higher sandstones of the Rocky Mountain formation and suggested a redefinition of the Tunnel Mountain formation.

Douglas and Raasch presented their final conclusions at this meeting.

R. J. W. DOUGLAS and P. HARKER, Geological Survey of Canada, Ottawa, Ontario
Mississippian Succession in Mount Head Area, Alberta*

The Mississippian rocks of Mount Head area in the Southern Foothills of Alberta are included in the standard formations of the Alberta Rocky Mountains, the Banff, Rundle, and Rocky Mountain formations. The succession differs in several respects from that of the type region at Banff, these variations being, in part, of economic interest.

The Banff formation is Kinderhookian in age. The Rundle formation is raised to group status to include two formations, the Livingstone and Mount Head. The Livingstone formation, of Osagian age, is divided into two members, Pekisko and Turner Valley, and the latter member into the following groups of beds: Banner, Dark Lime, Lower Porous, Middle Hard, and Upper Porous beds. The Mount Head formation of Meramecian age contains the following members: Wileman, Baril, Salter, Loomis, Marston, and Carnarvon. The Rocky Mountain formation is divided into a lower or Etherington member, Chesterian in age, and an Upper member of Pennsylvanian or Permian age.

The Mississippian succession throughout the Southern Foothills of Alberta resembles that of the Mount Head area. Its division into several formations and members permits detailed correlation and study of the lateral variations of the beds.

G. O. RAASCH, Canadian Stratigraphic Service, Calgary, Alberta
Carboniferous Section at Highwood Pass, Alberta

The upper 605 feet is assigned to the Rocky Mountain formation, which is here amended to comprise strata of Permian age. The formation is divided into an upper quartzitic sandstone member, 503 feet thick, for which the term Storm Creek is proposed. The lower member is believed to be the equivalent of Warren's (unpublished) Norquay member of the Banff region, on both faunal and lithologic grounds.

The name Tunnel Mountain is redefined to cover the underlying 602 feet of resistant dolomite and limestone with interbedded gray and green shale, of Chester age. Below this, a topographically weak unit comprises 557 feet of Meramecian strata and is correlative with Douglas' (1953) Mt. Head formation. Its upper 188 feet is interbedded black bituminous shale and black bituminous dense limestone, while *Lithostrotion*-bearing biostromes are intercalated in the lower portion. Finally some 300 feet of resistant Livingstone (Osage) strata intervene between the base of the Mt. Head and the thrust which terminates the section below.

Two major faunal zones have been discriminated in the Tunnel Mountain and three in the Mt. Head. Indicated affinities of these are with the late Chester, Ste. Genevieve, St. Louis, and Salem units of the standard Mississippi Valley section. Corals in the Mt. Head also permit correlations with the Brazer limestone of Utah. More locally, lithologic and faunal evidence indicates a close correlation with type sections at Mt. Head and Banff.

P. HARKER and D. J. MCLAREN, Geological Survey of Canada, Ottawa, Ontario
Devonian-Mississippian Boundary in Canadian Rocky Mountains*

Over most of the Alberta Rocky Mountain region, the Palliser formation, containing an Upper Devonian fauna, is overlain with disconformity by the Exshaw formation. The Exshaw, consisting of a lower black shale and an upper calcareous siltstone, has been considered to be Devonian but the faunal evidence of Devonian age is inconclusive. The Exshaw, though widespread, is not present throughout the region and in some sections the Mississippian Banff formation rests disconformably on the Palliser. The Exshaw occupies the same stratigraphic position and is lithologically similar to the Bakken of Saskatchewan. The Sappington of Montana which is reported to contain an early Mississippian fauna bears some lithological resemblance to the siltstone member of the Exshaw. It is suggested that the Devonian-Mississippian boundary be placed at the base of the Exshaw formation in the Alberta Rocky Mountains.

W. H. H. PATTON, Canadian Gulf Oil Company, Calgary, Alberta
Mississippian Succession in South Nahanni River Area, Northwest Territories

A thick section of Mississippian rocks is exposed west of Jackfish River in the LaBiche Range of the MacKenzie Mountains near South Nahanni River, Northwest Territories.

From fossil evidence rocks of Kinderhook, Osage, Meramec, and Chester ages are known to be present.

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Strata with a Kinderhook fauna equivalent in age to the Banff formation are present. They are followed by a sequence of rocks with Osage, Meramec, and Chester fossils and consisting of interbedded argillaceous limestones and calcareous shale overlain by a great thickness of sandstone with minor shale and coal beds. Fossil plants, *Stigmaria* sp. and *Lepidodendron* sp., and coal were found in sandstones below the Meramecian *Spirifer* cf. *pellaensis* zone.

Microspores from the coal were identified by P. A. Haquebard of the Coal Research Branch of the Geological Survey of Canada, Sydney, Nova Scotia, and were found to indicate a Lower Carboniferous or Mississippian (Tournasian, partly Visean) flora. Spores in the coal are unlike those found in Mississippian coal of Utah but are very similar to those described from the Lower Carboniferous of the Ukraine by geologists of the U.S.S.R.

P. F. MOORE, Shell Oil Company, Calgary, Alberta

Banff to Shell–Anglo-Canadian Pine Creek No. 1 Well via Bow Valley

The first section runs from Mount Rundle to Grotto Mountain in the Bow Valley to the southern end of the Fairholme Range near Exshaw and thence to the bore holes Roxana 1 and Shell–Anglo-Canadian Pine Creek No. 1. The Rocky Mountain formation is present from Mount Rundle to Exshaw and absent eastward owing to pre-Jurassic erosion. The upper Rundle formation at Banff is shown to include the Tunnel Mountain and upper Mount Head members, both of which are present as far east as Exshaw but absent at Pine Creek. The lower Rundle, which is massive at Mount Rundle, gives place eastward to the lower Mount Head, Turner Valley, Shunda, and Pekisko formations. The Banff-Rundle contact is strongly diachronic, the upper Banff at Banff (*Spirifer rowleyi*) being much younger than the uppermost Banff in the Foothills and Plains (*Leptaena analoga* zone) and being the age equivalent of part of the Pekisko and probably the Shunda.

The second section follows the strike northward from Pine Creek to the Superior et al. Solomon Creek No. 1 bore hole and thence to Jasper Park (Mount Greenock), Wapiti Lake, B.C. (South Gap), and to the Amerada Crown GF 23-11 bore hole north of Sturgeon Lake.

On this section the Rocky Mountain formation is represented by the "Permo-Pennsylvanian" beds at the top of the Amerada Crown well and by the upper part of the Mount Greenock formation at Jasper.

Equivalents of the Tunnel Mountain formation are probably present in the lower part of the Mount Greenock formation at Jasper and in the green sandy shales at the top of the Mississippian at Amerada Crown.

The Mount Head formation is present, though thin, in Pine Creek, doubtfully so in Solomon Creek; a coral zone at Jasper suggests that it is there in a relatively pure carbonate facies. At Wapiti Lake it is faunally recognizable (*Lithostrotion* zone) and the characteristic change from a silty dolomite to the underlying limestone of the Turner Valley formation can be traced to Sturgeon Lake area.

The Turner Valley formation is limestone from Jasper north, but dolomite in Solomon Creek and Pine Creek; in both these bore holes there is little or no overlying Mount Head formation.

The Shunda formation is in a silt-shale-dark lime facies in the north but becomes anhydritic to the south.

The Pekisko is everywhere recognizable and is characterized by oölitic zones. The Banff-Rundle contact retains a relatively constant age along this strike section and wherever there is fossil control the top of the Banff lies in the *analoga* zone. The Livingstone formation of Douglas appears to be directly correlative with the Dessa Dawn formation of Laudon.

D. G. PENNER, Royalite Oil Company, Calgary, Alberta

Mississippian Stratigraphy of Southern Alberta Plains

The Mississippian sediments of Southern Alberta Plains region, known only from the subsurface, are described as to lithology, thickness, rock units, their correlation with adjacent areas, and history of deposition.

The section thins from west to east due to post-Paleozoic erosion and to less degree by reason of depositional thinning. In the extreme western part of the map area, there remains approximately 1,400 feet which is one-third of the total Mississippian measured in the mountains.

The rock units and member names defined and introduced by Douglas in 1953 and the more recently emended subdivisions and new names being proposed by the Mississippian Committee for the Foothills area in the vicinity of Turner Valley oil field are defined, for adjacent Plains region, in Shell-Anglo Pine Creek well. The formation names, Bakken, Banff, Pekisko, Shunda, Turner Valley, and Lower Mount Head, are used for this general area. It is further proposed to introduce the name Elkton for the commercial gas zone of the Elkton well. This zone is regarded as correlative of the Crystalline and Lower Porous of Turner Valley field usage.

The correlation of these rock units is illustrated on cross sections from the Pine Creek well to the northeast, toward the Big Valley fields, southeast to Saskatchewan and south to Kevin-Sunburst area in Montana. The Banff of Pine Creek well is correlated with the Mc+Mb2 (Lodgepole) of the Kevin