late Precambrian, Caledonian, Hercynian, and Nevadan orogenies has been observed.

The region under study can be divided into two on the basis of structural history and structural type. The southeastern segment comprises the Selwyn, Mackenzie, and Franklin mountains, and adjacent plateaus. Numerous reverse faults characterize the western part of this area. Intrusive bodies are common near the Rocky Mountain trench. Farther east simple folds are the predominant structural type. The eastern margin of the belt is in most parts of the area marked by a high-angle reverse fault. Pre-Cretaceous movements have contributed relatively little to the over-all structure.

The northwestern part of the region is characterized by a complex structural history and a variety of structural types. It comprises the Richardson, Barn, British, Keele, and Ogilvie mountains, and adjacent highlands and basins. Structural belts widely divergent in trend and consisting of structures ranging between simple folds and complex imbricate faults characterize this area.

The principal geologic features distinguishing mountainous regions in the Northwest Territories and Yukon from those making up the Canadian Rockies on the south are the higher degree of structural activity through time, the greater breadth of the mountainous belt, the greater breadth of the region in which thick late Precambrian sedimentary rocks occur, and the presence of intrusive rocks in considerable quantity in the interior ranges.

33. Post-Mississippian Unconformity in Western Canada Basin: JOHN BOKMAN, Western Canadian Venture, A. M. Lloyd, Operator, Calgary, Alberta

One of the most important geological features of the Western Canada basin is the major unconformity of post-Mississippian age. Seventy-eight oil and gas fields in Alberta are situated either overlying or underlying this surface. Detailed knowledge of this fossil topography is obviously important for successful exploration for oil and gas in the basin.

Structurally, the Western Canada basin is a large asymmetrical feature with gentle southwest dips over most of its extent. It is bounded on the east by the Canadian shield and on the west by the thrust belt of the frontal Cordillera. The stratigraphic section consists of a lower, Paleozoic, carbonate portion and an upper, Mesozoic, clastic portion; the two are separated by the post-Mississippian unconformity, the subject of this paper. In the eastern portion of the basin the unconformity is very pronounced; westward it decreases in magnitude and breaks into a series of disconformities and diastems; over the present site of the Rocky Mountains the unconformity probably disappeared entirely, deposition having been continuous throughout late Paleozoic and Mesozoic time. Beneath the unconformity beds ranging in age from upper Mississippian to Precambrian subcrop successively from west to east. Outliers, inliers, and other erosional complexities are present along all the truncated edges. The lithologies, thicknesses, and attitudes of the beds overlying the unconformity are to a considerable extent influenced by the configuration of the surface.

An over-all stream pattern is discernible on the unconformity throughout southern and central Alberta. It consists of three sets of streams, a southwest-flowing consequent set (the master streams), a northwest-southeast-oriented set of subsequent streams, and a poorly developed set of third-order (obsequent and resequent) streams aligned northeast-southwest. This pattern is similar to that described by text writers for streams developing on an emergent coastal plain composed of gently dipping strata. Valley gradients, slopes of the upland surface, and local relief corrected for regional tilt are very low. These facts, plus the existence of numerous flat upland surfaces and streams with broad upper valleys and steep lower valleys, suggest that at least two cycles of erosion are represented on the surface.

Of the 76 oil and gas fields in Alberta at the unconformity, 59% produce gas, 34% oil, and 7% both. Approximately two-thirds of them are Cretaceous and one-third Mississippian. Most of the Cretaceous fields lie over at least some minor nose or closure on the unconformity. However, many similar anomalies have been proved dry or are untested to date. All fields underlying the unconformity are on noses or closures. It is not entirely clear whether any true structural anomalies and (or) textural changes in the carbonates occur where the truncated edges are productive. Oils present in reservoirs at the unconformity have an average gravity of 31° API compared with 38° API for non-unconformity oils. Various observations bear on the problem of time of migration and accumulation of unconformity hydrocarbons.

34. Structure and Tectonic History of Alaska: GEORGE O. GATES and GEORGE GRYC, U. S. Geological Survey, Menlo Park, California, and Washington, D. C.

The major trends of the Cordilleran backbone of North America can be traced through the conterminous United States and Canada into Alaska, where they form a distinctive arcuate pattern bending sharply near the border and flaring out toward the west. The origin and pattern of the dominant tectonic elements of Alaska can be traced back to geanticlines and geosynclines that developed from Middle Jurassic to early Tertiary time. The Brooks Range geanticline forms Alaska's northernmost mountain barrier, a counterpart of the Rocky Mountain system. The range is composed chiefly of Paleozoic limestone, shale, quartzite, slate and schist in faulted folds, and giant plates and nappes, overturned and thrust north over the edge of the west-trending Colville geosyncline. Subsurface data indicate that this geosyncline deepens beneath the arctic foothills and coastal plain to at least 20,000 feet and then rises to within 2,500 feet of the surface near Point Barrow.

South of the Brooks Range and extending to the Alaska Range is an irregular array of low mountains, uplands, and flat lowlands, the Alaska counterpart of the intermontane area between the Rocky Mountain system and the Pacific Mountain system of the conterminous United States. Although several tectonic elements have been traced through this area, some trends are oblique or normal to the major Mesozoic and Cenozoic arcuate pattern. The eastern part of this area is underlain by metamorphic rocks of Precambrian and early Paleozoic age, including what are probably the oldest rocks in Alaska. West interior Alaska is underlain chiefly by folded and faulted marine and continental sedimentary rocks of Cretaceous age and volcanic rocks of Mesozoic age. Bedrock of the Seward Peninsula is mainly schist, gneiss, marble, and metavolcanic rocks cut by granitic intrusive masses. Older structural trends in the metamorphic rocks are chiefly northward on which a younger eastward-trending pattern has been superimposed.

The Pacific Mountain system is extended into Alaska by two major mountain chains divided by a line of depressions that bend in a great arc around the North Pacific Ocean. These mountains consist primarily of great thicknesses of tightly folded graywacke, argillite, conglomerate, and basaltic and andesitic lava flows and tuffs.

The greatest igneous activity has been in the Pacific