times, plus periodic emergence between Mississippian and Cretaceous times, interrupted sedimentation causing the erosion of considerable portions of each of the Paleozoic systems.

The major Paleozoic reservoirs are organic and clastic carbonates of the Devonian and Mississippian systems. They form three types of stratigraphic traps: reefs, lithologic pinchouts and unconformity traps. "Draped" anticlinal structure also aids in localizing accumulations in Nisku reefal reservoirs which overlie Leduc bioherms.

The Devonian reefs of the Swan Hills, Leduc and Nisku units indicate the existence of shoaling conditions when the Devonian seas transgressed over the Elk Point basin. The reef fields contain gas reserves of eight trillion cubic feet, 50 percent of which are essentially non-associated.

In the lithologic pinch-out fields gas occurrences of the Wabamun group frequently include hydrogen sulphide gas up to 35 percent by volume. The indicated reserves in these fields are 1.9 trillion cubic feet of non-associated residue gas and 19 million tons of sulphur.

Gas accumulations associated with the post-Paleozoic unconformity have reserves of 3.4 trillion cubic feet in Mississippian rocks, 60 percent being non-associated.

Production to date from Paleozoic gas fields has been mainly dissolved gas from oil producing areas. Non-associated gas production awaits the development of adequate markets. Paleozoic gas reserves are expected to increase considerably as exploration continues in the deeper drilling areas of the Alberta Plains. An estimate of the ultimate potential gas resources in the Paleozoic rocks of the Alberta Plains, based on similar criteria used in recent forecasts for Canada and the United States, is 50 trillion cubic feet.

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November 11, 1963

GROVER E. MURRAY, LSU, Baton Rouge

"Geology and Oil and Gas Prospects of Australia"

Australia, with a land area of 2,974,581 square miles, is the largest accessible land area in the world which is relatively unexplored for oil and gas. Approximately 600 exploratory wells have been drilled in the country whereas the figure for the United States, on a comparable area basis, is 1,500,000. Exploration has resulted in the discovery of one medium-sized field (Moonie) in Queensland. Oil and gas indications and residual hydrocarbons have been found in several basins in Late Precambrian, Paleozoic and Mesozoic strata.

The island continent is one of the most stable cratonic regions of the world. No major orogeny has affected it since Permian times, the structural history since then being primarily one of epeirogenic movements. Throughout the western two-thirds of the continental mass, no geosynclinal development or extensive orogeny has occurred since the Precambrian. No widespread marine invasions of the western half of the craton have taken place since the Ordovician.

A Precambrian craton, exposed throughout most of central and western Australia, forms the nucleus of the continent. Large areas of unmetamorphosed, mildly deformed Late Precambrian sedimentary rocks are an integral part of this craton. Relatively minor additions to the western and southern parts of the continent have occurred through deposition in a series of fringing, partly embayed, partly transient sedimentary basins which have been intermittently negative since the early Paleozoic.

East of the exposed Precambrian craton, additions to the continental mass took place during the Paleozoic through deposition in a series of belts which appear to have progressed generally to the north and east with time. Zones of tectonic activity and igneous intrusions occur in broadly similar time and spatial patterns.

Sandstones, siltstones and limestones are the predominant lithic types in most of the sedimentary basins; shales, clays and marls are generally subordinate in amount. However, as the basinal facies of most areas are as yet unknown, conclusions based primarily on surface data may be incorrect.

Precipitates, other than carbonates, appear generally to be scarce in the continental area. Chlorides and sulphates are present in the Canning-Fitzroy Basin of Western Australia and in the Amadeus trough of the Northern Territory.

Major regional unconformities exist in all the major basins. In many places, the sedimentary strata above these discontinuities are arenaceous, a condition usually not conducive to the entrapment of hydrocarbons. Lithic variability does exist throughout the sedimentary section .however, and appreciable numbers of situations exist where entrapment could occur. The conclusion is hardly escapable that stratigraphy will prove to be

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 nonprospective. 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 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.

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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