing demand for energy from hydrocarbons. The percentage increase is not important—there will be a market for an ever-growing supply of energy.

Secondly, the geologist must find these hydrocarbons under deeper and more hazardous drilling conditions, in remote and inaccessible areas, and in obscure stratigraphic traps. This will require a large number of holes. All of this can only add up to larger exploration costs.

Thirdly, no relief can be expected in the price situation for liquid hydrocarbons. The excess supply outside our borders within the next decade will be a strong deterrent to any domestic price increases. A rise in price would make competitive the vast quantities of hydrocarbon liquids in the tar sands, oil shales, and coals. The price ceiling which we have now must be lived with for some time.

Since we can't expect an increase in the price received for oil, and no decrease in the costs to develop and operate, where will the exploration money come from? There remain two ways to obtain the necessary increased exploration funds.

1. Obtain gas prices in line with the cost of finding, developing and producing gas and commensurate with its value as a fuel compared to other fuels. This is a political and consumer relations problem, requiring a great effort on the part of industry employees in educating others.

2. To compete successfully with foreign oil, we must develop our fields at a lesser cost by drilling fewer holes. It behooves us as geologists to continually strive for regulations and legislation that will allow wider development spacing, and allowable production rates which will provide economic incentive for wide well spacing.

Geologists have paid court to the words "stratigraphy," "sedimentation," and "lithology" for years, but only recently has the profession started to tie them together in a bundle and use this to develop knowledge that is understandable and useful in searching for the elusive "stratigraphic trap." The industry and the profession now have the tools and know-how to organize as concerted a search for "strat traps" as has been the hunt for structures the past 30 years. These two requisites can be combined to find ample hydrocarbons on this continent during the next generation to fill the needs of the following generation. The will-o-the-wisp "little black box" is in our head, and is not the gadget modern alchemists are searching for.

December 9, 1963

ROBERT SARMIENTO, Jersey Production Research, Tulsa

"Advances in Logging Technology"

Since 1950 new well logging tools have been developed at an accelerated rate. During this interval the oil industry has seen the introduction of density, continuous diameter, sonic (velocity), induction, electric, salinity (chlorine), nuclear magnetism, acoustic amplitude (microseismogram) and spectral logging. These tools provide measurements of rock properties previously unavailable.