unexplored area suggest a shift in major sources of supply. Thus in the future, the Tertiary Gulf Coast embayment and the Rocky Mountain area will be the major source of new gas reserves in the United States, excluding Alaska.

The importance of Alaska, this great new frontier, as a source of natural gas can not be predicted at this time, but tremendous physical obstacles, both in exploration and transmission must be surmounted before Alaska can be exploited for the benefit of our ever increasing demands.

Vast untapped reserves exist in both Canada and Mexico, but only a small fraction of these reserves will be available to consumers in the United States.

The ever increasing demand in our own country must depend on new discoveries within the contiguous 48 states of our country. The geologist responsible for discovering the necessary reserves to satiate an ever increasing demand faces a unique and unprecedented challenge. Not only must he deal with and understand the problems and risks inherent in all exploration, but he is beset by the series of confusing and contradictory economic conditions which often appear to defy solution.

38. Oil Accumulations along Abo Reefing, Southeastern New Mexico: William J. Le May, Hondo Oil and Gas Company, Roswell, New Mexico

During Abo (lower Leonard) time, clastic deposition in the Delaware basin was separated from the lagoonal deposits on the Northwest shelf by a transgressive barrier reef. A lithologic study within the Abo formation reveals facies changes from shelf to reef to basin. Shelf, or back-reef deposits, consist of interbedded green shale and light gray to tan, fine crystalline, anhydritic dolomite. The interfingering of shelf and reef dolomites forms an effective permeability barrier to the migration of fluids back-reef. The Abo reef is a clean white to light tan, anhydritic, fine to coarse crystalline dolomite exhibiting secondary porosity development due to fracturing and solution activity. Interconnecting vertical fractures and vugs give the reef excellent reservoir characteristics which would otherwise be absent in the tight reef matrix. Basin deposits (fore-reef) include black to dark brown argillaceous and cherty dolomites and limestones interbedded with fine-grained sandstones. Fore-reef deposits are called "Bone Spring formation" and are believed to be Abo equivalent.

Hydrocarbons are trapped where porosity has been well developed in relatively high structural areas along the reef. At present there have been four fields discovered along the Abo reef trend in New Mexico: (1) Lovington Abo, (2) Empire Abo, (3) Corbin Abo, and (4) Turner Abo. The latter three are currently being developed. The size and reserves of these fields are dependent on the following factors: (1) thickness of reef above water, (2) structural configuration of the reef, and (3) quality of the reef pay. In the Corbin and Turner Abo fields, oil is trapped along the crest of an elongate reef ridge, one or two locations wide. The productive limits are defined by their respective water tables. The reef in Empire and Lovington is characterized by the same steep dip toward the basin (10°–30°) but has a gentle slope toward the shelf; thus, the productive limits are wider (3–6 locations wide) and production is limited shelfward by an effective permeability barrier.

A successful exploratory procedure has been to estimate a well's proximity to the reef crest by defining its relative stratigraphic position through correlation with areas of close control which traverse the reef. The intermediate drilling depth (4,000–8,500 feet) and high reserves (average 500,000 barrels per location) account for the acceleration of activity along the Abo reef trend.

39. Faulting Associated with Deep-Seated Salt Domes in Northeast Part of Mississippi Salt Basin: Dudley J. Hughes, Triad Oil and Gas Company, Jackson, Mississippi

Faulting in the northeast part of the Mississippi salt basin is principally local graben-type resulting from salt doming. On deep-seated salt-dome structures, the faulting has common characteristics throughout the area which can be applied to great advantage in subsurface interpretations.

Faults are localized over each dome. The general fault strike is usually parallel with the long axis of the deep-seated dome with which it is associated. Faulting over deep-seated salt domes can usually be related to derivative gravity minimums which are expressions of the salt uplifts causing the faulting. Generally, the relative intensity of the derivative gravity minimum becomes greater as the complexity of the faulting becomes greater.

Fault dips over deep-seated domes in the northeast part of the Mississippi salt basin average approximately 45° in the Upper Cretaceous and 60° in the Lower Cretaceous.

The increase in throw with depth is principally a result of lengthening of stratigraphic section in the downthrown block relative to the same section in the upthrown block. This lengthening of section is caused by thickening of the downthrown beds, and by preserved wedges below unconformities in the downthrown block which are absent in the upthrown block.

The crests of structures at Lower Cretaceous horizons through this area are commonly located near one side of a graben system. The faults on this side, termed "axial faults," generally bisect the anticlinal crest so that closure is present on both their upthrown and downthrown sides. Lower Cretaceous production is most commonly found along the structural crest on both sides of the axial faults.

Faults with opposing dip on the opposite side of the graben, termed "flank faults," are farther removed from the structural crest and exhibit closure only on the upthrown side. Flank faults provide potential traps if upthrown reservoir beds remain against impervious strata in the downthrown segment during growth of the fault.

40. Geomorphic Expression of Selected Concealed Structures in Western Canada: Robert H. Barton* and Andy J. Broscoe, Geophoto Services, Ltd., Calgary, Alberta, Canada

Analysis of drainage patterns can be used to delineate concealed structures. To do this effectively, a thorough understanding of the regional geology and general geomorphic history is necessary. In glaciated areas, air photographs and mosaics can be used to determine the general glacial history so that glacially controlled patterns are not confused with structurally controlled patterns. As with any unconventional technique, drainage pattern interpretation has been misunderstood, misused, and handicapped by the lack of a generally acceptable theory to explain the reflection of buried structures in surface stream patterns.

Geomorphic analyses are used in both regional and detailed studies. Regionally, the area between Fort St. John and Fort Nelson in northeastern British Columbia exhibited a pre-Pleistocene trellis drainage pattern, adjusted to structural conditions. Glaciation altered the existing base-level equilibrium. After the ice melted, large-scale stream piracy took place. Due to glaciation and subsequent piracy, non-structurally controlled

* Denotes speaker.