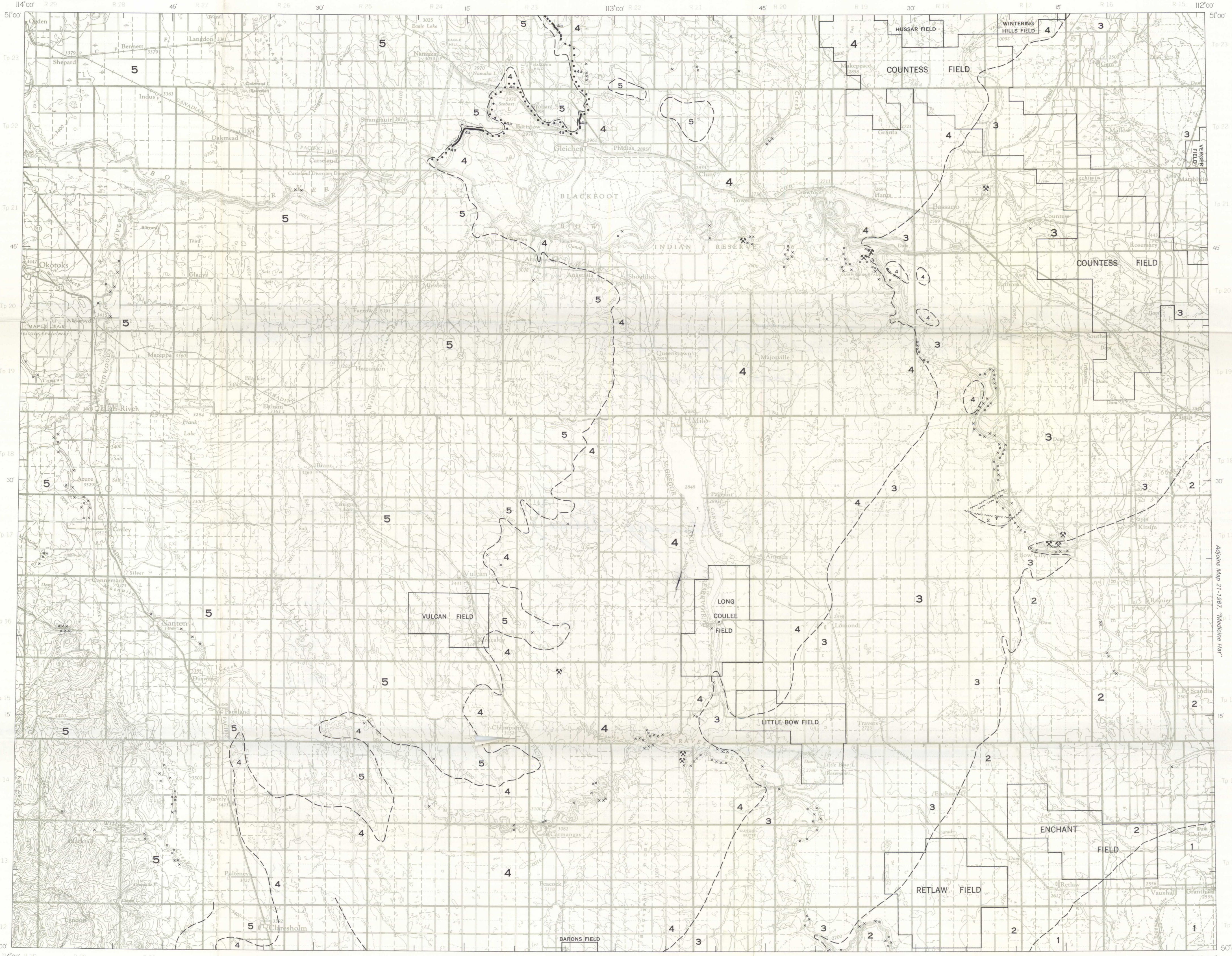




GEOLOGICAL SURVEY OF CANADA  
DEPARTMENT OF ENERGY, MINES AND RESOURCES

PRELIMINARY SERIES



LEGEND

- CENOZOIC**
- TERTIARY**
- 5 PASKAPOO FORMATION: grey shale; brown to black carbonaceous shale; buff weathering, medium- and coarse-grained sandstone; small amounts of conglomerate (non-marine)
- MESOZOIC**
- CRETACEOUS**
- 4 EDMONTON FORMATION: grey and light grey argillaceous sandstone; grey, green and brown bentonitic shale; dark grey carbonaceous shale; light green bentonite; coal seams (4a) KNEEHILLS TUFF ZONE: white-weathering argillaceous sandstone, white- and cream-weathering shale; dark, purplish grey bentonitic shale. tuff (non-marine)
- 3 BEARPAW FORMATION: brown, argillaceous sandstone; brown, sandy shale; dark grey shale; ironstone nodules (marine)
- 2 OLDMAN FORMATION: grey shale, dark grey carbonaceous shale; grey and dark grey siltstone; grey and light grey sandstone; thin limestone beds; ironstone; coal seams (non-marine)
- 1 FOREMOST FORMATION: green and grey shale; carbonaceous shale; grey siltstone; grey and pale brown sandstone; ironstone; coal seams (non-marine)

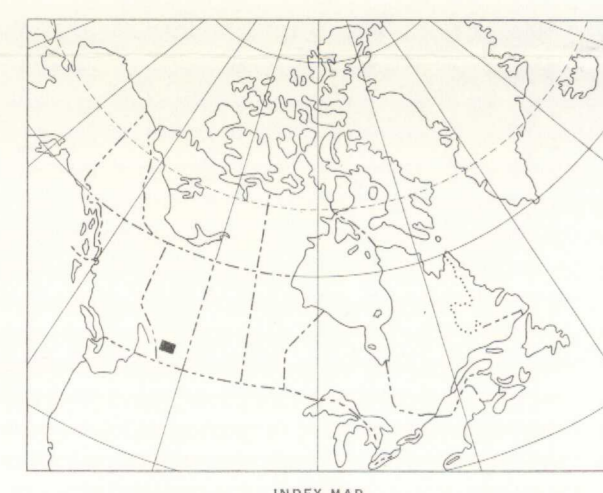
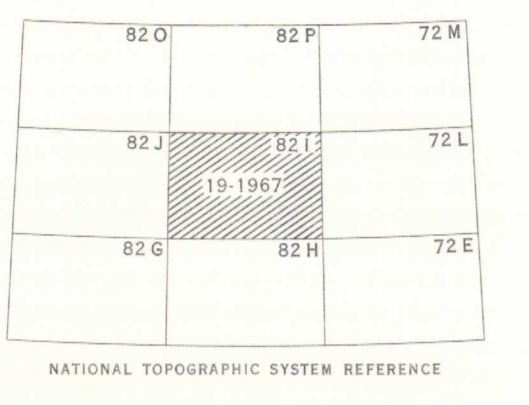
- Geological boundary (approximate) .....  
 Rock outcrop .....  
 Fault .....  
 Coal mine .....  
 Oil and gas fields .....  
 Geology by E. J. W. Irish, 1965, 1966, 1967

Geological cartography by the Institute of Sedimentary and Petroleum Geology, Geological Survey of Canada, 1967

Base-map compiled and drawn by the Surveys and Mapping Branch, 1959

Magnetic declination 1968 varies from 20°23' easterly at the centre of the east edge to 21°14' easterly at the centre of the west edge. Mean annual change decreasing 3.3'

All elevations in feet above mean sea-level



DESCRIPTIVE NOTES

Glacial and glacioluvial deposits of till, clay, silt, and gravel cover most of the map-area so that bedrock exposures are rare except in the deeply eroded parts of stream valleys and in the hills along the extreme western part of the area. Bow River, the largest stream, flows easterly across the northern part of the map-area as far as Tp. 21, Rge. 19W4. From here its course is about thirty degrees east of south to the point where it leaves the map-area in Tp. 14, Rge. 15W4. Areas of bedrock are exposed alternately with areas of glacial and glacioluvial deposits along the valley. Highwood River enters the map-area from the west in Tp. 18, Rge. 30W4, then flows north to its confluence with Bow River in Tp. 21, Rge. 38W4. Tertiary sandstone and shale are exposed at intervals along this river. Little Bow River, the only other large stream, drains the southern part of the map-area. Rock outcrops in the river banks are numerous from Travers Reservoir south to the border of the area but are scarce along the upper reaches of the stream.

The geological formations that occur at the surface or immediately below the unconsolidated deposits are of late Upper Cretaceous and Tertiary ages. Isolated outcrops are shown on the map but it was not practical to show the continuous areas of outcrop where the rock is exposed in stream banks.

The oldest strata, those of the Foremost Formation (1), are believed to lie below the Pleistocene deposits in the extreme southeast corner of the map-area. Surface exposures together with information obtained from the drilling of wells in adjacent map-areas indicates that this formation consists of a succession of interbedded green and grey shale; dark grey, carbonaceous shale; grey siltstone and grey to pale brown sandstone. Ironstone bands are common. The carbonaceous shales grade, in some places, into coal seams. Most of the shales are either silty or sandy and show great variation in colour and hardness. The sandstones are mainly soft and argillaceous though thin, hard layers and concretionary masses of calcareous, buff-weathering sandstone occur throughout. Generally the individual units are thin, less than 10 feet in thickness and do not extend far in any direction. Extreme lateral variation in the rule. Shell beds containing *Ostrea* and *Corbula* are common in the middle part of the formation.

The lower contact is gradational downward into shale of the Paskapoo Formation. The upper contact is transitional into the overlying Oldman Formation and is usually placed arbitrarily. At some localities in southern Alberta a massive, buff-weathering sandstone unit is used to mark the base of the overlying Oldman Formation. Where this sandstone does not outcrop it is difficult to assign a contact with any degree of accuracy. Probably only the upper beds of the Foremost Formation are present within this map-area and the thickness of this formation is not known.

Beds of the Foremost Formation are overlain conformably and gradationally by the Oldman Formation (2). This younger formation consists of a succession of green, grey and light grey shale and silty shale interbedded and interlined with grey and light grey sandstones. Some thin ironstone bands occur and thin limestone beds are common in the lower one-half of the formation. Hard, calcareous sandstone beds occur at several horizons. Thick, cross-bedded, light-grey weathering, lenticular sandstone units are typical of the upper part of the formation. Plant impressions and carbonized wood are present in some strata though the formation as a whole is not very carbonaceous except for the Lethbridge coal member at the top. This carbonaceous zone marks the approximate top of the Oldman Formation throughout southern Alberta and contains mineable coal seams at several localities.

Throughout the formation the amount of shale predominates over the amount of sandstone as it does in the underlying Foremost strata but the latter formation has a more sombre aspect because of the prevalence of darker coloured shales and sandstones. Fragments of vertebrate remains are common and shells, principally of *Ostrea*, occur at several horizons.

Beds including the Lethbridge coal member at the top of the formation are exposed along Bow River in Tp. 17, Rge. 17W4. The upper beds are exposed, also, along Little Bow River in Tp. 12, Rge. 19W4. Other than these two localities, exposures are confined to scattered outcrops along Bow River in Tp. 14, 15 and 16, Rges. 15 and 16.

The Bearpaw Formation (3) rests conformably and relatively abruptly upon the Oldman beds. It underlies an area between 12 miles and 24 miles in width trending about 30 degrees east of north across the eastern part of the map-area. Outcrops are confined to the valleys of Little Bow and Bow rivers. Exposures of black shale occur at several places in both banks of Little Bow River in Tps. 12, 13 and 14, Rge. 20W4. On Bow River the transition beds at the top of the formation are well exposed on the east side of the river in Tp. 20, Rge. 19W4. These strata consist of about 100 feet of chocolate-brown, argillaceous sandstone with included brown shale lenses and are overlain by light-grey weathering, argillaceous sandstone of the Edmonton Formation. The grey to dark-grey, marine shales and sandy shales typical of the formation are well exposed in both banks of the river between Tp. 17 and Tp. 20. Thickness of the Bearpaw Formation on Bow River is estimated to be about 1,000 feet.

The non-marine Edmonton Formation (4) overlies the Bearpaw Formation. The lower part of the formation is well exposed on the north-east slope of Jumping Buffalo Hill in Tp. 20, Rge. 19W4, where approximately 350 feet of strata are exposed above the transition beds of the Bearpaw Formation. These strata consist of non-marine, light-grey weathering, argillaceous sandstones; buff to grey-weathering, silty and sandy shales; minor amounts of thin, brown-weathering, hard, calcareous sandstone; ironstone; coal seams; and thin bentonitic beds. Scattered outcrops of younger beds occur along the river in Tp. 21, Rges. 20 and 21. On Little Bow River outcrops occur in Tp. 13, Rge. 23W4; Tp. 14, Rge. 23; Tps. 14 and 15, Rge. 22. All of these beds have been mapped as belonging to the Edmonton Formation but the section here includes toward the base nearly 400 feet of typical Edmonton sediments overlain by, in the vicinity of Carmanagay (Tp. 13, Rge. 23W4), hard sandstones and friable shales resembling the lithology of the St. Mary River Formation to the south. Farther upstream, exposures are poor but outcrops in sec. 11, Tp. 14, Rge. 23W4, and in sec. 26, Tp. 14, Rge. 23W4, include rubbly, green shales containing a profusion of white-weathering, calcareous concretions. Such concretions are typical of the Willow Creek Formation. The evidence indicates that there is interfingering of the Edmonton with the St. Mary River and Willow Creek formations as far north as Tp. 14, in this map-area.

The uppermost beds of the Edmonton Formation are not exposed within the map-area, but beds including the "Kneehills Tuff zone" are exposed on the north side of Bow River in secs. 13, 14, 21, 22, and 23 of Tp. 22, Rge. 24W4, in sec. 25, Tp. 22, Rge. 23W4, and in sec. 26, Tp. 23, Rge. 23W4. The "Kneehills Tuff zone" includes the Whitelut equivalent, a white-weathering, bentonitic sandstone unit about 10 feet thick and the overlying Battle equivalent consisting of 20 to 30 feet of dark grey to purplish grey bentonitic shale which contains, near the top, a 6-inch to 10-inch thick stielitic tuff called the Kneehills Tuff.

On the north side of Bow River, erosion has removed the upper beds of the Edmonton Formation to a depth just above the Battle equivalent and on the south side of the valley it has removed, at least locally, all beds comprising the Battle and Whitelut equivalents. From Bow River to the south border of the map-area no outcrops of the "Kneehills Tuff zone" were found and it is possible that these beds have been eroded through this region although the presence of the zone farther to the west is indicated from a study of well logs. The maximum thickness of the Edmonton Formation, where it forms the present bedrock surface, is approximately 750 feet.

The Edmonton Formation is overlain unconformably by medium- to coarse-grained, massive, buff-weathering sandstone that is similar, lithologically, to typical Paskapoo strata and which may be of Tertiary age. In places these massive sandstones are crossbedded and appear to be channel fillings. No break could be found between these channel sandstone units and overlying sandstones and shales of the Paskapoo Formation of known Paleocene age. But, because these lower beds have yielded no fossils their age is still in doubt. On this map they are included with the Paskapoo Formation (5).

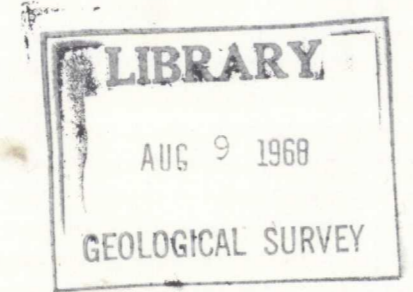
Strata of the upper part of the Willow Creek Formation and the overlying Pleistocene Hills Formation which occur to the south and which are, also, of Paleocene age, are present in the southwest corner of the map-area but, because the exact relationship between these two formations and the more northerly Paskapoo Formation has not yet been established, they are grouped with the Paskapoo Formation in this region.

The Paskapoo is the surface bedrock formation over most of the map-area west of range 23W4, meridian. It consists of non-marine, hard to soft, grey- and buff-weathering, grey, fine- to medium-grained sandstone; green and grey, friable shales; and some thin beds of argillaceous and siliceous limestone. Conglomerate is rare and is usually present as thin lenticular cobble layers. Some sandstone units contain clay pellets and angular shale fragments. Both terrestrial and aquatic molluscs, as well as mammalian remains are present in Paskapoo strata. The lower contact with the Edmonton Formation is assumed to be unconformable and the upper boundary is the present land surface below the Pleistocene deposits. Maximum thickness of Paskapoo strata in this map-area is estimated to be about 950 feet.

All formations within the map-area are located on the eastern limb of the Alberta syncline and the dip of the beds is to the west and south-west at between 5 and 10 feet per mile. Locally, dips of up to 200 feet per mile are known. The thick glacial cover over most of the map-area obscures most of the local structures that may be present. Small thrust faults are known to be present in secs. 25, 26, 27, 34, 35 and 36 of Tp. 17, Rge. 18W4, and others probably occur in the Thigh Hills region of Tp. 16, Rge. 24W4.

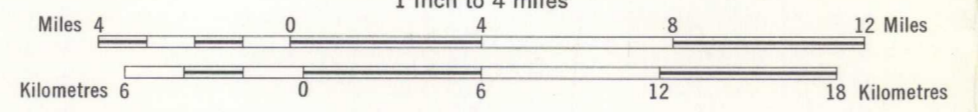
Coal occurs at the top of the Oldman Formation (Lethbridge coal member) but is being mined at only one locality within the map-area. In secs. 15 and 16 of Tp. 17, Rge. 17W4, strip mining is in operation on the north side of Bow River. Numerous coal seams occur within the Edmonton Formation. The actual number of mines that have been opened in the area is not known because most have been small and ephemeral. Those which were found are located on the map. All are small underground operations abandoned many years ago.

Both oil and gas are recovered from the area and the established fields are shown on the map.



MAP 19-1967  
GEOLOGY  
GLEICHEN  
WEST OF FOURTH MERIDIAN  
ALBERTA

Scale 1:253,440  
1 inch = 4 miles



Alberta, Gleichen  
1 inch to 4 miles  
Map 19-1967 (Preliminary Series)